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**Theology & Technology: An Exploration of their
Relationship with Special Reference to the Work of
Albert Borgmann and Intelligent Transportation Systems**

Presented for the Award of Doctor of Philosophy

Department of Theology

University of Durham

by

Rev. Dennis William Check, BA, BS, MA, PhD

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2006

- 4 JUN 2007



Abstract

This thesis summarizes a large body of literature concerning the sociology, philosophy, and history of technology and the specific set of technologies concerned with Intelligent Transportation Systems (ITS). It considers technologies of various kinds within the Old and New Testaments and how technology has been understood and occasionally discussed by contemporary theologians. Intelligent Transportation Systems are a very prominent area of modern technologies that will shape the future of society in profound ways. The overall field of ITS is described and then a specific case study concerning a set of automated highway systems applications within three states and two large national parks within the United States is presented. The case study then provides a backdrop to explore specific ways in which theology might engage in a conversation with intelligent transportation systems specifically and technology more generally. Since theologians have written relatively little about technology, we draw upon the work of a leading philosopher of technology who is informed by his Christian commitments, Albert Borgmann. The extensive philosophy of Borgmann about technology and the character of contemporary life is described. Various considerations about how to create, foster, and maintain a sustained dialogue between disparate intellectual traditions and disciplines are suggested. This includes attention to goals for dialogue, respective strengths that various parties bring to the conversation, and the willingness to hear and learn from the other. A framework to categorize interactions between theology and technology is introduced. Borgmann's ideas, coupled with those of other theologians and philosophers are then applied to the case study. The worth of this approach is then assessed in light of what theologians might contribute to discussion and decision-making about technological

systems and devices facing toward the future. Consideration is also given to what technology might contribute to the theological enterprise. The investigation demonstrates the importance of such dialogues and the viability of initiating them.

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Chapter One

Technology and the Technological Society

“Today the endangered state of the natural environment, the deteriorating human-built world, and the threat of technology out of control reflect people’s values and their resigning themselves to determinism. A change in values and an activist stance toward technological change will be an effective response to these pressing problems. Such a value change and activism will not come about, however, unless technology is better understood.”

(Thomas Parkes Hughes 2004a: 173)

We live in a pervasively technological world. Technologies of all types are so deeply engrained in the fabric of everyday life even before our birth that we often fail to register their ubiquity. They extend human capabilities to perceive, explore and interact with our environment. Ever-changing medical technologies aid in the prevention of disease and hold promise to “undo” the results of genetics or time as exemplified by a goggles-mounted camera and belt-attached processor that compresses visual images and transmits data to a device implanted in a blind person’s eye that in its prototype phase allows the person to crudely “see” (Wickelgren 2006). The integration of tissue engineering, control, and neurophysiology promises to transform the performance of artificial limbs (Evans-Pughe 2006). Cochlear implants bring the sense of hearing to tens of thousands of profoundly deaf people across the globe (Laursen 2006). Human-designed communication devices mediate human interaction across time and space, facilitate commercial transactions both near and far, and provide endless hours of entertainment. Electric Time Car Rentals (2006) in San Francisco rents electric vehicles equipped with integrated geographic positioning system (GPS) and tourist information that guide visitors all over the city without the aid of a human tour guide. The United Airlines inflight magazine, Hemispheres, recently profiled the growing number of elite

resorts in the USA, Sweden, Japan, Germany, and Dubai that have created huge indoor artificial environments that resemble outdoor beaches with powerful wave making machinery, indoor “ski” slopes that accommodate up to 1,500 people at a time, and indoor tropical “islands” that include hundreds of species of exotic plants and allow guests “camping” privileges on the island beach at night (Thorne 2006). Holidays (vacations) to these artificial environments eliminate the time, expense, uncertainties, and dangers associated with visiting their “real” counterparts.

Technologies also provide means and methods for social control, greatly enhance damage from the worst in human behaviours, and raise profound social and ethical questions. In recent years engineers and biologists have teamed to create an online Standard Registry of Biological Parts (<http://parts.mit.edu>) that mimics the manner in which silicon engineers share their ideas and designs with the goal that biological engineers can accelerate progress toward fabrication of living materials, advancing personalized medicine and the mass assembly of needed biological replacements (Bio Fab Group 2006; cf. Gibbs 2004, Endy 2005, Church 2005). Cloning, genetically modified foods, stem cell research, commercial orbital space travel, and other examples of technological developments daily fill world media outlets.

Despite technology being a major arena of human activity and engagement, it still scarcely enters the critical thought processes of most people, despite our interaction with technological systems and artefacts virtually all of our waking moments (McGinn 1991: 1-12). Those persons who do think critically about the impact of the human-designed world on humans and human nature recognize that “technology is arguably the most pressing issue of our age” (Higgs, Light and Strong 2000b: 2).

1.1 Plan for this Thesis

Theologians, like most other moderns, have not given technology much thought at the level of their formal writings. This thesis explores the potential interface between technology and theology. Our goals are to: 1) obtain a general understanding of technology and its import in the past and the present, 2) see how technology has been discussed both by biblical writers and representative theologians within the past seventy-five years or so, 3) use a case study of intelligent transportation systems to develop some specific understandings about a singular set of technologies and systems, 4) draw upon some recent work within the philosophy of technology that is especially pertinent to theologians and their interests, and 5) see what benefits there may be for both technology and theology if these two fields of human endeavour can successfully engage in sustained dialogue. Our rationale for proceeding to address these five goals may be described as follows. First, we must grasp with some degree of detail what technology is so that we may have a firm conceptual grasp of its range, pervasiveness, meaning, and importance for human life in general and the domain of theology in particular as we move into the twenty-first century. Arriving at such a definition will take us well beyond the word *technology* within general language and necessitate understanding technology as it is discussed and analyzed by philosophers, historians, sociologists, and anthropologists of technology. We will survey the range of viewpoints and then adopt a definition for the purpose of this thesis that shall be consistently applied.

Since theologians draw upon the texts of both the Old and New Testaments in their theological work (albeit with dramatically different views among themselves about

how much weight to accord to biblical texts) it seems vital to consider anew whether, to what degree, and how technology is presented by biblical writers as both a window into technology in the past but also as a way of considering how such an awareness might further inform theologians as they confront technology within the current century. Since modern societies are pervasively technological, it makes sense to take a careful look at representative theologians from a wide range of theological traditions that employ a variety of approaches in doing theology to see how much and in what ways technology has figured in their theological work. If technology is extensively discussed, we can synthesize across theologians searching for common insights, diverging viewpoints, and points where further work may be needed. If technology is virtually ignored, we can question why this might be so and what might be done to better position theology to engage with technology as we face a collective future.

Technology is so broad in its features and so ubiquitous within modern life that it becomes impossible to digest the full range of its movements, dominance, and impact. To ask a general question about the engagement between theology and technology is likely to rapidly deteriorate into a non-starter conversation. Therefore we shall pursue our investigation focusing on a set of interrelated technologies that go under the general rubric of Intelligent Transportation Systems (ITS). Such a case study approach will ground us in specialized literature regarding specific representative technologies and present an opportunity for understanding concrete examples of technology.

Simultaneously we will remind ourselves of the larger fabric of technology within which these particular technological examples reside. This approach should permit us to describe specific technological applications and their importance and allow us to search

for ways in which theological thought might engage with each specific application – including attention to what theology might receive as well as give in such an exchange as well as instances where it may “be dumb” before particular applications.

Pursuit of our overall aims will be enhanced by drawing upon the work of two noted Christian philosophers of technology, Albert Borgmann of the University of Montana, USA and Carl Mitcham of the Colorado School of Mines, USA. Mitcham is generally acknowledged as the “most important historian of the philosophy of technology” (Achterhuis 2002: 97) and his comprehensive summaries, incisive comments, and artful expression will anchor our exploration of the meanings of technology. Albert Borgmann “speaks with a distinctive and recognizable voice” (Tijmes 2001: 11) about a “philosophy of technological devices and information technology” that “opens an important perspective on technology” (Verbeek 2002: 91). His three major books provide a comprehensive philosophy of technology that has already witnessed several major books and symposia critiquing his ideas. Borgmann’s ideas will provide a rich source for theologians seeking to understand and engage with modern technology.

We will maintain modest expectations that a series of exchanges between technologists working on applications such as those of ITS and theologians can point the way toward how such conversations may occur, a general sense of the benefits and costs (the overwhelming majority non-monetary in nature) associated with such an engagement, and some concrete examples of what may result. Any benefits to such an engagement will be presumed to transcend the particular applications and types of technologies we will consider and the thesis will indicate reasons for thinking this to be so.

The thesis will not exhaustively track nor discuss the lengthy history of interactions between technology and religion but will principally limit itself to modern theology and its interaction with modern technology. While we will incorporate recent work by theologians in the area of genetic engineering, cloning, and other issues concerning humans and the life sciences/medicine, our concentration on intelligent transportation systems is designed to advance the argument that *all* forms of modern technology, not just those that seem to strike the core of what it means to be human, are ripe for exploration and engagement by theologians. Theology as a discipline needs to take much more awareness of the technological society within which it conducts its work, understand that milieu far better than appears to be occurring today, contribute to the betterment of technological applications on a go-forward basis – including in some cases directly challenging its hegemony - and use its emerging knowledge of these technologies as a foil to advance the theological enterprise.

For the remainder of this chapter we will take up the question of technology in an effort to understand its importance, major effects, and the significant personal, policy, and societal issues it raises.

1.2 The Nature and Nurture of Technology

Considerable confusion frequently arises in social circles when one mentions the word “technology.” Americans, for example, typically believe technology refers principally to computers, computer networks, software, and related devices that are part of the Information Age. Most people in industrialized societies by this definition are not

only explicitly aware of technology; it is consciously used on a daily basis and they are often proficient in its use.

Technology, as we will employ the term in this thesis, is of much older vintage than modern information technologies. While it includes computers and related devices, technology also embraces the entire human-constructed world of artefacts and systems (Volti 1995: 3-7). There have been two major meanings for the word '*technology*' and the different origins of these meanings have created semantic confusion about technology in contemporary discourse (Sun 1984: 174f.). The first historical meaning is the art of discourse or *logos* (e.g., Aristotle, *Rhetoric* I, 2, 1354b17). Although Cicero brought the word into Latin, it was only occasionally referenced until its re-emergence in the Renaissance where it came to mean the logical organization of liberal arts (Sun 1984: 174). By the 17th and 18th centuries technology came to also be a shorthand way of referring to the mechanical arts. Slightly later, it gets refined to mean both the application of scientific knowledge and the application of rigorous methods to a wide range of human affairs. It is, of course, this meaning that is the principal thrust of this thesis (Sun 1984: 175).

Plato and Aristotle employ the word *techne* extensively, with an emphasis on making, acting, and doing as opposed to contemplation (see the extended treatment of Roochnik 1996). In the *Nicomachean Ethics* (1.7.1097b11; cf. 6.4), for example, Aristotle argues that all activity aims at some good and draws upon a series of everyday activities to illustrate the point, pointing out that sometimes the making aspects of activity can be subordinate to one another, e.g., cooking food. He argues for a final good in itself, the "master art" which directs all orders and is not directed by any. Crafts, skills, and the

arts are viewed as inferior to the world of contemplation with the deepest knowledge only available via dialectic (e.g., *Gorgias* 450b, c; *Ion* 532c, 533d; *Statesman* 258e; *Philebus* 58a ff.; *Metaphysics* 7.10.103a9 and Aristotle's discussion of carpentry in *On the Generation of Animals* 1.22.730b.10-20). This divide between thought and action still pervades academic conversations that separate the practical and applied from the domain of theory and those who engage in it (cf. comments by Newman 1997: 48; Peters 1967: 190f.).

The Indo-European root of the word "technology" is *teks*, meaning to "fabricate or to weave," with *tektōn* in Greek referring to a carpenter or builder and *tekhnē* to a craft, art, or skill (Hughes 2004a: 3; cf. Mitcham 1994a: 117f.). Throughout these ancient cultures we have a sense of the importance of human fashioning of materials to arrive at desired ends as well as the understanding that technological activity can come in almost an endless variety of manifestations both within and across cultures.

Stephen J. Kline (1985), the late Professor Emeritus of Mechanical Engineering and co-founder of the Science, Technology and Society Program at Stanford University, suggests that technology is a complex set of concepts, artefacts, and systems, that can be discussed in four major ways: 1) as artefacts or hardware, e.g., pencils, microscopes, antiballistic missiles; 2) as sociotechnical systems of production, e.g., an automobile assembly line; 3) as technique or methodology, e.g., the skills, knowledge, and general know-how to rebuild an engine or to engage in oil painting; and 4) as sociotechnical systems of use, e.g., an airplane presupposes a much wider system of rules and regulations, licenses and trained pilots, passengers and/or cargo, maintenance, airports, manufacturing facilities, and air traffic control. Often we think of technology only as a

single artefact. Yet behind every artefact is a network of raw materials, human thought, design considerations, production, etc. Very few artefacts have significant meaning in themselves. They derive their meaning for us in a system of use that involves a complex set of interactions among ethics, values, human creativity, and many other artefacts to which they relate or can be related in some manner. As these artefacts come together in increasingly complex systems, the whole becomes much greater than the sum of its constituent parts. This amplification of the power of single artefacts was known at least since the time of Francis Bacon who noted in *Novum Organon* (79) that printing, gunpowder, and the compass literally changed the world in fundamental ways (Bacon 1859).

The importance of systems cannot be overstated when considering the power of contemporary technology. Systems become the means by which massive changes in society come about and also become a means by which society can be laid low. This can be readily seen by a consideration of the electric power industry. Electrification on a large scale within Western society provided the essential backbone to power massive industrial plants, rapidly expand the size, parameters, and services of cities and surrounding suburbia, and consolidate the power of elites in key ways (Hughes 1983: 461-465). Large-scale electrification systems also set the conditions for far-flung impacts that are often difficult to predict or avoid. On November 9, 1975 a small switch automatically and unexpectedly turned and made an electrical connection inside a “black box” within the bowels of the Sir Adam Beck power station in Niagara Falls, NY. Within three seconds of this small technological change, over thirty million people on the East Coast within an area of 80,000 square miles were plunged into darkness for anywhere

from three minutes to thirteen hours (Burke 1978: 1ff.). The tight interconnectivity and the rapidity within which information and electrical power within such networks moves, created ideal conditions for this “trigger effect” that affected millions and threatened societal chaos as looting, crime, deaths due to emergency equipment failure or nonavailability, and a host of other conditions ensued (see Chiles 2001 for a collection of more recent examples across a range of technological systems and Baura 2006: 163-175 for an analysis of the more recent 2003 blackout in the Northeastern USA). It is, in fact, the very presence of these large systems that causes us to use the term *technology* rather than *technologies* since they exhibit a common essential characteristic that Mitcham has termed *technicity* (Mitcham 2006: 546). Whereas in the more distant past no technology could be separated from its originating context, today’s technology is no longer grounded in this manner. Technicity can be “defined as a systematic or scientific study of means that suspends examination of ends” (Mitcham 2006: 547). Today’s highly interconnected, linked, and “virtual common culture” can be termed *meta-technology* (Mitcham 1995a: 22).

Jacques Ellul spent much of his academic life writing about technology. He prefers the French term “*la technique*,” believing that its connotations are more exact and meaningful. *La technique* for Ellul refers to the “reality of the technological,” and refers to a concrete thing. The term for a discourse about things or the teaching of the subject itself is covered by the term *la technologie* in French. This is similar to the use in English of earth (gē in Greek) and geology (the scientific study of the Earth) or the difference between society and sociology (Ellul in Vandenberg 1981: 32f.). For Ellul, it is *la technique* that is the chief defining element of modern existence and also of values.

French is not the only language that provides a distinction between *technologie* and *technique*. German distinguishes between *technologie* (technological science) and *Technik* (technology, or technical things). Yet even in these languages, the range of meanings for technology has broadened as technological systems grow ever more complex as will be explored below in the work of Albert Borgmann (Willoughby 2005: 135)

Ellul believes there is a somewhat distinct point in the history of the West when *technique* came to ascendancy with its obsession with *efficiency* as its chief defining characteristic rather than its justification under religious, traditional, or practical reasons (Ellul in Vandenberg 1981: 36f.). Lewis Mumford, the social historian and critic, suggests that the modern technological society can be distinguished by the fact that there is “only one efficient speed, *faster*; only one attractive destination, *farther* away; only one desirable size, *bigger*; only one rational quantitative goal, *more*” (Mumford 1970: 172f.). Certain approaches and artefacts were favoured over competing approaches and artefacts with the chief criterion of choice being one of deriving the most benefit with the least cost in human labour, time, materials, etc. The concerns of the World War II generation of social critics like Ellul, Mumford, Heidegger and other writers of similar ilk reached a high-water mark during the peak of the Cold War leading one scholar of the time to speculate that technology “could produce a new civilization, or it could mean the end of the human race” (Ferkiss 1969: 56).

Technology is neither exclusively then just computers nor merely “those things that engineers do.” It is a wide range of human activities where the goal is to design

something or manipulate nature in such a manner as to realize one's desires. Success in this venture over multiple occasions requires that a series of techniques be learned and utilized in particular ways to achieve desired ends. As a report from the National Academy of Engineering in the United States explains, technology embraces not only products but also the know-how to create those products and the infrastructure that makes the generation of those and other products on a large-scale possible (Pearson & Young 2002: 2f.). It is a whole way of *being* rather than just isolated artefacts and it is clear to most observers that there is, or at least should be, a strong interplay within modern societies between technology and human values (Ferkiss 1969: 49).

Carl Mitcham, a distinguished philosopher of technology, has reviewed quite carefully the vast literature that has been produced about the nature and focus of technology from the writings of the ancient Greeks to modern engineers, sociologists, historians, and philosophers. He notes historically both an engineering philosophy of technology and a humanistic philosophy of technology. The engineering approach is narrow and tends to focus on technical aspects of making and doing technology, sometimes losing any connections to broader concerns (e.g., Bunge 1985). Technological thought and action is adopted "as the model for all human thought and action and attempts to explain or reformulate all apparently non-technological thought and action in technological terms" (Mitcham 1995a: 17; e.g., Koen 2003 who reifies the problem solving approach of engineering to a generalized method suitable for solving all problems confronting society). The strong internalist tradition of engineering philosophers of technology appear to have some utility to technology practitioners but may prove far less useful and often inaccessible to those sitting outside of engineering and related practices.

The humanistic approach, best exemplified by writers such as Lewis Mumford, José Ortega y Gasset, Martin Heidegger, and Jacques Ellul, is extremely broad and tends to ignore technical details, so much so that it can result in characterizations of technology. These classical philosophers of technology can be credited with recognizing that modern technology was much more than simply a collection of artefacts and technical processes (the chief focus of the engineering approach to philosophy of technology). They understood that the growth of systems or the “megamachine” as Mumford styled it, resulted in technology being the *l’enjeu de siècle* (Ellul). Prior generations of technologists worked within the framework of a culture that bounded their activities while the modern technologist no longer recognizes “any cultural or other constraints that might arise from the human condition” (Achterhuis 2002: 96). In a style reminiscent of the Old Testament prophets, Mumford (1946: 58) and Ellul especially saw modern technology as substituting for the Christian ideals of grace and redemption offering salvation to all who would come under its intoxicating spell of technological capability and transformative power over society. This view is in opposition to the traditional view expounded as early as Francis Bacon in his utopian *New Atlantis* that the progress of science and technology would herald a new age, restoring what was lost in the fall of Adam and Eve and simulating anew the divine works of creation (Schuurman 1997b: 42f; for a more complex explanation of Bacon’s relationship to historic Christian belief see McKnight 2006). Classical philosophers of technology like Ellul, Mumford, and Heidegger still erroneously assumed that language (*homo loquax*) held sway over making and doing (*homo faber*) but at least they recognized the critical gap between these two theories of human nature (Achterhuis 2002: 97).

Various general orientations have been advanced concerning technology but they can basically be summed up by the following table from philosopher of technology, Andrew Feenberg (2006: 10):

Technology is:	Autonomous	Humanly controlled
Neutral <i>(complete separation of means and ends)</i>	Determinism <i>(e.g., modernization theory)</i>	Instrumentalism <i>(liberal faith in progress)</i>
Value-laden <i>(means form a way of life that includes ends)</i>	Substantivism <i>(means and ends linked in systems)</i>	Critical theory <i>(choice of alternative means-ends systems)</i>

Table A: Ways of Thinking About Technology

Most people who write about technology can be placed in an appropriate square of this grid in terms of their focus and orientation with the understanding that virtually all substantivists are also determinists.

Mitcham creates a framework for technology that emphasizes four key aspects as represented in the diagram below (adapted from Mitcham 1994a: 160).

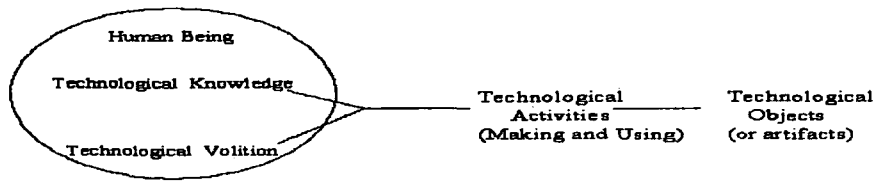


Figure 1. A Framework for Technology

The human being is, of course, central to technology both as producer and as user. As the Canadian philosopher George Grant expressed it, “All descriptions or definitions of technique which place it outside ourselves hide us from what it is. . . . Technique comes from and is sustained in our vision of ourselves, as creative freedom, making ourselves, and conquering the changes of an indifferent world” (Grant 1969b: 137). Each person possesses both technological knowledge about various things and a will to engage technologically with the world. This fusion of knowledge and will leads to technological activities that produce technological objects or artefacts (including systems). The spectrum of artefacts is large and Mitcham (1994a: 162-163ff.), adapting the work of others, has created the following general taxonomy that represents this range:

- Clothes
- Utensils
- Structures
- Apparatus

- Utilities
- Tools
- Machines
- Automata
- Tools of doing or performing (e.g., musical instruments, letters, numbers)
- Objects of art or religion (meant to be contemplated not “used”)
- Toys (artefacts of play and games)

Technology as knowledge in Mitcham’s schema focuses on the distinct types of knowledge that those who utilize technologies routinely employ as part of their engagement. Four main categories have been delineated (Mitcham 1994a: 193f.): sensorimotor skills or *technemes*, technical maxims (rules or thumb, recipes), descriptive laws or technological rules, and technological theories (e.g., aerodynamics as an application of fluid dynamics). In similar manner, behavioural engagements with technology as activity can include one or more of the following orientations (Mitcham 1994a: 210): crafting, inventing, designing, manufacturing, working, operating, and maintaining. Technology as volition has been explicitly discussed or implied by numerous writers about technology and can be loosely grouped as follows (Mitcham 1994a: 247): the will to survive or to satisfy some basic biological need, the will to control or power, the will to freedom, and the pursuit of or will to efficiency.

Technology is the oldest of human endeavours. Early tools, art, production of clothing, human language and other forms of symbolic communication all are examples of technologies in use since the dawn of time. The role of language especially, can be

seen as the ultimate technology since it so profoundly influences the ways humans think about the world, communicate their intents both to themselves and others, and pass on to the future their aspirations, insights, and accomplishments. To have language is to be fundamentally *technological* in the deepest core of our being – although it should be noted that we are not the only organisms that possess both the capacity and demonstrated capability of utilizing language ranging from sophisticated vocalization systems of birds, nonhuman primates, the communication systems of bees, to those of many other species (Oller and Griebel 2004). While we can no longer assert that language sets us uniquely apart from other creatures as was erroneously asserted in the past, we may note that it is one more thing that connects us with our larger environment and other organisms. We *can* still assert that human language has a level of complexity seemingly unsurpassed by any communication system possessed by other organisms, although it appears that other social animals may have more intelligence than previously assumed, including recent evidence of wild meerkats teaching their young (Pennisi 2006; Thornton & McAuliffe 2006).

Technology predates by thousands of years the advent of other fields of human endeavour such as the sciences, history, and the social sciences. It is, therefore, a mistake to consider technology merely as applied science. Technologies evolve in response to changing human needs or environments or changing desires that function somewhat independently of environment and can reshape the environment in distinct ways. This reminds us that without human beings there would be little technology beyond that employed in things like communication systems and simple tool use among nonhuman species such as primates and dolphins (Moura and Lee 2004; Krützer, Mann, Heithaus,

Conner, Bejder, and Sherwin 2005). Technology is then always dependent upon the human social sphere and its course and influence is profoundly shaped by human desires and human discourse.

Developments in technologies are influenced by a variety of factors including available materials, time, creativity, market demand, and prevalent ideas and beliefs within human cultures in terms of religion, philosophy, and social mores. For these reasons, human beings have often created very different technologies to meet the same basic human needs. Ancient cultures depended on rivers for their existence, for example, evolving a variety of river artefacts and systems to aid transportation and commerce, exploit the river's resources, and manage the river's course (Landels 2000: 58-83; Bass 1995). While there are some commonalities among these cultural responses across cultures, the range of responses to perceived needs is quite broad. Each culture pioneered highly particular designs in both artefacts and systems, often influencing subsequent generations in adjacent cultures or even societies quite a distance away.

While best described as a process, technology is more commonly known by its products and their effects on society. It is enhanced in modern times by the discoveries of science, shaped by the designs of engineering, and often as it advances brings about changes in both science and engineering. Technology is conceived by inventors and planners, raised to fruition by the work of entrepreneurs who bring new products and services to the marketplace, and implemented and used by society. Sometimes it enters the social system almost imperceptibly and brings about many subtle changes, often in unforeseen ways that only become fully apparent in retrospect. This phenomenon has

even spawned an evaluation technique associated with its study known as retrospective technology assessment.

Technology is always in part a social process. Technology is supported to serve the society that generates and controls it through society's private and public institutions and individuals. Large public or private funding that goes towards the developments of particular new technologies frequently confer decided advantages to the results of those investments within the marketplace of ideas, goods, and services. Sometimes technologies that would prove promising fail to evolve sufficiently to be broadly useful due principally to a lack of sponsorship. Society affects and is affected by its technology. Within modern societies even the functions of government and the governing process itself is strongly shaped by the pervasive influence and environment wrought by technology. The results and dynamics of all these highly complex interactions are key to the ways in which technology affects people's lives.

Technology is also a technical process. Science focuses on understanding the natural world and trying to provide explanatory frameworks that enable humans to predict things with some regularity as well as to understand the relationship between causes and effects. Technology's role is focused much more centrally on doing, making, implementing and improving things. The principles of science, whether discovered or not, always underlie technology. The results and actions of technology are subject to the laws of nature the same way as anything else in the cosmos, even though technology has often preceded or even spawned the discovery of the science(s) on which it is based. Increasingly, engineers and scientists are able to design or engineer a structure or material that has a unique set of *predetermined* properties. This leads to a linear interrelationship

among processing, structure, properties, and performance that typifies the discipline of materials science and engineering but that is also found in many other fields of modern engineering (Callister 2001: 2f.).

Much modern technology, particularly that embodied in systems, is fabricated through the technical designs of engineering and it enters society according to the perceived needs of the socioeconomic system often informed by both designers and consumers in an iterative process. Many manufacturing firms only develop and bring to market a product that has been extensively tested out with consumer focus groups and more and more frequently in pilot marketing runs in limited markets before large-scale production commences.

Technology can be discussed by invoking general concepts such as work, flow, design, innovation, and risk/benefit. It may be regarded as benevolent, making modern life possible. It may also be seen as evil or as not always to be trusted. Technology's embodiments and processes are often described as wonders – such as the wonder of antibiotics and the wonder of transmitting pictures of distant planets from space probes. Or technology may be a source of public concern and consternation – for example, there is the continuing problem of what to do with both low-level and high-level radioactive wastes (Shrader-Frechette 1993; Gerrard 1994).

Through technology, the public is drenched in information, much of it technical itself. Radio, television, and newspapers all spew out undigested and sometimes conflicting information. The Internet provides for user consumption texts of many hues that grow exponentially with each passing year with only one website in the world in 1990 and over 26 million today (Frauenfelder 2004: 42f.).

Technology is chiefly responsible for the ever-increasing rate of change in the world. Such changes are vital to growth, and perhaps they are inevitable, since the world must support a burgeoning population. Modern production demands an advancing yield of technology and change.

Technology is revealed by its contributions to humankind, both current and historical, and by technical advances foreseen for the near future. Its uncertainty and ambiguity, and its possible unexpected consequences for good or evil, cannot be neglected or minimized. Technological solutions to human problems are not unique. There are no inherently right answers, and forced choices must be made (Shinn 1991: 3-5). It is vital that these choices be informed.

All technologies embody the explicit and implicit values of their creators (Grant 1995a; Morgall 1993: 109-118). A chair, for example, in a modern manufacturing plant embodies the concept of “normality” or “average” in terms of its dimensions. It presumes certain things about the unknown user including the length of their limbs, the amount of sustained time they might spend in the chair, and varied uses for the chair. It also reflects views of its creators in regards to style, colour, and “feel” (Pursell 1995: 77). A handmade chair created by a colonial craftsman, on the other hand, while often more individually tailored for a particular user, also unavoidably embodies certain values of its maker (see Pounds 1989: 184-218 for many other examples from the home environment).

Another key concept for all technologies is the idea of “tradeoffs.” Each technological artefact, system, or methodology conveys certain benefits while imposing certain burdens or costs associated with its use or implementation. For example, a statewide testing system enables central policy makers, the public, and other interested

individuals and organizations to get a read on how well the system is doing in regards to certain valued ends as measured by the testing instruments. On the other hand, such a system also involves direct financial and other costs due to the processes of creation, dissemination, administration, and reporting of the results. Some users are benefited by the technology, others suffer at its hand, while for others this particular technology is relatively neutral (Wenk 1995: 204-207; Winner 1986: 125, 128).

Every technology also results in unanticipated consequences for users and others affected by it (Rothenberg 1993: 46-53; Sarewitz 1996: 175). These consequences cannot be forecast in advance by the designers of the technology but come to the fore as particular technologies are implemented in situations not within the purview of the original design work (MacKenzie 1996). For example, the first paved roads in cities were initially placed there due to the huge amounts of horse droppings that had to be collected from city thoroughfares and the problems with carriages getting stuck on muddy avenues. This network of paved streets was improved and expanded substantially due to the introduction of the bicycle as a common means of conveyance, which in turn created conducive conditions for the first “horseless carriages” and aided their rapid adoption by affluent city dwellers (Cardwell 1995: 366-370). A further justification for these ‘horseless carriages’ was, ironically, that they would reduce pollutants within cities, i.e., the horse droppings which amounted to tens of tons per day across a single city.

Developers of the “peaceful uses of atomic energy” in the United States in the fifties did not foresee the present problems of low-level radioactive waste disposal, nuclear power plant failures and decommissioning, and public opposition to expansion of power plant sites. They were optimistically responding to a technology that already had

become known as a “destroyer of worlds” in the deadly mushroom clouds of Hiroshima and Nagasaki (Bauer 1997: 1-41; Chiles 2001: 39-50).

Within modern science and technology, the boundary between these two fields of endeavour is becoming increasingly blurred. Large-scale research and development projects like the Human Genome Project, global change research, or intelligent transportation systems, involve a cast of thousands of scientists, engineers, and technicians. At any given point, on any given day, a freeze frame of activity would lead to an irresolvable debate among purists as to whether science or technology was being utilized. Despite these convergences, it remains true that science is fundamentally engaged in explaining the workings of the natural world while technology is fundamentally concerned about taking raw materials in the natural world and blending them with human expertise and creativity to create products, goods, and services that meet human needs. Many people, especially persons in the sciences, erroneously define technology merely as “applied science.” While in specific cases such a designation is accurate, in many other instances technology is employed with little or any explicit use of scientific knowledge or understanding and rarely is there a smooth, uniform transfer of technique from the science laboratory to the technological development cycle (Petroski 1996; Weber 1992; Schwartz 2004).

Design and design constraints play a major role in the development and evolution of technologies. The very tools used in the design process (e.g., CAD, CAM) are themselves technologies, and therefore subject to tradeoffs inherent in all technologies. Each type of tool has certain advantages and disadvantages. The goal of all design activities is to optimize the design. This value-laden process is vital to ultimate market

success, health and safety, and customer satisfaction. Optimization involves a complex balancing of competing desires on the part of those commissioning the design work. The process of optimization also requires a seemingly endless round of tests, redesigns, and retests, until a desired balance is achieved in the overall design and its performance. There is rarely, if ever, an example of a design process where no failures or redesigns were called for on the basis of initial test results (DeVries, Cross and Grant 1993: 1-14).

Not all technologies are developed explicitly with human “needs” in view. While market pull is often a key factor in the development of many technologies, companies also use market “push” to bring new products to market. Sometimes a new product is developed on the basis of an individual’s or group’s perception of a “neat idea.” The company conducts some preliminary market analysis and then advertises to create market demand for the new technology. You see this market push most clearly perhaps in the world of children’s toys where each season brings a new raft of consumer products that a child “just has to have” (Norman 2004: 56-60).

Most technologies exist within the larger contexts of integrated systems. In fact, many artefacts only derive their meaning and power from their connections to a much larger system. Analysis of a particular artefact in terms of its impact must, therefore, not only consider the object itself but how it relates to other objects and systems. The modern world exemplifies the power of systems writ large and only the most isolated tribal peoples in the deepest jungles of the world escape the pervasive impact of modern technological systems. Yet of course, even these isolated tribes possess their indigenous technologies and technological systems.

Systems thinking has, therefore, become a dominant paradigm in many fields of human endeavour, including “systematic theology.” We might also note the marked tendency of many Christians to read the Old and New Testaments as a unitary “system” of doctrine or dogma (cf. Mabee 1984: 163 who argues a different point). The growth of systems becomes a centrepiece in the explanatory framework of the evolution of technology (Marcus and Segal 1989: 135-251). As humans increasingly attempt to assert themselves in a rapidly changing environment a systems approach becomes a critical skill to master for functional success within a society – particularly among the intelligentsia. A key factor of European society from 1750 to the present is “the high value placed on the rational manipulation of the environment” (Landes, 2003: 21). This came about through the interactive effects of a strong belief in rationality (the adaptation of means to ends) and a sense of mastery over both man and nature. The role of the Church in supporting these two interactive effects cannot be ignored, even if it cannot be fully explained (Landes, 2003: 21-27). The tight interweaving of technology with the economy and the mutual push and pull that fosters and enhances each as it interacts daily and pervasively with the other domain constitutes a fundamental interlocking system within the modern world (Rapp 1995: 37). Systematization becomes an inevitable by-product of these powerful ideas and sociotechnical movements. These systems are further enhanced by the “inherent accumulation structure” of technology whereby greater efficiency and continuously optimization of performance raises the bar of technical proficiency and leads to a further cycle of improvements and accumulating knowledge (Rapp 1995: 36f.).

Appropriate uses for varied technologies and the impact of technological systems have to be constantly monitored by an alert citizenry to ensure that democratic ideals are

upheld and that values implicit in civic life are promoted or at least not stifled by technological advances (Sclove 1995: 180-196). This includes attention to the differential impacts of various technologies on subcultures or on gender (Wacjman 1991: 1-26). The historical evolution of a particular technology rarely serves as a highly useful analogue or predictor for the potential future impact of a technology in terms of changing culture, modifying social behaviour, or impacting political and religious life (Westrum 1991: 328-337; Landes 2003). In this light it is helpful to remind ourselves that technology is a pervasive element of human life going all the way back to the first humans. Throughout the history of civilizations, therefore, the social fabric of humans and their enterprises has been interwoven with the thread of technology and the construction of both the fabric and the enterprises that comprise it has greatly accelerated in the modern era. The underlying purposes of technology are to release humans from the drudgery and danger of hard work, to promote luxury, and to generate the wealth which makes a life of leisure possible, in short, to serve the “pursuit of happiness” (Rapp 1995: 36). The accumulating objects, knowledge, activities, and intentions associated with modern technologies therefore “constitute a source and a challenge for ethics” (Briggle, Mitcham, Ryder 2005: 1908). The fact that ethics is not routinely a part of technical decision-making is in part due to the manner in which engineering finally was established in the eighteenth century as a stepchild of the Scientific Revolution. It developed in a context where an analytical, empirical, Baconian approach was preferred and where emotions and values were purposefully suppressed. Engineers, as the entrance above the Kirkaldy Testing Station in London declared in its motto after a disastrous bridge collapse, were interested in “Facts – Not Opinions” (Stephan 1999: 2). Technology poses

serious questions about the structure and nature of the “good life?” since the pursuit of happiness as the ultimate criterion for technological capability and use may not be the right criterion and human beings have constructed happiness itself in many different ways over the course of civilization (McMahon 2006). The pervasive presence of technology in all domains of life and living requires serious attention by practitioners from many disciplines to foster “theories that guide us toward a critical rather than a passive engagement with technology and its effects in our lives” (Higgs, Light and Strong 2000b: 1f.).

1.3 A Definition for Technology within this Thesis

Technology will be defined in this thesis as **the application of knowledge, tools, skills, and systems to solve practical problems, extend capabilities, and expand opportunities to meet or invoke human needs.** A very wide range of human activities “count” as technology following this definition, certainly far more than casual thought about technology might imply. Traditional fields of human endeavour under this definition will inevitably contain particular technological applications within them that are essential to their execution while not consisting solely of these applications. Culture may be conceived of as the broad context within which technologies operate alongside of and in dynamic relationship with other elements. Culture is all about relationships among groups, persons, ideas, and perspectives and is concerned with a myriad of issues including aspirations, symbolic exchange, structures, coordination, identity, and practices that serve relational ends such as rituals, norms, and beliefs. Culture is always contested in various ways by particular subgroups and individuals and is continuously reshaped by

social, economic, and technological aspects of human interaction. (Rao and Walton 2004: 4, cf. the older and inadequate conception of Niebuhr 1951: 31f.). Technological artefacts, processes, knowledge, theories, and volition are nested within the broader culture(s) of the modern world; although technological elements are increasingly homogenizing cultures via commodities and systems in ways seemingly more pervasive than either economic or social aspects of human interaction.

Yet even technologies themselves are strongly influenced by culture. This can be seen even in highly technical applications where the particular culture within a given company or organization can influence how a particular technology is applied. Nathalie Ravaille and Dominique Vinck (2003) in a very interesting anthropological study, show how two companies who both were engaged in the production of aluminium window frames, ladders, bicycles, and boats operated with extremely different cultures and with differentiated results. In the one company the design engineers routinely employed a set of formal rules and followed the attendant computer calculations as a matter of principle. In the other company, the design engineers viewed such automation of decision making as less useful and employed a much more synoptic evaluation that relied most heavily on their own design experiences (p. 112).

A “non-technological” field such as history uses a very wide range of evidence that survives from the past to create a narrative interpretation that enables people in the present to obtain knowledge and understanding about human ancestors and human societies before the present (Bentley 1997). These imaginative recreations are based upon but not derived solely from evidentiary materials as human creativity is essential to good historical writing. Each generation finds it necessary to reinterpret the past in light of the

present always with an added duty of incorporating any “new” evidence that has emerged in the interim period. Historians as they go about their endeavours employ technologies of many different types in their pursuit of insights regarding the past including but not limited to technical aspects of palaeography and epigraphy, computer analysis of large-scale records, and analyses of material culture (i.e., the artefacts that remain from the past).

In a similar manner, the arts utilize a range of technologies from both past and present as part of a much larger set of factors that feed into contemporary paintings, drama, musical compositions, etc. An argument has been made by Walter Benjamin and others that mechanistic forms of modern art have acted as “aesthetic forerunners to the clone” as they alter traditional approaches to aesthetics and artistic choice (Northcott 2005: 226).

The sciences have advanced enormously in the past two centuries in part due to the new tools and techniques that technology provides as we are able to see deeper, further, and in new ways the natural world and better analyse the vast array of raw data that can be collected from the natural world utilizing a wide array of technologies for data capture, data analysis, and data display. Yet science is so much more than the host of technological tools, techniques, and systems it employs as it generates theories (general explanatory frameworks), conceptual understandings, and predictions about nature.

We see then, across different disciplines and modalities of human existence the complex interplay that technologies of various types have with other forms of human knowing and doing. There is probably not a single human sphere of activity that remains untouched by technology. The next chapter will consider the pervasiveness of technology

within the texts of both the Old and New Testaments and then take a look at the degree to which theologians over the past seventy-five years or so have thought about technology in their formal writings.

Chapter Two

Technology in the Old and New Testaments and among Contemporary Theologians

“We live today in a world in which the changes move at speeds that leave our minds spinning with the uncertainty of too-rapid motion. If Christianity is to speak throughout these changes, it must speak illuminated and not bewildered by them. The world belongs to him who can best see where it can go. Could that, even today, be Christ?” (William Kuhns 1969: 142)

Technology is such a pervasive presence in the modern world that we take its presence for granted as simply part of the environment in which we live, work, and have our being. We implicitly accept the ways in which technology shapes, manages, extends, and otherwise affects our day-to-day affairs. Similarly, when we read the Bible, we fail to discern the pervasive impact of technology within its pages as well and perhaps miss fundamental insights that this collection of ancient writings might supply to moderns living in a society that is even-more pervasively technological in its fundamental character.

Exactly how to appropriate the Bible for our purposes in this study raises a host of questions around biblical interpretation that are daunting and complex. We will adopt a canonical approach to the Bible since our goal is to understand how the Biblical text as received *by the Church* portrays technology in both the Old and New Testaments. Pioneered by Brevard Childs in the twentieth century, a canonical approach to Old and New Testament theology takes an explicit stand that “one reflects theologically on the text as it has been received and shaped” (Childs 1985: 11). Ancient Israel and the Early Church are both viewed as fundamentally communities of faith that shaped their traditions within the light of their understandings of God. Considerable scepticism is maintained in this approach to the time-conditioned efforts of modern scholars who seek

to judge the truth or falsity of biblical data based on their own criteria or a search for “events or experiences behind the text, or apart from the construal in scripture by a community of faith and practice” (Childs 1985: 6 and the entire discussion in Childs 1992). Removing the historical community and its perceived witness to the acts of God reduces the study of the Old or New Testament canons to the very *technique* syndrome that Jacques Ellul and others have identified as symptomatic of the modern age where the vibrancy of faith-community “witness” is reduced to fine-grained analysis guided chiefly by analytical approaches, contemporary concerns, standards of evidence, and argumentation quite foreign to the biblical writers and often accompanied by a deep scepticism toward religious phenomena. The Bible is fundamentally a faith document that demands something of its readers and is viewed by those within faith communities as impossible to understand absent the active aid of the Spirit (Childs 1985: 12; Seitz 2004: 99; Goldingay 2003: 866-868; but cf. the stinging critique of Childs by Barr 1999: 378-438 and the less polemical discussion by Brett 1991: 38-57). The stance taken here neither denies the potency of alternative approaches nor the power of sustained critical-historical studies that contribute important insights to our understanding of ancient texts and the communities for whom they served as valuable life-centering, spiritual sources. It is a purposeful reaction against both reducing the Christian canon to the status of merely religious history or a history of religions approach or a “dogmatic mislocation” that separates the concept of *sola scriptura* from the equally valid and essential concepts of *solus Christus*, *sola gratia*, *sola verbo* and the overarching *solus Deus* of the Protestant Reformation where Trinitarian, pneumatological and ecclesial considerations are held in tension with one another (Webster 2001: 9f; and the more extensive discussions of

Webster 2003a: 42-67 and 2005: 33-67). While we will draw upon selected critical-historical work at particular points below, we will concentrate on summarizing the message of the texts as they stand as a unity recognized within the Christian community while admitting that alternative views are possible and perhaps in some quarters, even desirable. Our concern is with the Bible as a whole as it is appropriated by today's Christian community for understanding the will of God and for guidance in facing the vicissitudes of life. Since the Bible is the normative starting point for many denominations, churches, and Christians throughout the world (even if not viewed in the same manner by many contemporary theologians or biblical scholars) for framing general principles and approaches to life and living in the contemporary world, it seems imperative to take a sustained look at how various technologies are described and employed within the Bible.

2.1 Technology within the Old and New Testaments

Drawing upon our exposition of the nature and import of technology in Chapter One, we now move directly to the texts of the Bible to see whether, employing our definition and understanding of technology, we can find much about the topic within the Christian canon of scripture. To what degree does the Bible address the “application of knowledge, tools, skills, and systems to solve practical problems, extend capabilities, and expand opportunities to meet or invoke human needs?”

2.1.1 God as the First Technologist

The ability to create, to make, to do, to engage in “technological” activity, predates humankind. God Himself, in the Hebrew Bible, is described 32 times in Genesis 1-11 as engaging in the work of creating, making, preparing, or doing. He is presented as the “Creator-Craftsman” (Newman 1997: 117), “arch-technophile” (Alexander 2003: 2), “artisan” (Lodahl 2003: 73) or what we can appropriately call today a “technologist.” Recognizing this particular implied Biblical metaphor for God is not new to the twentieth century, since the ancient term for an “engineer” or “technologist” was an “architect.” A New Testament writer declares, “for he [Abraham] was looking for a city which has foundations, whose architect and builder is God” (Heb. 11:10). Irenaeus described God’s work in creation as that of an Architect when he wrote to the deacon Demetrius in *de Fide* (as quoted by Maximus in *Fragments VI*). Martin Luther uses the metaphor of God as both an architect and master builder, a Father God who desires to dwell within the house he has furnished [quas hunc patremfamilias gessisse constat, qui est Deus aeternus, conditor et Servator omnium] (Maier et al. 1983-1985: 42: 28f., 440-443; 46: 558; Pelikan 1955-1986, 1: 11, 39; 2: 253-255). Thomas Hobbes wrote of God as the Great Architect while René Descartes viewed God as the perfect technician (Schuurman 1997b: 42-44). Jean Calvin frequently refers to God as an Architect, viz. *Institutes of the Christian Religion*, Ch. 5, sec. 4; Ch. 14, sec. 1; Ch. 15, sec. 5; and his *Commentary on the Psalms* (Ps. 19, v. 1 and Ps. 147, v. 2). Such a metaphor and the insights that can be derived from it will be explored here with the recognition that utilizing other metaphors such as those explicitly within the Bible (e.g., Shepherd, Rock, Refuge, High Tower) or

others of more contemporary vintage (e.g., God as Mother, Lover, and Friend by McFague 1987) deepen our insights into divine mystery.

The opening chapter of Genesis has God separating the water from the expanse and creating light, dry land, vegetation, sun, moon, and living creatures of various types, including human beings made in his image. It is important to note here that God appears to call forth animals, plants, etc. from the earth that acts as an “active empowering agent” (Welker 1999: 41ff.). There is a dynamic interplay between the Creator and his creation in the process of yet further creative “acts.” The author records a conversation where God deliberates “let us make (‘*śh*) man (‘*ādām*) in our image, in our likeness.” (v. 26) He also makes (‘*śh*) a companion for man. The word ‘*śh* is used 2,627 times in the Old Testament as a verb, 2, 527 times in the *qal* form, 99 times in the *ni.* stem, and one in the *pu.* In the *qal* form, the verb generally has the meaning of “to make or to do” with context adding subtleties (Carpenter in Van Gemeren 1997, 3: 547). While context is the chief determiner of the meaning of ‘*śh* in the Old Testament, its two chief senses are making something as an act of creation (*ex nihilo*) or refashioning in some way something that already exists.

The meaning of being made in the “image of God” referenced here occupies biblical commentators and theologians to this day. Four principal views have developed over time along with many variations of them (Blocher 2001: 79-88):

- Image as spirituality (Philo, Hellenistic *Wisdom of Solomon*)
- Image as dominion (Ecclesiasticus 17: 3-5 and ancient Judaism)
- Image as original righteousness (Luther and many Protestants since)
- Image as human relationship, including sexuality (Karl Barth, Eastern Orthodoxy)

Being made in the image of God could include human technological capability, although many theologians holding views other than image as dominion would not readily embrace this view. Some commentators, like Jacques Ellul (see below), would explicitly reject it due to the radical break created by the Fall. Recently, Schüle (2005: 4-7) has analyzed the Priestly Code sections of Genesis and finds four different dimensions of *imago dei* that constitute a “*thick* but nonetheless *vague* symbol” that mixes in ways that may never be untangled references to creation, religious practices, human physiology, and human sexuality. He points out that only Adam is proclaimed to be “like” God and sees in the exercise of *dominium terrae* in Genesis 1:28 a parallel to other Ancient Near Eastern concepts but a broadening of what was retained exclusively for the power of the king in other ancient literature into a transformation in the Hebrew Scriptures to the entire human race with a creativity birthed by God that makes humans the agents of *Elohim* as they execute “creative powers on all cosmic levels – the seas, the earth, and the skies (Schüle 2005: 6).

Genesis 2:7 relates, “then the Lord God formed man of dust from the ground, and breathed into his nostrils the breath of life; and man became a living being.”¹ The assonance of the one long sentence that forms Genesis 2:4-7 of *hā’ādām . . . min-hā’ dāmā* can be thought of in English as something along the lines of “God formed earthling from the earth” (Hamilton 1990: 156) or as Robert Alter (1996: 8) expresses it, “God fashioned the human, humus from the soil . . .” In similar fashion, Genesis 2:19 records “And out of the ground the Lord God formed every beast of the field and every bird of the sky, and brought them to the man . . .” The identical verb is used for creation activity related to both humans and nonhumans. The image of the potter, found elsewhere

in literature of the ancient Near East, reinforces for the reader/hearer the intimate connection between creation and creator while underlining the earthen, “of this world” nature of the creature and its connection to the environment over which it will have dominion (Fretheim 1994: 349f.; 2005: 36f.). It is also important to note that God proclaims human beings and indeed all aspects of his creation as “good,” not just beautiful in itself but in relation to other creatures and things that have been created (Pannenberg 1985: 77f.). There is a community of existence within the creation accounts where it is clear that human beings are part of the environment even as they are singled out particularly within the narrative (Moltmann 1993: 186f.). Human beings, in the view of the Old Testament, are God’s partners “situated in the same transactional process with the holiness of Yahweh as is Israel, so that in a very general way the character and destiny of human persons replicates and reiterates the character and destiny of Israel” (Brueggemann 1997: 451). The concept of human beings as autonomous is quite foreign to the Biblical worldview. Human beings only exist and have meaning as they have relation to Yahweh.

God also is the one who makes (‘*śh*) a new heaven and new earth for this people. Isaiah 66:22-24 declares: “For just as the new heavens and the new earth which I will make will endure before Me, declares the Lord, so your offspring and your name will endure.” Viewpoints as divergent from one another as conservative evangelicalism and P and J source criticism see chapter one’s focus on God’s preparation of a land for His people – arguing that this is the story of the Old Testament (e.g., Sailhammer 1996: 19, 130f. with Gunkel 1997: 165). Dearman (1992: 146) affirms, “Just as Yahweh chose (*bhr*) Israel from among the peoples as a special possession, so Yahweh will choose (*bhr*)

¹ All Scriptural quotations are taken from the New American Standard Bible, 1977 edition.

a place (*māqôm*) from among the tribal lands to cause his name to dwell there.” The eschatological view expressed by the prophets is then a further extension of God’s continuing desire to have a pure land within which can dwell His purified people (Brueggemann 2002: 187-191). Thus, even by the seventh day of creation, we see the plan of Israel’s future, and by implication the establishment of a system.

He begins the process of “making” a people to declare his name by telling Abram in Genesis 12: 2, “And I will make you a great nation, and I will bless you, and make your name great; and so you shall be a blessing.” Here the focus is not just on an individual but on a whole series of acts by God over time that will bring into existence something uniquely His and “fashioned” to accomplish His purposes and plans in the earth and with whom He will have communion via various mediatory mechanisms. The intentionality, or in modern parlance “strategic planning” which is demonstrated here and the manner in which the writer stresses how God acts on a continuing basis to bring it about makes this for our purposes, a *technological* activity in keeping with our earlier definition. Later the Lord declares to Moses “Then I will take you for My people, and I will be your God; and you shall know that I am the Lord your God, who brought you out from under the burdens of the Egyptians” (Exodus 6: 7). We have images in the Old Testament of God as a potter moulding his people (Jer. 18:3), acting on behalf of His people (Isa. 5:4), granting a new heart (Ezek. 11: 19; 36: 26-29), and engaging in acts of justice and judgment (e.g., Ezek. 5: 10, 15; 11: 9; 25: 17; Judg. 11: 36). We can agree with Simkins (1994: 121) who underscores the point that at the core of the Israelite religious tradition is the recognition of God’s activity in both the affairs of nature running the gamut from annual agricultural cycles to natural catastrophes to the affairs of human

beings in times of prosperity and peace and times of chaos and warfare. All have meaning and purpose since all of Israel's experiences are part and parcel of the acts of Yahweh.

Yahweh is the god who acts, creates, makes, fashions, shapes, moulds, breaks, and prepares. Intentionality on the part of God becomes a vital key to understanding who he is – and we come to know *who* he is by what he *does*. The making, fashioning, and other metaphors used to refer to the acts of God throughout the Old Testament links what God does to *technological* activities and it is in the execution of those activities that we come, operationally and experientially, to understand who God *is*. William F. Albright and his students argued that the name of Israel's God, *Yahweh*, reflects creation.

“Grammatically, the name is a causative verb that literally means ‘he who brings into existence,’ or ‘he who creates’” (Simkins 1994: 90; cf. Freedman 1997: 82-87). Not only is God present and active at creation, but also creation in the biblical sense is understood as a continuing activity that transcends time. An image of Yahweh as a distant deity who simply winds up the clock of the universe at a single point in time and then “lets it go” is absolutely foreign to the worldview of the ancient Israelites and their texts. God appears not only in the linear sequential series of acts in Genesis and throughout the lives of the patriarchs but also manifests Himself through the various cyclical processes of the year and multi-year cycles such as springtime and harvest, the seasons, and the life cycles of both human beings and nations (Simkins 1994: 127f.).

As Eugene Carpenter says, “In sum, the Lord is the doer (‘*ôśeh*) of all things, and the proper subject of this ubiquitous vb. [‘*śh*] in the OT” (Carpenter in Van Gemeren 1997, 3: 549). Thus the Lord is fundamentally engaged in the design of patterns and the creation of systems. Yahweh engages in what we can only describe as technological

activities combining human and nonhuman resources in various ways to accomplish His plans and purposes in the universe and principally among humankind. We have in the Old Testament, therefore, an organic unity between God and His creation, including human beings. Humans are granted dominion over the earth but in a manner that is qualified as they are accountable to God for their actions (Dyrness in Granberg-Michaelson 1987: 52).

This interplay between acts and results leads to a clear image that God, as the master builder, rejoices in each and every element of His creation, declaring it intrinsically “good” (Barth 2004, III.1, esp. 330, 363-365). Michael Welker (1999: 9-13) has focused our attention in Genesis 1 and 2 on God as not just someone who serves as “causation” in order for “production” to occur, but as a being who engages in “reactive experiencing.” God perceives and evaluates, responding actively to the results of His own creative efforts in an ongoing engagement with His creation, epitomized most forcefully in His interactions with the human who provides important input on a current state of affairs (his loneliness) to which God creatively responds by creating woman – taken from the man and in a manner full of grace, given back to the man as so much *more*. This evokes images of the work of modern engineers and artificers who have deep and iterative relationships with their creations where they constantly seek to optimize the design and minimize its negative consequences. There is a relational theology of creation with both God and human beings “involved in creative activity for God’s sake” (Fretheim 2005: 270-273).

The created realm itself has value for God and creation is an ultimate end rather than a means to an end. At each point in the process God stops, contemplates, and evaluates and declares it “good” (Santmire in Granberg-Michaelson 1988: 179).

The New Testament reaffirms the statements of the Old Testament of God as Creator. Mark 10:6 records Jesus saying “But from the beginning God made (*poieō*) them male and female.” The Early Church in Jerusalem prays after the deliverance of Peter and John affirming “O Lord, it is Thou who didst make the heaven and the earth and the sea, and all that is in them . . .” (Acts 4: 24). One of many angels in the book of Revelation (14: 7) declares, “Fear God, and give Him glory, because the hour of His judgment has come; and worship Him who made the heaven and the earth and sea and springs of water.” The writer of Romans (1: 20) goes so far as to assert that “. . . since the creation of the world His invisible attributes, His eternal power and divine nature, have been clearly seen, being understood through what has been *made*, so that they are without excuse.” In other words, God can be known vicariously through tacit familiarity with his technological feats.

Historically, the Church and selected philosophers and theologians have used these activities of God (although usually not drawing from biblical references) to frame an *argument from design* for apologetic purposes ranging from Leibniz’s concept of God setting the world in mechanistic motion to Newton’s vision of continuing but episodic interventions, to Kant’s thought of God as supreme architect with Hume remaining unconvinced by these arguments (Ashworth 2003; Ratzsch 2001). William Paley’s rendition is one of the better known expressions of the argument from design while today’s weak or strong versions of the anthropic principle and the existence or

nonexistence of multiverses finds the debate engaged anew with John Barrow, Frank Tipler, Freeman Dyson, Steven Weinberg, Stephen Hawking, Andrei Linde and the late Ilya Prigogine a few of the main combatants (Rees 2002; Davies 2004; Barr 2003; Ellis 1996). The Intelligent Design movement in the United States has declared itself as heir apparent to Paley, although many other scholars within and outside of Christendom are less convinced of its cogency (cf. Dembski 1998, 2004 with Forrest and Gross 2004; Young and Edis 2004; Shanks 2004). As Martin Krieger (1990:229) has remarked, “Arguments from design are just a part of the composition of the world.” Such arguments continue to thrive and evolve due to the perceived “engineered” aspects of the cosmos, the work of a grand, continuously engaged, cosmic designer who is a technologist *par excellence*.

The writer of Romans when speaking of Abraham as a model of justification by faith says, “yet, with respect to the promise of God, he did not waver in unbelief, but grew strong in faith, giving glory to God, and being fully assured that what He has promised, He was able also to *perform*” (Romans 4: 20-21, lit. “to do”). I Thessalonians 5:24 declares “Faithful is He who calls you, and He also will bring it to pass.” God, in the fulfilment of His plans and purposes, acts in human history configuring and reconfiguring systems of people, resources, time, and space. Performance, bringing things to pass, is seen not as fortuitous, opportunistic series of events that occur randomly but as the outcomes or end products of a God who patiently works in and through human beings, governments, nature, and other means to accomplish *particular* plans. Biblical writers do not presume to know what those plans are with clarity when facing the future but are quick to ascribe outcomes to be the result of prior workings on the part of God.

