

A Learning Encampment
at
Chaco Canyon and Santa Fe, New Mexico

Is it possible
to have
Information Technology
that reflects
Indigenous Consciousness?

Convened by
the
Native Science Academy
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*The Navajo speak of Nitasahaikees....
all the potentiality of all things
before we begin to put limits on it*

*The Polynesians speak of Te Kore,
the darkness, and recognizing the potentialities*

*The Lakota speak of Wo Lakota
the process of strengthening relationships
to all things*

*In English it is often called the visioning process,
it is the activity of looking into the darkness
for what wishes to emerge.*

Illumination - Introduction

In the first weeks of May 2007, The Native Science Academy convened a Learning Encampment in Chaco Canyon a World Heritage Site which was a major center of Puebloan culture between AD 850 and 1250. The Chacoan sites are part of the sacred homeland of the Pueblo Indian peoples of New Mexico, the Hopi Indians of Arizona, and the Navajo Indians of the Southwest.

The focus of the encampment which brought together Polynesian, Lakota, Navajo, Cherokee, Tuscarora, Japanese-American and Euro-American scholars, computer scientists, artists and educators was to explore the question: Is it possible to develop Information Technology that reflects Indigenous Consciousness? The knowledge we share in these pages was brought to the encampment by Waikuki Kingi, (Maori), Tania Haerekitera Wolfgramm, (Tongan, Maori) James Rattling Leaf, (Lakota) Nancy Maryboy, (Navajo/Cherokee), David Begay, (Navajo), Rose von Thater-Braan, (Tuscarora/Cherokee) Patricia Search, Isabel Hawkins, and Jeanette Zerneke tended and cared for by Kehala Gleason. Their professional relationships are listed in the appendix.

The purpose of convening at Chaco was to bring us to a place of irrefutable beauty and spiritual depth in order to nourish our learning spirits and clear our minds of the many pre-conceptions that we carry as a result of our journeys through the Western educational paradigm.

Learning from place is an integral part of the Native worldview and the winds, stars, cliffs, the silence of the ruins of the Great Houses, the Kivas and the magnificent petroglyphs expanded our understandings and brought renewed clarity of what it means to learn from place.

As we began to look more deeply into the words framing our question, unexamined assumptions rose to reveal and tease. What is Indigenous consciousness? Is Information technology unconscious? What are the characteristics distinct to Indigenous technologies? What are the combinations of senses that allow a human to perceive wholeness?



What follows is the unfolding of our learning journey which began with these seven days and nights. What soon became apparent was that the journey will continue far beyond the time we spent in each other's physical presence. As we moved from Albuquerque, to Chaco Canyon to Sunrise Springs just outside of Santa Fe each place offered its own unique perspective while each person brought their own lived experiences to the learnings and the knowledge that enfolded us.

As is our tradition, we began with prayers and ceremony requesting permission to enter these lands and to carry knowledge away with us. Often when Native people speak about occurrences in realms that are not visible in the day to day western world, using words like, ceremony, song, spirit and dream, they are thought of as mystical, or magical. However, in actuality, what is magic other than a simple shifting of consciousness and perception.

A further clarification that may prove helpful to the non-Native reader: what Native Americans refer to as 'spirit' and energy waves are the same thing. Everything in the Creation consists of a unique combination of energy waves. In other words, what appears as material objects is simply the manifestation of a unique combination of energy waves. Conversely, all energy wave combinations do not necessarily manifest in terms of material objects.

Background

To begin to conceive an information technology that reflects Indigenous consciousness it is necessary to know something about the Indigenous worldview, the significance of learning from place, the primary differences between English and Native languages and Indigenous learning processes.

A Native Worldview of Time and Space.

In the Indigenous worldview the universe is relational, conscious, animate and interactive. Time is experienced as movement, an unending shifting of patterns that appear and disappear in a multiplicity of rhythms. Concepts of linear and finite time are superimposed over an innate experience of time as reflected in the spiraling patterns seen in galaxies, shells from the sea or a fern in the forest. Space is perceived as a chaotic flux that is constantly transforming. The flux is made up of energy waves that carry knowledge. The energy waves form different combinations to manifest as everything that exists. When people think about Native Americans, or Indigenous people in general, they usually talk about us as a very spiritual people. That is generally true, but there is an important distinction between religion and spirit. Although some now follow the various religions brought by the Europeans, there is not a Native American system of beliefs that worship a single deity or deities. When you hear the term "Creator" it refers to the spirits that create nature, and that created us, their

relationship to life and our relationship with them. In this knowledge system in which energy waves carry knowledge, we say they 'know', they are animate. All that exists then, plants, animals, and elements are animate, innately spiritual, carry knowledge and are related. From this perspective "relationship" is the heart of our science as well as the search methodology. The technologies that evolve are relational, They mirror and are responsible to the ecology in which they are applied.

To live in relationship with an animate world is to embody the art of listening from an internal place of connection. The Polynesian refer to it as "te pitou" the center, the umbilical cord which connects all from the dark unknown world of unlimited potentiality to the world of light and consciousness and to the core energies of Mother Earth. It is this connection that allows an enhanced awareness of place.

Learning from Place

It is relationship to place that lies at the heart of our learning process and is the center of Indigenous knowledge. In Native American teachings, effective learning stems from looking deeply into the conditions that create learning. Place grounds learning and contextualizes knowledge. Place teaches our senses, opens our consciousness and shapes our memories. Native American teachings speak about the obligation to learn and respect the rules of the place which they share with other life forms, all of which have life and spirit. This worldview unites life science and human science in extraordinary ways that affect learning theory and design.

