TECHNOLOGY AS METAFORM: CULTURAL CONSERVATION IN THE GLOBAL ENVIRONMENT

by

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A thesis submitted in conformity with the requirements
for the degree of Doctor of Philosophy
University of Toronto

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Degree of Doctor of Philosophy, 1999

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Abstract

This research investigates the personal and cultural dimensions of technology, with special attention to heritage preservation, including today's collaborative, intercultural efforts in conservation/restoration. The author's extensive practice as a conservator/restorer of antiquities in diverse environments, combined with a knowledge of materials science, revealed multiple associations and symbolic content in the materials and technological processes involved. Often overlooked, the meaningful dimension of the physical component of our contemporary technologies merits investigation, particularly now, in the rapid globalization of technology.

This dissertation addresses the evident need for a conceptual strategy to retrieve and interpret these influential environmental associations. To this

end, the concept of *metaform* is introduced and developed as a conceptual tool recognizing technology as a phenomenon that is both instrumental and symbolic. Accordingly, this research is directed toward an holistic understanding of technology, in the sense of the mediating role of technology in human relationships.

The research is interdisciplinary, the methods multimodal, emergent, interpretive and reflective, developing the core concept of metaform through diverse examples and case studies. These research sources, supplemented with textual research, artifact analysis, interviews and visual media, inform an interpretation of technology and related activities as situated phenomena, a synthesis of matter and meaning.

Preservation technologies have particular significance to this research as they engage a deep investment of knowledge across disciplines; they represent a tangible commitment to certain choices in the selection, care and restoration of objects of cultural importance. More commonly perceived as a tool, technology functions as an extension of the human in all aspects -- psychological, spiritual and physical. By examining the motives, aspirations and fears that account for our inventions, we reclaim our membership in technology as an expression of human relationships at various levels with others and with the world at large.

Examples draw on studies of both ancient and contemporary preservation practices in Canada, the United States, China and Japan. Parallel technologies in medicine are explored to illustrate the broader applications of metaform. Global studies in conservation provide a context in which the relevance of metaform emerges in cultural exchanges in technology.

This research demonstrates the transferability of the concept of metaform, first as it applies to preservation technologies, then as it serves as a conceptual device to elucidate the human element inherent in the use of any technology. In conclusion, technology as metaform presents a new means of knowledge development, compatible with a holistic model for intercultural exchanges in technology.

* * * * *

ACKNOWLEDGEMENTS

I would like to thank the following people,
whose knowledge and assistance have been invaluable:

Members of my Thesis Committee:-
Dr. John A. Eisenberg, Theory and Policy Studies, OISE/UT,
for supporting my research with care from the beginning;
Dr. Gerald Carrothers, Founding Dean, Faculty of Environmental Studies,
York University;
Dr. Ruth Hayhoe, Professor and Director, Hong Kong Institute of Education;
Dr. Barbara Whitney Keyser, Professor, Arts Conservation Program,
Queen's University;
Dr. John P. Miller and Dr. Joel Weiss, Curriculum, Teaching, and Learning OISE/UT;
Dr. Richard Townsend, Theory and Policy Studies, OISE/UT.

Thanks are extended to my colleagues in conservation:
Philip R. Ward, my first teacher and mentor;
Marianne Webb, friend and colleague, Royal Ontario Museum;
Andrew Todd, former partner in private practice, Vancouver;
Kazunori Oryu, colleague of many years, formerly of Oka Bokkodo and the
Tokyo National Research Institute of Cultural Properties;
Iwataro Oka, President, Oka Bokkodo, Kyoto;
Bob Barclay, Stefan Michalski, Judy Logan, Dr. Cliff McCawley, and Tom Stone of the
Canadian Conservation Institute;
Dr. David Grattan, Chair, Conservation Committee, International Council of Museums;
Dr. Miriam Clavir, University of British Columbia;
Susan Stock, Royal Ontario Museum;
Tom Chase, recently of the Smithsonian Institution, Washington.

Sincere appreciation is extended to:
Rebecca Hayes, daughter of Rutherford J Gettens;
Stuart Smith, son of Cyril Stanley Smith and Alice Kimball Smith;
Dr. Keith Oatley, Dr. Edmund O'Sullivan, Dr. Ronald Silvers, OISE/UT; Dr. Ray Rogers,
York University; Avinash Agnihotri; David Granville; Jack Howard; Dr. Nelly Ng;
Michael Osler; and David Pepper.

My gratitude for the grace of my friends and advisors:
Sophia Armenis, Dr. Colin Baxter, Powie Chang, Shera Delain, Elizabeth Forestell,
Dr. Maridene Johnston, Yasmin Karim, Edith Leslie, Shirley Ma, Joanne Nonnekes,
Dr. Edward Slopek, Peggy Smart, Nancy Ward, Sally Martin and her family.

My family has seen me well and truly through this adventure:
Ernest J. Howatt, my late father, who set my course on uncharted territories;
Bonnie Hennessey Howatt, my mother, who said so many priceless things while
sustaining the journey, and my sister, Suzanne Howatt.
My son Noel Burton-Krahn and his family provided insights with love and humor,
and gave it all meaning.
Dr. Ellen Shearer has been my bright lighthouse on this writing expedition.
I am sincerely grateful to each and every one who has enabled me to reach this
happy destination.

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INTRODUCTION: RESEARCH OBJECTIVES AND METHOD

Prelude

In professional practice as a conservator of art and artifacts, my work in cultural conservation engaged me in an intimate way with diverse experiences of peoples and place, through the things they made and used. A knife-line cutting sharply across wood grain, a fingerprint impressed in a clay vessel, a strand of hair woven into a root basket -- all these encounters from centuries before made me aware of the maker over my shoulder -- the person and the making, their materials and their means.

The immediacy and the reality of the maker, present in these materials, made me more keenly conscious of my personal responsibility as a preservation practitioner than any ethical or theoretical discussion could have done.[1] As Howard Carter reflected, on examining the treasures of the pharaoh, Tutankhamen, "Time is annihilated by little intimate details such as these, and you feel an intruder".[2]

Looking back, my earliest experience of a similar encounter occurred at the Royal British Columbia Museum,[3] while I was reconstructing the shattered features of an early wooden mask, carved by a Haida artist native to the Pacific Northwest Coast. It was a deeply three-dimensional rendering of the head of a bear, intended to be worn by a fully-costumed performer who would dance the spirit of the bear. Its expression was powerfully

[1] By this I am not suggesting that such encounters displace ethics, rather that such experiences can impress on the conservator whatever it is that prompts us to develop ethics.

[2] Howard Carter, *The Tomb of Tutankhamen* (London: Barrie & Jenkins, 1972), 38.

[3] Formerly the British Columbia Provincial Museum, Victoria, British Columbia, Canada.

animated, yet the carving delicate -- the bare wood between eye and cheekbone was so thin that one could easily have pierced it with a small chisel. With the larger pieces, a finger brushing along the grain made the sound of a whisper. The very physical qualities of lightness and shapeliness that suited it for performance made it vulnerable to careless handling. By the time I had received it in the laboratory it was in pieces.

The thin edges of the breaks had to be bridged with filaments of stainless steel; losses in the wood had to be filled for both structural and aesthetic reasons, sometimes with balsa wood, other times with a tinted synthetic compound. After many weeks of work, the fierce features again commanded attention, but something had changed. It was the sound.

Where before the sound of a touch across the wood suggested wind through reeds, now there was a dullness, a flatness. Somehow, while the form was now intact, a dimension of its resonance was lost -- insignificant, perhaps, to someone whose first impression of the restored mask would be that of a vivid apparition from the past, but to me it was disconcerting. On the one hand, I experienced a true sense of accomplishment in my treatment, but on the other, I was surprised by what was lost. And I was reminded of it years later when a carver in Bali, Indonesia, explained how a mask is carved and shaped with sound in mind, "tuned" to the needs of the character and dancer. But then, only I and the dancer could sense this.

It couldn't be avoided, that shift in the timbre. Conservation science and the arts of restoration had enabled us to recover some dimensions of the form of the mask, yet had altered and obliterated another quality. It would be a long time before I could begin to articulate the complex nature

and unpredictable consequences of the dynamic relationships between technology and culture.

Rationale for this Study

If the purpose of technology as we commonly understand it was simply to accomplish a particular task with material means, then presumably we would have few "variations on the theme", in such areas as the design, medium and detail of our instruments. But this is not the case. For one thing, as we know from our own experience, the development, use and proliferation in trade of technologies -- from ancient to contemporary times -- has depended on the fact that humans invent and select a wide variety of artful instruments according to our changing perceptions, needs -- and feelings. In fact, great global debates and profound consequences are arising as a direct result of our diverse technological visions and choices, particularly in such areas as genetic medicine, the militarization of space and planetary environmental concerns.

Certainly I became aware of this diversity in technological "consciousness" and commitment in the practice of cultural preservation. This activity of caring for cultural heritage often takes place behind the scenes or in protected sites, but it has recently come to public attention through the publicizing of such high-profile projects as the controversial restoration of Michelangeo's paintings in the Sistine Chapel at the Vatican.[4] Another example involves the politicized speculation surrounding the "real" identity of the head of the Giza Sphinx, as reconstructed using digital technology --

[4] David Jeffery, "A Renaissance for Michelangelo," *National Geographic* 176 (December 1989): 688-713.

an instance of "virtual restoration."[5] Over and above these more spectacular issues, on a regular basis, the field of heritage conservation has provided me with many practical opportunities in diverse cultural and environmental situations, where I would be required to reconsider the meaning of technology as I had formerly known it. As a result, I came to respect that technology goes well beyond addressing the obvious task at hand. In any inter-cultural exchange, it is valuable to acknowledge and to identify, as best we can, how our personal technological preferences relate to the individual, cultural and civilizational associations that a technology and its subject have come to embody for us. In this dissertation I organize a substantial share of my material around these three loci of technological relationship -- that is, the individual, cultural and civilizational contexts.

Evolving a Conceptual Framework

My conservation practice afforded me opportunities to question the meaning of the instruments we as humans create and use. My experiences in the preservation of cultural heritage led me towards an integrative way of perceiving tools, instruments, and technical systems in diverse environments. My perception is condensed in a conceptual instrument or lens that I term *metaform*, on which I elaborate in Chapter I. In the ensuing chapters, I will apply this conceptual device to amplify our understanding of technology as a synthesis of matter and meaning, and as a mediator of human experience. I will show how this vision of technology applies to preservation. In addition, I will demonstrate its adaptability as a conceptual device with far-reaching implications across diverse

[5] Archaeologist Mark Lehner, specialist on the Giza sphinx, offered the comment that in his experience, matters regarding the preservation and dating of this subject, including digital re-constructions of its facial features, have become highly politicized. Personal communication with the author, 1991. For technnical details, see Mark Lehner, *Archaeology of an Image: The Great Sphinx of Giza*, 1991. Unpublished Dissertation, Yale University.

environments and cultures.

Technology has been interpreted by Marshall McLuhan as an extension of human beings.[6] In this dissertation, I amplify McLuhan's ideas to embrace technology as an extension of the human in all aspects -- physical, psychological and spiritual. The conceptual instrument of metaform recognizes technology as a phenomenon that is both instrumental in a physical sense, and at the same time functions symbolically by embodying the experiences, aspirations and fears that account for our inventions. By examining technology in this way, I seek to understand and reclaim technology as an expression of human relationships and of our connections with the world at large.

In this way, we can begin to see how our thoughts and feelings about technology are the source of our agency and ultimately, of our discretion, choice, and use of tools -- and of what we are communicating, directly and indirectly, through these instruments. Consequently, this research will synthesize insights from past and current developments in several fields to illustrate a new means of navigating the transitions and territories of existing and emerging technologies.

Raymond Williams clarifies technological terminology for us in his discussion of technology, communication, and society.[7] He defines a technique as "a particular skill or application of a skill. A technical invention is then a development of such a skill or the development or invention of one of its devices. A technology by contrast is, first, the body

[6] Marshall McLuhan, *Understanding Media: The Extensions of Man* (New York: The New American Library, Inc.,1964).

[7] Raymond Williams, "Communications Technologies and Social Institutions," in *Contact: Human Communication and Its History*, ed. Raymond Williams (London: Thames and Hudson, 1981), 226-7.

of knowledge appropriate to the development of such skills and applications, and, second, a body of knowledge and conditions for the practical use and application of a range of devices."

Williams's distinction is helpful for an understanding of my concept of metaform in that he relates technology to knowledge. However, in this dissertation, I use the term technology as it is understood and employed in colloquial discourse; that is to say, when I refer to technology, I include not only theoretical and practical knowledge, but also the physical instrument itself. From my perspective in this dissertation, it is crucial to avoid isolating intellectual processes from physical, emotional and psychological ones.

The central objective of this research is to investigate the humanistic, cultural dimensions of technology, with special attention to today's efforts in heritage preservation in the global environment. A further objective is to elucidate possible approaches to inter-cultural exchanges, particularly in the conservation/restoration of cultural heritage. My method is interdisciplinary, for reasons that will soon be apparent.

Recent advances in educational research provide a means for articulating this experience of technology as an expressive human activity. Here technology as *metaform* will be examined as a new means of knowledge development; it will be discussed across disciplines, not to advocate a specific technology *per se*, but to explore this conceptual instrument for what it reveals about the role of technology in mediating human relationships.

Field of Study: Technological Thought

Not only in theory, but in lived experience, people throughout the world are constantly having to adapt to the proliferation, diversity and rapid development of technology. Indeed, technology is increasingly recognized as a major environmental presence.[8] In the same way that we are just beginning to realize the scope, significance and vast implications of our environmental relationships, so, too, we are awakening to technology as a "new sort of being" -- as David Kilgour has said with reference to the ideas of philosopher George Grant.[9] As the growth and diversification in other areas of environmental research demonstrate, there is a similar need to bring new and diverse intellectual resources to our understanding of technology and its place in human relationships at these multiple levels -- personal, cultural and civilizational. As an open, flexible field for the study and research of technology, technological thought can encourage an approach which deals with the subject, not as "a static, observed entity, . . . [but] as a spontaneous, dynamic object."[10]

Adapting my research experience of environmental studies to this dissertation, I take an interdisciplinary approach in order to address and refine this question of the expressive forms and meaningful relationships that engagement with technology can engender. An interdisciplinary approach is in keeping with the complexity of my topic, which otherwise

[8] See, for example, McLuhan, *Understanding Media.*

[9] David Kilgour, " George Grant Still Makes you Think," a review of *The George Grant Reader*, ed. William Christian and Sheila Grant (Toronto: University of Toronto Press, 1998) in *The Globe and Mail*, 4 April 1998, sec. D15.

[10] John Eisenberg, *The Limits of Reason: Indeterminacy in Law, Education and Morality* (Toronto:OISE Press, 1992), 60.

would be impractical to address within the conventions of a single traditional academic discipline. For these reasons, I have located my study within the new field of technological thought. I take my precedent from the field of Environmental Thought, a field of graduate study at the Faculty of Environmental Studies, York University, Ontario.[11] These are new fields for new situations.

Research Components

Within the field of technological thought I integrate the following components: I explore substantial, working relationships between selected technologies and areas related to the preservation of cultural heritage. Here technology is examined and interpreted as an extension of the human at all levels, and is, therefore, a related form of expression. In keeping with conservation/restoration practices, I will draw on materials science for the physical elements that contribute to the instrumentality of the technology as well as the making and interpretation of meaning in context. Since I use case studies[12] and examples to explore the mediating role of technology in human relationships at the multiple levels of the individual, culture and civilization, I refer selectively to perspectives from psychology that are familiar to education, the social sciences, and philosophy in education to develop such areas as self-knowledge and social/cultural interaction. Therefore, the following disciplines will be selected and given varying emphasis in relation to each example and case study in conservation and related areas, according to what I require for its

[11] I refer the reader to the work of Neil Evernden, originator of Studies in Environmental Thought at York University ("The Environmentalist's Dilemma," in Evernden, ed., *The Paradox of Environmentalism* [Toronto: York University, 1984]; *The Social Creation of Nature* [Baltimore: Johns Hopkins University Press, 1992]).

[12] Eisenberg, *The Limits of Reason*, 108-111.

representation and interpretation.

Application of Disciplines

It is important to bear in mind that the following categorization of disciplines is only that -- a categorization, an abstract construction. In lived experience and professional practice, it is generally acknowledged that there is considerable overlap in the ideas, activities, concerns and methods ascribed to each discipline. This overlap will be evident in the following case studies, where various disciplines may be appropriately featured according to the context in which technological activity occurs.

Educational theory informs my research in both general and specific areas: generally speaking, my research emerges from educational theories that perceive learning to be experientially-based[13] and a life-long practice,[14] an activity that takes place within the world at large as well as in the academy.[15] This has supported my case-study approach, which draws on actual life situations for a working knowledge of technology. In this way, technology can be explored in context, as a lived experience. In this environment, technology can also be studied and interpreted as a material object with a system of techniques that synthesize both instrumental and

[13]See John Dewey, *Experience and Education* (New York: Macmillan, 1938) and *Art as Experience* (New York: G.P. Putnam's Sons, 1980]; David Kolb, *Experiential Learning: Experience as the Source of Learning and Development* (Prentice-Hall: Eaglewood Cliffs, New Jersey, 1984).

[14] Alan Thomas, "Creating a Society of Lifelong Learners," *Beyond Education: A New Perspective on Society's Management of Learning* (San Francisco: Jossey-Bass Publishers, 1991), 160-193.

[15] Joel Weiss, notes from lectures, "Learning in Non-School Environments," OISE, University of Toronto, 1992-3.

symbolic relationships.[16] In the particular intersection of technology, educational theory and philosophy,[17] I explore aspects of the nature of the relationship between the individual and the technology. In particular, I interpret the relationship as one that bears meaning and is reflective of a sense of holism,[18] where the meaning that emerges begins to reflect an integration -- or lack of integration -- between body, mind and spirit. The complex interconnectedness implicit in a holistic view appears as a major contributing factor in the unpredictability of human/technology interactions.[19]

Where I focus on the person in technologically-mediated relationships, education-related studies in psychology centre on the individual, and take into account such processes as "the formation and effects of beliefs, desires, intentions," and symbolic representation in technology for example.[20] Within this discipline I draw on object-relations theory, which has been developed in the context of education because of its specific attention to

[16] See, for example: Roland Barthes, *Camera Lucida: Reflections on Photography* (London: Fontana Paperbacks, 1984); Donna Haraway, *Simians, Cyborgs, and Women: The Reinvention of Nature* (New York: Routledge,1991); Derrick de Kerckhove, *The Skin of Culture: Investigating the New Electronic Reality* (Toronto: Somerville House,1995); Marshall McLuhan, *The Gutenburg Galaxy* (Toronto: University of Toronto Press; *Understanding Media : The Extensions of Man*, (New York: The New American Library, 1964]; Marshall McLuhan and Quentin Fiore, *The Medium is the Massage: An Inventory of Effects* (New York: Bantam Books, 1967).

[17] I refer the reader to the work of John. Eisenberg, Ursula Franklin, George Grant, Don Ihde , Harold Innes, Lewis Mumford , David Noble, Neil Postman, Alvin Toffler.

[18] John P. Miller, *The Holistic Teacher* (Toronto: OISE Press, 1993), 14-15. See also Miller, *The Holistic Curriculum* (Toronto: OISE Press, 1993).

[19] Eisenberg, *The Limits of Reason*.

[20] Lucy A. Suchman, *Plans and Situated Actions: The Problem of Hman-Machine Cmmunication* (Cambridge: Cambridge University Press, 1987), 2.

the place of personal interests,[21] art, and technology, and how they are represented in social and cultural relations.

In social studies, the "crucial processes are interactional and circumstantial, located in the relationships among actors, and between actors and their embedding situations."[22] Within social studies, I draw on selected aspects of sociology and cultural studies, including histories of technology.[23] Sociological perspectives also support the subjective component of my research method as discussed in "Methods," below. Sociological perspectives inform my interpretive approach to technology, with further reinforcement in the area of interpretation from studies in cultural history.[24]

The Place of Preservation

In the context of the broader implications for technological thought that these expressive, relational aspects of technology imply, preservation technologies may seem rather specialized and esoteric. In fact, these conservation/restoration tools and techniques are particularly relevant for this study of technology for the following reasons: they engage a deep investment of knowledge across disciplines; they are practised world-wide

[21] See Chapter I, where I discusss the ideas of Morris Eagle, D.W.Winnicott, Christopher Bollas, and Ronald Schenk.

[22] Lucy A. Suchman, *Plans and Situated Actions*, 2.

[23] Tessa Morris-Suzuki, *The Technological Transformation of Japan From the Seventeenth to the Twenty-first Century* (Cambridge: Cambridge University Press, 1994); Shigeru Nakayama, *Academic and Scientific Traditions in China, Japan, and the West*, trans. Jerry Dusenbury (Tokyo: University of Tokyo Press, 1984); Ivan Illich, *In the Mirror of the Past: Lectures and Addresses 1978 -1990* (New York: Marion Boyars, 1992).

[24] Roland Barthes, *Mythologies* (London: Collins, 1973); Donna Haraway, *Simians, Cyborgs, and Women: The Reinvention of Nature* (New York: Routledge, 1991).

in a variety of ways; and they frequently elicit information, directly and indirectly, regarding technological thought at the level of the individual, society and civilization. Environmental knowledge, beliefs, cultural values, thoughts, feelings and perceptions of technology are often revealed during the consideration and use of preservation instruments and technical systems. This is especially true for the cases and examples that follow, where technologies represent a tangible commitment to the care and restoration of highly valued, irreplaceable cultural heritage. As we shall see in the case of Japan, these values may be expressed as being tangible or intangible.

Locating Myself as a Researcher

In Chapter II, I will outline the key components of cultural conservation and restoration for the reader who may not be familiar with this field. In this chapter, I will work on two levels: the personal/experiential, using conservation examples; and the theoretical, grounding the reader in the terms and structures of the conservation field. At this stage of the Introduction, I relate those opportunities in conservation/restoration which guided me to the realization that behind every means there is a meaning -- often many meanings, and rich associations.

Paradoxically, it was my experience of preserving ancient cultural objects that gave me new insights into contemporary inventions, and the nature of our relationships to them. As a result of my experience, this exploration of technology takes place very much in the present, where our knowledge of the past and our intentions for the future converge. There are few fields where this convergence -- and divergence -- are more apparent than in

today's intercultural collaborations in heritage conservation.

Across Canada, I encountered great cultural and environmental diversity during my professional practice as a conservator/restorer of cultural heritage. These experiences engendered an awareness of the strong relationships between people and place. This consciousness was transferable.

When I travelled from the Atlantic to the Pacific Northwest coast, for example, I was prepared to see the art and technology of its First Peoples in relation to their connection with their environment. Colour became more than a decorative element. The earliest red paint that I observed on ceremonial masks and monumental sculpture was a traditional, indigenous material. Tradition tells us, and conservation science confirms, that this pigment was bound with salmon-roe, a real and symbolic essence of life on this coast. [25] Similarly, early black pigments were commonly constituted from carbon, the ground charcoal produced by the wood-fires that warmed shelters, cooked food and illuminated dance and ritual. Where cultural continuity or learning permit such associations to occur, even in such everyday matters as paint technology, the technology is experienced at various levels of consciousness.

I discovered the origins of these materials gradually, as a result of collaborations among individuals from diverse cultures and areas of knowledge. [26] I took this awareness of the relationships among physical

[25] R. Scott Williams, "Northwest coast masks: salmon egg paint unmasks fakes", *The Journal of the Canadian Conservation Institute* (Ottawa: National Museums of Canada, 1980).

[26] Ann Howatt-Krahn, "Field research in the Conservation of Ethnological Collections: An Ecological Approach Applied to Polychrome Monumental Sculpture," *Symposium 86: The Care and Preservation of Ethnological Materials*, ed. R. Barclay et al. (Ottawa, Canadian Conservation Institute, 1986), 156-169.

materials, their origins, and their cumulative cultural meanings as a guide for my subsequent international collaborations.

As a result, my case studies draw extensively from my working knowledge as a conservator. At its best, the interdisciplinary nature of conservation involves the integration of theoretical and applied studies in science, technology, the arts and humanities. This integration can take place at the level of the individual, to varying degrees, and through collaboration among colleagues working in related fields. This interdisciplinary factor was a part of my own preparation for the field, and was refined over twenty-five years of practice. A combination of biology, studio arts, and art history set the stage for my initial conservation studies with Philip R. Ward, formerly of the British Museum, who became the founder and Chief Conservator of the first Conservation Division at a Canadian museum west of Hudson's Bay. His was a formative influence in developing my specialization, which was the care of ethnographic and archaeological subjects in museums, archaeological sites, private collections, and communities.

My initial opportunities in Canada provided a substantial foundation for my later practice and work as a researcher and instructor in conservation across the country, and internationally, in the United States, Egypt, France, Australia, Germany, Denmark, Indonesia and Japan. I am also grateful for the generosity of my colleagues in Canada who have shared their international experience. The fact that Canada is a technologically-advantaged country has been, in my view, one factor in our international participation. This should make us question all the more the implications of our technological interventions and recommendations. Conservator Bob

Barclay, speaking mainly of conservation in Canada, says: "I still believe that what we do here is transmitted, reflected and absorbed by the conservation culture at large. We still do act as a canon in the conduct of heritage conservation world-wide. So what we do here about our local problems will inevitably set a wider standard."[27]

I agree that Canada does have considerable influence internationally, wider than one might expect, given our relatively small contingent of conservators; but I would also say that while we may influence standards, we do not set them beyond our own boundaries. Even more to the point, we still have much to learn about the shaping of Canada's own conservation history, its roots in diverse environments and in the formal and informal preservation practices that continue to emerge within the cultural heritage of the many peoples who have come to this country. We are well placed to learn *of* other nations, and we have much to learn *from* them. For example, we could benefit from China's experience in the management of large-scale archaeological sites, according to conservator Judy Logan.[28]

Barclay's observation regarding the transmission of information through worldwide conservation networks is germane to this research, especially as it implies interdependent relationships on a global scale. This makes it all the more important that we consider carefully the cultural context and implications of our technological advice and choices. These are factors in my understanding of technology in the larger context of globalization and

[27] Bob Barclay, "1997 Per Guldbeck Memorial Lecture," *Canadian Association of Conservators Bulletin* 22, no. 3 (1997): 8.

[28] Judy Logan, Archaeological Conservator, Canadian Conservation Institute, Ottawa. Personal Communication, 1997.

intercultural exchanges in conservation, particularly between Asia and North America.

It is my intention that through this research in technological thought I will be helping to prepare a ground for future dialogues -- dialogues in global studies that move beyond "globalization" as a "political and economic buzzword in the present period, [to] involve a self-reflexive and mutually constituted dialogue between Eastern and Western civilization."[29]

In Chapter III, I present a case study based on a working example from my own professional experience. In this dissertation, I have deliberately given a central place to my own work with stone, singling out a treatment that involved the use of a steel chisel. It was here that I felt strongly my personal connection, as a conservator, to the artisan whose work I was in the process of repairing centuries later. My experience illustrates in a concrete way the "bridge" that technology -- in the form of chisel and stone -- can make.

My approach to knowledge development in this case is experiential.[30] In keeping with its emphasis on the personal, the research method in this chapter is reflexive: I explore my personal process of exploration and discovery through a reconstruction, several years later, of my conservation experience. I apply the instrument of metaform to analyze this experience, and to open it up as a source of new meaning.

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[29] Ruth Hayhoe, *East-West Dialogues in Knowledge and Higher Education*, eds. Ruth Hayhoe and Julia Pan (London: M.E. Sharpe,1996), 6.

[30] John Dewey, *Experience and Education* (New York: Macmillan, 1938).

In Chapter IV, I relocate metaform from its focus on the personal dimension of technological relationships, and apply it instead to the collective level, that is, within the context of culture. At the same time, I select a case study from the field of medicine, in order to exercise and demonstrate the transferability of the concept of metaform across disciplines.

This case involves blood and its related technologies in France, at a time when AIDS victims were confronting the medical establishment and certain practitioners regarding their mishandling of contaminated blood products. Many of the facts and impressions surrounding the case are drawn from a text by Jane Kramer that appeared in the *New Yorker.*[31] I explore and develop this investigation using an analysis informed and expanded by metaform. Metaform is the catalyst for an interpretive exploration of the focus of the technology relevant to this case, namely blood.

In Chapter V, I investigate the case of metallurgist and historian Cyril Stanley Smith. Smith demonstrates, in the course of his work, the significant range and unpredictable nature of technological experience that can be encompassed in one lifetime. My first, brief encounter with Smith was *via* his writing, during my conservation practice. It was only later, through my research for this dissertation, that I came to appreciate how poignantly his life exemplifies the overarching theme of this dissertation, which is the primary significance of attending as fully as possible to the human factor in all of our technological relationships. His engagement with technology lent itself to two critical aspects of our understanding that I intended to study -- that is, the roles of thought and sensibility (in

[31] Jane Kramer, "Letter from Europe: Bad Blood," *The New Yorker* 69, no. 33 (October 1993): 74-95.

relation to intention), and of personal choice in regard to our invention and use of technology.

This chapter focuses on the first of these humanistic elements -- the central role of intention. Here "intention", considered as an extension -- or failure of extension -- of thought, is interpreted broadly as a conceptual parallel to technology, a material extension of the whole person. I examine the first major instance of Smith's stated intentions for his technological research during World War II. My discussion is based on his own comments and those of his contemporaries, including those of his wife, historian Alice Kimball Smith. I apply metaform to the application of his metallurgical research in order to reveal the inherently contradictory and unpredictable nature of his intended technological solution for securing world peace and the actual, long-term result of those intentions.

The second half of Cyril Stanley Smith's life provides us with a distinctly different case. In Chapter VI, drawing on recent interviews and on Smith's own written work, I reveal how Smith was inspired by an example of technology to reach across time and distance, to make a highly significant personal crossing to another civilization. He attributes major professional and personal transformations to this technological encounter, which I amplify and illuminate through the concept of metaform.

Global Context of Study

Throughout these chapters, I will be exploring humanitarian dimensions of technology in the context of globalization. Today's technologies enable us to compress time and space in such a way that our encounters across

cultures are increased.[32] Understood here as the intensification of cross-global contact through various means, globalization clearly increases exposure to technologies across cultures; in the process, technologies have the potential to deepen these encounters -- in positive or negative ways.

A key to realizing this potential for mutually beneficial exchanges in a world of increasing interdependence[33] is a deepened awareness on our part of the complex connections we have, and continue to build, through our technological relationships worldwide.

I conclude by discussing selected implications of technology-as-metaform, including holistic approaches to conservation exchanges at the level of culture and civilization. Particular attention is given to Asia, notably China and Japan. These implications are drawn, in part, from reflections on the key themes of my case studies, and from current international perspectives on transition and technology. Finally, I propose adaptations of holistic theory in education in order to support future exchanges, and to reintegrate humanistic concerns into our concept of technology.

Methodology

Technological thought, like its environmental counterpart, advocates interdisciplinarity for reasons that are both conceptual and instrumental. Conceptually, an interdisciplinary approach to technological inquiry recognizes that technology is playing an increasingly prominent, pervasive and critical role in all areas of human activity. More importantly, our

[32] David Harvey, *The Condition of Post-modernity: An Inquiry into the Origins of Cultural Change* (Cambridge: Blackwell, 1992).

[33] David Glover, "Global Institutions, International Agreements, and Environmental Issues," 277-289.

experience of technological development is causing us to reconsider what it is to be human and whether or not we will even survive as a species on the planet.[34] These fundamental questions are causing deep disruptions in conceptual and relational areas, and in the process are opening up spaces for new formulations in all spheres of human activity, especially where technology is involved. Consequently, we are being urged to open ourselves up to "new ways of seeing,"[35] and new levels of consciousness.[36] This effort often means breaking through -- and going beyond -- the fixed habits of thought that can prevail through the vested interests of a single, conventional discipline. Here I am taking my inspiration from Marshall McLuhan, when thirty years ago he urged that we work to open up our inquiry in technology, and take our concerns into the more global arena of human thought. "The interplay between the old and the new environments creates many problems and confusions. The main obstacle to a clear understanding of . . . [these] effects . . . is our deeply embedded habit of regarding all phenomena from a fixed point of view." [37]

This brings me to the instrumental perspective of interdisciplinarity within the context of of globalization. If we are to address technology as a subject of study across cultures and civilizations, we will have to open up our territory of inquiry in such a way that it is not confined to the categories and disciplinary conventions of the western academy alone. Indeed, this same opening of territory applies in a very tangible way to an expanded awareness of environmental settings for technologies. Where technology is

[34] Paul Goodman, *New Reformation: Notes of a Neolithic Conservative* (New York: Random House, 1970.
[35] John Berger and John Mohr, *Another Way of Telling* (New York: Vintage), 1995.

[36] David Bohm and Mark Edwards, *Changing Consciousness: Exploring the Hidden Source of the Social, Political and Environmental Crises Facing our World* (San Francisco: HarperCollins,1991).

[37] Marshall McLuhan and Quentin Fiore, *The Medium is the Massage: An Inventory of Effects* (New York: Bantam Books, Inc., 1967), 68.

considered holistically, as it is here, it calls for diversity in technological study and research, new conceptual approaches to accommodate and shape them, collaboration, conceptual synthesis, and innovation. The field of technological thought is discussed here as a territory within which I re-conceptualize technological research in relation to Environmental Studies. This holistic, interdisciplinary approach is a response to the urgent need for new insights and appropriate action in the face of complex issues and far-reaching effects of rapid, substantive changes in both these areas of environment and technology.[38] My study of technology in the context of cultural preservation and related fields is offered in support of inclusive, globally-responsive research in education and technology.

The interdisciplinary method is characterized by what Liora Salter refers to as a "multi-modal" approach. Citing Julie Thompson Klein, she elaborates: "The . . . 'solution to maintaining the characteristic flexibility and adaptability of interdisciplinarity is for the researchers to adopt a process of multi modality -- i.e. the use of several different modes of inquiry: theory, history, empirical, work, and so on.' "[39] Since I am exploring various forms of technology, each a creation of human intelligence, this multi-modal approach implicitly recognizes the diversity of "multiple intelligences" that may inform the production, use and study

[38] Dr. Gerald Carrothers, Founding Dean, Faculty of Environmental Studies, York University, Toronto. Personal communication, 1994-5.

[39] Leora Salter and Alison Hearn, "Report to the Social Sciences and Humanities Research Council of Canada on Interdisciplinarity" (Toronto: Social Sciences and Humanities Research Council, 1991), 71. Cited with the permission of L. Salter.

of a given technology.[40] Consequently, each of these modes of inquiry -- theory, history and empirical knowledge -- will be used in combination throughout, as will interpretation, drawing on visualization and imagination. Each mode will be selected, weighted and combined in the best interests of the case study or example under consideration.

On a personal level, interdisciplinarity characterizes my orientation to research, which is guided in this instance by holistic and interpretive aspects, as featured in emergent or naturalistic inquiry.[41] At the centre of holistic studies is an awareness of the interconnectedness of reality -- of relationships: connections are sought between domains of knowledge and experience in an on-going effort toward wholeness, the integration of body, mind and spirit. [42] Indeed, within technological thought, this dissertation is meant to support exactly those connections. The linkages occur first, where I recognize technology as a mediator of human interaction at various levels; and secondly, where I interpret it as an entity that embodies and integrates materials, forms, human skills, thought, emotion and expression. Consequently, interpretation, as the second element of emergent inquiry, is a compatible research mode for the holistic study of technology as I develop it here.

Working in the spirit of McLuhan's observation that it takes an artist to make our technological environment visible, I will draw on imagination,

[40] According to the theory of multiple intelligences, intelligence ("the ability to solve problems, or to create products, that are valued within one or more cultural settings") depends on a wide set of competencies, which may include: "linguistic and logical-mathematical intelligences; musical intelligence; spatial intelligence; bodily-kinesthetic intelligence and two forms of personal intelligence, one directed toward other persons, one directed toward oneself." (Howard Gardner, *Frames of Mind: The Theory of Multiple Intelligences*, *10th Ed.* (New York: HarperCollins, 1993), x-xi

[41] Yvonna S.Lincoln and Egon G. Guba, *Naturalistic Inquiry* (London:Sage Publications, 1978).
[42] Miller, *The Holistic Teacher*, 14-15. See also Miller, *The Holistic Curriculum*.

visualization and reflection for my interpretation, applying these to observations regarding the characteristics of the material component of technologies, while relating these interpretations to documented information. Consequently, this research not only discusses actual case studies and specific examples of technologies; it also draws on metaform as a conceptual device to interpret individual technologies, where they inform relationships, and where they feature prominently in cultural and professional exchanges.[43] By providing these examples of creative, but not arbitrary interpretation, I satisfy the educational goal for metaform, which is to expand our existing understanding of technology by eliciting new perceptions and associations of it, and in the process to recall an awareness of our responses, our own agency, and that of others.

Reflection, as the final mode, is in keeping with this sense of personal agency and responsibility. My research is reflexive in that I draw on and elaborate my own experience and learning, as well as that of others, in the reconstruction of case studies related to conservation. In one case study specifically, and in certain discussions that follow, I make this reflexive, autobiographical dimension explicit. In doing so, I benefit from the example of those environmentalists and social scientists, among others, who are actively demonstrating in their research that "There are ways of reflecting upon and theorising the total experience of fieldwork which cannot be reduced to a set of neo-positivistic techniques. And that would

[43] For discussions of interpretative studies from the social sciences see: Vivian Darroch and Ronald J. Silvers, eds., *Interpretive Human Studies: An Intrduction to Phenomenological Research* (Washington, D.C.: University Press of America, 1982) and Judith Okely and Helen Callaway,eds., *Anthropology and Autobiography* (London: Routledge &Kegan Paul,1992). For interpretative studies in psychology, see C.G. Jung,ed., *Man and his Symbols* (New York: Doubleday,1964) and C.G. Jumg, *Memories, Dreams, Reflections* (New York: Random House, 1961; Vintage, 1989) and Ernesto Spinelli, *The Interpreted World: An Introduction to Phenomenological Psychology* (London: Sage Publications,1989) and Marie-Louise von Franz, *Alchemy: An Introduction to the Symbolism and the Psychology* (Toronto: Inner City Books, 1980). For interpretative studies in archaeology, see Ian Hodder, *Reading the Past: Current Approaches to Interpretation in Archaeology* (New York: Cambridge University Press, 1986).

include autobiographical reflection."[44]

This type of personal reflection or reflexivity in research is increasingly advocated as a remedial measure to balance tendencies toward reductionism, and to challenge the value claims of some scientific interests regarding the general desirability, or even achievability in practice, of intellectual objectivity.[45] At the same time, I take responsibility for those elements of subjectivity in my choice of cases, as well as any emphasis in their analysis and interpretation. In this dissertation many of my insights regarding technology have emerged from my experience as a conservator/restorer of cultural heritage; for this reason, I believe that personal reflexivity is necessary in order that this study be in integrity with its research subject, and that I be respectful of my sources.

At the root of this methodology, as Roland Barthes put it so well, my intention is not "to fill the scene of the text with my individuality; but on the contrary, to offer, to extend this individuality" to an exploration of our subject. [46]

This integrated methodological approach is used in conjunction with empirical research in materials science. In fact, an holistic view of technology -- instruments and actions -- would favour their interpretation

[44] Regarding "total experience," anthropologist Judith Okely states: "Long-term immersion through field work is generally a total experience, demanding all ... (the researcher's) resources: intellectual, physical, emotional, political and intuitive." (Judith Okely, "Anthropology and Autobiography: Participatory experience and embodied knowledge," in Okely and Callaway, eds., *Anthropology and Autobiography*, 8, 10). One could also add spiritual resources.

[45] Nel Noddings, "Gender and the Curriculum," *Handbook of Research on Curriculum* (New York: Macmillan, 1992), 659 - 684.

[46] Roland Barthes, *Camera Lucida: Reflections on Photography* (*La Chambre Claire*), trans. Richard Howard (London: Fontana Paperbacks, 1984),18.

as *situated* phenomena, to borrow a term from Lucy Suchman; that is, each technology can be studied in relation to its various environments.[47] I draw on a number of research processes selectively to demonstrate in an authentic manner how "Theoretical links lie between . . . experiential and embodied knowledge, its continuing resonances and the ultimate printed text."[48] This dissertation is therefore integrative, combining empirical and interpretive approaches to the study of technology as a human activity that is expressive of personal and cultural relationships. Technology as metaform is the unifying element in the chapters that follow.

Strategies

The research strategies I employ in support of this method include: supplying detailed descriptions of the physical materials and technologies involved; providing relevant context as a reference for understanding interpretations of technologically-mediated relationships; profiling new observations/events as they emerge during the course of my research; interviewing those in related fields; and, wherever feasible, presenting the personal experiences of individuals as they have related these themselves in print, interviews and electronic media. I consider this last feature of drawing on original sources -- including the subjects' personal narratives and representations of their own technological and/or cultural experiences -- to be very important for grounding the inferences and

[47] The term "*situated action*" was introduced in specific connection with computational technology by Lucy Suchman; this term is derived from ethnomethodology, and "underscores the view that every course of action depends in essential ways upon its material and social circumstances. Rather than attempting to abstract action away from its circumstances and represent it as a rational plan, the approach is to study how people use their circumstances to achieve intelligent action." It is neither behaviouristic nor mentalistic, while recognizing that "the significance of artifacts and actions, and the methods by which their significance is conveyed, have an essential relationship to their particular, concrete (also 'physical') circumstances." (Suchman, *Plans and Situated Actions*, 49 -50).

[48] Okely, "Anthropology and Autobiography," 24.

interpretive aspects of this research. All of these strategies are meant to explore as closely as possible the essences and origins of human experience as the raw material for a new way of understanding technology -- a way that reunites it with the dynamic personal, human element, and allows for some degree of study in the subject across cultures and civilizations.