We might term such a view *engineered outcomes* where the end desired state is realized through an explicit series of deliberate acts that lead to a desired result, all the while taking account of environmental changes and creatively addressing the consequences and necessities of those changes in a continuously evolving design pathway. A key difference, however, between the portrait of God as maker of heaven and earth in the Bible and contemporary ideas of technologists is the manner in which God is intimately connected with the creation itself as a work of love so that love itself might flourish (Lodahl 2003: 57).

This conceptual metaphor for God's activities aligns with Aristotle's original definition of *techné* as a habitual disposition that is in accordance with a correct understanding of the thing to be made (*Nicomachean Ethics* 6.4.1140a11). Aristotle connects his famous four causes (material, formal, efficient, and final) by references to technical products to show how purpose, raw materials, and existence as a thing are all intertwined (*Physics* 2.3). This ancient conception focused on the manner in which the artisan brought out of the material that which was already there, allowing it to emerge as the material was worked with each production uniquely suited to that for which it was already prefigured, although always less than the union of form and matter found in nature itself (*Physics* 2.1193a12-17). Aristotle and Socrates along with their peers would have reacted strongly against any notions of mass production. God the creator as portrayed in the Bible creates that most perfect union of form and matter as a consequence of His own will and desires, infused and informed by love.

Reading the Scripture as a series of systems descriptions will, of course, take us far beyond the *Sitz im Leben* of the writers or even how various theologians and exegetes

have read the scriptures in the past or present. The frame within which one approaches Scripture may have much to do with what is “found” there as one compares the Westminster School of evangelical American Protestantism, Yale School of narrative theology, dispensationalism like that of the late C. I. Scofield and his disciples (e.g., Dallas Theological Seminary), and contemporary liberation theologies. The theological enterprise is itself a dynamic exercise in creative imagination that profoundly shapes the tradition itself and influences how this tradition is appropriated within the Church and responded to by those outside of the Church. Never is the past simply “received” as tradition but rather the tradition is always creatively read, understood, and reinterpreted in light of present realities. The theological enterprise maintains meaning and relevance in the contexts of the present rather than remaining completely and inexorably attached to prior meaning or fixed at a particular point in space and time. It subsumes but also transforms in fruitful ways the best of the past as defined by the needs of the present and facing toward the future (see the superb exposition of this point by Brown 1999, 2000 and the appreciative comments of Barr 1999: 586-604).

Christ’s sacrificial death on the cross could also be viewed as an explicitly goal-directed behaviour designed to achieve certain results. By its very nature then, we can construe it as a “technological” act, minimally at least in a metaphorical sense, following our definition as “the application of knowledge, tools, skills, and systems to solve practical problems, extend capabilities and expand opportunities to meet or invoke human needs.” Ephesians 2:13-16 shows how Christ as supreme technologist becomes both artefact and the means (system) through which grace is effected: “But now in Christ Jesus you who formerly were far off have been brought near by the blood of Christ. For He

Himself is our peace, who made both groups into one, and broke down the barrier of the dividing wall, by abolishing in His flesh the enmity, which is the Law of commandments contained in ordinances, that in Himself He might make the two into one new man, thus establishing peace, and might reconcile them both in one body to God through the cross, by it having put to death the enmity.” Similarly, Hebrews 7:26-27 affirms, “For it was fitting that we should have such a high priest . . . who does not need daily, like those high priests, to offer up sacrifices, first for His own sins, and then for the sins of the people, because this He did once for all when He offered up Himself.” The old technology system (law and sacrifice) is superseded by its fusion into the new system of the Paschal Lamb. Not all of the old is superseded in the new, however, as faith remains a constant component of both systems (Hebrews 11) and in both cases, God seems more interested in getting systems in place (sacrifices) than He is on particular individuals (be they lambs or His one and only Son). Certainly penal theories of substitution, or “satisfaction” as it is coming to be retitled by evangelicals in a rediscovery of Tertullian and other early church fathers (Williams 1999), have argued that God willingly submits Himself to the dictates of His own law and becomes subject to what amounts to a *technological* system of His own making characterized by inevitability (e.g., Erickson 1998: 833-840).

2.1.2 Use of Technology among Humans in the Bible²

Technology in human cultures predates science by millennia. It is not surprising, therefore, that the Old Testament is replete with references to technology commencing with the first chapters of Genesis. Genesis 2:5 describes the early Earth by saying, “Now no shrub of the field was yet in the earth, and no plant of the field had yet sprouted, for the Lord God had not sent rain upon the earth; and there was no man to *cultivate* the ground.” Fretheim (1994: 349; cf. 2005: 53-56) comments on this passage:

The earth remains in a pre-creation state, not only because God has not yet done something, but also because no human beings are active. The divine purpose for the man in 2:15 is expressed with the same word (*šāmar*, “keep,” “protect”). This change gives responsibility to the human being, not simply for maintenance and preservation, but for intra-creational development, bringing the world along toward its fullest possible potential. God intends from the beginning that things not stay just as they were initially created. God creates a paradise, not a static state of affairs, but a highly dynamic situation in which the future lies open to various possibilities.

Many have seen this comment by the writer of Genesis as a clear indication that Adam in Eden was both a worker and in our terminology here, a technologist. If Adam was required by God to cultivate the Edenic soil, then surely he must have employed tools and God must have intended from the beginning to both endow and allow human beings with the capability to make changes in their environment. Lutheran theologian Philip Hefner (1993: 35-39) has taken the insights of modern science along with those of classic theology to take this idea one step further and infer that due to both our evolved status and our freedom to act within the world, that *co-creator* is God’s intention for human

² This thesis will not consider relationships among technology in the Old and New Testaments and that of other ancient peoples (e.g., Sasson 1995) nor discuss the historicity of Biblical narratives. Its sole focus here is

beings. While his concept has been strongly criticized because of its strong overtones of equality with God (cf. Cole-Turner 1993: 98-103; Deane-Drummond 2001: 97-101; Hauerwas 1995: 108-124; Northcott 2005: 229; Waters 2006: 102-104) his views have drawn support from others (e.g., Peacocke 1979: 305; Peters 1997: 123; Peterson 2004: 828-829). Advocates of Hefner's view see the concept of co-creator as placing more rather than less accountability on humankind since "it suggests that we are as much in control or responsible for creation as God is" (Peterson 2004: 829). It also leaves the future as radically open rather than determined, although it should be pointed out that some scholars who diverge from Hefner on his concept would equally hold that the future could be open rather than foreclosed. More recently Hefner (2003) has argued that humans are cyborgs, that technology is the shape of religion, and that technology is both a sacred place and a medium of divine action and self-transcendence.

Not all commentators or theologians see Gen 2:5 as determining a pattern for man's efforts in the Garden that is identical to what we today mean by the terms "work" or "technology." Jacques Ellul is a most forceful spokesperson for this viewpoint, arguing that there is collaboration between human beings and God but that it is not creative since man before the fall adds nothing to creation in any way since it is already good (perfect). Work in the Garden bears no relationship to work as we know it after the Fall (Ellul 1984: 125f.).

Another indisputable ancient technology that clearly mirrors today's technology (*technique*) is human language. Genesis 2:19 – 20a records, "And out of the ground the Lord God formed every beast of the field and every bird of the sky, and brought them to

on perceptions of technology and technological systems among the Biblical writers as arranged in the Protestant biblical canon.

the man to see what he would call them; and whatever the man called a living creature, that was its name. And the man gave names to all the cattle, and to the birds of the sky, and to every beast of the field . . . “ Adam then becomes a co-technologist with God as the Creator brings his creations to Adam in order for Adam to christen them with a name – which God Himself presumably also applies to the creatures following Adam’s lead. We perhaps see hints here of a single unitary language spoken by both God and man – a linguistic harmony to be later disrupted by the arrogance of Babel.

Some have erroneously discerned in this naming process the work of the first taxonomist who “scientifically” assigns creatures to various categories based on similar characteristics – a Hebrew speaker who anticipates Linnaeus by millennia. This likely reflects the human authors’ search for systematization of God in the Bible in a manner that may, in fact, not be fully reflective of either the nature or character of God. Two distinct yet superior alternatives to this interpretation present themselves. Ellul explains the one that has attracted the most support as follows:

To assign a name [biblically] is to discern a spiritual reality; it is to assign a spiritual value; it is to set forth a role, a destiny; it is to establish a relationship for God. To give a name to something is to reveal it in its entire being and to put it at the disposal of the speaker. It is to accord it truth (and not reality). Biblically, we have a spiritual act that has nothing in common or no point of contact with the intellectual operation of science Let us reflect further. This naming was also an act of dominion by which he affirmed himself as Master. It was not in using or constraining creation that he was the Master, but it was in naming, that is, in speaking. He used the word – like God. Adam, in the image of God, spoke as God has spoken” (Ellul 1984: 130f.).

It is this focus on dominion as a property inherent in Adam’s naming of the creatures that Lynn White (1967), the noted Christian medievalist, expanded into an argument about Western culture’s rape of the environment which was viewed as fully enabled by a Judeo-

Christian tradition that had lost its way and was badly in need of reformation. White (1967: 1205) asserted: “The victory of Christianity over paganism was the greatest psychic revolution in the history of our culture Christianity is the most anthropocentric religion the world has seen By destroying pagan animism, Christianity made it possible to exploit nature in a mood of indifference to the feelings of natural objects.” This view was widely accepted in the years following his address to the American Association for the Advancement of Science annual meeting and “while it is an exaggeration to claim that Christianity is largely responsible for negative attitudes toward nature, it is also an exaggeration to claim that it is largely innocent” (McDaniel 1994: 71). White’s influential thesis is today viewed as a gross overstatement although it surely accomplished the author’s purpose to draw attention to what he thought was a misunderstanding of the proper role of Christianity in relation to the environment (cf. Welker 1999: 70ff.; Beisner 1997: 130-133; P. Harrison 1999; F. Harrison 1990). As Jewish commentators have traditionally noted, God’s charge to Adam to “fill the earth and subdue it” (Gn. 1: 28) is offset by the charge to cultivate the Garden and guard it (Gn. 2: 15). The Torah also contains laws designed to protect animals from human abuse and to prevent the indiscriminate destruction of fruit trees (Wurzbarger 1994: 12).

A second alternative regarding the significance of naming is to argue that many biblical scholars have misinterpreted the original author’s intent in Genesis. We need not see this as a story designed to show human dominance over other creatures where naming of another constitutes power over that other. The narrative is building toward a focus that there is no creature with whom Adam can share companionship. Adam discerns that no other creature is like him in the vast cornucopia of creatures that pass before him, which

sets the stage for the creation of woman (Simkins 1994: 183). This second view finds support among theologians like Wolfhart Pannenberg (1985: 77f.) and John B. Cobb (1972: 48ff.).

Regardless of which interpretation is correct, for our purposes here, we can clearly see that human language, as a technology for communication between God and man is present in the Garden. Presumably the biblical writer wants us to infer that God has endowed his creature with the ability to speak as a special gift (cf. Sarna 1989: 22). We see humans employing their new technology, language, in the service of malevolent desires as Genesis 3 records the conversations among Eve, the serpent, and Adam that lead directly to the fall. Thus, the earliest chapters of Genesis enshrine one of the important principles about human technology – the same technology can be employed for radically different purposes, some of which can be characterized as “good,” some as “bad/evil,” and others as neutral in their moral status.

The consequences of the Fall are catastrophic as Adam and Eve are sentenced and put out of the Garden. The disarrangement is catastrophic for all concerned as:

Every conceivable relationship has been disrupted: among the animals; between an animal and humans; between the ground and humans; between human beings and God; between an animal and God; within the individual self (e.g., shame). More abstractly, one could speak of humiliation, domination and subordination, conflict, suffering, and struggle. The sentences touch every aspect of human life: marriage and sexuality; birth and death; work and food; human and nonhuman. In all of these areas, one could speak of death encroaching on life. Disharmony reigns supreme (Fretheim 1994: 362f.).

Schuurman (1984) sees a fundamental divide in humanity between technology before and after the Fall – not in its substance but in its fundamental intents and purposes. Humanity from thence onwards has exhibited a will to power and technology is transformed into *technicism*, the idolatry that exalts human capabilities and skills above that of God,

substituting human creations for the Creator. Ellul alleges that religion, commencing with the sacrifices of Cain and Abel, is one of many techniques that humans employ after the Fall to effect changes in the world. Religion is a way to approach the God that one can no longer approach directly and intimately as in the Garden. Ellul within his system of thought views all religion as *technique* believing that much of it does not lead toward God but toward an exaltation of form over substance, symbols over transcendence, the creation for the Creator (Ellul 1983: 126-156).

Before expelling the humans from the Garden, God engages in yet another technological act as “. . . the Lord God made garments of skin for Adam and his wife, and clothed them.” (Gen 3:21) These garments (*kotēnôt*) should be thought of as tunics, or durable garments, not merely animal skins. They contrast with the pitiful attempts of the humans to fashion their own garments out of leaves and illustrate God’s grace toward His now fallen creatures (Mathews 1996: 255; Sailhammer 1990: 58).

Chapter 4 of Genesis intimates that humankind has already developed technologies of animal husbandry and rudimentary agriculture as witnessed by the conflict between the two brothers, Cain and Abel. Earlier commentators have seen in this chapter the conflict between two very different lifestyles in the Ancient Near East as sedentary patterns of existence begin to challenge or supplant nomadic patterns of existence [ultimately perhaps 90-95% of the population of ancient Israel would engage in farming or extraction of raw materials according to Rohrbaugh (1993: 4ff.)]. The more likely “story within the story” revolves around issues of primogeniture and sibling rivalry – themes that serve as a thread throughout the rest of Genesis. Another alternative is that the writers see God favouring the younger and weaker over the older and stronger just as

He will come to favour Israel over other much more powerful nations, the young Joseph over his older and more experienced brothers, and fishermen over the learned and educated as the first preachers of the Good News, reminding all of us that “. . . God has chosen the weak things of the world to shame the things which are strong” (I Cor. 1: 27).

Abel and Cain also have taken the first steps in formulating a system of sacrifice perhaps also employing some type of undefined liturgy (v. 4), although envisioning an accompanying altar is not necessarily warranted. This system receives extensive elaboration within the book of Genesis and become even more complex as the Israelites exit from captivity in Egypt.

Animal husbandry receives further stimulus from the creative work of Jabal (4: 20). Cain builds the first “city” in verse 17, naming it after his son Enoch. Verse 21 attributes the origins of musical instruments (lyre and pipe) to Jubal, brother of Jabal (v. 20). Verse 22 also informs us of metallurgy by Tubal-cain who is working in both bronze and iron. Some have interpreted the conjunction of these technologies with the line of Cain as a negative biblical view toward technology. This need not be the case however as the names of Lamech’s four children denote capability, productivity, and beauty with the seven generations of Cain mirroring the seven days of creation (Fretheim 1994: 375; 2005: 78f.). The writer is principally focused on making the point that knowledge of the past is going to be passed down through Noah and his family and become the inheritance of Israel since that is the key thread of the main story through the early chapters of Genesis (Fretheim 1994: 377). The reference to Tubal-Cain’s work with bronze and iron flies in the face of standard contemporary understandings of the periods (Stone, Chalcolithic, Bronze, and Iron ages) in human prehistory and history (cf. Levy 1998:

233f.). It may be anachronistic (so Speiser 1964: 35 but see Westermann 1994: 333). The reference may be to meteoritic iron and surface deposits of copper that were hammered (*lātaš*), similar to copper examples from Turkey dated to the sixth millennium BC and iron amulets from the third millennium BC (Hamilton 1990: 239; Mathews 1996: 287). Regardless, we can affirm with Westermann (1994: 333f.) that Genesis 4:22 stands for the proposition that technology can lead to (positive) progress (concurrence by Fretheim 2005: 78). There is even a firm hope expressed in the Old Testament that God will ensure that the technologies of war will be displaced by technologies of peace (Is. 2:4; Mi. 4:3).

Drawing upon detailed study of the J creation account by Kawashima (2004) who draws substantially upon the original insights of Westermann (1994: 56-62), we can glean yet further insights regarding the ancient Hebrews' understanding of technology and its relationship to both God and human beings. The Garden of Eden can be seen as a "culturally bounded space" which is juxtaposed by the writer to the outside field (*šādaeh*) that lacks cultivation and water – a huge divide between nature and culture (Kawashima 2004: 486). Human kind falls and reaps the consequences as Yahweh's presence is withdrawn, humans experience death, and now they must cultivate plants of the field (*'ēsaeb haššādaeh*) forsaking their earlier diet of fruit. Bread (cooked grain) and a whole history of human achievements arise in the face of want and desperation as the banished humans apply knowledge and skills to solve very real problems confronting them resulting in innovation breakthroughs associated with tent-dwelling, animal husbandry, music, metalworking, and urban life. Kawashima (2004: 485) observes that "in the process of compensating for this . . . lack, humans construct their uniquely mortal existence: civilization in response to a cursed nature; fame in response to a foreshortened

life; worship in response to a distant God. In this way, humankind comes to define itself as *homo faber*, “man the maker.” The P narrative attributes culture to divine revelation while the J narrative attributes culture to human ingenuity.

Human arrogance reaches a point in these primordial times where God determines to rid the earth of humankind except for the righteous Noah and his family (Gen. 6:5-8). A very elaborate palistrophe spanning Genesis 6:10-9:19 then relates the salvation of Noah, his family, and selected animals and the utter destruction of all other living things (Wenham 1994: 438). At the core of this narrative, we learn that Noah makes a triple-decker ark with dimensions and following instructions decreed by God (Gen. 6:14-16; cf. discussion in Westermann 1994: 418-422) and likely a parallelism to the later birth and rescue of Moses on the part of the writer(s) of the Torah (Cassuto 1992: 59). God employs through the person of Noah a *technological innovation* as the principal means to save this righteous man and a remnant of animals and humans for the future. Through the J narrative we also learn that Noah plants the world’s first vineyard and discovers how to ferment the fruit of the vine (Gen. 9:22) with attendant consequences that still plague society today (Kawashima 2004: 490).

Then we come to the famous site of Babel, where humans in an “arrogant abuse of technology” (Westermann 1994: 53) attempt to ascend to the heavens – the very dwelling place of God. Babel, the archetype for all cities and urban life through time, becomes a confusing place with a multiplicity of languages and a site of human discord rather than harmony (Westermann 1994: 554ff.). The Noachic Flood Generation and the Tower of Babel and its Generation of Division become common motifs within rabbinical tradition for the wickedness of humanity and God withholding His light for the

“righteous in times to come” (Van Bekkum 1998: 126f.). The Bible ultimately restores that which God severed in the image of the New Jerusalem where seemingly one language for “every kindred, tribe and tongue” now predominates in the simultaneous worship of the Lamb around the throne of God (Rev. 21-22).

Biblical writers assign neither positive nor negative attributions to many of these technological applications and inventions but simply catalogue their appearances in association with particular individuals. Humans, made in the image of God, fashion and refashion materials derived from many sources in pursuit of human goals. It is in the fashioning of systems and the implementation of such systems in opposition to God’s will (or His grand design), that trigger judgments from the Lord with attendant negative consequences.

An exhaustive treatment of technologies within the Old and New Testaments is beyond the scope of this thesis. We can, however, note in passing the occurrence of several hundred different technological artefacts, methods or techniques, and technological systems within the Bible. Broad general categories include systems and artefacts related to agriculture, education, economic life, social life, war, worship, death, government, horticulture, the arts, literature, real estate, and health and hygiene. Diverse examples include altars (Gn. 8:20) and anchors (Ac. 27:29), baskets (Nu. 6:15) and boundary markers (Jb. 24:2), carts (I Sam. 6:7) and contracts (Gn. 23:20), dungeons (Jud. 16:21) and dyeing (Is. 63:1), earrings (Eze. 16:12) and education (Da. 1:17), feasts (I Chr. 12:39) and fortifications (II Sam. 20:15), gallows (Jos. 8:29) and golden calves (II Chr. 11:15). An army of craftsmen from many nations is employed in the building of the Temple, second Temple and the palaces of the Hebrew kings (as seen both biblically and

archaeologically). The many biblical references attest to both the widespread deployment of technologies across the culture and the use of technological artefacts and processes as metaphors to better understand both divine and human actions. God's word is a "lamp unto our feet and light to our path" (Ps. 119:105). The people are admonished to "Drink water from your own cistern and fresh water from your own well." (Prov. 5: 15) The metallurgist's craft becomes a metaphor for the actions of the prophet and the word he brings from the Lord: "I have made you as assayer and a tester among My people, that you may know and assay their way They are bronze and iron; they, all of them, are corrupt. The bellows blow fiercely, the lead is consumed by the fire; in vain the refining goes on, but the wicked are not separated. They call them rejected silver, because the Lord has rejected them." (Jer. 6:27-30) Amos declared that the Lord "will shake the house of Israel among all nations as grain is shaken in a sieve, but not a kernel will fall to the ground." (Amos 9:9)

We should also not forget that Jesus is the carpenter's son (Matt. 13:55) and Paul is an occasional tentmaker (Ac. 18:3). Peter, a fisherman (Matt. 4:18), stays with a tanner (Acts 9:43) while the troublesome Christian (?) Alexander is a coppersmith (II Tim. 4:14). Jesus uses lamp stands (Luk. 8:1; Matt. 25), a fishing dragnet (Matt. 13: 47), working in a vineyard (Matt. 20: 1-16 and Lk. 20:9-16), a winepress (Lk. 6:38), venting wine (Mk 2: 22), a house on a firm foundation (Lk. 6:48), a cornerstone (Lk. 20:17-18), sewing (Mk. 2:21), and an acropolis itself (Matt. 5:14) to illustrate spiritual truths. He employed boats as part of his mobile Galilean ministry (e.g., Lk. 8:22-35, Mt. 9:1-16) and made many strategic trips over the roads of the region during his three years of public ministry.

In the words of civil engineer, Samuel C. Florman (1976: 100), “In the Old Testament . . . we find ourselves in an ancient, barren landscape, where man-made objects are the subject of wonder and delight.” We can affirm with Newman (1997: 116f.) that:

“... the serious student of Scriptural theology can hardly afford to overlook that large parts of Hebrew Scripture are given over to what amounts to detailed technological instruction, in which the children of Israel or particular Israelites are guided in exactly how to go about performing essential tasks, both sacramental and worldly. The reader of Hebrew Scripture is constantly reminded of the precision that one is obliged to bring to doing certain jobs and making certain objects. The Torah is often spontaneously associated by Jews and non-Jews alike with God’s commandments and laws; but what is so often overlooked is the fact that the instruction provided in the Torah regularly takes the form of the master Creator-Craftsman’s directing students and apprentices on how to perform tasks that for a variety of rather different reasons they find themselves required to perform. The Torah does not legislate; it instructs. It shows those who will hearken to its teachings how to perform countless specific procedures, and of course, it provides general instruction on how to live in accordance with both natural desire and Divine purpose.”

Archaeology has in more recent time greatly expanded our knowledge of technology in use within ancient Israel. Excavations of Middle and Late Bronze and Iron Age sites across Israel reveal distinctive technological artefacts associated with Israelite cultic practices while also exhibiting clear associations with the various cultic (“idolatrous” in the words of the Old Testament writers) practices of their neighbours and competitors (Nakhai 2001: 81-193; Keel and Uehlinger 1998). Cities and even small towns within ancient Israel reveal marked dispositions in style and sometimes innovative architectural and engineering features in regards to citadels, tripartite-pillared buildings, sanctuaries, and water systems (Fritz 1995, De Geus 2003). These architectural designs and materials show strong affinities to assemblages located outside of Israel. An entire set of integrated technologies can be seen in the artefacts revealed by archaeological

excavations including agricultural technology, animal husbandry, mining technology, manufacturing, the technology of war, measuring systems, tools, and writing (Deist 2000: 189-232; King and Stager 2001: 85-121, 164-175, 223-258, 300-318). Musical instruments and arts of various kinds have surfaced in excavations that enrich our understanding of these aspects of daily and religious life well beyond that described within biblical texts (Braun 2002; King and Stager 2001: 129-161, 285-299). The ancient Israelite house, especially in its pillar-courtyard rendition, was a living testament to the merger of various technologies under one roof, providing space for food processing, stabling and care of animals, storage of food and water, dining and sleeping facilities – an arrangement seemingly modelled after Egyptian prototypes rather than growing out of the Israelite wanderings in the wilderness as dwellers in tents. Villages also were organized in a manner that efficiently capitalized on these features (King and Stager 2001: 28-35; Dever 2003: 102-107, 163-165).

Looming large in the Old Testament is the extensive technological system of sacrifices, systematic rituals employed as humans seek the divine – many of which once again are presented in the narrative as decreed by God as to the form and function they should take. These serve collectively, and consistent with our earlier definition of technology, as “the application of knowledge, tools, skills, and systems to solve practical problems, extend capabilities and expand opportunities to meet or invoke human needs.” Gorman (1990:19) points out that *ritual* “ . . . refers to a complex performance of symbolic acts, characterized by its formality, order, and sequence, which tends to take place in specific situations, and has as one of its central goals the regulation of the social order.” Not all who study religion from a scholarly perspective would agree with this

highly functionalist definition which focuses on the externality of the practices to the exclusion of simultaneously exploring the internality of these practices as they are perceived and acted on by believing participants (cf. Waaijman 2002: 307-366). No matter which way we read the *meaning* of ritual, sacrifice may qualify as one of the most complex and certainly one of the most important technological systems within the Hebrew Bible in terms of its spiritual and cultural significance. These sacrifices and their attendant rituals focused on expiation, consecration, and communion, can be classified as technologies because they represent ways in which humans have fashioned resources within their environment and control to accomplish/meet human perceived needs, in this case the need to obtain divine forgiveness for sins (Dearman 1992: 47f.).

As we have seen, its origins in Scripture are dated to the time of Cain and Abel (Ge. 4) with the first burnt offering offered on an altar by Noah (Ge. 8:20). Abram builds a series of altars to God as he first enters Canaan and passes through it to Egypt (Ge. 12). The exact nature of these early patriarchal altars is not specified by the writer or the kinds of sacrifices that are offered on them. Yet clearly the narrator assumes some pattern reasonably established since Isaac knows that Abram usually offers a lamb as the sacrifice (Ge. 22: 7). Yet God does not leave the patriarchs solely on their own to develop a technological system of sacrifices. He gives Abram explicit directions in Genesis 15 as to the kinds of sacrifices Abram was to provide. Whether Abram then follows his own design, some other pattern with which he was already familiar, or a pattern that God communicates is left unsaid by the writer. The sacrifice ritual itself bears marked resemblance to a purificatory ritual known from Hittite texts first translated

by O. Masson in 1950 as well as other scattered ancient references (cf. O. R. Gurney 1991: 151 and Hamilton 1990: 427-438).

That the Israelites place great stock in the efficacy of the sacrifice (artefact) to achieve its desired expiatory function is witnessed by their imploring of Pharaoh in Exodus 5:3: "Then they (Moses and Aaron) said, 'The God of the Hebrews has met with us. Please let us go a three days' journey into the wilderness that we may sacrifice to the Lord our God, lest He fall upon us with pestilence or with the sword. " It is also clear that the sacrificial practices of the Israelites were markedly different from those of the Egyptians as Moses counsels Pharaoh in Exodus 8: 26 when he asks them to go sacrifice to their God, "It is not right to do so, for we shall sacrifice to the Lord our God what is an abomination to the Egyptians. If we sacrifice what is an abomination to the Egyptians before their eyes, will they not then stone us?"

At the same time, we see God continually exercising a firm hand in the development of Israel's system of sacrifices with His stringent command to Aaron and Moses to offer their sacrifices to Him in the wilderness and not in the urbanized environment of Egypt (Ex. 8: 27). This reaches a zenith in their Egyptian sojourn with the explicit instructions from God of the procedures the Israelites must employ to avoid the Angel of Death who will strike down firstborn sons throughout the land of Egypt (Ex. 11-12). God also institutes via Moses the first feast for the collective tribes, the Feast of Unleavened Bread, as a continuing memorial of their deliverance commencing the very night in which it occurs (Ex.12:14-22).

The sacrificial system reaches its most extensive elaboration in the sacrifices of the Temple. Yearly a fixed number of bullocks (71), rams (15), lambs (105), and goats

(8) are required to atone for the sins of Israel and to make offerings to God (Beckwith 1996: 1036). These sacrifices are supplemented by the individual sacrifices required under the law (e.g., Lev. 4).

None of these sacrifices, however, exist in isolation. All are part of a much larger sociocultural and religious fabric that is ancient Israel. Worship, sacrifice, prayer, vows, warfare, dancing, religious instruction, and the ebb and flow of daily life are intertwined. Sacrifice is never an end in itself but always tied into one's personal piety before God and a reminder of His holiness and one's own sinfulness and dependency. Offerings, both communal and personal, occupy a significant place in daily life and the life of the community and become part of the bond that ties families, tribes, and the people of Israel together (Dearman 1992: 47f.).

These reflections demonstrate clearly that technologies play a major role in the Old Testament, in the life of ancient Israel, and in the New Testament. We also discern that technologies within both Testaments are neither inherently good nor evil. Human *intents* as they interact with the respective technologies or technological systems are key to judging any particular technology or system since even proper ritual procedures is no substitute for the intent of the heart (Eze 20:28; Hos 6:6; cf. Mk 12: 33). The biblical fall leaves humans in the position of developing culture but no longer being able to fulfil their original God-given functions. The environment itself becomes uncooperative and humans are simultaneously part of creation and yet alienated from it due to their sin. Human power and greed becomes a key subtext throughout the Bible, asserting itself over God's original intentions for creation and influencing human attitudes toward their technologies as well as each other (Schuurman 1984: 110). The "whole creation groans and suffers the

pains of childbirth . . . even we ourselves groan within ourselves, waiting eagerly for our adoption as sons, the redemption of our body” (Rom. 8: 22-23). Yet technological projects become a basis to create the means whereby human beings can worship God, whether in the form of the ark, the tabernacle, or the temple. All are designed to promote worship. They also provide opportunity for creative gifts to be exercised, for community to be enhanced, for technical skills to be offered unto God, and all are undertaken in a manner consistent with God’s instructions (Alexander 2003: 2).

2.2 Technology in Contemporary Theological Thought

The pervasive nature of technology throughout the Bible, an *assumed* environment for all that takes place in the narrative, is strikingly clear even from our abbreviated discussion. Early church fathers like Augustine admired what we would today call technology and believed that it served as a preparatory function for “understanding of the truth and constitutes a propaedeutic to the acquisition of wisdom” (Fortin 1984: 197f. citing *De quantitate animae*, 26.51; cf. Noble 1997a: 15). Augustine waxes rhapsodically about the genius of human beings and their arts as gifts from God, always imitative of the divine and not creative and always subordinate to wisdom and virtue (cf. *De civitate Dei*, 22.24; *De diversis quaestionibus* 83.78; *De musica* 1.3-6). In somewhat similar fashion Aquinas considers *ars* (which includes much of what we would call technology) as right reason in the area of making (*factibilium*) and an intellectual virtue (*Summa theologiae* I-II, q. 49 prologue and q. 90 prologue). Consistent with his first principle of natural law (*Summa theologiae* I-II, q. 94, art. 2), these arts are to be employed for good and evil is to be avoided. Technological advances may also be part of

the additive change to natural law that benefits human life while not in any way subtracting from that which is already in accord with natural law (*Summa theologiae* I-II, q. 94, art. 5). An entirely separate thesis would be required to trace the thin and fragmented discussions of what would today be considered technology in the writings of theologians across the centuries from the early Church to modern times as no one has searched the primary materials with this distinct goal in mind and no doubt much has been overlooked (cf. Jennings, Jr. 1990; McDermott 1992; Lazareth 2001; Stone 2001; Wengert 2004). Historic attitudes of Christians toward technology would in many cases have to be inferred from works of art and other evidence from material culture rather than explicit discussion by theologians. For example, the writer of the *Nuremberg Chronicle* in 1398 briefly argued that all machinery was from the Devil. Early images of the printing press feature ghostly skeletons hovering over the workers representing the impending death and decay that would emanate from the use of this new technological invention but by the 16th century they are replaced by angels who are helping the printers spread the gospel and dispel ignorance (White 1994: 17f.). Since the goal of this thesis is to consider how contemporary theology can interact with contemporary technology in all its manifestations this difficult but important task will not detain us (cf. Noble 1997a for a good beginning and a grasp of the difficulties). We will turn our attention to the question of how contemporary theology has both acknowledged technology as a potent force that shapes all within its “path” and the nature of any interactions and dialogue there might be between technology and theology.

A natural point of departure is to consider how systematic theologies or prolegomena to theology have taken up the issue of technology. A somewhat random but

diverse set of twenty-one mostly multivolume theologies produced within the twentieth and the dawn of the twenty-first centuries were selected for analysis. The authors of most of these works intended to produce systematic theologies. A few (e.g., Barth) explicitly deny that was their intent, but they are included here because they are important contributions to modern currents in theology generally or within particular traditions. Two Catholic theologies were included in the set to provide some balance, although a distinct missing voice is that of Karl Rahner who will be discussed separately below. In order to sweep the net as widely as possible, mention or discussions of modern science were included in the search through these volumes. Since the mention of technology was quite limited, the comments section usually highlights the main ways in which science is discussed.

Table B below details the findings. Technology is rarely discussed even in passing within these works despite the pervasive influence of technology within the modern world and its widespread influence within the Church and throughout Biblical times. One thinks of the tremendous innovations associated with great medieval cathedrals including the flying buttresses of Durham (invented by Norman masons and widely used in later Gothic cathedrals), innovations spread by the Benedictine order throughout Europe, Reformation preachers in Germany who dispensed knowledge of mining and minerals alongside that of the Bible, the ways in which religious thought motivated countless innovations or expanded their use such as printing, architectural structures, and artefacts associated with worship and ritual and mastering nature (Stewart 2006: 342ff.; Noble 1997a). The results might be explained on the basis that Protestant theologians in particular are apt not to discuss technology while Catholic theologians may

**Table B: Discussions of Technology and Science in Selected
“Systematic” Theologies of the Twentieth and Twenty-first Centuries**

Author(s)	Total Pages (English edition)	Pages mentioning technology	Ratio of technology to total pages	Pages mentioning science	Ratio of science to total pages	Additional comments
K. Barth (2004)	8,161	3	.00037	7	.00086	Technology generally viewed with suspicion
D. G. Bloesch (1992, 1994, 1995, 1997, 2000, 2002, 2004)	1,997	5	.0025	16	.0080	Technology as contemporary idol following Ellul
C. W. Carter, R. D. Thompson, C. R. Wilson (1983)	1,140	0	.000	2	.0018	Scientific study of Bible and relation between Bible and science
M. Erickson (1998)	1,253	1	.0008	13	.0103	Uses science as apologetic or foil
J. L. Garrett (1990, 1995)	1,446	0	.000	8	.0055	Uses science as apologetic or foil
W. Grudem (1994)	1,223	4	.0033	12	.0098	Uses science as apologetic or foil
D. J. Hall (1989, 1993, 1996)	1,524	24	.016	7	.0046	Recognizes serious need to engage with technology
G. Lewis, B. Demarest (1996)	1,353	0	.000	28	.0207	Uses science as apologetic or as foil
J. W. McClendon, Jr. (1986, 1994, 2000)	1,264	1	.0008	47	.0371	Seeks concord between science and theology
A. E. McGrath (2001, 2002, 2003)	915	0	.000	Pervades	.70	Anchors entire approach in scientific methods and dialogue with science

T. Oden (1987, 1989, 1992)	1,449	0	.000	34	.0235	Link between Christianity and sciences, accepts scientific methods
W. Pannenberg (1991, 1994, 1998)	1,558	3	.002	22	.014	Negative effects of technology within society
T. Peters (2000)	392	0	.000	9	.023	Dialogue with science
F. S. Fiorenza, J. P. Galvin (1991)	696	0	.000	25	.036	Relation to creation, limits of science, ecology
H. Thielicke (1974, 1977, 1982)	1,323	1	.0007	6	.0045	Argues human <i>will</i> affects uses of science and technology
P. Tillich (1951, 1957, 1963)	892	14	.015	3	.003	Discussed below
Van Noort, M.G. 1959a, 1959b, 1961)	1,112	0	.000	15	.013	No conflict between science & religion
G. Wainwright (1980)	462	1	.002	3	.006	Positive orientation to both S & T
O. Weber (1981, 1983)	1316	0	.000	0	.000	NA
O. Wiley (1940, 1943, 1952)	1,397	0	.000	0	.000	NA
J. R. Williams (1988, 1990, 1992)	1366	0	.000	7	.005	Science and creation sole focus
Median Totals	1,316	0	.000	8.5*	.006*	NA
Mean Totals	1,535	2.7	.001	12.5*	.008*	NA
Cumulative Totals	32,244	57	.001	264*	.008*	NA

* These columns are lower than actual due to the pervasive discussion of the sciences within the three-volume work of Alister McGrath, a molecular biophysicist and systematic theologian.

discuss it more frequently. Or it could be that writers in America, Britain, and Germany from which all of these examples were drawn display a reticence to discuss it or see technology as irrelevant to their theological task. We shall return to these possibilities below when we move beyond the field of systematic theology to consider treatments of technology by theologians working in various traditions and branches of theology. For now, it is important to make the point that systematic theology by the very nature of its *own* existence testifies to the pervasive influence of technology as biblical texts, philosophical argumentation, exegesis, hermeneutics, history, tradition, and a host of other processes and techniques are brought together to create a “system” of understanding about God and God’s relationship to the cosmos and its inhabitants. Some may object that construction of systematic theologies is merely about attaining intellectual coherence and has nothing whatsoever to do with technology.

It may be helpful to recognize that systematic theology can be formulated in at least two rather distinct ways. The historic purpose of systematic theology was to organize materials related to the Christian faith for pedagogy or presentation as its primary focus, going back to Augustine and other early church fathers (of course sometimes their purpose was also apologetic as well). Logic, philosophical analysis, and other disciplines are brought to bear only to the extent that they advance the central purpose. This style of systematic theology can be traced through a lineage of theologians after the Early Church from John of Damascus’s eighth century *Exposition of the Orthodox Faith* through Peter Lombard’s *Sentences* in the twelfth century, Thomas Aquinas’s *Summa Theologiae* a century later, Philipp Melancthon’s *Loci Communes* and Jean Calvin’s *Institutes of the Christian Religion* in the sixteenth century, to the best

exemplar of this approach in the twentieth century, Karl Barth's *Church Dogmatics*. The second approach to systematic theology is of more recent vintage and is focused on organizing materials using rigorous philosophical and logical analysis as its primary *modus operandi* and focused on situating theology (and religion) within human experience rather than exposition or teaching directed to the faithful. It places human understanding as exemplified by critical inquiry at the core, a move that can ultimately minimize or completely ignore any direct transcendent dimension in its analysis, a weakness strongly attacked by Barth (e.g., 2004, 1.1: 192f.; 2.1: 139f.), although it need not necessarily do so (e.g., McGrath 2006). Perhaps the first sustained example of this approach is Friedrich Schleiermacher's *Der christliche Glaube nach den Grundsätzen der evangelischen Kirche* of 1821 (revised edition 1830) who looked to a fundamental, universal human "feeling" as the foundation of theology while seeking to construct a system of religious belief that would resonate with findings outside theology. This second form of systematic theology which has characterized most liberal theology in the past two centuries is open in its very theological method to the charge of Jacques Ellul that the reification of *la technique* and its application to the discipline of theology makes it inherently technological. Further we have already observed that human language is technology *par excellence* and is at the very root of what it means to be human so any theological talk about God, the world, or anything else is influenced by technology at the cognitive level.

It is striking that technology receives such little notice by these systematic theologians, occurring at a rate about five times less frequently than science – which is itself another surprise given the ease with which theologians have embraced modern

“scientific” assumptions, worldviews, and methods in their approach to their task. Some of these systematists, such as Douglas Hall, clearly recognize the need for a serious engagement with technology but do not engage in the task. Others, such as Donald Bloesch, discuss technology to some degree in other works (e.g., Bloesch 1984) but only give it a passing nod when writing a seven-volume systematic theology! Over half of the writers analyzed here do not mention technology even once in their works and the overall mean is two mentions.

Perhaps we have not looked sufficiently? An electronic search using the word “technology” and its derivations within the online Gifford Lecture series (www.giffordlectures.org) on 9 June 2006 yielded only one reference to the lecture of William Wallace 1892-1894. He mentions technology on one page. These lectures on natural theology delivered annually from 1888 to the present (with the exception of 1942-1945) at the universities of Edinburgh, Glasgow, St. Andrew’s, and Aberdeen would presumably provide some attention to technology given the technological changes occurring over these years in Britain, Europe, and the United States from which virtually all the lecturers have come. Admittedly the archive does not yet contain more recent lectures, and certainly a few mention technology including Paul Tillich’s Systematic Theology (1953), Ian Barbour’s Ethics in an Age of Technology (1989), Christopher Dawson’s Religion and Culture and Religion and the Rise of Western Civilization (1947), and Arthur Peacocke’s Theology for a Scientific Age (1992) although even in these works with the exception of Barbour, mention of technology is infrequent and scattered. The most recent published Gifford lectures are those of Princeton theologian J. Wentzel Van Huyssteen (2006). This 325-page exposition on human uniqueness in light

of science and theology mentions technology on a total of nine pages. Since the focus of his lecture at the University of Edinburgh was on paleoanthropology, all of the references are to early hominid tool making and use.

There is no mention of technology with the recent Handbook of Latina/o Theologies (Aponte, De La Torre 2006) despite chapters on ethics (82-90), aesthetics (98-104), health and healing (212-218), sacred space/public identity (250-256), sexuality (257-264), and language, community, and identity (250-256) even those these topics have themselves been strongly impacted by technology. There is no entry for technology in the comprehensive index to the 800-page The Modern Theologians: An Introduction to Christian Theology since 1918 (Ford, Muers 2005) yet there are entire chapters on Theology and the Social Sciences (370-388), Theology and the Physical Sciences (342-356), Theology and the Biological Sciences (357-369), Theology and the Visual Arts (706-718), and Theology and Film (736-759). Once again we can observe that all of these areas have themselves been impacted by technologies. There is no mention of technology in A Handbook of Contemporary Theology: Tracing Trends & Discerning Directions in Today's Theological Landscape (Smith 1992), the almost 600-page survey of Theology in a Global Context: The Last Two Hundred Years (Schwartz 2005), and The Blackwell Encyclopaedia of Christian Thought (McGrath 1993). Technology is mentioned in passing in but five sentences within the new Handbook of Process Theology (McDaniel, Bowman 2006: 97, 175, 181, 190, and 224) and this is almost always in conjunction with “science” and devoid of analysis.

One could object that one can scarcely expect that theologians *would* address technology given the great distance between these two ways of human knowing and

human praxis. Yet within the past several decades theologians have increasingly incorporated within their work the findings and techniques of modern psychology, economics, sociology, literary studies, the sciences, and a host of other arenas of human endeavour as well as sometimes reacting explicitly against particular theorists, ideas, methods, or policies. In fact this very failure to engage modern technology even by radical theologians who were all about engaging with modernity on secular terms has been taken to be one of the key reasons why their efforts proved inadequate to the challenge (Pattison 2005: 4, 17). Jacqui Stewart and George Pattison are two theologians who are working to make up for this gaping hole in the literature. Both strongly concur with the view advanced here that this “apparent neglect of the subject cannot be defended in a technological age” (Stewart 2006: 340) and that “it has left a gaping hole in theological literature – and precisely at a point where, as seems more and more certain, the future of humanity itself is at stake” as “technology as such has rarely been thematized as a matter of theological reflection” (Pattison 2005: 1). If theology can be accepted as “the attempt to establish mutually critical correlations between an interpretation of the Christian tradition and an interpretation of the contemporary situation” (Tracy 1994: 36) then we must conclude that theology in general and theologians in particular have failed in fulfilling its fundamental purpose by ignoring technology so utterly and deeply.

Langdon Winner (1986: 10, 169) has argued that technology is so pervasively a part of our world that we end up sleepwalking (*somnambulism*) through it while it reshapes everything, including us. Perhaps we have so acclimated to it that we fail to see its influence, even in our theologizing, and take its presence as so much of the essential

and common background to our lives that it has escaped theological analysis – the proverbial elephant within the room. While the picture, as we shall see below, is not quite as bleak as this table leads us to believe, clearly a lot more additional thought needs to be given to how living within a technological world has shaped our theological understanding of it and the need for theologians to recognize and address this pervasive aspect of modernity. George Grant, in a manner similar to Heidegger, has argued that *technique* is so pervasive that we dare not place it outside ourselves but it is in fact sustained by our “vision of ourselves as creative freedom, making ourselves, and conquering the chances of an indifferent world” (Grant 1969: 137). Viewed in this light, we can argue that the works of all the theologians mentioned above are pervasively influenced by the very technology they do not mention. We can go further and admit that the method of analysis employed in the table itself exemplifies the modern fusion of *techné* and *logos* as it was explicitly created to make a point and systematically applies a particular viewpoint to a diverse set of writings in a uniform matter that strips them of context and reduces their worth to the matter at hand.

While our analysis reveals that technology is mentioned on average only once every 566 pages in these writings, it would be a mistake to presume that theologians have said nothing important regarding technology in its many manifestations. The remainder of this chapter will look at specific discussions of technology by a range of theologians including some mentioned above, not with the goal of being comprehensive but to illustrate various ways in which theologians have understood technology as a subject of inquiry and action, articulate what relationship (if any) they think can or should exist

between theology and technology, and identify any specific stance towards technology they have developed.

2.3 Selected Protestant Ruminations

There are a number of theologians who have mused on the meaning of technology both as part of the general humanities critique of technology in the tradition of Lewis Mumford, José Ortega y Gasset, Martin Heidegger and Jacques Ellul, especially from the standpoint of what theological principles are in play when considering the effects of technology upon society and upon the Church. Overall, it is clear that very few theologians have enunciated a well-defined position regarding technology in general although some have articulated positions about particular technologies or aspects of a particular set of technologies. Some have written about technology and engaged in an ample critique of it but without drawing upon much formal theology in a sustained manner (e.g., Shinn 1991 and Ellul, discussed below).

2.3.1 Robert Neville

Robert Cummings Neville, former Dean and Professor in the School of Theology of Boston University, is a philosophical theologian in the pragmatist tradition who studied under Hans Frei and George Lindbeck (Neville 2006: xiii). He invokes both Plato and the Old Testament to arrive at an understanding that “in the ancient roots of our civilization technology was viewed at worst as morally neutral, and its habitual employment was a source of learning the natural joints of nature and the good” (Neville 1990: 185). Neville is not principally

concerned with how we might engage technology from a theological standpoint, but rather has focused his writing to explore the question of how technology in all its modern manifestations, keeps the *richness* of the world hidden from our view and experience. This draws upon Neville's extensive work fusing the semiotic theory of the American pragmatist philosopher Charles Pierce and the theology of symbol developed by the American theologian Paul Tillich (Neville 1996). As technology has gained ascendancy, nature with all its power, beauty, and sensuality, has receded from the senses. Many moderns, particularly those in cities and surrounding environs, live in an entirely human-constructed space where even "nature" in our daily experience is nature as conceived by a landscape architect and delivered by trees, grasses, and other objects that are not native to the area nor distributed in a way that is "natural." But Neville argues that there are even deeper riches to the world that are lost to us in our technological milieu within which we have our being. We have lost sight of the insight that things have "essential and conditional features" that are part of an "Infinity of Eternal Identity." We have substituted for it a view that values things for their functional value alone within our technological world (Neville 1990: 197). We also miss the "Infinite Contingency of the Finite" with a focus solely on everything being brought into existence by humankind for humankind. Technology's powers of creation and ability to solve human problems and meet or invoke human needs leads us to adopt a direct, here and now view of the nature of things and the nature of the world. A transcendent belief in creation among prior generations generated thankfulness at what we have been "given" rather than a singular focus on what

we “create.” As Neville remarks, “We are indeed authors of our deeds, and have moral responsibility because of that; but we are not authors of the ontologically contingent context of our actions” (Neville 1990: 198).

Technology has the capacity to distort the “Infinity of Order” that finds our own world as part of a larger order which in turn is part of an even larger order, and so on. We engage in activities with a view that only the order that we inhabit matters and with little or no consideration to how it might link, disrupt, enhance, or detract from a larger order that sits beyond our tools and techniques. Thus, “Human orders, the goals of technology, are precisely the ones that do not ordinarily register the infinite nestings of the world’s orders. Ecological mistakes are mistakes about the real order of things. Moral mistakes are mistakes about the real structures of value. The traditional critique of technology, as in Roman Catholic thinkers of antimodernity [he does not name them but they might include Kerans 1974; Queffélec 1964; Guardini 1994], is usually a valid critique of a technology’s distortion of the infinity of orders” (Neville 1990: 199).

Neville also argues that there are infinities of existence, the unlimited, and harmony in the world, each of which are obscured or transgressed by technology or rather, technological hubris. These centre around a confusion about the “real” nature of things with a human desire to deal with things in an atomistic, mechanistic, reductionist manner that one sees things as being comprised of component parts, all subject to human manipulation. In Neville’s view (Neville 1990: 202):

“The greatest sin technology can commit is to suggest, because of the enhanced powers it delivers up to the human will, that the world is not

ultimately mysterious. That sin has the ancient dignity of being the sin of pride. It leads to a profound misapprehension of what is real and good, and very quickly to a diminishment of the potential of human life As finite, our visions, actions, and goods are limited, and our moral obligations stem from the reality of our finite nature. We are not gods whose taste is purely aesthetic, and therefore transcendent of morality. Consequently, we should sin not. In particular, we should circumscribe our technology so as to prevent it from diminishing the richness of the world.”

Neville takes strong issue with the stance of Stanley Hauerwas about the fundamental orientation of theology despite the fact that both are Methodist theologians who studied under Hans Frei and George Lindbeck, view ethical actions as vital to Christianity, and are pacifists who share additional similarities (Neville 2006: xii-xviii). Neville believes that theology as symbolic engagement is important for our age in that truth claims for Christianity must be subjected to the same standards and critique as other traditions and beliefs. He believes that there is strong place for an inquiry-based, pragmatic theology that searches for truth wherever it may be found in a process of “continuous learning, humility, and daring” in the public sphere rather than the private, witness-oriented, assertive interpretation of Christian identity that is first and foremost directed within the Christian tradition as favoured by Hauerwas.

2.3.2 *Jacques Ellul*

While not a theologian by formal training, the late sociologist’s 40 books and voluminous writings testify to a deeply theological orientation for his sociological analysis of technology, or more specifically, a worldview concerning technology. Some of Ellul’s work, most notably his *Présence au monde modern*:

Problèmes de la civilisation post-chrétienne (1948), is explicitly theological and forms the background framework for his nontheological work. For Ellul there are seven major characteristics of *la technique* that causes him to see its singular attribute as being self-determination, autonomously shaping and remaking everything in its path (Stewart 2003: 260f.):

- Rationality (systematization, standardization, suppression of creativity)
- Artificiality (“elimination, absorption, and subordination of nature”)
- Automatism (most efficient option selected and focus is on use of means not ends or larger purposes and values)
- Self-augmentation (each rendition generates yet further “improvements” that accrete and grow in power and influence)
- Monism (the “interconnectedness of technical means”)
- Technological integration (each part of the system gets “improved” in order to drive other parts of the system in a never-ending cycle)
- Technological universalism (cultural values become irrelevant as technology goes “global” and becomes the antithesis of culture)

Ellul believed that both nature and society, including political structures, were all powerless before the technological environment since it cannot be escaped and we are no longer subject to nature. The two prior primary environments have now become secondary as both become dependent upon the now primary environment of technology for their very continuance and the exercise of their importance and potency (Ellul 1987: 180-187). All relations, interactions, means, instruments, and other things in our environment are all technological and part of this massive system that has replaced the former world of forests, mountains, and rivers. It has the power to destroy as well as to enliven and uplift (Ellul 1987: 180f.). For Ellul, technology is incapable of providing us freedom in a true Biblical sense but provides an illusion of freedom which is actually bondage:

I did not say that technique is a fruit of sin. I did not say that technique is contrary to the will of God. I did not say that technique in itself is evil. I

said only that technique is not a prolongation of the Edenic creation, that it is not a compliance of man to a vocation which was given him by God, that is it not the fruit of the first nature of Adam. It is the product of the situation in which sin has put man; it is inscribed exclusively in the fallen world; it is uniquely part of this fallen world; it is a product of necessity and not of human freedom (Ellul 1984: 134f.).

We have been socialized by the technological society since our youth to unquestioningly accept the “smooth functioning of sciences and techniques,” being continuously “fascinated by the marvels of science and technique,” and even diverted by “games and distractions of all kinds” so that the technological bluff can continue and we can passively accept its domination and our utter lack of freedom (Ellul 1990: 405). To be truly free is to question and criticize, to refuse to blindly accept the hegemony of science and technique, both within the Church and within society at large. Contrary to what some commentators think of Ellul, he is not against technology *per se*, but wants humanity to be more critical of its designs, more attuned to its implementation “costs” and more evaluative of its effects both small and large, incidental and central, implicit and explicit, and near-term and far future. This stance against the technological bluff would, in Ellul’s view, be best informed by a theistic perspective that assumes that there is a transcendent reality and that there is a life beyond that of this present world. In fact, influenced as he was by the views of Karl Barth and Søren Kierkegaard, Ellul believes that without grace we are left in despair and it is only in Christian hope that one can live “in the deterministic technological world that we have created for ourselves” (Ellul 1983: ix, 1980: 318; Wenneman 1990: 188; cf. Pattison 2005: 52).

2.3.3 Douglas John Hall

This professor emeritus of theology at McGill University, along with fellow Canadian philosopher George Grant (a D.Phil. in theology from Oxford University) upon whom he relies heavily (Grant 1966, 1969a, 1969b, 1976, 1986), has been quite expressive about the importance of an engagement between theology and technology, primarily in the form of sustained critique. In our sample of systematic theologies above, Hall speaks about technology five times more than the next closest commentator. Hall believes that the “dream of Western technocracy” where all progress is good and all is well with others and us in a gluttonous feast of materialism has clearly failed to deliver on its promises. This failure provides a clear entrée for a gospel “that dares to pronounce that real hope can begin where illusions end, and real life where death is tasted” (Hall 1989: 43f.). However, he finds that Christian theology has failed to articulate deep values and meaning for modern life, in part because it has identified too closely with the dominant culture and has been utterly incapable, with few exceptions, of critiquing the most cherished notions of modernity (Hall 1989: 197f.). He finds it astounding that Christianity has not challenged “technocratic mastery” since there is a Biblical mandate to exercise human stewardship over the creation which he finds incompatible with Western industrial society with its focus on efficiency, profit, and the exploitation of nature in its drive for power and nonaccountability (Hall 1989: 222). The close intertwining of western technological prowess and Christianity coupled with the well documented “worldly success of the Christian religion and of most of the peoples who have adopted it” creates particular

challenges in gospel witness to non-Christian peoples who not surprisingly conflate these two successes (Hall 1996: 119).

Theologically, Hall finds that systematic theologies created in the First World today fail to penetrate into the troubled contexts within which we live and as a result “imply a noticeable measure of control, certitude, well-being, magnanimity, and personal security characteristic of the affluent. To the victims of our society, our theologies must on the whole appear as self-satisfied as our economies and our technology. . . . we cannot give ourselves to systems which preclude the grace of recanting, or at least of revising, what proves productive of questionable consequences” (Hall 1989: 47). In part this is due to the fact that the Church has assumed that progress is good and ceased to be the confessional body in the world it was intended to be (Hall 1996: 63). Advanced technology not only gives, it also takes away. Hall points to the phenomena of both structural unemployment and the manifest ways in which native peoples of North America have lost touch with nature and in so doing have lost touch with their very selves as technology causes the world to recede from them and adds to their depression (Hall 1996: 110, 486). Rampant consumerism has been offered to modern societies as a means by which one can obtain and maintain one’s individuality. Instead, what it delivers is a complete loss of individuality and a commonality and banality that causes cities and entire cultures to look more and more the same rather than distinctive (Hall 1993: 110f.; Hall 2003).

The elevation of rationality to be the final and sole arbiter of truth within the technological society “invented marvels of technique, conquered ancient

diseases, overcame distance and barriers to communication . . . and produced, in the process, the wherewithal necessary to its own [Western humanity] and perhaps all nature's annihilation" (Hall 1993: 144). He especially worries about both the "destructive powers" of nuclear weapons and the "peaceful deployment" of nuclear energy with its attendant problems, believing they express the "full irony and terror of this aborted bid for human control" (Hall 1989: 223f.). Hall takes hope in the fact that an increasing number of intellectuals in North America have awakened to the limits of rationality while lamenting the fact that the humanities have tended to "associate themselves more keenly with the sciences than with the arts (despite their continuing association with the latter in name), partly in order to justify themselves to a pragmatically orientated society, and partly on account of the power of the scientific-technological mind-set that has been part of the mythology of our era" (Hall 1989: 322f.). This leads to the practice of focusing on research, data collection, and data manipulation with an attendant decline in thinking, connoting for him "an entry into the hidden depths of the self, a pondering, a contemplative self-forgetfulness that is a far cry from anything that goes on in the electrical interior of a computer, however intricate" (Hall 1989: 285).

While Hall is quite explicit about a number of important issues regarding modern technology and calls the Church firmly and openly to engage more systematically and thoroughly with the technological worldview that dominates so pervasively North American life, he has not created a fully articulated theology for technology. He has suggested that the Judeo-Christian tradition does have

important things to contribute to a dialogue with technology and a critique of it. For example, he explores in a highly cursory manner the issue of extra human personhood, i.e., can a robot or computer possess personhood or even replace fully a person as Ray Kurzweil and some other computer scientists have alleged. Hall finds that both the Old and New Testaments speak about creaturehood in a manner that can be fruitfully applied to this situation, believing that “the Scriptures contain far more potential for the development of this subject than has been actualized in the history of Christian doctrine” (Hall 1993: 200f.). He does not develop this subject or any other critique of a particular technology in a sustained manner but he clearly articulates the challenge and its importance.

2.3.4 Paul Tillich

The German-born and educated theologian Paul Tillich recognized that nature itself revealed the possibilities inherent in technology as he considered biological structures such as carnivorous plants, the vertebrate eye, and the manner in which human beings have adapted technological designs from those found in nature such as flight from birds and underwater submersibles from dolphins. He took from this observation that technology is grounded in our very structure as human beings (Tillich 1988: 52). Tillich may have developed this keen interest in technology from the four years he spent as a professor of religion at Dresden Institute of Technology (Wettstein 1984: 119). He sought a means by which human beings could recover from their separation of means from ends within technology and avoid reducing themselves to mere “things” in a

Heideggerian sense (Wettstein 1984: 121). Technology itself exhibited a threefold rationality in that it was constructed to fulfil a specific purpose, was built consistent with the best of relevant materials and using the best methods possible at that moment in time, and that it served clear economic and/or societal purposes (Tillich 1988: 60).