Indigenous Learning Processes

Native American teachings assert that everyone has a learning spirit. This is not a supposition but part of our lived experience. Everyone emerges from the spiritual realm into the physical world with guardian spirits, inherent knowledge and gifts. The learning journey is awakened by the Learning spirit(s) nourished and guided by place, kinship and experience. The Learning spirit(s) operates on a macro level; it motivates significant behavior, shapes belief, thought and other cognitive processing and influences communally patterned experience and interpretations. Learning is conceived of as an encounter with embodied spirits of the implicate order and generates an emphatic part of the cognitive process that enhances learning capacity as a source of empowerment. The dynamic, transformative capacities of the learning spirit(s) unite and develop a meaning spectrum between human perception and thinking. Little distinction exists between learning as dream and learning as life lived; this exists as a spectrum. The powerful and dramatic range of the learning spirit lifts Native peoples out of culturally bounded research environments and reveals the potency and potential of visionary learning.

Indigenous Languages

In the Indigenous worldview humans perceive the sensuous order of the natural world through te pitou, (the center) as well as their eyes, noses, ears, mouths, and skins. Since people enter into language through their sensory relationships with the natural world, languages cannot be understood in isolation from the ecologies that give rise to them. An important doorway to an understanding of the Native worldview is an awareness that Indigenous languages, which rise from the land and the elements are process based and can be created in the speaking to describe movement in process. They are not noun based languages. Interpretations of Indigenous thinking in English are like any translation, they come through a linguistic lens and if the speaker or writer is non-Native, through their cultural lens.

How Knowledge is Held in the Indigenous Paradigm

Individuals

An individual can gain knowledge through lived experience, through transmission

from elders, family, the community the natural world and the invisible realms. One can gain knowledge through dreams, and ceremonies, such as a vision quest. An individual can be entrusted with knowledge as a keeper for the benefit of the "Nation" (the society as a whole).

Sacred Societies

The societies hold knowledge about a particular aspect of the web of relationships. That knowledge can only be shared among members of the society, and a person that wants to be privy to that knowledge must become a member of that society. This is part of the checks and balances regarding knowledge in native culture, to ensure that potentially powerful knowledge is not abused. In turn, there are checks and balances on the knowledge keepers themselves; the community knows who they are and the members of these societies are continually watched by the society at large to gauge their integrity.

Nation

Lived experience by the whole nation, which would include individual and collective experiences. This knowledge is conveyed by and arises out of traditional oral history.

North - Seeking Answers:

What is Indigenous Technology?

Indigenous peoples across the globe have developed technologies since pre-history. Tools for building, measuring, carving, hunting, holding, preserving food, making clothing, for communicating across distances, ceremonial objects and regalia for communicating with the spiritual realm through song, dance and ritual, , objects to entertain and stimulate, implements that employ sound and wind, gauges for travel and navigation, methods for the transport of goods and materials, instruments for making art and music, for compounding medicines, for cultivation and gathering, for the holding and passing of information and on and on, all emerging in response to the myriad needs of a dynamic community.

*Indigenous Technologies emerge from the implicate order
to reflect 'the art of skillful living'.
Indigenous technology is pragmatic,
it is responsive and responsible to the ecology in which it lives
and from which it came.*

What are the characteristics that are distinct to Indigenous technology? Indigenous technologies are recognized as taonga, living treasures imbued with the breath of life, they value and respect the natural world and they recognize the realms of the invisible. Indigenous technologies symbolize the collective nature of our cultures while acknowledging our diverse and unique identities as individual Indigenous people in relationship with the whole. They express our dreams, visions and imaginings and they come into form to nurture the spirit and the life force in its expression.

An indigenous technology attracts the learning spirit(s) and provides a learning ecology that supports the transformation and revitalization of awareness and knowledge. Indigenous technology is intended to enhance the ability to maintain and renew balance and harmony within a multi-dimensional, complex and interconnected environment.

Indigenous technology is created within a complex sensory environment that builds on our sense of

relationship, meaning, balance, feeling, memory and place as well as sight, sound, smell, taste and touch. In meaningful interactions it seeks to engage and evoke significant knowledge and experiences unique to the Indigenous world. Indigenous technology has the obligation to come into existence, to be used and to transform within an ethical space that is responsible to life in all its forms. The ability or capacity to make something, does not constitute a valid reason for its existence. Indigenous technology is coherent with the natural order.

Examining the Unexamined Assumptions

On our first afternoon in Chaco Canyon we sat in a circle in the small living room of our cabin. We had spent the morning in the desert in ceremony and silence. We had lunch and then listened to a teaching on the Learning spirit(s) as a way to bring us to the question of what is a technology that reflects Indigenous consciousness? Almost immediately we were confronted with the conundrum that we live in an animate, relational universe made up of energy waves that carry life force and knowledge. If that is so, then how did our laptops become unconscious, inanimate?

