

Introduction

The metaphor of the Internet as a web emerged seriously in the 1960s when Paul Baran suggested that distributed networks offered more hope of survival in emergency and hostile situations than simple point to point networks, From this emerged the metaphor of the system as a cloud, invisible to all but the network operators. To this cloud were attached IP addresses that evolved into URLs, and visions of URNS and URIs. The introduction of HTTP/ HTML protocols by Tim Berners Lee and colleagues at CERN, which led the World Wide Web Consortium (W3C) made the image of the World Wide Web into a household name.

Several things have changed. Since 1990, the fixed Internet has grown from 1 million to 1000 million in 2005 and 86 million more in the first 9 months of 2006. English has dropped from 95% to 28%. Enormous increases in speed of operating systems, size of storage and speeds transmission have transformed our notions of E-Content. In the decades 1945-1970, the largest projects were under 100 books. In the past decades, projects of over 200,000 full text books have been finished and plans for 6 million and 14 million books have begun. Astronomy data is growing by 100s of Megabytes a day, a digital scale model of the entire earth is progressing and similar projects under the ocean are underway. As a result, the Internet, which started mainly as a small net among scientists in high energy physics, is now capturing very detailed knowledge about three traditional realms: the heavens (astronomy); earth (GPS, GIS, UMTS) and the “underworld ” (geology, oceanography).

Meanwhile, a vision of a Semantic Web is emerging that continues to address the earlier paradigm of the world wide cloud, as if the challenge of a web of trust lay primarily in determining the logical truth about identities via URLs, URNs and URIs within the born digital domain of the web. This paper examines briefly examples of earlier webs in order to suggest that the web needs to link to worlds beyond itself and to propose 12 concrete challenges for future visions of a semantic web.

A. First Webs

Notions of a web have a much longer history than the Internet. In ancient Greece, the metaphor of threads in a web was used to describe the course of life, which were joined by three fates (Clotho, Lachesis and Atropos) and ultimately cut off by Atropos. In ancient Greece also, the goal of a good life was to achieve *Areté* a word typically translated as virtue but which means, literally, away from the web. In ancient India, there was a view of the whole of life as both a weaving and a flow of language, time and space through *vana*, again with a goal to escape, now via *Nir-vana*. So the Greek quest for *Arete* and the Indian search for *Nirvana* arose from the same root metaphors of weaving.

These were much more than pleasant figures of speech. They built on a precise use of squares as matrices of 2 x 2; 3 x 3; 4 x 4 ...10 x 10. These matrices sometimes functioned as magic squares and led directly into the realm of gematria as much as geometry. These matrices

traced the creation of the world in terms of seven basic stages. The first three stages (ANAM, AGAM, ALAKSHA) were abstract and prepared a framework. A fourth stage (AUM) combined the three primal forces with a nutritive principle (MAMA), to produce sound (cf. the Western *logos*). A fifth stage entailed 5 points and introduced the notion of time (KAL or KALA); a sixth stage entailed 6 points that led to space (DESH), while a seventh stage led to individuation (PATRA or ANU).

These seven stages served to structure the metaphysical, mental, physical, man-made and social worlds. At the man-made level, for example, sets of 8 x 8 squares became the basis of the vastu purusa mandala, whereby they effectively became the ground plans for temple architecture. At the social level, these same 64 squares became the starting point for games such as chess.

With respect to our topic, these matrices are of enormous interest because they played a role in the development of the Sanskrit language. They served to define combinations of first simple, then complex sounds in a coherent system that resulted in a Meru Prasthara, a binomial triangle of combinatorial possibilities a full 1800 years before Pascal gave his name to this mathematical concept. In this triangle, the top row has 1 combination, the next row has 1 + 1; the next row has 1+2+1 to generate 511 combinations in the nine lines. This system generated not only basic sounds but generated the names of the gods. Hence SI+VA=SIVA, marries SA+TI =SATI who dies when she performs SU+TI =SUTI and becomes SI+TA = SITA and then goes on to have PAR+ VA+TI as his principle wife.