As early as the 1920s Tillich was writing about the inherent alienation of modern cities and the technological environment that could all too quickly subvert everything via its anti-human power. He identified the unholy trinity of scientism, capitalism, and technicism as chief determinants of the religious situation of modernity and believed that these could only be overcome by what he termed *theonomy*. These technical things were conceived as artefacts that people could “love for the form and meaning embodied within them” (Thomas 2005: 159; cf. Pattison 2005: 46f.). He believed that through a strong humanistic effort, the fruitful nature of technology could be recovered and its strong alienating and disempowering effects be mitigated. In some ways he prefigures in a prescient manner recent thinking among contemporary philosophers of technology such as Albert Borgmann and Carl Mitcham whom we shall discuss in a subsequent chapter.

2.3.5 Karl Barth, Helmut Thielicke, and Wolfhart Pannenberg

The noted Swiss theologian, Karl Barth, has surprisingly little to say regarding technology in his over 8,000 pages of theological discourse in *Church Dogmatics*. Barth recognized that while there were tensions between mechanized

or mechanical work and that of the artisan, it is overly simplistic to allege that one form of work is necessarily superior to the other in terms of cultivating a spirit of creativity and engaged thought (Barth 2004, Vol. III, Pt. 4: 547). In some cases technology acts as an enabler that frees the individual to spend more time thinking rather than dehumanizing them and stifling thought or creativity. Barth also speculated that modern warfare, despite its much higher kill rate, was in fact “far nobler” than ancient warfare since it “simply aims to cause the enemy to retreat before the deployment of a mass of neutral force” (Barth 2004, Vol. III, Pt. 4: 453).

The longest comment of Barth in relation to technology in the *Church Dogmatics* recognizes the miraculous ways in which technology has transformed the world but highlights its “corresponding and comprehensive” will for power along the lines of Nietzsche. Barth questions whether “many of our modern requirements are really necessary, justified, sensible or even genuinely felt?” (Barth 2004, Vol. III, Pt. 4: 395). Using transportation as an example, he queries whether greatly accelerating the rate at which people travel has brought us any attendant advantages and what we have lost in this Faustian exchange. Barth affirms that at the core of this dilemma, “man should not accuse technical skill of being ‘soulless;’ he should accuse himself and his irrational will for power. He himself is the problem of modern technical skill” (Barth 2004, Vol. III, Pt. 4: 395).

Barth’s generational German counterpart, Helmut Thielicke, correspondingly also has surprisingly little to formally say about technology. His

three volume systematic theology does accord with Barth's general view regarding technology in placing the blame for the ills of technology squarely on human actors: "Power, technology, and the ideal are favourite objects for the mythicization which deflects us away from our own history, i.e., from the history of powerful, technical, and idealistic man, and which thus offers us an excuse, as though these other things were really to blame for what happens, and we ourselves, I and Thou, were deceived and dragged along as tragic victims" (Thielicke 1974: 397).

Wolfhart Pannenberg, arriving on the German speaking theological scene slightly later than Barth and Thielicke recognizes human reason as a means by which individuality is expressed, maintained, and through which aspects of God are revealed. It also forms the "basis for the constructs of human technology" (Pannenberg 1994: 197). Central to this reasoning ability is the use of language and culture mediated through action that allows human beings to overcome their biological limitations, organize their social life, and exert "social control of the world by means of technology" (Pannenberg 1985: 39f., 317f.).

The ecological problems that have been created by modern technology are not, according to Pannenberg, due in any manner to some predispositions within the Judeo-Christian tradition to denigrate nature and justify human abuse of the environment. Rather he traces this tendency to devalue nature to the eighteenth century when Western Christianity began to markedly lose its hold on the culture and the concept of a creator God of the Bible began to recede from direct effects on the lives and actions of human society. "It was in fact," he asserts, "only the

emancipation of modern humanity from biblical revelation that turned the biblical commission of domination into a subjugation of nature to human beings on their own authority and for this own arbitrary use” (Pannenberg 1985: 78). A Biblical view of human dominion over nature “excludes control of exploitation. It is like the work of a gardener, as in the second creation story (Gen. 2:15). Because the world of nature is still God’s, in spite of being handed over to us to rule, our self-rigorous misuse of the power we have been given by God rebounds upon ourselves and plunges us into ruin. In this sense we may view the ecological crisis at the end of the modern age of emancipation as a reminder that God is still the Lord of creation and that human arbitrariness in dealing with it is not without limits or consequences” (Pannenberg 1994: 205).

2.3.6 Selected American Evangelical Theologians: Wayne Grudem, Paul Jewett, and Donald Bloesch

The American evangelical community has witnessed a resurgence of interest in systematic theologies over the past several decades as well as an increased level of sophistication in theological work. Wayne Grudem, Professor of Biblical and Systematic Theology at Trinity Evangelical Divinity School, a bellwether institution of the conservative evangelical community, has drawn upon 34 systematic theologies produced by evangelicals over the last century along with older or more abbreviated treatments in composing his own work, Systematic Theology: An Introduction to Biblical Doctrine (Grudem 1994). Technology is scarcely mentioned in his volume, nor presumably does it have

much presence in the many systematic theologies from which he draws insights and makes continual cross-references. He follows a general Reformed view that “all science and technology carried out by non-Christians is a result of common grace, allowing them to make incredible discoveries and inventions, to develop the earth’s resources into many material goods, to produce and distribute those resources, and to have skill in their productive work” (Grudem 1994: 659). The “abundant results of technological progress” that are all around us along with the many other goods, services, and helps we receive from our fellow human beings are “a manifestation of his abundant grace,” he observes and “the realization of this fact should cause our hearts to swell with thanksgiving to God in every activity of life” (Grudem 1994: 665). There is no discussion of the burdens or costs associated with modern technology and progress is viewed as good and something for which we can only thank God.

The late Paul Jewett (1919-1991), a systematic theologian at Fuller Theological Seminary, while only addressing technology in a cursory manner in his neo-evangelical theology, critiques the myth of technological progress pointing out that “our focus on technology – on control of the environment as the solution to our problems – has at one and the same time robbed us of the sense of wonder and of the reverence and of gratitude with respect to the natural world; and turned us away from what was once our primary human task: learning wisdom and self-control in the face of the often recalcitrant and difficult ‘givens’ of life. That is, a problem of morals has been transformed into a problem of technique” (Jewett and Shuster 1996: 372f.). Jewett recognized that in some

ways, Christianity found it harder than many other world religions to reject the “inevitable and good” progress that science and technology provides reasoning as follows (Jewett and Shuster 1996: 368):

We *do* affirm the value of reducing human pain and struggle in this life. However, the leap is short from the proper valuing of our bodies and the rest of the material creation to a greedy, disproportionate attention to them and a blithe and half-unconscious substituting of our vision of how a ‘more competent’ God would have designed them. A broadcasting historian suggests that the underlying message of the entire commercial world is that God’s ‘work of Creation has been largely a disaster, functionally and aesthetically. Almost everything done in the making of man and his environment was a mistake; fortunately, man himself has invented products to correct the errors.’ It is commonplace that modern materialism and commercialism turn trivialities and luxuries into necessities, try to persuade us that happiness can be found behind the wheel of an air-conditioned, high-powered sports car, and lead us to pursue with evangelistic zeal the goal of making the world safe for Coca-Cola.”

Donald Bloesch, one of the most formidable evangelical theologians in America (although he has eschewed the evangelical label), has produced both a two-volume and more recently, a seven-volume systematic theology. The latter *magnum opus* contains only five references to technology in its two thousand pages. Following Ellul, Bloesch contends that rational efficiency is the hallmark of the “technocratic mentality” where the overarching aim is to gain “power over the world rather than the wisdom that teaches us how to live in the world as brothers and sisters with a common origin and destiny” (Bloesch 1992: 27). In this modern era, we have “succumbed to the arrogance of our own expertise,” (Bloesch 1992: 26) and rather than embrace historic Christianity have gone wholeheartedly after a new mysticism. This cultural turn reflects a “flight from reason and an enthronement of human feelings and instinctual drives. A new

romanticism threatens to usurp the hegemony of a deadening rationalism”

(Bloesch 1992: 27). Pragmatic utility now trumps dialectical reasoning like that of Plato and inductive logic like that of Aristotle. He recognizes that this reification of immediate utility and limiting of knowledge to what is obtained by the senses and in an evidentiary manner poses particular problems for our conceptions of truth and takes them far from the biblical view of veracity. While truth “in the biblical perspective is primarily a conformation of understanding to ontological reality rather than a correspondence of perception with facticity,” truth in the technological milieu we inhabit is that which can be scientifically measured and pragmatically modified. In this world, “praxis becomes the measure of all truth” (Bloesch 1994: 291f.).

Bloesch has a much more extended discussion of technology woven throughout his book, Crumbling Foundations: Death & Rebirth in an Age of Upheaval (Bloesch 1984). He explicates and endorses the basic viewpoint of Ellul regarding the norms of the technological society and its impact in reshaping the world into its image. This leads to a society where the church and its members are squeezed towards a “monolithic statism” where there is a “demand for the total allegiance of its people” and where consequently “a conflict with the claims of faith is made inevitable” (Bloesch 1984: 67). Technology in its varied and endemic forms within society has become the “main enemy” to Christianity and the Church rather than specific ideologies like Marxism, Maoism, and democracy, since “it is our mode of life with its implicit values and assumptions rather than a particular explicit philosophy of life that seems to present the greatest peril to the

faith” (Bloesch 1984: 30). In the midst of this revolutionary challenge, “religious conservatives can be faulted most” for “their glaring inability to discern the encroachment of the values of the technological society upon the domain of the church” (Bloesch 1984: 30). Bloesch’s point echoes concerns of selected theologians and Christians from many walks of life that technology among the people of God can change the kind of persons we are and how we perceive our relationships to both God and the world. James Houston, the Christian geographer and theologian at Regent College in Vancouver has argued that “*techné* is the Trojan horse in the City of God,” (Houston 1980: 161) an ancient concern going back to Augustine that was generally framed in prior generations under the threat of materialism or consumerism.

Churches seek out ways to deliver their programs more efficiently and effectively and Christians are taught various rote and systematic techniques for more effective prayer, Bible study, witnessing, and decision making while the worship services themselves become technologically driven experiences with sermons and teachings increasingly dictated by the deployment of Power point slides, preprinted lecture notes, and “national” teaching series such as those of the Purpose-Driven Church, Purpose-Driven Life, and 40 Days of Community from Pastor Rick Warren and the Saddleback Church in Lake Forest, California (www.saddleback.com). Ellul’s worries about *la technique* and its seductive powers are swept away without a moment’s contemplation about the ways in which the medium *is* now the message (to borrow McLuhan) and the Holy Spirit recedes into the background as a minor player in the quest for spiritual maturity

and a “deep” spiritual life that looks more and more like that of my fellow Christians. While Bloesch does not employ the term, the McDonaldization of society (an extension of the arguments of Max Weber about rationality and standardization within modern societies) has now become the McDonaldization of the church (Bloesch 1984: 32; cf. Ritzer 1993 and Drane 2000).

We noted earlier that one way to “read” the Bible is to see that worship is a technology instituted by God. Susan White (1994) has pointed out that there is a long history of interaction between technologies and liturgical practices so in some sense technology has always been present within the Church. She argues for the need for a comprehensive dialogue between technologists and liturgists regarding the role of technology within worship and a better understanding on the part of liturgists about contemporary technology. In a similar vein but from an American perspective, Quentin Schultze (2004) of Calvin College has urged churches to very carefully consider how to approach modern presentation technologies for their deployment in church settings for worship, preaching, teaching, etc. So we can agree with Bloesch’s point that there is an incipient danger for technologies in various forms to be uncritically appropriated by the Church. These appropriations can erode the fundamental character of the Church in ways detrimental to its chief purposes.

Bloesch calls the evangelical church to “remain true to the faith once delivered to the saints” rather than being caught up in the emphasis on growth and change. Rather than joining the technological society proponents in their quest to “subject every area of life to rational control, Christians should sound the call to

liberation from the fixations and delusions that the powers of this age impose upon people, preventing them from perceiving the reality of the human situation” (Bloesch 1984: 16). This includes rejecting the totalitarian growth, reach, and moral arbitration of the state that “demands allegiance in every area of life, including the spiritual and ethical” and is quite happy to tolerate the church so long as it makes “people fit for service in a technological society” (Bloesch 1984: 24). As Bloesch sees it, the inextricable advance of technology gives rise to a new sacralism “which invests with sanctity such ideas as the method of objectivity and technological programming” and concentrates more and more power in the hands of a technocratic elite (Bloesch 1984: 86). Contrary to Ellul, however, Bloesch believes that the “pseudo-god of technology slowly but surely [is] being edged out by the mystical gods and goddesses of the earth, blood, and nation. Technological rationalism is being supplanted by a neomysticism that celebrates immersion in the world” (Bloesch 1984: 149).

2.3.7 George Pattison

George Pattison is Professor of Lady Margaret Professor of Divinity at Oxford University and Canon of Christ Church, Oxford. He is a philosopher of religion with a strong interest in Hegel, Heidegger, Kierkegaard, and Russian religious philosophy educated at the University of Edinburgh, the Scottish Episcopal Theological College, and the University of Durham. He was a schoolteacher and psychiatric nursing assistant before becoming a Curate and professor. He is one of only a handful of theologians who has wrested deeply

with technology in his recently published Thinking about God in an Age of Technology (2005).

Pattison (2005) opens his book by a consideration of the demise of religion in the West and the impact that technology has on modern life and its fundamental character (pp. 15-36). He next considers selected theologies of technology of which there are admittedly few, namely Jacques Maritain (p. 38), Teilhard de Chardin (p. 40f.), Romano Guardini (p. 41f.) Nicholas Berdyaev (p. 42ff.), Paul Tillich (pp. 42-47), W. Norris Clarke (p. 47f.), Rustum Roy (p. 49), Philip Hefner (p. 50f.), Jacques Ellul (pp. 52-56), and Quentin J. Schultze (59-61) – several of whom are not theologians in any traditional sense and some of whom have written relatively little about this topic that would properly rank as theological. The third chapter of his book is an exposition of the thinking of Martin Heidegger concerning technology (pp. 66-93). The next section of three chapters is a response to the current problem facing theology regarding technology. It raises the questions of can we think about God in our technological time (he answers affirmatively, pp. 98-124) and how are we to think about God in the technological society (pp. 125-170). His exploration of this second question is more of a prolegomenon, as he does not derive an answer to this question in part because he believes it is almost impossible to think non-technologically about anything in our modern era in light of his neo-Heideggerian stance and his embrace of Tillich's theology of correlation. He also does not expect an answer or response to technology as a direct result of thinking about God (p. 11). The next section considers various contexts regarding God's actions in the world (pp. 173-

193), the role of theology and thinking about God within the university or cyberversity (pp. 194-217), and the religion of art in an age of technology (pp. 218-239).

Pattison recognizes quite clearly the pervasiveness of technology including how technology gets “inside our heads and affects the very way in which we conceive our reality” (p. 2), the entanglement that technology presents to virtually any issue including those of ethics and theological thinking (p. 193), the impossibility of “overcoming” technology in some manner (p. 35), the failure of theologians and even Marxists to adequately address the challenges of technology (pp. 1, 37), and the observation that the fundamental problem of our modern age is technology and everything else is subservient to it. He thinks that turning to our usual formulations of theology are completely inadequate to the challenge and that entirely new means of inquiry concerning God and the technological age must be launched (p. 9). We must consider quite seriously the “refraction of human consciousness in the lens of technology” (p. 63).

Pattison believes that since universities set the gold standard for what counts as knowledge in our age then theology clearly must maintain full membership in this academic environment. However, the challenge of technology and a university that itself constructs knowledge “in accordance with the technological paradigm” presents a huge obstacle for the maintenance of theology within the university since the nontechnological nature of theological thinking predisposes fellow academics to be dismissive of it counting as worthwhile knowledge or even knowledge at all (pp. 9, 69).

2.4 Selected Views from the Roman Catholic Tradition

Just as there is no uniform Protestant view concerning technology, so there is great diversity within the world of Roman Catholicism regarding the meaning of technology both for society and for the Church (see for example differing views about war and nuclear weapons in Au 1985). Some Catholic thinkers, such as priest-paleoanthropologist Teilhard de Chardin, have been surprisingly highly approving of technology in all its manifestations, believing this is a natural evolutionary progression where humankind is exercising the mastery it was always intended to have over nature (Teilhard de Chardin 1961: 141f., 220; 1971: 181; cf. critique by Bloesch 1984: 67; Ellul 1976: 195, 364; and Pattison 2005: 40ff.). Teilhard de Chardin (1964: 165f.) visualized that “all the machines on earth, taken together, tend to form a single, vast organized mechanism.”

The definitive sources for formal Catholic views on the subject are papal encyclicals along with other formal church documents. There is no encyclical focused explicitly on technology, but a number of them do comment on aspects of both science and technology in a manner illuminative for our purposes.

Mater et Magistra: On Recent Developments of the Social Question in the Light of the Christian Teaching was released by Pope John XXIII on May 15, 1961. It contains a number of references to technology within a broader context of the nature of society and especially economic development issues. Communications technologies of various types (e.g., press, radio, television, cinema) are recognized as means to diffuse human thought in a manner that

enables individuals “to take part in human events on a worldwide scale” (full text of encyclical is in O’Brien and Shannon 1992: 84-128; citations here and below are to specific numbered sections within the document). As the various means enable new forms of associations to develop, there are concomitant increases in the number of “rules and laws controlling and determining relationships of citizens,” although the Pope argues unsuccessfully that they are no longer personally responsible but are simply following rules, laws, and the inevitable pressures and shaping forces of institutions and social groups outside of themselves (sec. 62). The force of systems logic is rejected in favour of a natural law argument that “it is the creation of free men who are so disposed to act by nature as to be responsible for what they do” (sec. 63). The document favours a delicate balancing act between the outputs of the economy and the services provided to citizens where “the means of production” are adjusted “to the progress of science and technology” (sec. 79). As far as the “common good and the state of technology” allow, family type enterprises (both agricultural and service oriented) should be protected and fostered, including providing technical assistance (secs. 85, 143). Yet this preference must keep pace with changes in production, structure, and operating methods and cooperative associations need to be formed to advance technical, spiritual, and intellectual matters (sec. 87).

The production function’s reaction to accelerated change, “thanks to the impulse deriving from advances in technology and science,” require on-going training of workers that will also attend to their morals and religious needs (sec. 94). The agricultural sector is particularly singled out as an arena where new and

better production technology and methods need to be introduced on a continuing basis (sec. 128). This will decrease the abrupt dislocation of rural workers by the modernization of agriculture as they acquire transferable skills for other jobs and job sectors (sec. 130).

The dignity of work is described with its “manifold relationship to the mechanical arts, chemistry, and biology” with a particular emphasis on the importance of science and technology for rural life (sec. 145). Countries that are only minimally industrialized, in the same manner, require an infusion of technical skills and knowledge to achieve their potential from rich nations (sec. 165). The document declares “there is no doubt that when a nation makes progress in science, technology, economic life, and the prosperity of its citizens, a great contribution is made to civilization. But all should realize that these things are not the highest goods” (sec. 175). There must be a focus on social justice and spiritual values which often does not occur because “while they pursue progress in science, technology, and economic life, they make so much of external benefits that for the most part they regard these as the highest goods of life” (sec. 176).

The increased global interdependency requires that nations collaborate more fully since “individual countries, although advanced in culture and civilization, in number and industry of citizens, in wealth, in geographic extent, are not able by themselves to resolve satisfactorily their basic problems” (sec. 202). The assertion of human autonomy, while widespread and often linked to perceived progress in science and technology, results in a situation where “men often find themselves involved in difficulties that affect all peoples and which can

be overcome only if they duly recognize the authority of God, author and ruler of man and of all nature" (sec. 209). The sheer terror that modern technology and machines can spawn requires that "things pertaining to the spirit and to moral life are to be preferred to all else, so that progress in science and technology does not result in destruction of the human race, but prove useful as instruments of civilization" (sec. 210). In summary on these matters the Pope affirms:

For it is indeed clear that the Church has always taught and continues to teach that advances in science and technology and the prosperity resulting therefrom are truly to be counted as good things and regarded as signs of the progress of civilization. But the Church likewise teaches that goods of this kind are to be judged properly in accordance with their natures: they are always to be considered as instruments for man's use, the better to achieve his highest end: that he can the more easily improve himself, in both the natural and supernatural orders (sec. 246).

Pope Paul VI issued Gaudium et Spes: The Church in the Modern World

on December 7, 1965. It was one of the most important results of the Second Vatican Council, having been ratified by a vote of 2,307 to 75 by the attending bishops. The ways in which technology has changed the fabric of societies and created a global community of interlocking groups and peoples is recognized by the document. The Pope notes that:

Today's spiritual agitation and the changing conditions of life are part of a broader and deeper revolution. As a result of the latter, intellectual formation is ever increasingly based on the mathematical and natural sciences and on those dealing with man himself, while in the practical order the technology which stems from these sciences takes on mounting importance.

This scientific spirit exerts a new kind of impact on the cultural sphere and on modes of thought. Technology is now transforming the face of the earth, and is already trying to master outer space. To a certain extent, the human intellect is also broadening its dominion over time: over the past by

means of historical knowledge; over the future by the art of projecting and by planning.

Advances in biology, psychology, and the social sciences not only bring men hope of improved self-knowledge. In conjunction with technical methods, they are also helping men to exert direct influence on the life of social groups. At the same time, the human race is giving ever-increasing thought to forecasting and regulating its own population growth.

History itself speeds along on so rapid a course that an individual person can scarcely keep abreast of it. The destiny of the human community has become all of a piece, where once the various groups of men had a kind of private history of their own. Thus, the human race has passed from a rather static concept of reality to a more dynamic, evolutionary one. In consequence, there has arisen a new series of problems, a series as important as can be, calling for new efforts of analysis and synthesis (O'Brien, Shannon 1992: 168).

Twenty-five of the 93 sections of *Gaudium et Spes* (full text in O'Brien and Shannon 1992: 166-237) contain references to science and/or technology and it is the most ample document concerning these topics to issue from the Vatican. It recognizes that "the human race is passing through a new stage of its history" (sec. 4). It sees technology as primarily flowing out of the sciences rather than being an independent arena of human activity (sec. 5). Living in an industrialized and urbanized society is seen as advantageous (sec. 6) with the attendant problems that a specialization of tasks and knowledge can "deprive a man of a comprehensive view of reality" and an imbalance can arise between "a concern for practicality and efficiency and the demands of moral conscience" (sec. 8). The alluring possibility (temptation) of thinking that "solely by human effort" all problems can be overcome and a "total meaning" can be derived by human "ingenuity alone" is to be guarded against and seen as idolatrous (sec. 10).

The use of human intellect to advance understanding of the physical world and “subjecting it” to human desires is seen as a progressive working out of the implications of sharing in the “light of the divine mind” (sec. 15). “For when, by the work of his hands or with the aid of technology, man develops the earth so that it can bear fruit and become a dwelling worthy of the whole human family, and when he consciously takes part in the life of social groups, he carries out the design of God. Manifested at the beginning of time, the divine plan is that man should subdue the earth, bring creation to perfection, and develop himself. When a man so acts he simultaneously obeys the great Christian commandment that he place himself at the service of his brother men” (sec. 57).

Despite the capacity to alter many things, the ability to conquer death still eludes humanity and there is a “desire for a higher life which is inescapably lodged in his [sic] breast” (sec. 18). The bishops recognized that interdependence of societies and peoples is “a development very largely promoted by modern technical advances” but that those advances are incapable solely by themselves of fulfilling humanity’s desire for deep and meaningful interpersonal relationships (sec. 23). Nevertheless, there has been a radical shift of perspective produced by technology as the bishops explain:

Through his labours and his native endowments man has ceaselessly striven to better his life. Today, however, especially with the help of science and technology, he has extended his mastery over nearly the whole of nature and continues to do so. Thanks primarily to increased opportunities for many kinds of interchange among nations, the human family is gradually recognizing that it comprises a single world community and is making itself so. Hence many benefits once looked for, especially from heavenly powers, man has now enterprisingly procured for himself (sec. 33).

The marked benefits of technology and science “can foster a certain exclusive emphasis on observable data, and an agnosticism about everything else.” This can lead to a situation where man “confiding too much in modern discoveries, may even think that he is sufficient unto himself and no longer seek any higher realities” (sec. 57).

Despite the tremendous achievements of technology and science, humans still ask fundamental questions about the purpose and meaning of all this activity. They yearn to know where all this activity is headed and how these things and capabilities should be properly used (sec. 33).

The value of human activity is seen in the human desire to “subject to himself [sic] the earth and all that it contains” but with an attendant requirement under God to “govern the world with justice and holiness” as part of the fulfilment of the biblical mandate (sec. 34). The bishops pronounce “it is clear than men are not deterred by the Christian message from building up the world, or impelled to neglect the welfare of their fellows. They are, rather, more stringently bound to do those very things” (sec. 34). Technical advances “supply the material for human progress, but of themselves alone they can never actually bring it about” (sec. 35) for “when God is forgotten the creature itself grows unintelligible” (sec. 36).

When considering the proper development of culture, the bishops recognize the ways in which technological developments are imposing a uniformity (standardization) upon the world. This mass culture creates “new ways of thinking, acting, and making use of leisure” (sec. 54) and the “artisans” and



“authors” of this culture recognize a “combined sense of independence and responsibility” (sec. 55). At the same time, these conditions and the attendant changes within cultures that they provoke raise a series of questions, all of which are pertinent to our exploration of the meaning of technology (sec. 56):

What must be done to prevent the increased exchange between cultures, which ought to lead to a true and fruitful dialogue between groups and nations, from disturbing the life of communities, destroying ancestral wisdom, or jeopardizing the uniqueness of each people?

How can the vitality and growth of a new culture be fostered without the loss of living fidelity to the heritage of tradition? This question is especially urgent when a culture resulting from the enormous scientific and technological progress must be harmonized with an education nourished by classical studies as adapted to various traditions.

As special branches of knowledge continue to shoot out so rapidly, how can the necessary synthesis of them be worked out, and how can men preserve the ability to contemplate and to wonder, from which wisdom comes?

What can be done to make all men on earth share in cultural values, when the culture of the more sophisticated grows ever more refined and complex?

Finally, how is the independence which culture claims for itself to be recognized as legitimate without the promotion of a humanism that is merely earth-bound, and even contrary to religion itself?

The role of information as an important component for decision making is stressed since a man must “be free to search for the truth, voice his mind, and publicize it; that he be free to practice any art he chooses; and finally that he have appropriate access to information about public affairs” (sec. 59). It is also vital that a “view of the whole human person” be preserved, particularly where the “values of intellect, will, conscience, and fraternity are pre-eminent” (sec. 61).

The bishops provide passing recognition to the fact that “recent studies and findings of science, history, and philosophy raise new questions which influence life and demand new theological investigations.” Conversely, they encourage theologians to “seek continually for more suitable ways of communicating doctrine to the men of their times.” This will require that they “blend science and its theories and the understanding of the most recent discoveries with Christian morality and doctrine. Thus their religious practice and morality can keep pace with their scientific knowledge and with an ever-advancing technology.” Lay persons within this new milieu “possess a lawful freedom of inquiry and of thought, and the freedom to express their minds humbly and courageously about those matters in which they enjoy competence” (sec. 62).

Technology is seen as one means through which the economic disparities of the world can be corrected, therefore “technical progress must be fostered, along with a spirit of initiative, an eagerness to create and expand enterprises, the adaptation of methods of production – in a word, all the elements making for such development.” The purpose of this development must not be “profit or domination” but the service of man “viewed in terms of his material needs, and the demands of his intellectual, moral, spiritual, and religious life” (sec. 64). The means and modes of production are to be utilized to benefit humanity and this means not making any technologically-driven decision that would “be detrimental to any worker” since the “entire process of productive work, therefore, must be adapted to the needs of the person and to the requirements of his life, above all his domestic life” (sec. 67).

The final area the bishops address that has technological implications concerns the avoidance of war. They recognize that “now that every kind of weapon produced by modern science is used in war, the fierce character of warfare threatens to lead the combatants to a savagery far surpassing that of the past” (sec. 79). The capacity for destruction by these weapons far exceeds “the bounds of legitimate defence” where “any act of war aimed discriminately at the destruction of entire cities or of extensive areas along with their population is a crime against God and man himself. It merits unequivocal and unhesitating condemnation” (sec. 80). The arms race is foolish and the doctrine of mutually assured destruction, although not named explicitly, is viewed as “not a safe way to preserve a steady peace” (sec. 81).

The overall stance toward technology in both *Gaudium et Spes* and *Mater et Magistra* is generally positive, reflecting both the Catholic view of common grace and a belief that technological developments are sanctioned by God’s commandment for human dominion over nature. This positive orientation toward technology is maintained in a more recent encyclical, *Laborem Exercens: On Human Work*, which was issued by Pope John Paul II on September 14, 1981. The gradual development of science and technology are seen as contributing positively to the transformation of agriculture and human society. Technology itself is hailed as “that ally of work that human thought has produced in the interaction between the subject and object of work (in the widest sense of the word). Understood in this case not as a capacity or aptitude for work, but rather as a whole set of instruments which man uses in his work, technology is undoubtedly

man's ally. It facilitates his work, perfects, accelerates, and augments it. It leads to an increase in the quantity of things produced by work and in many cases improves their quality." At the same time, we are cautioned, "in some instances technology can cease to be man's ally and become almost his enemy, as when the mechanization of work 'supplants' him, when it deprives many workers of their previous employment or when, through exalting the machine, it reduces man to the status of its slave" (O'Brien, Shannon 1992: 357f.; sec. 5 of document). Structural unemployment and other negative results of the "basic coefficient of economic progress" raise fundamental ethical challenges that the Church must address.

The balancing of positive and negative aspects of technology continues to be a feature of formal Vatican pronouncements. Cardinal Francis Arinze, President of the Pontifical Council for Interreligious Dialogue, sent a formal message to the Muslim community on the occasion of the end of Ramadan 'Id Al-Fitr 1422 A.H. in 2001 which remarked (Bunson 2003: 601):

This year it is precisely upon this theme of human values and their promotion in an era marked by great technological progress that I wish to reflect with you. We are living in an era of technology, which touches all spheres of activity: transport, communications, information, medicine, genetics, etc. Technological advances are constantly transforming the face of the earth and even allowing human beings to reach out to conquer space. However the most exciting and at the same time controversial field of technology is genetics which touches human nature directly, as human beings try to pierce its mysteries with the aid of technology, with the risk that human life itself and the respect due it are endangered.

Another area is that of information technology which, through the Internet, makes possible widespread and rapid communication. We can only praise the Creator for human genius which has invented these means of information, learning and communication. Here also, however, much depends on the use which humans make of these means . . .

Catholic scholars, including social critics and philosophers of technology (e.g., Paul Durbin, Herbert Marcuse, Carl Mitcham, Albert Borgmann, Frederick Ferré) have ruminated frequently about technology but Catholic theologians have not wrestled with it much. We shall consider briefly two examples: Hans Küng and Karl Rahner.

2.4.1 Hans Küng

Likely one of the most important theologians within the modern Catholic tradition and an ecumenist who speaks across traditions, the Swiss theologian Hans Küng became a professor of theology at the University of Tübingen at the early age of 31 and as a result of a much-publicized clash with the Vatican over the issue of papal infallibility, had his permission to teach revoked by the Catholic Church. He was an active behind the scenes participant in the Second Vatican Council and according to his own recollections, quite influential in shaping some of its deliberations and decisions (Küng 2003: 268-328). Overall, despite many books that wrestle with the dilemmas of Christianity in general and the Catholic Church in particular as they confront modernity and postmodernity, Küng has relatively little to say directly about technology. He comments on the ideology of technological progress that has so suffused every corner of the modern world, a naïve optimism that the future is extraordinarily bright and that humankind now makes the future as a god who has failed in the past and has the capacity to fail catastrophically in the future (Küng 1974: 40f., 57). He notes that the first great technological revolution was the invention of agriculture in the Neolithic period

that gave birth to the first great river civilizations of the Indus, Nile, and Mesopotamia regions. The industrial revolution supplanted agriculture in its ability to remake the world. Now the “supraindustrial age” has come and Küng rhetorically asks, “Does this mean the fulfilment of what so many had been thinking and hoping: the optimism of the French Encyclopaedists with their philosophy of history, Lessing with his ‘Education of the Human Race,’ Kant with his idea of an ‘eternal peace,’ Hegel with his theory of history as ‘progress in the consciousness of freedom,’ Marx with the Utopia of the ‘classless society,’ Teilhard with his idea of evolution to the ‘omega point?’” (Küng 1974: 38f.). Consistent with the Catholic tradition in general, Küng is not against technology *per se*, but against its glorification and elevation into an idolatrous form of worship and servitude that suppresses any other viewpoints and values, squashes dissent or criticism, and marches onwards in a manner of assumed inevitability:

The baby must not be poured out with the bath water. What has to be given up is the *ideology of technological progress*, controlled as it is by vested interests, which fails to take account of the true reality of the world and with its pseudo-rationality creates the illusion of a manageable world. This is not to say that we must give up our concern for science and technology and thus with human progress. What we must abandon is only *faith in science as a total explanation of reality* (a *Weltanschauung*), in *technocracy as a cure-all substitute religion*.

The *hope* is not to be abandoned therefore of a *meta-technological society*, of a new synthesis between controlled technical progress and a human existence freed from the constraints of progress: a more human form of work, more closeness to nature, a more balanced social structure and the satisfaction also of non-material needs, of those human values, that is, which alone make life worth living and yet cannot be expressed in monetary terms. In any case mankind is fully responsible for its own future (Küng 1974: 43).

2.4.2 Karl Rahner

The German Jesuit, Karl Rahner (1904-1984), was a professor of theology at the Universities of Munich, Münster, and Innsbruck and one of the most influential Catholic theologians of the Vatican II era, during which he served the bishops as a *peritus* (expert). A prolific writer with 1,651 publications in German to his credit, Rahner never wrote a systematic theology but did publish extensive essays taking up various issues facing the modern Catholic church as well as utilizing numerous sermons and more popular forms of communication to convey his ideas to others. He spent four semesters as a postdoctoral student of Martin Heidegger at the University of Freiburg (his birthplace) and was also deeply influenced by Hegel, Kant, Aquinas, Maréchal, and Rousselot.

Rahner realized that science and technology as quite “successful” human enterprises “have all unintentionally contributed to the fact that men have come to prize truth merely as a means of gaining control and mastery over the environment in which they exist (and from this point they have gone on actually to define the nature of truth in terms corresponding to this essentially functional view)” (Rahner 1977a: 231). The ascendancy of a pragmatic, practical, and functional view of the nature of things and ideas leads to a philosophical position that denigrates other forms of knowing as merely biologically, sociologically, or psychologically influenced beliefs or opinions that carry no weight (Rahner 1977a: 232). On the other hand, Rahner held out hope that somehow the “honest objectivity of natural science and technology really have penetrated into his

[man's] nature and exercised a formative influence upon him" (Rahner 1977a: 235).

Fully accepting the importance and God-given nature of science as a means of learning about creation, Rahner longed for a deeper engagement between science and the Church, calling for the sustained involvement of Catholic scientists at the forefront of such a dialogue and positioning such an exchange as a veritable *praeparatio evangelii* which the Church must engage (Rahner 1977b: 104-108). The complexities of the sciences did not escape him nor the deep need for an interdisciplinary dialogue between the sciences and the humanities, including theology (Rahner 1975: 113, 116, 120). Success at this interdisciplinary dialogue will entail certain dispositions as well as some clear methodological and procedural steps. The beginning point for such a dialogue is for the theologian to subject "his own science to the most searching criticism," and then accepting the challenge to speak about the ultimate "Mystery" even if this is perceived by some others to be a "radical threat to our rationality." This approach must be coupled with a very strong humility about what theology does and can know in a similar way that it calls other sciences to acknowledge their inherent limitations of viewpoint, values, and verifiable knowledge. If successfully modelled by theology, Rahner believed that this would mitigate the problem of each discipline claiming superiority over all others, putting an end to "gnoseological concupiscence." While historic sciences generally have learned humility in the face of the deep puzzles which the world continuously supplies to inquiring minds, newer sciences as they seek to assert their importance inevitably overreach

in their claims and can benefit from a patient reminder that all ways of human knowing have limitations (Rahner 1975: 88ff.). A third contribution that theology can make is to provide a knowledge of the history of theology since the history of ideas in the Western world has been deeply intertwined with theological thought and most academics are unfamiliar with these extensive discussions across time and space. This must be done with a view not to gain ascendancy over the other discipline but to mutually learn from one another since theological thought has also been influenced by social, economic, scientific, technological, and political thoughts and events (Rahner 1975: 91).

Rahner writes of the need for theology to also learn from the sciences, especially those dealing with the human sciences. Conversely, since a core focus of theology is the human person, “theology can and must remind the scientists concerned for the human responsibility entailed in every finding of natural science” (Rahner 1975: 92). This would include a “critical inquiry by theology with regard to the image of man which determines their outlook” as well as theology critiquing its own content by more closely considering what the social sciences tell us about society and human culture. Ideally this *rapprochement* could lead to the creation of new disciplines and forms of inquiry and new organizational structures that promote rather than curtail fruitful interdisciplinary exchange (Rahner 1975: 93). This exchange is not without its risks since “the concrete outcome . . . cannot exactly be foreseen by either side,” but if totalitarian claims can be muted then progress can be made and deeper insights developed. Rahner also recognized the growing powers of the state and the danger that it will

uphold the frequently displayed “arrogance of the empirical sciences” (Rahner 1983: 23).

In contrast to any of the theologians we have considered to date, Rahner also probed in-depth one specific issue of contemporary technology, the problem of genetic manipulation, in a number of his writings but which for our purposes will be limited to just one such example (Rahner 1977c: 225-252 within which he references many of his more technical or extensive papers on selected aspects of this topic). He recognizes at the very start of this essay the extreme problems that modern science and technology pose for the theologian who wishes to grapple with their theological and moral dimensions since by their very specialized nature they demand a level of knowledge, personal experience, and skills that would be quite impossible for a theologian to obtain or even after obtaining, to maintain (Rahner 1977c: 225). We might recognize in passing that the same thing could be said about a biologist or physicist who wished to enter into complex theological conversations without the benefit of the arduous and lengthy process of acquiring the knowledge, experience, and skills associated with this unique sphere of human intellectual activity. The age of specialization has produced its share of wins for humanity but one of its costs has been the impossibility of anyone becoming a consummate master at multiple disciplines. Even a theologian trained to a high degree in this arena, e.g., Alister McGrath, would find it necessary to continuously read and keep abreast of detailed developments within a particular field or subfield for fear that missing a particular detail “might be the decisive factor in his case.” The challenge this poses becomes even more daunting when it

is considered that such ethical pronouncements, informed by theological thought, would have to hold not just for the immediately foreseeable future but also for a time that the theologian himself will not see since frequently the consequences of these moral decisions once they are translated into scientific or technological applications have irreversible effects (Rahner 1977c: 226).

A lengthy and informed discussion disposes of many possible features of the problem of genetic manipulation and Rahner then homes in on the importance of recognizing and listening to a “universal moral faith-instinct,” akin to the kinds of practical decisions people make all the time about who to marry, what to do in a particular situation, when to do something that cannot be subjected to analytic reflection or if it was so subjected, would lead to what would on its face be clearly “wrong” decisions. As he points out, “A moral awareness of this kind (which both is and does more than we have mentioned here) forms the context in which man has the courage to make decisions; thus a decision is also more than its rationale, because the act is always more than its theoretical foundation” (Rahner 1977c: 251). Viewed from this standpoint, genetic manipulation can be viewed as wrong because the intents that underlie its usage are ill-conceived and immoral, e.g., manipulating genetic materials to control the production of what we desire, making the created object subservient to our own intents, creating the means whereby the state can produce human beings in its own image and for its own purposes, violating the moral reason for the creation of life as an expression of love between a man and a woman and a gift of God. Rahner recognizes that adopting this position will not be popular and may not even be successful in

stemming the tide but calls on the Church to take this very step consistent with its role as prophetic voice down through the centuries since “it is one of the fundamental duties of a genuinely moral and Christian man to endeavour to do precisely this: to be absolutely faithful to a thing in a situation where it seems hopelessly doomed to failure” (Rahner 1977c: 250).

A final important point from Rahner is that Christians “see in the dark” (Rahner 1966: 328; 1974: 181), i.e., *Docta ignorantia futuri* is the watchword for Christian theologians. When facing speculations about technology and the future, we cannot presume to know any more than our secular counterparts, even as we possess eschatological hope.

2.5 Some Concluding Thoughts

We have examined the manner in which technology is mentioned or inferred in both the Old and New Testaments. It is a pervasive presence in both Testaments with God as the ultimate technologist. We have selected twenty-one substantial theologies of the twentieth and twenty-first centuries and subjected them to an analysis to discover how frequently science or technology is mentioned and the specific manner in which they are discussed. Our results showed clearly that neither topic seems to be given the attention it might deserve given the fundamental ways both of these areas of human endeavour shape both the modern world and the ways in which theology itself is practiced. Technology is mentioned six times less frequently than science although it is arguably a much greater shaper of the modern milieu than the sciences. Selected theologians have

briefly discussed technology and a few representatives from various traditions and orientations were considered to gain a flavour for the ways in which theologians have (for the most part fleetingly) thought and written about these matters. These findings are consistent with an analysis Mark Ellingsen (1993: 299-304) undertook for the Institute for Ecumenical Research in Strasbourg, France when he analyzed forty-two formal statements issued between 1969-1991 by ecclesial bodies spanning 11 nations and the World Council of Churches regarding the broad field of genetic engineering. He particularly wanted to see what theological warrants they offered for the particular stances they took. He was disappointed to discover that in 21 of the documents there was not a single clear theological warrant and the bulk of the others only asserted one or two theological appeals that they claimed informed their positions. In a similar manner he analyzed documents regarding nuclear armaments for roughly the same period of time and arrived at similar results (Ellingsen 1993: 226-283). We can note that the situation within Jewish theology may not be markedly different although Judaism did not import Aristotelian concepts of nature into its thinking as did much of Christian theology due to the influence of Thomas Aquinas and as a general stance Jewish rabbis and thinkers have looked favourably upon technology. Recent technological developments related to genetic engineering have, however, started to fracture this more uniform historic Jewish stance (Sagoff 2005: 82-86).

What we have been seeking in this thesis has so far largely eluded us. We have not found a detailed exposition of theological thought as it relates explicitly to technology, although we have identified some valuable sources upon which we

may draw. We can also note that the theological richness of the Christian tradition, despite its seeming lack of explicit attention to technology, may yet provide sufficient resources for sustained engagement with technology although we shall have to test this hypothesis out in light of explicit examples of technological applications. This venture will occur in chapter five where we will seek to create a framework for engagement between theology and technology. We will then employ a case study method concerning intelligent transportation systems as an arena where the framework can be both fleshed out in some specifics and also be subjected to a test of its potential. We will draw into this discussion insights from the rather extensive amount of thinking, writing, and sometimes dialogue regarding theology and certain areas of genetics and molecular biology, where much activity has already occurred.

But before we can undertake such an endeavour, we must develop more than a passing familiarity with the broad features of intelligent transportation systems as they are rapidly developing in nations around the globe. This will be the focus of chapter three to which we now turn. Chapter four will then further prepare ourselves to explore the engagement of theology with technology by considering the work of Christian philosopher of technology Albert Borgmann.

Chapter Three

Intelligent Transportation Systems

“Shallow understanding by people of good will is more frustrating than absolute misunderstanding from people of ill will.” (Martin Luther King 1992: 91)

“Technology environments are not merely passive containers of people but are active processes that reshape people and other technologies alike.” (Marshall McLuhan 1962: 2)

Much of the discussion about technology from both theologians and philosophers has been at a level of generality that may obscure rather than clarify the contributions of these two disciplines to beneficially understand and employ technology (Mitcham 1994a: 64f.). The failure to fully engage with technology also leaves insights that technology might stimulate unrealized by theologians and philosophers since any benefits from interaction would presumably be bidirectional.

We need to explore how sustained interaction may provide important insights and opportunities for challenge, learning, and exploration. We turn in this chapter to a particular domain of technological applications that are linked together into what is now known in the United States, the European Union, and elsewhere as Intelligent Transportation Systems (ITS) and sometimes less frequently as telematics (which in ITS parlance now has a more restricted meaning related to wireless vehicle communications systems). Our goal will be to gain an awareness of the many complex issues that ITS embodies so that we may employ it as a case study to explore the many ways in which theological thought might fruitfully engage with modern technologies and be informed by them. The specificity of the case should enable us to minimize simplistic connections or

interactions between these two domains of human activity while at the same time maximizing the number of concrete instances where specific unidimensional and unidirectional contributions and multidimensional/multidirectional contributions can be recognized. Simultaneously, it will reinforce the point that engagement between the boundaries of theology and technology is wide-ranging rather than being limited to the better-traversed areas of theology and human genetics and theology and information technology.

3.1 Transportation as an Arena of Human Action

Intelligent transportation systems are a very recent set of technical developments in the very long history of human transportation systems. It is helpful to understand some of the history and contexts of more general transportation systems and transport issues since ITS is intended to enhance existing systems as part of an ongoing evolution of these particular technologies and their applications.

Roads and highways, for example, have been principal means by which entire economies and societies have emerged and grown over time. They have contributed positively to the spread of ideas, cultures, languages, inventions, goods, and services. Disease, enslavement, demands for tribute, and warfare have also spread through networks of roads and highways to devastate entire peoples and areas and immeasurably alter the course of history.

The first roads dating back to the dawn of civilizations (c. 3000 BCE) were little more than dirt paths worn down by frequent travel from one location to

another via wheeled vehicles (Astour 1995: 1401). Rivers were the main highways of this time period as goods and people moved up and down their courses and any city that desired to rise to importance was located on a river. Yet within a period of a few hundreds of years, roads became a commonplace and began to reshape the geopolitical history of entire regions. Even during this period, rivers and canals still were the most economical way to transport large quantities of goods with roads being used to link river trade to cities and towns throughout entire regions (Astour 1995: 1403).

The earliest roads were designed to bear the weight of wheeled traffic including carts, large wagons, and swift chariots. Within cities the main thoroughfares were paved and varied in width from two to ten meters (Dorsey 1997: 431). A series of “narrow streets” connected to these “broad streets” within cities and enabled populations within them to increase substantially in size. The Neo-Babylonians and Assyrians constructed royal roads that linked major cities across their empires. The Persians took over many of the practices of the Assyrians and maintained excellent royal roads, some as long as 2,670 kilometres. These roads featured “excellent inns,” as noted by the Greek historian Herodotus (c. 485-425 BCE), as well as special parks so that the king or his senior administrators could take their rest in leisure when travelling across the vast reaches of the Persian Empire (Astour 1995: 1417f.). Similarly in ancient Egypt, roads were constructed both within large cities and linking cities and regions of Egypt and her territories to one another. The typical Egyptian road was about five meters in width (Dorsey 1997: 432). Outside of cities, most roads in the ancient

Near East were unpaved but had been carefully prepared and levelled, and were regularly maintained. The ancient Greeks did not favour roads and built only a skeleton of dirt roads from one region to another until the time of Alexander the Great (356 – 323 BCE) who saw the need for better roads linking the rapidly expanding segments of his empire.

The Romans, likely expanding upon earlier techniques of the Etruscans, took road building to new heights of engineering excellence, constructing two, four, six, and eight lane highways connecting all key parts of the Empire (Adkins & Adkins 1994: 171ff.). Roads themselves became a symbol of the might of Rome and the certainty that if they were needed, a Roman army would arrive swiftly to deal with any socio-political unrest or the incursion of enemies from outside its borders. Roman surveyors determined the optimum location and direction of roads, favouring straight traces whenever possible. Roman engineers constructed roads that would last for centuries through careful attention to the underlying base materials, superb drainage to keep water away from the road and its foundation, the careful use of stones and cement, and regular repair. Many miles of these Roman roads survive throughout the former Empire and quite a few modern roads follow the exact same course as their Roman predecessors. While originally designed for military purposes, the roads became the means by which Roman ideas, life, and culture spread across the Empire. All roads carried mileage markers always delineated in terms of their distance from the imperial city of Rome, a reminder to all of the might and power of the Empire. By the time of Diocletian (245 – 313 AD), there were 372 main roads throughout the Empire,

covering a distance of some 85,000 km. The Romans went well beyond any of their predecessors in the extent and interconnectivity of the system of secondary and primary roads they created and maintained across the Empire. In Roman Britain alone, over 9,656 km of roads were constructed and maintained. Bridges and tunnels, milestones to enable a traveller to instantly know their location, wooden signposts, and many other “modern” features of roads and highways were common throughout the Empire. The roads created ideal conditions for the growth of a postal service for government use and also a private postal service employed by wealthy citizens. A series of posts were set up so that couriers only had to move from one posting station to another – a design that would later be used by the famous but short-lived Pony Express in the American West.

Roads were not a distinctly Roman and European phenomena. The Qin and Han dynasties of China created a highly integrated network of roads, mainly for military use in the second century BC. The first Qin Emperor, Qin Shihuangdi (c. 259-210 BCE) constructed 7,000 km of roads radiating out from his capital city of Xianyang in northern China (Shaughnessey 2000: 174). One hundred years later, there were over 35,000 km of roads in northern China serving an empire of some four million square kilometres. Similarly, the Incas created an empire running from Ecuador to central Chile and held it together via a network of over 10,000 roads built across some of the most difficult mountain terrain in the world. Remnants of these Incan royal highways still exist today and many modern roads follow the traces of these roads as a continuing tribute to the foresight and skills of these early highway engineers in South America.

The road systems developed by the Romans throughout the western Empire declined considerably after the fall of Rome while those in the East continued to be maintained to a reasonable degree both under the Eastern Roman emperors and their Muslim conquerors. Many medieval roads in Europe declined to little more than dirt roads and were subject to flash floods and steady deterioration.

3.2 Modern Roads and Highways

Roads in the West began to be vigorously revived in the seventeenth century with the introduction of street lighting, ferry services, and emerging regulations from local, regional, and national governments. Central governments began to assume more direct responsibility and control for roads and centralized planning and maintenance became common, supported by general tax revenues.

Pierre Trésaguet, director of the École des Ponts et Chaussées in Paris in the mid-eighteenth century had studied long and well the achievements of the Romans (Vance 1990: 154f.). His department had responsibility for some 40,000 km of roads throughout France, many built in the exact traces of earlier Roman roads. Trésaguet ensured that exacting road preparation methods were employed, following earlier Roman techniques and the road system throughout France improved dramatically under his tenure. Two Scottish engineers made similar improvements throughout Britain in the early nineteenth century (Vance 1990: 162). Thomas Telford built an exquisite model road between London and Holyhead demonstrating the superiority of preparing a very solid and carefully

constructed roadbed before providing surfacing materials. While expensive to build, it was vastly superior to other roads. John Loudon McAdam, his fellow Scot, pioneered the use of natural materials as the base of a roadbed and developed methods to highly compact these materials to provide the same type of firmness that Telford achieved, only with much lower production costs. The surface material used on his road and the entire type of road took its name after him – macadam. This was a period of time in which in the words of McAdam, “Roads must be built to accommodate the traffic, not the traffic regulated to preserve the roads” (Quoted in Rose and Seely 1990: 23). By the late nineteenth century the use of asphalt and portland cement (first used in Scotland in 1865) also became common and the maintenance required for roads became much less labour intensive.

Roads, including early toll roads such as the Lancaster Turnpike in Pennsylvania, USA, where travellers had to pay a fee to enter and/or exit the road, were a principal means of commerce in Europe and colonial America and traces to the American West eventually were turned into roads that enabled white settlers to push rapidly westward in search of new lands and opportunities (Vance 1990: 519-522).

The advent of trains and railroads in North America, Europe, and elsewhere provided new opportunities to create many smaller secondary roads that linked smaller towns and farming areas to commercial nodes. Consequently, these roads became the means by which goods and services circulated far more widely than was economically feasible before with attendant mobility of goods,

people, and ideas. The combination of railroads and roads during the American Civil War, for example, enabled large and rapid movements of troops and influenced the outcome of many a Civil War battle.

The nineteenth century saw the introduction of steam-powered equipment to construct roads, with the most important invention being the steamroller of Louis Lemoine and Amedee Jean Ballaisson. These steam rollers quickly found their way to India and other nations far from Europe and the United States. New gasoline powered vehicles provided even more powerful machines to build roads and also led to more plentiful traffic for roads, resulting in yet further expansion of networks of roads across nations. By the nineteenth century it was common for city roads to be made of portland cement, and bitumen (pitch) or concrete was used for cross-country routes. Rural roads in the hinterlands continued to consist of dirt and packed gravel.

The first multilane, limited access highway in North America was constructed from 1917-1925 as the Bronx River Parkway, a NY thoroughfare still in use in the twenty-first century. The first bone fide superhighway in the United States was the 160 mile Pennsylvania Turnpike from Middlesex to Pittsburgh which opened in 1940 and quickly outstripped expectations as 2.4 million vehicles used it annually within the first few years. Adolf Hitler and Benito Mussolini were aficionados of superhighways and under their direction, massive superhighways were constructed in Italy and Germany in the 1930s that provided jobs for thousands of workers, advanced political ideology, and subsequently, enabled the rapid movement of troops (Sachs 1992: 47-62; Vance 1990: 513).

President Franklin Delano Roosevelt appointed a National Interregional Highway Commission in 1941 and a Federal Aid Highway Act was approved in 1944 that authorized \$1.5 billion for interstate highway construction. By the time of the Eisenhower Administration, the federal highway legislation resulted in the construction of over 64,000 km of highways running across the United States in both north and south and east and west orientations (Vance 1990: 507ff.; Fox 2004). Many states, such as New York, Pennsylvania, Ohio, and Illinois also built their own extensive toll roads that connected in networks running particularly throughout the northeast. Today similar highway systems can be found throughout the world and the proportional number of miles of such highways within a nation even serves as a rough gauge of its economic status in the world. These extensive networks of superhighways and their linked secondary roads enabled the expansive growth of suburbs and attendant suburban “flight,” substantially altering the tax base and quality of life of central cities – a situation readily observed in places like Atlanta, Boston, Chicago, London, Los Angeles, Paris, and Philadelphia.

The building of these complex systems of interlocking major roads linked to secondary and tertiary roads coupled with the evolution of automobiles and the *mentalité* that they promote, has led in the past fifty years to an enormous expansion in these networks of roads globally (Sachs 1992). Cars and highways were named as two of the top twenty engineering achievements of the past century (Constable & Somerville 2003).

The United States in 2001 had 3,948,335 statute miles (6,354,229 statute kilometres) of highways, including secondary roads (Bureau of Transportation Statistics 2004: 1-1). In that same year, 4,432,327 million passenger miles were travelled on these highways, slightly over half of which were accumulated by automobiles (Bureau of Transportation Statistics 2004: 1-37). The European Union (15 nations) in 2000 had a total of 4,300,000 kilometres of roads of which 51,800 kilometres were motorways (European Commission 2003: 3.1.11).

3.3 Highway Planning

Highway planning today is a complex branch of civil engineering that is designed to move goods and people efficiently, effectively, and safely across large distances (see Wright & Dixon 2003 for details this section merely summarizes). It includes attention to forecasting demand, acquiring land from various parties, designing roads and arteries that make for safe and aesthetically pleasing experiences for highway users, moderating costs, and providing for long-term maintenance and expansion when needed. Traffic volume is generally measured in terms of annual average daily traffic which allows for derivation of a figure that avoids the inevitable peaks and troughs of traffic flow in any given day, week, or month. An entire route is divided into zones and then estimates are made about travel between zones and the amount of travel that will be undertaken by different modes of transport (e.g., trucks, cars, buses). A maximum theoretical traffic flow rate is calculated using reasonable parameters of environmental, highway, and traffic conditions. A further factor that is taken into account in

planning is what level of service the road will need to bear that will be acceptable to its users. This is due to the fact that travel is an inherently subjective experience and planners attempt to find an acceptable level of service (LOS), avoiding the extremes of very good (index A) and very poor (index F).

A number of additional factors then need to be considered. All human technological applications have environmental effects. Highways directly affect matters such as noise pollution from horns, tires on road surfaces, engines, the speed of traffic, and shock effects from heavy loads on road surfaces; air pollution due to carbon monoxide, nitrogen oxides, volatile hydrocarbons, sulphur oxides, and particulate matter from exhaust fumes and as well as evaporation from road surfaces; water pollution due to runoff that picks up oils, trash, and other materials from road surfaces; and environmental effects from the initial siting of the highway and its continued maintenance. These latter effects can include changing migration patterns and habitats of birds, mammals, amphibians, fish, and other creatures as well as increased road kills which number well over one million mammals a year in America alone. Sometimes road kills result in the total extinction of a species or a severe threatening of its existence, e.g., Florida panthers.

Highway design includes attention to both aesthetics and safety issues. Each highway has to surmount certain physical challenges that land presents and decisions have to be made about how much to use the natural features of the land in construction or to substantially alter it. Modern highways attempt to utilize natural materials and natural roadbeds as much as possible since it is far cheaper

than completely excavating and hauling away such materials and replacing them with others. Sometimes the natural material base is not conducive to the type of heavy travel a particular road will be required to bear and then such steps have to be taken.

A much larger portion of land is required than just that needed for the roadway itself. Most highways require a median that is almost equal in size to the width of the one or more lanes on one side of a divided highway. Then the outer edge of the driving lane requires a shoulder so that vehicles have a space to move off the road safely when they encounter vehicular or other problems. A drainage ditch is usually found outside the shoulder to handle run off from the driving lanes which are sloped in such a way that water runs off the highway quickly. The ditch also serves as the means to handle runoff from surrounding land on either side of the road cut to keep water off the road surface and prevent erosion from undermining the pavement or roadbed.