One of our group is a 5th generation carver, a gifted artist whose father is a revered knowledge holder of his tribe. During the night he had finished carving a Pukea (spirit caller), a 42" long trumpet. The pukea had seen first light when we had used it that morning in the desert. "Pu" denotes our voice or our essential true being deep within us "Kaea" is the messenger. Pukaea therefore intimates the messenger from deep within us. Our [normal] voices are used to speak to humankind. The pukea allows a human to communicate with the energies of the implicate order using breath and sound. It lives in the same material world with a laptop, a cell phone, a GPS system, or a dark field microscope. We immediately recognized the pukea as animate. However we then had to ask ourselves why is the same status and treatment not accorded to more modern forms of technology?



Indigenous Technologies (taonga) are recognized as being imbued with the breath of life. They have intrinsic value because we know their ancestry, where they came from, we know their place in our world and we know they will transform and return to the realms of energies. We recognize their capacity to carry with them the knowledge they gather in their relationship with us. This describes a different life trajectory than that of a fax machine. The pukea will not find itself discarded in a landfill, replaced by something sleeker and faster. The efficacy of this technology has not diminished over thousands of years of use. We recognized the pukea as a true example of technological design coherent with the natural order.

That afternoon we saw a 21st century example of Indigenous technology, the Hakamana Maori Keyboard System. The usual framework for the design of new technologies, including computer hardware and software, has resulted in mainly generic systems of communication being developed which have ignored the cultural and language needs of Indigenous peoples or "small markets". These design practices have a direct negative socio-cultural impact on societies and communities relying on communication systems to ensure their unique languages and worldviews in our increasingly global world.

Although Te Reo Māori (the Maori language) has always been effectively communicated 'kanohi ki te kanohi' (face to face), a technologically driven society now influences our ways of interacting and communicating with each other. With rapidly increasing computerization, the most common keyboard layout used (English/QWERTY) is not an optimal design for speakers and writers of languages other than English.

Research, focusing on the way that the language is learned, led to a keyboard specifically designed in the Māori language, making it more logical and intuitive for a Māori language user and writer. Recognizing that Indigenous learners acknowledge the senses that perceive and recognize the reciprocity innate to relationship the keys were made of paua shells which are significant in the Maori cultural cosmology and of themselves carry knowledge.

The Māori/English Multilingual Keyboard is named HAKAMANA. This word is comprised of a number of important words and concepts that are known throughout Aotearoa, (New Zealand), the Pacific, the Indigenous world, and beyond. In various Polynesian languages HA, speaks to the breath of life, our connection to the Divine Creator; KA, the fire that burns within us; and MANA, infers having qualities of power, strength, authority, a miracle, a wonder, and honour. HAKAMANA in Rapanui Māori means to sanction something, and to give someone power. The first four consonants on the keyboard are h k m n, which in the Māori alphabet are known as ha ka ma na, thus there is a functional component to the name. Most of all, it is an important tool, a song/waiata used in the kohanga and kura to teach babies and children the Maori language



The keyboard system offers both the Māori language (with letters, macrons and keywords laid out following the way Māori is taught and learned) and the English language (using the standard QWERTY keyboard layout).

Throughout the afternoon we continued to explore and make distinctions regarding ‘technology’ and ‘indigenous technology’ and about the ways in which different tribes are integrating conventional technologies into their communities. The Lakota are using Geographic Information Systems (GIS), Remote Sensing (RS) and Global Positioning Systems (GPS) to identify and map the sacred places in the heart of the earth, the Black Hills. And so, as it has for millennia, Native people continue to adapt, innovate, refine, using the gifts of the material world to express the spirit of skillful living.

*Nitasabaikees....
all the potentiality of all things
before we begin to put limits on it*

The West – Synthesis, Form, Structure, Pattern & Process

All things emerge into being from the implicate order, the dark, unformed wholeness of unlimited potentiality out of which comes the world of light and consciousness, form and structure. From this illuminated consciousness come patterns which express the natural movement of the cosmos and the forms of the implicate and explicate order of life. According to Indigenous ways of knowing the movement becomes a complex, dynamic, regenerative process, simultaneously cyclical yet timeless.



The Great Kiva of Casa Rinconada at Chaco Canyon



A model of Pueblo Bonito at Chaco Canyon



Figure 1

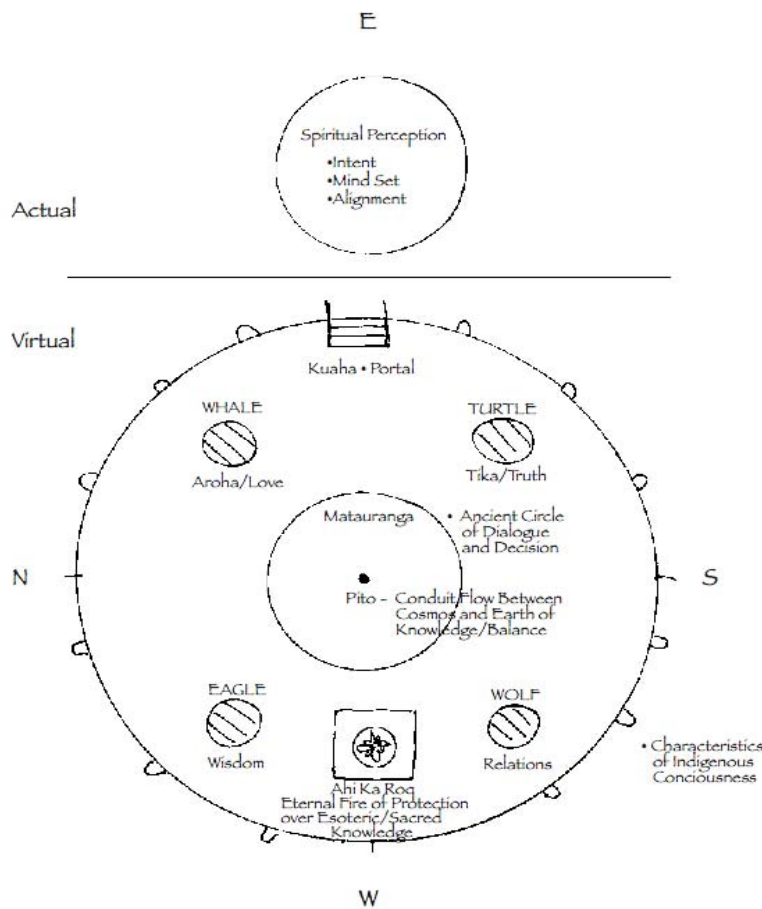
A western recreation of a pre-historic Kiva