What made the Indian system remarkable is that this was not just a generator of sounds in the manner of a language juke box. The matrix meant that given letters had a precise position within the matrix. These positionings thus related the days of the week, the months of the year with larger cycles such as the 12 year cycle of Jupiter. Hence the language generator served equally as a time and space generator.

As we proceed down the levels towards physical creation the same combinations recur in increasingly complex form. At level 3, we find four abstract letters ALKS that mean the Incomprehensible and form a square. At level 4, these abstract letters become four concrete sounds. At level 5, these remain in the same square but now there is a 5th letter H in the centre of the square. At level 6, this becomes a six letter word ALAKSHA (ether). At level 7 this becomes a seven letter word of AL + AK +SA with a letter H in the line above. The Sanskrit word MALA means original sin, and bead. The word ALAKSHA is combined with this four letter word MALA (MA + LA) to create the word ALAKSHAMALA, which is the term for a special set of 9 + 1 beads made of sacred thread used by Buddhist monks.

Level 3	ALKS
Level 4	ALKS
Level 5	ALKSH
Level 6	ALKSHA
Level 7	AL AK S H A + MA + LA

Figure 1. Combinations of Alaksha (Ether).

In terms of the basic matrix, this defines a series of 3 basic lines that connect the inner section plus a diagonal, which meets them in the centre as a mystic knot. So at one level we merely have 10 points, which become 9 + 1 beads superimposed on a model of the universe.

Pisces Meena	Aries Mesha	Taurus Vrisab	Gemini Mithun
Aquari- us Kumbh	ॐ	हैं	Cancer Kark
Capric- orn Makar	सः	जुं	Leo Simha
Sagitta- rius Dhanus	Scorpio Vrischik	Libra Tula	Virgo Kanya

Figure 2. The basic cosmological matrix of the Indian system.

At another level, the same threads create a mystical link between the 3 worlds with 3 threads. So the monk's praying beads are a model of the universe. This model of the universe evolves in several ways at a number of levels. In the cosmological matrix, the first four stages become a set of four central squares. Around these are the twelve signs of zodiac, which function simultaneously to define the twelve solar months and a 12 year cycle of Jupiter. In the early Indian system, the year ends with the autumn equinox at Tula (Libra). Tula represents much more than balance. It also represents the world tree symbolized at one level by Tala (the palm). Immediately after the equinox comes a 9 day passage of the sun through Scorpio which involves a) the star Mala (original sin) in the lunar mansion Mula; b) the lunar node of Rahu, known in the West as Serpens Caput and c) a crossing of the Milky Way where it bifurcates to form a Y in the manner of Yama, the name of the first man, and a name of the Lord of the Underworld (who is also called Kuvera). As such this period became associated with a passage from one life to the next. In the West, these traditions are reflected in our feasts of Hallowed Evening and All Souls. In Nepal and India, the successful "crossing" of this period led to the feasts of Dashain (Dasara) and Diwali. These were seen as a renewed triumph of light over darkness, the beginning of a new covenant and a new cycle.

In this approach, Dhanus (Arrow = Sagittarius) becomes the base of a new pillar of action. This is followed by Makar (Capricorn); then Khumb (Vessel = Aquarius) and Meena (Pisces). Together these form the male column that will subsequently become the pillar of severity. Similarly the four months Gemini, Cancer, Leo and Virgo define a female column that will subsequently become the pillar of mercy in the West.

In the bigger picture of the Indian narrative, there is a nectar of immortality that functions at different levels of metaphor. In terms of the cosmic cycles, it is seen as the life giving rains and thus associated with the vase of Aquarius who begins the new year with life giving waters from the south. In terms of the Milky Way, Aquarius co-incides at a point where there is a renewed confluence of the streams. At the terrestrial level this becomes linked with the city of Allahabad where the Ganges, Jumna (Yamuna) and formerly also the Sarasvati meet. To celebrate this event there is an annual festival called the Khumb(a). Every 12 years which defines the cycle of Jupiter and explains why we have 12 zodiac signs, there is a Khumba Mela. So the problems of the original sin (Mala) in the lunar mansion of the root (Mula) are attacked by the arrow of Sagittarius (Jupiter) and resolved by the vase (Khumb) of Aquarius

in the feast of Mela, which restores the elixir of immortality (amrita) through the waters of life, physical and metaphysical.