Pavement materials for roads and highways have to meet technical standards in order to be used. All materials must be sufficiently strong and durable to meet the required criteria that planners have established for that particular type of road. A typical highway is a composite of many different types of materials that are laid down in a carefully defined sequence and constantly checked to verify that they meet required specifications. Materials include sand, gravel, crushed rock, portland cement, asphaltic cement, lime, and more and more frequently, recycled materials such as crushed glass, scraps from old roadways, and pulverized tires (Fwa 2003: 62-23ff.).

Road geometry takes account of the steepness of curves, the slope of hills and valleys (road grades), passing manoeuvres on varied terrain, and the need to maximize clear lines of sight. This is further complicated by situations where two highways meet one another where a whole series of considerations must be addressed to plan and construct effective intersections and interchanges that enable a smooth and safe flow of traffic.

The actual siting of highways is always a complex decision that involves balancing factors such as travel time, vehicle operation cost, accessibility, environmental effects, societal acceptability, safety, total cost of construction, and viable alternative routes. Increasingly local, state, and federal governments in many countries have to use the concept of eminent domain to assert their primary claim over land held by owners reluctant to relinquish their claims frequently because they are opposed to the siting of the highway through their property. Government agencies generally are required by law to provide a fair-market value price to the owners.

The impact of interstate highways on commerce, migration, immigration, and employment growth has been the subject of much study. The overall findings indicate that counties or administrative units that reside alongside interstate highways typically see an increase in net immigration, employment growth, and commercial activity while counties which have been bypassed by the interstate suffer net migration, a loss of employment over time, and declining commercial activity (Lichter & Fuguitt 1980: 509f.). The large amounts of particulate matter generated from major roadways has been identified as a source of chronic

exposure that produces negative health effects within communities, especially in children and adults suffering from various respiratory preconditions (Korenstein & Piazza 2002).

Roads and highways also have to be managed by agencies to ensure that traffic flow is maintained at a reasonable level and that users of the roadway obey traffic laws designed to maintain such flows. Traffic signals of many different varieties have been developed and a set of international standards have been promulgated for signs so that drivers can travel virtually around the globe and know what they are supposed to do in particular situations. Toll booths, highway exit and entry, emergency breakdown services, quick response to traffic accidents, enforcing traffic laws, and many other facets of roads and highways are generally underappreciated by users but essential to maintaining a working system of roads and highways. Driver error, including falling asleep at the wheel, is by far the most common source of traffic accidents and deaths and injuries to drivers, pedestrians, and wildlife. Traffic fatalities worldwide are projected to exceed 1.2 million by 2020 when about 1.47 billion vehicles will be on the roads. This reflects a global death toll rise of 66% from 2000 with the fatality rate in high-income nations projected to decline by 30% while it rises about 80% in developing nations over the same period. This yields a traffic fatality incidence rate of 8 per 100,000 in high-income countries and 20 per 100,000 in developing nations in 2020 (Kopits and Cropper 2003: 26-29). Injuries due to traffic accidents are projected “to be the third leading cause of disability-adjusted life

years worldwide by 2020,” making it the largest single source within the category of injuries (Baker and Baker 2002: 1237).

3.4 Other Means of Transport and a Systems Approach

While roads and highways certainly figure large in the overall scheme of transportation systems, especially in heavily industrialized nations, they are only part of a much larger set of environments including maritime (both surface and subsurface), air (lower atmosphere), space (beyond the lower atmosphere and currently expanding just beyond the limits of our solar system), and off-road travel. Modes of transport include cars, trucks, railroads, ships, airplanes, space vehicles, submersibles, bicycles, gliders, subways, monorails, pipelines, buses, and human locomotion.

Transportation in all its varied modes taps a broad array of issues that exist within an interactive domain space that embraces technology, systems, and institutions (Sussman 2000: 3-9). The *technology* dimension refers to actual devices, tools, and techniques that are employed across the transport sector. *Systems* bring these technologies together in complicated ways in a matrix that can be thought of as possessing three dimensions: ownership (joint, private, public), venue (rural, urban, intercity, international), and focus (traveller, freight). *Institutions* serves as a reminder that the *technologies* and *systems* always relate to social, political, and cultural institutions that shape their evolution, implementation, and use.

All transportation systems have physical components that include infrastructure, vehicles, equipment, power systems, fuel, control systems, communications systems, and location systems (Sussman 2000: 11-15). These may all be thought of as internal components of transportation systems. Human operators and operations provide the means by which these physical components are designed, integrated, and used. These factors include labour (unionized or nonunionized), labour management, strategic planning, operations management, maintenance management, information management, operations research, and administration (e.g., legal and regulatory affairs, payroll). Finally, all of these components must be put together in a coherent manner in the form of an operating plan that includes such items as schedules, crew assignments, flow distribution, connection patterns (hub and spoke design), cost and level of service (generally a tradeoff situation where an increase or decrease in one directly impacts the other), and contingency planning (Sussman 2000: 21-25).

Externally, transportation systems always are part of an even larger complex of players and actors that includes government (local, regional, national, and in some cases, international), the customer, general public, stakeholders (individuals or groups who have some personal stake in the enterprise), supply industry (often spanning the globe in terms of raw and finished materials), financial community (public or private investors with for-profit or nonprofit motives), and competitors (Sussman 2000: 27-31). It is this particular socio-political dimension that provides opportunities for theologians and the Church in

its many manifestations to be involved in decision-making regarding transportation issues (Wachs 1995, 2004).

An extremely wide array of issues come into play with modern transportation systems ranging from those involving highly technical matters and generally heavily quantitative in nature to those involving determination of human values and aesthetics (Sussman 2000: 33-170; Soleyret 2002: 34, 52). These include desired/acceptable levels of service (LOS in industry parlance) for both freight transportation customers and travellers, issues related to the design and deployment of networks (heavily mathematical in nature), supply and demand issues (including dealing with peaks), measuring performance, modelling these systems so that appropriate decisions can be made in anticipation of future demands and needs (often involving econometric models and computer-intensive simulations), and logistics (ensuring that people and goods get to where they need to be in an acceptable manner). All of these many issues embody within them implicit or explicit value decisions where final selection of a course of action is made balancing a set of competing priorities (there are always constraints in time, personnel, money, capabilities, and capacity), information (data quality spans a continuum from data about which the quality is uncertain to data that can be classified as poor, fair, good, and excellent in terms of its validity and reliability), and risks (often ranging from near certainty to highly uncertain).

Even more deeply, as the noted Christian philosopher of technology, Albert Borgmann (1990a: 319; identical in 2003a: 39f.), reminds us:

The highways [in the twentieth century] reshaped space in its horizontal dimension, the skyscrapers in the vertical dimension. In all of human

history there has never been so massive a reordering of public space. Remarkably, both of these new kinds of public structures have an avowedly subservient or instrumental position in our culture; they are means to an end. Expressways are meant to get the commuter from home to work and goods from one place to another Naturally, we feel a desire to centre our culture in its most prominent tangible expressions. We are moved to celebrate the highways as the distinctive way in which we appropriate this country and to see in the skyline of the metropolis the embodiment of modern power and sophistication. But these sentiments are belied by the grim or sullen moods that we exhibit when we drive on the expressways or work in our offices.

Borgmann's observation and its implications will be explored subsequently, but it reminds us that there are more to highways than simply their surface features and that Christians and theologians would do well to attend to these hidden aspects of highways and their associated systems.

Highways and all other modern transportation systems are products of socio-political as well as technical processes. While road engineers long resisted the intrusion of the public into their technical decision making, it became apparent by the 1970s in America, for example, that legislators, critics, and local residents had to be accommodated within a political decision making process where not only the initial authorization of roads but various steps in their design, building, and maintenance were all open to public scrutiny. The process also became even more complicated by the fact that modern society no longer accepts the "singular importance or correctness of any particular grand scheme" and experts can be played off against each other in the political arena to advance various agendas (Rose and Seely 1990: 44f.). Despite the complex nature of highway authorization, construction, and maintenance, it is clear that there is ample room

for theologians and Christians with expertise or just a strong political interest to be involved in these sometime acrimonious but always public debates.

3.5 Intelligent Transportation Systems (ITS)

Pervasive computerization is the next major innovation in transportation, including roads and highways. Virtually every industrialized nation has a wide range of current applications in the area of intelligent transportation systems (ITS). ITS “refers to a variety of tools, such as traffic engineering concepts, software, hardware, and communications technologies, that can be applied in an integrated fashion to the transportation system to improve its efficiency and safety” (Chowdhury & Sadek 2003: 1). Similarly, another engineer defines it as “the integrated application of well-established technologies in advanced information processing and communications, sensing, control, electronics, and computer hardware and software to improve surface transportation performance, both in the vehicle and on the highway” (Stephanedes 2003: 65-2).

Safety concerns have been a major motivating force behind the effort to harness the power of computing and information networks and apply it to transportation devices, vehicles, and systems. A total of 6,316,000 crashes were reported in the United States in 2002 with 2,926,000 injuries and 42,815 deaths (Bureau of Transportation Statistics 2004: Highway profile). A total of 17,419 of the deaths were alcohol related and 20,416 deaths occurred in passenger cars with motorcycles claiming another 3,244 lives, light trucks adding another 12,182 victims, and 4,808 pedestrians losing their lives to moving vehicles (Bureau of

Transportation Statistics 2004: 2-1). Within the European Union of 15 nations in 2001 a total of 39,849 persons were killed in road fatalities while the number of persons killed per year per million population reached 102 across the EU in 2002. (European Commission 2003: 3.6.1). The number of accidents involving personal injury across the EU-15 stood at 1,279,400 in 2001 with an accident rate involving personal injury per 1,000 population of 3.4 across the EU-15 that same year (European Commission 2003: 3.6.2).

A second driving force for the application of ITS solutions to transportation in Europe, the United States, and other industrialized nations are the total amount of expenditures on transportation and the amount of revenues generated by the transportation sector. The goal is to increase efficiency, since even a 1% net gain in efficiency results in a significant saving of public monies. The United States expended 167,455,000,000 U.S. dollars in 2000 on transportation at federal and state levels (Bureau of Transportation Statistics 2004: 3-25a). Europe invests about 80 billion Euros for transport infrastructure annually with about 20 billion of this total being spent on the trans-European transport network (El-Araby 2004: 1148).

Six interlocking system areas define the general space of ITS as pursued in the United States and there are similar typologies for other nations: advanced traffic management systems (ATMS), advanced traveller information systems (ATIS), advanced vehicle control systems (AVCS), advanced public transportation systems (APTS), commercial vehicle operations (CVO), and advanced rural transportation systems (ARTS) (Stephanedes 2003: 65-4). Four

core technologies are involved in most ITS applications (Stephanedes 2003: 65-15):

1. Sensing: typically the position and velocity of vehicles on the infrastructure.
2. Communicating: from vehicle to vehicle, between vehicle and infrastructure, and between infrastructure and centralized transportation operations and management centres
3. Computing: processing of the large amounts of data collected and communicated during transportation operations
4. Algorithms: typically computerized methods for dynamically operating transportation systems.

Automated toll booths, for example, allow vehicles with appropriate stickers on their vehicles to pass through the booth and automatically be billed for their trip rather than having to stop and manually deliver money or tokens to a human or automated operator. Designated Short Range Communication that employs either microwave or infrared signals makes the automated billing possible. The battery-powered tag is activated by microwave and sends back a code identifying the vehicle. These systems are in use by more than seven million Americans annually and are increasing around the world. Currently the system allows system operators to track vehicles who move through the tolls and this has led to the arrest and conviction of some criminals as it showed that their vehicle was in a particular location at a designated time. Some long-haul truckers deliberately sabotaged these systems in protest over the ability of managers to more closely monitor their driving behaviours (Bell & Dooling 2000: 181). Manufacturers, in response to growing public concerns about privacy, are now working with governments to create smart cards that would be used in lieu of the stickers. These cards would automatically debit an account but not record an

association with a particular vehicle and could be implemented in such a manner that only limited persons have access to the debiter's name and address (Fischetti 2001: 92). Another innovative use of this technology has been the implementation within central London of an anticongestion scheme that charges cars for driving within the designated target area (Wheatley 2003). The scheme, being avidly watched by governments and think tanks in other large cities with significant congestion problems (e.g., Poole 2004: 44), uses 688 cameras at 203 sites across the eight square mile area that has 174 entrance and exit points. It employs Automatic Number Plate Recognition technology to send charges to the respective automobile owners – a combination of visual and information processing technology that could never be implemented by human operators alone. It is part of an even larger system that includes the cameras, image management software and hardware, telecommunications links between the cameras and the image “store,” and a customer services infrastructure that allows for payment via multiple means including selected retail outlets. Preliminary results indicate a 20% reduction in traffic congestion and a 5% decrease in travel times within the zone. It is anticipated that the scheme will generate about \$2.2 billion over the next ten years that will be deployed to upgrade public transportation systems within central London. Similar systems that do not involve charges and payments but are used to provide real-time traffic information to travellers have been deployed in many cities and regions including the Hampton Roads area (VA), Seattle and Tacoma (WA), southern New Jersey, northern Taiwan, and for buses in the region of Twente, Netherlands (Witbreuk, Zoontjes,

& Drijver 2004; Ozbay & Bartin 2004; Lin, Wang, & Ting 2004; Monroe & Trimble 2001: 18-19).

Automobile manufacturers now offer customers an option to purchase a vehicle that uses a Global Positioning System (GPS) to track the physical location of a vehicle upon demand. OnStar, from General Motors Corporation, is the most widely deployed current application of this technology with over 2.5 million users (Monroe & Trimble 2001: 18f.; Danigelis 2004: 30). It enables drivers who leave keys inside their cars to have their car doors opened remotely. The technology also automatically alerts emergency personnel when you have a serious accident and provides driving instructions and other information upon demand. On board navigational systems provide oral and/or visual best route options for drivers and if the driver turns off the computer suggested route, the system automatically adjusts and provides instructions to the intended destination “on the fly” as the driver responds to local traffic conditions. More sophisticated future versions of this technology will obtain up to the minute traffic conditions from local wide area networks and make appropriate route modifications to speed travellers to their destinations by the most efficient route (Zhao 1997: 136-141). The telematics of the future car will not only feature functions currently available in systems such as OnStar, but also send information about damages sustained to the vehicle to emergency personnel who can then better determine what resources to deploy to the accident scene and to enable hospital emergency rooms to better manage their response to major accidents (Danigelis 2004: 30). The European Commission (2001: 68f.) has taken this one step further and taken the position

that “black boxes” within the cars of the future can “record parameters which help explain the causes of accidents, will make motorists more responsible, speed up court proceedings following accidents, lower the cost of court proceedings, and enable more effective prevention measures to be taken.”

Many interstates or roads in heavily congested areas of the world use computers to regulate entry into the highway as traffic lights and barriers allow only one vehicle at a time onto the highway such that mergers happen more seamlessly and the flow of traffic on the road is not impeded by entering traffic (Benouar & Kanafani 2004). Many cities have sophisticated computer systems that regulate traffic signals across the city with the timing of signals changing throughout the day to accommodate the daily ebb and flow of traffic to and from major zones within the city (Mariani 2003: 67). A recent modification introduces real-time complex modelling of data into traffic management to determine what particular approaches to traffic management actually yield “on the ground” and to optimize decision making (Jacob & Abdulhai 2004). Global positioning technology (GPS) now makes it feasible to track vehicles anywhere in the world and many large transport companies already utilize this technology to keep track of their vehicles both on the road and also across railroad and maritime systems in seamless global transportation networks that enable managers to ensure that their products arrive at required destinations in a timely manner and in good condition (e.g., Marais, Flancquart, & Ambellouis 2004).

ITS planners have created plans for intermodal transport systems that utilize advanced telecommunications and computer systems to move goods across

entire continents through underground tunnels or highways dedicated solely to the movement of freight. These intelligent systems would only require human operators on points of entry or exit within the system and once on the network, goods could be accelerated greatly in their passage to desired destinations. Similar designs exist for automobiles of the future that would go on “autopilot” once the human operator had placed the vehicle on the superhighway, doubling or tripling feasible road volumes (Motavalli 2001: 128; Whelan 1995: 206). Computers would then guide the vehicle to the required exit point and then the human operator would take over control functions to move the vehicle safely off the superhighway. Such a system could minimize the traffic jams so familiar to major interstate highway systems during peak flow times and enable resources to be used more efficiently.

Adaptive cruise control uses data from front-mounted lasers or radar transmitters on a vehicle to automatically override a driver’s decisions in order to maintain a safe distance and speed (Motavalli 2001:124f.; Liu & Tate 2004). Two barriers to widespread implementation of this technology by automakers are potential risk exposure to liability claims and driver disinterest (Garrison & Ward 2000: 11). A third factor worth mentioning is that these Advanced Driver Assistance Systems have not yet been demonstrated to positively affect driver safety. It has been speculated that the impact of these systems may be mitigated by unknown behavioural adaptations of drivers in ways neither anticipated nor predictable by designers (Dragutinovic, Brookhuis, Hagenzieker, & Marchau 2004).

Similar technology applications exist for trains (Roache 2000). There is a vision for the future of trains that will have their internal and external information gathering and monitoring systems so interlinked that the train can initiate “self-repair” by automatically scheduling services, commanding immediate service attention, altering interior air and lighting conditions without human intervention, etc. (Boehmer 2000: 180).

A wide-ranging set of wireless communications, including cellular and cordless telephony, personal communications services, radiopaging, private land mobile radio, radio data networks, wireless local and wide area networks, terrestrial microwave relay, satellites, and even meteor burst technology (!), provide a dazzling array of possible ITS applications for both vehicles and travellers (Elliott 1995).

Coupled with these wireless communications systems is an ever-broadening cornucopia of sensors and sensing devices that are integral to traffic management. We are all familiar with sensors in automobiles such as fuel lights, speedometers, cruise control, and odometers as well as the radar guns used by law enforcement to monitor vehicle speeds. This toolkit of sensors has substantially broadened in recent years to include radio and infrared beacons (both passive and active), vehicle-mounted transmitters, sound detection systems, overheight sensors, weather sensors, distance warning systems, precrash detection and immobilization systems (Klein 2001: 182-192). Traffic flow is now routinely monitored within urban areas utilizing surveillance, infrared video imagery, microwave radar, CW Doppler radar, FMCW Radar, inductive loop detectors,

magnetic detectors, fluxgate magnetometers, and sensors that combine two or more types of detection (Klein 2001: 243-295). These systems are sometimes supplemented or complemented by other data collection systems such as the Floating Car Data Project in Berlin which continuously compiles data on traffic conditions using information obtained from all of the taxi companies within the city who voluntarily supply real time data from the on-board equipment carried in their fleets of vehicles (Gühnemann, Schaefer, Thiessenhusen, & Wagner 2004).

The necessary interconnectivity of transportation systems, further intensified by the application of information technologies of various kinds, has resulted in promulgation of mandatory national and international standards for ITS applications and systems. As goods and passengers move from one region to another, one nation to another, and one continent to another, it has become imperative for the various conveyance systems to “talk” to each other so that efficiencies can be obtained and safety assured. The various standards encapsulate within them the express values of their designers and subsequently shape not only the technologies of the moment but also *future* developments of those technologies.

Responsibility for creating standards is often shared among various official bodies, including professional associations of engineers and others with technical expertise. Government funders generally serve in a quasi-supervisory capacity to ensure that standards are created within a reasonable time and with sufficient quality to be useful in advancing the field. In the United States there are

currently eight officially recognized Standards Development Organizations

(Chowdhury & Sadek 2003: 136):

- American Association of State Highway and Transportation Officials (AASHTO),
- American National Standards Institute, Committee X12, Electronic Data Interchange (ANSI),
- American Society for Testing and Materials (ASTM),
- Electronics Industry Alliance/Consumer Electronics Association (EIA/CEA),
- Institute of Electrical and Electronic Engineers (IEEE),
- Institute of Transportation Engineers (ITE),
- National Electrical Manufacturers Association (NEMA), and
- SAE International (SAE, formerly the Society of Automotive Engineers)

European nations have similar bodies at the national level but increasingly the European Commission is taking a more direct role in this arena as well as other areas where standardization is justifiable on economic, technical, procedural, and/or safety grounds. The European Commission (2001) issued a white paper titled, *European Transport Policy for 2010: Time to Decide*, which lays down ambitious goals and a timetable to meet them across the EU. There is explicit attention to ITS and the trans-European transport network is seen as “an ideal candidate for the deployment of intelligent transport. It is not limited to large traditional infrastructure such as roads and motorways, railways, ports, and

airports, but also includes the traffic management systems and information, positioning, and navigation systems and services which make it possible to operate such infrastructure to best effect” (European Commission 2001: 117).

The widespread use of ITS raises a host of ethical and sociocultural issues, many not particularly unique to these applications but part of a broad set of issues common to technological innovations. Increasingly the operators of these systems would have knowledge of one’s whereabouts and be able to track the movement of a single individual across a city, state, or even potentially around the globe as these various systems come online and interconnect both operationally and informationally. Technical managers would also be able to shape human perceptions and experiences of reality by varying conditions on these systems, e.g., deciding that today’s optimal travel time from point A to point B will be 25.8 minutes, and programming the system to deliver these results. It is vital, particularly in democracies, that citizens have access to policy makers and designers of such systems to ensure that the products and approaches developed are acceptable. The exact manner in which that occurs, current problems in achieving consensus, and the functional role that theology might provide in these public deliberations will be explored in chapter six.

The President of the United States signed the Intermodal Surface Transportation Efficiency Act (ISTEA) into law in 1991, following its passage by Congress. This major piece of federal legislation placed less of an emphasis on construction of the federal interstate highway system, which already is quite well developed. Instead it emphasized a variety of modes of transportation, including

cars, trucks, buses, trains, bicycles, and promotion of walking and vehicle-free environments. For the car-obsessed culture of America this was revolutionary. ISTEA also required that there be citizen participation and input into transportation planning, implementation, and evaluation for all federally funded transportation projects (Carlson, Wormser, & Ulberg 1995: 89). This landmark legislation provides an open door for theologians, churches, and denominations to become more closely involved in this particular area of modern technological development. But how can and should such persons and institutions engage in these conversations? What might they positively contribute? What might they learn and how might they be challenged anew in their theological thinking? It will be useful to gain some further particularized knowledge about an explicit realm of transportation projects related to ITS and a formal case study of one particular set of applications for a distinct region of the United States.

3.6 Current ITS Applications and Decision Making about ITS

There are an exceedingly wide range of ITS applications that can be split into two main categories, those that relate to intelligent infrastructure and those that relate to intelligent vehicles. Intelligent vehicles embrace three distinct functional areas with the indicated subareas (Mitretek Systems 2001, 2003):

1. Collision warning systems (including intersection collision warning, obstacle detection, lane change, road departure warning, forward collision warning, and rear impact warning);

2. Driver assistance systems (including navigation, driver communication with other drivers and with carrier/dispatch, vision enhancement, intelligent cruise control, speed control, guidance/steering assistance, precision docking, coupling/decoupling, on-board monitoring, and safety event recorders);
3. Collision notification systems (including “mayday” automated collision notification which signals an accident and advanced automated collision notification which senses and automatically assesses likely damage and possible injuries and radios this information to emergency personnel).

Intelligent infrastructure can be categorized into thirteen functional areas for which we will only list the first level subareas (Mitretek Systems 2001, 2003):

1. Arterial management systems (systems focused on subsidiary roads that radiate from major highways including traffic surveillance, traffic control, lane management, parking management, information dissemination, and enforcement)
2. Freeway (major highway) management systems (systems for the major highways of a locale including traffic surveillance, ramp control, lane management, special event transportation management, information dissemination, and enforcement)
3. Transit management systems (concerned with fleets of vehicles of various kinds, including safety & security, transit demand management, fleet management, and information dissemination)

4. Incident management systems (systems that deal with problems such as accidents, natural disasters including surveillance & detection, mobilization & response, information dissemination, and clearance & recovery)
5. Emergency management systems (systems that focus on response personnel and equipment including hazardous materials management, emergency medical services, and response & recovery)
6. Electronic payment systems (including toll collection, transit fare payment, and multi-use payment)
7. Traveller information systems (pre-trip information, en-route information, and tourism & events)
8. Information management (chiefly data archiving)
9. Crash prevention & safety (road geometry warning systems, highway rail crossing systems, intersection collision warning, pedestrian safety, bicycle warning systems, and animal warning systems)
10. Roadway operations & maintenance (information dissemination, asset management, and work zone management)
11. Road weather management (surveillance, monitoring & prediction, information dissemination, traffic control, and response & treatment)
12. Commercial vehicles operation (credentials administration, safety assurance, electronic screening, carrier operations & fleet management, and security operations)

13. Intermodal freight [freight tracking, asset tracking, freight terminal processes, drayage (empty container) operations, freight highway connector systems, and international border crossing (IBC) processes]

This high level summary of the world of ITS makes it clear that these are a wide-ranging set of applications, all of which are in use at some level (pilot test, field test, or full implementation) in many nations around the world. Additionally, new products are in the research pipeline that virtually guarantees that these applications will become more widespread and ubiquitous in coming years. There are several different points of entry into a dialogue with organizations and individuals who create and maintain ITS. Each point of entry requires different forms of engagement and it may be useful to mention them here.

Research in ITS applications is a thriving sector internationally with several billion dollars per year spent in research at universities and private companies around the globe (Ülengin 2004). The ITS research enterprise frequently is charged by its funders to undertake studies that sometimes include ethical concerns related to specific applications. This may provide a window of opportunity for persons with expertise in Christian ethics to participate on a research team. ITS **planning** is another funded area where large-scale analyses of present and future needs, opportunities, and challenges are commissioned, often at the behest of government agencies. These planning studies with their associated data often become influential in policy making and legislative activities that appropriate the enormous sums of money required to build and implement ITS

applications. While these ventures are highly technical in nature and involve specialists in a wide array of disciplines including engineering, geography, finance, statistics, law, and public policy, there may be ways for theologians to join themselves to such endeavours – especially theologians who possess undergraduate degrees or professional experience in technical areas. ITS **standards** have to be created and revisited on a continuing basis by international and national bodies to ensure that architectures are standardized and that interoperability ensues within systems that span entire continents and increasingly the globe. While generally not heavily funded, the important work of national and international bodies in this area can become a means of leveraging changes in the ways in which the business proceeds if these alterations can become part of the standard way of conducting ITS practice in the field. Environmental groups have been successful over time at helping to shape environmental standards in many countries with the end result that the policies pursued have required steps and means of evaluation and assessment that did not exist prior to the intervention of such self-interest groups. Some thought would have to be given to what theology might distinctly seek from such a role but the possibility clearly exists to participate in this important activity that shapes the implementation of public and private policy and actions. All ITS applications undergo **evaluation** using mainly formal but also some informal methods. Standard methods include cost-benefit analysis, relative rating and ranking, deployment tracking, impact assessment, benefit estimation, deployment analysis systems, and traffic and other simulation models. Many of these approaches are highly quantitative but it appears there may

be room here to add “softer” methods that would provide additional and useful sources of information as part of an overall evaluation as well as pushing for different weighting schemes and modifications to methodologies for the evaluation methods currently employed. Once again, some thought would have to be given to what theology would specifically seek in this domain beyond what persons from other disciplines outside of the ITS core would be seeking. Participation in these activities by theologians would be enhanced by drawing from the ranks of theologians who have some detailed knowledge of the sciences or the social sciences. Then there are the actual **public policy** arena itself and the attendant **corporate** shareholder meetings where there is opportunity to bring issues to the attention of decision makers in a direct manner or via indirect means by working through proxies (e.g., professional lobbyists or large shareholders) or elected representatives. Beyond all of these internal processes, there remain in Western democracies ample opportunities to also speak directly to the public through the platform that public intellectuals can occupy. As we pointed out previously, Karl Barth, Reinhold Niebuhr, and Paul Ramsey are fine historical examples of theologians who left a rather large public affairs imprint in Germany and the United States. Niebuhr, for example, was a very powerful and well-regarded social critic of the nuclear weapons race between the United States and the Soviet Union at the height of the Cold War (Robertson 1967: 235ff.). As a public theologian and active preacher and pastor, he wrote 21 books and more than 2,600 articles – many published in the leading newspapers and thought journals of the day (Douglas 2006: 412). He “moved with utter ease between the

language of Zion and that of regnant secular culture” (Rasmussen 1991: 3).

Jürgen Moltmann in Germany is a living example of the kind of political influence that a theologian can exert under the right conditions and with the right skills and temperament (Forrester 1997: 35f.).

Just as Ramsey worked out his approach to what became the field of medical ethics in relation to explicit cases, so we will employ a similar strategy since one of the principal criticisms of prior critiques of technology by classical commentators such as Ellul, Heidegger, Arendt, and Illich was their failure to address specific practices and developments in technology and the ways in which these applications alter not only environments but cultures themselves over time (Achterhuis 2002: 98).

3.7 Our Selected ITS Case Study

Our analysis and ruminations to this point have now laid the groundwork for testing the feasibility of theology and ITS engaging in dialogue around a specific set of ITS applications. We will employ an extensive case study that was commissioned by the State of Montana (USA) Department of Transportation, Research and Development Program in cooperation with the National Automated Highway System Consortium, California Department of Transportation, and Lockheed-Martin, Incorporated. The contractor for the study was the Western Transportation Institute, Civil Engineering Department, Montana State University – Bozeman (Gomke 1998). This particular study was chosen because it was of sufficient length (64 pages) and complexity to provide a suitable set of

information for analysis and engagement (many “case studies” in the world of transportation that are released to the public consist of 10 pages or less) and because it highlighted a rather interesting set of issues that it is hoped will sufficiently maintain reader interest in what can be a highly technical field of endeavour. Continuous pagination information from the case study will not be provided. All information is summarized from the actual case study itself but placed in this author’s words except where quotations are employed and then specific pagination is provided. The particular research problem was to investigate the feasibility of implementing a rural automated highway system in the Greater Yellowstone Rural Intelligent Transportation Systems Corridor that traverses portions of the three Western U.S. states of Wyoming, Montana, and Idaho and includes within its very rural boundaries two extremely large national parks, Yellowstone National Park and the Grand Teton National Park (as well as three other much smaller and infrequently visited national forests and parks). The two large parks are major U.S. tourist attractions that combined received 5,299,093 visitors in 2005 (National Park Service, USA 2006). Within the region also lies part of the northern Continental Divide with an elevation of 7,072 feet.

3.7.1 General Characterization of the Study and Region

The National Automated Highway System Consortium in collaboration with the State of Montana Department of Transportation commissioned this study because there was a perceived need to study the feasibility of deploying ITS applications in rural parts of the United States. Most ITS development and

deployment in the United States has occurred in urban areas with a unique set of problems that are quite distinct from those seen in rural America. This particular segment of rural land was selected due to the very high volume of traffic into and out of the region, particularly during the spring and summer months but also relatively heavy in less severe winter months due to winter sporting activities. The Greater Yellowstone Rural Intelligent Transportation Systems (GYRITS) corridor is an important transportation link for the trucking industry and about 20% of its annual traffic is commercial, moving mining, forestry, and agricultural products as well as foodstuffs and other essentials. Most of the corridor consists of two-lane highways, many of which are windy in nature and hazardous in terms of passing situations. The corridor presents some unique challenges due to the 80-90 inches of snow it receives annually and temperatures that can reach as low as 65 degrees below zero (Fahrenheit) and with a temperature swing in a single day of as much as 50 degrees. Very heavy snowfalls challenge maintenance crews and drivers unfamiliar with the area can sometimes find themselves in dire straights rather quickly due to the sudden weather changes, high gusts of wind, and blinding snowstorms that are common. The region is also an active seismic zone, which causes unexpected rockslides in the mountains that strike vehicles, block roads, and contribute to vehicle collisions.

The corridor is home to an abundance of wildlife, due in part but not exclusively to the large area of national park land that comprise its chief attractiveness to visitors. These include large animals such as deer, elk, American bison, and moose. A recent three-year period registered 367 animal-vehicle

collisions and unreported incidents would likely push this number much higher. Much of the corridor runs between mountain ranges, therefore mobile phone service is spotty with huge swaths of land within the corridor, including Yellowstone National Park, where there is no mobile phone service. The lack of familiarity with the roads and conditions of the region encountered for the first time by its many visitors, the large numbers of wild mammals present and active within the region, road and weather conditions, and the isolated nature of the corridor constitute fairly typical conditions that can be seen in many rural parts of the United States. The federal government and consortia experts on ITS consider it an “ideal location to showcase field operational demonstrations of advanced technologies” (p. 2). This is in recognition of the fact that very few of the systems developed, implemented and optimized within urban environments can likely be successfully transferred unchanged to rural environments.

Safety issues become more important in rural environments due to the isolation with emergency help sometimes hours away or unreachable. Two-lane highways result in much greater numbers of vehicles passing other vehicles on the roads. While 40% of national vehicle miles driven in the United States each year take place on rural roads, they represent a full 80% of all roads in the nation. Accidents on rural roads account for 58% of all road accident fatalities.

A total of four major secondary roads (U.S. 20, 26, 89, and 191) traverse the corridor. Since it traverses three states and one national park (Yellowstone) that maintains its own roads, it also was viewed as an ideal location to work on ITS issues across government agencies and organizations.

The long-range stated vision of Automated Highway Systems (AHS) according to the National Automated Highway Systems Consortium is that AHS “will safely operate properly equipped vehicles under automated control on properly equipped lanes” (p. 9). Planners and policy makers have elected to go with a staged approach to this long-term goal since it is clear to them that political support for the costs involved and changes to the life anticipated will require users to clearly discern direct advantages and benefits. Rural parts of America are constrained by fiscal resources, smaller numbers of transportation and other essential workers, extreme and various weather conditions, and many more lanes of highway to maintain than their urban and suburban counterparts. Rural roads, including the GYRITS corridor have higher speed limits, more irregular terrain, less desirable road designs (from a safety standpoint), older drivers (average 45.8 years and 18% are over age 64), more unlit roads, fewer alternate routes, more roadside obstructions (since there are not the wide access and breakdown lanes that one finds in urban areas), and people who take far longer trips suffering greater fatigue and heightened inattention.

3.7.2 The Specific ITS Technologies

The focus of this case study was to determine ways that could assist the rural driver to avoid impending collisions through the use of appropriate collision avoidance technology (CAT). It was assumed that four different levels of CAT would be utilized progressively and hierarchically over time. The first stage would be **spot application**, i.e., particular spots where accidents tend to

frequently occur would be the initial focus of CAT using both infrastructure and active messages to achieve the desired result. The second level of service would consist of **information assistance**, i.e., directly relaying warnings to the driver of the vehicle throughout the entire corridor. The third level of service would be **control assistance**, i.e., warnings are relayed to the driver and if the driver does not respond the vehicle will assume control automatically until clear of the danger area. The final level of service would be **full automation** where the vehicle is fully autonomous once the driver is on any of the roads within the corridor. Three different types of collision warning systems would be deployed. **Longitudinal Collision Warning/Guidance System** is designed to warn a driver of excessive speed when approaching a particular segment of the road. Under both control assistance and full automation the car would automatically decelerate. **Lateral Collision Warning/Guidance System** detects whether a vehicle that is leaving the road is situated properly on the road surface and at a speed appropriate to the specific geometry of the chosen exit point. A visual or audio warning alerts the driver. In the case of control assistance the vehicle automatically applies some torque to reposition the vehicle in the centre of the driving lane. In the case of full automation, the vehicle drives itself off the major roadway and the driver engages near the end of the exit ramp. **Intersection Collision Warning** detects the presence of all vehicles on major roadways and relays appropriate information to vehicles waiting to cross the main thoroughfare from secondary roads. Sensors or loop detectors ascertain whether crossing, left turn, or right turn manoeuvres are safe based upon American Association of State Highway and Transportation

Officials (AASHTO) standards. The use of open architecture for the associated Information Technology (IT) system was recommended because it would allow rural agencies to start with particular applications and then add more incrementally as they were willing and able to do so.

3.7.3 Study Methodology

The author does not fully describe the study design or its methodology but a flow chart on page six provides some key information. The starting point for the study was an accident analysis that tracked accident rates, severity rates, and locations to identify atypical accident locations and to identify trends for the corridor. Countermeasures were then identified that might address the observed trends and “hot spots.” Simultaneously lane and shoulder widths for every highway in the corridor were obtained and this data was analyzed in terms of road geometry. Meteorological data was obtained for a period of time and also analyzed. Communications data in terms of emergency services and mobile and land phone availability was also obtained and analyzed. The results of the geometric, meteorological, and communications data were combined to create a detailed corridor description. This detailed corridor description was then combined with the countermeasures identification for the purpose of conducting a benefit-cost identification which resulted in the selection of potential early test site locations.

3.7.4 Institutional Issues

Deploying and maintaining AHS within the corridor would, as we pointed out earlier, fall to local transportation agencies. Testing of these systems would have to occur on both state and local right-of-way lands across multiple jurisdictions – a not insignificant challenge. The study investigated impacts of institutional issues including how they will procure, pay, maintain, operate and insure an AHS. Privacy issues, technical demands, user acceptance, system reliability, integration of AHS within state strategic transportation plans in each of the three states, environmental impacts, and the role of public-private partnerships were also investigated. Finding champions for the project from respective AHS users was also identified as an important issue.

Since a full automation application would remove the driver from control of the vehicle, this transfers all potential liability to the state under current tort laws. Each of the three states has capped state compensation per claim for tort obligations. The transportation provider (i.e., the state and local municipalities) would bear the brunt of high-risk areas in the early days of deployment and evaluation of AHS since under current law in these jurisdictions “although a person is required to use reasonable care for his own safety, he is neither required nor expected to search for obstructions or dangers” (page 18). Over time as the technology matures and more linked applications appear within the region, responsibility can shift to vehicle based risk.

Public acceptance was judged to be a challenge that might require the demonstration of tangible travel and safety benefits, education, financial

inducements, and technical resources. Procurement of AHS was viewed as a problem since rural agencies tend to seek low-cost, near-term solutions within their limited budgets and strive for an adequate but not extravagant level of service. Funding similarly is an issue since federal highways funds are allocated on the basis of population and these locales have small populations and small tax bases for revenue generation. It was felt that rural areas might be ideal to test the feasibility of private/public partnerships although no rationale was presented as to why this might be possible. Operations and maintenance responsibilities were assumed to be primarily federal and federal contractors in the early stages with state agencies assuming responsibilities once the system is functional. It was viewed as doubtful that with current resources that these three states could assume that burden either financially or technically.

Privacy issues were addressed in the form of recommendations to develop standards and guidelines for the control and use of motorist-related data gathered through AHS applications. It was believed that a good system would address “individual and vehicle identification, storage and access of the information and any secondary uses of the information” (page 20). Standards and clear guidelines were thought helpful to enlist public support for AHS. Aesthetics were viewed as far more paramount in rural areas than in urban ones – especially in this region with two national parks, three additional national forests and parks, and hundreds of campgrounds. No mention of other environmental impacts was made. Societal issues that were merely mentioned in passing include community mobility, local economy, land use, and social equity. Finally, jurisdictional coordination was

believed to be a hurdle to progress since a mix of state and local agencies control the over 500 miles of roadway in the three states and two large national parks. It was felt that funding an effort to address this issue within the corridor would help to develop a “seamless rural architecture and provide a tangible product” (page 21). Survey data from three of the four major state or local transportation providers was presented with 18 of 27 answers related to the above issues as “need more data” or “no concern” (page 21). Who completed the survey was not identified other than that it came from three agencies.

3.7.5 Accident Analysis

Data from a three-year period in each of the three states was examined for traffic accidents. The overall economic impact to society for the 2,538 accidents over the period was calculated at just over \$131 million US dollars. Accident rates and severity rates for each mile or half-mile segment of road within the corridor were calculated except for Yellowstone National Park, which employs a different distance metric. On the basis of these preliminary calculations atypical accident locations were chosen for study. A geographic information system was used to examine the data employing geographic areas of focus and looking at geometric alignment, city limits, mountainous areas, and state lines. Using three characteristics, geographic areas were identified for focus if they met two of the three characteristics. Heavy (commercial) vehicles exhibited no spot locations where accidents occurred more frequently. The recommendation was that they not be candidates for near-term applications of AHS, despite the fact that they had

accident fatality rates over twice that for heavy non-commercial vehicles (since the accidents seemed to be distributed randomly across various terrains). Highway 191 in Montana exceeded the national average in property damage, injury, and fatality rates. No conclusions could be drawn about out-of-state versus in-state accidents due to small sample sizes.

3.7.6 Spot Location Countermeasures

A series of spot locations that had higher than average accident rates were identified. Several potential AHS countermeasures were recommended including: **Friction/Ice Detection and Warning Systems** which calculates a safe speed advisory warning for the local conditions and displays it by the roadside to oncoming drivers. A single location costs \$111,620 including installation, message sign, four-point detection system, weather station, and processor. A non-AHS application would be a **Static Ice Warning Sign** that costs \$108 including material and installation. For intersection warnings at spot locations, the AHS technology of choice is a Crossing Detection System that warns drivers when any possible manoeuvre is unsafe. Because drivers can ignore this warning, accidents are never completely eliminated. The total cost of \$35,590 includes “two inductive loop detectors, two sign controllers, two signs with illuminated vehicle icons and estimated installation costs” (page 38). There are no traditional countermeasures. **Animal-Vehicle Collision Avoidance** uses a transmitter placed along the road that scans an area of up to two square miles. If an animal is detected an approaching vehicle’s radar detector is alerted [Note: many cars do

not possess this technology and in some states it is illegal to own it]. The cost for the transmitter associated solar pack and installation is \$3,800. Traditional countermeasures are fences, reflectors, repellents, hunting, reduced vehicle speeds, vegetation clearance, improved vehicle lighting, and public education. Some of these measures are only effective if one significantly distorts the natural aesthetics of the area. **Horizontal Curve Speed Advisory** is accomplished through an AHS dynamic variable message sign that calculates safe speeds for conditions and drivers are warned in advance of a suitable speed to safely negotiate the curve in the road. The cost is \$4,000 without a power source. Traditional countermeasures are advisory signs, including chevrons indicating a curve (6 signs cost a total of \$615 installed).

On a grander scale there are **regional countermeasures** that could be applied to the entire corridor. **Longitudinal Sensing** for this region is optimal utilizing radar rather than laser radar, vision sensors, or ultrasonic pulses due to the severe weather. The system is accurate to plus or minus 1 meter for ranges between 15-100 meters. **Lateral Sensing** technology appropriate for the severe weather of this corridor are magnetic pavement markers, with the two choices being magnetic nails or magnetic tape, each made under patent by one manufacturer. The former is less expensive but may cause pavement problems in the long term. The latter is better for cold climates but is more expensive. Interestingly the author found that magnetic nails had not been tested in cold climates with flexible pavements. Magnetic nails are about \$17,000 per lane per mile and require no power for their operation. The vehicle sensors that position

the car properly on the centreline of the road detect the polarity of the nails.

Magnetic tape costs \$23,760 per lineal lane mile if greater than 10 miles is used.

GPS is a competing but vastly more expensive and more difficult technology to implement and maintain.

3.7.7 Benefit-Cost Analysis

Benefit-cost analysis values the financial impact of deploying various projects. It analyzes the advantages, benefits, and cost reductions of a system application with a calculation of the gains compared to the capital expenditures required for its implementation. The goal in most cases is either/or to increase safety or to increase levels of service (e.g., carrying capacity, speed of transit). Since there were no significant rural AHS applications in the United States when this study was conducted, there was insufficient information on system reliability and insufficient data on driver response in light of AHS deployment. A series of calculations were performed but data for the analysis was taken from another study regarding accident reduction factors (AFRs) in an undisclosed location that was presented by three Japanese researchers at a conference in Berlin, Germany a year before the study was completed. Readers were reminded that these were “theoretical values” and that actual field operational testing would be needed to confirm its accuracy (page 46). All calculations within this section involved the use of these theoretical AFRs that will not be summarized here due to their source. However, it is helpful for our analysis to list the various AFRs that are derived for such studies:

Longitudinal Assistance: rear ends, animal-vehicle conflicts, following too close, and motor vehicle parked along roadside.

Lateral Assistance: head on collisions, sideswipes, overturned (after leaving the roadway), ran off road, struck another motor vehicle in transit, struck fixed object, struck guard rail, struck ditch, struck cut slope, struck tree, struck sign, struck fill slope, not in right lane.

Intersection Assistance: disregard traffic control, failure to yield.

Other: inattentive, travelling too fast for conditions, fell asleep, illegal lane change, illegal backing manoeuvre, fail to signal, over corrected, improper pass.

Accident reduction factors are then calculated and reported on a scale from 0.0 – 1.0 which translate into percentage reductions. A Spot Location benefit-cost analysis was also conducted, however, we will not summarize the results here since the same ARFs were used to produce these figures too. The tables themselves report the results in the form of an annual cost contributed by the trend and an annual benefit. In a similar manner annual regional benefits with AHS were calculated providing annual financial benefits for the three categories of applications (i.e., information assistance, control assistance, and full automation). Consistently across this table the annual benefit increases as the driver's personal control of the vehicle decreases with about a four to one ratio in favour of full automation (this would presumably hold true even if local accident reduction factors data was available). There is also benefit-cost ratios for specific segments of roads and what is interesting here is the variation across segments of road ranging from a 1:1 ratio to a 125:1 ratio.

3.7.8 Deployment Vision

Since there is limited data about AHS benefits in rural America and very slow market penetration due to various factors presented previously, the study recommended an incremental deployment of AHS technologies. Over the next five years it was felt that spot locations deployment of AHS in locations with favourable benefit/cost ratios was prudent. Collecting local data that confirmed the benefits versus the costs was believed critical to gaining local support and subsequent growth of AHS within the corridor. A public/private partnership for a particular segment of road within the corridor that would employ an automated snowplough application was also recommended. [My assumption was that its proximity to Yellowstone, a national treasure, would enhance the visibility of the participating private company in promoting the product assuming the test was successful.] As data from the field tests materialized, it was recommended that a public awareness and education program be commenced in order to attract new users. Within a ten-year time frame, it was anticipated that AHS-ready vehicles would be commercially available in sufficient quantities within the market to have perhaps 20% fleet penetration by 2009, with rural percentages being somewhat lower. These fleet vehicles could provide a source for collecting user satisfaction data from across the corridor. Finally, 20 years out, the study foresees a great increase in AHS-ready vehicles to perhaps 50% of the market and full automation being justifiable in rural America where it would mix with non-automated and semi-automated traffic. Yet at the same time it warned “uncontrolled access

would result in many points of conflict that could have an adverse effect on automated AHS” [engineer speak for vehicle collisions?].

A section of the Benefit-Cost Analysis also provided some data regarding deployment vision benefit-cost. Once again many of these calculations employed the suspect figures from unknown location discussed earlier so the specifics need not detain us here. Since full automation was believed to be in the distant future no benefits were calculated for its realization. Control assistance (driver in partial control) shows up to a ten-fold benefit as compared to information assistance (driver still in full control) and a low benefit of at least six times that of information assistance. Similarly, benefit-cost ratios run from a low of .02:1 to a high of 20:1 for segments of road under the information assistance deployment and from a low of 2:1 to a high of 137:1 for segments of road under the control assistance deployment. What the author does not make sufficiently clear to the reader, however, is that he compares information assistance (defined as 20% penetration after 10 years) with control assistance (defined as 50% penetration after 20 years). These impressive ratios, therefore, should be viewed with a great deal of suspicion.

3.7.9 Next Steps

The study selects five sections of highway for field operational tests of four different AHS applications. Potential for increasing safety was the main criteria for their selection. A series of suggested measures of effectiveness is provided for the field operational tests including accident rates per million

vehicle-miles travelled, total accident reduction, speed reductions, number of annual crashes, number of annual fatalities, annual fatality rate, annual number of injuries, annual injury rates, injury severity index, annual costs of injuries, and infrastructure damage.

3.7.10 AHS Benefits

By now it should come as no surprise to the reader of this case study that the author recommends the implementation of AHS applications within the corridor on a field operational test basis. He believes it will reduce the frequency of accidents and that moving to the level of Control Assistance “will help reduce the rate and severity of crashes” (page 14). He goes on to assert that:

If fully automated vehicles were provided on rural two-lane uncontrolled access highways, crashes could be eliminated. With an evolutionary deployment AHS can provide the rural traveller with:

- Safer travel
- More efficient travel
- Environmental benefits
- Additional mobility for the aging rural population; and
- Reduced insurance rates due to the reduction in accident frequency and severity (page 14).

This case supplies a concrete instance of the applications of ITS to a specific set of perceived problems in a particular geographic region of the United States. It allows us in the next chapter to see how the ideas of Albert Borgmann, coupled with ruminations from other philosophers of technology, engineers, and theologians, might be applied to such applications with the intent of understanding how theologians might engage with modern technology and what they might learn from such engagements.

Chapter Four

Insights from Albert Borgmann: A Christian Philosopher of Technology

**“What we in fact witness about us . . . is the most radical and forceful reshaping of the world ever. Something is going on here that needs to be illuminated and understood.”
(Albert Borgmann 1984a: 73)**

We have developed an understanding of the multifaceted nature of technology, explored its depiction in the Old and New Testaments, overviewed the work of contemporary theologians who have written concerning technology, and acquired a preliminary appreciation for intelligent transportation systems and their emerging roles in contemporary society. The paucity of work by theologians concerning technology requires us to reach outside of theological discourse to find insights and approaches that might be useful for theologians to appropriate as they take up the fundamental challenge of the technological world which we inhabit. Philosophy of technology is an academic area of study that holds promise for our quest. These scholars have been engaged for several decades now in the study of modern technology including consideration of the fundamental nature of technology (we drew upon some of their insights in chapter one), the impact of technologies across a wide range of human activities, general analytical thinking about technology conducted in a disciplined manner, “ferreting out the value assumptions which allow arguments to go through to conclusions,” and being open to criticisms from both within and outside their discipline (Pitt 1995: 30f.). Philosophy of technology is a latecomer to the specialty subfields within philosophy and many of its earliest scholars were drawn to it by their practical and political concerns about the

impact that various technologies were having within the broader culture (e.g., Durbin 2000: 38f.). While the discipline has its own societies, journals, professional meetings, and distinct theories and schools of thoughts, it has sadly not overcome its marginalization within general philosophical discourse despite the fact that the focus of its sustained inquiry, technology, “cuts across the full range of disciplines” not only in philosophy but human life (Feenberg 2000: 294; Higgs, Light and Strong 2000b: 7). Interestingly, many philosophers of technology possess underlying religious sensitivities or interests and have written a number of articles or books that regularly incorporate or allude to religious or spiritual concerns including Frederick Ferré (e.g., 1990, 1991, 1993), Paul Durbin (e.g., 1974), Carl Mitcham (e.g., 1983b, 1990b, 2005a; Mitcham and Grote 1984), Egbert Schuurman (e.g., 1980, 1984, 1996, 1997a), George Grant (e.g., 1969b, 1986; Athanasiadis 2001), and Albert Borgmann (e.g., 1968b, 1983b, 1986b, 2002b, 2003a). Albert Borgmann’s thinking along these lines is one of the best developed and several of his concepts and ideas seem especially pertinent to the task before us. We will therefore undertake an exploration of the thinking of Albert Borgmann regarding technology and its unique position within the modern world, seeking insights that will aid our inquiry into possible interactions between theology and technology.

4.1 The Life and Career of Albert Borgmann

Albert Borgmann was born in Freiburg, Germany in 1937. His parents were well educated Roman Catholics acquainted with many professors and doctoral students at the University of Freiburg including the Catholic philosopher of religion Bernhard Welte, theologian and Freiburg-born Karl Rahner, and Heidegger’s philosopher disciple, Max

Müller, who would later serve as Albert's doctoral supervisor at the University of Munich (May 1986: 56). Young Albert followed the usual German system of primary and secondary education and following gymnasium, was admitted into the University of Freiburg where in 1957 he attended a series of lectures by Martin Heidegger. He later recalled that at the time he found them impressive but much too challenging and concluded that perhaps he was not cut out to be a philosopher, despite his burgeoning interest (Borgmann 1993: 157). Borgmann relocated to the University of Illinois at Urbana-Champaign and took up the study of German literature, earning his M.A. in 1961. He subsequently returned to Germany and successfully completed his Ph.D. in philosophy at the University of Munich in 1963 and also married that year, returning to the University of Illinois as an Instructor in German Literature in 1964. Two years later he became Assistant Professor of Philosophy at DePaul University in Chicago and then moved to the University of Hawaii at Manoa for the period from 1967-1970. He left Hawaii as an Associate Professor and took up the same level appointment at the University of Montana at Missoula where he has remained. Naturalized as a citizen of the USA in 1972, he has three children. Promoted to full professor in 1973, he was appointed Regents Professor of Philosophy in 1996, a university-wide honor (Borgmann curriculum vitae and May 1986: 56).

Four major books of Borgmann will concern us here as they are interconnected and collectively advance a comprehensive, subtle and interesting way of coming to terms with technology in a manner that is informed by philosophical acumen and undergirded by a distinctly Christian worldview. They are Technology and the Character of Contemporary Life: A Philosophical Inquiry (1984a), Crossing the Postmodern Divide

(1992a), Holding onto Reality: The Nature of Information at the Turn of the Millennium (1999a), and Power Failure: Christianity in the Culture of Technology (2003a), the latter a compilation of articles previously published with some slight alterations by the author. Some readers of Borgmann have judged his work to reflect an “uncritical, undialectical nostalgia for premodern values” and staunch conservatism (Cutrofello 1993: 96). The importance of Borgmann’s work, however, has been widely recognized by his fellow philosophers and by many social critics and academics outside of philosophy. A book (Higgs, Light, and Strong 2000a), a section within a book (Durbin 1988: 1-43), and a theme issue of the journal Techné: Journal of the Society for Philosophy and Technology (Baird 2002) have focused exclusively on Borgmann’s work and provided opportunity for him to respond to his critics – a task that Borgmann clearly enjoys and from which he appears to greatly benefit. There are only a few theologians who have explicitly referred to the work of Borgmann, with virtually all focusing on one or more of his ideas concerning the device paradigm, focal things, or focal practices. There is no sustained summary of Borgmann’s entire corpus of thought concerning technology by a theologian or philosopher at the present time nor an extensive application of his ideas applied by a theologian to a particular arena of technology as we are attempting here. Theologians discussing and applying selected portions of Borgmann’s thought include Michael Northcott (e.g., 2004a: 420f.), Kathleen Cahalan (2002), Larry Rasmussen (1993: 78), Celia Deane Drummond (2004: 89f., 104), Peter Scott (2003b: 287f.), and Brent Waters (2006: 12f., 146-150). The only book-length treatment of Borgmann by a theologian that this author could locate was that of the Roman Catholic systematic theologian Richard Gaillardetz (2000), a small book targeted to a general audience published by a small

Roman Catholic press in the USA. Interestingly, Pattison (2005) makes no reference to Borgmann's work or that of many other philosophers of technology speaking from Christian perspectives.

Borgmann's thought has been markedly influenced by two twentieth-century giants of philosophy and social thought: Martin Heidegger and John Rawls. While he was overawed as a young student by the mature Heidegger, in later years while still appreciative of the "radicality" and brilliance of his thought, he found Heidegger's views of science inaccurate, his failure to seek any empirical confirmation for his views disappointing, and his ultimate answer to the challenge of technology impractical and useless (Borgmann in May 1986: 56). What he did take away from Heidegger was a realization of how important technology was as a challenge to modern life, the importance of concrete examples in philosophical discourse, many suggested investigations and arguments that Heidegger himself never explored but that served as focal points for Borgmann's thinking, and the use of terminology that "prevents insights from evaporating and lends guidance to further exploration" (Borgmann 2005b: 431). Heidegger's most essential insight, which forms the central pivot for much of Borgmann's work, is that the greatest threat of technology to human existence is not some human-made technological disaster but rather the changes that technology makes in human *essence*, a change that in Heidegger's view has already occurred and is terminal but for Borgmann is still amenable to treatment and recovery by sustained and determined human (counter)actions (Rojcewicz 2006: 141 citing Heidegger 2000: 28f.).

John Rawls' book, A Theory of Justice (1999, original edition 1971), impressed Borgmann greatly and served as a standard for how he could and should approach his

life's work – taking up the challenge of technology. He appreciated the careful analytical approach of Rawls, the marshalling of social science data in support of central arguments and to refute objections, and subjecting his ideas to empirical tests. Other named influencers of Borgmann include philosophers John Winnie and the late Henry Bugbee, and his longtime friend and fellow Christian philosopher of technology, Carl Mitcham (Borgmann 1993: 158; Borgmann in May 1986: 56).

4.2 Technology and the Character of Contemporary Life (TCCL)

Borgmann's first book-length treatment of the problem of modern technology and likely his most significant book to date, Technology and the Character of Contemporary Life (1984a), reflects in its title his central thesis: technology is so pervasive and influential that it fundamentally shapes the character of contemporary life. The first section of the book (pp. 1-32) takes up the general problem of technology by reviewing major theories of technology (primarily those of the humanistic philosophy of technology variety), the nature of scientific theory and scientific explanation, and the relationship between science and technology. Consistent with his Heideggerian heritage and sustained study of both language and philosophy, Borgmann employs a very expansive, engaging and thick description approach for the subject(s) of his analysis. He purposefully eschews the structured approach of analytical philosophers, preferring instead to describe in a very detailed manner the object in focus so that the reader is drawn into perhaps "seeing" the artifact, phenomenon and/or world in a new way.

Borgmann (pp. 7-11) recognizes three major classes of philosophies of technology: substantivism, instrumentalism, and pluralism. *Substantivism*, exemplified by

Jacques Ellul who viewed technology as autonomous and beyond human control, is a “demonizing” view that Borgmann rejects since he finds its fundamental position of autonomous technology inadequate because humans create all technologies. He does agree with Ellul, however, that modern technology has wiped out the former Aristotelian distinction between technology as human making and the human doing of political, religious, and moral action since modern technology pervades culture to such a degree that it fundamentally shapes everything in its path (p. 13). The trinity of *techné*, *logos*, and *eidos* has now been thoroughly conjoined with *poiesis* and *pistis*. *Instrumentalism*, often the view among the engineering philosophy of technology school of thought, views technologies as basically neutral in character, a view Borgmann finds inadequate to account for the pervasive ways in which modern technology shapes human beings, societies, and the world at large. All technologies, Borgmann finds, are created with particular ends in view and cannot therefore be held to be somehow philosophically and morally neutral in their intent or their impact. *Pluralism* is a view that seeks to complexify our understanding of technology by responding to the perceived shortcomings of both substantivism and instrumentalism. Bruno Latour (e.g., 1996) and others of the science and technology studies movement exemplify this approach. While Borgmann finds much to commend, he thinks pluralism misses the larger ways in which technologies are alike and create impacts far beyond those of specific technologies or technological systems (the level of analysis undertaken by this school of thought). He seeks a paradigmatic approach since he believes there is a paradigm that “inheres in the dominant way in which we in the modern era have been taking up with the world” (p. 3).