The reconstruction of prehistoric architecture using three-dimensional (3D) modeling software involves a series of compromises concerning what should or should not be portrayed in a 3D model. In the majority of cases, the data recovered from prehistoric architectural features are

inadequate for the complete virtual reconstruction of a structure and its contents. The underlying issue is therefore focused on how "real" we should make our models, especially since the realism inherent in 3D modeling is easy to construe as the past reality when in fact a large proportion of what the viewer sees is heavily dependent on numerous inferences made by the modeler in the absence of relevant data. Virtual Reality in Archaeology 2000, edited by J.A. Barcelo, M. Forte, and D.H. Sanders, Archeopress, Oxford.

The Virtual Kiva

In exploring the potential of technologies to reflect and express Indigenous consciousness, we were influenced by the inspirational structure of the Great Kiva of Casa Rinconada at Chaco Canyon, whose form informs our shaping of a "Virtual Kiva". While this approach expresses a lived reality for Indigenous people, for those educated in the western paradigm, it will be more easily understood as a metaphor, used to communicate the Indigenous worldview and the intuitive and illuminating process we followed as Native scientists. In expanding the metaphor of the Kiva we name and give meaning to some of the parts and processes contained and activated within the "Virtual Kiva".

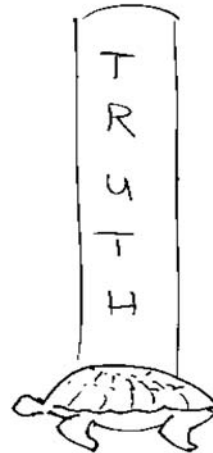


The Virtual Kiva is a protected sacred space, representing a covenant between Indigenous Peoples and the natural order. According to agreed upon protocol, entrance into the Kiva requires considered preparation of the mind, body, soul and spirit which may take the form of purification, initiation and invitation. This process of preparation translates into the manner in which Native students are introduced to technology and the manner in which technology is made a part of a Native community. These preparations recognize that the human is an integral part of the universe and is interconnected and aligned with the energies within the Virtual Kiva

The Virtual Kiva is cosmically aligned with the East, the direction of the rising sun and place of all beginnings. It aligns with the other cardinal directions of the South, West, North, Earth and Sky. The Virtual Kiva contains and provides alignments with the sun, moon and stars. It is a circular shape, the circle representing never ending cycles of the natural order, harmony and balance, a cyclical journey without end, signifying the beginning and continuously unfolding renewal and fruition of all things.

The entrance, the doorway is aligned to the east. It is the portal to the ceremonial sacred space and activities, signifying entry into the womb of Mother Earth, the sacred generative space of potentiality.

Che atiin the Navajo word for entrance, describes a path from the inside out. In English, an entrance is seen as a structure such as a door, and perceived as an exit, with the implication that you are outside wishing to enter. Che atiin implies that you are inside, like being inside your home or a womb and it is an entrance to the outside. You are in your home, you follow a path to get out, but you exist within the home. Your mind originates from your home, your sacred space, your place of being.



The Four Poles, the Foundational Principles of the Kiva. The four poles, each with their own guardian, represent the foundational principles

of truth, relations, wisdom and love and signify strength, support and connection between all realms, seen and unseen.

Whale guards the Pole of Love
Whale travels vast oceans linking islands and continents of the earth, representing love, nurturing, compassion and self sacrifice for the benefit of others.

Turtle guards the Pole of truth
Turtle represents the truth of the natural world of Creation.

Wolf guards the Pole of relations.
Wolf represents the strength of the family, the community and the connections of all our relations within the Cosmos.

Eagle guards the Pole of Wisdom
Eagle can see the furthest afield, yet still see the smallest detail. Eagle flies into the realms of the sky to bring messages back to earth.

Te Pito, the Center - The Center is the source, the umbilical cord which connects all from the dark unknown world of unlimited potentiality to the world of light and consciousness. It connects us to the core energies of the earth and an enhanced awareness of place.

Nahookos Bi'ko – Ahi Kaa Roa – The Place of Fire - The place of fire is between the center and the poles of wisdom and relations. Nahooko Bi'ko represents the central fire of the sky and the north star, the star that never moves providing a navigation point and guidance. The fire is consciousness. Ahi Ka Roa is the “long burning fire” speaking to the timeless nature of the knowledge of the Kiva. The fire also gives light to the processes within the Kiva which house the deeper esoteric and sacred knowledge that is hard to access.