In this cosmic scheme, the sound AL becomes the line of the equator. The sound AK becomes the tropic of Capricorn. The sound S(H)A becomes the arctic circle that is effectively the beginning of heaven. One is tempted to consider whether the great Alaqsa Mosque in Jerusalem, sometimes spelt AL AK SA might not be a physical version of this cosmic ALAKSHA model. In any case, these examples help us to see how sounds in language generate physical and metaphysical consonances at different scales and levels of reality.

In these links are also many sources of key Western ideas, the idea of three fates or three nymphs, who weave the web of life and then cut it. At the banal level, this is a starting point for how we do shoelaces in our shoes. At a deeper level this inspires the mystery religions of the Great Mother (ASHTHAR and DURGA who goes via Ashtoreth and Cybele to Demeter and Kore. This in itself is noteworthy. More remarkable is that the Sanskrit names of the gods who define their cycle of weeks and months become a starting point for the first letters of the alphabet in Latin and English (figure 3).

A	Agni
B	Budha (= Mercury= Wednesday)
C	Chandra (=Moon = Monday)
D	Dharma (=Law =Mars = Tuesday)
E	Ena (= Capricorn= Saturn = Saturday= Energy= male trigram of three strong lines)
F	F (a diminished form of E with final bar is missing= trigram with weak central line)
G	Guru (= Jupiter = Jove= Thursday)
H	Hera ¹ (= Queen of Heaven = Friday)

Figure 3. The first seven letters of the alphabet and the days of the week.

Following this approach we find that the first 13 letters of the English alphabet (A-M) correspond to the first 6 months of the year dominated by the male and the sun. The second set of 13 letters (N-Z) correspond to the second 6 months of the year dominated by the moon and the female. The choice of 13 seems curious until we recall that in the lunar calendar there are 13 months. Indeed, in the Celtic calendar the 13 months are also linked to 13 letters of the alphabet and 13 trees. The Indian cosmological system assumes that there are 8 elephants at the 8 points of the compass. Elephants have a gestation period of two years or $13 + 13 = 26$ lunar months.

This link with a cosmological framework also explains the origins of number systems. In Sanskrit the day is divided into 3. In the morning, the primal force is like the upward flame of an A. At noon that flame is horizontal and looks like a K (i.e. an I + <). In the evening it is a downward flame in the form of a V. This threefold process summarized in the letters AKA becomes linked with the number 1. The number 2 is when the reversed form of the moon C is on a horizontal line. The number 3 combines two lunules of the moon. The number 4 originally arises when the creator god Daksha literally cuts the square of the universe into 4 by creating a diamond shape within the square. This number 4, in inverted form later becomes associated with Jupiter. The number 5 traces the period from November through spring when a straight line of time encounters an inverted half moon. This defines the shape of a scythe and becomes the symbol of Chronos and Saturn. The number 6 represents a transition connected with Cancer. So 6 9 becomes the symbol for the Zodiac sign, Cancer. In the Indian

system, the letter L is sometimes drawn in the form of a line with the smaller part of the L leading to a star Mala, the tail of Scorpio, in the mansion of the moon Mula. Mala was also the Sanskrit word for original sin and linked with the dangers of eclipses. The number 7 as a mirror version of this problematic sign became seen as a lucky number. The number 8 corresponds to the beginning of a second week. If we take the H of Hera, associated with day 7 and add an upper and a lower covering we have two boxes, which also define the number 8.

In terms of chronology, this number was simply a bridge to the second week in a monthly cycle. In the cycle of the year, 8 months passed between the end of the year in Libra (Tula) and the arrival of Gemini, the twins. This evolved into a complex story of two twins, one born after 7 months and other born normally after 8 months. This led eventually to stories of sons of the sun, one of which fell, the other of which rode on (Phaeton and Phainon). At a cosmological level, the two boxes that transformed the letter H into a figure 8, which is also the symbol of infinity, had a deeper meaning. In a cosmos of 3 worlds, Heaven, Earth and Underworld, the 3 horizontal lines of the 3 boxes defined the equivalent of 3 steps to heaven. In India, these became the 3 steps of Vishnu. In the West, this led to the Jacob's ladder.