In his search for a better approach to understanding technology, Borgmann (pp. 12-25) next explores three types of knowledge and discusses the *apodeictic* orientation typical of the physical sciences with its deductive-nomological explanation of phenomena, the *deictic* orientation that looks at the reality of particulars such as occurs in the arts and literature, especially poetry, and the *paradeictic* orientation (a new term he creates) that seeks generalizable knowledge that is exemplified by history and many of the social sciences. This pattern, is defined by Borgmann as “an array of crucial features, abstract and simple enough to serve as a handy device, concrete and detailed enough to pick out a certain kind of object effectively” (p. 73).

Borgmann devotes pages 26-32 to discussing the complex relationship between science and technology in the modern world, noting that while “scientific knowledge is a necessary condition of modern technology, it is not, however, sufficient” (p. 31). He sees science as informing technological developments and understands that sometimes technological developments underpin new scientific information and analysis. While recognizing that technoscience is a reality, he believes technology and science can and should continue to be distinguished for the purpose of analysis.

The central and largest section utilizes a paradeictic orientation to consider in depth the character of technology (pp. 33-154). Borgmann spends four pages (pp. 35-39) noting the benefits that modern technology brings to human beings. It is clear from this discussion and subsequent comments scattered across Borgmann’s writings that he finds much to commend about modern technology despite his very deep concerns. He then introduces the first of his major ideas, the concept of a technological “device.” He uses a stove or hearth (pp. 41f.) to talk about how technological “things” in prior centuries

served not only the purpose of meeting basic human needs, in this case heating and cooking, but also served as the focal point for a variety of other daily occurrences that contributed to the distribution of labor, communication among persons, and a convening point for human interaction and companionship. He labels the hearth (literally *focus* in Latin) a “focal thing” since it met a basic human need but also centered a variety of other functions, persons, and interactions around it in a manner that enhanced the quality of human life.

He contrasts the focal thing (the hearth) with its modern technological replacement, the heating plant (pp. 41f., 147, 192). The modern home furnace sits usually out of regular sight and does not require the kind of sustained human attention and maintenance that the fireplace requires for successful operation. A “black box” switch controls heat and the owner of the home provides at best only the annual act of changing an air filter on the furnace itself. Repair personnel have to be used to maintain the operational efficiency and performance of the heating unit. This technological “device” in Borgmann’s terminology becomes part of a larger “device paradigm” (pp. 40-48) that pervades modern technological society and provides its essential character. This device paradigm by its very nature separates means from ends, causing devices to become mere “commodities,” and leading human beings to engage in “commodification” of their environment as they seek to fill it with ever more and more devices to make their lives less burdensome, provide entertainment, and in short, produce a life of leisure and intended happiness. All the while, human beings interact only with the surfaces of the devices (foreground) and are neither interested in, nor in most cases capable of, successfully interacting with the actual machinery that makes the devices “work” (the

background). This leads to alienation from nature, a de-skilling of human beings, and human disappointment as the increased acquisitiveness of consumption precipitates an insatiable appetite always for something new and little satisfaction with what one already possesses (p. 92). A subtle point frequently missed is that Borgmann seems to allow some exceptions to seeing all devices as being inescapably part of the device paradigm. He indicates that “devices that furnish a productive commodity . . . fall in part outside of the device paradigm” (Borgmann 1984a: 139; 200a: 364f.).

Devices are inherently appealing to us because they make no demands on us in the way in which things do and are readily available, safe, easy to use, and seem to enrich our lives while lessening burdens (p. 41). [This point was also realized in the early 1930s by Karl Jaspers (1957: 45) who remarked that the steady supply eliminated the relish of anticipation and the “aroma of that which is produced by personal effort.”] They do not require sustained human intervention for their function (p. 42). They serve us best when we hardly even know they are present and “working” but at the same time their very efficiency and lack of engagement with us leads to boredom. They forever “dissolve the coherent and engaging character of the pretechnological world of things” where our sustained engagement was critical often to survival and certainly to success at the venture at hand (pp. 47, 77, 140). This view hinges on Borgmann’s belief that “Human life is always full at any one time, and innovations can take place only by displacing some tradition” (p. 116).

The device paradigm, Borgmann’s paradeictic term for the overarching manner in which devices operate within our world, exerts inexorable pressure within basic social, economic and political structures towards increased consumption and continuing

alterations in the natural environment (p. 96f.). Consumption is “to use up an isolated entity without preparation, resonance, or consequence” (p. 105). It is the ultimate form perhaps of disengagement from reality as the consumer only sees a device and misses entirely everything that lies in the background of the thing that is in the foreground. Consumption within the natural environment takes a somewhat different look but exhibits the same issues. A valley split by a road, he reminds us, is no longer a great spot for hiking and the pervasiveness of TV programming discourages theaters and symphonies.

Politics itself “finds its orientation in the device paradigm” (p. 107) or put another way, “liberal democracy is enacted as technology” (p. 92). The device paradigm radically separates means and ends as it seeks to disburden us (but simultaneously disengages us) with things that are easily and widely available while hiding the full human context of the thing or the activity in question (pp. 40-48). Both Borgmann and George Grant recognize the particularly powerful relationship that exists between modern technology and capitalism within the liberal state. Both scholars recognize the role that the trinity of freedom, equality, and self-development play in liberal societies. They create the substrate that provides such a fertile ground for the blossoming and domination of technology and technological ways of thinking within modern society. A continuously expanding market economy is seen as a social good, the personification of the “good life,” as it provides the means by which people can attain equality – even if never realized it presents the tangible possibility to the less affluent and provides enough substance to keep them engaged and committed to the general principle (pp. 92ff.). Grant believed that liberalism with its strong emphasis on human freedom and individualism places “no limits to the technical control of natural and human processes” (Andrew 2003: 480). He

has a more jaundiced view of capitalism than Borgmann seems to possess and for which Borgmann has been criticized (Borgmann 2000a: 344f.).

Borgmann provides in the book a series of powerful examples of focal things from earlier and contemporary times including a medieval cathedral (pp. 159f., 179f.), a Greek temple (pp. 159, 197, 199), a modern city if it is a “memorable place,” e.g., contains historic restored sections (p. 244), and what in his view is the most powerful focal thing, wilderness - which brings together time and space in an eloquent manner (pp. 184f., 191). Yet even as humans trek into the wilderness he admits and readily accepts that they do so with the aid of modern technological devices and artifacts such as hiking boots, backpacks, portable stoves, freeze-dried foods, portable cell phones, etc. (p. 193). He contrasts these focal things with technological devices such as a stereo set (pp. 3f., 53), a TV set (pp. 43, 50, 142), a wrist watch (pp. 43, 149), the insurance industry (p. 117f.), and wine as a commodity rather than home-produced (p. 27f.). These commodities perform certain desired functions but do so at a steep cost of human disengagement from reality. While they promise more human control over their lives, they in fact deliver up less control as human beings more and more succumb to the device paradigm that ends up controlling them far more than they control the devices or the character of their everyday lives. Focal things, following his reworking of Heidegger’s insights, only come to the fore in their full power when one comes to understand the true nature of modern technology and the device paradigm with “the central vacuity of advanced technology” becoming apparent and making way for the revealing and treasuring of focal things (p. 199).

Focal things according to Borgmann can lead or support “focal practices” which are means by which human beings engage in deep interactions within their environment and intense engagement with the “real” world on a regular basis. Examples of such focal practices that he discusses in thick description include listening to a live symphony or concert (pp. 4f., 221f.), gardening, long-distance running, the culture of the table that accompanies a sumptuous home-cooked meal (pp. 200-206), religion in pretechnological societies and perhaps continuing in a more hidden manner in the present (p. 218), and a live poetry reading (p. 217). He also recognizes that for scientists and engineers who engage in their work, such work is itself a focal practice for them (pp. 118, 216) even if it becomes merely devices and part of the device paradigm for others. Borgmann avoids fine-grained definitions that are uniformly applied, he does provide examples and passing comments that give substance to any concept he is invoking. Thus he says that a focal practice “generally, is the resolute singular dedication to a focal thing. It sponsors “discipline and skills which are exercised in a unity of achievement and enjoyment of mind, body, and the world, of myself and others, and in a social union” while at the same time, being “inprocurable and finally beyond our control” (p. 219). Focal practices connect us powerfully with both means and ends as well as resolutely with reality in the form of things that are central to these practices (p. 209f.). These practices could be mental activities and not just physical in nature such as writing poetry or producing something on a computer although what is important is the “force and extent to which it gathers and illuminates the tangible world and our appropriation of it” (p. 217).

Borgmann discusses at length three possible explanations for the technological society: the market, capitalism, and the device paradigm (pp. 68-77). He finds them

largely compatible with one another and sees the device paradigm as essential to liberal democracy since one of the things such democracies strive for is to limit inequalities among people. The device paradigm and the rampant consumerism with which it is associated enables even people who are currently lacking particular commodities to believe that they can one day acquire them as the economics of production drive down prices and as further innovations result in even cheaper and better products (p. 75 and a point expanded further in Borgmann 2000a: 344f.). The economy itself is almost purely in the service of affluence as it produces ever more varied and refined commodities and neglects the creation of true wealth, defined as the settings within which focal things can flourish (p. 223).

Political structures, claims Borgmann (p. 113), will never become the venue where the nature of the good life can be discussed and debated as a means to halt the hegemony of the device paradigm. Rather, because modern democracy can only exist in the presence of the device paradigm that holds out hope to all for equality and advancement as measured by commodities and the “good life” of leisure, safety, entertainment, and happiness, it will never seek a fundamental reform of modern technology.

He cites empirical evidence from social surveys that Americans, living in the most pervasively technological society on the planet, are much less happy than less affluent counterparts in the world (pp. 124, 130). This finding, for Borgmann, demonstrates both the fundamental flaw at the core of the device paradigm and the need for society to engage in sustained discussion about what does it mean to live the good life (p. 91). Success in this venture would required deriving some sense of excellence and

Borgmann proposes a series of questions to guide such an enterprise: 1) How well educated and literate are people? How well do they understand the structure of the world? 2) What typically is the condition of people's physical vigor and skill? 3) How well acquainted are people with the arts and how proficient are they in making music and in other artistic practices? 4) How compassionate are people privately and as citizens? How devoted are they to helping others who suffer deprivation and hardships? (p. 127). He adduces a variety of social science data that suggests that on these measures, Americans are not faring well and concludes that this is due to the overwhelming presence of the technology they love so well.

Borgmann finds no hope that society will somehow respond to a moral critique of the defects of technology and believes that even its proponents "sense the weakness of their approach" (p. 144). The explicit invocation of focal things and focal practices are the only means by which technology can be reformed (p. 221). This cannot, by his definitions and understanding, be undertaken from within the device paradigm but can only occur as it seeks to recognize and restrain the device paradigm by limiting devices to their respective place and allowing room for focal things and practices in daily life (p. 220). This would require persons to desist from some of their usual practices where they exhaust themselves in the "building, rebuilding, refinement, and maintenance of stages on which nothing is ever enacted" (p. 222) as he thinks is the case with the well manicured lawns, finished basements, well maintained automobiles, etc. that are so typical of American suburbia. He calls for definite actions on the individual level that "shed light on changes that imperil things, practices, and engaging human relations, and the desire to make room for such phenomena when they are struggling to assert themselves against the

dominant pattern,” recognizing “the claim of things in their own right” (p. 76f.). He wants human beings to make focal things and practices be our ends and allow machinery and commodities to be our means with a “discerning use of technological products at the center of one’s practice” (p. 220f.).

He suggests that we can create a world where there is a community of communities that embrace the good life and that cultivate a collection of focal things and focal practices that connect humans with reality. These communities he hopes over time might one day unite and “surpass the peripheral ones [i.e., those that do not engage in such practices] in concreteness, depth, and significance.” (pp. 199, 218).

4.3 Crossing the Postmodern Divide (CPD)

Borgmann’s next book in his core trilogy, Crossing the Postmodern Divide (1992a), invites us to “see the postmodern divide rising from the plains of modernity and of the views that open up once we have left the modern realm behind” (p. 4). He begins his exploration by focusing on what he sees as two fundamental features of contemporary American life: sullenness in the public and personal sphere and its somewhat unexpected accompaniment of hyperactivity. He juxtaposes these two features to ask how in the presence of an unrelenting overdrive of activity within the Attention Deficit-Hyperactivity Disorder (ADHD) American society we can find such sullenness (pp. 1-19).

He takes us back in time in section two (pp. 20-47) to recount the origins of modernism and three distinguishing characteristics of this period in American history: aggressive realism, methodical universalism, and ambiguous individualism. *Aggressive*

realism (pp. 27-33) was the classic “taming of the wilderness” as Americans created tools, invented devices, tapped latent ingenuity, and utilized power obtained from water, coal, and steam power to conquer the land, subdue the Native Americans, mine the hills, clear the forests, till the soil, blast through the mountains, build the roads, dig the tunnels, lay the railroad tracks, and bring an entire continent under the direct influence and sway of technology. *Methodical universalism* (pp. 34-36) featured the rise of systems thinking in every sphere of American life including the mechanization of the factory, the interconnectedness of transportation systems and procedures to move goods and people easily across the nation, the rise of the corporation (applied with gusto in America), and the regimentation of daily life aided by a myriad of technological devices. *Ambiguous individualism* (pp. 37-47) traces back to Alexis de Tocqueville’s observation that in America, people’s fortunes were won or lost at the level of the individual and that this created a dynamism within society that he found entirely lacking in continental Europe. Borgmann describes rugged individualism (pp. 37f., 45f.) and commodious individualism (pp. 38, 43-45), the former surviving merely as myth in the present and the latter growing ever stronger in the presence of widespread consumerism, the voracious American appetite for things and technological gadgets, and the separation of public and private spheres in America which served to heighten individualism at the expense of community, especially in the postmodern economy (pp. 62-65). He chides economists for only arguing for a reduction in consumption on a momentary basis “for the sake of greater consumption in the future” (p. 80).

Modern “hard” technology in Borgmann’s terms, functions in a relatively rigid manner and focuses on human control of natural environments. Postmodern “soft”

technology, on the other hand, maximizes flexibility, adaptation, and customization while still focused on the goal of increased production and consumption (p. 88).

Chapter three takes up the postmodern critique and the postmodern economy (pp. 48-77). He recognizes the positive nature of postmodernism in the shift “from the belief of manifest destiny to respect for Native American wisdom, from male chauvinism to many kinds of feminism, from liberal democratic theory to communitarian reflections, from litigation to mediation, from heroic medical technology to the hospice movement, from industrialism to environmentalism, from hard to soft solution” (p. 78). At the same time he recognizes that there has been a “declining happiness and shabby standards of excellence” (p. 356f.) and that the fundamental problem of the “ambiguity of individualism” has been left unresolved (p. 79). Borgmann then introduces a new way of being in the world that he labels hypermodernism that breeds the sullenness he describes in the book’s opening paragraphs (pp. 78-109). He suggests that hypermodernism is distinguished by three key characteristics: hyperreality (pp. 82-96), hyperactivity (pp. 97-101), and hyperintelligence (pp. 102-109).

Hyperreality is a mode of being in the world that takes us beyond the “real” into a realm created by human beings. The distinguishing characteristics of hyperreality are its brilliance, richness, and pliability, i.e., “subject to our manipulation and control” (p. 87f.) The ultimate form of this hyperreality for Borgmann is the computer network, especially the World Wide Web of the Internet (p. 91f.). The more reality comes under human control the more the world recedes from us (p. 88). Hyperreality enables people to slip into a realm where they converse with disembodied human beings (and even machines) and have a virtual presence in the world, under their own name (but little else that truly is

“them” in an embodied way) or under a avatar or assumed identity. Other examples he gives of hyperreality are those wrought by technological devices such as a flight simulator (p. 85), TV (p. 91), videogame (p. 91), Disney World (p. 93f.), commercially produced and prepackaged food (p. 93f.), and glamour as advanced by advertising and the fashion industry (pp. 87f., 90f.). All of these devices enable “escape” from the real world into a new reality that is divorced from the real world and can lead to disengagement in Borgmann’s view (reminiscent of some of the themes of his earlier TCCL).

Hyperactivity, introduced earlier as a concept on pp. 13-19, is now further enhanced by thick descriptions of the hyperactive society (pp. 97-101) – a nation of Type A personality individuals that are fixated on the experience of hyperreality, addicted to a realm of constant motion and engagement with technological devices that take one away from the real world and promise release, entertainment, escape, and a wealth of human experiences that turn out to exhibit a shallowness of being and diminish true human engagement.

Hyperintelligence (pp. 102-109) is the realm of computerized, digital information that pervades the modern world in everything from phones, to computers, to monitoring and systems software, to instant news and a flood of information. Borgmann does not repudiate the realm of hyperinformation as he recognizes the “wonderful gain” that such technological information brings in enabling us to see further, deeper and more clearly our environment and the relationships among things (pp. 119, 216). A telephone system, the earliest version of hyperintelligent communication in Borgmann’s view, appeared to remove barriers to communication and makes more rapid transmission of thoughts among

human beings possible. Yet it reduces the need for the labor of contemplation and personal responsibility that was involved in writing a letter to someone in the past, resulting in disconnectedness with the human as online communication is superficial, truncated, and ephemeral (p. 105). Individuals who spend much of their waking hours on computers come under particularly harsh scrutiny as they are paragons of “omniscience and omnipotence” when on the network but when severed from that network become “insubstantial and disoriented” (p. 108).

Consistent with his earlier TCCL, Borgmann takes up the question of how the challenges of hypermodernism can be overcome, as he believes it is a great threat to our “sense of reality” (p. 12). He revisits again his earlier concepts of focal things in the form of focal reality that offsets hyperreality and reveals it for the shallow alternative that it is. Focal reality lies in the realm between but consistent with the macroscale of the universe and the microscale of atoms and molecules (p. 118). He describes the commanding presence of wilderness, arts and crafts, the soil, horses, trout, and a fishing rod as examples of focal reality that are associated with their respective focal practices such as running in the wilderness, painting, throwing a pot, gardening, grooming a horse, and fly fishing (pp. 118, 120f.). He contrasts long distance running as a focal activity with the same physical activity conducted in a gym with elaborate simulation equipment and finds the former so very much richer than the latter in terms of its engagement with the individual. Many other things that one experiences in the former can never be truly captured in the experience offered up by the latter (pp. 97, 94f.).

A concept he broached in TCCL, that of communal celebration, is here expanded considerably as he discusses at length the ways in which a diverse range of cultural

activities build communal celebration and enhance human life including baseball, church, community festivals, music, and public art (pp. 40f., 134-138, 140f.). This is in direct response to Borgmann's belief, supported by selected social science research he cites, that "we live in self-imposed exile from communal conversation and action" (p. 3). Many of these practices take on an almost religious atmosphere, including even "secular" activities such as the baseball game at the local stadium or sandlot (p. 135; cf. Eliade 1959: 27f. who held a similar view). These practices lead others to undertake such activities in the future, always with an appreciation that others elect to follow other pursuits that are equally worthy such as music, running, writing (p. 141). He suggests that individuals work together with patient vigor (p. 125f.) to purposefully create and regularly experience this true reality as a countercultural movement to the hyperreality, hyperactivity, and hyperintelligence that are so much a core realm of experiences in our everyday lives in the technological society.

4.4 Holding On to Reality: The Nature of Information at the Turn of the Millennium

(HOR)

Borgmann's third key book, Holding on to Reality: The Nature of Information at the Turn of the Millennium (1999a), focuses on information and argues for a balance of signs and things. This interesting book, which has found a wide readership in communication studies, library and information sciences, cultural studies, and philosophy classes, has been touted as a "semiotic envelope in which the theory and the ethics of information are woven tightly together" (Mullins 2002b: 53). Borgmann distinguishes

three different types of information that each comprises a section: natural information, cultural information, and technological information.

Natural information (pp. 7-54) is the information that is embedded in the world in the form of signs that are readily displayed. Early human beings and those who followed them learned to read the signs of nature to determine direction, changes in seasons or the weather, the presence of other creatures, coupled with a deep consciousness of reality as it manifested itself in powerful ways open to the senses for all who were “trained” to see. The latter part of this section takes up the origins of landmarks and then the rise of letters and literacy as a means of conveying natural information to others, preserving it for future generations, and capturing human experiences related to this natural information *about reality*. Landmarks, significant representatives of “things” in the ancestral environment, are focal points providing orientation, “alive with eloquence” (p. 23). In this world, “Intelligence provided, a person is informed by a sign about some thing within a given context” (p. 22). By this Borgmann means that a person sees a physical object (sign) that due to his prior knowledge and experience (intelligence) tells him instantly within this context, the meaning of the sign and orients him to the wider reality within which he finds himself.

Spoken language for Borgmann is a way that people represent themselves and inseparable from thought and feeling (p. 46). It takes its cue from fundamental reality and is different from writing in this respect, since writing need not be anchored so firmly in reality. Borgmann recognizes that some scientists today still can be found “attesting to faint echoes of divinity, to the gratuitous beauty and sacred magnificence of reality” (p.

33) but feels that most human beings have lost hold on this fundamental reality in favor of the other two forms of information he next proceeds to describe.

Cultural information (pp. 55-122) is information *for reality*. This is the realm of producing information through writing and structure (pp. 57-72) and through grids and measure, encompassing the world of the arts and architecture and such things as letters, texts, lines, graphs, notes, and musical scores (pp. 73-84). After information is produced through these means, it can be realized by other human beings through reading (pp. 85-92), playing (pp. 93-104), and building (pp. 105-122). All of these human activities provide information for the purpose of understanding and embracing reality. Yet when “literacy invades an oral culture, it drains vitality from the community” (p. 51) as natural signs and the interconnectedness of humans with the world begins to recede in the face of the power of the written word and symbolic communication replaces more natural forms of communication. Still Borgmann finds much to commend in literacy and finds reading in particular to be a focal activity of great importance as “Reading at its best realizes a world view. It is solitary and outwardly passive. But in reality it vigorously engages and shapes our vision of the world. Intelligent reading of fiction and poetry, far from being an escape, is a tacit conversation with actual reality” (p. 92). Borgmann prizes both written and oral cultural information as “Things have the richness and particularity of a picture while conventional signs have the precision and generality of a concept” (p. 114). A recent obituary of a prominent chemist, R. Bruce Merrifield, conveyed the importance of reading as a focal practice as it was recounted that for more than 40 years he and a colleague would commute from New Jersey to Rockefeller University in New York City via automobile and the one would read out loud to the other from a wide variety of books.

Merrifield would often mention in conversation with others whatever books they were reading at that point in time. The writer observed that: “My guess is that he relished this workday routine because it signaled to him that in an increasingly complicated world, there was still room for simple things” (Lerner 2006: 57).

Technological information (pp. 123-212), the most prominent and influential version of the device paradigm (Borgmann 2000a: 352), forms the largest part of the book and looks at the modern era when we experience *information as reality*. Borgmann discusses a series of topics related to technological information and semiotics including elementary measures – the electron, the bit, and content (pp. 125-140), basic structures – division, Boolean Algebra, transistors, random access memory (RAM), central processing unit (CPU), and light emitting diode (LED) (pp. 141-165), transparency and control – perspicuity, surveyability, transparency, and control (pp. 166-178), virtuality and ambiguity – the resolution of information and virtual reality with its Multi-user Domain (MUD) and Multi-user Domain, Object Oriented (MOO) space (pp. 179-192), and fragility and noise – physical and social fragility, structural fragility, cultural fragility, and the origin of “noise” and its effects within modern information systems (pp. 193-212). Throughout this extensive discussion of technological information, with ideas that we will draw upon extensively in chapter six when we critique our intelligent transportation system case study, Borgmann finds much to commend but much that reflects a very deep and sustained concern.

Technological information becomes largely independent of reality (natural information) and is not in itself a recipe for reality (cultural information) but appears *as* reality (p. 182). He uses the compact disc of music as an archetype of technological

information and explores what it does to information and reality (p. 187). The quality of the music is superb, a great variety of music can be presented sensitive to the listener's choice of order, time, and place, and the listener can control "how" they hear it by varying controls of tempo, balance, bass, etc. – even in marked contrast to the intent of its original composer, producer, or performer. When comparing this to live performance that is subject to human error, acoustics, and other variables that cannot be so easily controlled (the contingency of reality), "the actual world seems drab, poor, and hard in comparison" (p. 187; cf. p. 144). However, Borgmann thinks this view of the listener, while widely embraced, is false since "compared with the vividness and interactivity of actual reality virtual reality turns out to be a pale and brittle world and is bound to remain so" (p. 216). In support of this position he compares the Biblical story of Laban's daughter Rachel and that of a semivirtual woman in a MOO gaming simulation (p. 200). The former has a beauty that is both celebrated and anchored firmly in reality. The latter has a beauty that is elusive and functions as a disposable commodity. Technological information at its roots is about control and material greed (p. 177).

Borgmann employs a shorthand summary of one of his principal arguments in the sentence: "INTELLIGENCE provided, a PERSON is informed by a SIGN about some THING in a certain CONTEXT" (p. 22). By this Borgmann means that in natural information, which he takes to be the standard by which both cultural and technological forms of information should be judged, a human being taps their knowledge (intelligence) about the world to understand what a particular sign in the environment tells them about an object or thing in that environment. Both the sign and the thing are inevitably contextual and human beings have an amazing ability to discriminatingly infer

meaning from the conjoinment of signs and things within the natural world. He gives many examples of how ancient Hebrews, native Americans, and contemporary city dwellers exemplify this process of deriving meaning from the natural world around them through “reading” various natural “clues” we might say in their environment that do not involve either the use of written or other cultural information or technological information. Simple examples include certain kinds of clouds and other observable changes in the lower atmosphere signaling changes in the weather or danger to the observer, witnessing a buzzard or hawk circling overhead, or navigating through unfamiliar terrain using some well-known landmark(s).

Technological information causes “intelligence, things and context to evaporate and leave a person with self-sufficient and peculiarly ambiguous signs” (p. 183) in contrast to his earlier remarks about the potency of all five terms concerning natural information (p. 22) and the slightly more diminished cultural information which can lack sufficient *context* (p. 47). Borgmann in an interview with the University of Chicago Press (1999) about his book makes it clear that “Just as you cannot escape your body; you cannot really and finally escape reality. But you can degrade to utilities what should be celebrated as the splendor of tangible presence.” He views blogging as a way of “exploiting a quasi-private realm that is now open for inspection” and virtual communities as communities that lack any “moral obligation” (Borgmann on Keen 2006).

He argues that the good life must consist of a balance between natural information, cultural information, and technological information. This is, then, a balance of signs and things where neither dominates over the other and where the human being

purposefully navigates among these three forms of information on a daily basis. He revisits in this work some earlier themes including hyperreality (p. 184), hyperinformation (p. 230), wilderness as a focal reality (p. 217), focal things such as Bach (p. 101f.), an altar from Abraham's time (p. 34), the concept of an ancestral world (p. 34f.), and the fact that the ancient Hebrews were People of the Book (p. 31). He advocates again that there be planned festivity in the cities (pp. 225-227) as a means of sharing cultural information. He makes plain again the ways in which blackboxing of things turns them into devices that distance us from reality and cause things to become simply commodities (pp. 156-158, 167f., 176).

4.5 Power Failure: Christianity in the Culture of Technology

The final Borgmann book we consider here, Power Failure: Christianity in the Culture of Technology (2003a), is published by an evangelical publisher and is the most explicitly religious of Borgmann's five published books (the other one is on philosophy of language; another book is in press and concerns American society). It consists of a series of eight chapters that are all essays that Borgmann published in an array of journals and other publications that are purposefully arranged with some minor alterations in content. The initial section is titled "The Circumstances of the Culture of Technology." The first chapter takes up the issue of how invisible technology has become to us such that we rarely stop to consider its pervasiveness since it is the only world we have ever known (first published as Borgmann 1987c; here pp. 11-24). He has become known for the central example he uses in this essay which is Cool Whip – a nondairy substance that is virtually indistinguishable from whipped cream, suffers from none of its problems of

consistency and permanency, and yet is a chemically manufactured commodity and nothing more. Borgmann also considers the nature of advertising and how it builds a consumer culture by promising ease, escape, and happiness. The next chapter (first appearing as Borgmann 1992g; here pp. 25-34) drives home the point that material culture carries with it a moral significance that gives shape to how we understand ourselves, experience one another, and have our being in the world. Music, the telephone, and the television are featured as artifacts of the technological society that preclude the flourishing of the virtues of courage and care as they are suppressed by the acquisitiveness of material things in an artificial world where the natural world (true reality) has receded.

The third chapter (originally published as Borgmann 1990a; here pp. 35-62) describes Borgmann's concept of communities of celebration. These focal communities "serve as pockets of resistance to the emerging postmodern technoculture, for in contrast to its pervading banality, shallowness, individualism and consumerism, they offer a commitment to excellence, depth and celebratory communalism" (p. 33). Borgmann details how the arts, politics, and social theory have failed to deliver a "vision of the common order that would inspire widespread and enduring enthusiasm" while "technology continues to hold out the promise of millennial liberty and prosperity" (p. 35). His device paradigm surfaces in this essay as well although he does not call it by name (p. 41; cf. Borgmann 1984a: 40-48).

The larger second section of the book, takes up the issue of "The Place of Christianity in the Culture of Technology." Quite a few of these chapters first appeared in more theologically oriented literature. Chapter four (pp. 65-80; originally published as

2002b) considers contingency and grace. Borgmann finds the current culture “inhospitable” to Christianity yet admits there is little if any overt opposition. This indifference he identifies as a “problem of grace, of God’s presence in the world” (p. 65). In former days, there was a contingency to life that naturally caused people to look heavenward. The rise of modern science and the growth of modern technology have both worked to considerably narrow the realms in which contingency operates (with some like Weinberg, Dennett, and Dawkins, like Laplace of old, arguing that God is a hypothesis that is no longer needed). As Borgmann sees it, modernity is the “restless and endless assault on contingency, a process that at length has occluded the presence of things and haunted the peace of humans” (p. 73).

He believes there is a shared form of common grace that both theists and atheists can embrace within our culture that seeks to restore the “eloquent contingency of nature and culture and recovering the spirit of reverence” (p. 73). However, this grace can only operate if we recognize the distinct manner in which technology has changed the world and human beings within it. The larger culture believes that for every problem there is a technological fix and they have ample evidence that seems to support such a claim. Many diseases and other human ills that formerly were in the domain of prayer and the hands of God to respond have now been ameliorated or entirely eliminated by technological advances fueled in part by scientific knowledge. He adopts Karl Rahner’s view that there is a sacramental grace to be seen in these advances that we can welcome as part of God’s grace bestowed upon us (p. 74). He discusses, without using the term, the device paradigm and its effects, and calls for a return to the commanding presence of reality in explicit ways without discussing his concepts of focal things and focal reality per se,

although he does employ the trinity of common meal, hiking, and concerts (p. 79) while admitting they are not necessarily foolproof since each could provide a bad experience. He calls upon theology to help create suitable “technological standards of success” and calls upon everyone to be less accepting of the “technological strategy of demanding results regardless of circumstances” (p. 80).

Chapter five (pp. 81-94) takes up the issues of power and care which opens with the challenge that the “task of a theology of technology is to grasp the relationship of Christianity and technology both profoundly and fruitfully” (p. 81). He calls for a radical theology that will challenge technology and point out unrecognized problems, question evidence, and contest claims. He believes that our experiences of technology couched in this framework could cause us to hear the word of God in new ways (p. 82). He eschews an easy answer that Christianity can merely point out problems and that technology will somehow then surrender its hegemony since technology is an eminently successful, self-correcting enterprise that is impervious to challenges on its own terms. Even Christianity itself within modern society gets measured by the technological standards imposed by technology (p. 84). He reminds us again that many things formerly thought to be the provision of divine providence are now seen as readily obtainable, achievable, and attainable due to the powers of technology, in short a secular salvation from a life of want, toil, and need. He calls for a direct contemplation and experience of nature as a means to experience what he calls “careful power” where we are disarmed from all of the technological trappings of civilization and are restored to a “more profound engagement with the world” (p. 89). This contrasts with the “regardless power” of technology that achieves certain ends without any consideration of the means, special circumstances, or

reasons to not pursue a certain path. So long as the science and engineering indicate a “go” technology moves relentlessly forward (p. 88). He finds the ultimate source of careful power in Christ but admits that in a contest for evidence regarding careful power vs. regardless power he can provide none and then discusses why this is exactly so using music and nature and its effects on the human being as examples where experience and testimony and ultimate concerns trump scientific or technical knowledge or knowing (p. 90f.). Technology also presupposes that it is providing liberty when actually it is subjecting human beings to an “ever more tightly patterned” mode of existence. The world of simple things and practices, he suggests, “is now the realm of the holy” (p. 93). Christians must restrain technology in their lives not reject it and “make a clearing for the celebration of the Word of God” via a “deliberate and regular counterpractice” (p. 94).

Chapter six (pp. 95-108; originally published as 1986b) looks at liberty, festivity, and poverty in the context of a review of the work of theologian Harvey Cox. He commends the pioneering nature of Cox’s work and his analysis of secularization (with its disenchantment, desacralization, and deconsecration) and urbanization with its many bold turns. He finds Cox’s thinking about equating modern liberty as experienced through technology as the fulfillment of the Judeo-Christian tradition to be completely misplaced, although he appreciates the power of such a challenge to theologians of the time to become more engaged with practical issues and feels that such a challenge has yet to be powerfully issued to philosophers (p. 97). He goes on to consider various arguments Cox makes and points out deficiencies in terms of both argumentation and in the cold hard light of subsequent events which refute many of Cox’s claims on their face.

The next chapter (pp. 109-116), written after the terrorist attack of September 11, 2001 in the United States, considers courage and fortitude within the context of various recent writings about virtues and virtue ethics. He points out the highly circumstantial nature of virtues (p. 110) and argues for the courageous exercise of focal practices and focal things without using those terms and fortitude in pursuing them in the technological society.

The final chapter (pp. 117-128) takes up two of Borgmann's favorite examples of focal things and focal practices, the culture of the word and the culture of the table. This chapter makes the explicit connection between the everyday habits of steeping ourselves in words within a literate culture and the Church, the Bible, and the liturgy as well as connecting the culture of the homemade dinner around a common table and the Eucharist. He also calls for the rise of focal communities, recognizing the Church as one such community that will be the vanguard for reforming technology.

A final piece of Borgmann's corpus that is important for our purposes is his work on design as a topic within technology (Borgmann 2001). This has not been a critical feature of his books *per se* but it raises some important issues central to our analysis of ITS and is pertinent to a more nuanced view about Borgmann's remedies since the invocation of focal things, focal practices, and communities of celebration happen after the design, manufacture, and implementation of devices while design focuses on that which occurs before devices are made material. First, Borgmann consistently maintains that engagement with reality is most intense when human designs are minimal or nonexistent (p. 6). When technological devices are at their apogee in terms of construction and production, designers are marginalized to superficial surface elements of

design (e.g., texture, color, size). He employs an extensive discussion of the modern stove and its evolution over time to reinforce this point (p. 7). Designers of focal things, e.g., books, play a much larger and more central role in design and production and it is this role for designers that must be preserved in the presence of the device paradigm (p. 10).

4.6 Borgmann, His Supporters, and His Critics

By now it should be clear that Borgmann's contributions to philosophy of technology are important and worthy of serious consideration by theologians as well as others interested in more deeply understanding the nature of contemporary society and its technological shape. A major book focused on Borgmann's TCCL highlighted four reasons why his work is such a major contribution to philosophy of technology (Higgs, Light and Strong 2000b: 11-13): 1) it is built on a "descriptive phenomenological account," 2) his diagnosis of relationships between and among things, human beings, social organizations, and society, 3) his formulation of a social reconstruction program for technology (one of only a few philosophers who have made such an attempt), and 4) the extent of his analysis and remedies. Borgmann's replies over the years to his critics are always measured and seem to result in further work on his part to clarify, modify, and further elucidate his thinking about the challenge of technology (e.g., Borgmann 2002a: 122).

The extent of Borgmann's focus on physicalism with concrete objects embedded in reality or virtual reality as the case may be, is a distinguishing feature of his work and a major departure from classical philosophy of technology approaches. At the time of

Borgmann's TCCL it was even quite a novel approach within philosophy of technology more generally. The classical philosophers of technology (e.g., Ellul and Heidegger) maintained their level of discourse and analysis on a grand scale that rarely stooped to the level of individual artifacts and the particularities of systems (Strong 2000: 332f.). While it is readily apparent from both his writing and his footnotes, that Borgmann owes an enormous intellectual debt to Heidegger in particular, he moves well beyond Heidegger in his linking of things to practices and embodiment, brings ethical and political dimensions specifically into his analysis, and draws upon both the natural and social sciences in his explorations (Strong 2000: 332; cf. Hickman 2000: 91f.). An additional departure from his classical predecessors is Borgmann's emphasis on not only description and analysis but also prescription with his advocacy of focal things, focal practices, and communities of celebration as ways to limit the force and effects of the device paradigm (Tijmes 2001: 11).

Many philosophers have identified Borgmann as an essentialist in the tradition of Heidegger and Ellul who view technology as all about efficiency, rationality, and inevitability and this is often seen as a fundamental weakness in his approach (e.g., Feenberg 1999: viii). Borgmann believes that such critics have misunderstood Heidegger's highly nuanced and often torturous prose on this point and his own as well since he draws upon work by instrumentalists, substantivists, and essentialists in his writings and explicitly rejects much of the nature of technology discussions focused on autonomy and inevitability expounded by his predecessors (Borgmann 1984a: 10, 30; 2005b: 421).

While Borgmann's physicality has been applauded, there is a view that he suffers from nostalgia for the worlds of the past in a premodern society with its traditional technology. Yet his defenders have noted that a little nostalgia seems quite appropriate if Borgmann is indeed right in his fundamental assertion about the power and importance of focal things and focal practices, an insight that even philosophers who disagree with Borgmann find attractive at the personal level (Achterhuis 2002: 93; Tijmes 2001: 16; Brittan 2000: 85). Etymologically in the sense of homesickness, Borgmann is indeed nostalgic but he is not seeking a withdrawal from the present world into the past, in fact he explicitly rejects such approaches as foolish in intent and impossible in practice and points hopefully toward the future by his very response to the problem of the device paradigm (Brittan 2000: 71).

There is a feeling on the part of some philosophers that Borgmann's views would be more nuanced and more correct if he relied on a more dialectical form of analysis (Tuman 2002: 24f.). Borgmann purposefully embraces the so-called empirical turn in philosophy and recognizes that such an effort is still its infancy and has much to learn thus in principle he welcomes efforts by others to advance this analysis (Borgmann 2002a: 116). There are specific points in which Borgmann is likely wrong or misinformed, a not surprising finding given the broad sweep of his descriptions, analysis, and remedies, e.g., his treatment of semiotic action and physical causation in HOR (Fernandez 2002: 14). In general, however, as Borgmann himself recognizes in response to his critics, there is general agreement among them that technology as presently constituted does not "conduce to the good life" and that a response is necessary (Borgmann 2000a: 364). We now turn to some specific critiques of elements of

Borgmann's work that we will organize under two broad headings: diagnosis and remedy.

4.6.1 Borgmann's Diagnosis of the Problem of Technology

Borgmann analysis of devices has come under critical scrutiny from a number of colleagues. Verbeek (2005: 190) provides a series of counterexamples of the use of what Borgmann would clearly label as devices (e.g., electric piano, CD player, television, and microwave) to show ways in which they actually foster human engagement rather than diminish it. To return to Borgmann's own example of a CD of music, one can certainly argue that it makes music available to a much broader array of people and they get to experience a hugely broader array of music, including different artists, styles, and genres, than would ever be the case if their experience of music was limited to live performances. Many of these devices also open up new forms of engagement, as when for example; students use a CD player to provide music and a convivial atmosphere for a social gathering or an impromptu dance. Borgmann tends to always mark devices as promoting disengagement from reality and ignores the possibility that these objects may amplify involvement and even prompt new forms of engagement due to their existence and ubiquity.

Focal things, at least of the kind favored by Borgmann (e.g., distance running, preparing and sharing a homemade meal), are themselves a whole different class of activities than those from the pretechnological era that he so vividly describes, where survival was the main driving force rather than the leisurely, safe, and nonessential attributes of these more recent human activities (Verbeek 2005: 186ff.; see the

concurrence of fellow Dutch philosopher Tijmes 2001: 17). Focal things according to Borgmann's view do not require the effort and exertion of these pretechnological things but rather provide meaning, a very different form of engagement even if the outcome may in some way be the same. Verbeek suggests that these two really quite distinct means of engagement should be separated, particularly as Borgmann critiques devices. The nature of the meaningfulness that Borgmann seeks is not a fault of the device, which enables people to do more things with less effort. The device per se is not designed to address meaningfulness and it is not in the use of the individual device but giving oneself over fully to the device paradigm of unmitigated consumption that meaningfulness is lost. Yet even here, Verbeek doubts that this attitude is pervasive and makes a case that devices themselves may promote in selected instances focal engagement, e.g., transport that enables a person to reach true wilderness (a point also made by Hickman 2000: 93). Michelfelder (2000: 232) creatively supplies an example where even Borgmann's view of the running simulator in CPD (1992a: 87, 94-96) or golf simulators could actually support a focal practice, such as virtually playing golf or running with a family member virtually and sharing an experience and discourse in real time. It has also been pointed out that when people are engaged in these virtual experiences, no one confuses them with reality but rather frequently employs them for the very purpose of engaging with real people. Even computer games, which merge reality and hyperreality, differ only in form from other classic board games like Monopoly where a player assumes an identity and briefly merges into a "virtual world." (Verbeek 2002: 87).

A pragmatist such as philosopher of technology Larry Hickman (2000:104f.) finds Borgmann's approach lacking in sufficient empirical tests, although he

acknowledges that Borgmann does invoke data from the natural sciences and social sciences in support of his arguments. He would argue that various philosophical analyses must themselves be subjected to tests and that specific technologies should be tested for their impacts and results rather than a broad sweeping of every technology into a massive funnel that reflects a presumption of identical performances, effects, and outcomes. He has explained his pragmatechnics approach in two well-known monographs (Hickman 1990, 2001). His criticism of Borgmann concerning his use of empirical data is echoed by Achterhuis 2002: 107) who charges that Borgmann frames his approach in such a manner that there is no way to falsify his theory in a Popperian sense. Similarly, Borgmann's Montana colleague, Gordon Brittan, Jr. (2000:76-79) believes that the sociological data that Borgmann supplies in TCCL in support of his thesis of growing unhappiness in advanced technological societies is insufficient and reminds readers that "every age sees ample evidence of a decline that in retrospect is not always so apparent." Yet Borgmann himself makes it clear that so many of the issues he raises do present empirical questions and his books certainly illustrate his desire to look at data wherever it exists to support certain views and marginalize or critique others (Borgmann 2002a: 122).

Andrew Feenberg believes that Borgmann's commitment to a determinist view of modern technology is a direct result of his failure to appropriate the insights of the science and technology studies movement with their analyses of specific technologies in specific contexts. This inhibits Borgmann from seeing the various alternatives that confront technology as it develops and the fact that radically different technological futures are possible rather than only one inexorable result (Feenberg 2000: 294f.; a view seemingly shared by Verbeek 2005: 192f. with his concept of technological mediation of

involvement). Sarewitz (1996: 9) points out Borgmann's insensitivity to the ways in which products (devices in Borgmann's terms) are embedded in a wider social fabric and system that creates unanticipated effects that cannot be anticipated from physical laws but are a direct result of the contexts within which technologies are deployed and employed.

Dreyfus and Spinoza (1997: 323) in an essay comparing and contrasting Heidegger's and Borgmann's philosophies of technology, find Heidegger's views more compelling. The core danger facing human beings according to Heidegger is the absence of identity. Technology requires a collection of variable skills and modes of engagement that do not force us into one identity alone. Borgmann's view leans toward a generalizable impact from technology on human beings at the level of the device whose uniformity Heidegger would contest and Heidegger would condemn at least in principle the concept of a single device paradigm. Heidegger finds a positive relationship with technology so long as other ways of human identity can coexist with it in the same person and so long as multiple worlds can be disclosed.

Finally, Borgmann's conservative beliefs and support of free market capitalism has prompted a response from a number of scholars (e.g., Ess 2002: 36f.). They find his critique of consumption and consumerism generally compelling but believe he needs to extend that critique to free market capitalism.

4.6.2 Borgmann's Remedy for the Problem of Technology

Borgmann's belief that pristine nature can be a focal concern that speaks with eloquence and power to human beings in a technological society has found resonance and congruence with the work of environmental economists (cf. the summary by Power 2000:

284f. of research in this arena). They routinely differentiate nature from commodities in terms of their fundamental attributes noting that there is no substitute for nature, it is nonreproducible, can be valued for itself (versus a commodity that is always a means to an end), must be experienced directly, can be irreversibly damaged, and does not partake in the paradigm of consumption (i.e., it is not used up and discarded – or at least it should not be).

The concept of focal practices has come under scrutiny and some find that it consists of two distinct classes of activities. In some cases the focal thing is prominent and the focal practice is subordinate. In other cases the focal practice is dominant and the focal thing is subordinate. Furthermore, various focal things could be associated with a particular focal practice and the view of the participant may bear a large part in whether something is in fact “focal” at all. This has been pointed out in the context of an overall positive appraisal of Borgmann’s work on focal things and focal practices and is seen as a way of tidying up the analysis (Haworth 2000: 58f.; 67ff.). Some focal practices that Borgmann advances, most of which are related to leisure and free time, such as running, are really solitary activities so it may not break the stranglehold of the device paradigm in the way that Borgmann envisions it doing (Achterhuis 2002: 94).

Many scholars have called for a reform of technology that goes beyond Borgmann’s focal things and practices to an effort to change the nature of the devices themselves (Brittan 2000:85; cf. Feenberg 1995). Borgmann has responded quite positively to this idea and has even noted some examples such as the Windjammer, an electricity-generating windmill invented and refined by two rancher-farmers and philosophers at the University of Montana, that can sit on either side of the device/thing

divide depending on how they are used (Borgmann 2000a: 348; cf. Brittan 2001). It remains true, however, that his own writings do not provide much guidance in terms of what attributes such technological artefacts should exhibit to inhibit their use as devices and promote their use as things (Feenberg 2000: 299f.).

4.7 Borgmann among the Theologians

It was pointed out earlier in this chapter that very few theologians are aware of the work of Borgmann and even fewer appropriate more than a tiny slice of his body of work despite both his Christian perspective and his belief that the best critique of material culture comes from religious ethics (Borgmann 2005b: 1173f.). Some theologians simply draw upon an isolated observation he makes in a trenchant manner, such as that the term “orientation” dates back to medieval cathedrals positioned toward the east that witness by their very orientation to Christ’s birth and his anticipated return (noted by Long and York 2004: 333). Others summarize Borgmann on a key issue in a few sentences then briefly extend his argument into a more theological statement (e.g., Wells 1998: 146; Northcott 2004a: 420f.).

A philosopher of technology finds Borgmann weakest precisely at the point where he connects to religious concerns, using as an example the comparison of a stadium baseball game in Missoula, Montana and St. John the Divine Cathedral in upper Manhattan, New York City, that Borgmann invokes as twin examples of spiritual celebrations (Tijmes 2001: 34). He points out that these two events are moving in opposite directions: the baseball game focuses on baseball itself and human glorification; giving within the cathedral focuses on anonymity of giving and transcendence. He faults

Borgmann for not clearly indicating which “divinity is being celebrated” and calls for a much clear delineation of these “manifestations and mass experiences.” It could be that Borgmann is being purposefully vague in this context in order to find common ground with people of varied religious persuasion or none in terms of addressing the naked public square and the promotion of communal celebrations, focal things, and focal practices. A philosopher of religion, Charles Ess (2002) finds Borgmann’s religious elements in his HOR problematic in the confusion of both a prophetic and an apocalyptic strain in his thought and urges clarification. Overall he finds Borgmann’s critique of consumerism and affirmation of embodied existence exemplary but urges him to avoid a dualism between the dangers of cyberspace (evils of the world) and salvation in an afterlife (p. 29), a position that he believes aligns Borgmann with “precisely the modern and postmodern positions he is most at pains to critique and overcome” (p. 40). Borgmann’s reply to Ess is to plead for a “vision halfway between the prophetic and the apocalyptic positions as Ess understands them” as he believes we can and must recover those things that in his prophetic voice he heralds while still understanding all cannot be realized in this life and must be anticipated in that life which is to come (Borgmann 2002a: 113f.).

Kathleen Cahalan (2002), a theologian at St. John’s University in Minnesota, appropriates Borgmann’s work concerning the device paradigm to discuss the need for Christian temperance, “an ordered and unified sense of self in relationship to God” (p. 29f.) that moderates our approach to material things and urges the cultivation of virtues as well as focal practices by communities of faith. She raises several fundamental questions in light of Borgmann’s critique: “What kind of human beings are we becoming

by living in the device paradigm? Is our everyday use of technology altering or warping fundamental human capacities in ways that erode the basis for Christian spirituality and morality?" (p. 30).

The most extensive theological response to Borgmann has been that of Roman Catholic systematic theologian Richard Gaillardetz, a professor at the University of Toledo, Ohio (2000). He takes quite seriously Borgmann's view of the need for the device paradigm to be challenged by advocating for "both a mystagogy of daily life and a renewed Christian asceticism" (p. 61). Mystagogy in contemporary Catholic life is a rite of initiation between Easter and Pentecost when neophytes are immersed in the Christian faith. Karl Rahner (1967: 14) invoking this concept advocated that Christians needed to strive to see that "the very commonness of everyday things harbors the eternal marvel and silent mystery of God," with a very strong focus on everyday life and not just the simple things found within the Christian church, e.g., reading the Bible, prayer. In this way it dovetails nicely with Borgmann's concept of focal things as opposed to devices and the beauty and transcendence that can be found in reality. He uses the story of the gift of manna in the wilderness, which had to be consumed before the next day, and the temptation of Christ where he was challenged to turn stone into bread, to challenge Christians to see all things as gifts and to avoid the rampant consumerist urge to fill one's life with devices upon devices (p. 67).

A purposeful, conscious aestheticism is perceived as "vital if Christianity is to offer an adequate response to the technological shape of daily life" (p. 76). Technology pushes us to reject the idea of limits while aestheticism is focused on freely embracing those very things that technology seeks to keep from us, "constraint, loss, and the

necessary ‘friction’ of human existence” (p. 76). He relates how his own life has been immeasurably enriched by living in friction with his wife and other individuals of significance to him and how these interactions have helped positively shape the kind of person he has become. Suffering loss makes us treasure those things that we do have more fully and deeply while also acknowledging the value that inheres in daily life. Participating in the “pattern of paschal living” and embracing *kerygma*, *leitourgia*, *koinonia*, and *diakonia* all assist us to grow as followers of Christ and serve as focal practices for Christians (p. 92). The Church itself as a communion of persons stands in “opposition to an overly technologized existence” (p. 97). Real communion within a fellowship of believers requires engagement on many levels rather than the easy assent to consume goods. Ministry to others in need (*diakonia*) is done for the two-fold reason of ministering to the other and effecting change in oneself. Yet this service to others cannot be focused on returns from investments made but rather focusing on service to God by serving the other and consistent with God’s “self-gift, the paschal mystery” (p. 106f.)

He explores the ways in which simple objects associated with the Eucharist become holy, revered, and even are frequently distinguished from their more utilitarian forms to deliberately convey their connection to all of life and yet reinforce their uniqueness. The goal of these events and the liturgy in general is not “as an escape but in order to see one’s life in a new way” (p. 115). The liturgy is the “paradigmatic focal practice of the Christian life” and functions in ways that are completely opposite to those of the technological device (p. 116). Yet Gaillardetz takes to heart Borgmann’s observation that even focal things can “fall prey to the influence of the device and the temptations of hyperreality” (p. 130) and we must remain alert to any such tendencies.

The liturgy of the Church when viewed properly takes us into the liturgy of the world (Rahner's concept) where we transform the world whereas technology "devalues human engagement, commodifies human goods, eliminates all forms of friction, and circumvents all experiences of human limitation" (p. 113).

4.8 Summary of Borgmann's Main Ideas

It is evident that the Borgmann corpus has many ideas and concepts that are important to consider as we grapple with the multifaceted nature of modern technology.

His major ideas are:

- 1) There is a fundamental divide between things in the premodern era and devices in contemporary technological society. Things manifest a reasonably transparent relationship between means and ends. Devices convey ends but cloak the means, thereby diminishing our grasp of reality.
- 2) The device paradigm is the general form in which devices exist within modern society. These devices are viewed and function as commodities and the device paradigm connotes the modern consumer society where acquisition of an endless stream of commodities is seen as the road to happiness and a fulfilled life but which leads to an insatiable appetite for things, alienation from nature, de-skilling of human beings, and dissatisfaction.
- 3) Focal things are objects that meet a basic human need and provide an orienting function for persons and interactions that enhances the quality of human life.

Focal practices are conscious efforts on the part of humans to engage with focal things in a regular manner as an explicit attempt to center on reality and to combat

the influences of the device paradigm which rules so much of modern life. Focal things and focal practices are determined by the user rather than existing independent of users. Some things that are merely devices for many can become focal things for other human beings. Even the production of technological devices, for designers and manufacturers, can be but are not of necessity, focal practices.

- 4) Wilderness is the ultimate focal thing and in its purity, splendour, and power speaks to human beings of reality and provides the basic orienting form for judgments about beauty, value, and other attributes by which to judge human achievements.
- 5) Material culture carries a moral significance that gives shape to how we understand ourselves, experience one another, and have our being in the world.
- 6) The market, capitalism, and the device paradigm are deeply intertwined and the invisible hand of the market has been largely superseded by the device paradigm. Capitalism serves as the operational grounding for the exercise of the device paradigm. Political structures, especially democracies, can only exist in the present of the device paradigm which holds out hope to all for equality and advancement as measured by commodities and a “good life” of leisure, safety, entertainment, and happiness.
- 7) Resistance to the device paradigm is undertaken by fostering on the part of both individuals and communities a balancing of focal things and practices with participation in the device paradigm. Communities of celebration need to be

developed that unite around focal practices and help human beings maintain their sense of reality in the midst of modern life.

- 8) Hyperreality, especially as seen in the world of information technology, can provide powerful and useful ways to learn. It cannot substitute for reality itself and overuse can result in a marked disengagement from reality and a diminished life. Some individuals spend so much time in hyperreality that they are hyperactive and unable to appreciate any longer the real world and what it has to offer them.
- 9) The pervasive availability of digitized information that pervades the modern world provides wonderful capabilities to see, explore, and understand things that would otherwise be invisible to us. Without a discerning engagement with hyperintelligence we can surf through reams of information (data) and yet miss the meaning or create a meaning that is quite misleading as it reflects only those elements of reality that can be captured in some manner and in that exchange something is always lost of the true essence of that which is captured.
- 10) The good life must consist of a balancing of the three forms that information takes: natural information, cultural information, and technological information. Natural information is closest to reality and conveys information about that reality through signs that point to wider things within a particular context that are “read” by the experienced senses of the observer. Cultural information is information for reality and it reduces signs to printed forms and places things on grids and other means of organizing knowledge. Technological information is information as

reality where what becomes real is that which is captured by digitization and where true reality increasingly recedes into the background.

- 11) The device paradigm and ubiquity of modern technology pose a serious threat to Christianity, and indeed all religions. Technology narrows the realm within which contingency operates and God seems more and more irrelevant to the modern condition.
- 12) Christians must seek out common ground with people of many different persuasions if the hegemony of the device paradigm is to be contained and it is only through the deliberate regular engagement with focal practices within communities and an appropriate balancing of the forms of information that the good life can be realized.

4.9 The Road Ahead

We have now acquired a substantive understanding of the philosophy of Albert Borgmann regarding technology and the character of contemporary life. Before we apply his insights to our case study specifically, it is helpful to survey more generally issues related to a dialogue between theology and intelligent transportation systems. It is to this topic that we will now turn.

Chapter Five

Theology and Intelligent Transportation Systems

“Theologians, representing the articulated consciousness of Christians, have recognized the eruptive forces of technological change but have done little to explore the significance of these forces for understanding the presence of Christians in today’s world Technology has not really raised theological questions as much as it has subtly avoided doing so. . . . The undecipherable ways in which technology affects men and the stubborn persistence of most thinkers (especially those committed to a religious creed) to follow older modes of thought have contributed to a distancing of theological activity from the mainstream of technological forces.”

(William Kuhns 1969: 18f.)

We have surveyed the nature of technology and created a working definition, explored its specific manifestations in the form of intelligent transportation systems (ITS), summarized the manner in which the Old and New Testaments “present” technology, and analyzed how selected theologians have understood and engaged with technology as a topic for study. We have gained a deeper understanding and appreciation of the complex ideas of Christian philosopher Albert Borgmann regarding technology and the character of contemporary life. We will now explore the various ways in which theology and technology might relate to one another. We will then focus on ITS as a case study and use Borgmann’s ideas to explore what theology might specifically say regarding various ITS applications and features as well as giving some thought to what ITS might say to theology as a means of enriching theological thought. Our treatment will not be exhaustive but illustrative of how theology and technology might fruitfully dialogue with one another in a manner where both are appreciated but where neither is above criticism by its dialogue partner. We will draw into our investigation when relevant, examples from a growing “interchange” that has been occurring between theologians and specialists in the life sciences dealing with human genetics, cloning, and genetic engineering to see whether similar issues arise with respect to ITS. We may

discover commonalities in dialogues across various technologies while also seeking to discover whether theology has in any core way been affected by its interactions to date with the life sciences.

We have established both the pervasive nature of technology within ancient and modern times and the ways in which technology mediates our interactions. Remember that we are employing a definition of technology as “the application of knowledge, tools, skills, and systems to solve practical problems, extend capabilities and expand opportunities to meet or invoke human needs. The relationships we have explored to date may be summarized pictorially by a graphic.