Description, visualization, and imagination can also be considered strategies of interpretation. Each of these strategies is part of interpretive practice -- "the activities through which persons understand, organize, and represent experience."[49] Interpretive practice is an acknowledgment, *via* process, of how our experiences and interpretations of technology vary over time and according to historical, cultural and environmental circumstances.[50]

Visualization and imagination are strategies necessary to my implicit educational task as well, which is to bring an artistic sensibility to technological thought. The exercise of the research methods chosen for this dissertation will demonstrate, by example, an holistic mode of inquiry, an alternative to that of a purely theoretical argument based on secondary sources, arranged in the form of hypothesis, argument, proof, conclusion. Instead, by focusing on synthesis, context and original interpretations of technology -- its materials and techniques in action -- my research is

[49] Jaber F. Gubrium and James A. Holstein, "Biographical Work and New Ethnography," in R. Josselson and Amia Lieblich, eds., *Interpreting Experience: The Narrative Study of Lives* (London: Sage Publications, 1995), 3: 47.

[50] Indeed, at the level of individual experience, Ernesto Spinelli has said that "each perceiver constructs a unique 'other' *in each act of perception* ; within the limitations of human experience, our perception of others undergoes continuous (if at times unaccepted or unnoticed) change." (Spinelli, *The Interpreted World: An Introduction to Phenomenological Psychology* (London: Sage Publications, 1989), 72-73). The diversity of experience that follows from this dynamic view of perception also applies to technology. Here technology is both "other", in that it has a form external to us, and at the same time, it is "self", as an extension of ourselves.

guided by the desire to open up Huxley's "doors of perception." Within this context, the use of narrative and description correspond to the expressive style most compatible with this interpretive approach.[51] Description and imagery are also essential for reflecting the rich dimensions of this material. In the field of cultural conservation, for example, such methods can prepare a ground for not just the scientific act of conservation, but also for the quintessentially human act of preservation, the respectful act.

Some final thoughts on method: The research method as described above is congruent with my view of technology as an extension of the human being in all aspects. I have developed a more comprehensive, experientially-based, flexible and holistic model, one that is in keeping with the humanistic, and potentially humanitarian, dimension of technology. As well, as I have indicated in my discussion of environmental studies and educational innovation above, such a multi-modal approach is exceptionally suited to the complex issues of technological exchanges in today's global society.

Frames of Reference for Culture and Context

In regard to the context of heritage conservation/restoration in this research, in practice and in education, I place particular emphasis on cultural and inter-cultural perspectives. Within this context of conservation, particular emphasis is placed on intercultural relations in

[51] To theextent that many of these descriptions " focus upon the 'thing itself'" in order to evoke or to draw on various personal and collective experiences of materials and technologies, they correspond to Don Idhe's "expansive rather than reductionist" views of phenomenology. (Don Ihde, *Sense and Significance* [Pittsburgh: Duquesne University Press,1973),16-17). My approach differs from Ihde's in that I do not attempt a total "suspension of theories which attempt to go behind or under experience". Instead, I believe that it is very important to recognize the mediating, communicative aspects of technology in personal and cultural relationships, including technical exchanges, and I will locate these relational aspects of technology within a theoretical framework.

technology. I am using the term *culture* in its broadest sense, as a shared understanding and experience of a people, based on their distinctive relationships to particular physical and conceptual environments. [52]

The purpose of this research is *not* to analyze and stress difference or diversity for its own sake, or to judge certain preservation technologies as "right" or "wrong". While I do at times engage in comparative studies of different cultural approaches to conservation issues, my purpose goes beyond comparison to discover the deeper motivations and basic human concerns that inform the conservation field, and indeed many other manifestations of our engagement with technology. Diversity enriches this study, but its goal is to seek concrete examples of how the shared, underlying goals of cultural preservation are worked out. It seeks factors that can facilitate complex, inter-cultural technological exchanges. I claim that it is by making common human concerns and behaviours apparent that different approaches are most likely to be accepted for consideration.

[52] My principal sources for my understanding of culture in its broadest sense are psychologist D. W. Winnicott and Jon Lang, cited respectively, as follows: " In using the word 'culture' I am thinking of the inherited tradition. I am thinking of something that is in the common pool of humanity, into which individuals and groups of people may contribute, and from which we may all draw *if we have somewhere to put what we find.*" (D. W. Winnicott, "The Location of Cultural Experience," in *Collected Papers: Through Paediatrics to Psycho-analysis* [London: Tavistock, 1958], 7). "Much of human behaviour is governed by *culture* -- the system of shared attitudes and symbols that characterizes a group of people. The culture of a people is a shared schema that designates regularities in a group's 'thinking and behaviour. Individuals are socialized within a culture, but their behaviour also shapes the culture so that it is not something static, but something that evolves over time. This does not mean that certain values are not held by many cultures, but that each culture is a result of the past efforts of a people to deal with its physical and social environment.

"People can deal with their own cultures in an unconscious manner. As a result of being socialized into a culture, an individual has the ability to know appropriate behaviours. This holds for professional as well as societal cultures." (Jon Lang, "Symbolic Aesthetics in Architecture: Toward a Research Agenda, " in Jack L. Nasar, ed., *Environmental Aesthetics: Theory, Research and Applications* [New York: Cambridge University Press, 1988], 23.)

CHAPTER I

INTRODUCING TECHNOLOGY AS METAFORM: THEORETICAL ROOTS AND WORKING EXAMPLES

"By using a mirror of brass you may see to adjust your cap; by using antiquity as a mirror, you may learn to foresee the rise and fall of Empires."

Li Shih-min (A.D. 597-649) second Emperor of the T'ang Dynasty

"Any theoretical commitment . . . entails the attempt to find reasons to justify one's most deeply felt intuitions about the nature of human life . . . human subjectivity is constituted by a process of mirroring or reflection . . . this process enables the individual to posit an existence of the self."

Peter L. Rudnytsky, 1993

"I Am a Camera."
Christopher Isherwood, 1940

In this chapter I will present a record of my development of the concept of *metaform*. I begin by tracing the genesis of the idea as it emerged during the course of my work as a professional conservator. I proceed to define metaform and to provide a working, contemporary example. I do this at the outset so that the reader encountering metaform for the first time will be able to understand and "exercise" this interpretive device in a "real" situation. Subsequently, I review the theoretical structures that support this conceptual device and relate to recent research in global studies.

My background in art history, studio arts, and ecology informed my work as a conservator; as a result, my approach to the material and technical aspects of cultural heritage was guided by an awareness of the multiple relationships between a preservation subject and its diverse environments. As I became more familiar with the properties of materials, their treatments and their care, my inquiry shifted, and I began to ask, as many have before, what does it mean that we as human beings are impelled to give form to our experience through objects? As I have indicated in the introduction, and as we shall see throughout this work, there are sufficient substantial correspondences between technology and art to invite an interpretation of technology in some of the aspects it shares with art. Related to these correspondences, and of growing interest to me, was the diversity of conservation approaches, and the comparative overview of technology that I was building as a result of my international experiences.

Metaform Defined

In order to explore technology as an expressive medium, I found it necessary to invent *metaform*, a conceptual vehicle for understanding

ourselves in relation to technology -- in particular, I wanted to clarify the way we draw on technology to organize and "make sense" of the environment in which we live. Experienced as metaform, technology is a synthesis: it is at once its material self, grounded, in a physical sense; it also bears meaning. In fact much of the value and potential of metaform rests in our acknowledging these physical, material aspects of technology as rich in meaningful associations. Therefore, in addition to the instrumental function of a particular technology or system of techniques, I investigate their forms and their materials -- their origins, characteristics and selected associations -- as sources of meaning to be interpreted. When taken together, these dynamic aspects of technology present a myriad of combinations which can, in turn, be explored and interpreted to tell us much about ourselves, the world around us, and how we greet each other.

Metaform enables us to investigate technology as a physical medium that has a role in forming cognitive and affective relationships. For technology is first imagined, then created, thus lending itself to interpretation. Regardless of its characteristic utility -- or perhaps because of it -- technology is directly involved in the making of meaningful environments. My intentions for this inquiry become clear when we consider the origin of the word itself: *meta* "denoting change of position or condition, . . . of a higher or second-order kind" from the Greek *with* or *after* ; *form*, "a shape, an arrangement of parts . . . the mode in which a thing exists or manifests itself", from the Latin, *forma*.[53] To consider technology as metaform means that we look at its shape -- how it *is* shaped, that is, how we as humans relate to the making and use of instruments, and (from a "second-order" perspective) how technology shapes *us* in the context of our cultural and

[53] *The Concise Oxford Dictionary of Current English* , ed. R. E. Allen (Oxford :Clarendon Press, 1990), 745, 462.

environmental relationships. We can envision technology in both an instrumental and an interpretive sense.

My term *metaform* is not a figure of speech. It is in contrast to the literary term *metaphor*, which signifies "the application of a name or descriptive term or phrase to an object or action to which it is imaginatively but not literally applicable."[54] The derivation of the term metaphor is from the Greek *metaphora*, which means "transfer," and the key phrase in its definition is "not literally applicable." It is essential to understand that when I interpret a technology as *metaform*, I keep in the forefront its literal, physical existence, which provides the substance for my interpretation. This physical dimension is the key and concrete means for relating it to its context.

Technology viewed as metaform reveals itself to be a phenomenon that is instrumental for practical purposes, yet at the same time is capable of being experienced through the potential meaning that inheres in its materials and related associations. As we shall see, the physical properties and associations that form a technology can be critical elements in shaping their cultural significance. After all, technology is meant to do a real job in a real world. Understood in this way, the meaningful content of technology can be explored in much the same manner as we interpret other forms of human expression.

The Global Express: Metaform at Work

To demonstrate, we can work through the contemporary example of the Global Express, the "flying office" business jet, produced by Bombardier

[54]Ibid., 745.

Inc. Aerospace Group of Canada. It takes a large quantity of concentrated energy to keep this megaton mass airborne. Designed to move a relatively small number of passengers (often eight, maximum fifty) over long distances in a short time, the Global Express travels at .8 of Mach 1, the speed of sound.

A composite of rare and ordinary materials from around the planet, the "flying office" incorporates titanium, aluminium and synthetic silicon, complete with a "glass cockpit" of computer screens and satellite communications options. From stem to stern the body is an international assemblage -- wings and centre fuselage from Japan; flight controls from Montreal; forward fuselage from Belfast, Ireland; tail fins and landing gear from Toronto; navigational electronics and flight systems from the U.S.; tail cone from France; and finally, BMW/Rolls Royce jet engines from Germany.

This physical and geopolitical diversity of materials and components in the "flying office" invites us to interpret it as metaform. That is to say, through the process of "getting to know" the subject in terms of its physical composition and its associations, we can extend our understanding of it into other contexts, such as social, political, environmental and economic, as well as philosophical and historical areas. Using the metaform approach, we can identify and analyze key aspects of this technology in a way that prompts us to consider the associated non-technical implications of the Global Express.

For example, in the context of emerging transnational alliances, one telling aspect of globalized production becomes apparent at the working level. Bombardier Engineer David Granville recognized that the fitting of the

various components could be "tricky" in more ways than one.[55] Not only does it require special attention to bond the physical sections; it also takes skill and commitment to co-ordinate the corresponding diversity in cultural approaches to production and communication. The "flow of work" has to be based on a uniform system, and "on time" is a critical factor "because exponentially things can go out of whack." In this highly competitive industry, *Bombardier* prides itself on being "on time", according to a system that "can't afford anyone to be late -- no excuses, no delays -- work everyone as hard as you can." As Granville explains, "a system doesn't recognize a human. I've been called Captain Kirk by my people." Other partners, he acknowledges, may favour "a human factor worked into a system."

This is the human factor within the "stellar strategy", "high standards", and "dazzling" success of Bombardier, as reported in Time Magazine's "Companies that Take on the World: The Highest Flyer." Voted by Canadian executives as the country's most respected corporation two years in a row, Bombardier's corporate philosophy is: "To be a leader, you need to be a leader in the world."[56]

Clearly, there are many other dimensions of this jet that we could explore. For instance, it would be no surprise to learn that the cost of such aeronautical sophistication is high. This "flying office" is in fact thirty million dollars "green" -- that is, coated with primer only, without the final, custom paint job, interior seats or furnishings, such as showers and hardwood floors. The clients, actual and potential, include Kelloggs, Toyota,

[55] David Granville, Global Express Engineering, Bombardier deHavilland Inc. Personal communication, Toronto, 1997.

[56] Linda Gyulai, "Companies that Take on the World: The Highest Flyer," *Time Magazine* (28 April, 1997): 39-40.

and a sultan -- "multi-nationals and millionaires," according to Granville.

As metaform, the Global Express takes on many dimensions. Sherry Turkel, writing of the psychological and anthropological dimensions of computers, supports this understanding of technology when she says:"We ask not just about where we stand in nature, but about where we stand in the world of artifact."[57] Indeed, when technology as an extension of ourselves becomes an intrusion or a point of intersection with other boundaries (e.g. personal, physical, imaginal), we encounter our own limitations, and the "other", by which we redefine, recognize, ourselves. "We search for a link between who we are and what we have made, between who we are and what we might create, between who we are and what, through our *intimacy* with our own creations, we might become" [my emphasis]. [58]

We know beyond a doubt that human decisions in our choice and use of technology are major factors in the global deterioration of our environment, health and heritage. The keys to transforming this volatile situation are not to be found in technological remedies alone -- yet another "technological fix" -- but in bringing environmental and human concerns into balance. A key factor in bringing about this balance will be learning what technology means to us at the very basic level of personal and cultural relationships. What is the nature of this technological link? As we shall see, the concept of technology as metaform is one way of understanding and representing how we mediate these relationships. This

[57] Sherry Turkel, *The Second Self: Computers and the Human Spirit* (New York: Simon and Schuster, 1984), 12.

[58] Ibid.

is where metaform can take us.

Metaform, Theory, and Interpretive Studies in Technology

In the Flying Office, we have one example of technological response to intense and rapid changes in the culture of global economics, specifically at the level of privilege and multinational corporations. This example reflects the way technology, as an extension of ourselves, is one important manifestation of our need to reach across the unknown to make a successful transition during unfamiliar circumstances. This shift in circumstances may be initiated as a result of external conditions, or by our own internal conditions and altered perceptions. There are different ways of resolving or transcending the ensuing dynamic tension. Sometimes the transition is based on a calculated connection; at other times, it is a leap of faith -- and imagination. Once we acknowledge this tendency to depend on technology as a means of responding to change, we can draw on a number of disciplines to expand our awareness of our participation in technology, and to recognize it as a phenomenon of human relatedness . . . for good and for ill.

Anticipating philosopher George Grant's experience of technology as a new form of being, Marshall McLuhan described the pervasive, yet relatively unexamined, presence of technology as "the fish in water" phenomenon.[59] Writing in the1960s, with a focus on communications, print technology and electronic media, McLuhan maintained that technology is an environment that we take for granted. In particular, McLuhan claimed that media, as technologies, are invisible environments, forming the matrix of experience

[59] Marshall McLuhan and Quentin Fiore, *The Medium is the Massage*, 68.

that influences our lives. What he wrote is worth repeating in this context: "Environments are not passive wrappings, but are, rather, active processes, which are invisible. The groundrules, pervasive structure, and over-all patterns of environments elude easy perception . . . The interplay between the old and the new environments creates many problems and confusions. The main obstacle to a clear understanding of . . . [these] effects . . . is our deeply embedded habit of regarding all phenomena from a fixed point of view."[60]

It is highly significant that when McLuhan spoke of "gaining perspective," for example, he framed it in terms of psychology. He described this activity as "a psychological process [that] derives unconsciously from print technology."[61] This statement suggests to me that the fear he expressed for technology arose from his belief that it was affecting us at the level of the unconscious; in other words, that technology as environment was an updated version of environmental determinism. In discussions that follow, I shall present alternative psychological views of the role of technology, where the person is regarded as an active agent, not only as a passive recipient, in the human/technology dynamic. Equally important, in this view, the technological relationship is seen as being accessible to conscious examination (at least to the extent that any of our actions are accessible to our awareness); discrimination; and judgment in related decisions and actions. Metaform has a constructive, humanitarian role to play in making the human dimension of technology accessible, and in retrieving our sense of agency.

We cannot start too soon. Bearing in mind environmental hazards such as

[60] Marshall McLuhan and Quentin Fiore, *The Medium is the Massage*, 68.
[61] Ibid.

nuclear waste, industrial and domestic pollution, we can no longer afford to regard technology from a "fixed point of view" shaped by unexamined cultural conventions or personal attitudes. These "habits of thought" -- both in theory and in practice -- restrict our participation in technology to a narrow focus and a one-dimensional, functional quality of conscious engagement. A result is often a distortion of technology in the sense that our instruments begin to work against the very purposes they were intended to serve. Meanwhile, we are missing the rich potential, inherent in our inventions, for extracting key experiences that inspire us to acts of humanity.

McLuhan's solution to this situation was to enlist the artistic imagination. Artists, he said, are needed to reveal the nature of our inventions. His focus, however, was on an elaboration and diversification of the senses, to rebalance what he perceived as a narrowly visual culture. As well, he was hopeful for what he envisioned as an impulse to a global community, an alternative to isolated individual consciousness. In contrast, through metaform, I advocate a more holistic engagement with technology -- one that would integrate psyche and soma at the individual level for a more conscious awareness of our interaction with technology. Inevitably, as we shall see, each one of us engages with, and is affected by, technology in this way. We are simply not aware of it.

Interpreting Technology: Metaform and Integration

To interpret technology, to read its expressive, albeit often latent, dimension, amplifies our understanding of it as it mediates our personal and collective connections to physical and conceptual environments. In this regard, one of the distinguishing characteristics of

technology -- in contrast to written texts *about* technology -- is the relevance and import of its specific physical dimension. [62] My interpretation of technology places significant emphasis on this physical dimension and our experience of it.

With regard to interpretation, my work is a radical departure from that of philosopher and semiotician Roland Barthes in two important respects. First, Barthes proposed a "science of forms" and developed a series of terms to facilitate symbolic equations.[63] Rather than restrict interpretation to a fixed system, my project is to open it up, to acknowledge interpretation of phenomena as an act guided by multiple relationships. Secondly, and this is most important, Barthes decried "realism" in the making of meaning: "The danger," he said, "is to consider forms as ambiguous objects, half-form and half-substance, to endow form with a substance of form. . . .Here I am, before the sea; it is true that it bears no message. But on the beach, what material for semiology! Flags, slogans, signals. . . which are so many messages to me."[64]

By limiting his meaningful world to artifact alone, Barthes isolates himself from the meaningful experience of physical nature, thereby cutting himself off from a rich heritage and enduring source of symbolic life for the human being. I consider the physical aspects of phenomena essential to reintegrating those constellations of meaning that recognize the person as a whole -- body and soul, psyche and soma. By physical, I mean the physical dimension of whatever is under consideration, its material *being* -

[62] Morris Berman, *Coming to Our Senses: Body and Spirit in the Hidden History of the West* (New York: Simon and Schuster, 1989; Bantam, 1990).

[63] Roland Barthes, *Mythologies*, trans. Annette Lavers (London: Jonathan Cape, 1972; Paladin, 1973), 120.

[64] Ibid., 121.

- as it is by itself, before the human conceptualization or interpretation that we bring to it at any one time. Imagine Barthes at the beach. He arrives with his experience and expectations of that place where water and sand move against each other. He remembers it as placid, perhaps, even boring. But if a gale strikes, will he be unmoved?[65]

Returning to our previous example of the "Flying Office," on many levels, physical relationships were significant to our interpretation. The escape that this jet makes away from earth's gravity, and the height that it achieves in relation to the everyday life of "ordinary citizens" could easily reinforce any tendency on the part of its regular passengers to the delusion that they will be immune from the environmental consequences of unchecked industrialization and consumption. For others, like the team of Bernard Kouchner, founder of *Médecins Frontiers* (Doctors Without Borders), and photographer Yann Arthus-Bertrand, flying affords an opportunity actually to seek out alternative views, to capture on film, in full view from the air, the sprawling compounds and conditions of the world's disadvantaged, in order to bring potential supporters closer to this reality.[66]

My perspective represents a basic departure from the thinking of some contemporary scholars who maintain that the physical, material reality of technology is irrelevant to an understanding of our relationship with it, in

[65] Interestingly enough, in his later analysis of a "Japan of his own devising", without recourse to a shared spoken language, Barthes did come to analyse the physical: "To make a date (by gestures, drawings on paper, proper names) may take an hour, but during that hour, for a message which would be abolished in an instant if it were to be spoken, ... it is the other's entire body which has been known, savoured, received, and which has displayed (to no real purpose), its own narrative, its own text." (Roland Barthes, *Empire of Signs*, trans. Richard Howard (New York: Farrar, Strauss & Giroux, 1982; Noonday Press,1989),10).

[66] Bernard Kouchner, "Man and His World / Terre des Hommes," *enRoute* (Outremont, Quebec) August 1997, 38 - 47.

such areas as economics, for example. Ray Rogers, professor and author in Environmental Thought, is one who adheres to this view, when he says to his students, "The materials are not important. Look at the relationships."[67] As he explains it, the rationale for his approach has less to do with the irrelevance of materials *per se* than it does with the fact that the material origins and workings of technology have, in his view, been made "invisible."

I raise this issue of technological opacity because it relates to our perception of intentionality, which will be discussed in Chapter 5, and because it may be seen to challenge the utility of metaform. While it is not my task to apply metaform to computers at this time -- there are other technologies I will explore, of equal interest and of greater relevance to my experience -- our perception of "computational artifacts" presents a typical example of this apparent mystification of our technologies. According to Lucy Suchman, "the internal complexity and opacity of the computer" makes its overall behaviour "indescribable. . . To refer to the behaviour of the machine, then, one must speak of 'its' functionality. And once reified as an entity, the inclination to ascribe actions to the entity rather than to the parts is irresistible."[68] A next step could be to impart intentionality to this machine, whereby we see ourselves in an "interactive" relationship to it. In this instance, it becomes clear that despite one's philosophical position in regard to human agency, it is our lived, taken-for-granted responses and experience of certain technologies that can shape our ways of relating to them. In this case, it requires a conscious effort on our part to adjust our perceptions of these instruments, and to regain a person-

[67] Ray Rogers, personal communication, Faculty of Environmental Studies, York University. October, 1997.

[68] Suchman, *Plans and Situated Actions*, 15-16.

based sense of agency in our relationship with them. To locate a theoretical source and ground of action for metaform, we will want to consider various perspectives regarding technological "membership."

Re/membering Technology: Concepts of Relationship and Reclamation

Certainly technologies present new opportunities for experience and the raw material for thought and action. Still, it falls to the person in society to grasp and actualize this potential. Indeed, it is this issue of human awareness and responsibility that is at the heart of any understanding of human-technology interactions. This is what I intend to express through the concept of "re/membering" technology -- returning people to their place as conscious agents and users of technology. I advocate that it is essential for our individual well-being and that of the earth community to *attend* to the associations and extensions of technology beyond the tool aspect.

This re-humanizing of technology requires a thoughtful, persistent effort in any culture that anthropomorphizes technology and speaks of it as an agent, as "having a life of its own." For example, in our manner of speaking we often ascribe agency to technology, as in, "T. V. is destroying our children's brains!" This splitting off of technology as an independent entity may be symptomatic of our failure to recognize fully, and to account for, our intimate relationship with our own inventions.[69]

[69] In relation to McLuhan's focus on communications, media literacy programs support a sense of agency and discrimination in students by providing them with the means of production for public media through writing, media criticism, and creation of their own versions of events in video and other media. This approach was advocated and developed for Ontario Secondary Schools by educator Barry Duncan in cooperation with colleagues and the Ministry of Education for Ontario, 1989.

In this context of re/membering or humanizing technology, imagination is a responsible act, whether it is applied to interpretation or invention. As we shall see, imagination can never overcome the unpredictable consequences of our inventions, given the complexity of nature in the long term, including the influence of "human nature" and the human factor which is ultimately unpredictable. However, at times, our use of imagination can significantly moderate these unexpected outcomes and regain for us a greater sense of agency and discrimination regarding our intentions and choices. Without imagination we are doomed to learn through direct experience alone, and our technological capabilities are such that the planet may not endure our learning "the hard way".

Perspectives

In locating the human sources of potential problems and solutions, scholars and critics tend to do so according to their disciplines: for example, some tend to an emphasis on the collective, others to the individual.

It was out of such concern for what he saw in 1969 as a world that is "overtechnologized and wrongly technologized," that social critic Paul Goodman provided an historical perspective of the relation between philosophy and technology in Europe, tracing their progress from the high Middle Ages, when "Arts and crafts technology were, like all other activities, personal, moral, and responsible," and beyond, into the "continual useful cooperation between experimental natural science and practical arts and crafts, constituting scientific technology."

In 20th-century post-war America, however, Goodman observed that

"scientific technology, linked with basic research in the universities and corporations, is in the ambiguous situation that as a science it can pretend to be value-neutral, although it is directed to war and expanding the gross national product." In protest he advocated this "reconstruction": "Technology is a branch of moral philosophy, with the criteria of prudence, efficiency, concern for remote effects, safety, amenity, perspicuity and repairability of machines, caution about interlocking (technologies), priorities determined by broad social needs."[70] Goodman discusses technology and morality in the context of social criticism, cites disruptions in relationships that occur between generations, and searches for solutions in education at the institutional or collective level. [71]

Psychiatrist and psychoanalyst Carl Jung, on the other hand, locates the source of technologically-related problems and their potential solutions in the individual: "The destructive power of our weapons has increased beyond all measure, and this forces a psychological question on mankind: Is the mental and moral condition of the men who decide on the use of these weapons equal to the enormity of the possible consequences?" [72] Jung examines contemporary technological issues in the context of adult psychology, and looks to the psychological development of the individual as the necessary source of thoughtful action: " 'Society' is nothing more than a term, a concept for the symbiosis of a group of human beings. A concept is not a carrier of life. The sole and natural carrier of life is the

[70] Goodman, *New Reformation: Notes of a Neolitihic Conservative*), 43, 39 , 40, 43 , 44.

[71] It is interesting in relation to my dissertation that he sees the potential for common bonds in a shared commitment to a technological task, albeit a secular example of technological preservation: "Yet people who will not talk to one another can get together by working on a useful job that they both care about, like fixing the car." (Goodman, *New Reformation*, 208).

[72] C.G Jung, "Introduction: The Fight with the Shadow," in *Essays on Contemporary Events: The Psychology of Nazism*, trans. R. F. C. Hull (Princeton: Princeton University Press, 1989), 1-9, 9.

individual, and that is so throughout nature."[73]

Where do we look for the links between the polarized constructions of individual and society these views suggest? Media analyst and educator Neil Postman comes close when he notes the connection between the person and the *idea* that technology represents: "Technology is always an idea disguised as a piece of machinery," and he elaborates: "A technology which begins by giving us access to new facts about the world may end by creating new ideas about the world. Discovering the unseen world of remote stars and the secret presence of intimate microbes is not merely a matter of acquiring new sense data. Such a discovery leads to a reconceptualisation of what there is to see, how things might be seen, and what there is to know. . . In extending the scope of our senses, a technology extends the scope of our imagination."[74] Postman recognizes human agency in the "idea" as the prime generator of technology, as well as the material components; at the same time he acknowledges how the characteristics of the technology itself enhance the relationship by providing access to new sources of discovery. In other words, he suggests a mediating role for technology rather than a deterministic role, in learning and imagination. As well, he recognizes how technology can mediate between a person and interests, between a person and other forms of life in the environment. Similarly, technology also connects individuals to each other on the levels of culture and civilization.

[73] Ibid., 37.

[74] Neil Postman, *Teaching as a Conserving Activity* (New York: Delacorte Press, 1979), 186-187.

Mediating Relationships: Psychological Perspectives on Technology as Interest, Object and Meaning

As we have seen, if we are to respect the complexity of any form of technology, we need to consider not only its intended purposes on a functional level, but also its multiple connections and associations with other dimensions of human experience. In the Western worldview, for example, there is an open acknowledgement that technology has endured as a defining element of human culture and development -- to wit, Stone Age, Iron Age, Atomic Age. Paradoxically, we rarely appreciate that when we are participating in technology, we are participating on many levels. In fact, there are emerging indications that a substantial share of our *interest* in, and involvement with, technology may be involuntary, and prompted by deeper motives -- and habits -- than we recognize.

Educational psychologist Morris Eagle has explained that our "interests are always embedded in the instinctual-affective matrix of object relations." [75] He makes it clear that here "object relations" refers to "characteristic ways of relating to animate and inanimate objects in the world."[76]

Eagle credits the source of these theories -- with their connections to education, art and culture -- to the research of psychiatrist and paediatrician, Donald Winnicott.[77] Winnicott studied the processes whereby people (as "subjects") individually and collectively experience union with, and separation from, the persons and environments ("objects") with which they live. Often these processes reflected significant

[75] Morris Eagle, "Interests as Object Relations," *Psychoanalysis and Contemporary Thought* 4, no. 4 (1981): 555.

[76] Ibid., 560.

transformations in the subjects, which in turn influenced their responses to previous and new relationships. Frequently new linkages were accomplished by means of a "found" or created "object," meaning either a material "object" or other person(s) with whom the subject -- child or adult -- had formed a connection.

Winnicott identified three distinct areas of this interaction: 1) the "inner or personal psychic reality," 2) "the actual world with the individual living in it," and 3) the "transitional space" between the two. Here at the junction of the "me" and the "not me" are "phenomena of infinite variability."[78] In the child, these phenomena manifest as "play, which expands into creative living and into the whole cultural life of man."[79] This transitional zone links cultural experience to both imagination and relationships.

For Winnicott, *culture* was a form of experience related to "inherited tradition". More than this, he located a psychological "place" for culture that recognized its potential beyond that of a strictly instinctual mechanism, say for defence, or a "diversion of sexual aims to 'higher pursuits,'" as Freud would have it.[80] Winnicott saw culture and its creations as an integral and natural aspect of healthy living -- one which, through oral history for example, supported a shared human experience recorded "in the myths that were a product of oral tradition . . . a cultural pool giving the history of human culture spanning six thousand years. This history through myth persists," he claimed, "to the present time . . . (in

[78] D.W. Winnicott, " The Location of Cultural Experience," in Peter L. Rudnytsky ed., *Transitional Objects and Potential Spaces: Literary Uses of D. W. Winnicott* (New York: Columbia University Press, 1993), 6.
[79] Ibid., 10.

[80] Eagle, "Interests as Object Relations," 529.

spite of the efforts of historians to be objective, which they can never be, though they must try)."[81] Winnicott's thinking has been successfully applied across disciplines, including education. It is particularly relevant in the present context since he recognized that "It is these cultural experiences that provide the continuity in the human race that transcends personal experience."[82]

By recognizing the critical role of transitional or cultural objects -- including imagined and material phenomena -- Winnicott paved the way for technology to be similarly understood and interpreted as a transitional phenomenon in the context of relationships. With this latent dimension of technology in mind, it will become clear that cultural exchanges in technology have as much to do with *meaning* and expression as they do with pragmatism and instrumentation.

It is necessary at this point to ask what we understand by meaning. *Meaning* here may be taken to denote significance, either intended or not, but actually expressed and present to the responsive person. This meaning is latent in the subject in view, and may be experienced differently according to personal and cultural perceptions. These perceptions will be informed by diverse experiences of what is shared in the human condition -- love, fear, anger, grief, worry, joy.

Meaning can be expressed in a variety of ways, and not all meaning is symbolic. By *symbol* I mean "something that stands for, represents, or denotes something else; *esp. a material object representing or taken to*

[81] Winnicott, "The Location of Cultural Experience," 7.

[82] Ibid., 8.

represent something immaterial or abstract, as a being, idea, quality, or condition."[83] In some cultures, there is no gap between the material subject, physical act or gesture, and its meaning; that is to say, the subject or act itself is *experienced as* its meaning; it does not represent anything else. Take, for example, this case among certain Navajo.

For the traditional Navajo "There is no symbolic representation, no metaphysical move from signifier to signified . . . the question, 'What does it mean?', is itself meaningless."[84] This was the conclusion reached by Ronald Schenk, a psychologist and analyst who lived and worked with the Navajo for four years. He observed that traditional Navajo individuals understand the world directly from the appearance of the thing and from the "complex of meaning inherent in the thing itself," rather than drawing on "systems of derived meaning." He cites an example from personal experience that serves to illustrate clearly the cultural differences that can surround the concept of symbolism.

> I was talking to a singer (shaman) one day and he made mention of his grandfather. I inquired further about his grandfather and the man said, "I have him right here." He then pulled out his pouch of sacred objects and showed me a feather his grandfather had given him. In a way that I cannot fully comprehend . . . the feather *was* his grandfather just as much as his grandfather's flesh-and-blood being. When the singer paints a god, it *is* the god. What we call "symbol" is, to the Navajo, the *thing itself.* The very notions of "symbol" . . . are Western and not Navajo.[85]

While Schenk was able to acquire and relate this experience with the

[83] *The Compact Edition of the Oxford English Dictionary*: (Oxford: Oxford University Press, 1971), Vol. II, 3206.

[84] Ronald Schenk, "Navajo Healing: Aesthetics as Healer," *Psychological Perspectives* (Los Angeles: C.G. Jung Institute of L.A.) 19/20, no. 2 (fall-winter 1988): 222 - 40, 230.

[85] Schenk, "Navajo Healing: Aesthetics as Healer," 230.

permission of the Navajo, he stated clearly that he could not understand it fully. At best, he could say that for the traditional Navajo there is no gap between experience and meaning. Objects complete the passage across liminal zones that separate and join different dimensions of experience.

In an interpretive study, psychologist and educator Vivian Darroch-Lozowski describes what for her was a moving, transformative experience. In this article, she shifts her attention from the object or source of the experience to focus on the nature of the experience itself. For Darroch-Lozowski, hermeneutics is weighted "on the side of feeling-- 'feelings [not as] isolated impulses but [as] structured evidence of reality, namely the interaction of the organism/environment field, for which there is no other direct evidence except feeling.'"[86] The experience was a "body-felt consciousness."

Body-felt consciousness is often part of the technological experience, a valuable and revealing part. While this consciousness does not easily lend itself to articulation, it is recognized nonetheless as being highly significant, both as a form of intelligence,[87] and as a "way of knowing" in many areas of life generally, and in specific fields, such as conservation/restoration.

Working within my own culture, I find it difficult to express those experiences that seem beyond words. In time I have come to learn that this situation both reveals the inherent limitations of language and at the same time illuminates the mystery within lived experience.

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[86] Vivian Darroch-Lozowski, "Initiation in hermeneutics: An illustration through the mother-and-daughter archetype," *Human Studies* 13 (1990): 245.

[87] Gardner, *Multiple Intelligences*.

Beyond Words: Living with Technology as Experience

In Japan this "experience beyond words" is culturally honoured and integrated into the transmission of knowledge and skills, such as certain restoration practices. In many instances this learning "beyond words" is embodied, as in the spirit and practice of Zen Buddhism. [88] For example, Oka Iwataro, the internationally recognized master of paper conservation in Kyoto, Japan, advises that in order for aspiring conservators of Japanese materials to learn about restoration, there is no substitute for learning directly on site in Japan. [89] Here method, materials and meaning blend. The synthesis is cultivated not through conservation practices alone, but by introduction to other areas of culture which find their continuity in landscape and architecture, and in the aesthetics and protocol of the tea ceremony. In terms of technical systems and instruments, in addition to the most advanced contemporary technologies, conservators-in-training use traditional, indigenous tools and techniques. Being immersed in this cultural and technological environment, conservator/restorers learn through osmosis and directly through example and practice. In contrast, in North America, we tend not to acknowledge or articulate such "experience beyond words" when it comes to learning with and through technology. To varying degrees, in both Asia and the West, technology often emerges from -- and is seen to act from -- that gap between our experience and our intentions, conscious and otherwise, toward our social and physical environments.

At first it may seem ironic to many of today's educators who feel pressed up against the wall of pragmatism, that the closest we may come to

[88] Daisetz T. Suzuki, *Zen and Japanese Culture* (Princeton, NJ: Princeton University Press, 1959).

[89] Iwataro Oka, personal communication, Vancouver, Canada, June, 1996.

articulating this uncharted aspect of technology, an emphatically practical presence in the world today, is through Christopher Bollas's description of the aesthetic moment. We will, however, encounter aesthetics later, in Chapter 5, where it played a prominent role in the technological thought and work of a prominent historian/scientist and conservation educator, even in one of the world's most formidable inventions. But, to return to Bollas' description :

> The aesthetic moment constitutes this deep rapport between subject and object and provides the person with a generative illusion of fitting with an object, evoking an existential memory. Existential, as opposed to cognitive, memory is conveyed not through visual or abstract thinking, but through the effects of being. Such moments feel familiar, uncanny, sacred, reverential, and outside cognitive coherence . . . [An aesthetic moment] speaks to that part of us where the experience of rapport with the other [90] was the essence of being.[91]

This description of the aesthetic moment connects with the sense of immediacy that was suggested in the context of traditional Navajo healing and ritual practice, where the transition from illness to wellness was accomplished, in part, through cultural objects and gestures. It is also evocative of Darroch-Lozowski's body-consciousness. What these forms of consciousness imply for technology as metaform is this: that technology, as an object and/or technique, can be experienced at various levels of consciousness, some of which (as in the case of body-consciousness), while not easily articulated, are recognized as meaningful at a profound level;

[90] One can take "other" in this case to mean not only a significant person, as in "mater," but also "matter" i.e. environment. (Theodore Roszak, *The Voice of the Earth: An Exploration of Ecopsychology* London: Simon & Schuster, 1992).

[91] Christopher Bollas,"The Aesthetic Moment and the Search for Transformation," in Peter L. Rudnytsky, ed., *Transitional Objects and Potential Spaces: Literary Uses of D.W. Winnicott* (New York: Columbia University Press, 1993), 40.

this meaning can be communicated. The experience can be transformative.

Indeed, as Winnicott and Eagle explain, material objects, creative imagination and interests are often the individual and cultural means of navigating change -- of making a safe passage through the liminal zones, the transitional areas where, for example,we negotiate separation and union. Considered this way, personal and cultural objects -- including technologies -- can evoke strong feelings and powerful associations that help to structure the chaos of the passage, and reinforce the opening of one door and the closing of others.

Seen in this light, we can see why Bollas describes the search for the "aesthetic object" as a quest for what he calls the *transformational object*, which "promises . . . an experience where the unintegrations of self find integrations through the form provided" by it.[92] Among those phenomena that can be directly instrumental in completing one's sense of self, he specifically includes an example of technology.

> . . . . the search for this transformational object is an endless memorial search for something in the future that rests in the past. [93] I believe that if we investigate many types of object relating we will discover that the subject is seeking the transformational object . . . to metamorphose the self. On a transcendental plane, we believe in God, or we fall in love; on an empirical plane, we look for that ideal home, or job, or car because we hope to achieve reunion with an object that will transform our internal and external realities. [94]

Clearly we see that this urge toward wholeness will vary according to

[92] Bollas, "Aesthetic Moment," 41.

[93] Bollas relates this "past" to the "maternal aesthetic" (46), although it may also be considered in the context of Winnicott's "holding environment" in Winnicott, "The Location of Cultural Experience," 85.

[94] Ibid., 46.

individual aspirations and cultural values. Of particular relevance to my research is the prominent role that Bollas ascribes in this process to an example of technology -- a car. Moreover, his use of the term "transformation" is noteworthy for what it reveals about the profound implications of our living with, and through, technology. His choice of transformation, as opposed to change, suggests a process that is qualitatively distinct from a simple interpenetration of phenomena. The potential for transformation gives us a way of understanding not only advanced technologies, but the significance of shifts that may occur in human relationships and a complex environment, where these are mediated by technology.

Inherent in this process is the potential for continuity and discontinuity in the crossing to unfamiliar regions. In either case, it is the manner of crossing, the bridging that matters. It is characteristic of human endeavour to seek to extend ourselves, to construct or destroy bridges, according to our perceptions of changing circumstances. At best, the bridging process can be transformative in a positive way, applying the technological potential to the benefit of individual and society alike. At worst, technology may be an ill-considered or " 'primitive' defence. . . organised to defend against a repetition of . . . anxiety, or a return of the acute . . . state that belongs to disintegration of . . . structure." [95] We shall see a concrete example of this behaviour when we examine the case of collective or mass technologies.

Traversing Technological Opacity

Because technology increasingly pervades our daily interactions with our

[95] Winnicott, "The Location of Cultural Experience," 5.

environment, it is all the more urgent for us to recognize first, with awareness, that *we* use technology, rather than it using us, as McLuhan would have it. Secondly, metaform, with its emphasis on technology as mediator, asks us *how* we use our inventions, tools and instruments to engage with the world. What do they mean? What are the advantages? Disadvantages? Costs?

In the so-called "technological civilizations," we are so occupied with having to adapt to technological changes as an integral part of our settings that its compressed, accumulated "layers" of development have made its origins in human thought and nature's substance difficult to retrieve. Difficult, but not always impossible. It takes time. In our present environmental and political circumstances, it will take time to make time. Like the fast-forward on a sound tape, the very rate of change has obscured the *role* of technology in the dialogue between the person and his place. Technology also infiltrates the dialogue at source, that is, where meaning is created and registered within the individual. Where the individual connects to "outer" realities, McLuhan envisioned a global village woven together by media. There is equally the potential in the same media for mass delusion, radical disruption and cultural discontinuity. Both possibilities exist on the larger scale of collective dialogues, both among diverse cultures and between civilizations. Preservation at the most fundamental, radical level, requires that we prepare the human for these vast capabilities.

As object-relations theory has demonstrated, and others have shown, technology is a critical link in a variety of human relationships. The issue is that in many ways, technology functions on a material/symbolic wave-

length overlooked by analytical and interpretive approaches that stress the abstract, to the detriment of a holistic technological consciousness on our part. To acknowledge materials as symbolic does not compromise theoretical analysis in this case; this acknowledgement enhances it, as we shall see. I maintain that using metaform as a conceptual device we can, with relatively little effort, begin by making the materials and origins of our technologies visible -- and that it can enrich our research and practice to do so.