An understanding of these cosmological dimensions of the alphabet, language and number offers a framework for a new approach to world culture. First, it reveals that analogies between microcosm and macrocosm were much more than the vague associations of primitive and superstitious forefathers. They entail a highly complex and very precise system, an intellectual web of connections, among at least 7 levels of reality. Since the first three of these levels are all at the abstract level they can, for introductory purposes be summarized as metaphysical. This is followed by a mental level, then a physical, man-made and social level.

The Indian approach saw this as a system that was at once cyclical and evolutionary. As such it was consonant with the vision of a Book of Changes (*I Ching*) that saw the world in terms of yin and yang that constantly interacted with one another. The god Mitra, whose name means both friend and contract was seen as making a contract with the god Varuna. Mitra represented social law (4 beads on the right of the square). Varuna represented cosmic law (4 beads on the left of the square, 1 bead to connect them at the top and one mystic bead which linked symbolically the divine and human worlds and also represented the knot, Al Risha in Pisces linked with the equinox. Mitra and Varuna were symbolized by Gemini as two persons making a contract through a handshake: Mitra with one horn (cf. the unicorn) and Varuna with two horns, cf. the bull. Early versions of the contract began with Gemini, and Libra (Tula). The cosmological expression of this union of heaven and earth became the downward V of heaven meeting the upward A of Earth to create an hourglass like shape called the Dumaru Drum of creation. Not by coincidence, the Kalachakra (the wheel of time) became a dominant metaphor and generator of images.

As these ideas went westwards, the symbiotic system of change was increasingly shifted into a framework of opposition. Mitra became Mihr, i.e. light as opposed to darkness. There was an attempt to focus only on the positive: upward pyramids were in, downward pyramids were out. As a next stage Mihr became Mithra. The year now began at the summer solstice. The six first months when the sun was dominant were linked with the male in the combative sense: Ares and Mars. The last six months when the moon was dominant were associated with the female, with the male in a studious sense, Mercury and with peace: Antares. In the Hebrew tradition the model of the cosmos shifted once more. Now the year began in September (Virgo). Now the metaphors of thanksgiving dominated. The symbol of the fish in Pisces,

connected with creation in the original Indian myths were now faced straight down as Leviathan, the monster of the deep. The Sanskrit Ceta now became the Latin Cetus.

In terms of the heavens, the implications were equally profound. The Indian cosmology centred around the pole star (often called Druvalok) surrounded by the 7 stars of we call Ursa Major, which Indians linked with the 7 wise men: the Sapta Rishi. In this approach, the primal force who was ANAM, AGAM and ALAKSHA, personified a union of the female S with the male T to generate many of the building blocks of the Indian system (figure 4).

A	= Primal Force, Active Male Principle
N	= Second Primal Force, Passive Male Principle
AN	= Two Primal Forces Combined
S	= Sarasvati, Queen of Heaven, Milky Way, Abstract Female Principle
SAT	= Truth
Sattwa	= Creative force
Satya Yoga	= First Period
Saturn	
Saturday	

Figure 4. Some fundamental concepts linked with the letters S and T.

The cosmological turn of the Hebrew approach literally turned the world on its head. The image of a square stone topped by a pyramid was now replaced by an image of the world as a top (Dreidel) with a square cube balanced on a pyramidal form. The pyramid as architectural form was out. The rectangular temple was in. There were even discussions that the temple should be built vertically. The age of the skyscraper was presaged. As part of this shift, the stars of the South Pole became the new paradigm. Everything associated with the North Pole was vilified. The SAT of the primal god and the name of the two original primal gods A+N were now combined as SATAN and used as the personification of evil.

Meanwhile, in Egypt there were efforts towards synthesis. The two paths of India that led to the two main castes, the Kshatriyas and the Brahmans, the kingly and the priestly, the active and the reflective led to a new vision of a ruler who would combine both. So the Pharaoh held in one hand the flail associated also with the three stars sprouting from Antares in Libra and in the other hand the shepherd's or more precisely the cowherd's staff to represent this alternative way of life. These two alternatives were symbolized in the two geographical units of upper and lower Egypt. So their unification was much more than a political act. It also re-enacted the original creation. The original female AUM of level 4 now became ANUM.