The domed roof of the Kiva is a mirror image of the sky it reflects both the sky and our relationship to the Cosmos. As they exist in the sky - the stars and constellations also exist within the kiva . Therefore the sky is represented as the domed roof within the kiva. In this way the universe outside is brought inside, including star systems such as the Big Dipper, Coyote, The Seven Daughters or the Seven Sisters, called “Wiciwala Sakowin” by the Lakota, or Matariki by Maori known also as the Pleides .

The Niches (ba haza in Navajo) signify the “working spaces” wherein our knowledges, structures, forms, patterns, processes, characteristics, attributes, responsibilities are made manifest within the indigenous technologies. Ba haza describes a space which, when something is put there becomes more than a space. The space is always there it is reserved and (in this case) what is put there becomes a technology through the process by which manifestation occurs.

What Are the Responsibilities of Indigenous Technologies?

As part of the web of life we carry responsibilities for our thoughts and actions. In the Native world view of time we are simultaneously connected to that which came before and that which will follow. When you extend this premise to the notion of indigenous technology we recognize an ecology of relationships, to which we are responsible:

The natural order

In this relationship we continue to check that what is being created is in alignment

with the unfolding of the natural order,
that it is responsible to the ecology that births it
and that the impact on the future (7 generations) is being fully considered.

Experimentation, adaptability, innovation

Developing Indigenous technology is part of the human life pattern part of the human journey. Indigenous technologies move through the river of life, over the currents of time gathering from the cultures and environments through which they pass, being refined and adapted, growing, innovating, and dissolving into the cycle of knowledge. It is a responsibility to provide a safe place that allows for experimentation and failure. A place for resilience, and reflection, where the learning spirit(s) is nourished and the learning process is inextricable from a conscious relationship to the whole.

The stewardship of knowledge

We do not own knowledge, but are merely knowledge holders.
As individuals our communities assess and we assess ourselves:
How well have we learned, how have we held knowledge.
How has knowledge been used and how have we met our obligation
to transfer knowledge as part of the human journey.
Technologies grow and are refined through individual stewardship.

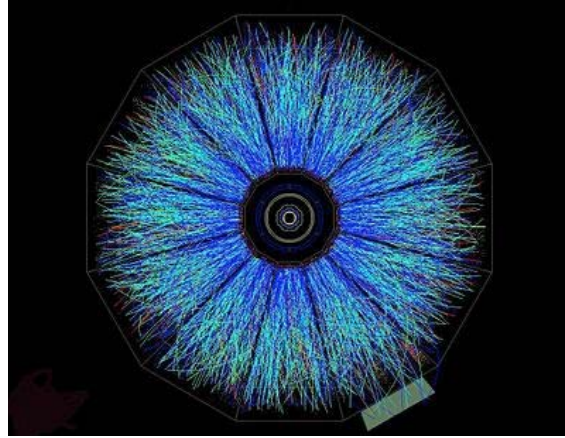
Most of what you have read to this point, primarily reflects the perceptions of the Indigenous participants at the Chaco Canyon encampment. In the following section western trained technologists share a trans-cultural view of technology that speaks to the possibilities for the reconciliation and synthesis needed to evolve an information technology that reflects Indigenous consciousness.

The South

A New Season – Synthesis

*Information Technology,
as defined by the Information Technology Association of America is
"the study, design, development, implementation, support or management
of computer-based information systems,
particularly software applications and computer hardware."
Information Technology deals with the use of electronic computers and computer software to convert,
store, protect, process, transmit, and securely retrieve information. (Wikipedia, June 2008)
Western science generally defines Information Technology as the set of tools
developed in the 20th century, which enable digital
data processing and telecommunications....*

If you consider the words, “Information technology,” they carry a much broader meaning than is normally ascribed to them. The words energy, spirit, and information are interchangeable. Information then, is what is expressed when the natural world emerges. DNA, particle physics, and music are all information.



Thousands of particles explode from the collision point of two relativistic (100 GeV per nucleon) gold ions in the STAR detector of the Relativistic Heavy Ion Collider. Electrically charged particles are discernible by the curves they trace in the detector's magnetic field.

In the Native American and Indigenous worldviews all technology is information technology. Any technology or tool is informed by or contains the information embodied in the materials; the knowledge, skill, and intention of the maker; and the collection of knowledge accumulated by its users. An Indigenous Information Technology is one in which the tools are in proper relationship with the community, the tools function correctly in the community ecology, and support the community's future. Design, management and use of technology is a conscious relationship.

The Nature of Animate Technology

The network created by the Internet is an animate communication network. Amelie Prescott, (Seminole/Pawnee) a founding teacher at the Native American Charter School in Oakland, California uses Marshall McLuhan to bridge the culture gap. In her teachings, McLuhan's expression "the medium is the message" and the idea of the 'global village' characterize the Internet as a whole, not a set of electronic parts. The internet has grown much as any organism does, manifesting a spirit beyond the sum of its parts. The Pomo tribes of Northern California build a structure called a Roundhouse in which they use song, ceremony, music and dance to communicate with what physicist David Bohm calls the implicate order. The implicate order of which Dr. Bohm speaks is the flux of time and space which contains spirits (energy) in its primordial forms. The internet having revealed itself as a method for the community to communicate and share knowledge is a reflection of the Roundhouse. Just as the Roundhouse revealed itself as an animate structure for the community to vision, experience and form.