By moving from our fixed point of view, by using our senses, our natural curiosity, and imagination, we can reclaim our sense of agency and our comprehension in the technological environment. Even the phenomenon of technological opacity -- such as the invisible, undercover machinations of the computerized navigational system in the Flying Office -- is itself a "ground" to be acknowledged and interpreted. I am reminded in this instance of the way space defines a figure in a traditional brush-painting in China and Japan. This Asian perception of the relationship between positive and negative forms provides us with an alternative way of engaging with phenomena, and in doing so raises the subject of educating for technological literacy by learning from a variety of cultural perspectives. As a North American, McLuhan himself recognized in Asia a source of new insights, particularly in connection with the artistic perspective as a way of gaining new access to understanding through alternative ways of seeing: "The art and poetry of Zen create involvement by means of the *interval*, not by the *connection* used in the visually organized Western world. Spectator becomes artist in oriental art because he must supply all the connections."[96] And it is by supplying even *some* of the connections that we become more conscious of our technological

[96] Marshall McLuhan, *Understanding Media.*, viii.

environment.

There is new ground to be recovered here, not only in our "high-tech" instruments; we have much to discover from technologies of the past, the tools and instruments that we have used -- and perhaps forgotten -- to shape our histories and to connect with the world at large. What is required to retrieve this information is commitment and an appreciation of the new insights into knowledge that international exchanges offer.

Certainly many transnational corporations are making it their business to investigate materials and their origins, albeit for their commercial potential as keys to new resources or inventions. For us to initiate and sustain productive, fruitful communications in the interests of local and global communities, it stands to reason that we should be equally well informed. This would require that we learn to re-connect as researchers and practitioners with the physical/meaningful components of technology as part of our built environments. In fact, as we have seen in the example of the Global Express, knowledge related to these physical factors can be keys to understanding and improving the relationships under study.

At the Human Level: Transformation

Taking into account the realities of the lived circumstances or environments that are continuous with the task and tools at hand, the consequences of technological exchanges often accumulate exponentially. With this in mind, technological exchanges among cultures are better appreciated as gestalt phenomena -- those in which the sum is bigger than its parts -- than as linear or additive progressions within a process of

problem-solving.

The result of accelerated technological change can be a new synthesis -- not simply an expansion, but a transformation of the original concept, task, or technology, to the extent that what we have achieved is more in the realm of metamorphosis than change. To use an analogy from nature, we have a caterpillar changing into a butterfly, as opposed to a caterpillar simply growing older or larger. We have a creation substantially different, a new phase that is both continuous with, yet distinct from, the original creature.

We can see a parallel metamorphosis occurring over recent generations of technologically-enhanced research in medicine. For example, the micro technologies and cryogenics that are supporting genetic research and biological engineering are enabling observations and manipulations of the basic elements of life. Our discoveries are challenging us to redefine our values, ethical conduct and laws around the essence of human life -- and death -- itself. Such innovation in, or through, technology creates new territories and spaces in our understanding. To navigate them, our approaches to knowledge development and collaboration across disciplines and cultures will have to be re-evaluated and adjusted.

By necessity, this navigation requires a transformation in the person, that is, in the perceptions of the practitioner/ researcher in relation to the larger technological project. This is especially true now, in an age of accelerated change. Often technological crises have occurred because of a failure not of science, but of imagination -- a failure to be flexible, to make connections, to deliberately provide for ourselves sufficient time and

space to imagine the possible consequences of our inventions and to visualize how they may be used.

As it has been introduced here, metaform provides us with a means of access to these intricate workings of technology. Through its reference to tangible experience, we cultivate our capacity for visualizing, in a coherent way, the complexity of specific technological relationships. Metaform can provide the links that lead to unanticipated insights and transformation.

Cultural historian and educational critic Ivan Illich reveals the transformation in his own attitudes to research. He gives a significant place to those essences that technology and art embody -- and can reveal, as we move toward one another.

> I wouldn't dare, any longer, in an anthropological reflection on the way of life of people, to speak about their values. Rather, I would ask an aesthetic question about the shape in which they perceive the good, the sound in which they address it, the feeling with which they respond to it . . .It becomes extremely difficult to know how we should speak about what is important to us, or about what we want."[97]

In the discussions to follow, we will apply metaform to specific cases that reveal as much about ourselves as they do about our inventions. We move next to the field of cultural conservation, which sparked many of these insights.

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[97] David Cayley, *Ivan Illich in Conversation* (Concord, Ontario: House of Anansi Press, 1992),160.

CHAPTER II

PRESERVATION

"If you want to know why I will not fight, I will tell you: in our country there are no towns and no cultivated land; fear of losing a town or seeing crops destroyed might indeed provoke us to hasty battle, but we possess neither. If, however, you are determined upon bloodshed with the least possible delay, one thing there is for which we will fight -- the tombs of our forefathers. Find these tombs and try to wreck them and you will soon know whether or not we are willing to stand up to you."

Scythian chief Idanthyrsus, addressing the invader,
Darius I of Persia (522-485 B.C.), in Herodotus (485 - 424 B.C.)

Cultural Heritage and its Preservation

As we saw in the previous chapter, technology, as an extension of ourselves, is one important manifestation of our need to reach across the unknown to make a successful transition during unfamiliar circumstances. We tend to think of radical transition as a defining characteristic of contemporary life; moreover, we perceive these transitions as an inevitable consequence of the rapid pace of technological advances. On the other hand, as we shall see, even the most radical technological transitions, by their very nature, must involve elements of continuity with the past One of these elements is the human factor itself.

In this chapter, I will show that the aim of preservation activities, and the purpose of the technologies associated with them, is to sustain a sense of continuity by maintaining these links, and to use them as bridges to new visions and realities. At the same time, I speak to the personal and cultural factors in these technological environments; these factors can have a significant -- and often unpredictable -- effect on conservation means and measures. And it is exactly these factors that need to be taken into account in collaborative projects or, in this instance, when cultural objects are transferred from one eco-cultural context to another. Here in these dynamic spaces between the familiar and the unfamiliar, challenges arise that test the flexibility and creativity of our technological thinking.

The field of cultural conservation (as distinct from nature conservation) is but a recent manifestation of the ancient and prevailing human activity of preservation. Ample evidence from prehistory includes the mummification, burial practices and commemorative architectural

complexes in ancient Egypt, as one example of the diverse and globally-distributed variations on the theme. Here material objects, such as murals, stone sculptures, gilded furnishings, foods, wines, perfumes, garlands of flowers and texts of safe passage had been preserved and integrated into rituals for the departed. These objects provided a sense of continuity between the living and the dead, and eased the transition through those liminal regions between realms of consciousness and regions of the soul.

Today, material preservation is practised globally for such purposes as those related to beauty, spirituality, authenticity, personal cohesion, cultural origins, learning, wealth, power, memorials, status, sacred ritual and secular ceremony. For example, great care is taken with such accoutrements of state ritual as the ceremonial mace used in the opening of parliament and for succession to public office.

Material and textual evidence attest to the human propensity not only to create and destroy, but also to preserve. Such a sense of continuity is not only dependent on material objects. However, where these material artifacts and images have been deliberately protected, their preservation suggests a human engagement with existence that reaches beyond the simple polarities of life and death, creation and destruction. A principal intention behind preservation, whether conscious or otherwise, is to protect, renew or strengthen in a tangible way the dynamic force that animates the lived space between these two polarities. Where the edges of life and death rub together, there is a generative friction that we sense as both duration and change.

Cultural conservation is today's means of providing the material expression

of this tradition of preservation. As well, both preservation and conservation are conceptual activities. In many world views, preservation is understood not just as a relationship between past and present, but as a parallel and equal phenomenon in its own right. In Hindu cosmology for example, preservation is recognized as an essential aspect of "the triple power of creation, destruction and preservation, of unfolding, maintaining and concluding."[98] In the corresponding triad of deities, Vishnu as Preserver or Maintainer personifies "the principle which maintains the balance between the life-processes of the universe and the negative and disruptive forces."[99] Here preservation is perceived in relation to continuity, a central force in the primal movement of life, expressed across cultures as *prana* or breath, *élan vital* or *chi*. Preservation has a dynamic, rather than a static role: it makes synthesis possible.[100]

For all of these reasons, the conservation of cultural heritage has the potential to be far removed from political conservatism.[101] In fact, at source, the work of conservators is to tend the deep roots of human experience. These roots, by their very nature, provide the essential elements for radical change and substantial growth in individuals and society. Kwakiutl leader and daughter of Chief Dan Cranmer, Gloria

[98] J.C. Cooper, *An Illustrated Encyclopaedia of Traditional Symbols* (London: Thames and Hudson, 1979), 115.

[99] Ajit Mookerjee, *Ritual Art of India* (London: Thames and Hudson, 1985), 93.

[100] "Ch'i is both a life energy permeating the whole being, physical, mental and spiritual, and a cosmic energy identifiable with the Hindu *prana*, the Greek *pneuma* and the Hebrew *ruah*: It is the vital breath of the universe." (Cooper, *Illustrated Encyclopaedia*, 99).

[101] Despite the valid criticisms of issues often perceived to be related to cultural preservation/conservation, such as treatment choices, preference given to items that maintain the status quo, and political bias in artifact interpretation, conservation can also support social awareness, co-operation and change for purposes of peace. It is important t to realize the broader potential for conservation activities beyond what Grant regards as typical of a "museum culture," where one may "observe past life as object." (George Grant, *Technology and Justice* [Toronto: Anansi, 1986], 98).

Cranmer Webster made this clear in the documentary videos, *Potlatch: A Strict Law Bids Us Dance*, and *A Box of Treasures*. These productions document the history and living traditions of First Peoples at Alert Bay, British Columbia. As Webster puts it: "You have to know where you are coming from, in order to know where you are going to."[102]

I shall return to this theme of cultural and personal self-awareness in my discussion of the implications of technology, where it forms a key element in global conservation exchanges.

Viewed as a dynamic form of continuity, material preservation operates within culture at the personal and collective level to integrate memory, experience, reflection and action. Communications specialist and philosopher of technology, Marshall McLuhan, recognized this reflexive dimension of continuity. He connected it directly to technological theory when he acknowledged a return to the past in order to go forward; specifically, he referred to it in describing the "nesting" of inventions, where each new development borrows from the last.

Looking across disciplines, a parallel recognition of continuity in the midst of technological change can be seen in art history in the concept of *mimesis*, "the principle whereby forms invented in simpler media tend to be reproduced in later, more complex, and more permanent ones, no matter how difficult or inappropriate that reproduction may be."[103] Art historian Alan Gowans relates this phenomenon of continuity to architecture: "By the principle of mimesis, Greek builders created in stone

[102] Gloria Cranmer Webster, Narrator, in *A Box of Treasures* (Alert Bay, British Columbia: produced by Chuck Olin and the U'mista Cultural Centre, 1986). Additional personal communication, November, 1998.

[103] Allen Gowans, *Images of American Living* (New York: Random House, 1964), 58-9.

architectural orders derived from the wooden forms of archaic temples." Clearly, as a means of achieving continuity, preservation is as much a conceptual act as it is a physical one.

Conservation: Its Tasks and Expressions

In view of the globally dispersed and diverse origins of preservation generally, and of heritage conservation in particular, every culture will have its own variations on the theme. These variations occur according to time, culture and environment, and as we have seen, can manifest as concept, action, or material. Even within the Euro-American context, perceptions of modern conservation vary. Increasingly, these matters of difference and commonality in the choice and application of conservation principles are coming under discussion with globalization. Indications of this development are to be found in new publications that address these issues, and that reflect emerging alliances along economic and cultural blocks.[104]

Understood in its broadest, professional sense, *conservation* is the formal term that has been applied in English-speaking countries, first in Great Britain and later in North America, to describe modern approaches to extend the life of historical materials, objects of art or antiquity. [105] Increasingly, conservation has come to be perceived today as achieving

[104] See, for example, Nicholas Stanley Price, M. Kirby Talley Jr. and Alessandra Melucco Vaccaro, eds., *Historical and Philosophical Issues in the Conservation of Cultural Heritage* (Los Angeles: The Getty Conservation Institute), 1996.

[105] For a detailed Canadian version of the definition of conservation see *Code of Ethics and Guidance for Practice for Those Involved in the Conservation of Cultural Property in Canada*, 2nd ed. (Ottawa: IIC-CG and CAPAC, 1989).

preservation mainly through the application of "normal science,"[106] through such disciplines as materials science, chemistry, physics, and more recently, biology. [107] It is, then, a special application of the general concept of conservation, "the ensemble of means that, in carrying out an intervention on an object or its environment, seek to preserve it as long as possible." [108] A typical example of "scientific conservation," would be the use of temperature-sensitive and relative-humidity monitoring devices to provide a controlled environment within an exhibition case for moisture-sensitive materials, such as painted ivory miniatures.[109]

Restoration, in the North American context, is coming to be used in a more limited way, usually with the connotation of an intervention to replace aesthetically-disruptive losses or to visually integrate them in an object or work of art. [110] An example would be the repair of a shattered, hand-painted porcelain vase, where the restorer would substitute lost fragments with a solid-coloured filling material, and then paint this fill to blend it in with the adjacent original designs.[111]

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[106] Used in the sense of Thomas Kuhn, as cited by John Losee, *A Historical Introduction to the Philosophy of Science* (Oxford, Oxford University Press, 1988), 204-208.

[107] For a conservator/educator's perspective on the role of science in the Canadian context, see Miriam Clavir, "The Social and Historic Construction of Professional Values in Conservation," *Studies in Conservation* 43 (1998): 1-8.

[108] Marie Berducou, "Introduction to Archaeological Conservation," *Historical and Philosophical Issues in the Conservation of Cultural Heritage* (Los Angeles: The Getty Conservation Institute,1996), 250.

[109] For a Canadian conservation scientist's perspective on the role of science, see Stefan. Michalski, "Sharing Responsibility for Conservation Decisions," in W.E. Krumbein, et al., edds., *Durability and Change : The Science, Responsibility, and Cost of Sustaining Cultural Heritage* (Chichester, U.K.: John Wiley & Sons, 1994), 241-258.

[110] See Price et al., edds., *Historical and Philosophical Issues*.

[111] For a conservator's perspective on the role of restoration in the Canadian context, see Bob Barclay, "1997 Per Guldbeck Memorial Lecture," 8.

However, as noted in the recent text, *Historical and Philosophical Issues in the Conservation of Cultural Heritage* (the first major, published collection of Euro-American ideas on the subject), this perception of a separation between conservation and restoration does not prevail to the same degree in certain cultural contexts as France, for example, where the terms "conservation-restoration" or "conservation/restoration" are used. [112] On occasion I will use such composite terms, since they reflect the wider historical and cultural range of conservation as it is practised globally.

As the scope of my research is interdisciplinary and extends beyond the Euro-American experience to that of Asia, I will adapt the terms *conservation* and *preservation* to the purpose of addressing a global readership. Consequently, by *conservation* I intend the current North American application of the term, which increasingly emphasizes the role of modern science and technology in the examination, diagnoses, treatment, preventive care, repair and restoration of art and artifacts. As I use the term, *conservation* will encompass all these elements, plus restoration, where these preventive measures and interventions emphasize laboratory-based science. Understood in this way, conservation need not be restricted to North American practice, since Euro-American principles and values are influencing other systems of cultural protection worldwide.

Preservation, on the other hand, will be used to denote a more general approach to the active care, treatment and protection of cultural property. While it may include conservation/restoration, it also includes those measures of heritage care distinguished by their continuity with spiritual,

[112] Price, et al., edds., *Historical and Philosophical Issues*.

philosophical, aesthetic and material practices of long standing -- practices that have emerged over an extended period of time and within a specific eco-cultural context.

In the Background: Shifting Relationships -- Art, Science and Technology

This integrated art/science approach was generative at the outset of the discipline. Conservator Philip Ward, drawing on over thirty years of museum experience in Great Britain and North America, conflates these multi-modal or interdisciplinary aspects of preservation when he describes the field of conservation from the perspective of its early years and foundational texts in the 1950s. Ward traces his lineage of teachers to his "great mentor", Harold Plenderleith, who wrote the seminal Euro-American classic in professional conservation, *The Conservation of Antiquities and Works of Art.* [113] In reference to this text, Ward says that "by contributing a knowledge of materials science to the skills and traditional wisdom of restoration, it shaped the new discipline of conservation."[114] However, by the time that Ward was commissioned in the 1980s by the Getty Conservation Institute to author a publication explaining his profession to the broader community, he observed what he believed was a counter-productive trend. He noted that amongst conservators there was "a tendency to immerse themselves in the technical aspects of their work, virtually to the exclusion of all else. The technology of conservation is absorbing, but too exclusive a devotion to it has led conservators to adopt

[113] Plenderleith, who came as a research chemist to the British Museum, was honoured by the 1996 Triennial Meeting of the International Council of Museums Committee for Conservation in Edinburgh, Scotland, as the father of conservation in Great Britain.

[114] Philip R. Ward, *The Nature of Conservation: A Race Against Time* (Los: Angeles: The Getty Conservation Institute, 1986), 3.

the conventions of science in their communications, which many other museologists find incomprehensible." [115] Ward is in fact addressing at least two cultures here: that of the conservation profession and that of the museum.

Ward's observations, as well as my research and cases that will follow, indicate that it is very important -- indeed, essential -- for us at this time of global communication to reflect on our own different cultures of learning, or rather, "sub-cultures", within our professions. For example, within conservation, there is what has often been described as "the art and the science" of conservation. Here art suggests subjectivity -- the spirit and skill of the art (often developed through hands-on apprenticeships within the continuity of a specific environment); whereas science suggests objectivity, the abstraction, through the scientific method and modes of expression, towards data and theory.

Unfortunately, some would argue that at the level of government institutions in Canada, progress toward the integration of the two sub-cultures of art and science is not only at a standstill; it is actually in regression, with science claiming the dominant position -- at least for the time being.[116] Where such imbalances or disjunctures do occur, they tend to be bureaucratically-induced. In my view, they are often functionally artificial distinctions, when it comes to the nature of the work to be done. This situation is particularly regrettable in a complex field whose ultimate goals are best served by interdisciplinary co-operation. Moreover, where such divisive trends do exist, they run counter to more progressive

[115] Ward, Preface, *The Nature of Conservation*, viii.

[116] Bob Barclay, conservator. Personal communication, Ottawa, January, 1997.

recommendations for comparative studies across cultures [117] and collaborations among those in different yet related disciplines.[118] Despite the potential for imbalances, the fact remains that these sub-cultures of art and science necessarily co-exist within conservation through their respective technologies, both traditional and modern.

Ward is concerned about the isolating effects of scientific language within the culture of the museum -- a community that often brings conservators into association with curators, educators, artists, designers, and fund-raisers, marketing specialists, sponsors, executive administrators, and board members -- all of whom are charged with making a bridge between these collections and the public. Ward's concern is a legitimate one, especially for conservators and artisans within the museum field. However, it is important to keep in mind that I am exploring the broader question of international encounters through technology. Within this context, my experience has been that in international exchanges between conservators from diverse cultures and languages, one of the first junctures of communication is often the specialized language of technology and science. For example, as a visiting scholar to the Museum of Ethnology in Osaka, Japan, I was able to make a professional connection with my colleague, Morita Tsuneyuki on the basis of our shared concern with biological deterioration. More recently, at the Royal Ontario Museum, Metals Conservator Susan Stock noticed that, during a visit by conservators from China, conversation was easiest on both sides when the common

[117] Ian Winchester, "Cultural Differences and the Reception of University Disciplines," in Ruth Hayhoe and Julia Pan,edds.,*East-West Dialogue in Knowledge and Higher Education* (Armonk, New York: M. E. Sharpe, 1996),17-25.

[118] Gerald Carrothers, Founding Dean, Faculty of Environmental Studies, York University. Personal communication, Toronto, 1995.

frame of reference was chemistry.[119]

The common language of science is a double-edged sword, because science is only part of the picture. The specialist's approach has the potential to bring a premature closure to issues and questions that might otherwise be explored in a deeper, more comprehensive, and ultimately more helpful way. We may forget to remind ourselves of the original impetus that led us to make such intrepid efforts in the first place. And it is at this point that my research is initiated.

Conservation and Place

As beauty and as ruin, material cultural heritage and its preservation both reflect and inform people's dynamic relationship to place and to each other. [120] Material cultural heritage includes "almost all kinds of material objects associated with cultural traditions." Also described as "cultural property," material or physical heritage has been classified into the two categories of movable works of art, history, archaeology or science; and immovable works, such as monuments, sites and buildings.[121]

Cultural heritage and its preservation are expressions of the knowledge and meaning systems that continue to evolve with generations of experience of a particular place. It follows that the methods and means

[119] Susan Stock, Conservator, Royal Ontario Museum. Personal communication, Toronto, 1997.

[120] "Beauty" in this context is best explained by Rollo May, as "the experience that gives us a sense of joy and a sense of peace simultaneously, ... eternity, serenity." (Rollo May, *My Quest for Beauty* [Dallas, TX: Saybrook Publishing Company,1985], 20, 70. "Ruin" on the other hand, implies dissolution, change, and loss.

[121] Hiroshi Daifuku, "The Significance of Cultural Property" in *The Conservation of Cultural Property* (Paris: Unesco,1968), 19. I prefer to use the term *cultural heritage* rather than *cultural property*, since the latter term suggests an understanding of cultural objects in which the emphasis is on the value of ownership, rather than heritage as a shared legacy.

selected to preserve this heritage reflect shared attitudes and relationships; where these involve technological choices, these technologies will also emerge from diverse cultural concepts and values. During the course of preservation, these concepts and values are often made explicit. Therefore, our understanding of technology, especially as a culturally expressive phenomenon, will be deepened by research into conservation and its associated disciplines.

At times, a technical exchange can become an opportunity to explore disparate perceptions of cultural heritage, and therefore of preservation objectives, across cultures. Such a catalytic exchange occurred during a discussion between two museum professionals regarding the conservation treatment of Oriental lacquered objects.[122] This particular lacquer, called *urushi*, has a long tradition in the Orient, and has been used in the creation and restoration of many of Japan's national, cultural treasures. Urushi serves as both a protective and decorative finishing material, commonly applied to a wide range of objects made of wood or metal, ranging from cabinets to sword scabbards to religious sculpture. Usually coloured black, red or gold, urushi exhibits a soft, glossy sheen and produces a smooth, stable and damage-resistant surface. This highly prized lacquer is processed directly from the sap of the urushi tree, and is made in carefully controlled conditions by craftspersons, who are, by necessity, highly skilled and well trained in traditional and contemporary lacquer techniques.

A conservator from Canada who specializes in the treatment of Oriental

[122] Marianne Webb, conservator, Royal Ontario Museum. Personal communication, Toronto, 1995.

lacquer[123] was recommending a new, synthetic material that could be used to repair damaged urushi objects. This treatment would be "reversible"; that is, it could not only be readily accomplished by a conservator, but could be adjusted or removed with reasonable ease, if need be, at any time in the future. Her colleague on the other hand, a curator from Japan, hesitated to accept this adhesives technology. Instead, he favoured indigenous techniques and materials to the synthetic, imported alternative. His choice was to draw on the living tradition of urushi restoration, which uses urushi itself. The main mechanical difference here is that, on curing, the natural material becomes a highly stable polymer, resistant to solvents, heat and moisture; therefore it is not reversible (i.e. readily altered or removed). Also, it requires the skills of an urushi specialist, one who is not only highly trained through long apprenticeship in the traditional art of urushi, but who has also proven himself insensitive to the wet urushi sap, which commonly causes strong, allergic reactions.

At first, the dialogue seemed deadlocked. Both approaches were appropriate, depending on the different assumptions and expectations associated with the intention, and therefore the meanings associated with these two preservation technologies. The visual result being virtually the same for both treatments, the intention in the Western case appeared to be mainly operational and pragmatic -- i.e., to accomplish a mechanically suitable, instrumental repair. The adhesive technology did the physical job of preserving the object, and did it well. For our Japanese colleague, the intention of the repair of urushi with urushi was not only to achieve physical stability. It was also a symbolic act, in that it gave form to a particular cultural sensibility that values the living tradition of the

[123] Marianne Webb, *Lacquer: Technology and Conservation, A comprehensive guide to the technology and conservation of Asian and European Lacquer.* Manuscript, soon to be published. Toronto.

craftsperson -- or, to put it another way, a sensibility that values the lineage of aesthetic, cultural experience as re-lived/re-vitalized/renewed through the craftsperson.

Given the potent physical character of urushi as a raw material, and the demands that the material places on the craftsperson, urushi technology has taken on symbolic associations in its own right. When these striking material properties are combined with an extensive history of cultural use in the making of artistic and sacred antiquities, the materials and techniques of urushi take on the central aspect of metaform. At this point, however, I will focus instead on urushi conservation as one example of the role that technology as metaform plays in the context of conservation/restoration.

For the makers of urushi, cultural value inheres in working in a respectful, synergistic way with the natural materials of the region. Through their work they reproduce, on behalf of cultural memory, a continuity with ancient history and with nature. Exceptional examples of urushi and the skills that serve to create it are recognized respectively as tangible and intangible cultural properties in the Cultural Properties Act of Japan. The designation of "intangible cultural properties" refers to the fact that "Because the cultural properties in this category are in essence the artistry and skills of particular people, in practical terms, they are embodied in the individual or group of individuals who have mastered them."[124] In fact, masters of urushi are recognized today in Japan as Living National Treasures. Urushi-based treatments, then, can be understood as renewing both the physical *fact* and the concept of duration through their material

[124] *An Overview of Japan's Policies on the Protection of Cultural Properties*, Agency for Cultural Affairs, 1995, available through the Embassy of Japan,Ottawa.

origins and properties, and through the transmission of related knowledge and skills.

Many North American practitioners in similar exchanges may find it difficult to understand why their apparently successful, highly-refined, laboratory-tested and more "generic" synthetic chemical technologies could be rejected. In fact, as conservators trained in this Western philosophical milieu, which leans heavily on laboratory-based science and objectivity in relation to nature, we are often required to consider cultural objects, at least in part, as "scientific evidence" -- of an historical event (e.g. the blood stains on Lincoln's clothes); of an artist's technique (e.g. the execution of Michelangelo's painting in the Sistine Chapel); and of authenticity (e.g. the Shroud of Turin). If we consider only one of these examples, that of the Sistine Chapel, it becomes obvious that this apparently objective approach can become controversial, despite its foundation in science and technology.

Conservators working in the paradigm of normal science seek to minimize the exposure of the cultural object-as-evidence to any unnecessary restoration, permanent treatment or intervention. Therefore, the Euro-American ethic to "maintain the integrity of the object" translates in practice to mean that today's repairs must be readily distinguishable from original or historical materials (as opposed to invisible restoration) and be easily removed or "reversed" without damaging the original. Hence the preference for "reversible" technologies.

As I have noted in the article, "East-West and the Paths to Conservation," one factor supporting this ethic is the environment, given the geo-cultural

and material diversity of collections in North America.[125] In the absence of original repair materials or specialist crafts persons and artists who can transmit and/or apply traditional knowledge of specific materials like urushi, conservators here, by necessity, require more generalizeable materials and techniques. In such cases modern science and conservation technology can help to ensure acceptable levels of predictable, long term materials behaviour within known, set conditions. This situation engenders habits of education and practice that are more likely to accept laboratory-tested solutions, which in turn are intended for a specified range of materials and environmental parameters.

Naturally, preservation priorities will vary for those who regard the cultural object as an integral part of a living, local and continuous tradition of artistic expression and production. In this case, preservation techniques are often derivative of, or closely related to, the means of production, which in turn have proved relatively predictable and effective for that setting in the past. Indeed, such emphasis on the continuity of materials usually reflects philosophical, psychological and environmental influences on current values that have evolved in relation to interactions with specific environments.

For example, many of Japan's cultural treasures have emerged from the roots of Shintoism, Taoism and Buddhism. Each of these spiritual traditions advocates the cultivation of direct, intimate and subjective experiences with nature and the things of nature. In keeping with these systems of belief and meaning, it is understandable that certain circumstances would favour a preference for "natural" compatibilities in preservation

[125] Ann Howatt-Krahn, "East, West and the Paths to Conservation" (L'Orient, l'Occident et les voies de la conservation), *MUSE, Journal of the Canadian Museums Association* (Ottawa: Canadian Museums Association) 5, no. 1 (April 1987): 38.

technologies -- to treat like with like, to nourish the ancient with living materials and to support and promote artistic traditions whose technologies share physical and spiritual origins.

In fact, in the case cited above, the living dimension of the technology did become explicit. It was, as the interpreter explained, a matter of the "spirit of the urushi".[126] At the broader cultural level, a relationship to heritage was also being expressed through this technological choice. The preference for urushi in this situation may be related to what 1994 Nobel prize winner Kenzaburo Oe reflects on as the "*Yamato spirit.*"[127] Here he is referring to a term "coined by a woman writer", Murasaki Shikibu, author of the Japanese classic, "The Tales of Genji". He relates Yamato spirit to Aristotle's "*sensus communis*", a "shared sensibility", which Oe understands as "an innate quality that exists in human beings at a higher level comprising our intellect, emotions, and imagination".[128] In other words, he suggests that Genji's creator intended Yamato spirit to reflect "a particular sensibility inherent in her fellow countrymen", a "cultural consciousness."

Toward a Common Ground

In intercultural exchanges involving technology, we must consider to what extent it is desirable or possible to reconcile issues of cultural

[126] Marianne Webb, Conservator, Royal Ontario Museum. Personal communication, 1995.

[127] Kenzaburo Oe, "Speaking on Japanese Culture Before a Scandanavian Audience," *Japan, the Ambiguous, and Myself: The Nobel Prize Speech and Other Lectures* (Tokyo: Kodansha International,1995),18-19.

[128] A postmodern critique of this concept would point out the potential for cultural diversity , social fragmentation, and conflicting values, perceptions, etc. within any country or geo-political unit. While these elements must be recognized, cultural heritage, by definition, informs the memory of an environment, and memory informs decisions of inhabitants at many levels of consciousness. For an elaboration on the role of memory and emotion in decision-making, see Antonio Damasio, *Descartes' Error: Emotion, Reason and the Human Brain* (New York: Avon Books, 1994.)

consciousness. For example, to what extent will exchanges be effective between cultures where one appears to emphasize a subjective experience of nature, while the other is based on a human/nature relationship that strives for objectivity? What indications do we have that globalization, mediated by technology, is influencing these dynamic human/environment relations, both between cultures and within them? How do educational practice and heritage preservation reflect these interactions? I raise these questions, not with the intention of carrying out a comprehensive investigation at this time, but more as a prompt, and as an indication of some of the issues that arise in the following case studies and examples. There is the additional factor of specialized groups or sub-cultures that operate to varying degrees across cultural boundaries, as in the cultural conservation field. Certainly, colleagues in conservation in Asia are not only familiar with contemporary scientific developments in the West, they are discriminating among them, selecting to address their specific needs, and to advance international research and technological capabilities across disciplines.

What can we learn, then, from these exchanges with the East, not only about sustainable alternatives to preservation concerns, but also about ourselves? Self-awareness is central to keeping these communications open and positive. For example, in terms of technological thought, what does it mean that conservation in the West has evolved in the service of a philosophy that values objectivity and material evidence as the most likely means to truth? Is it the case that in all situations "There is a difference between science and technology," as convention would have us believe? [129] Through conservation we can examine some of these issues in the context

[129] David Grattan, Research scientist in conservation, Canadian Conservation Institute, Ottawa. Personal Communication, 1997.

of specific situations, and see how they animate and direct knowledge development and technological practices. As well, we can explore relevant connections between technology, material cultural heritage and our broader perceptions of environment.

The Pacific Northwest Coast of America provides the site for one example of how European experiences in conservation were translated into the Canadian context. Philip Ward, coming from the Department of Oriental Antiquities at the British Museum in London to establish the Conservation Department of the British Columbia Provincial Museum in Victoria in 1966, was first conservator to make bridges successfully between Great Britain, Canada, and the First Nations of the Pacific Northwest Coast.[130] He pioneered approaches to field work and site conservation in the area, and in the process, he learned directly from the settings and the people whose material culture he was asked to preserve. From Canada to Alaska, he conducted the first on-site conservation surveys of totem poles, the monumental wooden sculptures, which for people around the world have come to represent the Pacific Northwest Coast.

In addition to his observations of the condition of the poles and the environmental factors affecting their longevity, he met with native people and informed himself of their world views. He gave his open and specific attention to their attitudes and preservation values about their own material heritage. In the absence of any obvious maintenance or

[130] This was not only the first Conservation Division in a major museum in Western Canada. It was also the first conservation facility to be recognized within the culture of Canadian museums on an equal footing with curatorial departments, which were established along traditional academic lines. This creation of a parallel relationship between conservators and academics was a major advance over the situation in many parts of Europe. Even today, conservators are often perceived more as the providers of services to curators in museology, rather than as equal partners with them in collections care and research. Such a relationship between curators as "researchers" and conservators as "technicians" has direct implications for education and communication regarding technological exchanges.

restoration projects outside of those initiated by the museums, Ward quite legitimately asked whether the material preservation of these earlier poles was important to native peoples. He needed to establish whether or not they did maintain a sense of continuity through the material aspects of this legacy, and if not, was there another means of achieving this sense of continuity. It soon became clear that one couldn't assume that the preservation of cultural continuity through the poles was strictly dependent on conservation and technology. His growing understanding of preservation in light of what he was learning of these First Peoples led him to a startling conclusion at that time: the poles should not be treated at all.

An important but often neglected aspect of preservation planning is reflection on past approaches to treatment and care. This reflection makes it possible to re-evaluate these remedies, and to compare and contrast their long-term results in the light of newer, alternative solutions. Here again, Ward's work was a significant departure from the past, because he did note and question earlier approaches to preservation. He gave particular attention to the totem pole in its physical and cultural context.

Ward opened a door I was ready to walk through, coming as I did from an ecological background. I was intrigued to see that he was making an opening to a territory at once new and familiar. The newness was in his rich experiences with cultural objects from around the globe, experiences he described in terms of his authentic responses as both an artist and a teacher in this relatively new field of conservation. What was familiar, and what I could appreciate in great detail, was the lively connection/synergy between these creations -- works of art and technology -- and the diverse biological and cultural settings from which

they originated. This environmental approach takes into account both people and place as situational factors that contribute to risk and risk reduction.[131]

I remember two especially instructive examples from Ward's teaching regarding the unpredictable consequences of technological interventions. First, before Ward's arrival in British Columbia, the provincial government took the initiative to preserve totem poles by engaging B.C. Hydro to treat these wooden sculptures *in situ* with creosote. Suitable for telephone poles, which are relatively easy to replace, creosote is not suitable for the conservation of irreplaceable, original totem poles. Certain properties of creosote perpetuate combustion, once it is ignited. And I do recall cases where some of these treated poles had been kept in an insecure area, stored lying down and subject to vandalism and/or accidental fires. This situation created a West Coast version of "the perpetual flame phenomenon." And of course, in a major museum in central Canada, there is a large totem pole, reportedly treated with wax formula -- the surface appearing to all intents and purposes, saturated with it -- and mounted in a stairwell-cum-fire-tunnel. This arrangement sets the stage for the world's largest candle phenomenon.

These examples illustrate my final point, the relatively unpredictable nature of preservation methods and technologies. Elements of unpredictability exist not only in these earlier technological solutions, but also in our most current applications of conservation. This potential for unanticipated results in the application of knowledge, including technology, is not by any means exclusive to conservation. Unpredictability is

[131] Ann Howatt-Krahn, " Field Research in the Conservation of Ethnological Collections: An Ecological Approach applied to Polychrome Monumental Sculpture," *Symposium '86: Proceedings of the Care and Preservation of Ethnological Materials* (Ottawa: Canadian Conservation institute, 1986), 156-170.

compounded by the complexity of "lived" situations, the ultimate "reality check" of any human experiment.

It does not diminish the promise of science and invention to admit that life is beyond the control of the laboratory. Indeed, the failure on the part of researchers to take context into account is a key problem that has been identified in feminist critiques of science. This shortcoming originates within both scientific practice and academia. Similar observations have been made by educator and philosopher John Eisenberg regarding the indeterminate nature of education and the law in contemporary Western society. Indeed, Eisenberg indicates a role for technology in the legal environment, when he observes: "Legal decisions are never made in the abstract but in the context of political, technological, economic and social developments."[132] More recently, the unforeseen consequences of technology are being exposed in the broader sphere, as Tenner, introduced above, revealed and elaborated recently in his book, *Why Things Bite Back: Technology and the Revenge of Unintended Consequences.* [133] Tenner's work is not a "fatalistic prediction of disaster", however. On the contrary, he describes it as "a call for alertness, anticipation and adaptation."[134]

It may be argued that there is less likelihood of unpredictability in preservation technologies that have evolved over generations in the context of a specific community or lived situation. Traditional systems of knowledge and technology, such as the making and conservation of paper in Japan, immediately come to mind. However, today's globalization of

[132] Eisenberg, *The Limits of Reason*, 111.

[133] Edward Tenner, *Why Things Bite Back: Technology and the Revenge of Unintended Consequences* (New York: Alfred A. Knopf, 1996).

[134] Jackson Lears, "Why Things Bite Back: An Interview with Edward Tenner by Jackson Lears," in *Invention and Technology* (spring 1997): 18.

information and technology is bringing new influences to bear in these environments, with the result that catalysts for unexpected change are located both within and without cultural settings. With specific regard to existing preservation systems, these incursions may become critical factors that can work for or against them. The point is that we must be aware of this phenomenon of unpredictability, and develop means for responding constructively to it in times of transition.

We can begin by consciously examining our own cultural responses to what we perceive as chaos and our relationships to environments in transition. The processes of engaging with change, of adapting successfully to the unfamiliar, require imagination. According to scholar and author Northrop Frye, imagination is "the power of constructing possible models of human experience."[135] It is important to bear in mind that Frye's use of the term "models" can be interpreted to include visual images, metaphors, fictions, and invented contexts.[136] Frye concludes: "A highly developed science and a highly developed art are very close together, psychologically and otherwise."[137] Frye has an ally for his claim in Albert Einstein. In circumstances that require creative solutions, Einstein has been quoted as saying that imagination can be even more important than knowledge. Creative solutions are often realized in technology. A combination of observation and imagination, then, will be used in this research to reveal new ways of understanding our relationships with -- and through -- technology.

[135] Frye, *The Educated imagination*, 127.

[136] This interpretation of "model" as inclusive , rather than limiting, is consistent with Frye's adherence to "the principle of manifold or 'polysemous meaning." For example, Frye recommends that symbols be "as versatile as possible, not pinned down exclusively to one interpretation." In regard to interpretation, he warns, "the danger of determinism has to be carefully watched." (Northrop Frye, *The Anatomy of Criticism* {Princeton, New Jersey: Princeton University Press, 1957}, 72, 102-103, 108-9.)

[137] Frye. *The Educated imagination*, 129.

CHAPTER III

THE SPIRIT AND THE STONE: PERCEPTIONS OF THE PERSONAL IN TECHNOLOGY

Life expands or contracts according to our courage.

Anais Nin.

Preservation technologies, because of their complex material and cultural requirements, engage a deep investment of many kinds of knowledge. In the case of cultural conservation, as we have seen in the foregoing chapter, the associated skills, tools, and techniques represent a tangible commitment to certain choices in the care and restoration of individual objects and sites. At this point I will explore the relationships between technology and the individual. In the chapter that follows this one, I will demonstrate the relationships between technology and societal forces. That is to say, here I will demonstrate metaform at the micro-scale of personal experience, while in subsequent chapters, I will show how it operates at the macro-scale of culture. Later we shall see how the dynamic between the personal and the cultural experience is like a pulse, expanding and contracting as the emphasis shifts from the one to the other.

This investigation of metaform will draw on a case from my personal experience in conservation practice. Writing about this experience and reflecting upon it required a narrative approach. I wanted to provide enough concrete details to inform readers and also to give them a sense of the experience. I realized that such an approach, based in the physical process itself, would enable me to return to this challenging work in such a way that I could discover why this manner of working had such a strong impact on me at the time. In retrospect, I realize that my involvement with the actual work was so intense that I was unable to seek out its larger meaning. Now, with the concept of metaform to guide me, I have been able to reflect in greater depth -- to develop and analyze this experience for its relationships to human understanding and culture, where material and spiritual matters converge. My intention is to invite the reader to

share a conservation experience -- one specific example from antiquity that can serve to open up new territory for each person's engagement on several levels. In this case, I emphasize the instruments and the materials as the palpable means of realizing what can become an emergent relationship with technology.

This conservation treatment involved substantial risk to the materials, as well as intense and prolonged attention -- one could liken it to surgery. As in surgery, the subject under treatment was precious, one of a kind. In conservation, one is always aware that what is at stake is a unique distillation of creation -- whether it is a creation of nature or of humanity. To intervene is an act of courage -- courage rather than daring. For daring implies a kind of bravado, impudence -- a testing of one's superiority; one approaches a task as though one is pitting oneself against an enemy or an obstacle. The concept of courage is radically different. It finds its root in the Latin *cor*, heart.[138]

Mine was a very revealing encounter with antiquity, one that demanded a recognition of the ultimately mysterious nature of the artifact and of the material as a manifestation of nature, something greater than myself. Even with good technique and the best instruments, I was aware of the inherently unpredictable nature of the work and of the materials. My experience became more rich and revealing in its cultural and spiritual dimensions as a result of using this case for reflective analysis *via* the instrument of metaform.

As we have seen, technology is an extension of human capabilities on all

[138] *The Concise Oxford Dictionary of Current English*, ed. R. E. Allen (Oxford: Clarendon Press, 1990), 265.

levels, enabling us to reach out in space and time. After we have made our connections, technology then acts as a medium, a channel that opens us to receiving unanticipated, alternative experiences. In this way, technology is often instrumental in developing our knowledge of the subject at hand.