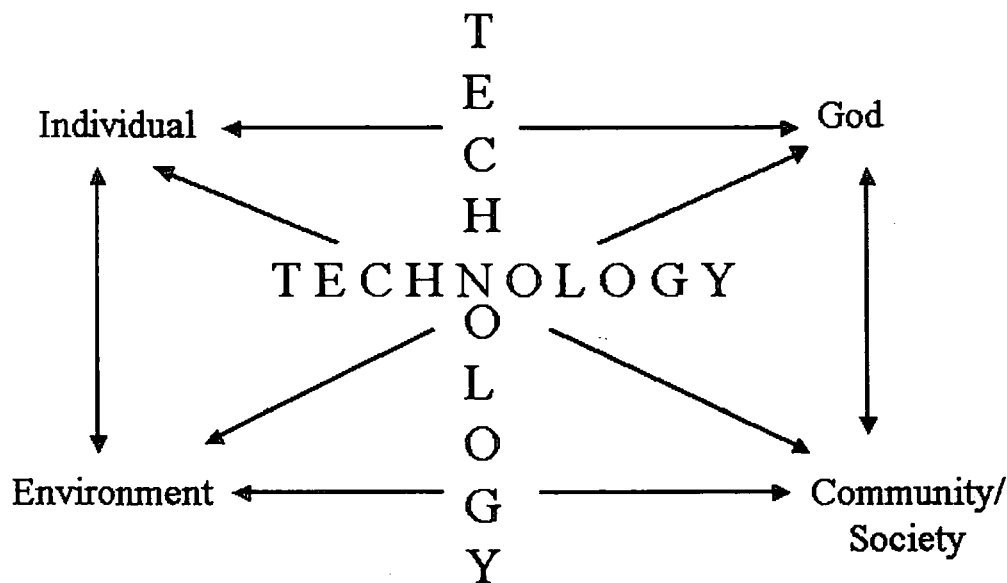


Figure 2. Technology as mediator

The graphic reminds us of the central role that technology has played in the past and that it plays even more fully in the present as a mediating influence between God and the

individual, God and community/society, the individual and community/society, etc. Note that the arrows run both directions indicating bidirectional influence. The environment, however, is a specialized participant in this scheme. It plays a passive rather than active role when it comes to technology and is the only unconscious/nonvolitional actor in the scheme. God, the individual, and communities/societies utilize the environment as the stage on which they construct and implement their technologies. All three actors also gather data and information on a continuing basis from the environment that shapes their approach, means and methods of communication, and other aspects of their interactions with one another and with the natural world. The environment does not create any special technologies of or on its own but its dynamic presence in the form of living and nonliving processes, cycles, etc., exerts considerable direct influence on the other actors – sometimes forcefully in terms of individuals and communities/societies (e.g., hurricanes, tornadoes, floods, droughts). God is not, as understood by most theologians (process theologians being a notable exception), directly influenced by the environment. He appears to work within its confines and constraints on a routine basis and even in the case of miracles, still is working within the environment, just doing so in what from our vantage point can be characterized as extraordinary ways. It provides an inescapable substrate for His activities in the world and the cosmos (and other multiverses should they exist).

Technology serves as a mediator between God and the individual via multiple avenues such as language [both oral (prophecy and audible pronouncements) and written (the Bible including the God-engraved Decalogue)], structures (the Church, organizations), and tangible icons and symbols and their underlying referents (e.g., the

Cross, the Eucharist). The graphic perhaps helps us to more clearly understand why we now “see in a mirror dimly but then face to face” (I Cor. 13: 12a) not because ancient mirrors failed to accurately reflect the viewer’s image but because our perceptions and understanding of God are not direct experience (which comes in the *eschaton*) but are mediated through various technologies as well as human psychosocial and neurosensory processes.

Technology mediates between the individual and the environment in myriad ways including the entire built environment and via sensory enhancement devices such as binoculars, telescopes, deep-sea submersibles, scuba equipment, etc. As Antoine Saint-Exupéry (1939: 67), an early enthusiast of flying, remarked, “it is not with metal that the pilot is in contact. Contrary to the vulgar illusion, it is thanks to the metal, and by virtue of it, that the pilot rediscovers nature.” Many city dwellers experience an environment on a daily basis that is, in fact, not natural at all – even when it looks or “feels” that way. Nothing that they see, taste, or experience is completely “natural” but everything is mediated by technology. Foods, even so-called “natural” ones, have the vapour if not the direct stamp of technology on them as they are grown in “local” soil that is not in fact local (i.e., native) at all, irrigated with water that has been purified or chemically treated, harvested using technological implements (many commercially manufactured), etc. Parks, lawns, and other plant life are presented to city dwellers on the basis of how landscape architects, gardeners, and other humans want them to perceive “nature” realizing a carefully designed plan rather than the riotous confusion of natural competition within an ecological niche. Birds, rodents, and other creatures that inhabit urban environments are often sustained by technologies of various kinds (e.g., bird

feeders, industrial and nonindustrial wastes) and sometimes even exhibit biological adaptations that are the end result of selectional pressures *imposed* by the built environment.

Communications devices such as telephones, the Internet and e-mail, video, TV, mail, signing, zoning laws, and means of conveyance are some of the technologies that mediate the interactions between the individual and the communities and societies within which they “live.” God interacts with communities and societies through biblical laws (whether acknowledged or not), via prophets, priests, and kings (servants of the most High God), through creation itself, etc. In all of these instances and many, many more we can see the critical role that technology plays as it shapes and reshapes social and personal interactions among beings and between beings and the wider cosmos. The values and goals of technology may coincide or conflict with values and goals in religious communities and among practitioners of religion – at the very least we may expect to find some implicit or explicit relationships or connections (Stewart 2006: 341). It has been suggested by Christian philosopher of technology and Dutch politician Egbert Schuurman that there is a spiritual-historical background to technological culture that needs to be understood and articulated if we are to successfully confront the major problems and threats that technologies create coterminous with the benefits they provide (Schuurman 1997b: 38). The need for theology to be involved in better understanding the form of these interactions, the manner in which they operate, their limitations, costs, and benefits, and how we may appropriate them in better or perhaps different ways should be clear. Success at this venture will require some careful thought as to how such an engagement should commence and how theology and theologians can monitor their

influence, moderate their claims and critiques, and modify their theological models and understanding to better accommodate these global realities.

5.1 Preliminary Considerations about Dialogue

Human areas of formal inquiry are so specialized in the present century that dialogue between and among them is difficult to cultivate for reasons we shall explore in more detail below. It is even harder to pinpoint benefits for such an investment of time and effort since there are limited examples of long-term, highly successful engagement where one can clearly describe in a compelling way how the dialogue directly contributed to a better end result. Even where these examples do exist, it is difficult to ascertain whether the result is due to singular or multiple features or aspects of the research program itself, the unique contributions of the particular actors, the nature of the problem selected for study, etc. Producing actual research results that followed from substantial dialogue among multiple fields is even more difficult as it requires a level of detailed and sustained engagement that is very hard to mount and even more challenging to maintain. Theology with all of its attendant subspecialties, many of which do not regularly dialogue with one another, is no exception to this tendency. It is undoubtedly true, as the late Donald Campbell noted concerning the social sciences, that no contemporary theologian could even claim to truly be an *expert* in their own “discipline” with all its diversity and massive quantities of information. Rather we are all narrow specialists who know, as the proverbial expression goes, “more and more about less and less.” ITS as we saw in chapter three is a vast conglomeration of various fields of engineering, the sciences, technical crafts, economics, public policy, law, and other disciplines that come together

around specific applications related to transportation. As ITS has gained in currency and grown in size, it is starting to manifest the same fractured environment as other large areas of human inquiry where increasing specialization inhibits intradisciplinary and cross-disciplinary dialogues while at the same time “advancing” the field or subfield by its particularized contributions. This peculiar result has become the hallmark of the modern world and is routinely taken to be what “progress” is all about. Yet the very specialization that provides so many benefits also comes at the cost of difficulties in seeing, let alone understanding, the “big” picture of things and its attendant consequences.

So what exactly might an exchange between theology and ITS deliver for either side? Steve Fuller (1998: 145-147) has proposed a model of interdisciplinary interpenetration that focuses on both the rhetorical aim of the interchange and the desired result as shown below. As a person (or discipline) attempts to dialogue with another person (or discipline) they can focus on persuading the other that the differences between them are not really all that great and that this gap can be successfully bridged so that both might benefit. This PERSUASION approach (think the Sophists) minimizes the differences between them. Conversely, a person may dialogue with the other with the goal of differentiating their disciplinary approach from the other in a manner that can amplify their differences, what Fuller terms a DIALECTIC approach (think Socrates).

Rhetorical Aim Trade Strategy	PERSUASION (Difference Minimizing)	DIALECTIC (Difference Amplifying)
	IMPORT (Negative Analogy)	EXCAVATION
EXPORT (Positive Analogy)	SUBLIMATION	REFLEXION

Figure 3. The Modes of Interdisciplinary Interpenetration (After Steve Fuller)

Overall “trade” strategies in regards to what is sought is also in play as the two parties dialogue and negotiate the communication space. Does the party in question seek to import an idea from the other discipline/person or to export an idea? Fuller draws upon the two principal functions of metaphor in the sciences, i.e., to test ideas in one domain against another to determine their cogency (“negative analogy”) or to apply the ideas from one domain to another to increase their worth both to the task at hand and to subsequent investigators (“positive analogy”). Depending on whether the rhetorical aim was to minimize or amplify differences we then end up with four results to which he has applied the following terms: 1) incorporation (the idea is taken on board by the second discipline and becomes part of its use and tradition), 2) excavation (the limits of the idea are highlighted and no appropriation occurs by the second discipline), 3) sublimation (the

idea is refined in some useful manner and utilized by both disciplines), and 4) reflexion (the idea is “returned” to its home discipline with modifications in light of the exchange but is not taken up by the discipline partner). Real interdisciplinary dialogue is, of course, not quite as neat as this heuristic device suggests but this helps us maintain our bearings in terms of what the nature of the sought interaction might be when theology and technology (or ITS in particular) engage in dialogue.

The scope of the challenge facing us in an interdisciplinary exchange between theology and ITS should not be underestimated. The leaders of an extensive interdisciplinary project at Wageningen Agricultural University in the Netherlands point out that there are broad and narrow types of interdisciplinarity with some unique differences between them. While the focus of our exploration is not on a collaborative research project *per se*, these challenges will apply to any interchange of ideas and concepts between theology and technology in general or ITS in particular (Dusseldorp and Wigboldus 1998: 301):

Table C: Two Types of Interdisciplinarity

NARROW INTERDISCIPLINARITY	BROAD INTERDISCIPLINARITY
Interaction between disciplines with: ▪ Same paradigms ▪ Same methods <i>Disciplinary outputs can be easily integrated</i>	Interaction between disciplines with: ▪ Different paradigms ▪ Different methods <i>Disciplinary outputs are difficult to integrate</i>
Few disciplines involved: <i>Simplifies communication</i>	Many disciplines involved: <i>Complicates communication</i>
Representatives of disciplines located in same organization: <i>Simplifies communication and organization</i>	Representatives of disciplines located in different organizations <i>Complicates communication and organization</i>
Representatives of disciplines from the same culture: <i>Simplifies communication</i>	Representatives of disciplines from different cultures: <i>Complicates communication</i>

Two or more disciplines when brought together by individuals representing them can manifest either a narrow interdisciplinarity or a broad one in terms of the distance between them. Disciplines that share similar modes of investigation and general conceptual frameworks clearly find it easier to find common ground and to combine their perspectives when confronting a problem or issue. Thus dialogue between selected physical sciences is easier than that spanning physical and life sciences, dialogue among the sciences is easier than spanning sciences and the social sciences, dialogue among patristics, historical theology and history is likely easier than that between systematic theology and psychology. The fewer disciplines involved, the easier it is to communicate since each discipline uses words drawn from a particular conceptual “dictionary” that is

largely unfamiliar to the other person. This results in the commonly observed phenomenon of two experts in related or unrelated fields talking past one another even while employing the “same” terms in their discourse. Since organizations also influence in dramatic and subtle ways understandings and approaches people develop over time and because there is a level of trust that occurs due to mutual association, it is often easier to dialogue with those within the same organization rather than adding yet another layer of complexity to the exchange by also having to negotiate differences that adhere to organizational affiliation (e.g., perceived organizational status differences). Another complicating factor is the role of culture itself that always shapes language, perceptions, understandings, and even the kinds of questions considered legitimate.

In the majority of instances, any dialogue between theology and technology will likely fall into the broad type of interdisciplinary exchange category rather than the narrow one – a fact that from the outset crystallizes the rather steep challenges to success. These Dutch researchers also point out that the *quality* of interdisciplinary research (or dialogue for our purposes here) depends on four factors: 1) attention given to the preparation stage, 2) quality of inputs by the disciplines involved, 3) process of interaction during the research process, and 4) the quality of the synthesis (Dusseldorp and Wigboldus 1998: 334). This author’s own experiences as a participant in a number of interdisciplinary efforts over the past two decades speaks to the amount of time it takes to get initially keen participants to begin to develop adequate knowledge of the other discipline(s) sufficient to initiate a conversation. It also becomes important to obtain some early “wins” in such an exchange where participants perceive an immediate value to the exercise in order for it to continue and deepen. Very few funding agencies and

organizations attend sufficiently to the enormous investment of time on the part of participants that is required for fruitful interdisciplinary exchange to occur and be sustained.

We must also consider a continuum for enterprises within and across disciplines that arises when we consider how theology and technology may interact in both the short and long terms. Thus far we have employed the term interdisciplinary without defining exactly what we mean. Interdisciplinary is actually one of five basic types of approaches that are defined and related to one another by Marily Stember (1998: 340-342) in ascending order of complexity as: 1) *intradisciplinary* (that which takes place within a discipline across its subspecialties, for example the various subspecialties found in a typical department of theology), 2) *crossdisciplinary* (seeing one discipline from the perspective of another), 3) *multidisciplinary* (two or more disciplines mutually bringing their perspectives to bear on an issue or problem), 4) *interdisciplinary* (integration of ideas, knowledge, skills, and/or methods across two or more disciplines that becomes essential to the solving of a problem or tackling of an issue), and 5) *transdisciplinary* (working out a unified structural framework for knowledge that *transcends* disciplines). We may suspect that much of the preliminary exchange between technology and theology would be of the crossdisciplinary type where neither side is looking for much beyond trying to gain some sense of the other. This approach enables both disciplines to utilize their own conceptual lenses and epistemological and valuative positions and express them to the other in an authentic manner that seeks to educate the other about key ideas, concepts, methods, and perspectives pertinent to the issue or problem analyzed. It appears that much of the current dialogue between theologians and life scientists as represented

by the Human Genome Project in the United States and in consultations in many other nations has been of the crossdisciplinary variety (see specific examples below). The hope would be that as a dialogue proceeds over time, theology and technology might find ways to bring their mutual perspectives to bear on major societal issues that call for technological applications but where theological mediation might result in superior products, services, and results. This could include even basic challenges to the plans and methods technologists advocate and result in the adoption of an entirely new set of goals, methods, and/or plans. Conversely, it can be hoped that in a similar fashion, technologists would contribute ideas, insights, methods, or understandings to theologians that would enable the development of superior theological understandings than those presently enjoyed. As noted above regarding the technologists, this could include a deconstruction and reconstruction process that substantially alters the goals, methods, and understandings of the theologians. Finally, there may be selected examples where a truly interdisciplinary effort might occur in the future between theology and technology although this would likely only happen if there were fruitful interchanges that are relatively easy to undertake and maintain. A narrowly focused project that tries to solve a particularly vexing yet contained subproblem within a much larger research problem may provide an excellent venue for such an endeavour.

Transdisciplinarity assumes on the basis of knowledge from quantum physics that there are different levels of reality that are governed by different levels and even types of logic. Any attempt to force human beings, objects, or analysis into a single framework is reductionist, absolutist, and a contravention of the inherent nature of reality as quantum physics reveals it to us (Nicolescu 2002: 15-22). It may well turn out that a theologian

and a technologist who is expert in a particular form of technology may be talking about the same reality but on different levels and employing different means of logic and vocabulary – neither of which describes the full ontology they are confronting but both of which can be fruitful in deepening our knowledge and engagement with the natural and human-constructed worlds we inhabit. Success in this type of venture would likely require some set of individuals who feel reasonably comfortable in both domains and are able to negotiate the various levels with some degree of ease and sophistication.

Any interdisciplinary dialogue has the potential to stimulate borrowing of concepts and ideas from one domain for appropriation to that of an entirely different domain. Borrowing becomes an attractive option since the discipline from which the borrowing occurs has developed experience and insights into the use of the concept or methodology, its limits, and its utility. This means that the borrower can then benefit from this acquired knowledge and see how the concept or method can assist the further development of their own discipline. Borrowing also entails very few risks since it requires neither domain to necessarily change in any fundamental way but may provide materials for *self-directed* change. Successful borrowing can lead to one or more of the following beneficial results (Klein 1990: 85):

- Structuring a relatively unstructured domain
- Simplifying a domain
- Completing a domain
- Explaining a domain
- Providing a more complete picture of the domain's current framework

- Permitting experimentation that is not possible under the current domain's structure, methods, or orientation

The more one's skills develop at dialogue and cooperation across disciplines, the more likely it also becomes that a set of new interdisciplinary skills develop as Klein (1996: 224) suggests:

- Knowing how to structure a workable framework that is flexible enough to allow for shifting groupings
- Knowing how to recognize ignorance of a particular area, then solicit and gather appropriate state-of-the art information and knowledge
- Knowing how to analyze the relationship among discrete pieces of elements of knowledge and weigh their relevance to the task at hand
- Knowing how to balance depth and specificity with breadth and general connection
- Knowing how to identify salient concepts and global questions, then using them in an integrative manner
- Knowing how to clarify and present results for mutual revision

This brief overview of some ideas about the nature and types of dialogue possible between theology and technology should open our minds to some of the potential for both domains as individuals begin to move into this exploratory space. A final point to note is the role of expediency in any dialogue between theology and technology. Technology, given its focus on applying knowledge, tools, skills, and systems to solve practical problems, extend capabilities, expand opportunities to meet or invoke human needs, is very time sensitive. Most research projects have clear deadlines and associated deliverables that are nonnegotiable. Technology proceeds in a fairly rapid manner from

initial idea through conceptions and plans to formal design, testing, refinement, manufacture, implementation, and maintenance. Even large-scale engineering projects that radically transform the environment take place within the span of just a few decades. Theology, on the other hand, proceeds at a much more leisurely pace and evolves slowly as a discipline (not unlike many of the other humanities). Successful dialogue must address the expectations and time constrained nature of engagement in order to create conditions for success.

5.2 A Taxonomy for Theology and Technology Interactions

We need a means to classify the various types of relations that could arise between theology and technology in order to better determine options, classify viewpoints that are expressed over time, and determine areas where greater dialogue is needed or where dialogue is proceeding at a reasonable pace. We will adopt a taxonomy of options initially created by William B. Jones and A. Warren Matthews of Old Dominion University (USA) for exploring the relationships between technology and religion. We substitute theology in place of religion adapting the language within the taxonomy where necessary to accommodate this change, although for practical purposes there may be warrant in both theology and religion becoming joint dialogue partners with modern technology. Clearly for some of the categories below “theology” or “theological tradition” does not function in the same manner as “religion” or “religious tradition.” We can, however, employ this taxonomy to classify various types of interactions we may observe and also to provoke both domains to think more seriously about engaging with the “other.”

Table D. A Taxonomy for Technology and Theology Interactions
(Adapted from Jones and Matthews 1990: 3-23)

- I. Relations between technology and theology in the absence of technological innovation
 - A. Mutual noninteraction: Disregard or lack of awareness of a technology by theological tradition(s).
 - B. Mutual interaction: Awareness exhibited by theological tradition(s), but no stance taken.
 - C. Acceptance of a technology by one or more theological traditions.
 - D. Support, by established technology, of theological institutions and values.
 - E. Rejection of, or opposition to, an established technology by theological tradition(s).
 - F. Established technology destructive of theological institutions and values.

- II. Actions and influences of theology upon technological innovations
 - A. Stances taken by theological traditions toward novel technologies, either imported or encountered externally.
 1. No awareness of alien or novel technologies.
 2. Awareness of the existence of such technologies, but no contemplation of the possibility, or of the implications, of their utilization in the society with which the theological tradition(s) is associated.
 3. Awareness of the possibility or actuality of the utilization of alien or novel technologies, but no stance assumed regarding it.
 4. Approbation or promotion of utilization of alien or novel technologies by a theological tradition(s) or leading theologians.
 5. Disapproval or opposition to alien or novel technologies by a theological tradition(s) or leading theologians.
 - B. Stances taken by theological traditions toward inventions, technologies newly devised in societies in which the theological tradition(s) is indigenous or established
 1. No awareness of an invention, or of invention generally.
 2. Awareness of, but no stance assumed regarding invention(s).
 3. Approbation or promotion of invention(s).
 4. Disapproval of, or opposition to, invention(s).
 - C. Indirect or unintended influences of theology upon technology
 1. Theological tradition(s) reinforces or promotes conditions that favour an invention or innovation generally.
 2. Theological tradition(s) reinforces or promotes conditions that preclude or hinder invention or innovation.

- III. The Impact of Technological Innovation Upon Theology
 - A. Direct effects of the utilization of new technologies upon theology or theological tradition(s).
 - B. Detrimental effects of technologically engendered alternatives upon theological institutions, beliefs, and values.
 1. Effects upon values.
 2. Loss of social function.
 3. Contributions to alternative sources of authority.
 - C. Other derivative effects of technologically induced social changes.

This taxonomy provides a way to map the various interactions between theology and technology in general as well as distinct theological traditions and particular technologies or features of technology since we have already seen in Chapter Two that theologians within the same general tradition and those from diverse traditions react to technology in general and specific technological issues in different ways. There is an exceedingly low level of interaction presently between technology and theology at a general level when compared, for example, to the interaction between science and theology or science and religion that is currently thriving around the globe – likely due in no small measure to the funding support and stimulation of the John Templeton Foundation and its donor founder, Sir John Marks Templeton (e.g., Brooke & Cantor 1998; Clayton 1997; Coyne & Moormann, 1994a, 1994b; Gregersen, Parsons & Wassermann 1997, 1998; Gergersen & Van Huyssteen 1998; Gregersen, Görman, & Wassermann 1999a, 1999b; Peters 1998b; Richardson & Wildman 1996; Van Huyssteen, Gregersen, Howell & Wildman 2003). When we move to specific domains, however, the science-theology or science-religion dialogue also becomes spotty, e.g., chemistry and theology or geology and theology, but once again even these areas are much more active than specific arenas of technology and theology with the possible exception of genetic engineering and related technologies which have spawned a good deal of theological and religious studies engagement (see below).

An interesting question is whether we can expect that the general scope of the dialogue between theology and technology will closely mimic the contemporary or historical dialogue between science and theology. At first glance it might seem that there will be relatively few instances where parallels will exist and where analogical reasoning

may prove fruitful in finding ways to collaborate, challenge, and learn from this other important set of dialogues. This would relate to the apparent nature of these disciplines as fields of study. The sciences attempt to create powerful explanatory frameworks that account for a wide range of physical phenomena and data derived from observational evidence both past and present. These explanatory frameworks also include a predictive function in that good scientific theories can be used to predict future phenomena and the effects of various kinds of physical, chemical, and biological interactions. Theology, at its root the science of thinking about God, seeks to develop explanatory frameworks as well although they are not formulated or subjected to scrutiny and refinement in the same manner as those created by scientists as part of their work. Both science and theology then operate in the realm of explanations and share an affinity in this respect. When either tries to assert hegemony over the other through invocation of large-scale metaexplanations that attempt to subsume everything of importance within their reach, the other discipline reacts with fervour (and venom). These clashes in the science and religion warfare paradigm are real but a sideshow in the long history of fruitful interaction between science and theology/religion (Brooke and Cantor 1998). Science and theology seem, therefore, very similar at a conceptual level despite the daily operational and surface aspects that cause them to appear quite dissimilar.

Their conceptual affinity has created the possibility for four distinct types of relationships between science and religion according to a widely known alliterative scheme developed by theologian John Haught (1995):

1. Conflict: There is no relationship between science and religion. One viewpoint is right and the other is wrong.

2. Contrast: There can be mutual independence and peaceful coexistence between science and religion. There cannot, however, be a true exchange because the worldviews are so different that dialogue is not really worthwhile. It is possible that both fields describe different parts of the same reality but neither their descriptions nor their perceptions of that reality accord sufficiently to make a meaningful dialogue feasible.
3. Contact: Differences between science and religion are real but dialogue is valuable to understand and learn from one another. Each may see things in their own domain in a new way as a result. Consonance and coherency is sought, although not necessarily achieved.
4. Confirmation: Science which is relatively new to human endeavour is in fact supportive of the basic insights of religion which is an ancient human endeavour since the basis human hunger for knowledge and a search for human meaning and significance in the cosmos is common to persons in both science and religion.

Technology, as we have defined it in this thesis, is the application of knowledge, tools, skills, and systems to solve practical problems, extend capabilities and expand opportunities to meet or invoke human needs. It seems to be largely functional rather than theoretical in its orientation and pragmatic rather than idealist. Its methods are utilitarian and efficiency, cost-effectiveness, efficacy, timeliness, optimization, and aesthetics are some desired attributes for the products and systems it generates. It does not function like science or theology in its fundamental conceptual orientation and shares few methods with either of these disciplines, even though in modern times it draws heavily upon the

basic sciences for its knowledge base. The conceptual distance between technology and theology appears much larger than that between science and theology. But this portrait may be too simplistic to account sufficiently for all activities within the arena of technology. Computer scientists for example (the self-chosen moniker for these “technologists” in itself is interesting), including those who build sophisticated computer software, engage reality at a very deep conceptual level in order to advance their computer applications. This includes the construction of alternative microworlds and self-replicating programs that learn as they go in a process that combines art as well as science. Such activities are exceedingly interesting and complex and these technologists attempt to predict the behaviours that these systems can and will manifest as well as demonstrating mathematically the impossibility of certain things occurring and the virtual certainty of other things occurring within the cosmos (Knuth 2001: 167-198). So it may turn out that the scheme of Haught summarized above and many other aspects of the science and religion dialogue will prove quite useful in any technology and theology dialogue.

It appears at first glance that technology and theology interaction lack the necessary characteristics to pose as *bona fide* threats to one another in the way that metaexplanations of reality operate for science and religion/theology. While there may be conflict between a specific technological development, methodology, or process it seems at first blush unlikely that one could today sustain a global “warfare” between theology and technology in the way that at least some portions of both the scientific and the theological communities keep alive the conflict mentality and activity. Yet many of the traditional roles played by theology and religion in the past appear to be wholly or largely

fulfilled by modern technology. People formerly relied on God directly for intervention concerning their medical problems and socioeconomic needs and accepted as God-ordained, the limitations imposed by biology, geography, psychology, sociology, etc. Today medicine miraculously saves people from certain death, people are freed from geographic and other constraints by a host of technologies, and genetic mistakes at both the genotype and phenotype levels are increasingly amenable to human technological interventions. Modern technology challenges religion and theology by its history of astounding achievements and at the level of the relationship between “efficiency and meaning” as increasingly we equate efficiency with meaning and seek no deeper purpose or understanding (Koyama 1984: 130f.). God’s “mistakes” are now being corrected by advancing technology and each year brings renewed promise of ultimate redemption wrought by technology. Recognition of the diminished influence that theology wields is reflected in language too as the medieval word for knowledge (*scientia*) embraced theology and philosophy while its modern English term *science* explicitly excludes theology and philosophy from its domain while technology tacitly decides for us how the world is to be used rather than human beings looking to historic sources of authority for guidance (McClendon Jr. 1994: 150f.). The good news of the Gospel appears less compelling, even “old” news, once the needs of the poor have been ameliorated by technology (Borgmann 2003a: 7f.). And it is not only religion and theology that seem to be left in the wake of advancing technology. Politics, the arts, and social theory all appear to have lost some of their lustre in post-modern times while the “only force of undiminished vigour and self-confidence is technology” (Borgmann 2003a: 35).

Yet this somewhat bleak portrait of the viability of theology and religion within modern life and inevitable conflict with technology as it further whittles down the influence of religion and theology can itself be subjected to critique as it only partially captures the scope of the current human predicament. Marcuse argued that today's scientific-technological mentalité creates a one-dimensional man who lacks the awareness of true values and transcendent realities. Incapable of making informed ethical and critical decisions, modern man feasts on the comforts provided by the technological society just like his ancient counterparts in Rome enjoyed the circuses and gladiatorial spectacles of the arena with no thought to what he had become (Marcuse 1970: 7).

Marcuse held hope that art would save humankind from itself and enable a multidimensional human being to again emerge. It does not appear that art can sufficiently rise to the challenge but clearly the prophesied demise of organized religion proclaimed by selected theologians, Marxists, and humanists in the 1960s failed to materialize (Macquarrie 2001: 375f., 405). Perhaps this is because scholars and social critics assessed the new technological environment from the standpoint of the values and orientations derived within the old environment, almost inevitably finding a diminishment of traditionally cherished values but viewed from a perspective that failed to see the fundamental incommensurability of the measures with the new outcomes. What was needed was to derive new values growing out of the new environment as the theological tradition has managed to do throughout its history – although often not keeping pace with the speed of social and technological change (Kuhns 1969: 21; Brown 1999, 2000).

One reason we would expect there to be rather large differences between the science and religion/theology vs. theology and technology dialogues even at a general level is that the sciences and technology have pursued very different paths in the realms of philosophy and interactions with sociology, anthropology, and history. In all of these areas there exist now separate societies (e.g., Society for the History of Technology, Society for the Philosophy of Technology, History of Science Society, Society for Philosophy of Science, Society for Social Studies of Science), publications (e.g., Technology and Culture, Isis, Osiris, British Journal for the History of Science, British Journal for the Philosophy of Science), annual meetings, etc., although sometimes there are deliberately planned joint meetings, joint publications, and a core set of individuals who maintain memberships and involvements in both the sciences and technology domains. Some societies and publications exist within the boundary between science and technology (e.g., Bulletin of Science, Technology and Society, Science and Technology Studies graduate programs at many elite universities such as MIT, Rensselaer Polytechnic Institute, Stanford University, Georgia Institute of Technology, Imperial College London) but these have been notoriously difficult to maintain and have a rather marginal status within the academy despite their elite institutional affiliations. The fact that the majority of activities within the sciences take place in forums and in ways unique from those of technology suggest that practitioners within these two communities do think and act differently.

Any dialogue between technology and theology will also be dramatically affected by the overall posture that theology will take toward even the possibility of such a dialogue. The taxonomy introduced above includes categories that assume a variety of

options ranging from total ignorance of one another through toward total antagonism based on genuine knowledge. Theology and religion more generally have adopted many different orientations over time in their engagement with the larger culture. Ernst Troeltsch, working from the methodology of sociologist Max Weber, formulated a classic position that suggested three different ways in which the church related to social phenomena (Troeltsch 1992, original German edition 1912). The *church type* adopted a social ethic from the culture at large, e.g., the medieval church's adoption of Stoic law. The *sect type* refused to accommodate the wider world and maintained its purity but also became politically irrelevant. The *mystical type* (Troeltsch's personal preference) privileged human freedom above all else. Sociologists of religion have discarded Troeltsch's third type but many sociologists still employ his first two types or a variation of them (Christiano, Swatos Jr., Kivisto 2002: 94-96, 303). H. Richard Niebuhr creatively adapted and expanded Troeltsch's scheme into a five-fold typology which he memorably characterized in the following manner (H. R. Niebuhr 1951):

1. Christ against culture (e.g., First John, Tertullian, Tolstoy)
2. Christ of culture (e.g., Gnosticism, John Locke, A. Ritschl, Rauschenbusch)
3. Christ above culture (Justin Martyr, Clement of Alexandria, Thomas Aquinas)
4. Christ and culture in paradox (Paul, Marcion, Luther, Kierkegaard)
5. Christ the transformer of culture (Gospel of John, F. D. Maurice)

While his categories have been criticized for vagueness and his definition of culture regarded as too broad to be useful, in considering possible orientations toward a dialogue with technology these provide at least a preliminary way to consider options (Long 2001:

82). We would likely not want to commit uniformly to a single orientation but if we considered these as possible roles to adopt at particular points of engagement it could serve as a useful heuristic device to ascertain and maintain our bearings within a specific conversation. Gascoigne (2001: 97) argues that there are three principal conceptions of the relationship of Christianity to other realms of meaning: 1) Christian identity as “praxis based in and inspired by a particular narrative” (e.g., Stanley Hauerwas, Samuel Wells, Robert Song), 2) Christian identity as “an interpretation of universal meaning, based in a theology of mediation” (e.g., Karl Rahner, Wolfhart Pannenberg, David Tracy), and 3) Christian identity as a “self-contained tradition” (George Lindbeck, John Milbank, Joseph Ratzinger). Conception #1 recognizes the possibility of dialogue with technology but it can only succeed if participants are willing to compromise after strongly stating their position from the heart of their own tradition (a position Robert Song seems to favour but that is soundly rejected by Stanley Hauerwas). Conception #2 is predisposed to dialogue with technology but may not in every case, depending on the theologian in question, present a well-defined position that is sufficiently theological to provide a meaningful counterpoint to worldviews and perspectives already well-nurtured in the secular arena. Conception #3 forecloses all possibility of dialogue with an unbelieving world and prefers to serve as a counter-cultural, revolutionary voice from the margins, maintaining fidelity to the Christian tradition, but in this writer’s view at high cost and to the further detriment of society and civic life. This thesis is written from the perspective of Conception #1 but with a definite commitment to engage in public and practical theology rather than fundamental theology or systematic theology that are addressed principally to the specialized publics, respectively, of the academy and the

church and religious community (Tracy 1981: 57). Christian theology must maintain its own strong and clear voice at the public table (stripped of patently religious terminology yet rich in theological content) but also must be willing to patiently listen to the perspectives of others, learn from them, critique its own position in the light of new information, and be willing to compromise when necessary (*contra* Hauerwas) to advance public concerns and values that are considered important to the maintenance and advance of civil society.

The degree to which technology is also considered as presenting new versus perennial challenges is an interesting factor to consider in theology and technology dialogue. If technology is perceived as presenting nothing new in the domains of ITS, genetic engineering, nanotechnology, and other emerging fields then theologians can simply trot out the same responses to this newest wave of developments as they have done in the past. If the current wave of technologies is perceived as completely and even radically new, it could demand “militant intervention” on the part of theologians to protect the Church, Christianity itself, and the wider society from this emerging evil. Finally, theologians could view themselves as facing new technologies which will inevitably raise new questions and concerns and seek out opportunities to come to understand these developments and explore their implications for society, the Church, and even the development of theology (Deane-Drummond, Grove-White, and Szersynski 2003b: 37). It is instructive that a leading technologist has recently confessed that we “simply do not have a good method for thinking and making decisions about how to apply (and not apply) the powerful tools of rationality, the scientific method, reductionism, and the combination of logic and efficiency embodied in technology”

(Rheingold 2004: 258). A Christian theologian who has thought and written extensively about information technology has confessed from the “other side” of the dialogue table that his initial attempt to “spell out what the questions were” regarding computers from a theological perspective was humbled by the complexities he encountered and how quickly facile questions and answers eluded him. He points out that when “we begin to reflect on contexts that we are not accustomed to relate to our theology, we find that we must begin the theological task without knowing what the questions are” (Lockhead 1988: 30f.). These difficulties are hardly new as prior generations of Christians ambivalently struggled with the meaning of and proper stance toward the emerging technologies of their day, including leading scientific figures like Francis and Roger Bacon, Robert Boyle, Humphry Davy, Hugh Miller, and Joseph Priestly, generally (and sadly still today) without the assistance of professional theologians (Brooke 2003: esp. 44; cf. McKnight 2006 for detailed discussion of Francis Bacon). Albert Borgmann has argued that theology in the past discovered the truth of nature and history and then began to reflect seriously on it, constructing a natural theology cognizant of these new humanistic studies and their import. He calls on the Church today to create a fundamental “theology of technology, the successor to medieval natural theology” (Borgmann 2003a: 81). This becomes ever more urgent in Borgmann’s view due to the “vigorous cultural force” of the information revolution since it is the most “prominent and influential version of the device paradigm” (Borgmann 2000a: 350ff.) A formal Christian response to technology is long overdue as Neo-Marxists, to the Church’s shame, have presented a critique of technology in both capitalist and socialist forms “which has often been far more penetrating than anything that has come from the churches” (Macquarrie 2001:

375). Any Christian response to technology, however, must move beyond the earlier classical work of Ellul and address both “concrete technological practices and developments” and how these developments “can rapidly alter the actual normative frameworks of culture” (Achterhuis 2002: 98).

A very good starting point for considering how to approach this task can be seen in the fine work on liturgical practices and contemporary technology undertaken by Susan White (1994). She finds a long and historic interaction between technologies and liturgical practices and suggests that many current dilemmas confronting liturgical practices in this new millennium should be addressed by considering more carefully the use and impact of technologies within liturgical settings. She suggests a set of principles for dialogue between technology and technological structures and liturgy and liturgical structures (White 1994: 125-129):

1. Utilize participants from both domains with a great variety among them.
2. Use the power of worship in its vision of God and promotion of biblical values to directly challenge technology.
3. Use the power of technology to challenge the status quo in liturgy and liturgical practices since it can nourish appropriate Christian values as well.
4. Adopt a historical perspective on both technology and the history of worship that informs the dialogue on a continuing basis.
5. Take both technology and theology seriously since they can both learn from the “immanent obsolescence of our certainties” (p. 128)
6. Focus the dialogue in a pastoral manner.

White puts forward this agenda for dialogue in full realization that the future of Christian worship is imperilled in the midst of a technological culture that favours the new over the old, superficiality over deep engagement, materialism over spirituality, and social

fragmentation over community. Yet she holds out hope that technology can indeed “become sacramental” and considers it essential to achieve this goal if the “search for God among the ‘nozzles and containers’ may not be in vain” (p. 129). Quentin Schultze has also given consideration to the relationship between technology and worship, working from within a Calvinist Reformed framework. He has been particularly concerned about offering advice to evangelical churches especially about how they should incorporate presentational technologies into worship. He suggests four fundamental approaches to using technology in worship: rejection (where there is “no stewardly warrant” for the technology), adoption (technology is employed in a manner similar to how it is used in the wider culture), adaptation (requiring a proper discernment of how, when, where, and why you are using a particular technology), and creation (where the church invests in persons or organizations that will invent the next generation of technologies for worship) (Schultze 2004: 45). He invokes the need for the deliberative cultivation of wisdom concerning presentational technologies including being open to critics of technology within church settings and developing in-house wisdom rather than importing it in the form of consultants since only local people can approach the matter in a manner that lives out the gospel in peace since changing worship formats is always contentious (p. 86). He reminds readers of the powerful statement of Archbishop Charles J. Caput who observed: “We certainly want salvation, and we acknowledge that salvation is of the Lord – but for many of us tools function as a pretty good insurance policy, just in case We’ve learned to trust our own ingenuity because it works. Unfortunately, the construction crew at Babel felt the same” (Caput 1998: 19; quoted by Schultze 2004: 86).

A final factor to consider in a dialogue between theology and technology is how both of them relate to humanity as a whole. Historically, Christianity has conceived of humanity as influenced by a triangular framework of the individual, the community or society, and God. We have become far more aware in recent decades of the influence of the environment upon humanity both at the individual and at the societal level and much of this environment is inherently and pervasively technological (Kuhns 1969: 28). This can be illustrated by Figure 4 shown below which is complementary to our earlier graphic (Figure 2) concerning technology as mediator. Here we are interested in how to construct the influence of various factors on humanity and what it means to be human. Theology must speak to the human condition in its totality and this must include the

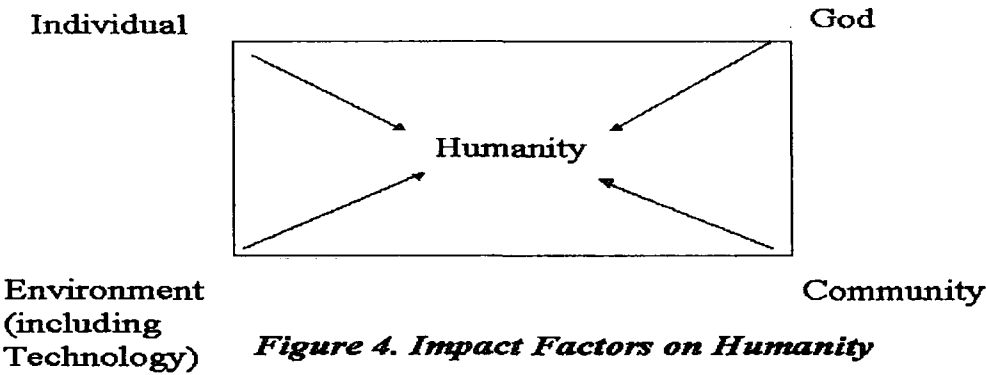


Figure 4. Impact Factors on Humanity

technological milieu in which humans find themselves. In the same manner in which an individual’s conception and awareness of God is affected by their own personality and psychological state (including cognitive, psychomotor, and affective domains) and their social relations with others (within and outside of the Church), so human technology in all its manifestations exerts an inexorable influence on an individual that affects in some

manner their perceptions, knowledge, and experience of God (coupled with the fact that God also employs technology in his communications and interactions with humanity as discussed previously). The medieval cathedral was one of many structures employed by the Church over time demonstrating that carefully engineered structures that alter the natural world can be a vehicle by which the human spirit is inspired, taught, and brought into contact with the living God (Radding and Clark 1992; Courtenay 1997). The Gothic cathedral allowed sunlight to filter through its walls in a manner that reinforced for the medieval visitor the mystery of the Incarnation and a celebration of the feast of the Incarnation during the winter solstice that highlighted light breaking into the darkness of the human condition (Von Simson 1988: 55). The axial pattern of sacred architecture within the cathedral was intended to transition the viewer into ever more sacred zones of “hallowedness” with the culmination being the high altar, the inner sanctum where “the power and concentration of the sacred force are said to be the most intense . . . reserved for the holiest of sacred objects, such as the image of Christ affixed to the cross” (Robert A. Scott 2003: 158ff.).

5.3 The Metaphorical Form of Our Engagement

We live in a time of profound and generally warranted distrust of grand explanatory schemes that appear to easily resolve pressing questions of the day. Postmodernity has questioned many of the foundational pillars of the modernist edifice and found them inadequate to the complexities of the modern world and inconsistent with accumulating human knowledge. The Christian philosopher Alasdair MacIntyre, along with many other Christians, despairs at the fact that there are no longer reliable anchors in

the post-modern public domain sufficient to provide a common foundation for moral discourse – at least according to the old ways of proceeding (MacIntyre 1981: 104f.). Even if the Church could formulate an expansive, complete theology of technology that could be used to efficiently and effectively provide guidance for every conceivable question that technology raises for self and society, it is doubtful that a hearing for its salience would be granted in the public square given the pervasive scepticism about such approaches as we enter the twenty-first century. Duncan Forrester, spotting an opportunity rather than an impasse, has developed a helpful metaphor in the concept of “fragmentary theology,” i.e., a theology that in lieu of a grand theoretical structure posits “illuminating fragments which sustain the life of the community of faith which nurtures them, and claim also to be in some sense public truth” (Forrester 1997: 202). This avoids completely the sometime “inhumane and brutalizing” aspects of “carefully developed theories” while at the same time providing useful insights and kernels of truth from which many can benefit and public discourse and decision making can move forward (Forrester 2000: 154). It also may allow theology a point of entry into the public square since it is clear that predictions that technology will collapse in a heap of social chaos or environmental catastrophe when the public realizes that the emperor has no clothes miss the mark by a large degree just as those who predict ever rosier benefits and a glorious redemption of humanity on the backs of technological innovations (Borgmann 2003a: 19). An older but still useful metaphor in these times is that of a computer interface that resides between the technical innards of the technological enterprise and the external publics (Kuhns 1969: 9 although I employ it differently here). The interface provides a face to the user that is if not friendly, at least not totally off-putting. It provides a face to

the machine to which it can functionally and effectively relate and two-way communication is realized. Theology often gives cogent voice and a public face to some of the deep questions and nagging doubts that many people within society possess but cannot express in a consistent and clear manner if surveys of the public regarding concerns about genetically modified food and genetic engineering are a sufficient verification (Deane-Drummond, Grove-White, and Szersynski 2003b: 17f., 38).

A third useful metaphor is that of theological ethics and theology in general as the improvisation that one sees in theatre (Wells 2004: 53ff.) Improvisation “works” because actors think and respond within a vast matrix of experience, knowledge, and pathos where the narrative is maintained but the actual details and the manner in which they may be put together is immensely varied (not unlike jazz to pick a musical version of this metaphor). A careful balance is negotiated “on the fly” as improvisers respond to verbal and non-verbal cues while holding in their heads an overall image of progress toward the desired end result and the necessary checkpoints that must be reached. Theologians who engage in a dialogue with technology could find such a metaphor useful as often in the exchange there is a need to maintain one’s composure in the face of unanticipated developments, a required fluidity in response that adapts to the other and “fits” with it rather than remaining stuck on one’s point expressed in a singular manner, and a need to focus on the long-term objectives rather than resolving all the particular difficulties that a single dialogue session invokes. The church is perhaps at its best when it serves as an illuminator of environments (Kuhns 1969: 133f.) that “calls into question what now counts as unproblematic, or what is commonly taken as evidence of justification for some claim” (Borgmann 2003a: 82).

The Judaic tradition, especially that of *Halakhah*, reminds us of the importance of developing our theological fragments concerning technology within the contexts of concrete cases rather than abstractions of both theology and technology that end up as characterizations of what actually pertains. We must develop our insights, critiques, questions, and suggestions for “real people in the real world” (Wurzbarger 1994: 112ff.). Just as “philosophical meaning arises out of the procedure of concrete daily activity” within Judaism, so theological meaning regarding technology can arise out of consideration of concrete applications of technology in the form of case studies (Katz 1994: 55). In keeping with post-modern understanding, our overall goal is not to arrive at an approximation of truth but rather to arrive at a “better estimate of truth,” one that has “fewer deficits and that seems to fit the information we have better” (Rescher 1992: 53).

Stanley Hauerwas (2000) has written about the unnecessary and even dangerous separation of evangelism and worship in contemporary Methodism. He argues that as soon as there is a distinct separation between one aspect of the Christian life AND other aspects of the Christian life, that the essence of Christianity has been lost. Historic American Methodist emphasis on tent meeting evangelism and the more recent move to make Methodist worship more “user friendly” creates an unwarranted tension between worship and evangelism. He argues against such a separation and envisions a Methodist church that fully embraces both worship and evangelism as part of a single Gospel rather than seeking to separate and then somehow join them. They are fully joined up in his mind as a single integrated Christian approach to reality, our relationship with God and our relationship to one another. In similar manner, we must work to make our theology and our appropriation and use of technology part of a single, consistent fabric of

understanding and living out the implications of the Christian gospel in a modern world badly in need of redemption. If what the Christian creed asserts is true, then it is imperative as ever that Christians speak truth to power even if “we be held to ridicule or put to death” (Lash 1996: 236).

Along with his colleague Don Saliers, Hauerwas has sought integration of piety and theology and to “make the world the world” (2000: 157). By this terminology, they mean that it is only by being the Church in all its fullness, that the world can begin to understand what justice, mercy, and other virtues actually mean. The Church in Hauerwas’ scheme functions in a similar manner as *wilderness* does for Borgmann, a fundamental orienting point for the comprehension, experience, and evaluation of reality. With this fundamental orientation in view, Borgmann, Hauerwas, Daniel Bell, and a host of other prominent Christian intellectuals launched the Ekklesia Project (Hauerwas 2000: 211-215. www.ekklesiaproject.org) to encourage such integration and to promote more thoughtful and powerful responses to the contemporary human condition by calling the Church to be all it was intended to be.

We are now prepared to undertake an analysis of the ITS case study presented at the end of chapter three in light of both the philosophy of Albert Borgmann and the considerations broached within this chapter.

Chapter Six

A Critique of the Case Study in Light of Albert Borgmann's Views on Technology

"Technological fixes are partial, reductionist responses to complex problems. They are not solutions. Yet Americans have avidly embraced technological fixes. The reason, in part, is their long-standing technological enthusiasm. Enthusiasm can be defined as fanatic religious ardour or supposed possession by a god In short, a god named technology has possessed Americans." (Thomas Hughes 2004b: 241)

"In a finite world, devotion to one thing will curb indulgence in another." (Albert Borgmann 1992a: 116)

We have reviewed a wide range of materials related to the nature of technology ranging from engineering texts through to biblical stories. We have considered in some depth the possibilities of dialogue between theology and technology and gained an appreciation for contemporary Christian reflections on technology, especially as seen in the writings of Albert Borgmann. Our knowledge of intelligent transportation systems (ITS) gives us a grasp of the fundamental ways that these technological devices within the device paradigm are already reconfiguring our lives and way of being in the world. Our case study provides a concrete means to now consider in specific terms what theology might say to technology regarding ITS applications. Our goals are to develop a good feel for how theology might fruitfully interact with technology in the specific form of ITS applications, test the viability of such a dialogue to the degree it is possible to do in a thesis – a poor substitute for live discussions with real actors in the realm of ITS - and see what light, if any, ITS may be able to shed on theological concepts and ideas to prod its continued development in our technological milieu.

6.1 A General Borgmannian Perspective on the Wilderness within the Case Study

Our case study presented in chapter three focuses on an area of the United States that is largely wilderness in its pristine glory. For Borgmann, wilderness is the preeminent focal thing and speaks with focal power in a pretechnological language to all who will take time and persistence to listen. He adopts this view from the standpoint that nature as created thing precedes human history and stands alone without any need for human intervention or sprucing up. Wilderness just by its existence presents a fundamental challenge to technology and has a unique capacity to summon forth a special kind of experience for human beings. The presence of the national parks system that seeks to preserve such wilderness areas could very well constitute a focal practice for those legislators, solicitors, and naturalists that work to preserve and maintain it in its original state for persons from anywhere to visit, experience, and enjoy. But the very fact that we have to organize and act deliberately and forcefully to preserve what is left of wilderness in the United States speaks to the manner in which we are with great “success” commodifying the Earth itself where it is now a “garden to be preserved and protected” rather than a “menace to civilization” (Waters 2006: 47). The injunction that “The earth is the Lord’s, and everything in it, the world, and all who live in it” (Ps. 24:1) is turned into the earth, or at least this part of it, belongs to whomever can stake a land claim and clear the land to “be used.” Borgmann might advise us to think more deeply about the fact that we have national parks that people pay a fee to visit – is this not turning the wilderness itself into a commodity to be bought and sold?

The wilderness of the Yellowstone corridor is alive with the natural information of signs as trees, plants, rivers, birds, mammals, amphibians, reptiles, geological formations, and all of nature participates in a profusion of silent and not so silent sounds (Borgmann 1999a: 1). It is this overwhelming presence of wilderness that takes us beyond the world of values imposed by human beings. Nature itself needs no such justification, it simply speaks. It requires no valuation of beauty, stability, integrity, or other terms that would argue for its preservation. Rather it speaks to us of what beauty really is. We come to appreciate the depths of beauty from the contemplation of nature in all its fulsomeness. "They who dwell in the ends of the earth stand in awe of Your signs. You made the dawn and the sunset shout for joy. You visit the earth and cause it to overflow. You greatly enrich it. The stream of God is full of water. You prepare the grain, for thus you prepare the earth" (Ps. 65: 8-9). Human terms are bendable to the whims of the author. Nature confronts us with something that is wholly other and teaches us meanings that we can only with partial success render into prose or attempt to capture using the most advanced of our digital technologies yet still somehow missing its essence.

Borgmann sees our case study as the continuing part of a long chain of events that slowly, inexorably is seeking to remake the wilderness, to tame its rawness and mute its power. In HOR (p. 217), he laments how Yellowstone National Park has a Grizzly Discovery Center where you read, see video footage, view mounted specimens, and experience a virtual world of "Yellowstone" via the 3-D IMAX movie that "shows" you grizzlies and wolves and other features within the park in a short compass of time and in a manner that may make nature itself seem rather boring by comparison. The endless

train of tourists recording images at the park via handheld video cameras, digital devices, photophones, etc. strikes Borgmann as “deracinating” flora and fauna as it removes them from their contexts and creates a collection of “desiccated” things that no one except the dearest family members would ever want to view again (Borgmann 2005b: 1175). This is but another instance of commodification as we seek to turn the wilderness itself and everything within it into commodities to be captured on film, exchanged, analysed, and catalogued. Just one more tick on a list of key tourist sites to visit. The roads, motels, camping spots, gift shops, parking lots, and other accoutrements within the park serve to “keep the wilderness at bay” and in some sense kills it as we get insulated from engaging it directly except through selected features such as “nature” trails designed still to keep us at a distance and to mediate our experiences (Borgmann 1974: 195).

Providing opportunities for people to experience wilderness is a good thing, even if they still will not likely experience it in its fullness but in some more shallow representation through the ways in which we appropriate wilderness areas for visits by the public. It certainly can still speak in a manner that is not likely to be experienced in any other way by most park visitors, who live their entire lives within a circle of activities where virtually nothing they see, touch, or experience is truly “natural” but is rather the world as various other human beings, known or unknown, have designed the experience for them by altering landscapes, creating parks, etc. Developing a practice of regularly seeking out wilderness can be a focal practice and help center people’s lives more fully on that which exists outside of human beings and the worlds they have created. However, the more people visit the Yellowstone corridor, the more commodification will likely occur and the less wilderness there will be to experience.

6.2 A General Borgmannian Perspective on Intelligent Transportation System

(Borgmann 2005e)

Intelligent transportation systems certainly confer many benefits, not the least of which is a good deal of evidence that suggests that such systems can reduce accidents, human fatalities, and the pain associated with them. In some clear sense they are a technological fix to a clear human problem of driver errors, poor judgment, and poor reflexes. Clearly as Christians we can rejoice in the reduction of human suffering and should seek out opportunities to see such benefits realized. A large-scale system like that envisioned here, however, also raises some interesting issues regarding classic virtues that Christians seek to live and promote. For example, in the presence of a fully deployed ITS within the Yellowstone corridor, there will no longer be a need for anyone to stop and assist another traveler, since the system itself will already have registered their plight and the other traveler can presume that help is on its way. The serendipitous nature of human caring and helping of fellow travelers will become a thing of a past, replaced by the wonders of a technological device within a device paradigm that attends to human needs as they arise without the intervention of other humans being required or wanted. This diminishes human agency and encourages self-centeredness, the exact opposite of the lesson of the Good Samaritan. It inhibits conviviality and the exchange of ideas and thoughts with other human beings. The experience of nature then becomes a lonely affair that is not shared, except with any passengers who happen to be in your vehicle.

Regulating travel within the corridor through ITS applications, that in their fullest rendition would actually take over control of the vehicle for long stretches, frees drivers

of many risks associated with driving not unlike passengers who board a bus, train, or trolley. Yet in this instance, it also reduces the possibilities to seek or to show forbearance to others, to yield the right of way, to forgive a driver for an error of judgment, to courteously allow a driver to go first, and a myriad of other human interactions that build community and solidarity with others. No longer will a human being have to brake because of an animal crossing the road but instead the vehicle will sense the danger and take appropriate actions. The driver no longer will have to attend to the grade of the road, the length and form of the curve, the force of the wind, and myriad other driving factors that immerse the driver in reality (Borgmann 2000h: 194).

On the plus side, riding in such a vehicle will enable the driver to observe the landscape as it goes by and to attend to details that would clearly be missed altogether as attention to the road conditions take preeminence. The automated vehicle however, will make it unlikely or impossible for there to be serendipitous opportunities to “pull over” to take in a vista, watch wildlife in the distance, or just to stop and talk or sit quietly in the presence of focal reality. Once the system takes over and control of the vehicle is turned over to some distant person that controls the corridor, the relentless march toward efficiency and maximizing throughput of the system will exert itself. Too many stopped vehicles at unpredictable places will create traffic jams and impede the whole point of the system that is to move the maximum number of visitors through the corridor within the minimum amount of time with the minimal amount of danger to others. Safety and efficiency concerns will trump considerations of the aesthetics of the experience and the wholesome fullness of experiencing wilderness rather than simply traversing it.

One's experience of the park will be almost completely "managed" by the technological device residing within the device paradigm. The common human propensity to seek entertainment when relieved of the burdens of engagement suggests that some former drivers will now tune in their mobile devices and glide blissfully through the corridor without attending to much of anything except their glowing computerized screens (Borgmann 1999a). Children, already immersed in a technological bubble every day of their waking lives, will be especially prone to find wilderness "boring" and naturally gravitate toward skipping the jarring but necessary experience of the world as it really is rather than the artificial virtual worlds we have created for them.

Borgmann (1990a; 2003a: 65-80) has proposed in his essay "Contingency and Grace" overviewed previously that this situation calls for a consideration of when "to expose people to misery so they can be good" and when to "forestall evil and make people indolent" (Borgmann 2005e). Having a car break down that leaves us frustrated also can open up time to experience the vistas around us while we await assistance and could prove liberating. It certainly also forms a focal point for conversations long into the future as one part of the overall experience of the trip and bonds us sometimes to others in our family and beyond that would not have occurred but for the difficulty. There are troubles we should oppose in principle and seek to eliminate in practice, forbearing them with patience until such time as they can be eliminated. Conversely, there are troubles we should welcome in both principle and in practice because there is a needed element of contingency and grace to them. Perhaps in the current situation, the ITS corridor should only be activated when the risk to human life is high and the possibilities of human interventions are low, e.g., in winter months when few travelers are on the road and

weather conditions are at their worst. Clearly entering completely into the world of devices and commodities leads to a nonrelational way of being when passing through the corridor. Allowing room for focal things and focal practices such as human caring opens up relations (Borgmann 2000a: 351). Perhaps there are even individuals who would relish the opportunity to help fellow travelers within the corridor during specific times of year for some modest reimbursement, public gratitude, or just the simplicity of fellow travelers' thanks. Yet the danger here would be that even this "service" can become another device rather than a focal practice the more it is routinized, scripted, automated, and expected (required) – not unlike the commodification of religion that we can witness around a globe impacted by technological systems and technological ways of thinking, acting, and valuing.