A Roundhouse created by Oakland Charter School Students

In Western Information Technology, the user may not know the creator of a particular tool. The conditions under which the tools were created may also not be known. Most Information Technology systems have been created by collections of people and are used by multiple communities in different ways for varied purposes. The intentions of the creators and users are often not known. Exploring the boundaries between Western and Indigenous science and technology can help illuminate these relationships and are considered on the Native Science Academy website. <http://silverbuffalo.org/NSA-NativeScience.html>.

Holistic Technology

Western Information Technology has evolved out of the traditions of Western science, which are framed by the tendencies to take things apart to understand them that came to us from the Greek and Christian civilizations. From the Platonic tradition of looking for the pure form behind each object and concept, to the obsession with list making and cataloging the entire world as created by God these processes are part of the Western scientific method's unexamined foundations. Scientists are now learning to re-integrate and synthesize the knowledge they collect using newly developed information technology. Among the tribes of North America the Creation (the natural order) is viewed as a whole. In these societies technology is not seen as something that can exist separately. Technologies reflect a relationship that is an integral part of the natural order. Indigenous technologies sustain, restore and maintain balance and are appropriate to place, ecology, and community.

Dimensions of Information Technology

Information technology, in the western sense, is composed of many different aspects and functions. Looking from the Indigenous perspective, how do these aspects integrate into conscious, animate systems, which support the community?

What is an appropriate interface with digital technology?

In the indigenous paradigm, all things are interrelated; this would tend to suggest that interfaces that enable interaction on multiple sensory levels would be most appropriate. Indigenous people question whether a digital system, one based on the duality of 1 and 0 can be made to *not* irreparably dissect the

real world. Digital systems can create the multitude of possibilities, just as DNA and waveforms can create the diversity of life. Originally computer monitors were only green and white. However, the information contained in the RGB code used to represent color on computer monitors can express a much wider array of colors.

More recently, systems are being developed which allow a much broader range of relationships with the digital world. These vary from new interface tools such as the I/O brush pictured below to immersive environments. These approaches are closer to Indigenous experience.



I/O Brush - <http://web.media.mit.edu/~kimiko/iobrush/>

Digital Communications/ Technology in Relationship

The network, the nodes, computers, devices connected to it, and the systems to support it are all in relationship. They embody the information structures of relationships. The Network protocols of data transfer mirror the protocols for knowledge sharing and transfer used by Indigenous people. The “participants” in the electronic data transfer are programs and tools. It isn’t managed directly by humans, but must follow the same patterns that humans follow i.e., at each step in the data transfer process, the sender and receiver must be able to confirm the identity of the other and ensure that each knows the appropriate process to pass the information without error. Knowledge transfer in indigenous culture reflects an ecology of relationships, appropriate to the specific place. The parties are in relationship and the intention is to ensure that the tools are used properly to support the community. These are functions we recognize must be implemented in an information technology that reflects Indigenous consciousness.

Digital Objects and Collections

We have seen that what we recognize as digital objects can be tools for knowledge holding and can embody information and narrative about place, process, and spirit, just as physical objects do.

“Dreams enter the realm of visible life in the same way that humans do.

Making a sound, a cry, a call that awakens.

Pou Kapua, the 26-ton carving stands atop the volcano that created Aotearoa, the lands of the Maori.

It rises 80 feet to pierce the sky.

Pou Kapua

came to the woman who would birth it in a dream in which she saw a pillar that touched the clouds.

It was she who made the cry that called the carvers.

*The woman sang the dream over and over again for a thousand days and nights,
while knowledge rose from the deepest cells of the bodies of the carvers to emerge and find form.”*

– Grandfather, How Do We Learn?

Report to the National Science Foundation October 2007 R. vonThater- Braan

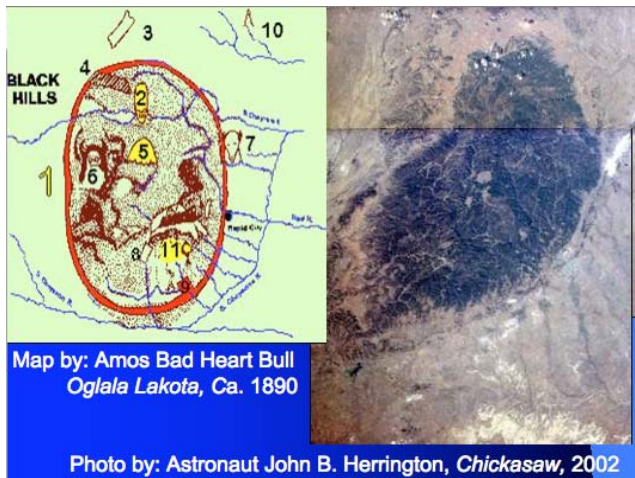


Pou Kapua, the cloud pillar in Auckland, New Zealand holds the spirits and stories of the Maori people. It helps sustain and nourish the community and maintain their communal knowledge. The entity that is Pou Kapua could also have a digital dimension. There is the possibility of video story telling, a representation of the Pou in an immersive environment, or a digital brush system to interact with the Pou could all provide a new dimension in knowledge holding.