In order to explore this aspect of technology and metaform at source, I will present the case, mentioned above, from my professional experience. In 1988, I had the opportunity to work with a collection of sculptures in stone and bronze from 10th century India.[139] Two lessons stand out from this experience: first, the relevance of one's embodied [140] interaction with technology; and second, the benefits of learning directly from the technological process itself. By this I mean what can happen as a consequence of having mastered, or at least absorbed substantial knowledge of, the tools and the matter for which the tools were chosen and used. By matter here, I mean not only the materials but their associations.

In this case, these sculptures were of deities in human form. Their strong and rhythmic shapes celebrated in stone the movement and music of nature. Many were life-size, while even the smallest of pieces presented an alluring sense of "expansiveness" that belied its size.

Certainly technique and materials contributed to this effect. Typical of

[139] In conservation in Canada, the ethical principle of confidentiality between conservator and owner applies to the identity of the owner /client on whose behalf treatment has been undertaken. The following information is released according to permission obtained through the Treament Agreement, which was to publish the following information for educational and research purposes. All detailed treatment documentation for this sculpture is kept by the owners and a copy maintained by Andrew Todd Conservators (formerly Howatt-Krahn, Todd Conservators) Vancouver, British Columbia, Canada.

[140] I use this term advisedly, since it allows me to refer inclusively to the multiple aspects of human experience – physical, cognitive, affective, spiritual .

Chola style,[141] the figure and ground were carved from a single block of stone, in deep bas relief, 3/4 of the figure free from the background stone. The stones themselves were of a fine-grained, even texture; most were unpolished and of a rosy-hued or russet sandstone, while others were delicate creams and dove-white. In all cases, the volumes were shaped to be round, the limbs soft. These contours were further softened by weathering, and their roundness heightened by the effect of strong light, which cast deep shadows.

Clothing was either minimal or represented as transparent, more in the way of ornament than cover or drapery -- jewelled belts and pendant girdles, earrings and necklaces on river goddesses, with names like Yamuna.

In gesture also, the stone figures turned out and away from their background, both men and women pushing gently into space in all dimensions. The movement in form was voluptuous, even in figures in repose -- each limb, even the fingers -- seemed musically informed and full of breath.[142]

This sense of an "inner fullness" was imparted by the sculpting of every feature of the body -- from the fine chiselling of forehead, cheeks, and lips to the modelling of the breasts and hips. The skin seemed taut and polished. This is how it appears now in memory -- the form shaped from the inside out.

[141] Sherman E. Lee, *A History of Far Eastern Art*, 4th ed. (New York: Harry N. Abrams, Inc. ,1982), 214 - 219.

[142] "Breath and dance are very important in determining the look of Indian sculpture, the stance and the representation of the body." (Ibid., 89.)

These sculptures were shaped by the *silpan* (artist, craftsman, imager) in keeping with Indian philosophy and cosmology. Indeed, at this time all Hindu sculpture in southern India was an expression of religion.[143] As explained by the late Anandas Coomeraswamy, art historian and curator of Indian art at the Boston Museum of Fine Arts, in this tradition "the purpose of the imager was neither self-expression nor the realisation of beauty. He did not choose his own problems, but like the Gothic sculptor, obeyed a hieratic canon. . . .To him the theme was all in all, and if there is beauty in his work, this did not arise from aesthetic intention, but from a state of mind which found unconscious expression."[144]

This state of mind was traditionally cultivated from an early age, and later on, through the artisan's study of sacred texts and his own ritual preparations. His was an hereditary vocation, learned over time within the context of family and community. In addition to learning the material properties and skills associated with his medium, he was charged to lead a chaste (though not celibate), moral life, refined through daily discipline and meditation. Ideally, the actual carving would be done either in isolation or in the company of other artists, but not in the presence of laymen.[145]

Through his own practice, he readied himself to invoke and receive the deity, to become "inspired" in the original sense of the word, that is, to be infused with the spirit of the subject. Through study and meditation the

[143] Ibid.

[144] Ananda K. Coomeraswamy, *The Dance of Siva: Essays on Indian Art and Culture* (New York: Dover Publications, 1985), 25.

[145] While some aspects of this tradition have changed, ritual practice, including sacred and secular expressions of Hindu cosmology, continue in many parts of the world today, and are reported in some places in India itself to be undergoing a revival. So integrated is the sacred with artistic expression that, to paraphrase Coomeraswamy, who can carve the gods when no one sees them? (*The Dance of Siva*, 134).

artisan would open himself up to become, for the duration of the work, a "container" for the immanent presence of the deity. In the practice of meditation, the silpan would attend to his own breathing in such a way that he would himself experience directly a fully awakened awareness of the spirit or essence of life. This transformation was necessary to realize the spiritual intentions of the work: the sculpture would be successful only if the essence of the god or goddess could be imparted, through the silpan, to the stone. His preparation enabled the artisan, through his work, to "breathe life" into the shaping of his materials so that they, in turn, would manifest the sacred dance of life. Transmitted to the stone through the container of the sculptor, the deity waited for the devout.

Ideally the artisan, as a result of his training, attention and commitment to the way he was living his life, would come to the work in such a way that he and the sacred subject could become one with the stone itself.[146] For example, in sculptures of Siva in his aspect as Nataraja, dancing the universe into existence, his chest is fully expanded, each limb lifted in gesture, and rounded as if informed with breath. *Prana*, as the breath of the spirit, is expressed as energy, as life in movement. [147] This concept reflects the belief that all matter, including stone, is in motion to some extent -- as in fact it is, according to the laws of molecular physics.[148]

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[147] Coomeraswamy, 22, 23, 46. See also Suzanne Downs, "Sacred Art Versus Profane," *Full Moon Journal: Reflections on Buddhism in Western Literature* 1, no.1 (summer 1997): 41-3.

[147] See Coomeraswamy, *The Dance of Siva* ; Joseph Campbell, *The Mythic Image* (Princeton, New Jersey: Princeton University Press, 1974); Ajit Mookerjee, *Ritual Art of India* (New York: Thames & Hudson, 1985), 89- 183.

[148] Citing a passage from his book, *The Tao of Physics*, physicist Fritjof Capra describes how the Dance of Shiva brought him to his realization of key aspects of theoretical physics : " I saw two basic themes running through all the theories of modern physics, which were also the two basic themes of all mystical traditions - - the fundamental interrelatedness and interdependence of all phenomena and the intrinsically dynamic nature of reality." Fritjof Capra, *Uncommon Wisdom: Conversations with Remarkable People*. (New York: Bantam, 1989), 34, 49.

In such an understanding of matter, each object and each gesture is significant as a reflection of an inner state and a creative force. In the case of sculpture, as Coomeraswamy puts it, "The nearest explanation of significant form should be *such form as exhibits the inner relations of things;* or, after Hsieh Ho, 'which reveals the rhythm of the spirit in the gestures of living things.' " [149]

Conservation Case Study

One thousand years and many hands later, some of these pieces crossed continents to North America. In 1988, I was privileged to be approached regarding the care of sculptures that had been acquired over time by New York art curator and agent Michael Dollard. He was representing a collector and benefactor to a number of major public art institutions in Canada. Originally, most of these mythic figures had graced architectural façades in city and countryside. Originating in the Chola Period (mid-ninth century to about A.D. 1310),[150] they had subsequently been acquired and integrated into collections in the West prior to India's independence. During the time I spent in private conservation, my partner in the practice, Andrew Todd, and I had been engaged by Dollard, acting on behalf of the colllector, to undertake the conservation of these works in Canada.

At this time all the sculptures were being prepared either for the owner's collection or for donation and exhibition. They were arriving at the conservation studio from across the continent so that their condition could be established and the appropriate conservation measures could be applied. According to our findings, each piece had to be individually

[149] Coomeraswamy, 43.

[150] Lee,. *A History of Far Eastern Art.*, 214.

prepared for exhibition.

With the generous co-operation of the former Director, Richard Graeburn, we were able to adapt a secure space for conservation purposes in a prime setting, the Nickel Arts Museum at the University of Calgary. Transported by jet and handled on the ground by specialists in the transportation of art works, the sculptures were arriving from several sites in individual, custom-fitted crates. On arrival and after a period of acclimatization, each sculpture was unpacked, carefully examined and delegated to one of two working levels, depending on its size. The very large and heavy sculptures were accommodated at improvised working stations on the ground floor, adjacent to, but secure from, the receiving space and within an area dedicated to treatment, while the smaller ones were carried to laboratory benches and cushioned tables on the mezzanine.

We were working with a difficult deadline: there were several pieces, all requiring examination and treatment in varying degrees. It was also necessary to design and fit custom-made supports for each stone sculpture -- all within a few weeks. With the exception of emergencies, it goes against conservation practice to rush; and even in crises the task exacts patience, deliberation and attention to detail. In this case, however, we had to ready these works for the exhibition schedule: the date for the ceremonial opening of the new Asian Gallery, for which this material was destined, had been previously established between the donor and the receiving museum.

Personal responsibility is keenly felt whenever a conservator is charged with the well-being of an antiquity, known to be one-of-a-kind, which has somehow survived all manner of circumstances to be in the present. This

project was no exception.

Every hour is precious in such circumstances, and one not only has to plan for efficiency, but also to allow for the unexpected. As an example of surprises, something as apparently straightforward as unpacking can be hazardous and time-consuming. Included in this collection was a massive, larger-than-life panel in stone of the Dancing Shiva. This panel had been shipped across the country from one of Canada's most prestigious public institutions. The crate was laid flat, the lid removed, and the upper packing cushions lifted to reveal the sculpture, which was carved in high relief. Originally it was an upright structure, and always displayed this way; therefore its physical strength and integrity were critical to its safe handling and exhibition. Although it had been carved from a panel of "living rock", major supporting areas had been carved completely in the round, leaving many features like arms and legs virtually free-standing.

Two broad packing straps had been laid horizontally under the sculpture, with their ends exposed as handles for lifting. However, examination revealed that there had been major breaks and previous repairs in the stone in the areas directly over these straps. The extent of these repairs was unknown, according to the documentation we received. This meant that until we could determine the extent of the original breaks, how they had been repaired, and whether the repairs had survived the trip, we dared not risk lifting it up into a vertical position by the means provided. A small fracture, undetected, or any failure in the joins could have caused the collapse of this piece under its own weight.

In this field one is frequently confronted with a variety of both ancient and recent technologies, and the latter are often more unpredictable than

earlier materials and methods. In the case of this piece, additional examination and correspondence had to be undertaken before we could even safely extract it and stand it up, as it was meant to be. This delay alone, while absolutely necessary, cost several valuable person-hours.

Under these intense conditions, it was a great relief to engage directly in actual physical work with the sculpture itself. Some people imagine that restoration requires an almost saintly amount of patience. Certainly it does require attention, but in my experience, it is the preparations that require the patience and constraint, whereas the work itself is a joy of discovery. This is the final stage in what conservators call "getting to know the artifact". As a colleague in Cairo said to me once, no two corners of an artifact are the same. And every change in colour on the surface, every change in texture and in line, suggests the imprint of its resting places. In surface and in form, each piece bears silent traces of its journey from hand to hand. From land to land.

Treatment

We examined the sculptures for a number of factors that would affect their well-being and aesthetic presentation, not only in the short term --that is, during further handling and shipping to their various destinations -- but also in the longer term. This long term perspective is at the heart of conservation. One takes into account the nature or properties of the materials involved and the conditions to which they have been exposed, or may be in the future. In this case, we were dealing with light-coloured porous stone, a material susceptible to such damage as staining, fracture and loss. Each of these pieces had a long but unevenly documented history of handling and long-distance travel through diverse environments and conditions -- not to mention previous unrecorded attempts at repair and

restoration.

In the major issue of structural integrity, previous repairs were not uncommon. As always, the critical tasks were to locate any camouflaged previous breaks, as in the case of the Dancing Shiva, and ascertain whether or not earlier adhesives were still secure. Once discovered, any break had to be scrutinized for its actual and potential effect on the subject -- that is, whether it was disruptive structurally or aesthetically, or both.

Documentation, including photodocumentation, is essential. To keep handling at a minimum, we secured each sculpture in one position that would give us maximum access to the surface area in different dimensions while we changed the lighting.

However, sophisticated diagnostic techniques were unnecessary in the case of one of the most exacting and potentially dangerous treatments I elected to carry out. Here an earlier and clumsy attempt at restoration was only too apparent. The subject was a sculpture deeply carved from a horizontal panel of fine-grained, dove-white sandstone, approximately 24 " long, 12" high, and 3" thick. Gazing out from the uniform, sugary texture of the stone were four female deities.[151] Forming a graceful tableau, each rested on a lotus cushion, cross-legged, "in a posture of perfectly balanced repose .

[151] A t the time of treatment, I had available to me only the names of these female goddesses: Brahmeshwari, Vaishnavi, Maheshwari and Devanagri. During my research for this work, I had the good fortune to meet Mr. Avinash Agnihotri, scholar and educator in the history and religion of India. He revealed these names to be the South Indian terms for the consorts of the Hindu trinity, mentioned earlier. Specifically, Brahmeshwari is the consort of Brahma, the Lord Creator; Vaishnavi (also called Lakshmi), the consort of Vishnu, the Preserver, Sustainer, Provider ; while Maheshwari is the consort of Mahesh or Siva, Destroyer, Dissolver, controller of disease and earthquakes. As Mr. Agnihotri explained, according to this religion, "Godhead is bestowed on anything revered or respected." So it was that the last of these goddesses -- and the one which drew on all my resources -- was Devanagri, a deity in the service of Sarasvati, the goddess of learning . In fact, it is said that "Hindi is written in Sanskrit , Devanagri's script, because she is the goddess of script." (Mr. Avinash Agnihotri. Personal communication, Toronto, December 31, 1997.)

. . . the so-called 'lotus posture.' "[152] Sitting side by side, so close that arms and shoulders almost touched, each woman held a gesture or an instrument -- together they appeared as a single rhythm of rounded forms, a balanced composition. But this moment of grace ended abruptly with the goddess at the end of the row -- in the place of a graceful shoulder was an amorphous, lumpy projection tenuously propped over a distorted shoulder -- apparently intended to represent a stringed instrument. There was no question that this musical instrument, together with the shoulder and the entire right-hand edge of the panel, had been added by another hand at a later date. In this case, the important point was that this addition had been coarsely reconstructed, not from stone, but from discoloured grey concrete. As a result the question of restoration became a critical one.

Such disruptive "restorations" are not uncommon in works of art and ritual. Stone sculptures from antiquity, for example, have often sustained mechanical damage not only as a result of everyday environmental factors, including erosion, but also from war and natural disasters. Such damage is especially common in architectural elements retrieved from fallen façades, or damaged during handling and transportation.

In the specific case under discussion, the heavy-handed attempt at "restoration" was counter-productive. In form and material the recent addition detracted significantly from the visual harmony of the original sculpture, thereby compromising the principles that had guided its creation. Without going into all the curatorial details, suffice it to say that this recent addition was out of keeping with the original aesthetic and intention of the sculpture. Dollard made a judgment based on the

[152] Campbell, *The Mythic Image*, 333

curatorial perspective and precedents in similar cases, that here was no question of the addition having any aesthetic or cultural value: if at all possible, the concrete slab had to be eliminated. We knew that it would be a calculated risk, but an acceptable one.

I had determined that the best conservation solution in this case would be a mechanical one. I proposed to work by hand with precision instruments to separate the hard concrete from the softer, original stone of the sculpture. Precisely because it was softer than the concrete, the risk to the stone was real; yet Dollard felt justified in taking full curatorial responsibility for the treatment. I was in complete agreement and grateful that he had taken on the responsibility.

Metaform

The means to achieve this transformation in the stone, both in the past and today, is the chisel. In trained and skilled hands, the chisel is the tool that continues to be used for quarrying, that is, for separating stone panels from the "living rock", and also for sculpting it. In fact, the late Henry Hodges, lecturer at the London Institute of Archaeology and co-founder of the Art Conservation Master's Program at Queen's University,[153] observed that for the most part, barring dynamite and power tools, ". . . the equipment of quarrymen, sculptures and masons had changed little over the past two millennia: the hand tools listed by Vasari and Cellini are almost identical to those used by a sculptor and mason today."[154]

What I was doing was in fact similar to quarrying, "a blend of skill and

[153] Hodge's co-founder of the Queen's Program, Kingston, Ontario, Canada, is Ian Hodkinson.

[154] Henry Hodges, *Artifacts: An Introduction to Early Materials and Technology* (London: John Baker / Humanities Press,1964), 109.

brute force,"[155] albeit on a much smaller scale, where force was tempered by precision. In the case of this sculpture, there was much less margin for error. My choices in technology and technique were critical. For one thing, the degree of adhesion or bonding between the original sandstone and the concrete layer was uneven and unpredictable, yet this was exactly where the separation had to be executed. As in the case of surgical intervention, one wants to avoid interfering with the "healthy" parts. Also, I was acutely aware that this piece was not only one of a kind -- all conservation subjects are -- but that the communication of its special qualities depended to a large degree on preserving the delicacy and proportions of its forms. What I had to do -- no more, no less -- was to separate the concrete from the stone.

While explosives were clearly not an option, it may be less obvious why power tools were also inappropriate, in my opinion, in this specific case. I needed to be able to know at every step what was happening at the interface of the stone and the concrete. I needed not only a visual reference, but a sound reference. This required a small tool, subject at all times to precise control. As well, and this is most important, the tool had to respond to the stone in such a way that the condition and character of the stone could "speak" to the person carrying out the operation. By this I mean that the tool had to have an acoustic component, a sensitivity to sound. At the time, neither I nor my colleague realized just how significant that acoustic component would prove to be.

Our initial objective was to custom-make a diminutive chisel, a strong instrument that would retain its keen edge, and at the same time could be

[155] Ibid.,109 - 110.

designed and tailored for maximum comfort and control in the grip.[156] As an extension of the restorer, its task was to seek, sound, and strike.
Up to this point we were selecting our technologies as part of the problem-solving phase of preservation. Subsequently, in the process of the actual work -- which brought together steel, stone and my body -- the experience took on the rich dimensions of metaform.

The size of the entire instrument was approximately 10 cm. The steel shank of this micro-chisel was 0.3 cm. wide and approximately 2.5 cm. long, with the cutting edge angled to form a wedge. The handle was made of rosewood,7.5 cm. long, carved by conservator Andrew Todd. The whole tool was shaped to be held firmly against the fingers of the left hand, while being tapped at the top with a mallet held in the right hand.

It is not uncommon for stone chisels to be made entirely of metal, blade and handle both.[157] However in this case, because the chisel was minute and the grip critical, wood was necessary since it could be carved to conform to my individual grip and to the alignment of my hand at work. In addition, wood is absorbent, unlike metal, which soon becomes slippery in hot hands. It is only when one is confident in the instrument and committed to the technique -- secure, especially, in the process of striking -- that one comes to an ease with the work. This ease frees up one's body, allowing one to find within oneself a natural alignment that is continuous with the tool. Once established, this freedom from tension opens one to a responsive state of mind, one that encompasses a physical relationship to all aspects of the work.

[156] Similarly in medicine, physicians have frequently designed and made their own instruments and equipment, both in the field, like Dr. Norman Bethune in China,and also in institutional surgeries.

[157] A. H. Cottrell, "The Nature of Metals," in *Materials of Sculpture* (San Francisco: W.H. Freeman, 1967).

The sound from the metal blade told me if I was on stone, on concrete, or in the granular space between -- or if there even was a space between -- because in some areas the two surfaces had bonded together strongly. As a result, instead of simply being jarred by striking against the unforgiving surface of stone, I could relate to each sound as a signal of contact, not just a noise.[158] Gradually these signals became more familiar. I became "tuned" to those "notes" that indicated the nature of the contact. These notes began to form patterns; they became an integral part of the process: they guided both the placement of the chisel and the timing of the taps. In the course of the work I was building a rhythmic response "in tune" with the stone. Over time, with repeated striking, I could discriminate more clearly between shifts in the sound - - listening for the rasp of steel against the grit in the concrete; the dull, hollow sound from a flake of stone which had been loosened from prior damage, and, in contrast, the firm timbre of solid sandstone.

What I sought by sound with the chisel was the interface between the two materials -- any place where the stone/concrete bond was weak, and therefore most likely to fail under the pressure of the chisel edge. With steel as sensor, the sense of that space took time to develop. Place, test, find an edge, wedge, tap, tap, feel the strike, listen . . . another fragment of concrete would have sheared away, cleared away -- or not.

I had to stay with it, breaking away only when I remembered to take a deep breath, or long enough to flex the muscles of shoulder, neck and arm.

[158] Sounding has been used as a diagnostic indicator in many fields in addition to sculpture, including marine navigation and cartography. My situation most closely resembled that of music, where it is not only understood that " all sounds are produced by vibrating bodies", but also that tones vary according to the structure of the source of the vibration. To paraphrase Leonard Bernstein, who describes music as "energy in motion", the tones depend on the consistency of the structure. (Leonard Bernstein, *The Unanswered Question, Lecture 1: Musical Phonology* (West Long Branch, New Jersey: Video Music Education, Inc, 1992). In my case, sound varied according to the materials struck.

The rhythm and the resonance, once established between hand, body and bone and the stone itself had to be sustained. Like writing or playing a piece of music, once it is going well, you don't want to interrupt it. You want it to play to its natural conclusion.

I worked, standing, for approximately six hours . . . six hours standing directly on concrete, sensing how even that floor took part in the resonance with the stone, as the striking sent vibrations through the chisel, transferring them to my hand, arm, shoulder, collarbone, spine, abdomen and straight through both legs, which were realigning my body in accordance with each new angle, rebalancing myself for each change in stroke.

Yet at the same time each stroke was discrete; no two strokes were the same. It was my own resonance with these materials -- both stone and steel -- that gave me the ability to match my actions with the reactions of the stone. Without this responsiveness, I could easily have misjudged the strike, forced the steel into the stone, and scored or chipped the original. Conversely, if I hadn't met the resistance of the material with sufficient force behind the instrument, my efforts would have had no effect. We learn from the material as a *subject*, not as an object of inquiry or investigation. By this I mean that it is only by allowing ourselves to be receptive to the *otherness* of the material world that we absorb new experiences to expand our existing repertoire of images, sounds, textures, and phenomena generally. In this way, using new raw materials, we can expand our imagination beyond the limits established at the outset of an inquiry.

In this case, the stone taught me its own peculiar music -- its tones, as I

worked, had found their way into a rhythm shaped by the merging of person, chisel and stone. It was eventually through sound that this process of restoration was transformed into what may best be described as a meditation in movement, multiple acts of attention that converge in a "single-pointed" awareness.[159]

My intimate relationship with the stone was worked out in notes to a happy conclusion. On the final day, the work had gone on into the evening. The gallery staff had all left, leaving the alarms on, and the lights out below. The only lights above, in the mezzanine, where I was working, were the bench lights and spots by my table. Just beyond them, and surrounding the area, stood several other gods and goddesses, tall and deep in shadow. As the last piece of concrete was struck from the stone, I could finally stand back to see, for the first time in peaceful repose, this entire gathering of diminutive goddesses. To my eye, each rested comfortably with one another; there was no longer any burden to weigh down this spirited array. I was aware, suddenly, of the stillness, now that the work had stopped. In the silent space where the only sound was my own breathing, it was their grace that filled the air, the luminosity of their peaceful, gentle figures.

Only much later, in the course of writing this dissertation, did I learn that the carvers of temple sculpture accompany their work with singing. The songs themselves are part of the tradition, one that engages music to set aside a place in time and space dedicated to work of a spiritual nature. In

[159] J. Krishnamurti describes what it means to "pay attention" in this way: "Either we try to discipline the mind so tightly that it cannot deviate, or we just let it wander from one thing to another. Now, what I am describing is not a compromise between the two: on the contrary, it has nothing to do with either. It is an entirely different approach; it is to be totally aware so that your mind is all the time attentive without being caught in the process of exclusion." "Listening to the Silence", in *Parabola: Attention*. (New York: Society for the Study of Myth and Tradition) 15, no. 2 (May 1990): 79-80.

fact, I have been informed by Indian history scholar Mr. Avinash Agnihotri that today's Hindi artisans of sacred sculpture continue to"sing" the deity into the stone. They sing in Sanskrit according to ritual as they create the carving.[160]

Metaform and Intention

The steel chisel was an ideal medium for my experience of the close relationship between the maker and the intention of his work. In the case of the Indian silpan, his metals technology was the material means of giving form to a spiritual experience, a sacred tradition that is highly developed around the concept of energy.

Metal, because of its unique atomic structure, is an excellent conductor of sound vibrations. This property has guided both the original artisan and the restorer: when we use the chisel as a cutting instrument, we are simultaneously "sounding" the sculptural material, learning its character, expressed as vibrational energy, through touch and sound.[161]

Given the properties and associations of the steel chisel and stone, we could analyze these materials from many perspectives in relation to metaform. What does this conservation process reveal in relation to

[160] Mr Avinash Agnihotri, scholar in history and past member of the National Council fof Educational Research and Training, New Delhi. Personal Communication, Toronto, January, 1998.

[161] The acoustical properties of metal, as in steel strings and tuning forks, are well recognized; while the musical qualities of stone are less familiar, they have been used since ancient times. In China, for example, stone instruments, notably the "sonorous stone" and the "stone chime" are musical instruments of percussion (C.A.S. Williams, *Outlines of Chinese Symbolism and Art Motives*, 3rd ed. (New York: Dover Publications, 1976), 376. In fact, as regards the use of music to supply the "necessary martial airs" and "to exercise a strong influence over the administrative faculties of the Emperor" it is written of the "sounding stones," that they "give out a tinkling sound, as a summons to the exercise of discrimination. That discrimintaion may lead to the encountering of death. When the ruler hears the sounding-stone, he thinks of his officers who die in defence of his frontiers." (Ibid., 289-290, citing Legge's*Li Ki.*).

continuity and change? In my treatment of the stone sculpture, was there any symmetry with the work of the silpan, any continuity of intention?

The cutting edge of the chisel is formed from steel, that is, iron which has been altered and hardened at high temperatures through the addition of carbon. Of course, at the macro-level we commonly perceive steel and most other metals as solids. However, when viewed at the microscopic level of structure, "a piece of metal consists of a mass of differently oriented crystals joined together along common boundaries."[162] What distinguishes metals from other materials is the free-electron metallic bond, whereby the free electrons in the outer shell of similar metal atoms are shared among similar metal atoms. These free electrons are then able to move in an electric field, their behaviour likened to that of an "electron gas", a "pervasive", "universal glue for all the atoms". This "binds the metal atoms tightly, so that their cores (nuclei and inner-shell electrons) fit closely among one another."[163] These atoms then form regular crystalline structures, which are dense and heavy. As mentioned earlier, it is the highly mobile nature of the free electrons surrounding each metal atom that accounts for many of its unique properties, including its electrical conductivity and mechanical properties.

For example, in steel, the metallic crystals exhibit cohesive strength at their grain boundaries, because they are bonded readily by their free electrons. At the same time, these "close-packed rows of atoms . . . slide past each other particularly easily, without coming apart." Thus metals are both strong and at the same time ductile, that is, they are malleable[164] and

[162] . Cottrell,. "The Nature of Metals," 55, 42, 47,39-40.

[163] Ibid., 39, 46, 40.

[164] Many metals can readily be drawn into sheets, such as gold leaf, and filaments, such as wire.

capable of being re-formed under certain conditions. In other words, metals owe much of their strength in use not only to their relative hardness,[165] but also in their ability to yield.

This free-electron metallic bond also accounts in part for the conductivity of metals, their capacity to transmit signals. For example, in the telegraph, signals are struck in coded taps by the key; these mechanically-induced signals consist of vibrations, which in turn are converted to electrical energy, transmitted as impulses, and sent out across a line.

Although metal can transmit signals efficiently, it does not appear in everyday experience to retain a "memory" of them. This property can be observed in an electrical heating element: it responds rapidly to the input of electrical energy, building up heat, and cools rapidly when "turned off". Once the connection with the external force or source of energy is interrupted or ceases, the metal, for all practical purposes, is usually seen by the naked eye to return to its previous, resting state (at least as far as its shape is concerned).

Stone, in contrast to metal, is commonly brittle, despite the fact that it, too, is mainly crystalline in structure. This structure derives from the fact that natural stone is composed of minerals ("naturally occurring solids formed mainly from chemical compounds where two or more elements are

[165] According to the standard Moh's scale of hardness, numbered in order of increasing relative hardness from one to ten, a fingernail has a hardness of two and one half; a copper coin is about three, and a steel blade about six and one-half, and diamond, ten. Pat Bell and David Wright, *Rocks and Minerals.* (New York: Macmillan,1985), 17.

combined").[166] These minerals usually occur in some variety of crystal form, and share many of the properties of a ceramic, such as hardness, strength, and brittleness. In these crystals, the atomic bonds are of a fixed, relatively rigid character -- in contrast to the flexibility of the free-electron metallic bond. This rigidity accounts for the fact that while stone is relatively strong, it is also very brittle and more subject to fracture under normal conditions. (Under extreme conditions, both these materials may respond quite differently).

Unlike iron and steel, which can deform in order to yield under a load, "Stone and concrete cannot deform." Without this ability to give way or yield, "they have only one way to go -- fracture. This is why a diamond gives way under a small chisel."[167]

This basic knowledge of sculptural materials "makes sense" of the physical interaction between carver and stone, and refines the interpretive potential of carving technology as metaform. In the case of the silpan, we shall see how this technology corresponds to what is essentially a process of transformation in both the carver and the stone.

When struck, the metal chisel transmits and amplifies the mechanical force of the artisan's blow through the surface and into the matrix of the stone. The combined force of artisan, hammer and chisel percusses the stone.

[166]Stone varies in hardness, of course, according to the types of minerals from which it is formed. Sandstones, for example, have quartz, feldspar and rock fragments as their three basic components, and are classified according to the relative propertions of each. Sandstones owe their colour to small traces of chemicals. (Bell and Wright, *Rocks and Minerals*, 122-123; 14-22). Generally speaking, in nature stone is relatively stable, and resistant to many forms of chemical attack. Until recently, with the advent of adverse environmental conditions such as acid rain, stone has been associated with permanence and has served as the material for monuments.

[167] Tom North, Professor, Department of Metallurgy and Materials Science, University of Toronto. Personal communication, 16 March, 1998.

This kinetic energy is sufficient to disrupt and shatter the physical bonds that make up the stone itself. The chisel breaches the resistance of the stone to "make its mark" in a lasting, immediately recognizeable form.

Through the chisel, the intentions of the artisan, transcendent and ephemeral, are concentrated, converted into action, and directed toward a single-pointed goal. The result is immediate, tangible and irreversible. Each strike will vary, but each must be directed by the artisan's or restorer's visions, which are continuous with the process and responsive to it.

This process is dependent on concentration. Given the shape of its fine, single blade, the chisel exacts concentration on the part of the user. On an instrumental level, the chisel focuses and transmits the kinetic, physical force of the person. On another level, the tool draws together or contracts the artisan's and the conservator's attention towards the goal. Simultaneously, over time it removes the practitioner from the immediate surroundings and mundane distractions. It has been my experience that this freedom to develop clear attention enables one to move closer towards the centre or heart of the matter, and it is here that the boundaries between thought and action, past experience and new encounters, dissolve.

This experience of mine was later supported by my reading in Coomeraswamy: he describes this concentration as an essential component of the artisan's technique and its successful outcome. In his discussion of art and culture, he relates the artisan's work to the practice of yoga: "It will be remembered that the purpose of Yoga is mental concentration, carried so far as the overlooking of all distinction between subject and the

object [of] contemplation: a means of achieving harmony or unity of consciousness."[168] In this expanded territory of experience, new channels of exchange are opened; new discoveries and insights are generated. In a similar manner, the contemplation of a work of art is intended to invite an intimate experience, to effect an infusion of the sacred within the beholder. In fact, in keeping with this tradition of sacred Hindu art, the work is intended to invoke just such a spiritual response on the part of the person coming to meet it. Within the context of this cultural tradition of stone sculpture, applying the concept of metaform to the chisel allows us first, to analyze this technology in terms of its physical operations and second, to use this understanding as a basis for exploring and interpreting its additional dimensions beyond a limited, literal study of the forces at work.

In the process of using and researching a conservation technology that was similar to the original method, I was able to discover personally how, in generating these sculptural forms, the artist and the chisel become, in different ways, transmitters. The chisel already transmits on two levels: instrumentally, it transmits *physically* the kinetic force and skill of the artisan to the stone, and also, constant in its own form, it transmits the *intention* of the maker. According to its unique properties, the stone manifests this intention in a permanent way.

In a parallel process, but on another plane, the maker himself allows his skills to be guided and concentrated by his experience of the sacred, so that he may then transmit this transformed energy to the stone. The chisel, directed by the decisive action of the artisan, transmits the cultural purpose and spiritual integrity that inform the work. As the medium, the

[168] By way of reference, Coomeraswamy cites another technical example: "I have learned concentration from the maker of arrows." (*The Dance of Siva*, 21).

stone is meant to take on the palpable essence of a deity.

In the case of the chisel, the technology of the silpan is a direct extension of the essence of his practice, both technical and spiritual. In its material characteristics and in the manner in which it is being used, the chisel is emblematic of the silpan's role in realizing what is at once a collective and an individual experience. Constant in its own form, the metal blade transmits the silpan' s intention, just as the silpan himself, as a disciplined human being, is the transmittor of the generative "mind" and breath of creation.

Once completed, as far as form is concerned, the artisan's intention is sustained in the material. However, the spiritual coherence and efficacy of the sculpture no longer depend on the intention of the maker, but rest instead with the receptivity of the person coming to meet it.[169] Even across cultures, this dimension of this work can be experienced to some degree. At least this was my feeling at the time, and it has been enriched by the amplifications of meaning provided by metaform.

Now, as we return to our earlier understanding of life as an active force in Hindu spirituality, as an interplay of destruction, preservation and creation, we can see how this technology embodies these dynamic relationships. First, there was the initial destruction of the "living stone" as it existed in nature; then, again with the chisel, the creation of the sculpture. The preservation was accomplished using the same instrument. Without appreciating the full extent of this dynamic at the time, I was

[169] This is true whether one is writing a book or restoring a scupture . . .and it remains true for sacred sculpture. As Coomeraswamy explains, as the stone had been receptive to the action of the chisel, and transformed permanently by it, so too the devout, in their receptivity to the sacred, are to be transformed by their relationship to the presence of the deity or muse who rests within the sculptural form.

living this continuity through the chisel. In this respect, technology became an agent of continuity. In its renewed form, the sculpture will continue in a generative sense as an agent of creativity, in its potential to elicit fresh responses.

This is the role of sacred sculpture within the Hindu tradition, as I have come to understand it through my work as a conservator and through my research. From this case we can see how what we call "technology" -- the tools, instruments and techniques -- reproduce at all points of its creation, the "mind" or generative forces behind it. In the final analysis, the continuity of intention and knowledge rests not in the tool, nor in the materials alone, but in the concept or vision of human beings.

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CHAPTER IV

THE SCANDAL OF THE BLOOD OF FRANCE: METAFORM, MEDICINE AND CULTURE

Come into my soul, dressed in white, like a branch
of blood-roses, like a chalice of ashes.

Pablo Neruda
Ode with a lament. 1931-1935

"*L'Affaire du sang contaminé* " -- the scandal of the blood of France -- is a tragedy of technology. It is a tragedy not because of the failure inherent in the technology itself, but because of its powerful impact on the lives and values of those who engaged with it.

Having demonstrated metaform at the micro-scale of individual personal experience in the preceding chapter, I will, in this case study, explore the conceptual instrument of metaform at the macro-scale of culture. I have chosen this case of *l'Affaire* because it illustrates three objectives for this research: first, it enables me to demonstrate the trans-disciplinary potential of metaform; second, it illuminates cultural perspectives on technology, such as the role of cultural values and attitudes; and third, it provides a more intimate, immediate sense of the lived implications of a given technology.

In the process of reading the article, "Bad Blood," an account of "the scandal" of the blood of France by the American journalist Jane Kramer,[170] I came to realize that the symbolic life of the state and the medical technology that vitalized it exacted a terrible price -- the death of an estimated three hundred persons with haemophilia, and one thousand more who are dying with AIDS.[171]

Kramer's detailed investigation coincided with my emerging sense of how the power of technology draws on the connections that it makes -- in this case on the intimate connections between the very life-force of a person and the cultural and personal structures that shape and sustain that force -- or conversely, do not sustain it. Here the patients, their families, their

[170] Jane Kramer, "Letter from Europe: Bad Blood," *The New Yorker*, 69, no. 33 (October 1993): 74 - 95.

[171] Ibid, 74. Subsequent page references to this work will be given in the text.

physicians, and state representatives were caught up in the convergence of conflicting values engendered by a specific technological environment. This conflict resulted in legal investigations that engaged blood and memory, medicine and nationalism in negotiations around life and death.

What intrigues me most about *l'Affaire* are the symbolic relationships that are constellated around the notion of the blood of France in relation to medical technology. This paper is not intended as a comprehensive examination of the legal and cultural issues *per se*. Instead, I am using an interpretive method to explore the incident where it engaged me -- where technology and its relationships have symbolic significance. I will demonstrate metaform as a means of expanding our understanding of an issue as it is reported in public media. That is to say, I have deliberately chosen Kramer's article as a textual source that lends itself to amplification through the conceptual device of metaform. In this way, I illustrate metaform as applied to contemporary sources of information about our most current technological issues.

As we shall see, the environment of *l'Affaire* is highly charged by the phenomenon of technology. Here technology embodies meaning, gives physical form to a sense of purpose, or is an expression of an object of desire -- or fear. My task will be to make this environment visible.

Blood, which is central to our understanding of *l'Affaire*, is colour and movement; it bathes and nourishes every cell. Suspended in its tides are the major nutrients of the planet. As fluid, it reflects the brightness we associate with vitality. It is a silent witness to the pain of many creatures, including humans. It warns of danger. It is a pulse. We feel its internal

rhythms. In flood, it is our inland waters leaving, warmth and life-force leaving. Slowing, it cools, gels on the surface of a wound, forming its seal. It has the scent of our origins, the iron of metallic earth and the sea-sharpness of salt. Within the terrain of our bodies and its boney solids, blood rounds these volumes, giving resilience. Its power owes much to its secrecy; for it is mostly contained, concealed, barely visible. It fascinates, startles, alarms. It flows in cultures as myth and in the language of life, war, sacrifice, vampirism, honour, desire and courage. Indeed, the cultural experience of blood can also inform the course of scientific research.

As "tools", medical technologies are both instrumental and symbolic. They incorporate physical components and are designed to do a real job in a physical world; at the same time they give concrete form, an image, as art does, to a new perception, discovery, desire or perceived need. As such, their effect is often ambivalent and unpredictable. Technologies, from the hypodermic syringe to the clock, from nuclear medicine to laser engineering, may be used for good or ill. In each major discovery and its practice is the seed of what Yeats described as a "terrible beauty." The key more rightly lies in our understanding of ourselves as humans and what it means for us to relate through our technologies, to each other and to our planet.

L'Affaire du Sang is the focus of such an exploration, where interpretation is applied as a guide to understanding aspects of human-technology relations. My interpretation acknowledges the dynamic and often contradictory workings between the realities of nature and the aspirations, values and imaginings of human beings.

By applying metaform as an interpretive device to components of *l'Affaire*, we can see how this case contains -- and exposes -- shared currents and continuities in human experience. Underlying change, there is an embodied continuity, one that is immediate, direct and personal. This continuity does not have to be experienced only through museums, an entity that McLuhan calls "a storehouse of human values, a cultural bloodbank."[172] We can move out from the museum to our actions in the world at large and consider the meaning contained there.

Seen as metaform, the technology of blood transfusion as a physical experience, as well as a symbolic one, is extremely invasive of the person. Consider that it begins as a silent extraction of fluid, a silent giving. It is transferred, by injection with a hypodermic syringe, into the narrowest of streams; it courses through one entirely. It enters through a tiny, focused point -- intense in pressure, the concentration so focused by the point that one may barely feel it. Yet the surgical steel focuses tons of pressure per square millimetre, poised above that boundary we call ourselves. One submits, in stillness, to the opening of one's boundaries, one's inland waterways. One accepts life-as-fluid -- the ultimate "I", blood -- from other persons. This transfusion, depending on the circumstances, can be accepted as a submission or as a physical experience of empathy, of compassion.

At the same time blood is specific; like a fingerprint, it captures identity. Each person's unique biological self and particular heritage is carried in the

[172] McLuhan and Fiore, *The Medium is the Massage*, 137.

bloodstream. [173] What does it mean that this "essence- of-I" can be extracted, identified, broken down into its component parts, manipulated, processed, and exchanged in whole or in part among many? What does it mean that it can be collected and pooled as "the blood of France" -- or any other collective?

The symbolism of blood in the cultural milieu of France has a strong association with the founding of the state, which emerged from the turmoil of a bloody revolution. It was medical technology that enabled its motto of "*liberté, égalité, fraternité* " to become realized in a kind of "blood brotherhood" that not only infused French ideology, according to Kramer, but became a locus for the active participation of its citizens. In France the collection and use of human blood for medical purposes was organized and controlled in ways that maximized this sense of community. *L'Affaire* exposed this *fraternité* as an illusion of conformity and "purity".

The main source of donated blood as of 1983 was the association of *benévolés*, a group of citizen volunteers, eight hundred thousand strong. As the "amateurs of sacrifice,, their regular sharing of this life-giving fluid was publicly recognized by the government. The relationship between the state and its citizen-donors-and recipients was intended to be reciprocal: in France, the state held the collective blood of the people in trust, and indeed, maintained a monopoly on 40 % of the blood and plasma products sold in the country through the Centre National de Transfusion Sanguine.

[173] As for blood and heritage in France, for example, the "authority to pronounce on the authenticity of Picasso's works derives from the idea that provides the basis for France's moral right law -- that the artist's descendants . . . are spiritually akin to him and the way he worked...The heirs are not presumed to be scholars, but they are considered to have firsthand knowledge of the works as well as a feel for them that comes from birth, blood and intuition. Jacqueline [his wife] had no say in the moral right because she was not a blood heir; for her to have had a legal interest in the moral right, Picasso would have had to assign it to her in a will." Sharon Waxman and Andrew Decker, "Picasso, Inc. Pain and Profit," *ARTnews* 94, no. 7 (September 1995),116.