The need for some theologically informed standards for technology to guide these deliberations becomes apparent rather quickly and Borgmann has himself called for such work (Borgmann 2000a: 348; 2003a: 80). Such an effort fits very well with a variety of Christian traditions that have argued strong cases for the involvement of Christians in advancing the well being of society as part of their calling and service to Almighty God. Richard Mouw, writing from a Reformed perspective, argues the case for Christians performing "righteous acts" that affect other persons and manifest the "gifts of common grace" as a direct consequence of the outworking of Christian virtues in the lives of believers (Mouw 2001: 76, 81f.). Father J. Bryan Hehir, former President of Catholic Charities in the United States and now a Professor at the Kennedy School of Government at Harvard University, suggests that Christian theological truths can be expressed as embedded convictions in an appropriate manner within the public sphere such that they

address the “pre-moral convictions that must be addressed to confront the societal questions we face today” (Hehir 1996: 5). Douglas Peterson, writing from a classic American Pentecostal perspective informed by years of missionary work in Latin America, argues for a Pentecostal hermeneutic for social service and social action ministries empowered by the Spirit with a particular emphasis on the poor and those who have “absolutely no one to plead their cause” (Peterson 1996: 224f.).

Canadian Christian sociologist William Stahl (1999: 146f.) has suggested the following six principles for a redemptive technology: 1) search for the common good (working off of fellow Canadian George Grant’s observation that the concept of the good was a basic part of the Western tradition before modernity), 2) commitment to justice giving priority to the marginal and the poor, 3) creativity that seeks “new and appropriate technologies with which to build the future” (following Christian philosopher Frederick Ferré), 4) respect for limits (balancing respect for nature and for human communities), 5) reciprocity (dialogue and debate among all members of the community), and 6) holism (take technical, organizational, and cultural aspects of technology equally seriously). Success would require holding these six principles in tension with one another. They become the basis for a focal practice of engineering that seeks to realize these principles throughout its activities.

Some years ago a group of engineers, theologians, and political scientists at Calvin College worked to create a somewhat different set of normative principles for technology that would influence how things were designed, how systems were created, and how they were implemented within society. Their approach builds upon the eight normative principles of the Dutch Christian philosopher Herman Dooyeweerd (1979)

within which all human activities reside (he has seven other modalities or aspects of reality but these involve physical laws and limits). These are: 1) cultural appropriateness, 2) information or openness, 3) communication, 4) stewardship, 5) delightful harmony, 6) justice, 7) caring, and 8) trust (Monsma 1986: 71-74). Underlying these eight normative principles is the commandment to love the Lord above all and your neighbor as oneself. They suggest that what this means for technological activity is that technology is called to serve fellow human beings and the natural creation. Thus all activities should “show respect for the various entities in God’s creation by developing and using them as he intends” by honoring the entity (focal thing in Borgmann’s terms) itself and seek to bring out the riches with which God has endowed it. Secondly, “technological activity should reflect love for God and neighbor by expanding, not constricting, the opportunities for men and women to be the loving, joyful beings God intends them to be” (Monsma 1986: 68f.). They suggest that there are three general aspects that should inform the realization of all eight principles. All approaches to technology should be: 1) adequate in scope (i.e., reflecting the multiform character of both God and the creation), 2) make necessary distinctions (a variety of facets in life where each has its place and gains meaning and significance as part of a whole and yet distinctive), and 3) integrate the diversity found in society (strive for coherence across realms of human activity where technology is but one of many arenas and all are important) (Monsma 1986: 63-66). Applying these ideas to the case study, coupled with concepts pioneered by Borgmann, will not yield quick or straightforward answers but it will suggest critical questions that theologians would want to raise as part of the design, engineering, and implementation process.

We can combine these ideas into the following set of principles:

- 1) Culturally appropriate technology that seeks the common good and treats one's neighbour as well as oneself.
- 2) Technology that promotes justice with particular reference to the marginal and poor.
- 3) Technological creativity that encourages stewardship of the environment, an openness toward the future and the ideas of others, and joy on the part of users of the technology.
- 4) Respect for limits, human finitude, and the diversity and plenitude of creation.
- 5) Trust and caring that balances technical, organizational, and cultural aspects of technology with genuine human need and larger societal contexts.
- 6) Communication concerning the technology that is open, respectful, accurate, and timely to allow others affected by technology to respond.

6.3 Looking at Some Specifics of the Case Study and Beyond

A list of specific issues detailed below will be addressed regarding ITS applications, using the specifics of this case whenever feasible and drawing in selected smaller cases if the need arises in order to make a point clear. The sequence that is used here has been created and arranged in a manner that seemed best in light of available materials (both theological and technical) but the reader should understand that this list is neither exhaustive nor illustrative of any exact sequence of analysis that has occurred in the past or might occur in the future in regards to specific ITS applications.

Sequence of Analysis for the Case Study

1. Purpose/Direction (including the concepts of growth and progress)
2. Research and Design
3. Automation and Control
4. Efficiency (including cost estimation)
5. Surveillance and Privacy
6. Information Technology
7. Aesthetics
8. Safety
9. Siting (including concepts of stewardship and dominion)
10. Evaluation (including cost-benefit analysis, technology assessment, and risk calculations)
11. Interconnectivity and Portability
12. ITS Workforce Issues
13. Planning and Public Policy Making

Our case study raises a myriad of issues, which adhere in the technical nature of the application, and more general issues that arise when one considers technology within society. The discussion here will raise particular issues that are more theological in nature while not shying away from pointing out general considerations that would fall under Rahner's theological concept of sacramental grace. We have organized these items around sociotechnical aspects of the case study, however; rather than theological categories because successful discourse within the public square will require theologians

to repackage their input in a manner that can be understood and talked about by persons who are not theologically trained and who may be immediately dismissive of input couched in classic theological terms and approaches. Obviously Christian forbearance on this point would have to be exhibited and some patience on the part of theologians is likely required to read through that which follows since it may seem quite foreign in its orientation and concerns. This is not unlike much of Borgmann's work that reflects distinct and recognizable Christian concepts for those explicitly seeking them but is clothed in secular categories and couched in terms that can be embraced by individuals coming from a variety of worldviews and perspectives rather than being solely accessible and acceptable to the faithful. We have already described why Hauerwas and some other theologians would likely reject this approach and will not reiterate those arguments nor our earlier response to them. An alternative set of theological principles could be enunciated but this would reduce the contributions of theologians chiefly to conversations within churches, a more modest goal that certainly has merit, but is not the focal intent of this thesis. We will also make comments at suitable points that take us beyond the specifics of the case study consistent with our overall goal to explore how technology and theology might engage in sustained dialogue.

6.3.1 Purpose and Direction (including growth and progress)

The case study before us exhibits the usual features of much government-sponsored research in contemporary times. Public policies that have developed over time and their associated authorizing legislation and legislative appropriations combine to drive an industry of requests for proposals or contract work that seeks to advance the

policies in question. In this particular case, the National Automated Highway System Consortium was a program launched within the U.S. Department of Transportation in 1994 whose goal was to investigate fully automated vehicles and highways, develop prototypes and applications, and create a national plan for their development and deployment (Horowitz and Varaiya 2000: 3; Bishop 2001). Three years later, this ambitious program created a sensation among highway engineers and public transportation officials with its Demo'97, August 7-10, 1997 in San Diego, CA. Over 1,700 people had the opportunity to ride in fully automated vehicles. A large number of research studies were funded across the United States, including the one that appears as our case study. In the same year as this case study was submitted to its funders, the U.S. Department of Transportation dissolved the NAHSC and the AHS program. Various consortia and smaller programs since then in the federal government and state governments continue to work on AHS applications. Governments in Europe and Japan have aggressive programs in AHS, built squarely on the achievements of the American program. The case study itself, coupled with this update, raises squarely for us the question of purpose and direction for ITS. At the very time that the government was closing down the program, our case study researcher was proclaiming to the housetops the sure benefits that would accrue from developing AHS applications in the hinterlands with admirable benefit-cost ratios and assertions about how the quality of life would inevitably improve and how, once fully implemented, vehicle collisions would be but a distant memory.

Technology innovators and early adopters of technology have always had a messianic zeal about the transformative powers of technology. Nietzsche recognized the

amoral will to power that technology could instil where technologists play the modern role of the *jinn* of the *Arabian Nights* who stand ready to accomplish any wish for any benevolent or malevolent purpose (Dawson 1989: 194). Some years ago, Howard Snyder went so far as to argue that *la technique* with its attendant tyranny that what was possible was automatically good was satanic in origin as it “cancels out all questions of ultimate purpose and meaning, and puts all life on the level of the ‘penultimate,’ the next to last” (Snyder 1975: 185). One hears the pressing inevitability of technological development within our case study where the outcome almost seems determined as one reads the opening lines and where data is gathered from far and wide to support the continued expansion of the technological beast (McDonagh 1979: 123). Yet going into a meeting with the author of this study as it is being conducted or attending a public event where the final study is brought into public view and launching into a tirade about technology as an unreliable god from whom we need liberation seems decidedly unproductive (Dussel 1996: 200; Jewett and Shuster 1996: 413). So how might theologians approach the question of ultimate meaning and purpose in the midst of a technological development system that seems to find its answer before it even asks its questions?

First, we must be clear within ourselves about the stance we wish to take toward technology on this vital issue. It is fairly clear that theologians have diverged considerably in regards to this question. To expect a single answer from theology or even a small set of closely affiliated responses is probably outside the realm of possibility. Unbridled technological developments are clearly not in anyone’s best interests except for those who stand to gain from the funding of such developments. The six principles we have enunciated previously can serve to guide the kinds of questions that can be asked

regarding the purpose and long-term direction of a particular technological trajectory.

What is the common good that is being sought in this set of developments? How does this particular set of developments positively impact the poor and marginal groups within society? What opportunities for active stewardship of the environment will this set of developments engender? How will the developments create an atmosphere conducive to joy on the part of the intended users of the technology? What are the limits beyond which the project will not go? What are the unknowns associated with the proposed set of developments? How will the environment itself be affected by the proposed developments and who is determining the likely impacts and by what methods? What is the communication plan associated with the proposed project that will ensure that information is freely shared to all concerned parties, including those hard to reach or outside of the usual communication channels?

One thing we may all agree on is that as we consider whether to plunge forward into a project that could lead to the expenditure of millions of dollars we can focus on the unknowns in the study. Recently Bill Joy, co-founder and former Chief Scientist of Sun Microsystems and Howard Rheingold, founder of *Electric Minds* and the founding executive editor of *HotWired*, independently expressed deep doubts about the information technology revolution they helped to lead. Joy (2000) horrifically realized that machines would soon develop the capability to struggle with and replace human beings in whole or in part as cyborgs competed among themselves in a Neo-Darwinian struggle for existence. Rheingold (2004: 254f.) took his argument in a different direction confessing that he came to the realization that we are building things we do not understand, to do things we cannot know, and that we have not the foggiest notions about

where we are heading nor about the tools we are using. Both feared that their colleagues would label them as Neo-Luddites and banish them forever from cyberspace yet both write with deep conviction and even fear about the forces they have helped unleash on the world. Rheingold finds himself no longer fully comfortable with the technophiles but certainly not ready to join the technophobes. He is strangely disquieted by the realization that he has been sleepwalking through the world he helped create but is (seemingly) glad that he now recognizes he has been oblivious. One can't help but think of the poignant observation of Václav Havel (1990: 11) that "as soon as man began considering himself the source of the highest meaning in the world and the measure of everything, the world began to lose its human dimension, and man began to lose control of it."

Christian theology must affirm that we are pilgrims in this world heading for a city whose builder and maker is God (Deane-Drummond 2003: 316f.). But what does this practically mean in the context of our case study? Perhaps we can ask the simple questions: Where exactly are we headed with automated highway systems? What is the desired goal in specific terms and why have we selected it in lieu of many other possible goals? And what might competing goals specifically be? Clearly to decrease highway collisions is a noble goal in itself but is it enough? What other options do we have to address the key problem such as decreasing the number of cars on the roads within this busy corridor whose roads were never designed for over five million visitors per year? How does ITS applications in the corridor lead engender the good life? Do the ITS applications create differential effects upon particular groups and how does it address the marginalization of the poor, the elderly, and the disabled?

Secondly, we need as Christians to develop a counter-narrative for technology as has already been attempted in a provisional manner in regards to human genetics and biotechnology (cf. Song 2002: 122ff. and Northcott 2003: 99f.). Borgmann has enunciated a strategy for limiting the device paradigm by engaging in specific focal things and practices. This strategy recognizes that an oblique attack that finds limits to the human aspirations that drive so much technological development activity is far more palatable than a full frontal assault on the bastion of technological imperialism (Jewett and Shuster 1996: 373). We can recast alternatives by figuring out what are the central desires and how they might be addressed in other ways. It is hard to discern from the case study itself what the real central desires are other than to just spend research and development money. The accident rate overall for this region, for example, does not seem prohibitively high given the extremely large volume of vehicles that pass through the corridor each year on two-lane highways. But let us suppose that the desires listed below are in fact drivers in the quest to explore and apply ITS. We will focus here on alternative solutions that require neither Christian commitment nor explicit theological justification, although we would maintain that helping one's neighbour can be a decidedly Christian thing to do:

1. A substantial decrease in the accident rate, say cutting it by half. This would speak to the earlier Stahl criteria of a search for the common good.
2. Increasing substantially the number of elderly persons who can visit the two major parks within the corridor. This addresses issues of a fundamental Christian commitment to justice for all peoples.

3. Maintaining the aesthetic appeal of the corridor whose vast expanses and vistas are themselves a major attraction. This addresses the earlier referenced Monsma criteria of seeking a delightful harmony among all the varied components of this living system in all its complexities.

For the first desire, we can imagine any number of ways to decrease the accident rate other than the proposed solution. Potentially viable strategies might include:

1. Issuing time-limited permits to local attractions that require a modest fee since we know from experience that once you charge even a modest fee the number of interested persons tend to shrink by a marked but not huge percentage. This speaks to the criterion of Christian stewardship, resources should not be wasted frivolously and persons in the park should be desirous of spending time in the wilderness and willing to provide a token signal of that commitment.
2. Providing centralized parking facilities within the busiest portions of the corridor and requiring visitors to ride public transport or transport that is at very modest cost to help cover some of the expense. This speaks to the important criterion of caring for creation by minimizing traffic into the nature preserve and maximizing natural space and the living conditions of flora and fauna.
3. Regulating park and other public facilities' hours to control traffic flow. This speaks to the Christian principle of respect for limits that is part of the Christian virtue of temperance.

4. Revitalizing an old rail line that may exist running through the corridor and develop a viable transport system that capitalizes on this older but still useful technology. Engaging human creativity is part of a criteria for a redemptive technology as the challenges presented by issues within the corridor call for innovative solutions that utilize existing resources well and to the glory of God as instantiations of sacramental grace.
5. Hiring additional law enforcement officers or using automated devices to better contain speed within the corridor and increase local government revenue by transferring funds from all those out of state speeders to needy local programming. The redemptive technology criterion of holism that balances technical, organizational, and cultural aspects of technology applications is the focus of this suggestion.
6. Closing off particular access roads that prove consistently to be danger points or installing gated access that requires people to stop. These gates could be controlled electronically and local residents could be given openers much like garage door openers. Manual overrides could also be provided but they require a driver to fully exit their vehicle in order to raise the gate (which will automatically lower back into position). The importance of human creativity rising to the challenge of creating new and appropriate technologies that build toward a positive future is exemplified by options such as these.

The second desire is a noble one and something that is becoming increasingly important throughout heavily industrialized societies as the age pyramid swings dramatically

toward the senior years and health of the elderly continues to improve. Clearly a variety of alternative options exist here including:

1. Providing deep senior discounts on admissions targeted to off peak hours at the park that is often the times when seniors are at their most active and families with young children are just trying to stumble out of bed. A commitment to justice and exercising creativity as part of a redemptive technology come to the fore here.
2. Working in a more coordinated way with major national and state organizations and groups that work with seniors to develop long-term relations and quality programming that meet senior needs or address senior desires. Always seeking the common good is a hallmark of redemptive technology.
3. Working with transportation providers to create better coordinated and advertised travel systems that link various modes of travel somewhat seamlessly to enhance seniors travel experience and make it easier for them to leave their automobile at home. The provision of information in a timely and appropriate manner always needs to be a hallmark of good technological practice.
4. Tapping into the fact that in America seniors are the most active group on the World Wide Web and creating websites under park auspices targeted to seniors and that might even enable seniors to car pool to visit the parks and area, even from a considerable distance away. The importance of information, openness and communication are clearly central to this suggestion.

Moving beyond the specifics of this particular case study, we can note a number of other important factors and theological responses that can arise under the realm of Purpose & Direction. We must also not forget that often in the quest to uncover our true desires, we may discover unvoiced desires that turn out to be more important than those we were busy pursuing. Sometimes these desires may even take us down paths never before explored. A group of Italian restaurants and over 100 towns and cities in ten nations, for example, have banded together since 1999 to maintain the slow food and the slow cities movement (www.cittaslow.net/world; Honoré 2004). Consciously responding with a “No” to the fast paced, globalization movement, their manifesto deliberately celebrates a more evenly paced life style with plenty of opportunities for conversation, conviviality, advancement of ecological harmony, the preservation of local skills, industries, and identities, and an explicit program of “taste education” that teaches the young as well as visitors how to truly appreciate the profundity in simplicity and wholesome, home-grown and home-made foods. This is a realization of E. F. Schumacher’s idea that the three purposes of agriculture are to keep people in touch with nature, to humanize habitat, and to appreciate the spiritual significance of agriculture (Schumacher 1974: 90; cf. Northcott 2003: 85).

In addition to raising questions of purpose and meaning, we also must find ways to confront attitudes that glorify growth as an end in itself. First because getting bigger, acquiring more, surpassing one’s neighbours and nations is in itself selfish behaviour that many Christians and non-Christians can readily recognize. Second, the push for bigger, better, faster, stronger, higher rapidly degenerates into a mindless and unfulfilling shell game since once you have satisfied all your basic needs the insatiability of human desires

deprives the pursuer of any lasting satisfaction. Growth has been a central goal of societies since Neolithic times but in more recent times we have shifted from a view that economics is about the “management of scarcity” to a view that it is all about unlimited growth (Boff 1997: 67). Companies that pay a dividend every quarter still ask their executives to double the dividend the next round. Yet we must also recognize that growth does have some good attached to it as standards of living rise, human life expectancy dramatically increases, and many more people, percentage wise, live in a lifestyle to which very few in prior generations could lay claim. Whether the globalization or anti-globalization advocates are right remains to be tested empirically and it is perhaps best for Christians to maintain a humble attitude that carefully considers both the pluses and minuses of both perspectives. Clearly we must speak against powerful forces of coercion that seek to force individuals to “subordinate their concern for their communities to their efforts to gain more goods for themselves” (Cobb Jr. 1994: 56f.).

We need to lend a helping hand and mind to society at large as it seeks better ways to explain, question, operationalize, and evaluate the meaning of progress. Progress at one time was chiefly defined in terms of the community whereas today it tends to be defined in terms of both the individual and science and technology for its own sake (Hopper 1991: 126). Recent accountability movements in education have struggled with questions about what does progress look like at the individual student level, class level, school level, and at larger organizational unit levels in terms of achievement and other attributes in which we have an interest. Christians should be in the forefront in helping to lead and sustain a conversation and experiments about the multiple shades of meaning for this elusive thing called progress. We would also do good to bear in mind that progress

should be considered in a multi-tiered manner where progress at the community level might look very different from how progress is defined at the level of either the family unit or a political or social unit at a level of scale beyond the community. More thought needs to be given to how eschatology, which is firmly facing the Christian toward the future, can be a valuable theological resource for questioning various forms of technology as Scott (2003b: 277ff.) has commenced with genetic engineering. It may be that these ideas can only be worked out in the forums of real debate with real people around real issues of contemporary technology rather than in the quiet repose of the academic study where it is all too easy to convince oneself of the correctness of one's view and to sweep under the conceptual rug the thorny issues and subtle nuances that mastery of any subject requires. There is also an important prophetic role for the Church to exercise within the larger culture as it speaks truth to power like the ancient Hebrew prophets (Schweiker 1998: 51f.). A good start has been made in this regards by the Jubilee movement for the forgiveness of Third World debt and current theological work in the area of cloning which rightly recognizes its proclamation of a biotechnological utopia with shades of a usurping creator with a small "c" and growing priesthood and liturgy to rival that of the Church (Lysaught 2004: 267; Cameron 2004: 32; Wells 2004: 194).

Finally, the Church needs to launch an internal conversation and exploration of these same matters where Christian theology is taken quite seriously and where theologians are committed to mixing ideas and accepting challenges from Christians in other walks of life, including engineering and allied disciplines. This project has frustratingly underscored for this author how great a gulf currently exists between

modern technology and modern theology. This is startling from the standpoint that Christians well recognize that technology can often be good but never salvific (Clark, Weigel, and Ong 1962: 297), that progress even in the best of possible terms and worlds is a very poor substitute for Christian hope (Forrester 1997: 255f.), and that we can cultivate a transcendent perspective on reality, including technology, because of the Incarnation and the rule of a God who is coming for His people (Dawson 1989: 201f.).

Few Christians have considered critically the nature and purpose of modern technology. For some it may be a way to recover the core of their Christian faith while others may discern that they have capitulated to the gods of this world and displaced God from his proper role in the centre of all human activity, including our technologies (Wells 2004: 206f.). The Japanese theologian Koyama expositis Jeremiah 22: 3-5 to remind us that the wheel and chariot, mighty symbols of the power of ancient technology, are placed near the end of Jeremiah's warning to the King of Judah. First and foremost in God's command is to "*do* justice and righteousness" in tangible ways and then "technology – the chariot, and nature – the horse, will make a peaceful contribution to your community" (Koyama 1979: 142).

6.3.2 Research and Design

Our case study presents to us a series of issues related to research and design. Many decisions in modern technology are made on the basis of prior research studies. Such studies are exceedingly technical and bristle with statistics, elaborate flow charts, computer modeling results, charts, tables, graphs, and narrative. Despite the wide array of available techniques, the ready availability of sensors and other automated data gathering

tools, endless manuals, specialized courses, online resources, and globally interconnected communities of researchers, it is still amazing how many research studies suffer from poor research design. Our case study suffers from a number of research design problems including a failure to fully describe the design of the study itself and why particular approaches were selected over the vast number of other options available, details concerning the scope and limitations of the methods and approaches pursued, inadequate information about the sources of evidence and the means by which it was collected, failure to adequately describe the methods of analysis that were employed and the rationale for them, a poorly designed and executed survey of key stakeholders, and a failure to indicate who reviewed the study for technical soundness. Yet as an experienced research journal editor and former member of several editorial review boards, this comes as no surprise. Here was an instance where considerable federal dollars would likely have flowed to this project on the basis of this inadequate study but for the intervention of the government closing down the entire program.

So given the fact that most theologians are not technically equipped to engage in the kinds of methodological and design issues that studies such as this one present, what might theology usefully contribute to the conversation about research and design? While the writer was unable to locate much in the way of discussion concerning this matter in theological literature, we may be able to suggest a few fragments that are worth pursuing in the context of live engagement with ITS researchers or other technologists around their research work. First, because Christians believe in the *imago Dei*, we can participate in the redemption of nature by welcoming the research and design enterprise as one means by which some of the harmful things in nature can be corrected or lessened in their

baleful impact (Reiss 2003: 78ff.). Borgmann has deliberately advocated an empirical stance in his philosophy of technology, informed no doubt by the Christian principles that we should actively search for the common good of our fellow creatures consistent with the fact that they are all valued equally by God. Similarly, it reflects the redemptive technology principle of the exercise of creativity as a gift from God to benefit God's world and the creatures that inhabit it rather than to glorify the self and engage in aggrandizement and pride.

Second, theologians can encourage technologists to utilize a wider array of techniques to solicit input from various publics concerning their work. This is consistent with our redemptive technology principles of a strong commitment to justice since many marginalized groups are never heard in technological research and design activities that will impact their lives profoundly. This need for reciprocity among human beings within society reminds everyone that we are all equal in the eyes of God and have much to teach one another as we engage in communion. Warfield (1994: 453-479) and Ertas and Jones (1996: 3-40; cf. Jones 1997) are just two of many sources that provide a wealth of techniques that would increase the range of ideas presented within any technology project and provide means by which those ideas can be sifted in a productive way. Insufficient attention is paid to qualitative techniques in many technologically-oriented projects and here a theologian may be helpful by suggesting techniques or connecting the research team to valuable local resources that can provide fuller information from a wider array of sources to the analysis and decision making process. These two suggestions of course will only be received "joyfully" if the theologian can also work to persuade policy makers at the local level and perhaps beyond that insufficient time is allocated for the

desired study. Many studies suffer from lack of quality because the project was rushed in a desire to meet unreasonable deadlines which often turn out to be not real ones anyway as the report then sits somewhere unread for weeks or months after being delivered “on time.”

A deeper level of engagement that theologians may have with technologists in the research and design phase is to serve as a foil for the key questions that need to be addressed. We have already commented that the case study may not have paid enough attention to the careful framing of the research questions. This is surely one of the biggest challenges in any study and it is the one where executors of studies usually find the least amount of help. Sometimes the questions that are generated may not be of value to the person commissioning the study but may prove essential to people at the local level that have to live with the study results and the implications and results that flow from the study. This speaks to a wide array of our Christian principles concerning technology including the search for the common good, respect for limits, holism, cultural appropriateness, and stewardship.

Andrew Feenberg, a noted philosopher of technology, describes a phenomenon that occurs across societies that points us in the direction of some further design considerations (Feenberg 2003a: 238f.). Historically most technology was underdetermined. By that we mean that as a technology (or research project) was developed at each point in the design and development process there are different options (branches) open to the designer. Competing groups of actors seek to influence these respective points in the process within large projects. Today technology (and sometime research studies) is progressively less and less underdetermined since once the winning

branch is determined the winning design is “black-boxed” and privileged to the point where it cannot be overturned or thwarted. Theologians can develop a sense for when this happening in a project and advocate that options be left more open than closed both from the theological perspective that human knowledge is exceedingly limited in its scope and from the standpoint that better designs could result and human creativity, a gift of God, can blossom in a fuller way if more rather than less opportunity for creativity to express itself is tenaciously guarded (Wurzbarger 1994: 105f.).

A separate but equally important development concept is that of layering. Sometimes what appear to be competing desires and layering these demands over a single design can combine irreconcilable ends. The designer works hard to try to address each demand that has been made, handling them either serially or in some combination with an attitude that accommodating as many desired features as possible, especially prior to testing and evaluation, may result in an optimal design or even an extraordinary design breakthrough. Not all alliances require tradeoffs and compromise. The golden rule and other scriptural admonitions that require the valuing of other’s contributions, even if substantially different from one’s own, can go a long way toward improving many research and design activities consistent with our redemptive technology principle of reciprocity.

There is also a tendency on the part of many technologists to overdesign. We see this perhaps most clearly in well-known commercial computer programs such as those of the Microsoft Corporation that have seemingly endless “bells and whistles” that the overwhelming majority of end users never utilize while consuming yet more and more space on one’s hard drive and opening yet greater opportunities for those who desire to

create mischief among the world's computer networks. Overdesign can also occur in the form of approaches that seek to monopolize, aggrandize, and dictatorially control design or research characteristics in the name of superior science, technological expertise, or other justifications that are little more than desires to dominate others and foreclose conversation, debate, and genuine choices. A flavour of this type of general attitude, although it may not be as extreme as that described here, can be seen in Knoflacher (2004). The tendency to overdesign may reflect the desire to "puff" the capabilities of technology where the goal is to impress not to improve. This takes us back to the earlier discussion of purpose since purpose is an issue that pervades the entire research, design, evaluation, implementation, maintenance, and retirement processes of technology. Some questions can be pointedly asked multiple times at different points in the technology continuum and formulating good answers to those queries can sometimes make a very large difference in the road that is taken and the one or more paths not pursued. Overdesign is a violation of our redemptive technology principle of a search for limits that balances respect for nature and for human communities. It also is a matter of Christian stewardship since overdesign is a waste of resources on so many levels that the designer never realizes or has to live with but that ripple out within interconnected systems in thousands of processes, energy demands, wastes of time, monetary results, and other effects whose aggregate waste perhaps cannot even be accurately gauged.

Globalization also affects the design enterprise in some fundamental ways (Feenberg 2003a: 241f.). Modern technological enterprises have a tendency to design a product for a particular locale and set of circumstances and then through the machinery of production and distribution, push that product all over the globe. This leads to the rather

ridiculous sites one sees in remote places in the world where a ill-clothed, illiterate, and ill-nourished individual is clutching a cellular phone, drinking a Coca Cola, or utilizing some other trapping of a world they will never know and never see except through these technological artefacts that keep appearing with regularity in their local area. Theologians can do their part, in concert with others, to encourage the growth of local, home-grown technologies that can create a deeper sense of closeness to the community, the land, and local environs and sometimes create a product that is more efficient, more aesthetically pleasing, or superior in other ways to a manufactured good that was created with other end users and systems entirely within its purview. This is consistent with our principle of cultural appropriateness and the redemptive technology principles of the search for the common good and a commitment to justice.

Finally, theologians may wish to contribute to particular technological research and development projects which are concerned with setting standards (e.g., Clark 2003: 176) that set limits on what can be explored, how technologies can be designed and/or employed, how results from technology should be shared and stored, and who must be involved in particular types of technology projects by virtue of social justice, quality considerations, accountability assurances (after all we are all sinners!), and basic considerations of conscience and human community. Standards within technology are one of those non-sexy human activities that have enormous consequences within systems. The fundamental importance of standards consistent with a redemptive technology cannot be overstated and involve issues of seeking the common good, a commitment to justice, reciprocity, communications, stewardship, etc. – in short all of our principles could apply here. Creative theological engagement in the standards-setting arena could more

profoundly affect the future of technology than any other combination of activities and certainly much more than Borgmann's practice of focal things and focal practices can ever attain. In a technological society where technical excellence and the standards that accompany them reign supreme, devoting necessary attention and focus to standard setting efforts, tedious and tendentious as they are, can multiply fish and loaves many times over to feed the multitudes sustaining food that is wholesome and good for humanity.

6.3.3 Automation and Control

At the centre of every technology sits a human being. Sometimes the human is like the *Wizard of Oz*, puffing voluminous smoke and creating a great clatter to hide insufficiency, finiteness, weakness, a lack of courage, or other serious flaws. This tendency sometimes leads humans to gravitate towards means to directly or indirectly control the movements, status, knowledge, and power of others. It is Borgmann's device paradigm in its full glory or actually, its shame. As C.S. Lewis (1975: 68-70) so tellingly put it:

The last men, far from being the heirs of power, will be of all men most subject to the dead hand of the great planners and conditioners and will themselves exercise least power upon the future Each new power won by man is a power over man as well. Each advance leaves him weaker as well as stronger. In every victory, besides being the general who triumphs, he is also the prisoner who follows the triumphal car . . . Human nature will be the last part of Nature to surrender to Man. The battle will then be won But who precisely will have won it?

The case study shows a strong preference for taking the wheel away from the driver and placing full control of the vehicle into the hands of the microprocessor and its associated

sensors and control mechanisms and the engineers who designed it, all in the name of safety (for a basic understanding of the broad array of these technologies see Lu 1996: 24-33). This reminds us of the observation of Borgmann (1984a: 319f.) that much within technology is not liberating at all but rather results in the ever more tightened patterning of human behaviour by the controlling machine. If we are not careful and continually mindful of the tendencies of hyperintelligence, we can shrink to a “source of instructions and finally to a point of arbitrary desires” (Borgmann 1992a: 108). There is little doubt that automation can and does bestow upon humans and many other creatures comforts and benefits that are innumerable and generally not considered at all within the contexts of daily life. In this sense, we are a thankless people! Who would want to return to a time when heat was coaxed from flickering flames or smouldering coals and one’s feet were toasty while one’s breath was hoary? At the same time, we exist at a time when the control systems we build are often beyond the ability of one human or a host of humans to fully comprehend or to troubleshoot in the event of an unpredictable turn of events. As famous names in the history of the twentieth century remind us, sometimes it is not the technology itself that is to blame but the human operators and the organizations within which they work, as carelessness, duplicity, lax safety standards, and aggregate social behaviour will forever be linked with the names of Bhopal (Morehouse and Subramaniam 1986: 1-22), Chernobyl (Dörner 1996: 28-35), and the *Challenger* (Vaughan 1996: 394-399).

Control systems are highly favoured by engineers who design technological systems because they operate far more reliably and dependably than human operators. Within dynamic systems, there is also a tendency for human beings to “over steer,” a root

cause of the disaster at Chernobyl and a common occurrence when fighter jet pilots override the automatic pilots, sometimes to their tragic deaths. So much of modern life is enabled by smart controls and automated processes where very little human intervention is required for months, years, and even decades. The tremendous value that these devices afford can sometimes blind us to the central issue that is at their core – someone else has made a decision that you are powerless to do anything about and your role is to passively accept their decision and live with the consequences that they have created for you – generally sight unseen and without you particularly in mind. On the positive side, we can note that theologically we see here the almost limitless capability of human beings to trust their fellow human beings literally with their life, finances, health, home, possessions, and family members. This provides a powerful anecdote to those who say that they cannot exercise faith in an unseen God since they daily trust countless human beings whom they will never see. We also are good at taking directions from these automated servants in the form of automated systems that control the traffic lights of major cities throughout the world (e.g., Sanchez and Mekkaoui 2004), and through voice-enabled GIS systems that guide travellers to their destinations – an interesting technological metaphor for the role of the Holy Spirit perhaps. These technological devices have freed human beings from repetitive activities that breed boredom and provided emancipation from a host of work that is dangerous (Clark, Weigel, and Ong 1962: 292f.). We can welcome the emancipatory nature of these technologies while still being cautious of their growing capacity to replace or greatly limit human freedom.

A disproportionate share of automation may also fall on the poor and oppressed sometimes resulting in structural unemployment. We are reminded that sometimes

Christian ethics and ethicists have ignored the injustices within society, some of them technologically conditioned, accepting the wider culture of privilege and its supposed objectivity in lieu of constructing ethics within the context of actual faith communities – some of them on the margins of the wider society (De La Torre 2004: 263f.). Working out the implications of this necessity will take strong commitments since most Christian theologians live in the dominant culture that leads one to ask, “How can I remain ethical in this corrupt society?” while their brothers and sisters in the marginalized culture are asking, “How can we possibly make this corrupt society just?” (De La Torre 2004: 52).

The preservation of human dignity has to be high on the list of factors that theologians will work with technologists to maintain, including protecting human beings from harm or intentional or unintentional manipulation that diminishes human dignity or self-worth (Mitchell 2004: 74). We have to also resist management models that use technology as a means of social control and do so at the distance rather than face-to-face where decisions can be challenged, concerns can be heard, and respectful dialogue can occur (Quash 2004: 308f.). This also includes attention to social and natural goods that technologies produce rather than far narrower, utilitarian concerns that focus only on a single aspect, e.g., relief of human suffering, to the exclusion of consideration of the many other issues that should be explored (P. Scott 2003b: 292). Success in this venture will likely require that theologians focus on the local level as an agent for change; a voice of cautious optimism and patient critique that seeks to establish places where faith, hope, and love can thrive in the midst of a society where control over many aspects of human life now lies in the hands of unseen engineers and complex devices that have so receded into the daily background of our lives that we rarely consider them.

6.3.4 Efficiency and Fiscal Costs

Our case study amply illustrated the key role that efficiency plays in the design, implementation, and operation of technological systems. The 360,000-member Institute of Electrical and Electronics Engineers (IEEE) could equally as well be called the Institute for Efficiency and Effectiveness Everywhere as engineers seek to optimize efficiency while maximizing effectiveness within cost and other constraints. We saw earlier how Jacques Ellul was a relentless critic of the obsession with efficiency that epitomizes *la technique*. On the positive side, we can observe that such an obsession has enabled engineers to do more and more with less and less in terms of materials (miniaturization has revolutionized medicine and many other fields to the benefit of many), power (in an increasingly energy-hungry world), reach (cell phones and other communication devices that can span the globe and yet fit within half the palm of one's hand), and cost (the poor of the world are now obtaining solar-powered hearing aids for example, through Project Impact (www.project-impact.net) and other agencies, that cost less than \$40 and whose costs are fully subsidized by creative pricing models that foists the costs onto those most able to pay who themselves still receive a substantial bargain over what these devices would cost through normal purchasing channels). An efficiency focus has revolutionized just in time manufacturing and retailing and spawned the development of integrated systems that have greatly increased movement and choice of goods within the marketplace. More efficient transportation systems within cities, such as the GÉOBUS in Montréal (www.esricanada.com), have cut transit time for passengers, more effectively utilized scarce resources, and enabled financially strapped municipalities

to do more with their money as a result of cost savings. Efficiency in its best sense would be enhanced by taking on more of the attributes of the Christian concept of stewardship that takes account of the careful use of resources but within a context that recognizes that all these gifts come from above, the Father of lights, and that the most efficient means is not always the proper answer to the question of how resources are managed or deployed. Christian charity has always in its finest moments given without expectations of return and grace requires that giving occur without any considerations of worthiness or the language of rights.

Efficiency can trump other important considerations in technological decision making if it becomes a “race to the numbers” and qualitative dimensions are not taken into sufficient account. We see this race to efficiency in the tradition of Mt. Sinai as the Israelites despaired at the disappearance of Moses and the strange rumblings from the mountain. They implore Aaron continuously to make a golden calf and he finally consents. Their efficient approach to producing a god to serve not only results in divine punishment for many but also distorts the meaning of their lives and sojourn in one quick, efficient, easy miss-step (Koyama 1984: 139).

We observed in the case study how financial benefits were used as a chief leg of the argument to fund the project and carry it forward. Ranking projects by their socioeconomic value is a favourite and seemingly necessary pastime of civil servants since there is never enough public money to go around to meet the insatiable desires of policymakers and their constituents (e.g., Bonnafeous and Jensen 2004). But ranking projects solely by their socioeconomic value, however it is determined, suggests that all that is worthy of consideration can be reduced to pounds and pence. One need only think

of the widow's mite in the gospels to consider the lesson that quality trumps quantity in many situations and that often non-monetary factors are more important than those things that can easily be counted. There is a well-known acronym in the testing industry – WYTIWYG – What You Test is What You Get. Similarly, not everything that can be counted counts, and many things that count cannot be counted. These modern variations of the biblical injunction, “Do not judge lest you be judged. For in the way you judge, you will be judged; and by your standard of measure, it will be measured to you.” (Matthew 7: 1-2), are equally useful and perhaps more instructive admonitions than mere rankings.

6.3.5 Surveillance and Privacy

A whole variety of surveillance technology was anticipated and evaluated for deployment within our case study. This mainly consisted of passive sensors although a few active sensors were also contemplated. Surveillance goes hand in glove with considerations of privacy since surveillance technology becomes the basis whereby most privacy is invaded. We undoubtedly live in the most watched societies of any period in human history. These surveillance technologies, coupled with powerful computer and information storage and retrieval systems, contributes to a pervasive culture of surveillance that becomes yet another form of technology that we sleepwalk our way through each waking moment and literally often through the night too! We are constantly asked for personal information in the form of forms to complete, papers to sign, fingerprinting and urine tests, photo ID checks, and so-called “security” cameras that now in some cities of the world enable you to be followed throughout the entire city on the

street and sometimes into major buildings and structures within the city as well (Lyon 2003: 61). What makes our current lifetime unique is the way in which surveillance technologies now depend on information and communication technology and is driven by consumerism (Lyon 2003: 173). Purchases within stores that utilize a credit card or other means of identification are routinely linked to other database sources to obtain as much information on your personal purchasing habits as possible so that marketers can effectively (and efficiently) target you for selected enticements to purchase yet more goods and deployment of a surveillance assemblage is increasingly the norm (Lyon 2003: 162). Most of us are now aware that as we visit sites all over the world on the Net we leave traces of our passing behind that can be exploited by persons with criminal, commercial, or other motives. The World Wide Web consortium at MIT has created a Platform for Privacy Preferences that manages your personal information while on the Net following the dictates you have specified (Bainbridge 2003).

Maintaining private relations between persons is one of the essential ingredients for a humane society. Surveillance of citizens by the government, even in the name of national security, can be a violation of the very society it is designed to protect. How this conundrum can be addressed will be important as the government exercises its considerable powers in the name of national security and citizen groups battle to maintain their privacy. Data fusion technology enables government agencies to search through massive databases pulled together over the Net in a way that undoubtedly violates the rights of individual citizens and perhaps subgroups of various kinds (Bainbridge 2003).

Within the watched society, it becomes important for theologians and other concerned citizens to keep an eye on Big Brother. Theologians' concerns might naturally

proceed from an understanding that the world is under God's watchful eye and care. Clearly God sees many things, including some of a heinous nature and yet He does not seem to, except for rare exceptions attested by Christian witnesses, directly intervene to stop them. While some have seen this lack of intervention as evidence that there is no God, others have argued that God's apparent inactivity is an indirect yet essential outcome of a desire to create a world where human beings can exercise their wills freely. Otherwise we would inhabit a world where a giant policeman dictates and enforces particular human behaviours deemed acceptable. The very fabric of the universe or universes, seems to require a "fertile interplay of order and openness, operating at the edge of chaos" analogous to the operation of the Christian Trinity (Polkinghorne 2004: 81). Human beings increased capacity to see more and more of what God sees and acting upon such information could easily result in an overriding of human choice which while seemingly a "godsend" in the short run, would result in the obliteration of human freedom with incalculable negative effects. Hollywood director Steven Spielberg has given us a glimpse of such a world in *Minority Report* (2002) where we meet Pre-Cogs who can hover over a city and see the future, alerting police whom to arrest before they commit criminal acts.

One of the central characteristics of information theory is that everything is on a grid and the finer and finer the grid becomes the more precise the information obtained (Borgmann 2000a: 134). Many government agencies have insufficient security systems to protect their own data from unauthorized users. A surprisingly large number of government agencies at local and even higher levels do not have written standards dealing with privacy issues on behalf of those from whom they collect data and those to

whom they transfer it. Going beyond written standards, many agencies never have run tests to see how vulnerable their systems actually are and how long it would take a trained person to penetrate their defence systems. Identity theft is now fast becoming a leading crime statistic, although many are so embarrassed by this event which daily becomes ever easier for perpetrators, that they never report it to authorities but simply to their creditors and others on a need to know basis (Schneier 2003: 75ff., 143). A number of ethical issues we have already mentioned surface in this area as well such as the preservation of human dignity, fundamental fairness, social justice, and the need for accountability on the part of the watchers as well as the watched. Redemptive technology would ask persons and systems in the surveillance and privacy arena to create devices that adequately address issues of the common good, a concern for justice and the differentiated impacts of such technologies, dialogue and debate with communities about policies that will govern activities, a respect for limits, openness about what is being done and why, and an approach that builds trust among people.

6.3.6 Information Technology

Successful prosecution of the case study required that the researcher obtain electronic records from a variety of sources and subject them to statistical and visual analysis. The field operational tests that were envisioned as the next stage of that project would have required the linkage of a host of data producing sensors and gadgets to an integrated information system that would enable the end user to simultaneously analyze relevant data sources as well as combine them in a virtually endless set of possibilities to explore relationships. Persons now have on their desktops computing power that could

not be bought anywhere in the world fifty years ago. Arrays of these desktop computers are now, at the volition of their owners, combining their processing power every night around the world to process massive quantities of astronomical data with a precision and combined speed that compares favourably with a supercomputer. Database management, database marketing, database design, database harvesting are now all very big businesses in the First World and increasing in the Second and Third Worlds.

Databases that hold massive quantities of data on human beings now can be seamlessly linked and profiles of individuals can be created within split seconds. Gambling casinos have learned how to use the raw processing power and speed of relatively small computers to maintain accurate and increasingly predictive records of their faithful clients' habits including their likely bets, favourite locations, average drink bill, total average stay, food favourites, and other important information that helps them maximize profits, create an enhanced sense of customer belonging, and assiduously apportion their investments in further cultivating each repeat customer.

Computer language itself is shaping reality through its words, images, symbols, and the narratives it weaves within our lives (Schweiker 1998: 55). Christians have been divided over whether the information age is changing spirituality for better or worse (cf. Groothuis 1997 and Zeleski 1997 and of course, Borgmann who is deeply concerned about technological information). Sometimes we are given the impression that computers will take over the world. An expert whose has spent considerable time with colleagues in the industry studying computer systems has identified five limitations regarding computers: 1) they operate within formal systems and do not change them or choose between them, 2) they cannot decide aesthetic qualities of things like mathematical

proofs, 3) they can check line by line mathematical proofs and do so rapidly but cannot exercise the broad array of functions a human mathematician undertakes to evaluate a mathematical proof, 4) only humans can judge the appropriateness of a formal specification within a computer program in terms of what it is intended to do, and 5) mathematics performed by humans is always the standard against which computer output diverges from that of human operators, never the other way around (MacKenzie 2001: 330f.)

From a theological standpoint, computers have much to teach us (see the final section below). Computers can be an instrument of human pride and be used to dominate other individuals. Computers also depersonalize people as to a computer you can only always be just a string of numbers. Computers may enhance life and even save lives as hospital applications of microprocessors daily shows. We may ask whether computers can serve a useful reconciliation role between persons? (Lockhead 1988: 35). Anecdotes tell of victims and their perpetrators who converse initially online and perhaps eventually meet face-to-face for a full reconciliation process. Computers may or may not further our modern alienation from nature, an example of a device that could be used in redemptive and engaging manner rather than a disburdening, disengaging manner that so concerns Borgmann.

Borgmann's full discussion of information technology in HOR will not be repeated here but it is clear that there are many issues that can be raised regarding this case study in light of his entire monograph. Fundamentally, it is unclear how the ITS application seeks to balance natural information, cultural information, and technological information. It appears more to be a hegemonic move on the part of engineers to sweep

more and more information into technological devices operating within the device paradigm. It seems to violate our principles of delightful harmony, caring, and trust and the redemptive technology principles of holism and the search for the common good.

Finally in this arena, we must note that recent Artificial Intelligence (AI) applications are becoming more commonplace. These AI applications may ultimately usher in a day when we are joined on a daily basis with a nonhuman machine that possesses some attributes humans possess and perhaps at a level equal to or exceeding that of the human being. There are a number of competing technovisions about the future and the human place within it. Theologians Harvey Cox and Anne Foerst (1997: 56-58) have created a good set of questions for the IT and AI communities:

1. Why do people use the discourse of technologies – cyberspaces – to express what are essential existential desires and needs? And- even more important – why do they fall back on motifs drawn from the Judeo-Christian traditions?
2. Why have the Judeo-Christian myths, which were powerful for 2,000-3,000 years lost their persuasive powers in the cybernetic world?
3. The development of techno-theology was almost inevitable. But how does it relate to the theory that still deals with the classical mythos?
4. Who will be included and who will be excluded from this emerging new worldwide cybernetic community?
5. Will there be any way to sort out the spurious from the truthful, the trivial from the urgent, indeed, the real from the unreal?
6. What about transcendence? Not in the first instance, transcendence as a theological category but as that which is not ultimately manipulable, not accommodative to our hardest efforts?

An important point to recognize about our growing reliance on large computer systems is the unknowns regarding the reliability of these systems. The Denver International Airport was heralded at its design and construction stage as a “high-tech jewel” of air travel that would feature the largest, most complex, and most efficient automated baggage handling system in the world. Running this massive system of 36 miles of conveyor belts would be a large computer program. Eleven years after the

start of this wonder of software engineering and after tens of millions of dollars, this advanced IT project was declared a failure and replaced by human baggage handlers. At its core, the fault was a software program so extensive that no human beings could find and fix all the flaws in it (Jackson 2006: 70). Recently engineers and scientists have created software programs whose sole function is to check software. Thus far, the data demonstrates quite clearly that there are major flaws in published software designs and that unreliable software will be a continuing problem although not surprisingly the author suggests a technological fix to this huge global problem (Jackson 2006: 75).

6.3.7 Aesthetics

Our case study made passing references to the need to maintain the aesthetic features of the corridor, especially in regards to not adopting animal restraints such as high fencing which would obscure the view of the scenery from the road. Clearly working to maintain an aesthetically pleasing environment is worth every bit of the effort. However, in light of Borgmann's critique of technology it does not address the most fundamental issue. Installing these restraints prevents any chance of focal practices and the experience of focal things in their natural habitat from flourishing. It turns yet another part of the wilderness into a giant human game park where animals are kept in their pens so that humans can ride undisturbed through the region. It violates design principles of delightful harmony, as the animals are made completely subservient to the perceived needs of the humans in a way that disturbs migratory and feeding patterns and many other biological rhythms that are central to the focal power of wilderness.

We must note that one of the most powerful but little realized features of successful technology is its aesthetically pleasing form. Because technologies are constructed to be highly efficient and often with demanding engineering precision and very tight design specifications, they have an intrinsic aesthetic appeal all their own (Koyama 1984: 136). This is a perfect illustration of Borgmann's point that engineering can, for its practitioners, be a focal practice. It reminds us that all true beauty in the world is *epiphaneia* and in some manner reveals to us aspects of the divine beauty that was beheld in Jesus Christ and will be revealed again in even fuller splendour (van Balthasar 1982, 2: 11).

The natural and pleasing aesthetics of technology also accounts for why technology seems to go along so nicely with attractive people on TV and other advertising media as they feed off each other and the commodification that is associated with modern devices. Sometimes the very strong allure of technology can be our downfall as Augustine (O'Donnell 2005: 273f.) and Saint Paul (Romans 7:22-23) remind us that we love the wrong things. Medieval writers took it one step further noting that we often love the right things but with either excess or defect. Thus we need help in the ordering of our loves and the manner in which we attach value to things, including technologies (Gustafson 1984: 297f.). Borgmann's remedy of focal things, focal practices, and communities of celebration brings hope that we can reset the imbalances in our lives on both a personal and a communal level.

6.3.8 Safety and Security

The driving force behind the execution of the research that became our case study was the desire to keep more people safe on the roads of the corridor. Safety concerns are behind a lot of the current worldwide ITS movement (e.g., Tatkeu, Berbineau, and Bernier 2004). In the case study we see safety concerns competing with what might be concerns about privacy or human freedom. Somewhere in the calculus of technological choice there are the inevitable tradeoffs that are part of every technological device and technological decision. In our case study, we are told (granted with some dubious data) that safety climbs precipitously when we leave the driving to the machine and eliminate the human operator. The operator now merely rides passively in the car and is no longer an active participant in its journey – although the trade-off could be that the driver is now able to take in the aesthetically pleasing surroundings seeing what he would have missed absent this technological intervention.

Safety or security is never absolute, as we shall see when we consider risk below. Every technology raises some sort of safety issue, some with great urgency and some with barely a whimper. Safety is also a personal construct in that what one person considers safe another may consider positively dangerous. Safety must extend beyond human beings in that creatures of God's creation also have a need and right to be safe – properly balanced to reflect the greater intrinsic worth of human beings as compared to other creatures. The need for safety is one of many considerations that led Michael Banner's Committee in the UK to argue that there were certain types of genetic modification that should not under any circumstances be permitted (Reiss 2003: 81).

Eliminating all harm from the world and all suffering and pain seems like a worthy goal but we have to consider its long-term effects on human beings. A theology of suffering may seem like an unwanted remainder from the distant past and a justification for that which is no longer inevitable and unavoidable. Yet many Christians can testify that it is within the fires of suffering that some of their deepest and best character traits were refined and while they never seek to repeat the experiences, they can see how they were useful shapers of a life of greater fruitfulness.

Security is a close and more specialized cousin of safety. It may be possible to feel safe without being secure or vice versa but perhaps that would have to be determined empirically drawing upon a suitable sample. In the wake of 9/11 and other expansive terrorist activities in the world, a full sense of security within the global community may elude us for some time. One of the vital things that 9/11 made many Americans realize is just how truly non-secure we really are. A small group of men with no sophisticated weapons or heavy equipment of their own brought down two major high rise buildings in a prominent city, killed and wounded thousands of people, created over \$40 billion dollars worth of damages, and left a world shell-shocked (Schneier 2003: 3-16).

Theologians can work alongside of technologists to help people realize their vulnerabilities on the one hand, and their sources of hope and life on the other hand. As ITS systems are designed and implemented broader public input is needed to ascertain that the kinds of tradeoffs that are being made are really the kinds of choices that are desired. These tradeoffs should adequately reflect our redemptive technology principles of caring, justice, trust, a search for the common good, and a respect for limits.

6.3.9 Siting

The case study led inexorably toward the designation of particular sites to be the future focal points for the operational field tests of selected AHS technologies. These sites were selected on the basis that they were areas where a higher than average accident rate occurred. The siting of technologies is one of several touchstone issues that can be the cause of raucous meetings and heightened emotions. Two famous acronyms endure to this day from environmental disputes of the past several decades in the United States: NIMBY: Not in My Back Yard and NIMTOF: Not in My Term of Office. There is something about the land that we don't want to part with it. People have even stayed on their land within the shadow of erupting volcanoes despite desperate evacuation pleas from public safety officials and family members, often till they lost their lives.

Land for the ancient Hebrews was central to their religious experience as it was a gift from Yahweh to be cherished and held in stewardship. The humans in Genesis are given dominion over the land but only to hold it in trust for God (Northcott 1996: 265). Consistent with this early charge, Judaism today retains the concept that the earth does not belong to human beings:

We are responsible to God for the preservation of His world. When conquest of nature for the enhancement of human welfare is viewed not as an act of self-assertion but as a religious obligation, conservation of nonreplenishable resources and the protection of the environment ceases to be matters of prudence but acquire the status of ethico-religious imperatives (Wurzbarger 1994: 107).

This concept is clearly espoused by Paul since we are not even “rulers over our own bodies” but hold everything in trust for God (Northcott 2003: 104). The Jewish Sabbath also reinforces the central truths of humans' relations to the land and creation, with it's saying, “we create nothing, we destroy nothing, and we enjoy the bounty of the Lord”

(Katz 1994: 59). Technology as a human enterprise acts upon things on the Earth and transforms them to meet human needs, being contained within the overall order of nature just as humans themselves are part of that same creation. Thus there is a continual usefulness to the Edenic scene of the garden and metaphors about our relationship to nature such as trustee (Thomas Seiger Derr), steward (Douglas John Hall), person-in-community (John B. Cobb, Jr.), gardener (Rosemary Radford Ruether), caretaker and citizen of the earth (Sallie McFague), the self-consciousness of the universe (Thomas Berry and Brian Swimme), and angels/Satan of the earth (Boff) that help us navigate between the extremes of lord, master, and *telos* of creation and a creature of no consequence (Hart 1997: 134, 136; Scharper 1997: 186; Hall 1990). Nature is not sacred, nor pure, nor divine yet as we work to transform it, it has the capacity to transform us and provide a substrate where transcendence can and does occur (D. M. Bruce 2003: 162; Scott 2003a: 110f.). Nature is an insufficient grounding for ethics since it cannot back up the claim of natural law that it can serve as moral norm nor can it be seen as unchanging given all that humans have done to transform it and all the many processes that we now know transform the earth from within (Jardine 2004: 20f., 277; Wogaman 1993: 283).

Christians have not thought sufficiently about the meaning of space and place within an overall context of caretakers on behalf of God. Pope John Paul II in his pastoral letter, "Concerning Pilgrimages" issued on June 29, 1999 reminded the faithful of the importance of the spatial dimension as seen in the Incarnation where Christ chose to "pitch his tent among us" and the role that space and place play in the Old Testament (Jn. 1: 14; Ex. 40: 34-35, and I Ki. 8: 10-13). While on the one hand space seems to be shrinking as humans find it ever easier to see and act in real time across enormous

distances, we also see an opening up of new forms of space in virtual reality and microworlds (Cormie 1999: 121). We have explored the extensive ruminations of Borgmann concerning these developments and they will not detain us here. We can observe that space serves as the medium where we link memory and identity together and where we connect with God who has visited this planet in the form of Jesus Christ (Sheldrake 2001: 33-63; Pahl 2003: 139-258). Maintaining sacred spaces in our everyday lives can and should be a focal practice that helps anchor us firmly in both present reality and that reality which is yet not fully realized but “seen in a glass darkly.”

6.3.10 Evaluation

A considerable portion of our case study and significant amount of the research and development activity associated with modern technology focuses on evaluation in its many aspects. Decision makers increasingly want objective measures to be employed that can be analyzed to provide policy recommendations. The past two decades has witnessed the growth of the “evidence-based policy” movement and increasingly the results of evaluation studies (poorly or well executed) are being cited in the halls of government in support of particular policy approaches or programmatic interventions. We have already mentioned WYMIWYG as an important reminder that evaluation itself is a set of technologies by which we seek to bring order, form, and meaning to the chaotic interactions of materials and beings within space, time, and place. Choosing what to evaluate versus what to ignore or minimize is an ethical choice that carries latent consequences. The tools, techniques, and timing of evaluation approaches all involve tradeoffs that are such a common feature of technology. Theologians might remind

evaluators in technical arenas of the importance of fairness in technology assessment even as we consider fairness as an important factor in the distribution of goods, services and opportunities for personal and social development (McDonagh 1979: 132f.). The importance of directly evaluating the ways in which particular technologies inhibit or promote fairness and provide opportunity is frequently not considered in technology assessment as fully as may be prudent. Not only because we live in neo-liberal societies but also because Christ has “set us free from the laws of sin and death,” Christians should have a concern for the ways in which technology promotes or stifles liberty, including the freedom to choose (McDonagh 1979: 131f.). We have already seen how control systems sometimes can be employed within technological applications to deny choice to human operators. Sometimes this is essential to preserve human safety but other times it may be unnecessary and inhibit other important characteristics that we should be cultivating and nurturing. It is evaluation studies that can help us determine more clearly whether these concepts are being realized concretely within the day-to-day affairs of technological systems. Better tools and approaches are developing, for example, to measure the quality of life in urban areas combining direct measures for quality of life as derived from participants in that life and visualization techniques to better understand the kinds of changes in quality of life that different policies related to transportation generate (Kachi, Sugihara, Sugiyama, Yasue, Kato, and Hayashi 2004).

A central technique in the evaluation of technological applications that we saw employed quite fully in our case study is benefit-cost analysis. In far too many evaluations of technology it is the only or dominant form of evaluation that is executed and this has sometimes resulted in a rightly deserved backlash from critics who allege

that it is too narrow in its conceptions of worth and value to be the sole means for decision making. Proponents of benefit-cost analysis would, I suspect, almost unanimously agree with this assessment and theologians and others would do well to work to require governments to ask for a wider range of techniques to be employed in technology assessment well beyond that of benefit-cost analysis. On the other hand, we should not be unduly dismissive of the power and utility of benefit-cost analysis.