Carving of Pou Kapua in Aotearoa (New Zealand)

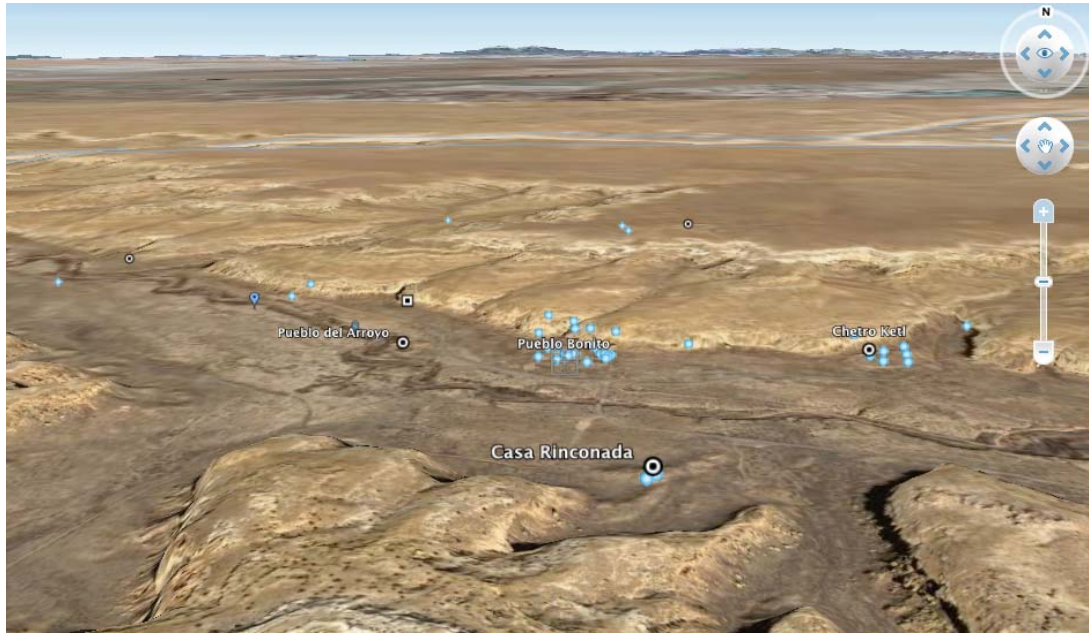
Born as digital objects, things created by indigenous people in the digital environment can also play a significant role in the future of the community. It may be possible for databases and repositories of animate digital objects to hold the knowledge of a community. This knowledge ranges from language, music, and song; to GIS mapping of the landscape and community history; to artistic creations that embody important stories and spirits. An indigenous information technology would integrate these facets in a multi-dimensional matrix with a complex multi-sensual user interface.



Interactive Mapping with GIS Data, Space Imagery, and Lakota Culture

http://www.sharingindigenouswisdom.org/PowerPoint/MikeCollins_files/frame.htm

Systems like Google Earth hold the potential to be an important tool in the development of an integrated environment.



Google Earth Chaco Canyon

Panoramio



Chaco-PuebloBonito 9-23-05

Photograph by [TGrier](#)

15 Km from Kimbeto, New Mexico (United States)



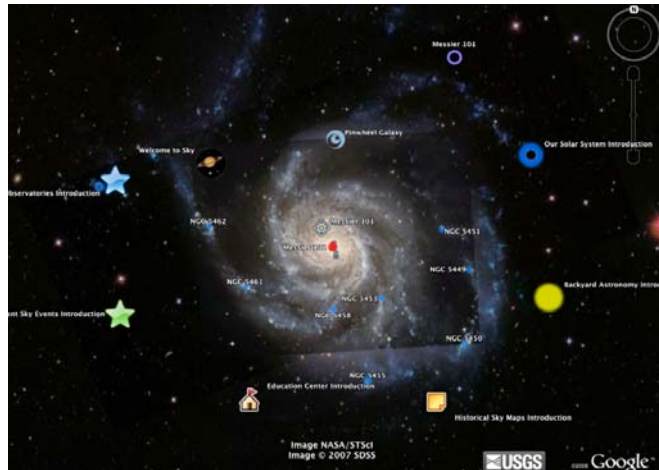
Quick time videos of Pueblo Bonita and Casa Rinconada can be seen at: <http://www.colorado.edu/Conferences/chaco/tour/chacovr.htm>

Global Information Technology

On an even larger scale, the earth is becoming linked by a layer of sensors collecting information about the whole planet. Place is no longer only the human scale experienced by individuals but holographic. In the Euro-American culture personal space is now in relation to larger spaces and the whole planet. Communication is no longer local and global communication can appear local. The data repository of global information can now more closely reflect the integrated system understood by Indigenous people.



Lights of Earth, November 27, 2000, NASA A composite of hundreds of pictures made by the orbiting DMSP satellites shows the night-lights of earth.



Google Earth Sky

The Interface for Knowledge Transfer

The interface for knowledge transfer in Indigenous technology should accurately communicate the sender's message. From "traditional" technology like hand-carved tools and pottery to today's digital technology, it is important to understand how to use contextual and sensory information in the design to communicate Indigenous knowledge to the receiver.

It is clear that in the context of a conscious technology, the sender must understand the audience or receiver in order to create a holistic experience and inform the consciousness of the receiver. Design elements in the interface may include symbols, color, line, texture, form, space, audio, narrative, rhythm, and movement. Each element carries cognitive and intuitive meanings that symbolize relationships and inform the receiver's consciousness. These elements provide context for the sender's message that creates a holistic experience. Words and sounds can also serve as portals that immerse the receiver in different places and times, including sacred places and times.