(74) According to Kramer, the Centre produced from 70 to 80 % of the coagulants; among them was Factor VIII, one of the key blood protein concentrates contaminated with AIDS but nevertheless "sold as a 'comfort product' to haemophiliacs back in 1985, four years into the epidemic."(74) The security of this donated blood was assumed by virtue of the trust both in the medical profession and in the state, and because of the confidence of the general public in the assumed altruism of the *benévolés* as "safe" sources.

The shadow side of this national symbol lies in the fallacy, of course, that the French citizenry is homogeneous. In keeping with this unfounded and misguided notion, it was assumed that its blood donors should, and do, conform, to a person, with the state's moral and behavioural expectations. Apparently it was not commonly perceived that the state itself was supplementing its "safe" *benévolé* blood stocks from other sources. Blood was also taken through "*la collects* "; that is, in 1985 half a million "bums and junkies and hungry students and African workers and prison inmates" exchanged their fluids for a small lunch. (75) Blood products were also purchased from countries other than France.

These realities were particularly significant at a time when many in France were quick to deny the possibility of French persons contracting AIDS, let alone transmitting it. They were also germane to the economic nationalism of the day. Ironically, in the milieu of competitive science and medical technology, the first link between France and AIDS in the area of research seemed promising. Credit accrued to the Institut Pasteur from its isolation of the AIDS retrovirus in 1983. As part of its national identity in related areas of science, France had also declared its intention to be "scientifically

self-sufficient", with ambitions, according to Kramer, to dominate blood research through the Institute. Owned as knowledge, but disowned as illness, AIDS in France came to be called "the American Disease."

The objectivity claimed by medical science was suspended in favour of maintaining the illusion of the nation's immunity; it claimed a boundary that existed in imagination only. The state's geo-political and cultural boundary was misapplied to the phenomena of the transmission of disease, a disease which recognized no such containment. Still others claimed that the political and cultural will remained committed to retaining the carefully cultivated image of France as a country dedicated to heterosexual sex and a macho image. Lt. Colonel Jean-Louis Recordon, as the investigating officer appointed by the examining judge, made a much more realistic, if cynical, observation: "All the French kids who had gone to Kathmandu, shot heroin, had homosexual experiences said, 'Not us, it's only Americans who get it.'"(82)

Popular perceptions of the equality and purity of "*le sang du France*" were further reinforced by medical practice. This became apparent in the case of Jacques Leibowitch, a young French researcher in immunology who had developed a preliminary screening test for the AIDS antibody. His father-in-law was due to undergo surgery, and Leibowitch attempted to ensure that in the event of an emergency, blood would be available from donors that he had screened with his test. The physician in charge of the blood bank at the hospital refused on the grounds that it "violated the principle of anonymity and equality of French blood." The "ethical" solution was to send "anonymous blood" to Leibowitch for testing. (89)

The most common defences, as well as the critiques and analyses of *le scandale* predictably arose from a matrix of values evolving from capitalist, materialist and technological trends. Economic factors (such as insufficient funding for the heat-treating of potentially contaminated stocks of Factor VIII) and controversies surrounding the availability of "definitive," "scientific" tests for detecting and locating contamination were cited on behalf of those physicians and bureaucrats under suspicion. But the truth, according to Kramer, and many of those people she interviewed directly, is that by July of 1985, many of the Socialist ministers in power and government bureaucrats were aware of the risks of contracting AIDS from untreated, AIDS-contaminated blood concentrates. In addition, Kramer states ,"Their medical advisers knew, and most of the AIDS researchers knew, and many of the doctors treating haemophiliacs knew. And while those people discussed the problem, at length, among themselves, and even argued about the problem, no one with the power to stop the sale of contaminated blood stopped it, and no one without the power to stop it quit a job in protest, or talked to the press, or warned a patient until it was much too late to save his life."(80) This, despite the fact that: "*Dans le doute*, you always abstain."(89)

In the end, neither the supposed lack of funding nor debates around scientific testing were sufficient to acquit the two physicians, Dr. Michel Garretta, Director of the Centre National de Transfusion Sanguine and Dr. Jean-Pierre Allain, his senior scientist. They were charged and tried, significantly enough, as "producers"and "merchandiser" in violation of consumer protection laws. They were found guilty of a misdemeanour, *"tromperie sur la merchandise,"* which considered "medical products and services" as "merchandise" involved in a fraud (80). The charges of

poisoning or manslaughter were considered by some to be closer to the reality of these victims of "misdemeanour"-- those who had paid with their lives or who were dying from their exposure to AIDS -- either directly, through contaminated blood proteins, or through those close to them.

But, as I indicated at the outset, it is not so much the legal technicalities of the case that compel me, but rather what the symbolism of *l'Affaire* may reveal regarding the interaction between individuals, society and its blood technologies. Especially, what does it mean that the practice of medicine, as a healing art and science, was perverted to a deadly practice? -- when the healing art is diverted by its environment from attending to the personal, and instead becomes depersonalized? For the prime directive for doctors remains, *primum non nocere,* to do no harm.[174]

Tragedy: Loss and Recovery

The art of dramatic tragedy unites profound sadness with the destinies of key characters to evoke moral reflection. The case of *l'Affaire du sang* is true to this form. The ironies that compelled my attention are constellated around the relationships bound by blood and torn by technology. They converge in the region of trust. Here the boundaries of the individual person, body and soul, converged with those of others, both individuals and institutions, who betrayed that trust. The irony lies in the perversion of the concept of the medical profession, as the guardian of health, and of the state as the citizens' advocate for individual freedom. By neglect or design, individually or in collusion, these institutions failed to respect the very persons to whom their efforts were ostensibly committed.

[174] Gerald Post,M.D. and Robert S. Robins, *When Illness Strikes the Leader: The Dilemma of the Captive King* (New Haven: Yale University Press,1993), 207.

It was the idealized image of these institutions that maladaptive practices of blood technology directly contradicted. Therefore, it is appropriate to engage imagination to explore the symbolism that informs these practices. For as McLuhan points out, the influence of technology is subtle and pervasive; it takes imagination and memory to penetrate the relationships created around technology.

The court, as the public, legal setting for this drama was not only instrumental; it was symbolic. It was explicitly discussed in these terms, by such persons as Robert Badinter, the Socialist Justice Minister at the time, who regretted the publicity of *l' Affaire*, as well as what he perceived to be the "confusion of real and symbolic guilt."(93) Indeed, there were questions regarding the extent of the justice done, especially later, when it came to light that this trial, by concentrating on the particular issue of the distribution of contaminated blood products for haemophiliacs, avoided, and perhaps deflected, attention from a much larger issue. That issue was the delay of a nationally available screening program to test whole blood in all collection and transfusion centres in France (90-92).

McLuhan's observation that technologies are absorbed by one another in the course of their evolution is directly transferable to this symbolic containment of the technologies of blood within the technologies of law and government. *L'Affaire* raised many issues of political immunity, as well as ethical issues for medicine. For many of those affected by AIDS, the results were unsatisfactory. As Eisenberg points out, however,"Legal decisions are never made in the abstract but in the context of political, technological, economic, and social developments."[175] Indeed, if Kramer's sources are correct, and there was collusion to conceal larger issues,

[175] Eisenberg, *The Limits of Reason*, 111.

Barthes' metaphorical association of politics with medicine is particularly apt: "One immunizes the contents of the collective imagination by means of a small inoculation of acknowledged evil; one thus protects it against the risk of a generalized subversion."[176]

Barthes perceived the double irony behind the "safety" of the inoculation. He applied it to a situation where it provided a false security. However, in its first, and positive, sense, inoculation is an antidote. One of the advantages of symbolic analysis is that symbols, and particularly prime symbols, bear multiple meanings, including contradictory aspects. Jung maintained that it was the creative tension between these meanings that evoked fresh insights. In this context, medical technology and tragedy share a paradox: in the source of each is both pain and cure, pathology and redemption. Just as anti-venime, the antidote to snake bite, is extracted from its venom, so the loss in tragedy (and there is always a loss) reveals what is missing.[177]

France was not alone in having to face the gap that had grown between its sense of cultural pride and its respect for the citizen as a person. In Canada, since1993 Mr. Justice Horace Krever of the Commission of Inquiry on the Blood System in Canada has been investigating "how more than 1,000 haemophiliacs and blood transfusion recipients were infected with the human immunodeficiency virus through the blood supply." There was

[176] Barthes, *Mythologies* ,164.

[177] Kahlil Gibran's *The Prophet* explains the paradoxical relationship of loss and compensation in relation to joy and sorrow:
"The deeper that sorrow comes into your being, the more joy you can contain./ . . . . Some of you say, 'Joy is greater than sorrow, and others say, "Nay, Sorrow is the greater.'/ But I say unto you, they are inseparable,/ Together they came, and when one sits alone With you at your board, remember that the other is asleep upon your bed./ Verily you are suspended like scales between your sorrow and your joy./ Only when you are empty are you at a standstill and balanced" (Kahlil Gibran, *The Prophet* (New York: Penguin Books,1992),40.

not only an 8 month delay between the start of the U.S. testing program and Canada's, but also testing within Canada was delayed when provinces like British Columbia, for example, were ready to begin, but were apparently delayed by policy decisions related to "funds controlled by the National Headquarters of the Red Cross in Ottawa". Funding was apparently withheld "until it had secured money from10 provinces before proceeding with the tests nationwide, in Nov.1985."[178] These and other issues, such as the monitoring and distribution of blood, and the additional threat of contamination by hepatitis C, were under investigation until November 26,1997, when the Krever Report was released to the public. [179] It was found that "The Red Cross and the federal and provincial health departments failed to act quickly and were contemptuous of consumers."[180] The headline on the front page of Canada's national newspaper, *The Globe and Mail*, read "Tainted-blood tragedy: Never Again."

It is in this sense of compensation, of restoring balance that Dr. Ursula Franklin, engineer and human rights activist, speaks of "redemptive technologies"; that is, technologies that we perceive as having as their first priority basic human needs and humane objectives.[181] For example, she recommends that technological development be directed to providing cleaner environments as a counterpoise to the "heroic technologies" of war, mass industry and the market place. She urges the democratization of communication, information and decision-making about technology, rather than the exclusionary trends of monopolies in the grander ambitions of

[178] "B.C. Red Cross Was Ready to Test Blood But Lacked Cash -- Screening for AIDS virus had to be delayed, inquiry told." Rod Mickleburgh, *The Globe and Mail*, 9 April 1994, 6.

[179] Anne McIlroy, *The Globe & Mail*, 27 November 1997, 15 (A).

[180] Andre Picard and Anne McIlroy, *The Globe & Mail*, 27 March1997, 1 (A).

[181] Ursula Franklin, "The Real World of Technology," CBC Massey Lectures (Montreal: CBC Enterprises,1990), 127.

corporate and military states. She seeks to minimize the dangers of depersonalization.

In fact, depersonalization is the key to "what is lost" in this tragedy of the blood of France. Mumford had anticipated this some time ago: "We must salvage and redeem the Displaced Person" from the "disintegration" of "depersonalised technics."[182].."What is the missing element? That missing element, I suggest," said Mumford, "is the human person. Our power and knowledge, our scientific discoveries and our technological achievements, have all been running wild because Western man turned his back upon the very core and centre of his own life. He has not merely lost confidence in himself: he has made his proper life insignificant, and so he finds the . . . world equally empty of values, equally insignificant."[183] Ironically, the same medical technologies that maintain life contain the potential for denying personhood. The physical reality of blood and the methods of blood technology reveal symbolic sites of both loss and recovery.

Life Force and Blood Technology

The technology of transfusion and the mass-production of intravenous blood products permits mass medical treatment. However, in the larger cultural environment, new symbolic meanings are constellated around this technology. Before blood transfusion of whole blood or its products was possible, each person had his or her allotted share of blood; it was one's life-force for a life-time. It was precious, personal, self-contained -- the inland waters of each person as microcosm, unique within the order of the whole, contained by the larger world. At the same time, blood reminded

[182] Lewis Mumford, *Art and Technics* (New York: Columbia University Press, 1952), 15.

[183] Ibid ,12.

us of our limits, our vulnerability, our need to take care. Bloodshed was the cost of invading those tender boundaries of self and others. Blood also forms bonds. In relation to this, the implications of blood transfusion as an invasive procedure are profound.

On the positive side, blood transfusion is a realization through technology of the unification of diversity, of an embodied, global sense of human co-operation in the interests of health. Paradoxically, it also represents the dismemberment of the person, the dissolution of individual, personal identity in a mass society. It is this transformation through technology of the person's sense of self and self-in-world that is cause for concern. What is at stake in the meaning of this technology is not only life; it is nothing more or less than the survival of personhood.

This is a far cry from earlier healing practices, which acknowledged the place of the whole human, body and soul, psyche and soma, in relation to an ultimately mysterious universe. Medical anthropologist Bryan Turner cites an example from Pouchelle, who explains that moral training was a requisite for those who would take on the healing of the body as a sacred task.

> In the history of the body in medical sciences, it is interesting to note that the surgical manipulation of the body in the anatomy lesson created enormous moral and religious problems, because in opening up the body the surgeon was opening up the mystery of the universe. What God had closed within the body should not be opened up for secular purposes by the surgeon. The surgeon's exposure to the internal fluids and juices of the body, particularly the blood, also exposed him to moral and spiritual dangers. Mediaeval regulations for the control of surgery often recommended moral practices for the surgeon prior to an operation which were parallel to the

preparations a priest undertook before giving the sacrament.[184]

A quality evoked by the sacred, according to Mircea Eliade, is awe in the face of mystery. The sacred is not dependent on institutionalized religion; the sacred is more a "mysterious act -- the manifestation of something of a wholly different order, a reality that does not belong to our world, in objects that are an integral part of our natural 'profane' world. . . . . To pre-modern societies . . . the sacred is equivalent to a *power, . . . to reality*. The sacred is saturated with *being:"* [185] For the western world, notions of wonder and the sacred came to be associated with the dazzling illusions of science and technology.[186] Human intelligence was to render all life ultimately knowable and controllable. Medicine as a science became vested with these powers, which enabled its invasive technologies and potentially hierarchical patient-physician relationships.

When we combine this expectation with the material separation processes and symbolic reduction of blood itself, from the life force of the whole person to a scientifically-processed "comfort product", we have a lethal combination. Here donors become "producers" (Garretta called American blood, "mercenary blood"; the person in need becomes a consumer; and this desacralized, personal fluid becomes a "commodity", a "national product". This cannot help but alter our perception of what it means to be a person.

Blood is powerfully evocative; combined with technology it engages

[184] Bryan S. Turner, *Regulating Bodies: Essays in Medical Sociology* (London: Routledge, 1992), 50.

[185] Mircea Eliade, *The Sacred and the Profane: The Nature of Religion* (Orlando, Florida: Harcourt Brace Jovanovich, 1959), 10 -12.

[186] Extending this theme into the "religious way" as "doctrine beyond question," philosopher George Grant observed that "the pursuit of a dynamic technology is now a world wide religion." (*Technology and Empire* [Concord, Ontario: Anansi Press, 1969], 120,114.) See also David F. Noble, *The Religion of Technology: The Divinity of Man and the Spirit of Invention* (New York: Alfred A. Knopf, 1997).

complex constellations of meaning around illness. Illness itself, as many have noted, is commonly described in terms of war and aggression. In the case of AIDS as a blood-related disease, profound and ancient associations engage patient and doctor in an intense struggle, where the physician leads the "fight against disease". In the linguistic environment of "battles against cancer and AIDS", the individual patient is particularly vulnerable to being "numbered among the troops," to becoming that anonymous foot-soldier, the faceless "unit," the unmarked sacrifice to research. The final stage of the metamorphosis that transforms a person into a patient, occurs in the dangerous reduction of patient to statistic.

Ironically it is bioethics itself that Ivan Illich criticizes for pushing this abstract reduction to the limit. In his view, "the pop-science fetish 'a' life tends to void the legal notion of person." With twentieth century technology

> "the physician came to be perceived as society's appointed tutor of any person, who, having been placed in the patient role, lost some of his own competence. Now he becomes the socially responsible manager, not of a patient, but of a life . . . According to one of the most reputable bio-ethicists, science has endowed society with the ability to distinguish between a life which is that of a human person and that which corresponds to 'a human non-person.' . . . Given the technological 'extension of medicine from conception to organ harvest'. . . medicine has ceased to look at the sufferings of a sick person: the object of care has become something called a human life. . . This transmogrification of a person into 'a life' is a lethal operation."[187]

The chilling truth is that in such an environment, the metaphors of war

[187] Ivan Illich, *In the Mirror of the Past: Lectures and Addresses, 1978 -1990* (New York: Marion Boyars, 1992), 230-233.

converge with those of "scientific" medicine and global economics -- to the ultimate detriment of the patients. They are abstracted to numbers. In such a hybrid technological environment, the statistical chance of loss of life is, by the conventions of war "acceptable," even inevitable.

Dr. Garretta and his senior scientist Dr. Allain at the Centre National de Transfusion Sanguine both quoted statistical chance as a justification for their decisions to continue to sell contaminated stocks of comfort products with a shelf-life of up to two years, and to apply them to treatments and research involving seronegative haemophiliac patients. Despite urgent warnings from international and national medical communities for the need to either heat-treat the concentrates for decontamination, or to purchase substitutes, and despite the fact that "One by one, the other blood-processing centres [in France] stopped distributing unheated products . . Garretta kept selling. Allain produced the [research] results of his protocols: 35 % of the seronegative haemophiliacs he had treated and tested through the Centre National de Transfusion Sanguine were now seropositive. Garretta kept selling. He said later that the medical wisdom then was that "only twenty per cent" of those seropositive patients would develop AIDS."(84 -85)

Ultimately statistics worked against everyone, including the medical establishment. They were shocking. "Seventy-one per cent of all the haemophiliacs in Paris were infected by October, 1985; ninety per cent of Allain's private patients were infected."(95). For the year 1985, "Britain, with roughly the same population as France, reported 75 cases of AIDS linked to blood transfusions;" France's record of contamination through transfusion for the same period was 1,500.(9I). In keeping with the mythology of medicine as science, these persons with AIDS were literally

the blood sacrifices to rituals of scientific "control" and the illusion of "predictability."

True to the practice of sacrifice and warfare, the ritual required the victims to comply with orders. The strategy to ensure compliance, as well as the "objectivity" of medicine-as-science, was secrecy: it required that the experiments be called by another name -- treatment. None of the persons with haemophilia in Allain's protocol were known to have been informed of the risks involved. None was advised that he was receiving unheated Factor VIII which, even without batch-testing, was almost certain to be contaminated. It took the blood of four or five thousand donors to produce one lot of Factor VIII (85). It is beyond an act of faith to think, in a time of AIDS, that not one of these would be infected.

This failure on the part of the government and the medical profession to disclose the truth was a direct denial of the patients' personhood, of their right as autonomous human beings to know their treatment, and its risks, and to make informed decisions regarding the hazards to themselves and those close to them. Such decisions regarding their own well-being and that of those close to them were moral decisions; yet they did not have a voice in them. This, despite the fact that disclosure remains, in theory at least, one of the main supports in the western ethical structure of doctor-patient trust. Beyond medicine, for that matter, as Eisenberg says:

> All humans are seen to have obligations to others by virtue of their being human. This means not treating others as objects but as subjects capable of setting values, making choices, and acting. This in turn means recognizing the rights of all to realize their freedom, 'their right to care and concern,' and their right to dignity. It ultimately means recognizing the rights of all

> human beings, to hear others, and be heard with respect. The denial of this right and its corresponding obligation is a violation of the humanity of others (though sadly it may be an expression of the humanity of the denier).[188]

Yet a violation occurred. The brotherhood of blood, if it ever existed, was shattered.

Resistance: Naming and the Self

Many haemophiliac patients in *l'Affaire* had the law mediate their claims and resistance -- their resistance to being denied the truth, to being treated as objects, to living with AIDS and without compensation (as if there could be compensation) for themselves and those close to them. Others went in person to trial, and reclaimed their experiences from denial and anonymity by making them public. They put their names and faces in front of France and the international community. In the process, they exposed the names of some of those otherwise faceless or protected persons who could be considered accountable in government and medicine.[189] (Many others remained protected.) They also demystified, to some extent, important information surrounding AIDS and related blood technologies.

By "naming" themselves, their antagonists, and the technology, these individuals reclaimed their humanity from a dehumanizing environment.

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[188] Eisenberg, *The Limits of Reason*, 63.

[189] Gen. IV :10 -12: :
And he said, What hast thou done? the voice of thy brother's blood crieth unto me from the ground.
And now art thou cursed from the earth, which hath opened her mouth to receive thy brother's blood from thy hand;
When thou tillest the ground, it shall not henceforth yield unto thee her strength. (King James Authorized Version).

Considered in the context of tragedy, their actions evoke the symbolic power of naming in rites of passage and myths of transformation. Across time and cultures, names are sought or given to mark one's development and major turning-points. At this time in our history, circumstances urge us to reinstate the personal in our environments, to uncover and understand the deeper meanings of living with technology.

"Christian" and "*la mémoire*". These are what Jean Peron Garvanoff said brought him to court for every session of the trial of *l'Affaire* and the appeal from June 1992 to summer, 1993. He said he "owed it to Christian" and to memory. The subject of memory was his experience and that of his dead half-brother, Christian.

> Jean learned from Allain . . . in 1985 that he was seropositive. In 1987, he learned that he and Christian had been subjects in one of Allain's research protocols: it followed the effects of different heated and unheated blood concentrates on four hundred and five haemophiliacs. . . . Jean says that at the time neither of them knew they were a part of any protocol. It is a 'betrayal' that haunts him. He is dying now, and he blames Allain -- for himself and for his wife, who has AIDS too. (98)

Garvanoff refused to settle out of court. He was "quietly" relentless. His betrayal was all the more painful because he thought he knew Allain, had played for him as a jazz pianist, and had considered himself a "friend in music." (78)

It is significant perhaps that this man is an artist, a musician, who insists on remembering, in the ancient sense of gathering together. This theme of remembering occurs in Egyptian myth: Seth, jealous of his brother, Osiris, cuts his body into fourteen pieces. It is Isis, the wife and sister of Osiris,

representing compassion and feeling, who re-members him -- that is, she gathers the pieces of his body and heals him. Significantly, she is in the company of Thoth, the god of wisdom and medicine.

"Physician, Heal Thyself"

Healing, in the sense of "making well," involves a "gathering together" an integration at the level of the personal: it acknowledges the person as a whole human being -- psyche and soma. As Francis Graeve, the eighty-year-old father whose two sons contracted AIDS through the Centre, reminds us: "the discourse of science and the practice of medicine are not the same thing."(93). It is the healing art of medicine that we are called to re-member.

The protagonists in this drama could easily have been caught up in the momentum of depersonalizing forces. In this secular ideology of science and nationalism, blood became a potential form of France's currency, with its value driven by the marketplace. Should it be any wonder that the director of the Centre National de Transfusion Sanguiné should be an "entrepreneur," and that blood becomes de-sacralized, anonymous, a fluid commodity or "product."..The donor is now a producer and the person in need, a consumer.

Medical administrators also are expendable where "mature societies have structured the political environment to guard against individual variability".[190]..This is not to say that the physicians and administrators of *l'Affaire* are necessarily victims of a technologically deterministic

[190]Post and Robins, *When Illness Strikes*, 207.

environment. However, considering the hybrid medical environment,[191] this secular ideology gave meaning to the purposes of doctors like Garretta, a "medical industrialist," and Allain, an apparently committed scientist.

Living in shifting ethical environments shaped by the metaforms of technology, we are, according to some, experiencing multiple alienations. Consequently, it is not unusual for persons to identify strongly with those ambitions and values that are reinforced by society. Also, under certain circumstances, including depersonalizing environments, it is not unusual for interests and ambitions to take the place of human relationships.[192] In fact, it becomes increasingly understandable that those investigated in *l'Affaire*, such as Dr. Allain and Dr. Garretta, could have committed their energies to the promises of medical technology within a hierarchical state.

Conclusion

In the tragic relationship between human beings and technology in *l'Affaire* there are the seeds of hope. For technology remains the product of persons acting in their environments. We can try to become more sensitive to the physical aspects of our lives, the actual settings in which we find ourselves, instead of relating primarily and exclusively to our

[191] "In such a world, man's spiritual life is limited to what part of it directly or indirectly serves science and technics [which Mumford defines elsewhere as "that part of human activity wherein, by an energetic organization of the process of work, man controls and directs the forces of nature for his own purposes."] All other interests. . . are suppressed as 'non-objective,' emotional, and therefore unreal." (Mumford, *Art and Technics*, 15). Indeed, the very ethics of medicine were caught in the flux of new technologies. Not only physicians are challenged. "Unless human nature and society are radically transformed so that the objectives and rules of social practice are changed, there is no possibility of effecting a unity or consistency between moral theory and practice. The vast array of social practices that constitute social existence carry with them commitment to objectives, rules, conventions, and principles that are incompatible with the humanistic and developmental values that most moral theorist advocate." (Eisenberg, *The Limits of Reason*, 41-43).

[192] As previously discussed in Morris Eagle, "Interests as Object Relations," *Psychoanalysis and Contemporary Thought* 4, no. 4 (1981).

abstract constructions of those situations.

It is true that even if it proves an illusion, the control and extension of power that technology offers is a powerful lure. It will be important to our future understanding, indeed, to our very survival, to consider what it means that we human beings put so much emphasis on control. What fears, for example, -- or illusions -- may be prompting it? If it is alienation or confrontation with the unknown, perhaps we would be better served by seeking ways to encourage empathy, flexibility and creativity -- by making room for attention and reflection, as well as action. Redemptions, where they are possible, are ultimately mysterious and often spontaneous. What I do support, as we develop studies in technology, is that we apply both analysis and imagination to explore the feelings and motivations underlying our technological ambitions and practices. Interpretation through metaform is one means for doing this. Rather than attempting to force outcomes to conform to a fixed point of view, interpretation is a matter of remaining open to emerging themes in technology.

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CHAPTER V

INTENTION AND TECHNOLOGY

" For thoughts to become activities and workings they require a will or force of intention, which is symbolized by the hand."

Robert Lawlor

"Every force evolves a form"

Ken Wilber

Once one has the knowledge, whatever one does after that is a moral act.

C.G. Jung

While we commonly conceive of technology as an extension of our physical capabilities and our senses, it is in fact, as we have seen, also an extension of our thoughts, emotions and purposes. In this respect, technology represents our intentions, both conscious and unconscious. By examining the motives, aspirations and fears that account for our inventions, we reclaim our membership in technology as an expression of human relationships with others and with the world at large.

In this chapter, in the course of my investigation, I shall introduce a man whose life exemplifies the crucial role of intention in the shaping of knowledge and its application to technology. The inherently personal component of living through technology is elucidated by our common understanding of human intention. Intention is defined as: 1) a thing intended; an aim or purpose; or 2) the act of intending. [193] While intention has been extensively studied in other contexts, particularly in the field of philosophy,[194] it best suits my present purpose to look at intention in its primary sense. It is in keeping with my approach to research to come as close as possible to the basic, primary sources of subjects under discussion. To investigate the characteristics and nature of a material, for example, one might look closely at the basic building-blocks, even at the level of atomic and molecular structures. This habit of looking to origins can carry

[193] *The Concise Oxford Dictionary of Current English*, ed. R. E. Allen (Oxford :Clarendon Press, 1990), 617.

[194] In *The Encyclopedia of Philosophy*, ed. Paul Edwards (New York: MacMillan, 1967), John O. Nelson discusses the meanings of intention as follows: "The concept of intention relevant to modern philosophy . . . is usually discussed under four chief headings: (1) expressions of intention -- 'I shall (am going to) do A in circumstances C'; (2) ascriptions of intention -- 'Jones has the intention of doing A in C'; (3) descriptions of the intention with which some action is done -- 'His intention in saying that was to embarrass her'; and (4) classifications of actions as intentional or as done with intention -- 'She shot him intentionally.' . . . the word 'intention' is ambiguous in the way, for example, that the word 'belief' is ambiguous, for . . . the word may refer either to a state or episode (in this case, intending) or to the intentional object of such a state or episode -- that is, to that which is intended" (198). In this case study of my subject's life and writings, the most useful application of "intention" is in the sense of (1) above, that is, a stated expression of intention -- in this case, by the subject, in his own words.

over productively into other technologies on which we build our sense of meaning: language is one of these technologies. [195]

In support of my use of dictionary definitions for intention in this case, I cite physicist David Bohm: what he has to say is in keeping with a sense of cultural heritage as well: "It is often useful to look into the derivation of words, even though the original meaning may not be exactly what it is now, because to do this gives insight into the archaeology of the thought process. By understanding how words have developed we understand their meaning better. Also people in early days when they coined the words may have had a fresher perception, less based on routine ways of using language. Our present meanings are often rather habitual, dull, and mechanical. To look at the roots of the words helps us to get out of this."[196]

The Latin root of the word "intention" is *intentio*, stretching, or purpose. Here the idea of the mind "stretching" toward something is analogous to McLuhan's application of extension to technology, where he emphasizes that technology extends the physical senses. It is important to be aware that it is *human* intention at work. Otherwise, without being mindful of the human component in this interaction, and of our human responsibility, we fall into the fatalistic camp of technological determinism, such as that

[195]According to Keith Oatley, educational psychologist (specializing in the psychology of emotions) and author in fiction (*The Case of Emily V.*,1993]), as well as in education. Oatley offered his opinion that language is a form of technology in our discussions of metaform and its support in object relations theory. Personal communications, spring-summer,1998.

[196] David Bohm and Mark Edwards, *Changing Consciousness: Exploring the Hidden Source of the Social, Political and Environmental Crises Facing Our World* (San Francisco: HarperCollins *Publishers*, 1991), 147.

advanced by Ellul.[197] With this view, there is a strong tendency to attribute to technology itself, or to its techniques, the power to act with deliberate, informed, conscious intent. For example, while television has its influences, it is not the "television" that is "ruining our children"; rather it is the intentional production of the materials televised, the control over these at all levels of society, and the viewer's participation that will affect the user. In this way, human receptivity, responsibility, and accountability are remembered as essential factors in any study of the relationships between culture and technology.

The following case study explores technology as expressive of human intention and choice by following the story of one man's personal odyssey in technological research and development. My subject is the metallurgist, historian of technology and conservation educator, Cyril Stanley Smith. Smith was among the first conservation-linked researchers to specialize in the application of Western metallurgical science to the study of ancient Oriental bronzes. As a result of his extensive knowledge of ancient and modern metallurgical practices, he came to learn that art, science and humanistic values were inextricably linked, and that they are given material form through technology.

While his work engages metaform, my emphasis in this chapter is on intention, change, and choice. Consequently, in addition to employing metaform as an interpretive device, in this case, I will, at different points, draw on Smith's published work and relevant work of others; carry out historical research, conduct interviews, and include studies in both

[197] Ellul ascribes an importance to technique as a "moving force" that supercedes all "social, human, or spiritual fact" .... "Technique has taken over all of man's activitities .... (it) transforms everything it touches into a machine .... But let the machine have its head, and it topples everything that cannot support its enormous weight." Jacques Ellul, *The Technological Society* (New York: Alfred A. Knopf,1964), 442-443.

empirical metallurgy and material science in order to relate the man to the circumstances and technologies of his times. Moreover, his work and that of his colleagues will lead us to contemporary issues of technological thought -- personal and collective -- in relation to technology. Along the way, we shall see how the course of his life encompassed the secrets of both ancient civilizations and modern inventions -- inventions extracted from the core of matter, with profound consequences for the future. My purpose is not to engage him in argument. My objective is to present his life, work, and writing -- on their own terms -- as an instructive case study. In this case also, the manner of Smith's narratives and the nature of his work make this approach more appropriate than ever.

As for the more complex machinations regarding intention (such as thought acted on and not acted on), there is no clearcut path by which we can honestly represent Smith's motivations and actions -- beyond what he has revealed himself. We have limited access to his deliberations regarding the most publicly significant application of his technological knowledge. This situation is a consequence of the manner in which he relates his experience. When he does, his statements are clear and succinct. They reveal only the tip of the iceberg that is Smith, a complex person facing complex decisions. Finally, Smith faced the same situation all of us share -- at the heart of our intentions, as in every other matter, we ultimately remain mysteries -- mysteries even to ourselves. For example, where Pascal says, " 'the heart has reasons that reason does not know at all,' " Antonio Damasio adapts this to say: "The organism has some reasons that reason must utilize."[198]

[198] Antonio R. Damasio, *Descartes' Error:: Emotion, Reason and the Human Brain* (New York: Avon Books, 1994), 200.

My understanding of intention here will be in the sense of personal extension -- an aspect shared with technology, as I have defined it holistically, as an extension of the whole person. We shall see that Smith's perceptions of the world and his role in it shaped his intentions toward the future and that he acted through technology to realize these.

An integrated, holistic understanding of these connections leads us to see that extension is common to both technology and intention, where technology gives form to human emotion and intellect, as Damasio reminds us. The technological instrument can be understood as a concrete manifestation arising out of our intentions.

In the case of Cyril Stanley Smith, the importance of this human element becomes apparent. We shall see how this human element continues to come to the fore in such areas as cultural conservation and medicine, while we are in the process of learning to extend our practices globally and collaborate across cultures. In the process, we experience technology as an extension of our purposes, as a dynamic and elastic force.

Anomaly as Opportunity

As an instance of the way in which culture and history may condition our expectations and interpretation of technological objectives and their products, consider the concept of the anomaly. The etymology of the word *anomalous* is from the Greek, *an*, not, without - *homalos*, even.[199] An anomaly is defined as: "1. Deviation or departure from the normal or common order, form, or rule. 2. One that is peculiar, irregular, abnormal,

[199] *The Concise Oxford Dictionary of Current English*, ed. R. E. Allen (Oxford:Clarendon Press, 1990), 44.

or difficult to classify."[200] While Cyril Stanley Smith and his contemporaries, including Thomas Kuhn,[201] were among the *avant garde* in attending seriously to irregularities in phenomena, such attention was not perceived as typical of Western thought. While cultural perspectives do change, Shigeru Nakayama, historian of science and learning, noted that "The persistent reluctance of the Western academic tradition to acknowledge and accommodate the anomalous might well be seen as its most distinctive feature. . . .East Asian scholarship began with the assumption that mutability and change were the ways of the world, recognized the legitimacy of the extraordinary as well as the normal, and sought within that framework to create a suitable place for everything."[202] One culture's anomaly can be another's norm and vice *versa*. This fact is as true of technology as it is of other manifestations of human perception and creativity -- as in ideals of beauty, tastes in food or music. Whether we are studying objects from antiquity or contemporary inventions, a feature may present itself as a surprising, even disturbing inconsistency or apparent anomaly -- at least according to more commonplace Western expectations of technological practice. In fact, this apparent "accident" or anomaly may prove instead to be a concrete illustration of a distinctive intention toward the object on the part of its originators. Faced with what appears to be atypical, one may actually be encountering one's own entrenched attitudes and values. In this way an anomaly will expose habits of perception and interpretation of phenomena. Consequently

[200]*The American Heritage Dictionary of the English Language*, 3rd ed. (Boston and New York: Houghton Mifflin, 1992), 75.

[201]Thomas S. Kuhn, *The Structure of Scientific Revolutions*, 2nd ed. (Chicago: The University of Chicago Press, 1962),1970.

[202]Shigeru Nakayama, *Academic and Scientific Traditions in China, Japan, and the West*, trans. Jerry Dusenbury (Tokyo: University of Tokyo Press,1984, 60.

potential is created for new insights and a broadening of experience.[203]

In other words, the forms and functions of technology are often quite specific to a people, period and environment. I first became aware of the work of Cyril Stanley Smith (1903 - 1992) through his description of just such an encounter with an apparent anomaly, in his selection of essays.[204] At the time, in 1985, I was visiting Harvard to conduct conservation research into the relationship between material studies and the digital documentation of artifact collections at selected Canadian and American museums.[205] My concern as a conservator/restorer was that during the process of transferring historical data into the new documentation systems, information regarding the physical materials of museum objects was frequently lost, neglected or relegated to peripheral, less accessible data bases. As a result of my early experience of the Canadian landscape, and later with the heritage of First Peoples, I strongly believed in the important connections among the *materials* of cultural objects, their natural *environments*, and the *meanings* that accrue to them because of their place in these environments. Smith's appreciation of the research potential of natural materials, and especially of materials from antiquity, was heartening to my purpose. Little did I know that several years later I would discover the fascinating background that Smith had brought to his conservation work.

[203]There is a fascinating conjuction occurring here between advanced technological research in the United States at the Massachussetts Institute of Technology (MIT), and ancient Chinese philosophy and thought. In both cases the importance of the unexpected and unusual receives special attention. The Physics Faculty at M.I.T. maintains a Department of Anomalies.

[204] Cyril Stanley Smith, *A Search for Structure: Selected Essays on Science, Art and History* (Cambridge, MA: Massachussetts Institute of Technology, 1981). Subsequent references to this work will appear as *Structure*.

[205] This research was undertaken with the assistance of a grant from the Canadian Museums Association.

As his story unfolds, I will select aspects of Smith's work and explore them for his intentions as they appear directly and indirectly during the course of his technical research and his life's work.

A native of Birmingham, England, Cyril Stanley Smith came to the United States as a graduate student at MIT. [206] After graduation with his D. Sc. in 1926, and in lieu of a permanent academic position, which had been his first preference at the time, he took a position with the American Brass Company in Waterbury, Connecticut. There he came to spend the next fifteen years, including the Depression, from 1928 to 1942, a time that he considered most valuable for many reasons. This experience helped to formulate his particular sense of history, one that grew from a respect for the workers who still practised the old industrial processes, which were being replaced. As he recalled years later, "Seeing it, I came to admire the skill and the real, if unintellectualized, knowledge possessed by men who work with furnaces, tools and machines to make things. . . the coordination of the physical, muscular component with mental understanding. "[207] During the working week, Smith developed alloys, conducted industrial research, and "learned something of management" and economic factors in production. On the weekends, he visited the Sterling Memorial Library at nearby Yale University in New Haven to further his research in the history of metals and their technology. As he puts it: "World War 11 ended all this."[208]

By the time Smith was describing his encounter with an anomaly, he was a

[206] The following details of Smith's life have been gleaned from several sources in his personal writing, all of which are documented in the Bibliography to *Structure* .

[207] Smith, "A Highly Personal View of Science and Its History," *Structure*, 355.

[208] Ibid., 356.

mature scientist, an experienced metallurgist, and a professor in both metallurgy and the history of science and technology at MIT since 1961. His title of Institute Professor distinguished him as a "faculty member whose work transcends individual departments and disciplines."[209] It is significant for this study that he made a point of describing himself as a "technologist" at this late stage in his professional life.

Anomaly and Temple Bells

During the late 60s and early 70s, when Smith was in his sixties, he was teaching metals conservation at New York University, concurrently with his work at M.I.T. At the same time, he was involved in the intensive study of monumental bronze antiquities from Asia. He and his colleague, Rutherford J. Gettens,[210] had selected for analysis various cast bronze objects ranging from ceremonial vessels from the Shang Dynasty (*c.* 1500 - 1050 B.C) to later, Buddhist temple Bells from China and Japan. These antiquities were recognized as "masterpieces of casting,"[211] examples of the most advanced metals technologies of both ancient and modern civilizations. "All of these techniques and the visual qualities of the objects that resulted depend on physical and chemical properties that have been

[209] Wolfgang Saxon, "Obituary: C.S.Smith, 88, M.I.T. Professor of Metallurgy," *The New York Times* 29 August 1992, 26 (1).

[210] Gettens went on to specialize in conservation, becoming one of the founding leaders of this field in the United States. Both Smith and Gettens became central figures in a lineage of conservators of Oriental antiquities and related materials; notable among them are W. Thomas Chase, recently Head Conservator, Department of Conservation and Scientific Research, Freer Gallery of Art, Smithsonian Institution, Washington, D.C. Chase, now of Chase Art Services, Maryland, was awarded the College Art Association and Heritage Preservation Joint Award for Distinction in Scholarship and Conservation in 1998; at that time he was recognized "more rightly as an ambassador" for his publications and collaborative conservation work in Asia, especially in the area of metals. Conservator Barbara Whitney Keyser, who researched Oriental bronzes during early studies with Chase, and was published in memory of Gettens (Keyser, 1979), is an educator in conservation at Queen's University in Kingston, Canada.

[211] Cyril Stanley Smith, *From Art to Science: Twenty-two Objects Illustrating the Nature of Discovery* (Cambridge, MA: The Massachussetts Institute of Technology, 1980), 31. Subsequent references to *From Art to Science* will be cited as *Art to Science*.

understood by scientists only recently. But they have long been understood by the artist in terms of the interaction of the eyes and hands and tools with the materials from which the object was being made."[212] Smith's idea, then, was to re-construct the technology of the Chinese bells through their derivatives in Japan, where the same technology continues to be applied today in the casting of temple bells.

Often weighing several tons, these imposing Chinese bells can be two meters or more in height. It is a tribute to the mastery of their makers that these bells, despite their large mass, often exhibit fine and precisely rendered surface details. Often they have various projections and densities that offer different striking options for producing a variety of sounds. Not only were they cast from complex moulds in several sections; the surfaces of the bells were often enriched with a variety of textures, as well as elaborate, symbolic decoration, including hexagrams from the Chinese text, the *I Ching* (in English, *The Book of Changes*), "one of the most important books in world literature," with its 3,000 year-origin in mythical antiquity, and still studied by eminent scholars today. [213]

For his research, Smith not only relied on texts and laboratory analysis; he also studied the casting of Japanese bronze bells on film. In keeping with the importance he had come to place on practical, working experience,[214] he went to Japan in1969 to observe directly the contemporary practices at the Takahashi foundry in Kyoto, where bells are cast for Buddhist temples. Given the cultural affinity between Japan and China in their sharing of

[212] Smith, *Art to Science*, 31.