Quantifying our valuations of the worth of things enables highly complex situations to be reduced into a manageable form of complexity such that we can begin to develop some understandings in lieu of a mix of items that are so diverse and disparate that decisions become more a function of that which last caught our eye rather than an overall weighing of the various factors (sometimes numbering in the hundreds or thousands) that need to be considered in some way. As a leading practitioner of benefit-cost analysis reminds us, as a tool used by human beings to deal with highly complex situations, it “is meant to give not answers but insights to produce better decisions” (Keeney 2004: B22). This of course, is an empirical issue, that itself can be subjected to evaluation and critique. In more recent years, like many other forms of evaluation, benefit-cost analysis is itself changing as new techniques and modifications are being created in the quest for ever better tools to measure things of importance to technologists and decision makers. Recent work has been comparing the output of benefit cost methods against those based on an analytical hierarchy process that employs multiple criteria in a weighted structure that may better reflect the differing levels of meaning and importance that are embedded within technological systems (Tudela, Akiki, and Cisternas 2004). Another method that is being more widely used is that of estimating the full costs of transportation projects,

including those involving ITS, rather than limiting analysis just to benefit-cost which considers discrete segments of the larger whole and often fails to account for intangibles or costs that can be derived but that are indirect (yet real) to the project in focus at the time (Bartin, Ozbay, and Berechman 2004). Theologians and others must work harder at resisting the natural human tendency to elevate numbers to an underserved status once they appear as answers to a series of mathematical manipulations. Evaluators need to do far better at explaining the limitations associated with the tools they elect to employ, the rationale for those choices, and spelling out appropriate uses for any numbers or other analyses that are generated by the evaluation.

Using cost benefit analysis solely by itself is dangerous precisely because of what it leaves out of its calculations, no matter how refined the techniques become. We can never lose sight of the fact that the technique at its core requires the assigning of value to material things, some of which are in fact irreducible, irreplaceable, and incomparable. Anything that is not a material “thing” cannot be assigned a value at all. Some materials things are themselves problematic in the extreme. Wilderness, for example, is a natural resource that cannot be replaced nor compared directly with anything else. Any valuations placed upon it are suspect for the very fact that the accuracy of the valuation cannot be determined independently and is clearly subjective. Some other important limitations of cost benefit analysis described by Ian Barbour (1993: 224-226) include: 1) the inability to separate the costs and benefits which fall differentially upon groups or individuals and often in an unpredictable manner, 2) discounting of the future in that future costs and benefits are always calculated in light of the present with an inability to accurately account for the price of these things in the unknown future, 3) the

undervaluing of natural assets and the impossibility to account for rare environments, ecological and genetic diversity, and other features of these assets for which prices cannot be calculated in a defensible manner, 4) the inability to account for how humans value things both now and in the distant future since the technique focuses on *material* values only (i.e., that which can be turned into economic commodities), 5) the clearly documented nature of institutional biases which overstates benefits and routinely underestimates costs and subsidiary impacts, and 6) the role of experts in the entire process which removes from the political arena debates about conflicting values and replaces them with what appears to be “rational, neutral, and objective calculations” emanating from experts highly trained in the intricacies of this complex undertaking (p. 225). Many of these aspects embody the very “pre-moral convictions” that Father Hehir (1996: 5) believes that theologians can and must express in public policy debates.

A second and highly important area within evaluation of technology is risk assessment (RA) or risk analysis (e.g., Khan and Tayyaran 2004). RA is a widely deployed set of techniques that seeks to quantify statistically the likelihood for the occurrence of both regular and irregular events. Simply defined, it can be considered as “those circumstances where the different outcomes and their probabilities are known objectively or subjectively” (Van Den Broecke 1999: 1). Yet its general usage in the English language is also helpful as we think of risk as the chance that something unpleasant will occur. Engineers of course are concerned with system performance and efficiency and therefore must consider all aspects of RA. The general public and users of specific technologies are less concerned about what normally works and more focused on perceptions of what may not work and what attendant consequences will accompany its

failure. All of us approach these matters not in a mathematical way but through the lens of human perception, meaning that at its heart risk is a subjective experience. Statisticians remind us that uncertainty in RA is unavoidable and that we need to counteract false senses of security that numbers can afford by also generating estimates of how uncertain the numbers we have before us really are (Bailer and Bailer 1999a: 276). Despite the widespread use of RA techniques, it is interesting to note that we still do not have established procedures to calculate unknowns in RA itself and their impact on the RA process (Bailer 1999: 371). This means that theologians and others can feel emboldened to question the results of RA and other evaluation techniques since sometimes the uncertainties actually swamp any findings of effects. Yet the dispassionate language within which RA and many evaluations are presented can obscure rather than clarify these points. Cultivating a spirit of humility regarding the unknown in the presence of risk is a useful habit since God bestows grace on the humble.

An attendant principle to RA is the so-called precautionary principle. The principle in its boldest form can be defined as “When an activity raises threats of harm to human health or the environment, precautionary measures should be taken even if some cause and effect relationships are not established scientifically” (Raffensperger and Tickner 1999: 8). The thinking behind the precautionary principle is that we can use it to minimize, and perhaps even totally avoid, any unintended consequences of technology. A detailed study of particular cases where this policy has been employed suggests, “the road to hell is paved with good intentions” (Goklany 2001: 94). What is required is a more formal way to consider the potential harms and benefits of technological applications that goes beyond just the issue of uncertainty. Goklany (2001: 9f.) has

suggested five criteria that should guide thinking about what kind of precautions are suitable for a particular application:

1. Immediacy criterion: Threats closer to the moment have priority over those in the more distant future.
2. Uncertainty criterion: Threats that are more certain take precedence over those that are less certain.
3. Expectation-value criterion: If two threats are equally certain actions that result in less negative effects are preferred over those that generate more.
4. Adaptation criterion: If technologies can be adapted and threats or adverse consequences can be avoided that may be the best path to choose.
5. Irreversibility criterion: Technologies that are reversible should be preferred over those that cannot be changed or reversed.

Clearly this is an area of evaluation where Christian theology has something to say that may be useful to all concerned. First, theologians recognize that in the modern era we have now assumed as human agents those risks that formerly were directly assumed by God (Northcott 1996: 259). God in the beginning created an object of risk in the Garden, the tree of knowledge of good and evil. By creating the tree God accepted the risk that they would disobey and this reminds us that risk seems to be a part of the very character of God (D. M. Bruce 2003: 155). Consistent with this view, it is then not surprising that risk is an inevitable part of human life. We struggle to correctly perceive the magnitude, frequency, and appropriate weight we should give to the many risks which confront us on a daily basis (D. M. Bruce 2003: 152). Sexual reproduction can be viewed as entirely about randomness, and thus about risk, although direct human interventions in this area are increasingly narrowing the scope for randomness and increasing the chances of pregnancy and desired outcomes in terms of gender and other features (D. M. Bruce 2003: 156). Risk can helpfully be thought of as a social contract and because it is at its roots about people and not about numbers, it is subject to negotiation and meaning making (D. M. Bruce 2003: 153). Christians can and should be involved in these

conversations not only because they directly affect us but also as part of our role as stewards. It is also vital to realize that as we develop new technologies we cannot avoid introducing new risks and it seems God intended for the universe to work this way (D. M. Bruce 2003: 157f.). This openness to randomness provides an interesting perspective on issues about human freedom and determinism – a matter to which we will turn in the last section below. Clearly there are situations and particular applications where caution is prudent since long-term consequences cannot be reliably foreseen or where RA suggests that the dangers are either higher than those we normally assume or that failure has ramifications that are too serious to be entertained (Clark 2003: 177).

6.3.11 Interconnectivity and Portability

One of the hallmarks of modern technology is the manner in which it facilitates human travel and exchanges of goods and services across great distances. The effortlessness with which this occurs on a daily basis is rarely considered by human participants and its very dependability produces frustrations and emotional outbursts when there is a breakdown simply because the reliability of the systems over time feeds an expectation of flawless performance. [The Xerox Corporation discovered this phenomenon in the early 1970s when their copiers performed so much more reliably than any competitors. Office managers felt the copiers were unreliable because their very reliability produced such elevated expectations of flawless performance that these highly efficient and effective machines could not meet them.]

A recent application in this arena is Barwil's vessel operations support system that is a comprehensive online shipping management application

(www.wipro.com/travel&transport) that enables this global shipping agency to integrate its operations across more than 200 offices in 55 nations and manage a diverse set of operations. Such applications are increasingly commonplace even though there are many instances, e.g., our case study spanning three states in the U.S., four large jurisdictions, and many smaller ones, when the fundamental incompatibility of local systems makes it difficult or impossible for coordinated or integrated operations.

The interconnectedness of the world through technological systems reinforces for us the commonalities of humanity, made in the image of God, while at the same time underscoring the amazing diversity that God seems to enjoy and in which we can participate. Yet this interconnectedness also sometimes increases risk, threatens privacy and security, and could over time constrain as well as enable human choice. Citizens must, therefore be vigilant to understand how such systems operate in general and how particular systems operate specifically to ensure that unintended consequences are minimized and that there is sufficient public accountability to prevent such systems from being subject to misuse. These systems also raise profound political questions since nation states are products of geography, culture, and history. As the world becomes ever more integrated, political systems will have to evolve to mirror these changes. The European Union is on the leading edge of some of these changes as information, travel, monetary, economic, and other systems across the EU inexorably move toward integration. Already citizens within the EU have been granted in recent years opportunities that were difficult to exploit only a decade ago and the end is not yet in view. These powerfully interconnected and portable systems also raise the spectre of a small group of technocrats increasingly consolidating power over the lives of humanity

and this is why theologians and others have to demand transparency in these operations and adequate accountability mechanisms.

6.3.12 ITS Workforce

Our case study raised at several points the demands that the anticipated AHS applications would make on the local transportation workforce – a demand for greater technical skills and a demand for a larger staff to accommodate the maintenance and monitoring functions that the new systems require for successful operation. There has been considerable discussion about the role of the worker within a technological world and we have discussed some of this work already in this thesis. Here we pause to consider some relatively recent work by theologian Miroslav Volf (1987, 1991) that raises a number of important issues regarding work in general. His overall thesis is that work should fundamentally be observed from the standpoint of a means to transform the world that is in keeping with notions we have already considered related to co-creators with God, stewards of God’s creation, and dominion. The transformative nature of technological work has occupied our attention throughout this thesis. Volf dares to suggest that such work should be considered in a pneumatological perspective. This role for the Spirit in the world of work bridges the divide between secular and sacred realms that has so plagued the modern Church and gives new meaning and vitality to how one considers that place and set of activities where so much time is spent. It also gives new meaning to the admonition to “do all to the glory of God.” Work then becomes part of worship and worship part of work. This work fits us for the eschatological transformation of the world at the end of time when a new heavens and new earth will come into being

and where humans will dwell on that new earth. Such a perspective also enables us to consider the human person in work as a field for God's action and love and should make us more frequently consider whether social justice is being served within the confines and configurations of the workplace. De La Torre's (2004: 58-69) recent work on the need for Christians to better attend to these issues and employing the hermeneutical cycle for ethics he develops to pursue this objective can emancipate workers in a manner that the revolt of the proletariat could never achieve.

6.3.13 Planning and Public Policy Making

The case study was produced with the explicit intent of informing a public policy choice about the development of ITS applications within the tri-state area and two major national parks. Increasingly researchers are realizing that their responsibility to the publics who fund their work and to themselves from the standpoint of safeguarding the integrity of their work, demand more of them in the form of engagement with policy makers around the meaning, implications and limits of their studies. Similarly, large public works projects and many smaller technological endeavours these days, are increasingly coming under public scrutiny and public accountability as governments seek to identify what value they are receiving for the investment of public monies. This is accompanied by less of a willingness to simply let technical people go off with public money and make their own internal decisions and take their own actions with little accounting for how their time was spent, what work they actually performed, and what results they obtained. Historic arguments that affirmed that only technically oriented

people could weigh in on technical problems and decisions find fewer and fewer adherents these days (Forrester 1997: 23f).

Technology itself is now widely understood as a social as well as technical process since virtually no technology is developed by a single actor and all technological developments involve complex negotiation, competing interests and perspectives, heated controversies, and above all choices (Feenberg 2003b: 74f.; Swierstra 2002: 223; Lemonnier 1993: 2f.). The very word “thing” traces back to Old English and Old Norse meanings for an assembly for action and to this day the parliaments of Iceland and Norway are called “things.” Things are, therefore, “objects in relationship” (Lathrop 1993: 90). Yet it remains true that there are strong tendencies for technical considerations to dominate discussions about the course of technological developments and in this sense technology is decidedly non-democratic in that certain views are given little or no countenance in a world where mechanization and efficiency is prized and processes or procedures that might inhibit efficiency are assiduously avoided (Scott 2003b: 288f.). Simone Weil (1952: 196) reminds us: “Speaking quite generally, in any sort of sphere, it is inevitable that evil should dominate wherever the technical side of things is either completely or almost completely sovereign.” Borgmann (1984a: 182-197) argues that the pervasiveness of technology has led to a strict divide between means and ends, the separation of actions from contexts, and a gradual thinning of our affective relationship with both nature and other human beings. Technology is the central force in the commodification of daily life and by virtue of its presence, performance, and power cannot be reformed from within.

We have noted that given the semi-autonomous nature of technology and its successes, it is unlikely that technology will ever approach theology for dialogue except in rare instances when public pressures raise the spectre of ethical violations and the system scrambles to respond by appointing perfunctory theologians to advisory boards in order to assuage public opinion (e.g., the Human Genome Project). The role of these persons is to then help advance the technology in question by conferring legitimacy upon the proceedings by their presence. This co-opting of external criticism by proactive construction of advisory bodies that generally have no power but provide illusions of power and public control is becoming harder and harder to achieve with a public that is better organized and better informed due to the very technologies that have been created by these processes. The public now has focused on these issues in a fuller way and this suggests that overt pessimism about the role of technology within society is unwarranted (Borgmann 2003a: 83) even while vigilance must be maintained. The essence of civil society is for citizens to have means and methods to register their opinions and to help shape policies and practices that will impact their daily and communal lives (Wuthnow 1996: 7f.). The new public policy arena can be a bit overwhelming as groups compete for social influence and ideologies are on display, sometimes resulting in “civil war carried on by other means” (MacIntyre 1984: 236). Yet the value-contrasts that are created within these forums are valuable means that enable us to see other things since we visually and conceptually fail to see things absent contrasts (Midgley 1989: 14). Money, markets, trade, and technologies are all sociotechnical constructs that are the result of various socially negotiated political, organizational, legal, economic arrangements that enable civil societies to function (Northcott 1999: 169). If Christians fail to participate in

these forums and means of social influence, they are removed to the margins of the larger society perhaps seen but certainly not heard.

Ian Barbour (1993: 240f.) has advocated in his Gifford lectures that Christians should respond to these challenges based on their background and experience. Experts in a domain should seek to serve on panels and commissions and directly engage in policy making related to the technology in question. Educators and persons in the media should seek to educate others about the issues that are relevant. Persons outside of these groups should try to become better informed, encourage public forums and discussion about these issues, lobby their legislators and support appropriate candidates, and support national organizations that seek to exert some influence on relevant policies. He reminds us that we all should seek to mitigate or minimize human and environmental impacts within our own control.

The role of language in technological decisions and policymaking should not be overlooked. How things are defined and the terms that are applied to them, as can be seen in discussions in biotechnology and genetics, can be the means for reducing their significance, stripping them of moral connotations, and shifting their focus or meaning in manipulative ways (Brooke 2003: 62). Language also is an issue in that moral vocabularies utilize the language of normative nature while today's liberalism employs the language of self-determination and self-government. This can lead to an impasse when people holding these two perspectives and speaking these two different tongues come together. The problem with the former is that it assumes a common tradition and perspective that is the heir of Aristotle and the Bible. This perspective is often not well received in public discourse since it appears to many moderns as taking a moral high

ground that cannot be logically justified other than from within its own tradition and understanding. The problem with the latter perspective is that it tends to be merely reactive and only comes into operation when self-determination or self-government is threatened in some manner. It lacks a developed moral perspective that grounds its discourse and arose historically as a means for interaction between citizens and between citizens and the state. It is not a language developed for a technological society, thus limiting its ability to be proactive. It has been recently argued that finding ways to bring these two perspectives together for dialogue is imperative in a technological society if we are going to preserve it and enhance it (Swierstra 2002: 237f.).

These developments provide a long-awaited opportunity for theology to advance within the public sphere and in a way that is perceived as necessary and helpful rather than obstructionist and pedantic. Diverse perspectives, grounded in live traditions, are increasingly sought within public decision making forums because experience has shown that the end products from such forums exhibit greater depth of insight and sounder public policy choices for ultimate decision makers to consider (Gascoigne 2001: 165f., 178).

This approach is consistent with recent arguments among theologians of the necessity of maintaining a strongly theological and uncompromised voice in public discourse (Song 1997: 228; Stout 1988: 163, 184; Thiemann 1991: 19). Nothing is gained if theologians come into public settings and pronounce perspectives of sociologists, psychologists, economists, and other discipline experts who already have a seat at the table and are better positioned by their expertise to speak on these matters. We live in interesting times as the very breakdown of deontological approaches creates an opening

in public policy forums where there are no explicit criteria for what constitutes public rationality and where no opinions and perspectives can automatically be ruled out of bounds (Forrester 1997: 32). The task before theologians in these settings is to fully share their faith perspective in a manner that evokes and enriches the possibilities for ethical insight and decision-making. In fact, it is just such theological perspective that appears “indispensable in helping explain to largely secular institutions the sources and dynamics of conflicts now threatening to paralyze the development of what is being posited as a key technology for the twenty-first century” (Deane-Drummond, Grove-White, and Szersynski 2003b: 22; cf. Gascoigne 2001: 188f.). The focus must be to relate all things to God since that is the core orientation for the Christian and becomes the only true basis by which actions can be rightly judged and seen in a proper perspective (Gustafson 1984: 309).

Theologians would do well to approach such forums with a favourable yet critical attitude toward technology with a goal of promoting a kingdom of peace and gentleness and the pursuit of justice in relational terms (Queffélec 1964: 69f.; Forrester 1997: 208). The latent but biblical perspective that recognizes the limitations of human knowledge, including our own theological musings, is an asset in an age distrustful of grand schemes and tidy pronouncements. At the same time we can contribute our fragmentary knowledge and insights to a larger social process in hopes of helping our wider culture and ourselves to better understand and utilize the enormous capabilities and potential of technology. Simultaneously, observing how people from varying perspectives understand and appropriate technologies will tell us much about their attitudes and responses to other human beings and God since Christians know that how we acquire and handle material

goods says much about what we value as the teachings of Jesus in the gospels so strongly underlines.

Christians may see their role in the public sphere as that of technological innovators who employ tradition + technology = transformation (Hart 1997: 141) as they pursue appropriate technologies that realize our definition as “the application of knowledge, tools, skills, and systems to solve practical problems, extend capabilities, expand opportunities to meet or invoke human needs.” Theologians, in concert with others, can advocate for:

1. Independent assessment and regular monitoring of technology.
2. Identification of gaps in current technology in meeting human needs and the setting of suitable priorities for technological development.
3. Access to suitable and understandable information about technology, including its impact on social justice and other key human concerns.

Theologians can find allies to develop our moral vocabularies for public discourse. This would include explicit attention to critiques of both deontological and consequential approaches in the search for a new way of speaking about these important issues. Discourse around these two perspectives has generally had a “take no prisoners” flavour with, for example, consequentialist method being labelled as “indeed unworkable, and notoriously so,” “incommensurable,” and “irrational” (Finnis 1980: 113). One suggested way out of this dilemma would be the development of an ethic of virtues that Celia Deane-Drummond (1996, 1997, 2003, 2004) has been centrally involved in as a developer and a promoter, drawing principally upon Thomas Aquinas and the wisdom tradition. This highlights the role of prudence, for example, as a means of adjudicating

claims and could be explored in relation to various technologies beyond biotechnology to which it has already been applied with some success (Deane-Drummond 2004: 115f.). One rather large advantage with a focus on virtues as a suitable means to guide public discourse rather than either deontological approaches or even consequentialist approaches at a deep level, is that no abstract rules are required with their endless limitations and exceptions. This ties back to earlier interests in an approach to theological ethics based on moral discernment (e.g., Gustafson 1984: 338). These types of approaches can be especially useful if it is true that technology erodes our ability to perceive goodness (Schweiker 1998: 54f.) and its specific operative character and implicit normativity (Keulartz, Korthals, Scheremer, and Swierstra 2002: 223).

Another important activity is to identify imaginative new ways of living, that push the boundaries of the possible in terms of improving the human condition, and that see technologies as useful but limited means to address deep human desires and the need for fulfilment and meaning (Garrison and Ward 2000: 291-300; Keulartz, Korthals, Scheremer, Swierstra 2002: 258f.).

The Christian community should also pursue its own internal agenda around technological decision-making. This allows for the development of a rich and robust expression of Christian belief fully consistent with the arguments of Hauerwas (1995, 2001) and Milbank (1993, 1997) in terms of developing a strong countercultural movement within the Church. This can serve as a helpful foil for developing new ideas of what true community should consist of, what forms of technology promote human conviviality and enhance communication with God and one another, and what limits there might be to what technology can provide versus what must be found via the arts and

other areas of human experience. It can also provide an environment where a viewpoint based around divine order, covenant, the nature of community, and other deontological concepts can be further developed; although these ideas must be tested in the world on a regular basis in order for them to have any hope of potency beyond the eager affirmation of true believers (Fergusson 1998: 167f.). We reject retreat from engagement with the world, assertions that Christian arguments are incomprehensible to secularists, and fears about cultural pollution that while legitimate at some level can be overdrawn (cf. Newbiggin 1989: 223; Fergusson 1998: 64-67). If the gospel means anything beyond platitudes we must reach beyond the church to society not only for witness but also for sustained engagement, theological reflection, and concerted action (Song 1997: 226; Forrester 1997: 11).

6.4 ITS Informing Theology

We close this section with a brief exploration of what ITS, as one set of technologies, might say to theology. Our case study probably is of little use to us here since it was limited in scope and focused only on feasibility issues primarily. Within the realm of ethics, we may note that technological innovations, in and of themselves, do not raise moral issues, although they do embody the values of their designers. Rather it is the case that we apprehend these new technological developments bringing with us not only our conceptual lenses but also our moral values and ideas. It is from the depths of our own moral values that we begin questioning the technology and eliciting its meaning (O'Donovan 1994: 92f.). Yet it may be true that by presenting us with new sources of information we may have to rethink moral categories or alter understandings of the way

particular moral arguments “work” or what particular moral concepts *actually* mean or to what referents they clearly apply.

The inherent creativity within technology would suggest that perhaps it does have things to say and teach theology. The most creative aspect about technology is not in the actual process of design and production but in the interactive exchange that occurs between users and artefacts. Kitaro Nishida is a Japanese philosopher who has identified a transformational process (*tsukuraretamono kara tsukurumono e* = from that which is made to that which makes) to account for the way in which technology radically transforms the existing structure of our historical world. This process is determined not so much by the producers but by the users of the technology through a process he labels reverse determination (*gyaku gentei*). This is a version of nonessentialism (Murata 2003: 256). At the level of the individual Christian this may provide clues to the great diversity of beliefs and viewpoints that one can find within Christendom as believers interact with a wide area of artefacts that do not come to them simply as given and then get applied within an environment that is also fully pre-given, but that also transforms that environment.

One further set of examples can be found in the work of the famous computer scientist Donald Knuth, a very active Lutheran. Knuth is one of the fathers of computer programming and Professor Emeritus of the Art of Computer Programming at Stanford University. He gave a series of lectures at MIT around the topic “Things a Computer Scientist Rarely Talks About” (Knuth 2001). A complete transcription of the talks was made, edited, and the full interchange between Knuth and the audience was also transcribed. The result makes for highly stimulating reading, especially for our purposes.

The final chapter titled “God and Computer Science” was originally delivered in December of 1999 (Knuth 2001: 167-235). Work with extremely large numbers, including something he christened Super K, have made it clear that being finite isn’t much of a limitation once you enter the realm of extremely large numbers. This leads Knuth to question theologians as to whether it is, in fact, essential that God been seen as infinite since finiteness at this range seems to provide more than enough room for God to be all that He needs to be. He correctly points out that the infinitude of God is not something seemingly demanded by the Bible, in fact Scriptural images along these lines are quite puny numbers (e.g., the total grains of sand on Earth or the total number of visible stars) compared to the sets of numbers with which computer scientists daily work. Much theological argumentation about whether God is finite or infinite turns out to be irrelevant when one becomes apprised of these large numbers and what they mean.

Second, in the realm of randomness (something we have already discussed above relative to risk), artificial life that generates patterns randomly and at very high rates of speed indicates that highly deterministic processes (after all these are computer programs) can generate entirely random and incredibly complex results. This set of technological innovations sheds light on the age-old theological dispute about free will versus determinism. The illusion of free will may be more than sufficient since whether one actually “has” free will is actually not as important as the sense and seeming actuality in the realm that one lives that free will “works” even if at some cosmic scale that turns out to be an illusion. A further insight that arises in this context has to be with branching diagrams. A full understanding of the science and accompanying technology behind this perspective is beyond the scope of this thesis, the intellectual capacities of this writer, and

likely the patience of the reader. Suffice to say that quantum physics suggests that event probabilities are sufficiently entangled with one another to leave plenty of room for the possibility that God behind the scenes prunes the branching tree diagram that computer scientists love so well in a manner that enables us to truly have free will and yet not violate any fundamental laws of physics (Penrose 2004: 578-608). Evelyn Monsay (2006) has recently explored how contemporary physics provides metaphors, myths, and models for theologians to use that advance and inform their arguments and their formulations of both historic and contemporary topics in theology. It is highly probable that an increased awareness of contemporary technologies on the part of theologians will lead to similar useful metaphors, models, and myths that can inform both theological argument and communicating the richness and power of theological thinking to the next generation, a generation already steeped in technological experiences and tacit knowledge.

6.5 Concluding Thoughts

This chapter has enabled us to develop a firm grasp of what a particular set of ITS applications involve and generate a series of ideas about how theology and technology may enter into a dialogue around particular features of those technologies. We have tested out the ideas of Borgmann in light of our central concerns and have discovered that the concepts he enunciates are quite useful for theologians who wish to think more deeply about and engage with technology in all its varied forms. We have established that the threat of technology goes well beyond particular technologies that seem to directly address the human person (e.g., cloning, genetic engineering) and argued for the engagement of Christian theologians and ethicists across a wide ranging frontier of

contemporary technological developments. We have also briefly explored the possibility that technology may over time and with many interactions offer some new insights into theological ideas that could spur further developments and provide useful metaphors, models, and myths to employ in their theological work and communication of that work to others.

Chapter Seven

Theology and Technology in Dialogue

“It is the glory and the curse of human beings that they shape their environment incisively. The curse works its evils when people neglect, deface, or destroy their environment. The good sense of human shaping prevails when people build something useful, and it reaches its glory when they fashion something beautiful.” (Albert Borgmann 2001: 5)

“Behind the development of every technology lies a vision.” (Michael Heim 1993: 118)

An acquaintance of mine was the new campus minister for Chi Alpha just commencing ministry on the campus of the Massachusetts Institute of Technology. Since he has never been to the campus before he was given a tour by a member of the staff who was explaining all the usual things about the history, number of students, stories of famous professors, etc. As they walked into the geographic centre of the campus, the minister noted a church building complete with stained glass windows in the middle of the quadrangle and expressed excitement about it being on the campus of this prestigious school and how wonderful that God was recognized by MIT. The guide eagerly agreed to take him inside the church. As they entered the minister was surprised to discover row after row of personal computers. “This is our god at MIT,” declared the guide, “our technology is now better than His.”

7.1 Technology as the New Religion of the Twenty-First Century

This true story highlights for us an important tension that exists in the modern world with the ascendancy and power of ubiquitous technology. Technophiles triumphantly proclaim that technology can and is righting all the wrongs in the natural world and that we are now fully in control of our own destiny. While not all people in industrialized societies subscribe to this viewpoint, it is widespread and influential

enough that technology can be viewed as a competing world religion to the historic religions of both East and West. It has its own rituals in the highly refined engineering design process to which legions of engineers and technologists worldwide pay daily homage as they create new technologies and continue to refine and improve those currently in existence. Technology has its own high priests and prophets whose words and insights are carefully attended to by the faithful. Moore's Law, named in honour of Gordon Moore, co-founder and now Chairman Emeritus of Intel Corporation, forecast (prophesied) over forty years ago that the transistor density on integrated circuits would double about every two years (an unbelievable prediction given what was known at the time). The Intel corporate website (www.intel.com/technology/silicon/mooreslaw) proudly broadcasts to the world's population the continuing fulfilment of his prophecy in the form of the following table:

Table E: Moore's Law

Type of Processor	Year of Introduction	Number of Transistors
4004	1971	2,250
8008	1972	2,500
8080	1974	5,000
8086	1978	29,000
286	1982	120,000
Intel386 processor	1985	275,000
Intel486 processor	1989	1,180,000
Intel Pentium processor	1993	3,100,000
Intel Pentium II processor	1997	7,500,000
Intel Pentium III processor	1999	24,000,000
Intel Pentium 4 processor	2000	42,000,000
Intel Itanium processor	2002	220,000,000
Intel Itanium 2 processor	2003	410,000,000

Moore announced to the International Solid-State Circuits Conference in February 2003 that “Another decade is probably straight forward . . . There is certainly no end to creativity,” although he acknowledged that when integrated circuit geometry reaches the point of one atom in thickness (2017), the law will no longer hold (www.intel.com/labs/features/em102031.htm). However, recent news of 3-D silicon single atom and spin transistors now looks like it will breathe at least another 20 years of life into Moore’s law. Two other “laws” that relate to information technology join the list of fulfilled prophecies. *Metcalf’s Law*, named after Robert Metcalfe, the originator of the Ethernet and founder of 3 COM, says that the value of a network is proportional to the square of the number of nodes. As a network grows, the value of being connected grows with it exponentially, while the cost per user remains the same or even diminishes. *Gilder’s Law*, named after George Gilder, predicts that the total bandwidth of communication systems will triple every twelve months – a law that so far has held.

Technology has its own congregations scattered in university departments, corporations, and in cyberspace that regularly gather to share conversion experiences, trade texts, and worship at the altar of modern technological prowess. Technology heals as artificial limbs, artificial hearts, electronic pacemakers, and other medical marvels capture the imagination and positively change the lives of millions on a yearly basis. Technology brings comfort, news, and human interchange to the most remote regions of Earth as cellular phones, satellite-based communication systems, and e-mail span the globe and even are accessible below the sea and in the near reaches of space. Technological doctrines develop and spread, including the technological imperative that everyone must have a personal computing device and not to have one is to contribute to a

digital divide that is to be avoided at all costs. The high priests and bishops of technology meet on a regular basis at COMDEX and other influential events and release to the adulation of the faithful, new technology standards. Companies pay large sums of money and devote considerable attention to coming into compliance with these standards as soon as possible so that others can subscribe to their goods and services. Cemeteries honouring the fallen in both people and machines exist in many sites around the globe where grieving technophiles can see the carefully preserved remains (mummies) of technology from older times and where curators keep alive knowledge about these machines and how influential they were in their day. Bill Gates, Chairman of Microsoft Corporation, one of the leading lights of modern technology's triumphant attitude, has famously declared: "Just in terms of allocation of time resources, religion is not very efficient . . . There's a lot more I could be doing on a Sunday morning" (Isaacson 1997: 51; quoted in Schultze 2002: 199). Technology is a direct challenge to Christianity as Borgmann realizes only too well and that theologians ignore to both their personal peril and the imperilment of the Church.

Lest this be considered the ravings merely of an aspiring theologian, consider the observations of the noted historian of technology, Thomas Hughes (2004b: 242):

Americans faith in technology in the twentieth and twenty-first centuries is analogous to the faith that medieval people had in God. God, they believed, not only controlled them and nature, but also occasionally performed miracles. Their religious ardour sustained faith in God and miracles. Similarly, Americans' faith in technology supports their passion for the miracle of technological fixes. Miraculous technological fixes today occur mainly in the military realm rather than the civil.

In the Middle Ages it was the alchemists who sought to fundamentally alter the very nature of substances and thereby create that which was thought to lie solely with God.

Debates from then through the seventeenth century raged about the degree to which this was both possible and appropriate (Newman 2004: 11-33). The ancient Greeks sought to steal fire from the gods and devise clever ways in which to imitate their actions and capabilities, e.g., Icarus. Modern technology brings these ancient ideas into focus and reality through its prowess and seemingly limitless ability to morph, adapt, and grow, creating ever more stunning achievements and radically and inexorably transforming the environments which humans inhabit.

We have seen in this thesis that technology is difficult to define in part because it is so varied and so pervasive. The Psalmist rejoiced that wherever he could go on the earth and under the earth the Lord was there. Jonah found it impossible to flee from the Lord. The new gods of technology seem equally present – and to many moderns – even more so. Technology contributes to the fall of mighty nations (former Soviet Union) and causes other nations to quickly ascend in global influence once they give in to the paradigm of economic growth, exponential development, and rapid expansion of technological systems, including manufacturing (e.g., the Asian Tigers). Technology facilitates, fascinates, titillates, and sometimes obfuscates and has become the *lingua franca* of the modern world. Increasingly it asserts itself between two human beings and becomes the means by which they communicate thoughts, emotions and even passions (sex toys and Viagra) to one another. Eugenics is enjoying its biggest resurgence in history, this time fuelled by the dream of the perfect child as prenatal techniques, knowledge of genetics, *in vitro* fertilization, and a host of other medical and technological breakthroughs are rapidly heading toward the realizable goal of picking in advance a child's gender, intelligence, ethnicity, health, and other desired characteristics

(Rothschild 2005: 225ff.). It is no longer a question of “if” but simply a matter of “when.” What this will do and mean for the less than perfect children born via normal means on the roulette of life’s biological processes remains to be seen. How people will define perfection and the implications it may have within society at large are only just now starting to be seriously considered and there still is little serious public debate about these emerging technologies and their implications. *Prosthesis*, a term that was not employed with the sense of the replacement of a missing body part until 1704, now stands for a very wide range of replacements, additions, enhancements, and augmentations for children and adults which usher in a posthuman era (Smith and Morra 2006: 1ff.). The device paradigm seems to just keep rolling along.

One of the founding fathers of cybernetics, Norbert Wiener, presciently realized the power of linking automatic control to machines. He recognized that just as machinery in the Industrial Age devalued the human arm, so the linking of computing power to machinery and devices was “similarly bound to devalue the human brain” with the potential for good or evil (Wiener 1948: 36ff.). Living effectively increasingly has become a matter of living within a sea of information that is adequate for the tasks at hand. It has fuelled the global glut of information – a data stream that no single human being can even begin to encompass or master – and left the human being increasingly dependent upon devices to filter information into manageable bits for human consumption (Wiener 1954: 17f.).

The filmmaker Steven Spielberg in *Artificial Intelligence: AI*, released in 2001, takes us to a world in the not-so-far future where the polar ice caps have melted and the resulting rise of the ocean waters has inundated all the coastal cities of the world.

Withdrawn to the interior of the continents, the human race keeps advancing in its technological abilities and starts creating realistic robots (called *mechas*) to serve the needs and wishes of their makers. One of the *mecha*-producing companies builds David, an artificial kid made to look like an 11-years old that is the first to have the capacity to develop a never-ending love for the first human who imprints him. Monica becomes that “mother” as she takes David as a substitute for her real son, who is in a coma. David is living happily with Monica and her husband, loving her deeply, even though she finds she cannot love him as she would a real boy. His robotic ways never allow her to forget his machine nature. When her own son revives from the coma, her need for this imperfect replacement ends. She places David in the woods and leaves him there to fend for himself. The remainder of the movie takes us through a series of other adventures ending thousands of years later where a group of highly evolved robotic beings dig up David, the only remaining intelligence on Earth to have actually known humans, creators of the first robots. They accede to David’s wish to bring Monica back for a day via cloning but advise him that they cannot get the clone to live more than a day. David gets his wish to be loved for a day. Science fiction for sure, but not entirely different from some of the speculations of working scientists in the realm of artificial intelligence, consistent with Bill Joy’s visions of a techno-future (discussed previously) where robots have eliminated human beings, and congruent with Hayles (1994: 178; Campbell 2000: 265) reporting that about ten percent of the population of the USA are in the “technical sense” cyborgs. Added to this startling scenario is the rapid progress in cloning with prospects of a human clone now appearing on an unknown time horizon yet seemingly inevitable. Such an act

“would mean the absolutizing of finitude” where the desires of human beings rather than an infinite God are the ultimate origin of the cloned person (Henriksen 2005: 159f.).

Already cybertechnology raises dimensions for ethical analysis that challenge traditional approaches, although it appears that with some modifications in methodologies employed, no fundamentally new framework of ethics needs to be developed at the present (Tivani 2005: 215f.). If we did create the beings that are envisioned in the movie *AI*, it would open an important ethical and theological set of questions about the responsibilities we would have to these sophisticated robots, the responsibilities they would have toward us, and what it would mean to have moral obligations at all (Tivani 2005: 229-232, 236).

The genie is out of the bottle. Instead of three wishes it appears that our wishes are virtually unlimited. Yet like so many who rubbed the lamp before us, we frequently lack the necessary insight or wisdom to ask for things that really matter and things that make a positive difference in the lives of others. Instead we keep having our wishes granted for an ever-increasing accumulation of material goods and self-aggrandizement. We become addicted to the genie and spend much of our waking time thinking about all the new gadgets we can acquire. Argos, the UK’s leading merchandise retailer confidently predicts that within three years 95% of the UK population will live within 10 miles of one of their stores (660 to date) and for the remainder there is always Argos online where you “Don’t shop for it. Argos it!” (www.argos.co.uk). Its printed catalogue eclipsed the Bible as the number one bestseller book in Great Britain in 2006, “*Tesco ergo sum*” (Berber 2006: 1).

Not surprisingly, in a world where so much technology overwhelms us, God seems to many to be receding from the modern world. Christians are called to be salt and light and the imperatives of the gospel are as pressing today as they have ever been. The early Church had to stand up to the might and power of the Roman emperors, their legions and legates. We face perhaps a more powerful foe, a “Beast” whose shifting form and shape and tentacles of power encircle the globe but who while present everywhere is really present no where. Technology, while certainly not autonomous, is so widespread and manifested in so many different forms and venues, that clearly it is hard to imagine that a single effort or strategic move can make a difference.

One Christian response to technology is to retreat into religious communities where technology is purposefully held at bay by disciplined practices and confinement of technological devices to particular roles within the community such as seen with the earlier Shakers and among contemporary Amish, Old Order Mennonites, and Old German Baptist Brethren communities who have become well-known tourist curiosities. All three sects allow their youth to leave the community for a selected period to experience the “world” and then decide whether to return to the community to take up life as an adult within the confines that such a community has created. Contrary to much public opinion, of course, these are “not so much naïve rejections of modernity as they are claims about the inherent values of older, more communal, and less rational ways of life” (Schultze 2002: 198).

While Albert Borgmann certainly would sympathize with these movements as countercultural reminders of the power of community in the midst of the threats that technology poses to modern life, although he explicitly rejects this romantic reaction to

technology as unrealistic. His writings provide a strong and reliable guide to understanding the challenges confronting us and possible actions we may take. While Borgmann well appreciates the enormity of the challenge of technology, he both recognizes its worth and couples such knowledge with a strong confidence in the grace of God and a belief that churches and their leaders are indeed a front line in this struggle as they work to understand the pattern of contemporary society and to cultivate the focal things, focal practices, and communities of celebration that are critical to limiting the advance of devices (Borgmann in Wood 2003: 25).

Borgmann (1996b) identifies three spheres: the device paradigm, the sacred, and the Christian religion. He sees the device paradigm and the Christian religion as mutually exclusive in many ways. Grace and sacrament operate in an entirely different manner than commodities. The device paradigm proceeds on the basis that it can provide all that human beings require or could possibly want, in fact it ushers in the end of want, fear, disease, suffering, starvation – in short it eradicates the four horsemen of the Apocalypse. When the device paradigm is strong, the formative power of religion is weak as the device paradigm aids and abets the growth of human pride and the cult of self-sufficiency.

Christians have a sacred duty at every opportunity to strengthen focal things, focal practices, and communities of celebration, both within the Church and within the wider culture. Unanticipated and underserved signs of grace are to be eagerly anticipated in the warp and woof of everyday life and such experiences are meant to be creatively shared. By doing this, the Church provides the “deep desire for comprehensive and comprehending orientation” within the wider society (Borgmann 1992a: 144). Yet

Christians cannot do this alone. They should join with allies wherever feasible, including those who love and want to care for the Earth and its inhabitants and atheists who can affirm the value of focal things, focal practices, and communities of celebration (Borgmann 2002a: 113). He (2000a: 366f.) envisions like a prophet of old a “commonwealth of the good life” where cities are eminently livable and convivial, pedestrians are welcome, high rises and other gaudy symbols of the device paradigm and its kin shrink or disappear, house designs reflect the importance of focal practices by designing spaces for them to occur with regularity, and focal points of education, the arts, religion, and play pervade the environment.

Even as the device paradigm and the Christian religion challenge one another, there is the sphere of the sacred that Borgmann wants us to recover. The sacred is seen most powerfully in nature in all its glory, splendour, and power. Yet it also manifests itself in the rhythms of everyday life when community, conviviality, personhood, and the mystery and contingencies of life are experienced whether in a community event such as a ballgame or carnival or in the home as an extended family gathers for a joyous celebration of a birthday or holiday accompanied by a lovingly prepared and delivered feast of bounty (cf. the recently published volume on Christians sharing food for enjoyment by Jung 2006).

So what must Christians do? We must do what Christians down through time have done. We start in our own Jerusalem with the good news of the gospel. Reflective practices within churches celebrate engagement with great art, wonderful music, drama, and beautiful liturgy that draws one into a sacred encounter that becomes the normative experience of the Church and its people (Borgmann 1990a: 334; identical in 2003a: 53f.).

We seek converts to a way of life that while appreciative of all that technology can do and the kinds of choices and lifestyles it affords, yet refuses to worship at the altar of technological wizardry and will to power (Northcott 2005: 234), “challenging long-standing myths about the salvific power of humanly fabricated devices” (Schultze 2002: 195). This may require protests and other means of social disobedience reminiscent of the student protest movements of the 1960s (Bloy 1967: 89f. who draws this parallel). We seek partners who will help us understand more about the subtle and not so subtle ways in which technology may lead us astray into unhealthy, unworthy, or unfulfilling practices and processes. We seek people of faith who will share with us an optimism about the future but recognize that faith is in the most High God of Abraham, Isaac and Jacob and who, when He comes, will look for justice on the Earth. We ask a host of critical questions such as: “What sort of a world are we putting together? Is it hospitable to the word of God and the kingdom of God? Does it bear the stamp of the kingdom of God?” (Borgmann interview with Myers 2003). Asking these questions critically, even within the Church, will reveal the ways in which commodification can be found in religious practices and religious imagery as for far too many Christians, heaven becomes “commodified as the equivalent of a kind of eternal Caribbean cruise, a heavily advertised and expensive commodity that must be purchased well in advance, on the testimony of celebrities, and with the stipulation that all sales are final” (Hickman 2000: 90). The critique of technology advocated here enables us to view even very well-intended movements within Christendom that seek to engage postmodern culture in evangelism as themselves undergoing commodification by the device paradigm, e.g. the Alpha movement (cf. Percy 2005: 41-62; Hunt 2000, 2003). We have already mentioned

the ways in which presentational technologies have in some cases been used inappropriately and with great detriment to the worship experience of the Church. We can add to it the ways in which listening to Scripture in the technological age can be all too easily commodified as the Bible itself becomes a device to be used to serve human ends rather than a means to hear from God (Perry 2003).

The concept of sojourner is an important one for Christians since such a person has a purpose and direction in mind, rather than a tourist or vagrant who merely is a spectator with no particular purpose or direction (Schultze 2002: 207). We judge the things of this world in light of the world that is to come, for we “desire a better country, that is a heavenly one” (Heb. 11:15). Meanwhile we seek as a sojourner in this world to honour our Lord and “do justice, to love kindness, and to walk humbly” with our God (Micah 6:8).

Theology, with its long and venerable history, “is responsible for articulating a theological reading [of] its present situation, not merely as a set of cultural norms of constraints or opportunities, but as an episode in the history of the gospel’s dealing with humanity, as one further chapter in the history of holiness and its overcoming of disorder, wickedness and unbelief” (Webster 2001: 5). While the terrors of the present may give one pause, “unless you grasp in some measure the terror of Good Friday, you can never understand the good news of Easter” (Childs 1985: 234). The Christian faith always has shined the brightest in the darkest hours of human history.

We can see perhaps most clearly with the pervasive power of technology the age-old distinction between human conceptions of happiness (following Aristotle) and those of Christianity. For Aristotle (*Nicomachean Ethics*) happiness lies in becoming fully self-

sufficient and thereby insulated from unpredictable fortune [not unlike psychologist Abraham Maslow's (1998) more recent concept of the self-actualized individual]. Christians maintain that true happiness lies in bringing one's life into relationship with and subservient to the lordship of Jesus Christ of Nazareth. It is only in relationship to Him that life has purpose and meaning and that happiness can be realized. Such contingency would be abhorrent to Aristotle but is, in fact, the very core of the Gospel – "he who has lost his life for My sake shall find it" (Matt. 10: 39; Hauerwas and Pinches 1997: 15f.).

Theologians must begin the arduous but important task of developing the mutually critical correlations between modern technology and the Christian tradition that David Tracy (1994: 52) has reminded us is the central task of theology. The central symbols of the Christian tradition must be reinterpreted in light of our present situation. New and potentially risky reinterpretations of both past tradition and present situation must be undertaken (see Pattison 2005 for an example related directly to the concept of God). A Christian future within the technological landscape of the future must be created, discussed, critiqued, and revised in the light of accumulating wisdom and insight. A hermeneutics of retrieval, critique and suspicion must be deliberately cultivated where technology and the work of those who study technology is taken as a vital dialogue partner and sometimes devastating critic (Tracy 1994: 35ff.). As Dillenberger (1986: 234) reminds theologians, "It may be fruitful, however, and altogether beneficial when we are forced to deal with facets of experience that defy direct verbal expression, that make us stammer in our struggle for understanding and coherence – not because we are feeble intellectually but because reality in all its diversity will not bow to our thought-forming

categories.” Christian theological concepts and constructs, as they undergo these various formulations and reformulations must be couched in terms that enable pastors, Christian ethicists, congregants, and public policy makers to benefit from the wisdom and insights of the Christian tradition and provide the basis of the application of some of these insights to the challenges posed by ever-advancing technology.

7.2 Summary of the Thesis

Our journey toward understanding more about technology commenced with an overview of the nature of technology. Technology is an ancient practice that goes all the way back into the mists of time and predates its child cousin, science, by millennia. Modern people are not the first to recognize that technology is somehow different than many other forms that we find in the world. Plato and Aristotle noted its presence and had ideas about its meaning. Technology is art as well as science, processes and knowledge, skills and applications, artefacts and systems. We defined technology as the application of knowledge, tools, skills, and systems to solve practical problems, extend capabilities, expand opportunities to meet or invoke human needs.

Our definition then was applied to the Old and New Testament to see what the Bible would have to say to us about technology. Surprising perhaps to many, it is clear that God Himself can be thought of metaphorically as the world’s first technologist who delights in designing, making, and executing. Creation itself is an exercise in bringing into existence a world and its associated creatures and biological, geological, meteorological, chemical, and physical systems to meet the needs of humans and all creatures. God throughout the Old Testament remains active in His world leading and

guiding the people of Israel and intervening directly or indirectly on behalf of His people. The Old Testament is replete with references to the human uses of technology as well. In fact, once you are oriented to what to look for, the Bible is full of technological applications and systems, including elaborate systems of sacrifice with many of the major segments of historic technology described in whole or in part within the pages of the Bible. The New Testament finds Jesus using technology both as a source of metaphors and illustrated stories for his listeners about aspects of the Kingdom of God (lamp stands, city set on hills, door) and to advance his own mission within the world, including His voluntary death on the cross.

Human language is one of many significant technologies that God uses to advance His kingdom throughout the Earth. Technology serves as a mediator between God and the individual and among God, the Church and society. Technology mediates between individuals and their communities/societies as well as with the environment.

The pervasiveness of technology both within the Bible and within contemporary society suggests that technology should be a major topic of discussion and a major touchstone for theological reflection in contemporary theology. This possibility was investigated by drawing upon twenty-one published systematic theologies or extensive theological treatises that have been produced during the twentieth century by Protestant and Roman Catholic theologians with a range of theological perspectives and speaking from a variety of traditions. An analysis of these works showed that technology was scarcely mentioned and when it was mentioned was discussed generally in an off-hand and highly delimited manner. A somewhat random but wide-ranging search for other theological writings on this topic did turn up some attention to theology in a number of

modern theologians, most notably Donald Bloesch, Douglas Hall, Paul Tillich, Karl Rahner and selected papal encyclicals. Presumably there are others that the author has not located and discussed but the overall trend is quite clear. Modern theologians have failed to take account of the importance of technology within the modern world and insufficiently considered what its pervasive presence and power mean for the contemporary Church and for the Christian in the twenty-first century. At the same time, it can be recognized that the entire theological tradition going back to the early Church is a potentially rich source for engagement with modern technology, although sustained success at this venture will require considerable work and deep conceptual thought since the forms, categories, terminology, and conceptual underpinnings of theology are not conducive to quickly and routinely transmitting them into secular discourse concerning technology.

Since technology is so broad it was elected to focus on a single set of technological applications to begin an exploration of the possibility of theological dialogue with technology in contemporary society. Intelligent transportation systems were selected as an appropriate set of applications for such an endeavour. Information technology and biotechnology were deliberately not chosen because the author was aware of work already underway in those fields involving theologians. The choice to look at another area of modern technological activity was to determine whether issues that are not quite so obviously speaking to the human condition might exhibit the same or dissimilar characteristics than these other two areas. We can conclude on the basis of this investigation that this is indeed the case.

Intelligent transportation systems (ITS) embrace a variety of technological applications that are focused principally on two areas: intelligent vehicles and intelligent transportation infrastructure. This is a growing field of engineering and technology and there are currently ITS applications in locations all over the world but particularly in North America, Europe, and East Asia. Formal public transportation policy in both the United States and within the European Union commit the governments of those nations to long term and extensive programs in ITS. The overall goals of ITS include greatly increasing the safety, efficiency, cost effectiveness, reliability, predictability, and seamlessness of transportation across the many modes of transportation available both now and in the future.

It was clear that there can be no vague general dialogue between theology and technology that would be sufficient to sustain interest on the part of either dialogue partner. Instead, it seems best to pursue a strategy of considering a specific case study as a means to provide context and increase understanding about the specifics of a set of ITS technologies, their applications and possible use. A case study was located that was an advanced highway systems feasibility study for a traffic corridor that spans three states in the Western United States and includes the major national parks of Yellowstone and Grand Teton. This area of the United States is rural and representative in a broad way of highways and roadways in some 80% of the United States by number of roads and some 40% of the United States by number of vehicles. The case study focused on an area that was somewhat unusual in that the two parks draw over five million visitors per year, all of them over two-lane highways so traffic congestion and attendant problems with accidents, etc. become an important venue for possible ITS applications. The area has

brutal weather conditions for part of the year and receives a large amount of snow. Large mammals are prevalent in the area posing an additional hazard both to vehicles and to the wildlife. The case study was summarized in sufficient detail to enable the analysis to proceed.

The philosophical work of Albert Borgmann was carefully described, especially his major trilogy that focuses on the technological character of modern life and the importance of holding on to reality. Borgmann's analysis was supplemented throughout this thesis by the work of another noted historian of the philosophy of technology, Carl Mitcham, especially in our discussion of the nature of technology. Borgmann and Mitcham are confessional Roman Catholics and make frequent connections to Christian themes, values, and implications in their many published writings.

A series of issues were then discussed drawing upon both the case study and the writings of Borgmann, theologians and other scholars regarding the following fourteen ITS-related issues: 1) Purpose/Direction, 2) Research and Design, 3) Automation and Control, 4) Efficiency, 5) Surveillance and Privacy, 6) Information Technology, 7) Aesthetics, 8) Safety, 9) Siting, 10) Evaluation, 11) Interconnectivity and Portability, 12) ITS Workforce Issues, 13) Planning and Public Policy Making, and 14) ITS Informing Theology.

This study provides preliminary evidence that there is reason to think that dialogue between theology and technology is both important and potentially viable. Both partners can learn valuable things from one another although if similar dialogues between science and religion/theology are a reliable guide, mounting and sustaining such a dialogue beyond a single project or moment in time will be difficult. We now return to

some issues that we raised at the start of Chapter Five in light of our case study experience.

7.3 Dialogue Between Theology and Technology

Current dialogue between theologians and technologists who work in the area of information technology and biotechnology is spotty but growing in both frequency and importance. It is difficult to discern at present that the dialogue is having marked effects as a dialogue per se, but it does appear that in the UK in particular there are examples where Christians working either from the technology side or from the theology side have and are making a difference in the focus and scope of public policy debates concerning both existing and emerging developments. The involvement of philosopher Stephen Clark, theologians Michael Banner, Michael Northcott, and Duncan Forrester, scientists John Polkinghorne and Arthur Peacocke, and scientist and theologian Celia Deane-Drummond, to name just a few have directly influenced government policy papers, general discussions in the larger societies, and perhaps even government regulations. This is laudatory and certainly should lay to rest accusations that Christianity has nothing valuable to say to technology. The impact of theology in the United States is much more mixed and the reasons for this are somewhat unclear but we may speculate. Some Christians have clearly had an influence on developments in technology in the United States including at the level of the federal government. One thinks particularly of the former U.S. Surgeon General, C. Everett Koop and Francis Collins, current Head of the Human Genome Project at the National Institutes of Health. Theologians in the United States generally reside within theological seminaries rather than research universities

with a few notable exceptions (Chicago, Yale, Harvard, Emory, Duke). This appears to restrict their access to public policy forums since there is much concern in the United States about separation between church and state. Much Christian thinking about technology, therefore, takes place outside of the high-powered research institutions and government policy forums such as the deliberations of the U.S. National Academy of Sciences and the National Academy of Engineering. This is a great pity and clearly requires strategic thinking on the part of Christians in America as to how to rectify this problem in a manner that is politically and socially acceptable. Trinity International University has been the host of the Centre for Bioethics & Human Dignity (www.cbhd.org) since its inception in 1993 and this organization has been highly active in considering particularly bioethical decisions as they relate to Christianity in particular, theology to some degree, and to the wider society. There are other examples of such engagement (e.g., American Scientific Affiliation) although the CBHD is probably the most prominent and successful example of this kind of venture in the United States. Yet these institutions have had little or no discernible impact on public policy at any level within the United States.

Clearly there is much work to be done to move any dialogue forward. Viewed from an academic standpoint there are a series of endeavours that would certainly be useful to advance the effort envisioned and tested in a preliminary manner by this thesis. These would include:

1. Developing an annotated bibliography of writings dealing with theology and technology that is global in scope and covers at least the last 3-4 decades.

Philosopher of technology Carl Mitcham has been building such bibliographies

for some time and it may be merely a matter of expanding and updating from resources he has already created.

2. Mapping the existing bibliographic materials into categories of technology using some taxonomic scheme such as the Library of Congress classification system (probably not the best for this purpose) or creating a faceted taxonomy on theology and technology.
3. Mapping major positions of key theologians and technologists regarding specific issues, beginning with general orientations toward technology and/or theology using the Taxonomy for Technology and Theology presented in Table C above.
4. Building a database of universities, research centres, theologians and technologists interested in this topic, including scholars in religious studies who may be active and/or interested.
5. Organizing one or more conferences that highlight this particular topic and inviting speakers from both sides of the aisles to present papers and engage in direct discussions around carefully and tightly focused topics.
6. Creating theme issues of journals in theology and in technology studies that can focus on a specific area of either theology or technology and invite papers from people in both arenas.
7. Seeking out Requests for Proposals or sending in unsolicited proposals to private and public funding bodies for focused research on a specific topic within either theology or technology that will *explicitly* engage in interdisciplinary dialogue as part of its core approach.

8. Develop a book series focused on specific topics with books ideally authored by pairs of authors reflecting expertise in both the technological topic under discussion and theology. The forthcoming edited book of essays by David Leal at Oxford University and a whole series of edited volumes related to the biosciences and theology may be good starting points for planning such an effort.
9. Inspire one or more noted and capable theologians to produce systematic theologies or other works that much more clearly interact with modern technology within their pages. Alister McGrath has provided a most helpful model of what this might look like in his three volume systematic theology and a more recent volume (McGrath 2006) that takes quite serious account of the findings, insights, and methods of modern science.
10. Find good case studies of particular technologies that can become focal points for dialogue and that raise significant theological and/or technological issues. Employ these with students studying technology or theology in university as a means to interest the upcoming generation in this type of engagement.
11. Write editorials for newspapers or other media outlets (including blogs) that tackle a particular technological application and engage in a critique of it drawing upon theological constructs and ideas.
12. Interest a film company or television program about filming the implementation of a particular technology and include within it reflections on the practices, approaches and results from a range of persons with different specialist backgrounds (or none), including theologians.

It will be important to maintain modest expectations, especially in the early days of such an effort. Almost all scholars who initially gravitate toward these conversations are already mavericks in terms of their intellectual interests and generally enthusiasts about the possibilities for advancing conversations and insights. Yet their very enthusiasm, focused and arising out of deeply held beliefs that have spurred their interest in such topics outside of normal academic interest, can be difficult to manage when brought face-to-face with someone who conceives of things quite differently than they do but who is equally passionate in their position. These meetings require highly skilled facilitators to keep them from deteriorating into an academic mud-wrestling contest that quickly sours participation. Virtually all participants also engage in newly emerging efforts as a sideline rather than a main interest – at least the ones who are likely to be both productive and good scholars. Anyone who had too much time on his or her hands and for whom this can be a full-time or near full-time pursuit may not be all that desirable.

7.4 Final Thought

We have come a fair way in our journey but it is clear that the road is long toward home. Christians derive strength for such journeys because of the hope that lies within them and God's world they inhabit and enjoy. We are good and faithful servants if we seek to advance His kingdom and His righteousness, including on the plains of technology.

We must hold to our hope and stand fast in the fight. The Christian is more and more like an army surgeon operating while the battle rages about him: he must stay at his post, and think only of the wounded being brought in, without allowing any thoughts of faint-heartedness or tiredness to interrupt his humble work for the

suffering flesh of man, in his defence of the frontiers of the kingdom of peace and gentleness (Queffélec 1964: 70).

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Note: Items with a * are referenced in the thesis.

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