Narrative is an important design element in the interface that engages the audience and facilitates knowledge transfer. Stories use images, words, and sounds to connect the past, present, and future. Traditional oral storytelling also incorporates voice inflections, rhythm, body language, and gestures to help the audience relate to characters and events. In digital technology there are also opportunities for new types of multi-sensory experiences that create immersive environments for the receiver. "Ashes and Snow", which features the photography of Gregory Colbert, is a unique website that uses images and words, line, form, space, texture, sound, and rhythm to create a multi-sensory space for the receiver.

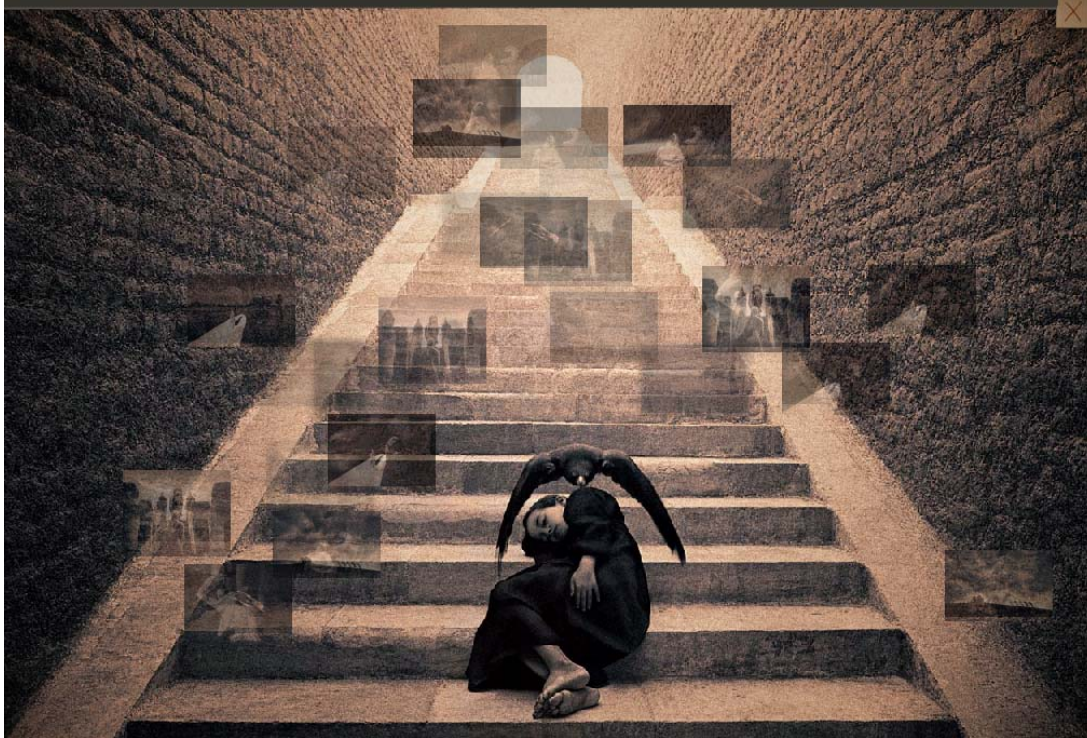


Figure 1: The interface in Ashes and Snow creates an immersive experience for the receiver. The website also incorporates the physical movement of the body as part of the interactive process. As the receiver interacts with the website by moving the computer mouse over the large photograph on the screen, small images quickly fade in and out of view in a rhythmic path that follows the movement of the mouse (see Figure 2). The website creates a multi-dimensional environment that integrates physical and intuitive senses, leading to a holistic experience that enhances the receiver's consciousness.

It is also important for the sender to have some interaction with the receiver in order to understand how the message is perceived. In oral storytelling the storyteller can see and gauge the receiver's reaction and adjust the message accordingly. With asynchronous digital technology, it is not always possible to have this type of direct interaction. However, the technology can invite receivers to contribute comments and participate in a dialog that provides feedback to the sender who can respond accordingly.

Continuing the Journey

The central question we have asked is whether information technology, initially developed and used to reflect a linear, binary world, can carry knowledge without fragmenting its inherent wholeness. Embedded in this question are issues of the responsibility of knowledge holders, protocols for the passing and preservation of knowledge and the ethical space in which the knowledge holder and the learner live. There is the serious challenge of the cultural disconnect between Native and Western learning processes, values and traditions and the critical need for equitable, productive, co-existence between the world views.

It is clear that the western, educational processes by which modern, digital technologies attempt to enter native communities are incomplete and exacerbate the cultural disconnect for Indigenous learners of all ages. If it is to be sustainable, the way in which a technology enters a native community must reflect and animate the principles, values, and philosophies of Indigenous learning processes and world view.

The synthesis between perspectives and worldviews of technology begun in ceremony in the deserts of New Mexico continues. We are developing a series of interviews with learners, scientists, technologists, educators and artists of diverse cultures and learning traditions. Some have spent their careers in western science and have now undertaken a committed learning journey into the Indigenous paradigm, others have entered computer science from cultures who describe and experience an animate universe. With their permission we will publish what they have to say as an addendum to this document.

There is a matrix of things that you know and things you don't know extending to the realms of the unknowable, or the place of learning. The present technology informs future technology. And so, held in ceremony, the journey continues.