[213] Introduction, *The I Ching or Book of Changes*. The Richard Wilhelm Translation Rendered into English by Cary F. Baynes (New Jersey: Princeton University Press,1990), xlvii.

[214] "I do not see how one can claim to be a metallurgist without some industrial experience." Smith, "A Personal View of Science and its History: Postscript," *Structure*, 355.

Buddhism, and as a result of this continuity in metal-casting techniques, it was possible for him to begin to unravel a paradox in the casting of the bells.

Smith was struck by the apparent contradiction between the extremely sophisticated method of manufacture of these bells and the rough edges and extrusions of metal left along the seams of the cast sections. Given the extraordinary skill with which they were made, the only reasonable explanation for the rough edges seemed to be that this "oversight" was eliberate. The knowledge and craftsmanship were clearly available, and all manner of care had been taken to perfect the casting of these bells, which were used in temple precincts. As Smith observed: "Most Japanese bells when hung still have on them one or more rough lines obviously arising in horizontal mould joints. These lines are not removed in fettling the bell, and they seem to be regarded not as defects but rather as a reminder of the reality of the founder's interaction with his materials. One is reminded of the ceramics that are most treasured in Japan which usually have some unexpected tool marks or irregularity resulting from a kiln mishap."[215] Even in the technology of everyday items, such as many cast-iron tea kettles, Smith noted how "mould-joint 'blemishes' are effectively displayed."[216]

Crossing the Bridge: Part 1

Smith's insight is true as far as it goes. On the other hand, one must seek a source closer to the origin of the work in order to appreciate the intention

[215] Smith, *Structure*, 263.

[216] Ibid.

behind it. Otherwise, one may be inclined, in a way that is certainly understandable, to go no further than seeing through one's own personal/cultural perspective an object or phenomenon that is emerging from another time or place. Certainly the physical object must be able to evoke some resonance within the person coming to meet it: one must be able first to achieve a degree of rapport with a new entity at the level of the familiar, in order to absorb what is unfamiliar, not yet integrated into experience, as we have seen with Winnicott. As we know from Smith's own description of relating to materials, he did realize a rapport with these magnificent castings on many levels related to aesthetics and to materials science; but he had to penetrate the meaning of the anomaly in order to experience the bells in a way that embraced the cultural, spiritual significance, the "heart of the matter."

Consider two people coming toward each other to meet on a bridge; each is crossing from one "bank" of understanding to another. One can cross it half-way, meet in the centre, and return alone to the same side. Or one can decide to cross with the other to that person's territory, to be with them at home. This experience is absorbed, integrated, and we return, altered in some way.

To what extent are we really willing to open ourselves to new dimensions of our technologies? Smith appreciated the unexpected -- anomalies or irregularities in a materials sense, that is, within the context of the physical sciences. Indeed, he said that these were critical. Given his relative silence on the spiritual, philosophical, or psychological intention or impact that informed the works he studied, it is reasonable to suggest either that he had less interest in these dimensions, or that he felt it was

inappropriate for him as a scientist to write about them. [217]

Smith is approaching an understanding of intention when he reflects that the apparent casting defects might be left deliberately "as a reminder of the reality of the founder's interaction with his materials". If we want to know more about the intention, we need to direct our inquiry to a scholar closer to the source.

Soetsu Yanagi, recognized as "the father of the Japanese craft movement,"[218] discusses the principle behind technological and artistic irregularities in the context of the Buddhist idea of beauty and the tea ceremony: "Unlike other collectors, most tea masters prefer the incomplete; they look for slight scars or irregularities of form. If carried to excess, this desire will, of course, become unhealthy, but that there is a close relation between beauty and deformation cannot be denied. Beauty dislikes being captive to perfection. That which is profound never lends itself to logical explanation: it involves endless mystery."[219]

Where Smith seems to emphasize the maker and his interaction with the materials, Soetsu emphasizes the mystery that is suggested by the spontaneous presence of the deformation itself. One emphasizes the concrete action of the individual, the other, the infinite unknowabilty of

[217] To some extent, of course, Smith was influenced by his time and culture. Historian and wife of Cyril Stanley Smith, Alice Kimball Smith, observed of their colleagues: "One of the marks of a first-class scientist was exclusive preocccupation with research. Private indulgence in music, travel, or mountain climbing was acceptable, but public display of interest in things other than science required special justification." Alice Kimball Smith, *A Peril and a Hope: The Scientists' Movement in America:1945 - 47 (Chicago*: The University of Chicago Press, 1965), vi.

[218] Bernard Leach, Introduction in Soetsu Yanagi, *The Unknown Craftsman: A Japanese Insight into Beauty*. Adapted by Bernard Leach. Foreward by Shoji Hamada (Tokyo: Kodansha International Ltd., 1972), 87.

[219] Soetsu Yanagi, *The Unknown Craftsman: A Japanese Insight into Beauty*.,117.

"that which is profound."

Profound experiences were not at all unfamiliar to Smith; at this time in the early 70's, he is approaching, and coming closer it seems, to coming to terms with his own history.

Smith introduces himself to us via his "Apologia" of October,1979, written to accompany the second printing of his book, *A Search for Structure.* [220] Here Smith explains, at age 76, the reasons behind his selection from "the nearly two hundred papers" he had published by that time. (It is important to note that while I will refer many times to this text, references are drawn from several papers written over Smith's entire career.) In this collection of selected works, Smith has excluded all of his professional work as an industrial metallurgist, "the job for which I was trained." He has included only one essay from the area of "pure science". Most important, he writes that "there is no hint of wartime experiences or service on Washington committees." He explains:

> What is left is largely the product of interests peripheral to my profession -- history, art, and what impinges on philosophy. . . it was my professional familiarity with materials that provided a bridge for conversations with experts in other fields; in rather the same way as materials themselves have interacted with mainstream history, for they are the stuff on which virtually all human activities are based. It was the search for the historical origins of down-to-earth metallurgy that introduced me to the techniques of the artist, and it was noting the similarities between the hierarchy of concepts in art and the structural hierarchy in materials that turned me into a philomorph, even at times into a rudimentary philosopher. . . . The essays are . . . experiments in the development of a

[220] Smith, "Apologia," *Structure*, vii -viii.

> viewpoint. They are meant to provoke thinking . . . rather than to stop it by suggesting that truth has been found . . . . I have learned not to be ashamed of the intuitive-pictorial approach, which as a young scientist I was taught to abhor.[221]

Secrets

Prior to his conservation research, Smith's expertise and his commitment to science and technology was applied to a very different purpose. His research was fixed exclusively on a massive technological intervention -- nuclear fission and the atomic bomb. It was a project from which he would eventually withdraw.

I am able to extend this discussion from the conservation of temple bells to nuclear warfare simply because this leap was the reality lived by one person who spent the greater part of his 88 years as a scientist and self-described technologist. This was the range and depth of living with -- and through -- technology for Cyril Stanley Smith, and it was within this context that his own, personal meaning system emerged and developed.

The following account is not intended to be a comprehensive biography of Smith's life, nor do I claim to have the definitive statement about the complex factors behind his decisions or his related involvement with nuclear research . Instead, my intention here is to explore some of those areas in his life where significant questions can be raised about the relationship between intention and technology, as they relate to one person's experience and meaning system. These questions will arise as much from gaps or lack of information as they do from the available data, since the ultimate reasons may have been obscure to Smith himself. As

[221] Ibid., vii.

well, serious consideration of Smith's experience would have to take into account his role in the development and application of atomic research, which, by its very nature, is obscured by secrecy and evokes strong feelings that continue to shape the perception and interpretation of events.

With these provisos in mind, the following account of Smith-as-technologist/scientist/ historian recognizes the nature of his work, including the place of metaform as it relates to aspects of the atomic or fission bomb, and follows him into subsequent technological research.

Before the Bomb

To understand Smith's position, it is necessary to consider the atmosphere and environment in which he was working. An excellent source for our understanding of the context is the historian Alice Kimball Smith, wife of Cyril Stanley Smith and later a fellow and Dean of the Radcliffe Institute for Independent Study. Even years later, long after the 1965 publication of her book, *A Peril and A Hope: The Scientists' Movement in America,* Kimball Smith was quoted as saying she thought it was "terribly hard to recreate for some people who didn't live through it, and even to remember, for those of us who did, how strong this uncertainty and this fear" was at the time.[222] Not only was it feared that American research into the properties of uranium was being copied in Germany; it was feared that the enemy would achieve the upper hand in its military applications.[223] Already by 1958, when secrecy was partially lifted, it was revealed that "the menace of a German uranium bomb . . . was in fact nothing more than

[222] Alice Kimball Smith, "Science and Conscience" in *Ideas*, (Toronto: Canadian Broadcasting Corporation, 1984), 16.

[223] Kimball Smith, *A Peril and a Hope*, 3 - 4.

a terrible phantom."[224]

Nonetheless, rumours in fearful times fostered a contrary view. Documentation proves that this push into the nuclear domain was advanced by "possibly the most famous scientist of his time," Albert Einstein (1879-1955). Einstein, at the exhortation of fellow scientists, urged President Roosevelt to pursue the potential of nuclear energy for use as weapons. As a theoretical physicist, Einstein was readily recognized by his colleagues as the voice that would reach the President's ear.[225]

Whether or not atomic research for military purposes was already underway in the United States, as has been suggested, as early as 1939,[226] Einstein was specific about the weapons potential of scientific research into the atom, when he signed a letter delivered to President Roosevelt in October of 1939:

> "This new phenomenon would also lead to the construction of bombs, and it is conceivable -- though much less certain -- that extremely powerful bombs of a new type may thus be constructed. A single bomb of this type, carried by a boat and exploded in a port, might well destroy the whole port with some of the surrounding territory.
>
> "In view of this situation, you may think it desirable to have some permanent contact maintained between the Administration and the group of physicists working on chain reactions in America. . ."[227]

[224] Robert Jungk, *Brighter than a Thousand Suns: A Personal History of the Atomic Scientists*, trans. James Cleugh (New York: Harcourt, Brace & World, 1958), 86-87.

[225] Ralph E. Oesper, *The Human Side of Scientists*, (Cincinnati, Ohio: University Publications, 1975), 59.

[226] Kimball Smith , *A Peril and a Hope*, 6, and Jungk, *A Thousand Suns*, 126.

[227] Oesper, *The Human Side of Scientists*, 59-60.

The response to this letter was concretized in the elaborate research project known under the umbrella name of the "Manhattan Project."[228] This American-based nuclear weapons research project called for the formation and mobilization of an interdisciplinary team involving top civilian scientists and their families from America and Europe, engineers, the military, major industrial corporations, and local people. Major recruitment began in 1943. Before it was over, some 150,000 people would eventually be employed.[229] "It was probably the first time in history that so brilliant a group of minds had voluntarily undertaken to adopt a mode of work and existence so unlike their normal way of life."[230]

We know from his later statements that Cyril Stanley Smith felt he needed to participate. Remembering his intentions fifty years later, he said: "In 1943 the defeat of Hitler would justify practically anything. So, I was a pacifist before the war, and I put that aside and said I'll work on this; it's necessary."[231]

Alice Kimball Smith also recalls their motives in 1942-43: "I remember vividly the succinct explanation that covered our own migration to an undesignated spot in the western mountains: the project would almost certainly end the war and afterward promised almost limitless benefits to mankind. Amidst the fears and uncertainties . . . what more could one

[228] The Manhattan Project was the code name, along with DSM [Development of Substitute Materials], established as the American component of the concentrated Allied atomic project, agreed upon by U.S. President Roosevelt and Britain's Prime Minister Churchill in 1942.

[229] 150,000 people and 2 billion in 1945 dollars. (Jungk, *A Thousand Suns*, 177).

[230] Jungk, *A Thousand Suns*, 115.

[231] Cyril Stanley Smith in *Remembering Los Alamos: World War II*, VHS, 60 min. (Los Alamos, New Mexico: Los Alamos Historical Society,1993), video. Subsequent references to this work will appear as *Remembering Los Alamos*.

ask?"[232]

I sense some retrospective irony here, in Kimball Smith's reflections on what were at the time their sincere intentions. But twenty-three years later, she would recognize how crucial it was that while the end seemed worthy, the means were largely unknown. The means at work included not only the technology, but also the overarching unpredictability of human beings. The willing participants in the making of the bomb seem to us now to have been hubristically unaware of indeterminacy.

John Eisenberg, writing about law in Western society, refers to "the great rational myth of our age that we can control nature for our declared purposes."[233] As they were to discover, the result of their work would prove to be literally beyond their imagination. Their ideals and intellectualism were confronted by the ultimate mystery of nature, as manifested both in the phenomenal world and in human nature itself.

In later years, Cyril Stanley Smith, in his research into the phenomenal world and human nature, would navigate between the two compelling valences of purely intellectual, aesthetic adventure and more inclusive, holistic "human terms". As we shall see, for Smith and many others who shared the questionable promise of "limitless benefits to mankind", their intentions and choices were caught up in a heady environment.

[232] Kimball Smith , *A Peril and a Hope*, 5.
[233] Eisenberg, *The Limits of Reason*:,164.

"Everybody I Knew Was Doing It" [234]

Smith shared this political and professional environment with many other scientists, engineers, industrialists and technologists in America at this period. In the main, for many scientists and politicians, the intention of nuclear research was to develop a weapons technology that would enable the United States to secure the highest ground in what some feared was an arms race with Germany and its allies. Fear infused the undertaking from the outset. Many were responding to the chaos and danger around them in Europe; scientists like Enrico Fermi, Edward Teller, Eugen Wigner, John von Neumann and Leo Szilard looked to America as a centre of refuge and research free of political fanaticism, prejudice, and persecution.[235] All these intellectuals were fugitives from threatening forces that were very different from the personal power familiar to them within their own institutional and professional domains. These scientists were accustomed to being on superior ground within a certain territory, that of intellectual pursuits. Through nuclear research they could press for action within the milieu of science and technology, where they were accustomed to feeling confident. They sought their solution in the energy of a force they thought they could imagine, but one that had never been produced by human beings before.

This heady atmosphere of intellectual endeavour, powerful alliances, and the excitement of a dangerous race generated a magnetism of its own. Although it was a race to arms within the specific context of World War II, the underlying pattern can be construed in terms of the psychological role

[234] "One component in this excitement was curiosity. And if a historic development was inevitable, why not share in it? 'I worked on the bomb,' says one usually independent physicist with a touch of bitterness, 'because everybody I knew was doing it.'" (Kimball Smith, *A Peril and a Hope*, 5.)

[235] Jungk, *A Thousand Suns*, 32-33.

of technology, as I have discussed earlier in connection with Winnicott's concept of the transitional object. The men and women who clustered around this mission, and their concentrated efforts, evolved into what some researchers in the "methodology of 'big science' " refer to as "the development of a nuclear weapons culture."[236] The intensity of the project in human terms was not unlike its parallel in the focused energy of the atom. As for time pressures, there was no set deadline -- only the idea of a frantic race to end the war with a bomb. Here the successful resolution of the conflict supposedly depended on a scientific/technical "fix". In retrospect we can ask whether, at very high levels of power, this secret, concentrated effort to produce a new mass weapon might have subverted a commitment to diplomatic efforts to end the war.

Atomic Culture on the Mesa: Los Alamos

This combination of intellectual inquiry, military security and personal ambition gathered itself within a highly secret compound that blossomed in the otherwise hot and dry mesa of Los Alamos, sequestered in the Jemez Mountains of New Mexico. Requisitioned for the Manhattan Project[237] late in 1942, Los Alamos saw the first atomic scientists arrive -- among them, in March,1943, "the energetic British-born metallurgist", Cyril Stanley Smith, his wife of twelve years, Alice Kimball Smith, and their two children. By April, he was leading the metallurgy group.[238]

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[236] Lillian Hoddeson et al., Preface, *Critical Assembly: A Technical History of Los Alamos during the Oppenheimer Years, 1943-45* (Cambridge: Cambridge University Press,1993), ix. (The copyright to this book is held by the U.S. Department of Energy, 1993.) Subsequent references to this work will appear as *Critical Assembly*.

[237] Los Alamos was one of ten research and production sites in the United States that were committed to some aspect of producing an atomic bomb as soon as possible.

[238] Hoddeson et al., *Critical Assembly*, 209 - 213.

Within a year, "3, 500 people were working and living there. A year later the figure had risen to 6,000."[239] Niels Bohr, a fugitive from occupied Denmark and probably the most highly respected atomic physicist among his peers, visited the international scientific team. Among those he visited was his friend and colleague, the American physicist, Robert Oppenheimer, who had been appointed scientific supervisor of the Los Alamos Laboratory.

At Los Alamos, Smith headed the CM - Division, the division responsible for research in the chemistry and metallurgy of uranium, initially and later, plutonium.[240] His role, along with those of others who were capable of translating theory to matter, was central to realizing the actual bomb, because without his practical knowledge of metals and his industrial experience, atomic theory, no matter how brilliant, could not have been transformed into the material product, a nuclear weapon. Within a project that from the start was "under tremendous duress,"[241] as one army engineer put it, Smith's was not an easy task:

> Besides devising workable 235 U (Uranium) metal production procedures, Smith had to provide fissionable and nonfissionable material for various tests and experiments and also make the bomb core, tamper and case. Realizing that the effort to create plutonium metal would consume most of the group's time and effort once sufficient quantities of the precious substance became available, he bore the considerable burden of providing reliable procedures and anticipating a variety of contingencies so that uranium metallurgy could proceed as smoothly as possible. The first item on Smith's agenda was recruitment, a difficult task because of the high wartime demand for metallurgists, who were needed to produce steel for guns

[239] Jungk, *A Thousand Suns*, 130 - 131.

[240] Hoddeson et al., *Critical Assembly*, 209 - 213.

[241] Donald Baker, U.S. Army Corps of Engineers, in *Remembering Los Alamos*.

> and ships. He also had to arrange for the acquisition, transport, and assembly of the necessary metallurgical equipment . . . Although this was standard equipment, acquisition and transport were slowed by wartime conditions.[242]

In other words, Smith's Division provided extensive and varied support for other divisions, including the physics laboratory, and it also had a critical research mandate of its own. It was Smith's practical capability, developed during his industrial experience, in combination with his theoretical knowledge, that accounted for his key role in the research, development and production of these first atomic bombs.

Even within his specialist field of metallurgy, he had to break new ground. For example, the metallic element plutonium, in all of its characteristics and manipulated behaviours, had barely entered into human experience: the isotope plutonium 239, had only been discovered in 1941.[243]

Because plutonium could only be separated out in micrograms (1 millionth of a gram) it took until 1945 to collect enough plutonium and other fissionable forms of uranium to build the first two nuclear weapons, which were detonated over Japan.[244]

As for the unpredictability of the undertaking, little was known of such basic properties of plutonium as its melting point. Even less was known of

[242] Hoddeson et al., *Critical Assembly*, 210.

[243] This discovery was made by American chemist, Glenn T. Seaborg and colleagues at the University of California at Berkeley in 1941. The following year the Manhattan Project was established for research into nucelear weapons, and Seaborg went to join the Metallurgical Laboratory at the University of Chicago, or "The Met Lab," as this component of the Manhattan Project was known. ("Seaborg, Glenn T.", *Nobel Prize Winners: An H. W. Wilson Biographical Dictionary*, ed. Tyler Wilson [New York: The H.W. Wilson Co., 1987], 945 - 948).

[244] Ibid., 947.

its actual behaviour,[245] even in areas that were critical to its use in the construction and controlled detonation of the nuclear weapons under development. For that matter, no one had realized the full extent of the forces that until then had been contained -- and constrained -- within the very heart of the atom itself. The concentration of energy contained in nuclei of these atoms could barely be embraced even by the imagination. Nevertheless, even at the time, the team was well aware that plutonium is highly unstable and its forms unpredictable. It was not only for reasons of allied security that the remote site of Los Alamos was chosen.

The bomb, with all its unknowns, was untried. Therefore, for strategic and scientific reasons, field testing was proposed for the various nuclear weapons under development. A site was selected for the test in a valley at the Alamagordo Bombing Range, approximately 200 miles from the Los Alamos mesa. The site was known locally as *Jornada del Muerto Valley* (The Journey of the Dead or the Working Day of the Dead).[246] Here the first nuclear mass weapon, the plutonium implosion bomb, was successfully exploded on the morning of July 16, 1945. Right up to the moment of detonation, as one witness from the U.S. Corps of Engineers recalled, "There were a lot of people praying -- no one knew whether this chain reaction could be stopped -- or would be stopped."[247]

No one could have predicted the forces that overtook the horizon, for no one had actually experienced such a concentration and release of nature's

[245] Even such basic facts as the melting point of this element had yet to be determined. (Hoddeson et al., *Critical Assembly*, 407- 409).

[246] Translated in consultation with Richard Wright, in reference to original translation in: *The Collins Spanish.English/English.Spanish Dictionary*, ed. Mike Gonzales, new edition (Barcelona:Grijalbo, 1989), 167.

[247] Joe Lehman, Corps of Engineers, in *Remembering Los Alamos*.

nuclear essence before that day. The explosion, its silent white-hot flash, the massive, roiling cloud and dazzling, radioactive dust were, to borrow a phrase from William Butler Yeats, a "terrible beauty."

"What seems like hyperbole to lay readers is gross understatement to those who took part, for the experience there in the desert . . . lives with them still as the most climactic of their lives . . . . the blast, the wind, the light and the power they had witnessed at Alamagordo had exhausted the capacity for astonishment."[248]

One Los Alamos witness, Felix A. De Paula of the Corps of Engineers, reported the reaction of a colleague, "Pop Borden," an older man who had worked with dynamite in his days before the service: "I recall 3, maybe 4 days after the detonation, that man still couldn't get over the detonation -- he couldn't get over it. He'd go around saying 'That's the most terrible thing I've ever seen in my life'. "[249]

"The bomb's force, equivalent to 20,000 tons of TNT, had exceeded by 10 per cent the highest estimates."[250]

"On the Impact of the Gadget"[251]

Until this time, nuclear research on such a scale had been mainly theoretical, a product of concentrated thought, mathematical calculation

[248] Kimball Smith, *A Peril and A Hope*, 76 - 77.

[249] Felix A. DePaula, Corps of Engineers, in *Remembering Los Alamos*.

[250] Kimball Smith, *A Peril and A Hope*, 64.

[251] Scientist Robert Wilson recalled a meeting at Los Alamos of his Princeton group: he entitled it "On the impact of the gadget " He recalled "a pretty intense discussion of why it was that we were continuing to make a bomb after the war [in Europe] had been won." (Robert Wilson, "Science and Conscience," in *Ideas* [Toronto: Canadian Broadcasting Corporation, 1984], 15.)

and engineering diagrams. Information concerning the atom had been exchanged in the currency of "ideas" and limited experimentation -- it was a highly abstract communication, a conceptual distillation of facts extracted from the material matrix of its physical origins. Once removed from its larger frame of reference, these theories developed as a phenomenon out of balance -- one that *under-* estimated the forces of nature and *over-* estimated humanity's judgement in the use of these forces.

Years later, the leader of the Los Alamos Project, Robert Oppenheimer, had this to say of his teams' inventions: "There are people who say that they are not such very bad weapons, and before the New Mexico test, we sometimes said that too, writing down square miles and equivalent tonnages and looking at the pictures of a ravaged Europe. After the test we did not say it any more."[252]

This re-evaluation is all the more significant because initially Oppenheimer had argued strongly against senior researchers at Los Alamos who had misgivings before the Trinity test. At that time other scientists in various disciplines at Los Alamos were beginning to ask themselves, "Are we doing something good or something bad?"[253] After the test, many Los Alamos scientists expressed their doubts, establishing groups in Los Alamos, and participating in other groups within the larger scientific community to state their objections more openly.

Their objections became a matter of official record in the Franck Report of

[252] Robert Oppenheimer, "Science and Conscience," *Ideas* (Toronto: Canadian Broadcasting Corporation, 1984), 14.

[253] Victor Weisskopf, "Science and Conscience," *Ideas* (Toronto: Canadian Broadcasting Corporation, 1984), 15. (Weisskopf was a physicist who worked under Oppenheimer at Los Alamos.)

June 11, 1945 to the Secretary of War.[254] Scientist James Franck chaired the social and political implications group of the Interim Committee of the War Department. This group advocated a non-military demonstration of the bomb, without loss of life, and advised against the deployment of the bomb as a mass-scale anti-personnel, anti-environmental technology.

> *From this point of view, a demonstration of the new weapon might best be made, before the eyes of representatives of all the United Nations, on a desert or a barren island.* The best possible atmosphere for the achievement of an international agreement could be achieved if America could say to the world, 'You see what sort of a weapon we had but did not use. We are ready to renounce its use in the future if other nations join us in this renunciation and agree to the establishment of an efficient international control.
>
> After such a demonstration the weapon might perhaps be used against Japan if the sanction of the United Nations (and of public opinion at home) were obtained, perhaps after a preliminary ultimatum to Japan to surrender or at least to evacuate certain regions as an alternative to their total destruction.

What the Franck Report emphasizes next is most pertinent to our present discussion of the unprecedented nature of this atomic phenomenon:

> This may sound fantastic, but in nuclear weapons we have something entirely new in order of magnitude of destructive power, and if we want to capitalize fully on the advantage their possession gives us, we must use new and imaginative methods. [255]

Ironically, behind the scenes -- according to documentation eventually

[254] "The Franck Report: June 11, 1945," included by Kimball Smith in *A Peril and a Hope*, Appendix B, 560- 572.

[255] "The Franck Report," 560- 572.

released -- "by the time of Trinity (the code name for the Alamogordo test) the whole machinery for using the bomb had been set in motion."[256]

As we now know, the alternatives put forward in the Franck Report were rejected. Their advocates, confident in their intellectual specializations, had overestimated their impact in the larger environment in which they found themselves. Once this weapons technology, first advanced in America by theorists, was given form, it became an instrument for intentions outside the control of those scientists who now resisted its use.

What prevented the subsequent growth of a further, overt protest movement among scientists who were against "using the bomb without warning"? According to Kimball Smith, they held back out of loyalty and secrecy.[257] If so, the majority of dissenting scientists, like their political, military, and corporate contemporaries, made their choices according to the internal imperatives of their immediate culture -- atomic or otherwise.[258]

As Smith would say much later, in a general discussion of the interaction between an individual and his community: "One cannot overemphasise the fact that everything -- meaning and value as well as appropriateness of individual human conduct or the energy state of an atom -- depends upon the interaction of the thing itself and its environment. . . . Is loyalty to a country or belief in one system of moral values admirable when it denies

[256] Kimball Smith, *A Peril and a Hope*, 49.

[257] Ibid., 81-71.

[258] In later years "professional solidarity and self-interest" maintained the solidarity engendered by the Los Alamos experience. (Jungk, *A Thousand Suns*, 321.) Such a sense of shared responsibility and a concern for accounting for their actions -- to themselves and others -- is also not uncommon among other veterans of war.

equal value to others?"[259]

The uranium weapon, called "Little Boy", was the first atomic bomb used against humanity when it was dropped on Hiroshima City, August 6, 1945, at 8:15 a.m. Japanese time. In keeping with the purpose of my research, which is to emphasize the human element in technological relationships, particularly at the level of the personal, I can best refer the reader to personal accounts of this "gadget" by the citizens of its destination. The experiences of a clerk, a doctor, a tailor's widow, a German priest, a young surgeon, and a pastor and a ten-year old are related simply in John Hersey's small book, *Hiroshima.* [260] Three days later in Nagasaki, the 21 kiloton plutonium implosion bomb, Fat Man, was dropped; its "yield" was determined in the main by radiochemical and fireball field data.[261]

Speaking in a commemorative video of Los Alamos, shortly before he died, Smith recalled the atmosphere when peace was declared: "Having achieved this, the natural thing was for the laboratory to celebrate. And we gradually began to feel in human terms what it meant and the party fizzled out."[262]

Metaform: The Bomb in Human Terms

It was not until much later that Robert Oppenheimer, the leader from the outset of the scientific teams at Los Alamos, was said to have recognized that "The pattern of the use of atomic weapons was set at Hiroshima.

[259] Smith, *Structures*, 381.

[260] John Hersey, *Hiroshima* (New York: Alfred A. Knopf, 1946).

[261] Hoddeson et al., *Critical Assembly*, 377.

[262] Smith, in *Remembering Los Alamos.*

They are weapons of aggression, of surprise and of terror. If they are ever used again, it may well be by the thousands, or perhaps by the tens of thousands . . . And the strategy of their use may well be different than it was against an essentially defeated enemy. But it is a weapon for aggressors, and the elements of surprise and terror are as intrinsic to it as are the fissionable nuclei."[263]

When he articulates this relationship between the physical properties of the bomb and its psychological effect, Oppenheimer is pointing to the kind of relationships suggested by metaform. And it is through metaform that we can set the stage for understanding intention, choices and change in the life of one person, namely Cyril Stanley Smith.

As metaform, what was this first atomic bomb? It was an intense concentration of energy: in a material sense it was a concentration of physical energy estimated as being equivalent to 22 tons of TNT: it had been contained in a form that could, with intention, be moved, positioned and detonated. It was a force that was suddenly released on itself, an "implosion" first, which unleashed both a searing energy and a lingering radiation. Implosion involved a sudden compression of a subspherical critical mass of fissionable material by detonating a surrounding high explosive layer."[264] Acting in parallel, the workings of the bomb can be interpreted as a material manifestation of mass fear, concentrated secrecy and aggression, a blind drive feeding on itself, forcing all of its resources blindly inward.

Such a nuclear force -- one that can be manipulated, designed and directed

[263] Oppenheimer, "Science and Conscience," on *Ideas*, 15.

[264] Kimball Smith, *A Peril and a Hope*, 272.

- - does not arise spontaneously in nature in such a concentrated form. It required an unprecedented compression of human effort over a relatively short time to produce this type of energy. Given its motivation, its narrow focus and its urgency, it is not surprising that the result would be an extreme technology, a product of fear and hubris. It was a complex synthesis of concentrated intellectual effort and diverse psychological motivations. From the point at which atomic research was applied to weapons, it was, by definition, intended as a technology capable of destruction, an instrument of mass destruction concentrated on fellow human beings -- their bodies, minds and habitat.

On the material level, the success of the plutonuium-based bomb depended on the relative instability of the plutonium at its core -- the tendency of its atoms to split apart when bombarded by nuclei, and in the process to release previously *indescribable* energies -- awesome energies. Considered as metaform, this atomic or nuclear reaction releases primal, natural forces -- in a parallel way, it represents an intense and focused discharge of collective emotions and feelings. In times of conflict and competition, demonstrations of atomic power release and manifest the danger of fear and anger beyond constraint.

While the destructive "yield" of this technology can be compared with that of other weapons in terms of physical damage, this atomic bomb was remarkable for its psychological impact.[265] For example, one of the unprecedented features of the atomic bomb was its utterly silent detonation. For the observer, the first sign of this detonation is light, an energy flash. Because light travels at a speed greater than sound, although

[265] "Oppenheimer. . . wondered, as he considered the matter in later years, if some demonstration capitalizing on the one phenomenon that the scientists underestimated -- the psychological effect of the tremendous light -- might not have been devised." (Kimball Smith, *A Peril and a Hope*, 49).

critical mass has been reached and the atomic force liberated, at first, everyday sounds continue as usual -- except that the everyday spaces that contain them -- the land and streetscapes -- are filled with a sudden brilliance. There is no noise, no signal, no warning, only a startling, blinding whiteness.

The sounds follow later.

So do the the secrets. The resources, knowledge and feelings that were intensified and hidden during the invention of these technologies, did -- on completion of their metamorphosis -- finally "come to light."[266] The effects of this force on all of our environments -- inner and outer -- are our legacy to this day.

Using metaform, even a broad analysis of this technological project reveals how the original appeal of extracting power "beyond limits," combined with the expressed intention of the Los Alamos project to build a weapon with it, could easily lead to extreme results. The ambitions were extreme. The intention was not only to develop a weapon by extracting energy from the heart of matter: it was literally, "to reach for the stars." As one scientist wondered: "Could we construct on earth anything that would liberate energy as the stars liberate energy?" [267]

To accomplish this, metal, as matter, had first to be translated into abstract theoretical systems, whereby its principles of energy could be extracted in

[266] Secrets and the tensions they set up existed on all levels, including the everyday: Kimball Smith admitted to a"welcome sense of release in the partial revelation of secrets. . .a feeling of emancipation" shared by their wives and families, "the partial relaxation of secrecy in everyday affairs." There "at Los Alamos. . .wives simply did not talk about these things."(Kimball Smith,*A Peril and a Hope*, 81). This was the case, despite the fact that all of them were at risk.

[267] Roy Glauber, "Science and Conscience," *Ideas*, 16.

the form of the numbers and symbols of chemistry and physics. These symbolic elements were conceptually rearranged and applied, in their newly transformed state, to matter and materials. In this instance, matter, in the material form of atomic metallic particles, was transformed into a weapon.

It is the nature of a weapon to have a target. A critical factor, therefore, in the complete equation was the ultimate reduction of human beings, first to enemy, then to target. The basic human element was, it seems, set aside, overlooked or denied by many researchers in the excitement of discovery.

For many of those at Los Alamos, the reality came only when they were faced with the consequences of their inventions. As Kimball Smith relates: "the death and suffering that attended the introduction of atomic energy acted upon some members of the scientific profession with the force of spiritual revelation." [268]

By the end of the war, Kimball Smith cites "a young scientist in another part of the Project", who described in a letter to a friend "a feeling of relief at the relaxation of security, pride in our part in ending the war, and even pride in the effectiveness of the weapon. And at the same moment, the bomb's victims were living through undescribable horror . . We didn't realize. I wonder if we do yet?"[269]

Kimball Smith came to understand this phenomenon within the larger perspective of human history: "A certain epic quality attaches to any experience by which men are so stirred as to be wrenched from their

[268] Kimball Smith, Introduction, *A Peril and a Hope*, v.

[269] A. Squires to J. Balderson, Sept. 7, 1946, cited in *A Peril and a Hope*, 80-81.

accustomed patterns of behaviour." Furthermore, Kimball Smith recognized that, in this case, "this experience stemmed from . . . a decision that threw into sharp relief man's unevenly developed powers over the realms of matter and of spirit."[270]

ALAS

By1945 at Los Alamos, as at some of the other centres of related atomic research, many researchers and technologists were making efforts to change the course of events after Hiroshima. Cyril Stanley Smith was among them. Kimball Smith observed that by late August, it was apparent that "stronger than any single influence upon scientists at Los Alamos was the bomb itself."[271]

By this time, Stanley Smith was 42, and regarded as an "elder scientist" by the young, incoming staff, to whom he became an advisor. Kimball Smith, in a rare mention of her husband (in a footnote) introduces him, among other "senior men [who] served as elder statesman: on advisory committees, in fund-raising and in speaking."[272] By late summer, support grew at Los Alamos for the "international control of atomic energy" and "democratization of the laboratory;"[273] on Aug 30, 1945, 500 people attended and approved a motion to form an organization called the Association of Los Alamos Scientists (ALAS). Smith became a member. Its aim was to "promote the attainment and use of scientific and technological advances in the best interests of humanity". . . initially, membership was

[270] Kimball Smith, Introduction,"*A Peril and a Hope*, vi.

[271] Ibid., 114.

[272] Ibid., 248-249, Note 19.

[273] Ibid., 114.

limited to laboratory staff with college degrees."[274] Smith, with many fellow scientists, was attempting to connect with the local artists, writers, and community members invited to special meetings in the local library, museum or the Laboratory of Anthropology. Later, he engaged in such activities as speaking at an "atomic age rally" in Taos, New Mexico, to aboriginal peoples, local artists and townspeople. "[275] Later, ALAS, with Stanley Smith as an active member, became part of a larger group, the scientists' or atomic scientists' movement , formed by some scientists who were recognizing the "magnitude and global ramifications" of their atomic research.

By November,1945 Smith, along with Robert Oppenheimer, was among the large number of "older, well-known scientists" in ALAS to go "on record as opposed to the May-Johnson Bill. They went on record as being opposed to restrictions on "the sharing of information with other countries upon which international control would necessarily be based." [276] But their resistance was defeated.

Coming to the end of his term at the close of 1945, Smith was one of the many scientists at Los Alamos who had to "choose between complete capitulation to the desire for peacetime ways by leaving for familiar campus or tempting industrial job, or continuing under the fairly rigorous regime that still pertained on the mesa."[277] Smith had no intention of staying with the arms project, and was one of the majority of Los Alamos Laboratory scientists and researchers to leave. Kimball Smith described

[274] Ibid., 115.

[275] Alice Kimball Smith, *A Peril and A Hope*, 300.

[276] Ibid., 249; Jungk, *A Thousand Suns*, 129 - 130.

[277] Ibid., 298.

his choice in terms of the culture of his intellectual colleagues: "Scientists are by and large a rational lot . . . Instead of brooding about the tragedy of using science for destructive purposes, they tended to plunge into a whirl of educational and political activity. A few. . . were drawn into years of distracting service on government advisory committees."[278]

Cyril Stanley Smith immersed himself in all these activities.

By January 1 of the next year, he had moved to the University of Chicago. Here he integrated his personal interests in metallurgy with the Los Alamos research experience, to become the founder and first director of the Institute for the Study of Metals, which he organized as an interdisciplinary materials research laboratory. He remained there until 1960.[279] We know that while his broader intentions were for peace, he also hoped for a positive application of his intellectual skills and recent knowledge. Do we have any indicators of a change in his hopes and intentions for the future?

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[278] Ibid., 80.

[279] Dr. Brooke Hindle, "On the History of Technology," in Cyril Stanley Smith, *From Art to Science*, 10-12.

Chapter VI

RECONCILIATIONS: CHOICE, TECHNOLOGY and the PERSONAL

One can learn without being taught.

Cyril Stanley Smith

When your own heart asks
How will you respond?

Yamamoto Tsunemoto

At the conclusion of the last chapter, I asked whether we had any indications of a change in the hopes and intentions of Cyril Stanley Smith. In fact, there is a change, and it will be the purpose of this chapter to draw on the concept of metaform to explore the role of technology in personal transition, choice and development. The following case, while it follows Smith's progress, gives substantial emphasis to the Japanese sword as one example of how a technology can be instrumental in personal development and in intercultural relationships.

Smith presents challenges to such a research inquiry, for a number of reasons. Suffice it to say, if we were to judge by the content and face-value of his prolific, professional writing alone, we would have few direct or explicit indications of any personal issues or change of heart on Smith's part. Exceptions to this are notable, as we shall see. When it comes to his pivotal encounter with the technology of the Japanese sword, for example, Smith is unequivocal about the fact that it had a major impact on his life and later work.

One very interesting fact that does emerge about Smith is that his actions do speak for themselves -- he expresses his intentions through his choices in career and research subjects. And one has virtually to mine his writing for the traces of awareness, doubt and hope that burn there, below the surface.

After having researched Smith's published works, his professional affiliations, extra-curricular activities, video appearance and related works by others, I was developing a sense of the man, which was confirmed, as far as his later choices and actions are concerned, by an interview with his

son, Stuart Smith.

As for his actions, we can recall, for example, how Smith, as a member of ALAS, officially protested the secrecy that prevented the sharing of information with other countries, as well as the anti-personnel use of the nuclear bomb in Japan. Later, President Truman appointed Smith to the General Advisory Committee to the Atomic Energy Commission (AEC), as one of its original nine members, with Robert Oppenheimer as elected Chair. During this appointment, a turning point came for Smith in 1949 when, in his own words, he "voted with enthusiasm for the Committee's famous (some say infamous) recommendation against a crash program to develop the hydrogen bomb."[280] Instead, Smith, with all the other advisory members, advised that "In determining not to proceed to develop the super bomb we see a unique opportunity of providing by example some limitations on the totality of war and thus of eliminating the fear and arousing the hope of mankind."[281]

As it happened, this group of leading scientists was going against the tide -- once again, strong lobby groups to develop nuclear powers won out against this recommendation. Smith looked again to a renewed involvement with "the halls of academia: and in retrospect I am glad that my distaste for the development of superweapons gave me the nudge to get out."[282]

Although he served on various government councils afterwards, and was honoured for his services, he later suggested that his stand on the nuclear

[280] Smith. *Structure*, 356.

[281] Jungk, *A Thousand Suns*, 283.

[282] Smith, *Structure*, 356.

megaweapons and his resignation from the AEC in 1952 effectively ended any larger ambitions for a political career.

Looking Back: A Quest for First Connections

Reflecting on this period,1948-1955, Smith identifies it as producing the "only part of my work in science that has any chance of being of lasting consequence."[283] However, it is also during this time that his research choices begin to indicate a digression from his earlier atomic research. Smith was moving toward another path. As he reflected on his research during this period: "It was an approach more appropriate to the nineteenth century than the atomistic study of crystal lattice symmetry that was attracting my more advanced scientific colleagues."[284] Note that there is no mention at all of Los Alamos in this personal history of scientific research. As we shall see again, despite the extensive bibliography of his works, the Los Alamos experience in Smith's writing is notable by its absence.

During this time, he also returned to his work in the "translation and interpretation of the classics in the history of metallurgy, begun while he was at the American Brass Company at Waterbury Connecticut," before the war.[285] After the war he was investigating a group of "milestone manuscripts" dating from the 9th, 12th, 16th, 17th, 18th and19th centuries, together with early published works. With the help of experts in the several languages involved, he translated and annotated these for

[283] Ibid., 351.

[284] Ibid.

[285] Noted by Dr. Brooke Hindle, Senior Historian of the National Museum of History and Technology at the Smithsonian. (Hindle, "On the History of Technology," in Smith, *From Art to Science*:, 10-12).

publication.

As part of this work, Smith returned to London in 1955-56 on a Guggenheim Fellowship, primarily for historical research. He recalled the London years as "tremendously important to me."[286] It was during the course of this research that Smith was first introduced to a cultural object in the Victoria and Albert Museum that was, to his exceptional eye, "the supreme metallurgical art."[287]

It was this discovery, in the museum, that prompted Smith in later years to say that through this cultural artifact, "Quite late in life I began to find meaning in art, and through it a better understanding of much that had interested me earlier."[288]

It was a Japanese sword blade.[289]

Toward a Reconciliation of Technology and the Personal

Already by the 1950s and 60s, Smith was taking a leadership role in America within the broader context of the international movement for the professionalization of the history of technology, according to Dr. Brooke Hindle, Senior Historian of the National Museum of History and Technology

[286] Smith, *Structure*, 354.

[287] Smith, *From Art to Science*, 40.

[288] Smith, *Structure*, 351.

[289] Smith was so inspired by this artifact that by 1957, directly after his stay in London (1955-56), he was already presenting his first paper on Japanese sword blades: "A Metallographic Examination of Some Japanese Sword Blades," *Quaderno II del Centro per la Storia della Metallurgia A.I.M.*, (Milan, 1957, 41-68). See "Bibliography", *Structure*, 395.

at the Smithsonian in 1980.[290] Shortly after his return to the United States from London, this movement was focused through the establishment of the Society for the History of Technology in 1958. The Society's journal, *Technology and Culture*, was launched two years later. Smith was a contributing author and became president of the new society. His London experience was incorporated into the publication of his book in the same year: *A History of Metallography: The Development of Ideas on the Structure of Metals Before 1890.* [291] This book established him as "*the* historian of that field." [292]

From these years forward, Smith's efforts were directed to a different purpose: he was no longer analyzing metals as resources, as the raw material of industrial and military technology. We can detect in *A History of Metallography* a sense of completion, and also the seeds of a new direction. This book hints of transitions for him -- an opening of communication (albeit, often cryptic), a broadening of his awareness, and a convergence, for Smith, between metallurgy, culture and art.

In this book, Smith makes tentative connections between his own personal experience with technology and his emerging theories. Knowing his background, we can infer -- and better appreciate -- the full significance of his statements, when he says, for example, in his Introduction, "It is the nature of man to exploit to the utmost a good new idea which gives order to his knowledge, but he should remember that he is likely to overexploit

[290] Cyril Stanley Smith, *A History of Metallography: Their Development of Ideas on the Structure of Metals Before 1890*, 1st. ed. (Chicago: The University of Chicago Press, 1960. Subsequent references to this work will appear as *History of Metallography*.

[291] Hindle, *From Art to Science*, 9.

[292] Ibid., 10.

it."[293] We see, as well, an emerging interest not only in structures and the patterns on which they are based, but also in the role and nature of change: how new patterns are achieved through anomalies and dislocations, both materially and culturally: "Change always occurs at the interfaces."(xxi) There is also an openness to reflection, to the operations of "chance," and to alternatives to purposeful thought: "Perhaps the very efficiency of modern technology will unintentionally produce the leisure for undirected thought."(xxi) Related to this idea is an acknowledgment, albeit very general, of psychological factors "consciously or unconsciously used" in technology. (xvii) Finally, he advocates a new approach to research: "Recent events call for a different historical approach, for perspective is inevitably lacking."(xix)

While he does not make this "different approach" explicit, we do know that in relation to his museum research, Smith had become acquainted with the work of biochemist turned historian and sinologist,[294] Joseph Needham of Cambridge. Needham, like Smith, was trained as a scientist.[295] His intellectual contributions were recognized mainly for their *comparative* approach to studies in the history of science and technology.[296] Both Needham and Smith also shared a recognition of new ideas and trends in this field: specifically, the "increasingly interdisciplinary nature of the subject." They collaborated with other intellectuals at a time when "Deeply worried scientists and non-scientists began to feel a pressing need

[293] Smith, Introduction, *A History of Metallography*, xxi. Subsequent page numbers from Smith's Introduction are cited in the text of this paragraph.

[294] In 1954 Needham had begun the monumental task of writing the seven-volume work, *Science and Civilization in China* . (Hindle, *From Art to Science*, 9).

[295] Smith, in 1968, cites Needham in his text of "The Japanese Sword", in *A History of Metallography*, 45.

[296] Mikulas Teich and Robert Young, eds., Introduction, *Changing Perspectives in the History of Science: Essays in Honour of Joseph Needham* (London: Heinemann Educational Books Ltd., 1973), i.

to analyse critically the past of science in order to understand its present and to prepare for its future." [297]

True to form, Smith took steps to bring his thoughts to action -- or deliberate inaction. He left the Chicago Laboratory to go to M.I.T., Cambridge in1961 "because I thought it was time for a change in emphasis and aim."[298] Here, as Institute Professor, he returned to "this blessed state" where history was "a primary occupation for me."[299] In 1968, on his "retirement", he was appointed Professor Emeritus of the history of science and technology and Professor Emeritus of metallurgy, whereupon he went to Japan to study the casting of temple bells, the same bells which became the means for me to introduce him and the course of his choices in relation to his expressed intentions for his life's work.

The Cambridge Years: On the Bridge

This period in Smith's life lent itself well to reflection and personal types of exploration and experiment. Reflecting later, in 1980, Smith described his position as having no assigned duties, and suggests that the fact that "I somehow never found myself acting as an effective member of either [faculty] . . . has enabled (perhaps, by relative indifference, even encouraged) the final development of my 'philosophy.' "[300] During this period, we can observe two kinds of shifts in Smith's odyssey with technology. The first type of movement consists of further growth along

[297] Ibid., xi.

[298] Smith, *Structures*, 357.

[299] Ibid., 351.

[300] Ibid., 357.

earlier lines, in terms of historical and materials research. The second shift takes place in the opening to new territories.of intellect and personal sensibility.

In the first instance, growth has occurred in the articulation of his "philosophy", or more accurately, his perspective on technological relationships, as summarized in the essay contributed to *Technology Review* and entitled "On Art, Invention, and Technology":

> How do the seeds of human achievement form in the first place? Not just by taking logical thought, but rather by giving curiosity full rein and using all of a human being's capability -- his holistic powers of understanding and aesthetic imagination as well as his analytical skills. I do not mean to imply that all technologists are sensitive aesthetes, but I do claim that the *beginning* of much useful technology (as indeed of most human achievements in the past) has arisen in aesthetic experience. The subsequent and more obvious stages of profitable development can occur only as a sequel to a quite different dynamics.[301]

Here we see how he has maintained his deep commitment to achieving a balanced relationship between art and science through a recognition not only of the aesthetic, but also of the "holistic," nature of each person. As well, indirectly, this passage reinforces his earlier advocacy of interdisciplinary approaches to scholarly work.

He moves closer to the new territory where inner and outer aspects of each person join when he says that the practitioners of technology "experience a rich interplay between their internal nature and the nature and meaning of things in general." He goes on to suggest that "the

[301] Cyril Stanley Smith, "On Arts, Invention and Technology," *Technology Review* 78, no. 7(1976): 41.

sympathetic study of the technologist" is of great importance to the future.[302] Here, in addition to the psychological or spiritual factor, alluded to in references to "their internal nature", he makes explicit the critical role of personal intention when he describes the individual technologist, "with various motives", as the " 'atom' that is at the base of the whole structure of technological institutions." [303]

Finally he demonstrates the extent to which he is enlarging his worldview beyond the intimate, exclusive setting of the techno/scientist and artist focused on materials research. He relates technology to the broader realms of environment and the cultural domain:

> "The transition from individual discovery and rare use of techniques to the point where they affect the environment of Everyman and the content and means of communication between people and peoples underlies virtually every great social or political change on man's view of the world . . . An understanding of the proper place of technology within the whole human experience is desperately needed in order that society can wisely decide what to develop and what to discourage." [304]

Here again, the matter of choice is paramount for Smith as he is broadening into the new (for him) intellectual territory of the relationships between the environment and the development and use of technology: "Perhaps the really new is around unnoticed, awaiting an environment that does not yet exist. In any case, neither art nor history can be understood without paying attention to the role of technology; and technology cannot

[302] Smith, *Structure*, 348.

[303] Ibid., 399.

[304] Smith, "On Arts, Invention and Technology," 36.

be understood without history and art."[305] Clearly we have evidence here of Smith's reaching out from the intimate relationship between human and object to encompass the wider environment -- a broadening sense of connection.

He provides specific examples using art and antiquities to illustrate their relationship to technological development in the context of art, culture and intentionality: "The painting of pictures preceded purposeful type, and the use of rockets for fun came before their military use or space travel. The techniques of casting bells, like the material of which they were made, were ready to be directed to a different kind of sound and purpose when princes wanted cannon."[306]

It is only now, with Smith in his 50's, that he's talking about the role of environment -- those larger spaces and social influences that complete his previous composition, which had been focused mainly on the maker, the scientist, and his raw materials. What made him change his worldview? To think in more global terms? Atomic technologies, for one.

The only hints we have of his feelings or assessment on this subject as far as his direct, personal experience is concerned, are, with few exceptions, to be inferred -- not only through metaphorical allusions via metallurgical phenomena. There are telling and frequent gaps in information, lacunae due, perhaps, to the apparent suppression, or perhaps denial, of "the atomic years." Writing "A highly personal view of science and its history" in 1989 in A *Search for Structure*, Smith provided details of his intellectual journeys, but Los Alamos and the atomic bomb were noticeable by their

[305] Ibid., 41.

[306] Ibid., 40.

absence.

It is only much later, in 1980, that Smith fills in the Los Alamos gap in his "Postscript" to this essay. Again, he voices no mention of second thoughts or regret. On the contrary he, like many of his colleagues, remembered it in the context of an intellectual adventure. As one of them expressed it, there was "a great amount of stimulation to be creative."[307]

It is during this period as well that he places an increasingly important emphasis on the direct, physical study of antiquities in his research. Inspired as he was by the London experience, he starts to make the shift from libraries to museums. He also visited the foundries of Japan in 1969. The result was a renewed commitment to research with new subjects.

True to form, Smith established at M. I. T. the Laboratory for Research in Archaeological Materials; this was the foundation for the establishment in later years of the Centre for Materials Research in Archaeology and Ethnology, a consortium of museums and universities in Boston and its environs. For the next several years, well beyond what he refers to as his "retirement" of 1968, Smith published extensively, and contributed to the work of different organizations and groups, including the Philomorphs.[308] He also instructed in conservation, along with the internationally recognized conservation scientist Rutherford Gettens, another civilian veteran of Los Alamos and one of the fathers of conservation in the United States. Throughout this time, according to his obituarist, Smith was known

[307] Donald Baker, U.S. Army Corps of Engineers, *Remembering Los Alamos.*

[308] David W. Brisson, a painter, sculptor and Associate Professor of Design at the Rhode Island School of Design, described the Philomorphs as "an interdisciplinary group of scholars. . . who are interested in visual aspects of form and who meet once a month on the Harvard campus." (David W. Brisson, ed., Introduction, *Hypergraphics: Visualizing Complex Relationships in Art, Science and Technology* [Boulder, CO: Westview Press, 1979], 2.)

for saying that "his purpose" was to "encourage the understanding of human history and human activity through the scientific investigation of the material record of the past."[309] How Smith went about achieving this purpose is entirely in character and constitutes the final event that I will discuss from his Cambridge years and his public life. He mounted his own exhibition.

Exhibition: Choosing Forms for Philosophy

Increasingly, Smith chose museums and their objects over libraries as original sources for his research. As an advocate for the potential of these original materials, he decided to develop an exhibition of artifacts and images that would demonstrate these dimensions, based in large part on his own personal experience and research approach in order to provide opportunities for others to share his generative encounters with antiquities.

The content, design and organization of the exhibition, *From Art to Science: Twenty-Two Objects Illustrating the Nature of Discovery* was developed for MIT by Cyril Stanley Smith in collaboration with Virginia Gunter, Director of MIT's Margaret Hutchinson Gallery; it was held from October through December, 1978.[310] The objects in the exhibit gave form to his vision: they were selected not only for aesthetic value and historical significance, but also for details in the form and surface that spoke to their craftsmanship; he also selected materials from many cultures and natural

[309] Wolfgang Saxon, "Obituary: C.S.Smith, 88, M.I.T. Professor of Metallurgy," *The New York Times*, 29 August 1992, 26 (1).

[310] A smaller, original version had been developed with Dr. Jon Eklund, Curator of Chemistry at the National Museum of History and Technology in Washington,and displayed there from February through August 1978. (According to Joel Orlen, General Editor of *From Art to Science*, 6.)

settings. But Smith chose to structure the exhibition *not* according to the conventional arrangement by history or culture, but according to his primary perspective: the objects were arranged in sections on the basis of their materials and technologies, such as ceramics and glass, as well as metals, for example.

The content of the accompanying text for the exhibit is unusual in its relatively large amount of specific scientific detail. For example, in Section II, "An Eclectic View of the Properties of Matter: Nonmetals", Smith writes: "Though the beauty of the ceramics depends on the potters' hands and eyes, they used -- and in their own terms understood -- the plasticity and recrystallization of clay, the formation of the glassy state, oxidation and reduction, diffusion, selective crystallization and most other types of phase transformation, and microfracture from thermal stresses. The phenomena are the same no matter how many syllables are used to describe them."[311] The result is that by choosing materials as his primary organizing concept, Smith at the same time extracts them for discussion beyond the confines of specific, academic disciplines. In this manner he concretizes his previous advocacy of an interdisciplinary approach to research and technology.

From this detailed description of ceramics and others like it, one gets the sense that Smith's intended audience consisted mainly of scientists and technologists, those of his community who were actively engaged in exploring and developing both conventional and new materials. In the process of communicating, of building a bridge, he first had to locate and reveal a strong, common point of reference where artisan and scientist could meet. Given the intellectual climate of his time, Smith must have realized that the primary point of contact between his colleagues and the

[311] Smith, *From Art to Science*, 43.

exhibition would have to be one that was based on "objective", pragmatic examples of successful technologies -- successful in terms of a purposeful and highly controlled manipulation of materials. In this way he could hope to introduce a new kind of empirical knowledge, which the artisans behind the objects in the exhibition demonstrated through the refined and advanced quality of their work. This culturally distinctive empirical knowledge incorporated not only control, but also acceptance of the unpredictable, of the ultimately unknown nature of materials, as they exist in relation to the limitless variability of nature. This approach was one that Smith deeply respected.

The "messages" of the exhibition are multi-layered and reflect an expanded awareness that is emerging in Smith's worldview. Ostensibly, a primary enticement to the viewer (aesthetic pleasure aside) is knowledge, with the potential of providing the pragmatic advantage of an alternative insight into the workings of art and technology-- such as a discovery and appreciation of the properties of artistic materials that may be exploited in the field of materials science.

However there is another, underlying communication encoded in these works of art that Smith ultimately hopes to convey. He indicates this clearly in the Prologue: the first part of this message to be communicated is a recognition that art and science are not mutually exclusive, even today, when the "conscious use of laboratory effects in modern art is the inverse of the relationship between artists and scientist in earlier times. Or is it? *Perhaps the distinction unnecessarily divides the capacity of the human being to react as a whole to the world.*"[312] (My emphasis). The questions that he raises here, and their implications, press us even more today in

[312]Smith, *From Art to Science*, 29.

such areas as education, environmental studies, psychology and philosophy.

The second part of his communication through the arts and technologies of the past represents his own development and explicit concerns within this expanded sense of wholeness. And what is the focus of this holism that Smith has chosen to engender via these arts, crafts and technologies? It is the conscious use of scientific and technological knowledge "in human terms," for the benefit of habitat and society. "Perhaps today's more environmentally and socially conscious art," he points out, "will suggest elements for a broader science in the future."[313] The exhibition provides the material evidence -- and the potential for inspiration -- to enlist others in the service of these issues. What he is sharing, then, is his own sense of a broader environment, one that reaches beyond the narrower focus of his former research issues. In the process, he has chosen to foster an expanded, more versatile intellectual community, one that can bring about the corresponding changes that are required to meet contemporary needs. In the Epilogue to the catalogue, Smith draws on technology, art and nature, as subjects of material culture, to articulate his own deepening sense of connection with this more "rounded" and inter-civilizational worldview. In one instance, for example, he describes Islamic mosaic patterns as designs that reproduce "successive levels of symmetry within symmetry as in the structure of complex crystals. At the same time, they express the Eastern philosophers's ideas on centre and infinity, suggesting to us something about the relations between a thing and its environment."[314]

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[313] Ibid.

[314] Ibid., 113.

Beyond simply giving concrete form to Smith's concepts, this exhibition, by virtue of the fact that he chose to create it, points to the integration of his own personal experiences and interests -- the revisiting of his earliest experiences with materials; his subsequent journeys to other times, lands and cultures; a confidence in his individual, unique way of conceptualizing and giving form to knowledge and an expanded inclusiveness. As well, by this time, he speaks openly of spirit, a choice which, as we learned earlier from Kimball Smith, was not often addressed in public by scientists. [315] But to one who has followed the course of Smith's life and his role in the development of the first atomic bomb, one of the most telling of exhibition choices is the inclusion of art and artifacts from Japan.

Crossing the Bridge: Part 2

We know that Smith had come to admire Far Eastern art generally for its "use, particularly, of quite subtle aspects of the behaviour of matter to achieve aesthetically appealing effects."[316] In fact he regarded these art forms as the links between aesthetic curiosity and the collective momentum toward ritual and society. But within this collection of Far Eastern arts/technologies, he has selected a specific item that recalls that presence from antiquity praised by Smith as "the supreme metallurgical art" -- the subject he credits for having a profound impact on his choices later in life.

Here, in the opening section of his exhibition, we meet again a Japanese long-sword (*katana*). It is accompanied by a mid-nineteenth sword-guard

[315] "While the objects record aspects of science, technology and history, they also reflect . . . aspirations and spirit." (Smith, *From Art to Science*, 25.)

[316] Smith, *Structure*, 351.

(*tsuba*), "a veritable three-dimensional painting in metal."[317] This long-sword, from the Dr. Walter A. Compton Collection, was signed by the artist Awataguchi Ikkanshi Tadatsuma, and dated "on a good day in February 1709."[318]

While this was a cutting blade, it was far more than a weapon. Smith points out how, in varying ways, its "full beauty becomes evident only on close, knowledgeable inspection."[319] Later, writing "A Highly Personal View of Science and its History", he acknowledges the catalytic role of such artistry in his intellectual life: "Quite late in life I began to find meaning in art, and through it a better understanding of much that had interested me earlier. (A Japanese sword at the Victoria an Albert Museum and its curator, B.W. Robinson, provided the first impetus for the change). "[320] Therefore, throughout his books, his essays and other written works from 1957, and finally in this exhibition, the Japanese sword features prominently.

"The Japanese sword blade," he says, "involves unmatched skill in forging, in control of composition, in heat treatment and in finishing to produce surfaces that reflect qualitatively the underlying metallographic structures."[321] Regarding its connection with philosophy and worldview, he acknowledged, "Everything to do with the sword was an object of

[317] Smith, *From Art to Science,* 40 - 41.

[318] This swordsmith, Awataguchi Ikkanshi Tadatsuma (Smith, 1980 : 40), who lived near Osaka, is ranked among the most famous of the approximately 3,000 "well-known" swordsmiths listed for Japan. They . in turn, are among the 30,000 entries for swordsmiths in this country, beginning c. 1055 a.d. (*Japanese Swordsmiths, Revised,* W. M. Hawley, comp. (Hollywood, CA: W. M. Hawley,1981).

[319] Smith, *From Art to Science,* 40.

[320] Smith, "A Highly Personal View of Science and its History," *Structure,* 351.

[321] Smith, *History of Metallography,*. 40.

admiration and reverence to the Japanese."[322] In the context of comparative studies in metals technology, he had not encountered its match in any of his prior research: "Unlike European metalwork . . . Japanese metalwork often reveals a deep feeling for the structure of metals and their chemical properties."[323] This was true praise indeed, given Smith's distinctive affinity with metals -- a connection that was intuitive, direct and physical. In later years, Smith reflected: "In the long gone days when I was developing alloys I certainly came to have a very strong feeling of natural understanding, a feeling of how I would behave if I were a certain alloy, a sense of hardness and softness and conductivity and fusibility and deformability and brittleness -- all in a curiously internal and quite literally sensual way, even before I had a sensual contact with the alloy itself."[324] As we shall see, this affinity of Smith's helps to explain why, from his first experience of the Japanese swords, their lessons resonate, both silently and as a palpable presence in the chapters of Smith's life.

The Making of a Katana

What are the specific material characteristics of these swords that still claim our admiration and respect today? The following description by Smith reveals why this blade possesses extraordinary strength, durability and flexibility. The key lies in the fact that the blade is not homogeneous: "The metal is multiply complex. The core is soft iron . . . Welded around this is the highest quality steel forming the cutting edge and sides. This was never melted, but was made uniform by welding, folding, re-welding,

[322] Ibid., 57.

[323] Ibid.

[324] Smith, *Structure*, 353.

and forging, repeated as many as twenty times (making two to the power of twenty layers.) [325] This would produce "slightly over a million layers of steel."[326]

Finally, "the blade was heated and quenched, . . . so that the edge became intensely hard, while the body remained tough."[327] This "unique process of manufacturing" satisfies "three basic requirements of the sword; resistance to breaking, to bending, and a capacity for maximum sharpness."[328] In addition to this utility is a feature of elusive beauty, "wholly unique to the Japanese sword, found in no other work in metal in all times and in all lands."[329] It is an intricate, shimmering pattern, an individual effect that is achieved within this edge, and along most of its length. This "hard crystalline structure running along the length of the blade, a few millimetres or more away from the cutting edge is called the *hamon*."[330] This is the transition area, the interface where hard and soft metals meet; and it is here that gradations of crystallization occur. In Smith's metallographic terms, in this band, "The material is replete with subtle gradations depending on variations of carbon content, grain size, and the local thermal gradients during cooling."[331] These variations form patterns

[325] Smith, *From Art to Science*, 40.

[326] Smith, *Structure*, 298.

[327] Smith, *From Art to Science*, 40.

[328] Ogawa Morihiro, "The Characteristics of the Japanese Sword," *Nippon - To, Art Swords of Japan: The Walter A. Compton Collection* (Tokyo: Japan Society, Inc.,1976), 10.

[329] Walter Ames Compton, "The Artistic Quality of the Japanese Sword," *Nippon - To, Art Swords of Japan: The Walter A. Compton Collection* (Tokyo: Japan Society, Inc.,1976), 7.

[330] Victor Harris and Nobuo Ogasawara, *Swords of the Samurai* (London: British Museum Publications, 1990), 8.

[331] Smith, *From Art to Science*, 40.

of texture that are enhanced by highly specialized polishing techniques, requiring a series of carefully selected abrasives.

This junction of different microcrystalline structures results in subtle, abstract designs -- graceful boundary patterns that recall Leonardo da Vinci's recommendations to artists, centuries later, for blending colours "in the manner of smoke." Japanese artisans describe the designs that are conjured in this shimmering crystalline boundary as "white clouds, cherry blossoms, a flowing stream or flashes of lightning."[332]

Indeed, according to one master Japanese sword-polisher, "each smith uses a distinctive pattern of his own for the tempered portion of the blade."[333] Smith's own sensitivity to this exquisite craftsmanship brought him to the same realization of the person behind the blade: "Various masters (smiths) introduced innumerable individual complexities with a double motive -- mechanical and aesthetic -- that has made these objects unique both as weapons and as works of art. The patterns of different swordsmiths are as diverse and as distinguishable as are the brush styles of different painters."[334] And indeed, historian R. Groussett confirms this irrepressible presence of the individual in Japanese art generally, when, in a discussion of the artist Sesshu (1420 -1506) he notes: "Japanese art, even in the joint work of a whole school, impatiently betrays the artist's irreducible personality."[335] Fosco Maraini, writing from Japan in the 1950s, elaborates on this quality:

[332] Inami Hakusui, *Nippon-tô, The Japanese Sword* (Tokyo: Cosmo Publishing Company, c.1948), 1.

[333] Ibid.

[334] Smith, *Structure*, 295-297.

[335] Maraini, quoting R. Grousset, in Fosco Maraini, *Meeting with Japan* (*Ore Giapponesi*), Eric Mosbacher, trans.(Viking Press: 1959), 315.

> You feel the personality of a *kamikaze* directed, not to the madness of destruction, but to the penetration of the ultimate secret of things.
>
> This impassioned discipline caused eastern artists many centuries ago to try things which in the west have been tried only in the last century; namely to penetrate to the essence of personality (human, animal, vegetable, mineral), striving, not to capture its outer resemblance, but to reveal aspects of it unknown until the artist revealed them, aspects truer than any mere resemblance; and then, choosing the simplest and purest of these possibly infinite aspects, stripping them, denuding them, laying them bare, until finally the soul, the ultimate 'wind' of life, lay exposed.[336]

All of these personalities -- artist, swordsmith, polisher and mineral -- met along the edge of the *katana*. So magnetizing was this convergence that Smith's son recalls him being "entranced."[337]

It was an artistry that required exquisite sensitivity toward the materials and a conviction arising from experience in metals technology. The same artistry is evident in the sword fittings that Smith selected for this exhibit. As well, in *A Search for Structure*, Smith presents a photograph of a nineteenth-century Japanese swordguard by Takahashi Yogi.[338] The composite, non-ferrous metal was worked in such a way that contrasts in colour between the different components have been forged to create "on its plane surface the illusion of cherry blossoms floating upon the wind-rippled surface of a pond." These perfect, five-petalled cherry blossoms, adrift in an enduring matrix of metal, capture the symbolism of the transience of life and the dissolution of form.

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[336] Ibid, 315.

[337] Personal communication with Stuart Smith, son of Cyril Stanley Smith and Alice Kimball Smith, 3 May, 1998.

[338] Smith, *Structure*, 104, 108.

These paradoxical combinations in form and material suggest the complementarity relationships of delicacy and strength, permanence and dissolution, which inhere in both Buddhism and Taoist religious thought. The treatment of the metal in both the sword and its fittings is both functional and poetic. Thus the art and technology of traditional, hand-forged swords reproduces a symmetry between nature, philosophy and metallurgy. Relationships between these factors are realized in the metallographic structures and appearance of the blade itself. For Smith, the Japanese sword combined in itself all that was artistic, making it, as he put it, a combination of all the arts.

What unanticipated dimensions of the maker and his setting were revealed to Smith during his research into this exceptional metallurgical achievement? Smithsonian historian Brooke Hindle, in his essay on the exhibition, wrote: "Smith has told us that he has conversed with a dozen ancient craftsmen. As every good scholar conducts a dialogue with the author of each document he uses, so Smith has conducted dialogues with those long dead and often anonymous makers of the many objects he has examined. He has asked . . . a thirteenth-century Japanese swordsmith about [his] motives and [his] processes. The answers were not verbal but visible in the form and texture or hidden in the microstructure of the objects. The yield is information that could be obtained no other way."[339]

Linkages

In recalling his debt to the Japanese sword in these later years, Smith prompts inquiry concerning what else he might have learned of, and from, Japan. We know from the sources he cites that he read the works of

[339] Brooke Hindle, "On the History of Technology," *From Art to Science*, 13.

contemporary Japanese artisans, who were transmitting technological instructions they had received from much earlier oral traditions. Among these primary sources, and dispersed in Smith's writing, there are indications of the broader perspectives that he began to develop in the post-bomb years. Smith's primary sources -- both artifacts and texts -- revealed new, complex relationships between Japanese swords and their natural environments, their cultural origins, and the personalities of the individuals who made and used them.

Textual sources were available in English in time for Smith's research, with more information forthcoming through seminal, post-war translations of original Japanese sources.[340] The technical details in written sources provided environmental information that indicated a close working relationship with nature, similar in a general way to what Smith had encountered in earlier mediaeval, European works. The difference in the case of Japan is that for him, this was a new and specific cultural and geographic environment that was being communicated through the sensibility of artisans from Japan. This sensibility of the artisan is one for which Smith expressed the greatest respect, as we saw in his exhibition catalogue, and in his book, *A History of Metallography*, dedicated: "To those craftsmen whose intuitive understanding of materials provided the seed from which metallurgical science grew." It was the artisan, through the sword, that formed the bridge for him to visit new territories.

For example, in regard to technical processes for the sword, Japanese artisans cited their own and their predecessors' techniques in terms that related directly to personal and cultural experiences of their immediate

[340] Much of this interest in Japanese swords was prompted by their collection/confiscation by occupying forces. While relatively few such swords remain in Japan today, it is estimated that over two million of these items are located in the U.S.A.

local, physical environments. In the production of the blade, one such critical factor was the correct temperature for the tempering water, in which the hot blade is quenched or cooled. This temperature varied in the external environment during the extended period for making a blade, which could be up to two years. Therefore, many operations had to be carried out on a seasonal basis, in accordance with the prevailing conditions that had to be conducive to achieving specific qualities of hardness and flexibility in the steel.[341] The following details have been recovered from translations of two books written in the 18th century by two men, "of very different status": Arai Hakuseki Chikugo no Kami, privy counsellor of the Shogun, (then "*de facto* ruler of Japan") and Inaba Tsurio, a "humble (yet learned) dealer of Osaka."[342] For example, the final tempering and burnishing were done in August and February, when the water temperatures in wells or rivers are "about equal, neither too cold nor too hot". One master among the older smiths kept the secret of a consistent temperature by attending with care to his well, a water source where the temperature is the same winter and summer. As for the forming of the hot metal, critical temperatures during this process of forging were guided by the colour of the steel itself: for example, according to one swordsmith, " 'summer moon-night' heat or [as] light seen through the paper andon is right."[343] This holistic approach extended knowledge beyond that of the interaction between the materials and the skills of the artisan to encompass other cultural associations and environmental knowledge. Smith, reading these descriptions, would meet

[341] Inami Hakusui, Foreward, *Nippon-tô, The Japanese Sword* (Tokyo: Cosmo Publishing Company, c.1948), xii.

[342] Henri L. Joly, Preface, *The Sword Book and the Book of Samé* (Arai Hakuseki, *In Honcho Gunkiko* and Inaba Tsurio, *Ko Hi Sei Gi*), trans. Henri L. Joly and Inada Hojitaro (1913; Reprint, New York: Charles E. Tuttle, 1963), ii.

[343] Arai Hakuseki and Inaba Tsurio, *The Sword Book and the Book of Samé*, 92-93 (page citations are for the reprint edition).

the artist -- but not as artist alone. He would meet another person who shares the same world -- they both have the same moon in August.

In the matter of environment, Smith also expresses an attitude that has less to do with the control of nature and more to do with being receptive to the kinds of changes that nature will inevitably provide: "Like a potter with his glazes, the smith sets up the environment . . . but leaves the actual outcome locally to the balance of physical factors . . . and time . . . . everything softened by the effects of time."[344]

For Smith, the connection that the sword enabled was complex. It was a matter of one person meeting another, one "empirical metallurgist," as Smith called him, communicating through the worked metal as the material medium. They were two individuals coming to meet on a common ground as specialists, or as what Smith referred to as intellectual travellers. He describes the view from his side of the interaction when he speaks of a resonance with the materials, earlier expressed as "a strong feeling of natural understanding." And it was the artisan on the other side who had informed that material with his own exquisite knowledge. The connection was personal, cultural and archaic, in the sense of the primal experience of the materials themselves.

By the time of his exhibition, if not before, Smith had come to recognize that, "Far more than a weapon, the Japanese sword was an expression of cultural ideals and philosophy."[345] His response sets him apart from many post-war collectors and trophy-hunters, who were not expected by Japanese specialists in the sword to appreciate any qualities beyond the

[344] Smith, *Structure*, 294-295.

[345] Smith, *From Art to Science*, 40.

functional. For example, as Inami wrote in 1948: "I know . . . that it is almost impossible to convince anyone not Japanese that the sword was ever considered anything other than an instrument for killing."[346]

The cumulative knowledge -- and secrets -- of the swordsmith were traditionally transmitted and practised within the inherited lineage of the family, extending in one case to eleven generations.[347] They were tested for more than a millennium. Over 30,000 recognized swordsmiths have been recorded, but their numbers have fallen substantially over the last two centuries in the wake of political, economic and cultural change. Those remaining artisans in the "applied art of metalwork" who sustain this tradition of empirical metallurgy, embody an invaluable knowledge of traditional materials and environments -- all encompassed and integrated within the self. In fact, among these artisans are individuals who are highly esteemed, and recognized by the national government of Japan as Living National treasures.

Before Smith went to Japan, he had already encountered among his literary sources this master swordpolisher Inabi, in his classic text, *Nippon-tô*, written for "those of you of the Allied Occupation Forces who are students of the history of human endeavour and have a real interest in the Japanese Sword."[348] The author introduces himself in the traditional manner, that is, with reference to his family: "For several hundred years my ancestors were professional polishers of the sword, employed by the

[346] Inami, forward to *Nippon-tô, The Japanese Sword*, xvii.

[347] One record of such lineage reads: "Iyeyasu,Satsuma,1558, 11th. gen." (*Swordsmiths, Revised,* W. M. Hawley, comp. ,118.

[348] Inami, Forward, *Nippon-tô, The Japanese Sword* , xii.

Daimyo (military governors of provinces under the feudal system)."[349] They were also "researchers into the history of the sword, and of the technique of making it". As he points out, "It is almost impossible to describe the reverence for the sword borne by those Japanese entitled to wear it, the thing being at the same time, both a religious and a military symbol."[350] Smith hears the maker in his own words.

Meeting on the Bridge at Last

Finally Smith meets the artisan, the empirical metallurgist -- a person like himself, a "fellow traveller" among Smith's "intellectual travellers," coming from the other side of the bridge -- the other half of the event. And this traveller, Inami, in describing the sword, integrates quite naturally the spiritual and cultural dimensions of the relationship between the maker and his technology.

The long-sword technology was holistic in the sense that it made explicit the moral and spiritual dimensions of the artisan's complex relationships with nature and environment. The 17th-century katana that Smith had selected for his exhibition was made in a period when "elaborate purification rites were performed by priests over smiths about to begin the forging of a blade. . . . Everything possible was done to ensure the smith's being clean in mind as well as body, thus eliminating the chance that any evil thoughts might enter the blade and later cause it to commit evil deeds."[351]

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[349] Inami, Preface, *Nippon-tô, The Japanese Sword*, viii.

[350] Ibid., v- vi.

[351] Inami, *Nippon-tô, The Japanese Sword*, 91.

There is a direct qualitative correspondence between the spiritual state of the maker and his creation. In the Edo Period, for example, when swordsmiths were supported in their work by patrons, "Master smiths worked only when the mood was upon them, and when they felt that their efforts would achieve results commensurate with their highest ideals; never when they were out of sorts, sick or mentally or physically fatigued. The greatest smiths sometimes spent two years completing a single blade, and many of them made only twenty or thirty blades in a lifetime".[352]

While Inami wrote of the "sacred work" of making a sword,[353] we know that Smith recognized these spiritual dimensions as well, not only from his reading, but also from his experience, when he says in reference to the sword specifically: "Our perception of beauty seems to involve the interaction of several patterns having origin and significance at many different levels of space, time, matter, and *spirit* [my emphasis]. In the Japanese sword blade there is heterogeneity in both the macrostructure and the microstructure. . . .With true artistry all these are made to interact."[354]

In the course of his research on the Japanese sword, Smith is coming to meet the makers both in the material and in the classic texts. Both reveal the resonance between maker, matter and technology, which is established by the purposeful extension of the maker into the making and maintenance of the sword. To complete this cycle of the sword as technological metaform, I will select aspects of its use, which can only be considered briefly here.

[352] Ibid., 91- 92.

[353] Ibid.

[354] Smith, *Structure*, 292.

The use of the Japanese long-sword can only be fully understood in the context of its spiritual and cultural dimensions. In addition to Inami, among those who treat this subject in depth are Daisetz Suzuki and Yamamoto Tsunetomo. All serious discussions of this matter take into account the role of the samurai, warriors who dedicated their services to their daimyo, or master. Inami describes their regard for their sword: "In the icy steel, born of fire, they saw revealed the mystery of life, indivisible from that of death. . . . In the untarnished face of the crystalline blade, they beheld the purity and chastity inseparable from true loyalty."[355] These are all aspects of the samurai code, which also draws on the five virtues in Confucianism: humanity, loyalty, courtesy, wisdom and trust."[356]

My point here is not to idealize the samurai or his times -- for in these times and circumstances, there were still those injustices, cruelties and superstitions that inhere in human society to this day. The point is that as well as the intentions of defence and aggression that were realized in this weapon, there was an effort to imbue it with moral and spiritual powers as well. "His sword was part of the samurai's own personality, and people were wont to judge his character from that of his weapon."[357] The relationship between a samurai and his sword was one-on-one, on the human scale of choice and action. And, bearing this human element in mind, the codes of behaviour were advanced to develop the individual accordingly, to cultivate a "rounded" human being. And where this failed, or when the samurai was unable to carry out his obligations, it fell to the person -- to individual, personal responsibility to make restitution, at the

[355] Inami, Preface, *Nippon-tô, The Japanese Sword*, v.

[356] Yagyu Munenori, *The Sword and the Mind*, trans. Hiroaki Sato (Woodstock, New York: The Overlook Press, 1985), 15.

[357] Inami, Preface, *Nippon-tô, The Japanese Sword*, v.

cost of one's own life, if necessary. The cherry blossoms suspended in the metal of the sword-guard symbolized such a surrender to a graceful death.

For the samurai, once he had drawn his sword, was committed to using it.[358] The preparation of the samurai, therefore, was to help him choose wisely -- would he use the weapon he had, or not. This choice had been put to Smith as well: more than once he had been solicited to build nuclear weapons technology. But as he said to his young son, Stuart, while they were hiking at the end of the war, and after he had been offered -- and just declined -- the directorship of the Los Alamos Laboratory, "I don't want anything more to do with bombs."[359]

After these experiences and his exhibition, Smith continued to write, and increasingly worked directly with artists in support of visual, nonverbal sources of research. When he died in 1992 at 89, as far as can be ascertained from currently available published works, Smith still had not directly addressed the war-time applications of his earlier research, with the exception of his appearance, late in life, in the Los Alamos video. Otherwise he referred to related ideas, situations and conflicts more obliquely, through metaphor -- in much the same way as the earliest alchemists, whom he had studied, referred to personal transformations through the transmutation of matter.[360]

His reticence makes his one singularly dark comment stand out as a highly significant anomaly. This oblique reference is tucked into a footnote -- an

[358] Michael Osler, personal communication, April 15, 1998.

[359] Personal communication, Stuart Smith, May 3, 1998.

[360] Marie-Louise von Franz, *Alchemy: An Introduction to the Symbolism and the Psychology* (Toronto: Inner City Books, 1980).

understated approach to concealing "atomic thoughts" in an anomalous detail. He is speculating about the future uses of aluminum: "It has many properties that make it almost ideal for working under primitive conditions. With all easily reduced copper ores already depleted, perhaps the new civilization that will rise from the radioactive ruins of the present ones will be aluminum-based!" [361]

Perhaps he resorted to such tactics because he believed that the atomic experience was more safely explored and better expressed by an intimate who shared it with him. Los Alamos and its history was written during the Cambridge years in the context of *A Peril and A Hope: The Scientists Movement 1945-47* by Alice Kimball Smith. In fact, in Stanley Smith's Postscript of 1980 (which he describes as "the nearest approach to an autobiographical statement that I am likely to write"[362]), his conclusion is literally suspended over a single footnote in which he cites Alice's publications on the people, places and spirit of their experience with the atom. In this subtle, almost encoded manner, he directs the reader to the atomic story as experienced by himself, his family and their community. For Alice Kimball Smith was not removed from his endeavour: she and their family were part of the Los Alamos community from the outset of the project.

From the Other Side

In his later years, Smith identifies himself as a technologist and a craftsman: "From beginning to end I have been a simple metallurgist using metals and their structure as a kind of inverted touchstone to assay all

[361] Smith, *Structure*, 304.

[362] "Postscript," *Structure*, 353-357; 353.

things."[363] In relation to his encounters with many different and changing environments, he describes himself in terms of the travelling scholar, an intellectual in parallel with those itinerant craftspersons of the18th- and 19th-century, the European artisans who had featured in his earlier history. As for the interpretation of his own earlier events, they may best be described when he speaks of the processes of mass technologies, where "the human characteristics of the individual technologist are not always incorporated in the megamachines (Lewis Mumford) that are constructed out of his work."[364]

When Smith came to meet the sword, he met, as he has said himself, the maker. Smith, via the sword as metaform, was crossing as a person to the other side of the bridge, crossing on human terms a span that he had helped to force in the war years as part of a collective, destructive endeavour. In his mature understanding of the sword and the smith, we can see the readiness in Smith's sensibility for reaching out in matters of spirit. In later years, together with his wife, he made several visits to Japan, travelling into the countryside, and often staying at night in the temples there.[365]

These experiences, including those in and through technology, came to transform his life -- transform in the significant sense that he would choose in the end to describe himself not as an intellectual but as "a simple metallurgist" whose concern is not for the "mega", but for what he calls "human terms" -- "the little things" and love.

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[363] Smith, *Structure*, 357.

[364] Ibid. 348.

[365] Personal communication with Stuart Smith, son of Cyril Stanley Smith and Alice Kimball Smith, 3 May, 1998.

Resting at the end of his journey, he says: "All big things grow from little things, but new little things will be destroyed by their environment unless they are cherished for reasons more like love than purpose."[366]

Meeting Smith on this point, from the other side of the bridge, is the poet Issa (1763-1827). Issa was writing in Japan at the same time as Awataguchi, (-1788), the swordsmith of the inspiring *katana*, which Smith chose and researched for his exhibition. The art and sensibilities of all these men coexisted across time in the forms of the poem and the sword: these sensibilities revolved around a centre which contained life and death, themes and forms that were familiar to Cyril Stanley Smith. Issa's poem[367] is dedicated, ON THE DEATH OF HIS CHILD. With great tenderness, he speaks for the preciousness of life, which Smith himself had expressed.

DEW EVAPORATES
AND ALL OUR WORLD
IS DEW . . . SO DEAR,
SO FRESH, SO FLEETING

*****

[366] Smith, "On Arts, Invention and Technology," *Technology Review*, 41.

[367] Issa, "On the Death of His Child," *Japanese Haiku*, trans. Peter Beilenson (Mount Vernon, New York: Peter Pauper Press, 1955-56), 9.

CHAPTER VII

CONCLUSION AND DISCUSSION: REFLECTIONS AND IMPLICATIONS

For the future, I see the greatest need and the greatest opportunity in the development of nonverbal sources for history and of methods for their interpretation.

Cyril Stanley Smith

Even today study abroad often leads to a change in one's basic approach to his subject. What is true of the effects of new encounters upon individuals seems also to have been true of cultural areas.

Shigeru Nakayama

"The tool is not only a means for a person to create, but also a means by which the character of the tool-user is revealed."[368] This observation by author and photographic critic Brooks Jensen applies whether one is working with a camera or a scalpel. This personal dimension may be less apparent when we are working at the micro-level of scanning electron microscopes, at the macro-level of mass technologies such as satellite communications, or in the the abstract realm of mathematical maps devised for computer programming. Nevertheless, we know that ultimately, we as humans are using technology to mediate the ways in which we engage with the world.

In this chapter, I review the key points and implications to be derived from viewing technology as metaform, as I have explored it in this dissertation. In summary, I have demonstrated that technology is used, both consciously and unconsciously, as a mediating device in human relationships; that technology operates on the level of meaning and symbol, as well as in the instrumental sphere; and finally, that it is possible to interpret and understand human-technology relationships by drawing on the physical aspects of the technology itself – its tools, techniques, materials and skills. These physical aspects bring original insights to technologies, which up to now have been more commonly dealt with through secondary sources, such as texts.

In the process of exploring the implications of metaform in human-technology relationships, I have included examples and cases of personal, cultural and civilizational encounters with and through technology. Gradually, I have introduced perspectives from Asia. In this chapter, I

[368] Brooks Jensen, "Editor's Comments," *LensWork Quarterly* no. 20 (1998): 9.

bring a more focused attention to Asian art and technology, with special attention to Japan and China. I do so because of my experience and long-standing interest in the cultural heritage of Asia, and because of the rapid transitions that are impelling new responses from conservation colleagues in these areas. Since conservation information from Japan has become more accessible in recent years, it is a helpful guide to possible issues in other areas of Asia. However, as other areas become more accessible, as in the case of China, there is much more to be learned -- and to be accomplished -- on behalf of world heritage. Conservation in general, and my research in particular, will be well served by following the advice of scholars who are intimately familiar with current developments in Asia, scholars such as Ruth Hayhoe, Professor and Director of the Hong Kong Institute of Education, who asks, "What can we learn from Asia?"

In regard to technological transitions in particular, there is much to be learned from the Japanese experience, especially in areas that lend themselves to the modes of exploration through metaform, as I have discussed in previous chapters. As a nation, Japan is at the stage of sharing its experience regarding the advantages and disadvantages of rapid conversion to industrialization and movement into the high-tech dimension, as we shall see presently.

Given this relational aspect of human-technology interactions, I discuss ways in which we can discern the nature of the relationships that are taking place. To do this, I draw on educational theory to clarify types of learning/instructing interactions where they are mediated by technology. I cite conservation projects and on-going examples of professional exchanges with Japan, with the aim of suggesting what these experiences

may imply for further collaborations in Asia.

Reflections on Metaform

Generally speaking, the main result of regarding technology as metaform is nothing less than a new way -- a more holistic and integrated way -- of experiencing technology, both on the conceptual plane and on the level of practice.

On the conceptual plane, we need to examine the implications of understanding technology as metaform in the context of technologically-mediated transitions and exchanges across cultures. Having established the dynamic role of technology in personal and cultural meaning systems, we can ask, Does this conceptual instrument of metaform have a role in preparing us to engage in cultural exchanges? If so, metaform will serve as a guiding element in fostering productive dialogues and establishing beneficial working relationships.

We have already seen the relevance of applying the conceptual tool of metaform to human relations in specific cases at personal and cultural levels. For example, in conservation, we have seen it applied to the treatment of lacquer artifacts, specifically Japanese lacquer or *urushi*. In this concluding discussion, I intend to focus on the transferability of the concept of metaform globally to selected areas via an educational framework. Given my conservation interests in exchanges between Asia and North America, a central place will be given to such exchanges.

The Personal Element in Global Research and Academic Exchanges

When one considers the role of technology at the basic level of human psychology (as discussed in Chapter I), it should come as no surprise that we can readily adapt the instrument of metaform across disciplines. We can see the potential for metaform in the work of Shigeru Nakayama, who has been writing over several decades in the field of the history of science and learning. As a global scholar, Nakayama draws on the international academic culture to elaborate his own areas of research. In his book, *Academic and Scientific Traditions in China, Japan, and the West*, Nakayama refers to the communication theories of Marshall McLuhan; specifically, he cites McLuhan's statement that "new communication media were exerting a decisive influence on patterns of human thought and action."[369] Nakayama adapts this theory to his comparative study of the phonetic alphabet, the Chinese ideograph and the Japanese combination of Chinese ideographs, phonetic *kana* and the Latin alphabet. He explores these instruments within the conceptual framework of technologies in order to examine the ways in which the "culture of the written word" and oral communication "have functioned in particular ages and civilizations."

Nakayama makes the bridge between social theory and the lived experience of technology at the personal level when he acknowledges the crucial role of the person in cultures of communication. Here he is almost echoing Cyril Stanley Smith's idea of the "intellectual traveller." Both

[369] Shigeru Nakayama, *Academic and Scientific Traditions in China, Japan, and the West* (originally published in 1974 as *Rekishi toshite no gakumon*), trans. Jerry Dusenbury (Tokyo: University of Tokyo Press, 1984), 78. Where McLuhan saw determinism, Nakayama does not. As an interpretive device, metaform elucidates human-technology interactions without necessary reference to such categories as determinism.

scholars obviously value words; however, they also honour the value of "knowledge beyond words," of which Oka spoke. All three speak as masters of their respective fields and as educators. Consequently they have chosen to emphasize that learning is experienced and knowledge shared at the level of a person's sense and sensibility. Nakayama puts it this way:

> Objectively, one can say that intellectual contact through books and printed materials provides an opportunity for dispassionate reflection. Yet the flesh and blood of a fashioner and maker of learning is not readily communicated on a piece of paper.
>
> But what are the academic conditions under which scholarship ferments and becomes creative? The answer, pure and simple, is the proximity of companions with whom one engages in serious academic discussions. [370]

It is in personal exchanges across academic communities that Nakayama sees the potential for "great psychological significance," not only at the level of the individual, but also in terms of the potential role of the individual in relation to society.[371]

Here we see the psychological significance of individual personal exchanges within the context of learning and society. As I have shown with reference to object relations theory, a corresponding psychological significance attaches to the use of technology as a means of mediating new relationships at various points of human interaction. Moreover, it is ultimately at the level of personal engagement with those complex, and often latent/unconscious associations, that we draw on technology to mediate the "tension and excitement" of cultural exchanges, as Nakayama expresses it -- not only within academic life, but in the larger sphere of

[370] Ibid., 80.

[371] Ibid., 229. Here Nakayama speculates about what might have happened in Japan had Albert Einstien been able to come as a university professor, as planned before the outbreak of World War II.

human/environment interaction. I say this in full awareness that there are, of course, collective and environmental influences that attend our experiences of technology. Recognition of these influences brings us to the question of metaform in its potential applications outside academic institutions.

Living Technology at the Centre and Periphery

Tessa Morris-Suzuki takes us beyond technological exchanges within the academic culture. In her recent book, *The Technological Transformation of Japan,* she considers the exchanges among various levels of society during the period of rapid transition and industrialization from the mid-19th to early 20th century.[372] In particular, Morris-Suzuki examines the reciprocal relationships between the initiating, socio-economic centres of industrialization in Japan and the peripheral agents (arts and craft producers) that responded to this impetus through technological adaptations and innovations of their own. Her model of technological transition is promising for conservation theory and practice, for example, because it reveals the dynamic nature of exchanges before, during, and after industrialization. These exchanges took place within networks of traditional craftspersons and artisans working in various media (often at the periphery) -- and state centres of industry, science and development. For example, her case histories include sericulture (cultivation of silk), weaving, ceramics and paper-making. What she points out is the "organic" integration of new technological objectives with well-established techniques, artisan skills, and fundamental environmental approaches that ultimately supported practical innovations.

[372] Tessa Morris-Suzuki, *The Technological Transformation of Japan From the Seventeenth to the Twenty-first Century* (Cambridge: Cambridge University Press, 1994). For further insights into the technological transformation in Japan, see Takeshi Hayashi, *The Japanese Experience in Technology: From Transfer to Self-Reliance* (Tokyo: United Nations University Press, 1990).

Since I am concerned in this conclusion with the general transferability of metaform across disciplines, the salient point for this discussion is that Morris-Suzuki's case studies, in their material details, offer rich potential for the application of metaform. The more we can incorporate the physical/material aspects of subjects, the richer our discussions will be as resources for research. It was only by reflecting on the matter of blood itself that I was able to penetrate deeply into the relationships that bound all the participants in the Scandal of the Blood of France. It was Cyril Stanley Smith's attention to and respect for the nuances of material structures, so carefully set out in written description and photographs, that led me to new questions, new colleagues and discussions about the Japanese sword in history, and in the present. Finally, on the personal level, it was my attention to the physical elements of the chisel and the stone, and my direct experience of these, that guided me to new insights regarding the close relationship between the spiritual life of the artist and the subject of his work, which was sacred sculpture.

From Problem-Solving to Awareness: A Technological Shift of Focus

There is a common tendency to regard the primary function of technology as a tangible means of problem-solving. Technology is called upon as a solution, a material intervention to correct or adjust situations that are seen as straightforward cause-and-effect interactions. Although these interactions usually involve complex relationships -- such as those between human beings and habitat as sustenance, shelter, spiritual ground -- they are often perceived according to prevailing values; for example in some areas, the conservation of cultural property may be reduced to materially-based, economic relationships, and measured accordingly.

As a result, a rational, pragmatic approach often prevails in research and development of applied science and technology. While this approach has had its benefits, recent critics regard it as reductionist, and argue that the costs of such an approach -- both on an environmental and humanitarian basis -- are high, often too high.

As I have demonstrated in the case of the invention of the atomic bomb, and in the case of HIV transmission through transfusion of contaminated blood products, technological interventions that arose out of a short-term or narrowly-defined problem-solving approach, to the exclusion of broader humanistic concerns, have not only proved to be unpredictable in their outcomes; they have, in the final analysis, failed to achieve what they set out to do.[373] As we have seen in Chapters IV and V, the roots of these difficulties can be traced -- through the use of metaform -- to their origins in the key materials involved and the associations that these materials had for the inventors and advocates of the technologies.

Metaform provides an interpretive device that urges us to take into account the human factor in our understanding of technology as we seek to redress its previous imbalances. Given the far-reaching, irrevocable consequences of certain of our large-scale technologies, such forethought is preferable to having to learn the hard way -- what Neil Postman calls "fallibalistic learning." Metaform can help us to achieve this holistic sense

[373] The atomic bomb and its derivatives have led to an uneasy global security fraught with the increasing possiblity, even as I write, of nuclear warfare and nuclear accidents. (See Brian Hall, "Overkill is Not Dead." *The New York Times Magazine*, 15 March 1998, 42-9, 64, 76-8, 84-5). As for blood technology, the cost of the mismanagement of this technology has now been expanded from HIV and AIDS to include thousands of citizens who have contracted the potentially fatal hepatitis-C. In France, on-going investigations into the case of the "tainted blood scandal" have led to criminal charges against the highest levels of government, including former prime minister Laurent Fabius; two of his Cabinet members are charged with involuntary homicide for "trying to keep a U.S. AIDS test off the market." ("International News, Europe: Ex-PM charged in Scandal," *TheGlobe and Mail*, 23 July 1998).

of technology because metaform itself is built upon a conceptual synthesis: by definition, it integrates the internal human experience of a sense of meaning with external, physical factors. Metaform is the means to a more inclusive, integrated perception of ourselves in relation to our instruments and techniques.

Taking Back Technology

By applying metaform to our personal and shared experiences with technology, we can re-conceptualize our own history and deepen our understanding and appreciation of the life experience and meaning embedded in the working arts in diverse cultures, whether at home or at a distance. This deepening was my experience in re-visiting the case of the chisel and the stone, in Chapter III. Here my investigation, based on preservation techniques, led to a much deeper knowledge of the sacred arts and artisans of India. A similar experience was described by Cyril Stanley Smith, when he encountered the artistry and cultural values that inhered in the crafting of the Japanese sword. Smith drew on material "lessons" he derived from the sword technology and adapted these to his understanding of the human situation. While he referred often to historical written sources, Smith based much of his "personal philosophy" on his observations of material technological phenomena. He repeatedly gave credit to his direct observations of material phenomena for his inspirations. For example, he saw in the complex metallic boundaries of the Japanese sword a material parallel to his theory that new knowledge and discovery take place at the edges of existing forms, at the boundaries where two things meet. Smith wrote that this experience caused him to re-evaluate what he had done in the past; he applied these lessons and intuitions to new endeavours in his personal development and professional

life.

Emerging research in neurobiology,[374] environmental thought,[375] and education[376] supports the need for a more expanded awareness of our various connections to technology beyond its strictly instrumental role. My research speaks to the importance of recognizing the role of the whole person -- psyche/soma, human emotion and feeling -- in decision-making in all areas of life.[377] It is precisely these affective and spiritual dimensions of human relationships -- as they apply to technology -- that the conceptual device of metaform enables us to access.

We need to recognize these humanistic dimensions in order to make decisions that will lead to individual and collective well-being. The need for this discernment directly supports the relevance of the conceptual tool of metaform for our understanding, interpretation and projections of technology, since it is at the level of person, culture, and civilization that these values, meanings and associations -- psychological or spiritual -- influence human behaviour. The appropriateness of a given technological

[374] Antonio Damasio, *Descartes' Error: Emotion, Reason and the Human Brain* (New York: AvonBooks, 1994).

[375] Neil Evernden, *The Social Creation of Nature* (Baltimore: Johns Hopkins University Press, 1992).

[376] Jack Miller (1993), Keith Oatley and Jennifer M. Jenkins(1996).

[377] In *Descartes' Error*, Damasio cites the philosopher Ronald De Sousa, who has argued that emotions are inherently rational; he also refers to P.N. Johnson-Laird and educator and psychologist Keith Oatley, who have "suggested that basic emotions help manage actions in a rational way" (*Descartes' Error*, 201). Damasio describes mind as "arising out of an organism" (229), which he explains as follows: "The action of biological drives, body states, and emotions may be an indispensable foundation for rationality. The lower levels in the neural edifice of reason are the same that regulate the processing of emotions and feelings, along with global functions of the body proper such that the organism can survive. These lower levels maintain direct and mutual relationships with the body proper, thus placing the body within the chain of operations that permit the highest reaches of reason and creativity. Rationality is probably shaped and modulated by body signals, even as it performs the most sublime distinctions and acts accordingly" (200). Damasio also discusses the ways in which "the primacy of the body as a theme applies to evolution."(228), where the experience of "images, feelings and somatic markers" are key elements for "the process of subjectivity, a key feature of consciusness." (236).

solution in a given circumstance will depend on our recognizing these human factors, on developing a more discriminating attention when integrating these factors into our decisions.

As Antonio Damasio expresses it, "Of course, there are risks when brains and minds that came from nature decide to play sorcerer's apprentice and influence nature itself. But there are also risks in not taking the challenge and not attempting to minimize suffering. There are, in fact, enormous risks in not doing anything. Doing just what comes naturally can only please those who are unable to *imagine* better worlds and better ways, those who would believe they are already in the best of all possible worlds."[378]

What can we imagine, in terms of new meetings, new collaborations and endeavours around, for example, world music? First, it is necessary to develop knowledge of one's own self, in order to improvise with others.

As we have seen throughout this research, these human factors are at work whether we recognize them or not; and where they are at work, out of sight of consciousness, they can undermine apparently benevolent initial intentions. This was the case where nuclear research was applied to atomic weapons as a solution to peaceful co-existence: in addition to the horrific short-term effects of this technology, the long-term, negative implications were overlooked. These implications dawned on its fabricators only in retrospect. As one commentator put it, when describing the recent nuclear tests in India and Pakistan, it is too late to put the genie back in the bottle.

[378] Damasio, *Descartes' Error*, 254.

Implications for Cultural Exchanges in Conservation: How Do We Participate?

We need to consider the implications of the personal component and how it relates to cultural and civilizational aspects. The format of this dissertation makes it impossible for me to look at all of the issues involved. However, I will draw from my own experience to select three guidelines that will sensitize us to the meaningful/symbolic associations of technology under consideration in cultural exchanges. Then I will proceed to relate my guidelines to parallel observations in the field of holistic education.

1. *One can initiate an analysis by identifying and describing the technology within one's own frame of reference -- eg. ecological, conceptual.*

Take sensibility as a factor in one's frame of reference: reflecting on my own experience, I realize that my own sense of cultural heritage emerged from a personal perception or sense of creativity, where I saw creativity and invention as a means for expressing relationships with nature in its human, natural and modified forms.

2. *Make inquiries as to what these associations represent within the other's frame of reference for technology.*

Related to my example of environmental sensibilities in the context of technological frames of reference, there are many different sensibilities, as environmental studies reveal. For example, where I see wood as a material with meaningful origins in nature and intrinsic individual characteristics that inform the meaning to be preserved, another may

experience wood as a medium for revitalizing living artistic and/or spiritual traditions. Alternatively, one may engage with it strictly as a resource to be managed, as a commodity with no intrinsic value, or as an economic tool in political negotiations. All of these parties -- conservator, artisan, curator, educator, economist, politician, spiritual leader, and diplomat -- may be called upon to negotiate cultural preservation, and each will come with a distinctive emphasis, reference, and ability regarding the instruments for achieving it.

We need to develop the conceptual means for identifying, comparing and contrasting these frames of reference, and to achieve a synthesis that will support the underlying short-term and long-term preservation objectives.

3. *Seek ways to collaborate, bringing in representatives from all preservation-related interest groups, where the interests are defined not only as "technical" in the limited sense of scientific technology, but more broadly as cultural/civilizational.*

History has demonstrated that for technological measures to be successful in the long term, the human factor must be taken into account. Here a paradox becomes evident between the rapid proliferation of our technological options, outstripping our ability to test them, especially *in situ*, in diverse settings, and the development of respectful, collaborative preservation measures, which depends on a long-term, inter-generational commitment that reaches across cultures.

Within a given culture, another paradox arises, because the larger institutions that can provide such long-term stability typically have built-

in structures, established interests and cultural and sub-cultural biases -- all perfectly understandable, but potentially counter-productive -- that preclude the necessary flexibility and innovation whereby they can respond appropriately to change.

According to Morris-Suzuki's analysis, fruitful cultural adaptations and technological advances have occurred in civilizations that cultivated a balanced relationship between centres of research and administration and peripheral, local sites, where these local and distinctive "satellites" are recognized as having an essential, complementary role as diverse sites for research initiation, application and technological field testing according to specific, local conditions. Hers is a sociological version of the environmental adage: "Think global; act local."

Connections and The Common Thread

At the heart of each of these guidelines for working person to person across cultures through technologies is the concept of relationship. From this relational perspective, technology as metaform has been explored previously in this dissertation as a mediating factor: for example, in the case of the Chisel and Stone, I discussed technology as a means of negotiating personal engagement with a conservation task. In the case of *l'Affaire*, I explored technology as a medical means that brought to light cultural perspectives regarding blood. As a means of focusing and directing knowledge according to the changing nature of one's intellectual and emotional connections to self and the world, we saw a range of technologies -- from destructive weapons to heritage preservation -- within the single lifetime of Cyril Stanley Smith.

Educational theory gives us a means for organizing and understanding the changing nature of relationships that focus on the development and exchange of knowledge, and in particular of global exchanges in preservation of cultural heritage.

Technological Thought in a Global Environment

Educator Jack Miller provides us with a framework from holistic education that complements my guidelines for preservation exchanges.[379] While Miller has developed his theory in the context of student-teacher interactions, I shall consider it in relation to the personal dynamics of knowledge development as realized in the interactions between one researcher/artisan/practitioner and another, where each may represent a particular cultural or sub-cultural matrix. In an era of global communication and travel, these interactions or exchanges may be perceived as occurring within a wide variety of relationships, such as those between visitor and resident, for example, or researcher and researcher, as well as any combination of these. In some cases, there is the potential for us to perceive these exchanges between individuals and cultural representatives in terms of a hierarchical relationship. However, I view them as communications between peers and co-learners in this fundamental respect, that learning may occur at any time, and in any manner, formally or informally, in the company of others.

While Miller's model applies to relationships among people, because my study focuses on the relational aspect of technology, we must include a sense of the technological presence in the midst of these interpersonal relationships. As we have seen, technology is a mediating element in

[379] Jack Miller, *The Holistic Teacher* (Toronto: OISE Press, 1993), 11-14. Subsequent page references will be supplied in the text.

human relationships. In previous chapters, I have emphasized the symbolic dimensions of technology as metaform; here, in our discussion of implications, the emphasis will be on the relational aspect of preservation technologies and related issues.

Holistic Model: Transmission, Transaction, Transformation

As a *visiting* researcher/instructor, one has a chance to learn first-hand about the lived reality, the total environment, and to gain in varying degrees a sense of the priorities, resources and values which technologies are intended to serve. The impact of these new insights -- both on the site visited and on related matters in the originating or "home" culture -- will vary according to the capacity of the visitor, and the receptivity and resources of these environments. As a *resident* researcher/instructor, one has the opportunity to contribute directly and indirectly to the situation through living out one's experience in the formal and informal learning settings of the new host environment, and by responding to extra-curricular questions and situations that arise out of a new environment. This last situation is perhaps the most inclusive context in which one can participate with one's colleagues, according to Nakayama.[380] In either case, such environmental opportunities not only enhance the learning of the visitor in the short term; they can inform one's future ability to make more meaningful connections in the long term.

I shall now consult Miller's model of interactive learning as a way of exploring the various relational aspects of technological exchanges that occur within the contexts suggested above. I will demonstrate my adaptation of Miller's model to technological exchanges through selected

[380] Nakayama, *Academic and Scientific Traditions in China, Japan, and the West*, 220-37.

examples chosen to suggest/elucidate implications that may emerge from the several modes of communication and knowledge development. Miller describes three educational modes: transmission, transaction and transformation modes.

Transmission. Miller's model of learning begins with transmission, characterized by a person "receiving and accumulating knowledge and skills . . .[where] knowledge is seen as fixed rather than as process. . . . . Transmission learning tends to be imitative and repetitive -- as when we are learning to perform a skill. We are given only preselected tasks to watch, repeat, and do as we are told." One apparent example of transmission involves rug weavers whom I observed in Cairo: each weaver was given only part of the pattern by the director, so that each one would have only a fragment of the whole design at any one time. This situation suggests a "lecture and recitation" mode of learning. The relationship between instructor and learner, in terms of information flow (or between two parties in a technological exchange) appears to be uni-directional.

I say "appears" in this case because appearances can be deceiving in learning situations where one may be unaware of the complex cultural relationships and ways of learning that are being experienced on both sides. This is especially true of apprenticeships, where learning is focused on personal interaction not only with abstract systems of knowledge but also with physical materials that impose their own inherent characteristics on the processes of learning and creation. These are not necessarily characteristics to be controlled and absorbed; in conservation/restoration, one needs to develop skills in harmony with these materials.

A case in point is described by conservator Susanne Barchalia, from the National Museum in Denmark. Barchalia had successfully applied as a fully qualified professional in her own right to study on-site with one of Japan's masters in traditional lacquer (urushi) techniques. Her previous experience as a silversmith and her training as a conservator of ethnographic collections had already acquainted her with the value of "learning without words", as I discussed in relation to metaform in Chapter I. As Barchalia explains:

> "In Japan it takes eight to ten years of apprenticeship to attain the level of a master artisan. A Japanese master willing to pass on his knowledge will not accept a student whose mind is prejudiced. The openmindedness shown by the master demands a similar openness from the student, who must be willing to receive the teachings of the master without reservation.
>
> "It is usually very difficult for a Westerner to understand this total submission because we are used to learning from a critical dialogue between equals, whereas in Japan one looks, listens and learns. So, obviously, one has to change one's behaviour totally and try to achieve the reticence expected if one wishes to acquire any knowledge from a Japanese master."[381]

Barchalia's experience suggests the positive potential of the transmission mode of learning. To consider the negative side, transmission can be seen as unidirectional in respect of the dictates of the instructor or alternative authority, which in the case of conservation could be a conservator/ technological consultant. It can also suggest a non-critical (in the sense of non-discriminating) acceptance on the part of the recipient. If such a

[381] Susanne Barchalia, "Apprenticeship and Conservation," *Urushi: Proceedings of the Urushi Study Group*, Tokyo, 10-27 June 1985, N.S. Brommelle and Perrry Smith, eds. (Marina del Ray, California: J. Paul Getty Trust, Getty Conservation Institute, 1998), 122.

relationship is abused -- that is, if knowledge or technological solutions are imposed or applied with little or no respect for the particular needs or context of the learner-- then at the best, the information will not be used, or at worst, it will be used to a bad end. We saw this in the case of *l'Affaire*, where the research and economic concerns took priority over the well-being of persons. In this case, the nature of such a hierarchical, authoritarian relationship stifled mechanisms for challenging authority, or for co-operatively carving away entrenched assumptions. Few opportunities arose in this situation for refining the perceptions of the recipient of this inflow of knowledge.

On the positive side of the potential for transmission, the beneficial outcome to be fostered is a mutual respect for the lineage of ideas and accumulated knowledge that is the civilizational heritage of such countries as China and Japan. As well, an on-going commitment to the relationship can develop between the parties involved. Openness and a sense of trust are often at the heart of the matter.

Transaction. Miller's second mode is transactional learning, which is "more interactive although the interaction is mainly cognitive. The student is often solving a problem -- knowledge is not viewed as . . . fixed in small units but as something which can change and be manipulated. The scientific method is often used as a model for transaction learning. . . . The transaction position can be characterized by an emphasis on dialogue between teacher and student."

The negative potential of this approach is a narrowness of view deriving from exchanges around the strictly cognitive aspects of a technological

issue, without allowing for other dimensions of the human factor, such as psychological and spiritual matters. In technology as the application of science, which is one projected outcome of this mode as Miller proposes it, modern technology can be seen as a product of a linear, conceptual trajectory, one structured by a set of rules. It is by means of such rules that we are led to suppose we not only understand the world outside ourselves, but that we can *impose* order on it. This attitude can limit the perception of learning to an extroverted activity, where the emphasis is on directing phenomena outside oneself, rather than reflecting on, and developing a sense of, meaning within the self. This rule-oriented, "problem-solving" approach to "truth" can leave little room for openness to the more complex, "lived" realities of one's self or others, or for developing an awareness of the key environmental connections beyond the immediate subjects at hand.

On the positive side of transaction, there is the opportunity for the sense of a common goal to unite researchers in a sense of collaboration and collegiality. Within a given discipline or school of thought, this unity based on an understanding of rules may diffuse or reduce the tension of competitiveness, as we saw in the case of the early days of Cyril Stanley Smith's intellectual adventure at Los Alamos. Here the joint experience of technological invention can develop confidence in many parties, and build a sense of mutuality.

Transaction, by introducing the element of a joint project as the focus of a cognitive dialogue -- i.e. the co-construction of knowledge within a given system of "factual evidence" -- introduces a certain concept of knowledge development. Here the exchange is focused and mediated by the jointly

constructed "knowledge project," such as social and physical science and, by extension, their applications in technology. The tendency, however, may be to produce only "measurable" solutions without regard for the alternative essential factors of the humanistic and environmental repercussions of applying this knowledge.

It was by using the conceptual instrument of metaform that I was able to identify and analyze these meaningful aspects of technology for their significance. In the process metaform became the means of penetrating the silence of Smith as a scientist, and of illuminating our understanding of the silpan as an artisan in the service of spiritual life. By opening ourselves to inquiry in this alternative human dimension, we become more receptive to the insights revealed through inclusive and imaginative thinking.

Ultimately, the holistic measure of a technological success will not reside in the science, theory, or material facts only, but instead in the larger human benefit and cultural meaning of those facts *in application.*

This insight returns us to the human factor in cultural exchanges. As conservator Susanne Barchalia expresses it: "To be taught the traditional skills of a Japanese lacquer workshop, it is very important to have recommendations from people whom the master trusts."[382] The questions of trust and openness are factors at the centre of all of these exchanges, and it rests with all parties involved to achieve this. Trust can be especially difficult in a Western consumer-driven society that values competitiveness, where one person's success is another's failure, and where knowledge is increasingly co-modified.

[382] Ibid., 121.

The factors of awareness and trust are crucial in this context -- mentors and colleagues who will open doors for each other. Again, this openness can originate with the initiative of an individual, or it may be cultivated at the collective level of the organization or institution.

We can see how transaction can be co-operative; it is conceived according to a conception of knowledge as a system of ideas originating *outside* the learner. The question is, How do we relate to what is happening *inside* the learner? To answer this question, we must consider the third education mode in Miller's model, transformation.

Transformation. Miller's third mode of learning is transformational; here the mode of knowledge development and communication acknowledges the wholeness of the learner. The parties in the overall project "are no longer seen as separate but connected. The aim . . . is the development of the whole person." Transferred to the level of culture, the implications of such inclusiveness for technological exchanges would be to expand the parameters of the particular project to include cultural connections and meaning systems as integral to the technological context.

The positive potential of working within a transformative technological mode is that participants are "not reduced to a set of learning competencies or thinking skills" but are regarded as "whole" beings, participating in a manner that is "authentic" to their own frames of reference. This authenticity is related to Miller's understanding of compassion as "not an 'escape' but a realistic encounter with our inner and outer worlds. In a compassionate state we do not harbour illusions about ourselves or others."(33)

As I understand it, self-awareness in regard to one's own cultural and environmental context can facilitate one's openness to alternative experiences, enabling "creative problem-solving, cooperative learning," and research.[383] This transformational opportunity can translate into an environment that is ideal for interdisciplinary exchanges, where "various types of connections" would be fostered. Such connections make communication personally and socially meaningful to the participants, who are also involved with other modes of technological practice, that is, with transmission and transaction, where transmission is the smallest domain and the "transformation position is the most inclusive."

The negative potential, as far as conservation is concerned, is that transformation by definition requires a significant change in one's outlook. Such change is often resisted, both internally and externally. Also, to act on such an inclusive approach takes time. However, a willingness to extend our time and commitment has been recognized by Philip Ward as essential if we wish to achieve the cultural understanding necessary for heritage conservation.[384]

With this time-consuming commitment in mind, we may transform our ways of thinking by deliberately seeking ways of moving beyond our "fixed habits of thought". We can cultivate the means to discover how others in diverse situations have drawn on both traditional knowledge and new, imaginative solutions, instead of habitually resorting to mechanical technologies. These imaginative solutions can arise out of a deeply felt

[383] Reflection is implicit in this cultivation of awareness at the holistic level, and has been discussed in the specific context of conservation practice as being central to the development of "practiced judgment." (Barbara Whitney Keyser, "Conservation as Connoisseurship: George Stout and the Natural History of Painting" [Ottawa, Annual Meeting of Canadian Association of Conservators, 1997], notes).

[384] Philip R. Ward, "The Poles of Kitwanga, Part Two:The Cultural Challenge," Unpublished manuscript, Salt Spring Island, British Columbia,1997.

respect for a heritage that is at once personally meaningful, and part of a growing sense of sharing in a planetary history and custodianship. Within this larger view, cultural attitudes and traditional preservation measures become an integral part of emerging technological relationships. Educationally, according to Miller, "The focus of holistic education is on connections. . . . the relationship between linear thinking and intuition, the relationship between mind and body, the relationship among various domains of knowledge."[385]

My own experience of such a transformative insight came during a meeting with a visitor from China. The young woman I met was not a conservator, but a member of an official delegation representing preservation concerns surrounding the Three Gorges Dam project.[386] This mega-construction of a hydro-electric dam across the Yangtze River in Southern China is at the centre of various debates, but what captured my immediate attention was our conversation about what this delegate referred to as "the glass fish."[387] This is how she described the first sturgeon that she saw being retrieved from the area of the construction site -- she was struck by the appearance of this ancient creature, which traverses the river to the ocean in regular migrations -- migrations that are now in danger of being obstructed by the dam. The local people

[385] Miller, *The Holistic Teacher*, 14.

[386] Elizabeth Childs-Johnson and Lawrence R. Sullivan, "The Three Gorges Dam and the Fate of China's Southern Heritage," *Orientations* (Hong Kong: Orientations Magazine,1996), 27, no. 7 (July /August 1996): 55-61.

[387] The delegate described this fish as the ancient sturgeon of the Yangtze: this is the Chinese paddlefish (Psephurus gladius), also called the swordbill sturgeon, and is one of two survivors of an otherwise extinct family. Fossil specimens of this highly-specialized, smooth-skinned fish date from 65 to 100 million years ago; its most distinguishing feature is it's paddle-shaped snout, one-third to one-half the total body length. The body-length can reach up to 6.3 metres (c. 21 feet). Paddlefishes are plankton-feeders, breeding at 7 or 8 years, and spawning during spring floods. (*The New Encyclopaedia Britannica: Macropaedia* [Chicago: Encyclopaedia Britannica, Inc., 1998.], 19: 218-220.)

clustered around the fish, cradling it in such a way that when the sun shone through its taut, translucent skin, it appeared to her as being transparent in the sunlight. Her concern for this "glass fish" caused her to inquire about solutions for its care. A mechanical solution, such as the fish ladders attempted in smaller projects, may not be possible. As she discovered, what is being considered instead is the active custodianship of the people themselves -- local people along the river's course who are looking at ways of literally bearing the "glass fish" to safety. What her description brought to mind was a series of watches, where people along the banks of the migration route would be on the alert to intercept the sturgeon and convey them safely through a relay system to the ocean.

As she spoke of this fish, it was clear that its strange beauty was being evoked once again; for her, the wonder of the experience was in the magnetism of the fish itself. What struck me, on the other hand, was that a community of people would take this "glass fish" upon themselves, apparently as a natural response, out of a profoundly felt connection to heritage and to the land. In terms of a transformation in my own way of perceiving possibilities for conservation, it was remarkable what resulted from this simple exchange between this young woman, who actually witnessed the sight, and myself, who had come to appreciate how rare insights frequently emerge in an oblique way. What makes us attend to these insights that could otherwise be overlooked?

According to my understanding of Miller's description of this third and "most inclusive" transformational mode of learning(14), the active forces in this exchange emerged spontaneously from the "whole" person: each participant in the exchange was "authentic," in the sense that our

engagement with the situation at the Three Gorges arose directly out of our individual frames of reference (35) -- including the practical work to be done; yet at the same time, each of us "connected" at a level close to what Miller calls compassion (32-36), and what Cyril Stanley Smith referred to as "more like love than purpose." As Miller expresses it, "Compassion arises most naturally out of our sense of connectedness to other beings" (32), and this quality "facilitates development . . . in a number of areas -- physical, intellectual, emotional, moral, social, and aesthetic." (36)

The example of the "glass fish" is no less remarkable for illustrating the convergence of ancient landscape, technological upheavals, and cultural responses in transition. It is important not to idealize the situation: there are many forces at work in turbulent times as the nation of China undergoes its metamorphoses. It is also important to recognize that throughout the world, the greater part of preservation takes place well beyond the boundaries of museum and conservation in the specialized, scientific sense -- it is a larger issue.[388]

In the case of China, how does the broader issue of cultural preservation relate to current attitudes to patrimony -- patrimony as a matter of personal and collective cultural heritage? In a Confucian system of respect for ancestors and family, which is reportedly in flux in China today, how will these changing attitudes relate to respect and protection of material and cultural heritage? These questions cannot be readily answered. While

[388] The very idea of a museum is foreign to many indigenous cultures and ancient civilizations, as noted by Dr. Colin Pearson, Director, National Centre for Cultural Heritage Science Studies, University of Canberra, Australia. Pearson is known in international conservation circles for his work in ASEAN countries. I interviewed Dr. Pearson at the Triennial Meeting of the Intenational Council of Museums, Conservation Working Group, Edinburgh, Scotland, 1996.

some Asian countries are adapting to become competitive economies,[389] part of the society is formalizing measures not only to retain patrimony, but to reclaim it.[390] Others are developing new programs to preserve objects of patrimony that have been dispersed globally. Japan has recently developed an outreach conservation/restoration program for artifacts overseas, which has been likened to a Red Cross program for artifacts. In consultation with the custodial institutions overseas, in Europe and America for example, Japanese institutions have been offering to carry out conservation treatments and re-mounting of Japanese paintings *gratis* , using their own specialists and facilities. [391]

Whenever nations undergo major transitions, there will always be conditions that work against such efforts. To return to the situation in China as an example, there is alarming mass unemployment and a people desperate for whatever means it takes to survive. In such circumstances, China will not be the first nation where the possibility arises of compromising its material heritage for the sake of pressing contemporary

[389] When Christitie's of London was engaged by co-owners, the Government of Malaysia and its partner, to auction off the cargo of Chinese export porcelain salvaged from the shipwreck "Diana," promotional strategies for the sale included not only exhibits and receptions at museum venues in major European cities, but also the use of advanced technologies to reach global markets: these technologies of dispersion and diffusion included "extensive video film circulation, radio interviews, and appearances of experts on "many of the world's major television and satellite networks." (Colin D. Sheaf, "The Diana Cargo," *Christie's: Review of the Season*, ed. Francis Russell (London: Christie's 1995),178-79.

[390]One such example of cultural retrieval within Asia occurs in Korea where "Korean museums and collectors, backed by a supportive govenment, are determined to retrieve what masterpieces they can. There is, moreover, a widespread fascination with the past in Korea today and a desire to place Korean culture on the world stage." This observation was made in connection with the record price for a Choson dynasty (1392-1911) Korean porcelain ceramic - - cost, $2, 800,000. Sebastian Izzard, "Korean Art," *Christie's: Review of the Season*, ed. Francis Russell (London: Christie's 1994), 240.

[391] Kazunori Oryu, conservator, Japan. Personal communication,1996. See also: i) *Restoration of Japanese Art in European and American Collections*, Ikuo Hirayama, editorial committee representative, (Tokyo: Chuokoron-sha, Inc.,1995), and ii) video on techniques: "*Techniques and Tools: Japanese Paper Conservation*," Tokyo National Research Institute of Cultural Properties (Tokyo: Great Dane,1994).

economies.[392]

Working at another level, technology itself, as I have demonstrated through metaform and its symbolic implications, is an equally pervasive, but more subtle and potentially more powerful, influence in the long term. For wherever technology is mediating an exchange or communications, as the technology changes, so will the dialogue -- and its outcome. I have drawn on Asia as a culminating example because the need is so great and the situation so ripe for this kind of approach. Consequently, when we strategize preservation matters holistically, as an area that includes intangible elements in cultural "properties", we must take into account these subtle technological forces.

Wherever technology is involved within any of the modes of exchange we have been discussing, alterations within the mediating technology will exert a powerful effect on the dialogue, and on the very nature of the relationship at the human level. For example in Western culture (where visual perception is said to be dominant), any change in our visual technologies is bound to have an influence.[393] Such is the case with photography, a technology presently in transition from the analogue mode to digital photography. In conservation, for instance, photography is basic in the documentation of condition and restoration as required in most codes of ethics. Digital photography is a radical change, as Brooks Jensen explains, since it "eliminates the unique physical record of the image's

[392] It is no small irony that those nations that tend to be the most technologically advantaged are often the very ones that provide markets -- legitimate and otherwise -- for the artistic and cultural heritage of other nations.

[393] In addition to similar claims by McLuhan regarding print media, Ihde observed that within philosophical and psychological literature, compared to auditory experience, for example, "Philosophy, particularly, seems to have a primary visual orientation in its metaphors and models for thought and reality." (Don Ihde, *Sense and Significance*, 70).

original registration on light-sensitive materials that the negative represents. That is, it gives us nothing external to the photographer against which we can test any aspect of its veracity. Hence the weight we give to stories told in this form ceases to depend on the assumed existence of an archive of verifiable original documents -- the photographer's slide or negative file -- and instead relies entirely on the plausibility and reputation of the story-teller."[394]

Ironically, despite well-known theories to the contrary, the opacity of this new photographic technology, instead of leading us away from personal responsibility, can be seen here as re-directing us towards the person -- towards matters of credibility and trust. Trust was at the centre of Barchalia's professional development during her experience in Japan. The cultivation of personal trust and professional openness remains a key factor in many of the negotiations that are taking place around global conservation ventures today. These goals depend on a generous respect for alternative beliefs, forms of knowledge, and environmental experience. Ultimately we may never know the essence of what is being preserved; the object, the architecture -- even the technology itself -- is what remains of each human effort to come close to an intimacy with "the essential aspects of non-subjective reality, the thing itself 'out there.'" In any culture that does not make room for these essentially humanitarian endeavours, "Something crucial, self-subsistent and independent is missed."[395]

In conclusion, my vision for future applications of this research is that it translate into a communicative medium for collaborations in cultural

[394] A. D. Coleman, "Analogizing the Digital: Issues for a Medium in Transition," *LensWork Quarterly* no. 20 (1998): 40.

[395] Eisenberg, *The Limits of Reason*, 138.

heritage preservation. My hope is that people involved in technological exchanges in this and other fields will read this work, comprehend, and respond by sharing their ideas. Technology as metaform takes us beyond dualism -- beyond old and new, and other rigid dichotomies -- into the dynamic interplay of human, environment and the making of meaning. What I am offering is multimodal research for a multimodal response -- one that reflects the environmental realities and richness of people living a global heritage.

The End
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