These almost random examples suggest how the matrices, which generated very specific sounds, language and cosmologies also created many links in their web of associations, which lose all sense if we ignore the framework in which they arose. In today's semantic web we might at best discover that *mala* = evil in Latin and that *mala domesticus* is a domestic apple, but we would have no clue how this relates to *mala* as original sin in Sanskrit, to cosmological systems of Buddhism and other religions. Nor we would understand how shifts in cosmological framework transformed approaches at various levels of reality.

B. Future Webs

In the present semantic web, there is a focus on logic as a means of resolving issues of trust. This system focuses on machine readable treatment of logical or semantic primitives. This is

essential in the realm of business, where the precise identity of clients is a sine qua non. As such it may more aptly be described as a transactions web. It has nothing to do with the complexities of human meanings, which entail a series of other fields such as etymology, semantics, semiotics, lexicology, lexicography, semasiology and omnimasiology.² In the realm of culture, to search for truth in logic is a category mistake. By definition, the realms of metaphysical religion and philosophy, of myth, literature and imagination are beyond the narrow bounds of Boolean, Bayesian and other logical systems. In these realms, the search for truth can only be in terms of precision of any digital surrogates and directness of links back to the sources from which they come.

Hence, the challenge of future semantic webs is to go beyond the details of a single word in a single language. We need comparative studies that take us back to the level of individual letters and trace the etymologies of these letters, their combinations, words and phrases in a comparative historical context. We need a new approach to hyperlinks that take us beyond the born-digital hyperspaces of the Internet-World Wide Web to link with at least five levels of reality and different scales. More specifically this leads to a series of 12 desiderata (figure 5).

1. Omnilinks for Multilayered Searching
2. Omnilinks extended to Physical World
3. Spatio-Temporal Image Capture and Metadata
4. Link Digital Physical World with Knowledge
5. Levels of Reality as Search Criterion
6. Goals as a Tool for Search Criteria
7. Thesauri to Augment Personal Terms
8. Historical Classifications and Thesauri
9. Images and Visual Dictionaries as Search Tools
10. Scale as Search Method
11. Virtual Reference Rooms
12. Ways of Knowing and Knowledges

Figure 5. Twelve challenges of future Semantic Webs.

1. Omnilinks for Multilayered Searching

Although a considerable body of hypertext research has considered the possibilities of multiple links, most systems focus on a given hot-word going to one specific website. Interesting exceptions are the All in One Dictionary site which goes to over 100 dictionaries and then provides a fairly random list of results. The vision of omnilinks goes further in three ways. First, it applies the notion of hyperlinks to every word, which means that words no longer need to be highlighted. Second omnilinks offers different levels of knowledge that can be accessed depending on the user's concerns at the time. Third, it offers multiple views of results at each level: e.g. author, date, place. Ultimately, we want not simple lists of findings, but lists, which can distinguish between primary and secondary literature and in the former between editions; between versions in different languages, etc.

Inherent in this approach is a cumulative dimension in learning, which may not be the fashion of the moment, but which is the basis for many major advances in the world of learning. That is why reviews of literature are a first step in major monographs. Lists of hits which give no inkling as to what percentage this represents of the corpus of knowledge in a field, are invitations to reinvention of the wheel.³

2. Omnilinks extended to Physical World

As E-Content extends into the various worlds of human action and thought, we need much more than a simple IP address. Today, there are thousands of addresses with images of Leonardo da Vinci's Mona Lisa. There is one version of Mona Lisa in the Louvre that is generally accepted as the original. We need tools to distinguish between the Louvre's official digital surrogates for this masterpiece and random variants. In culture the way to a web of trust entails being able to have direct links back to original sources.

This applies equally to objects in nature. By the year 2000, there were webcams that provided 24 hour views of Mount Fuji from 14 different positions. With the enormous rise of surveillance cameras the potential of linking to see any place at any time is becoming a reality. The scope of such cameras could be extended far beyond surveillance such that they become coupled with our knowledge systems.

3. Spatio-Temporal Image Capture and Metadata

The latest professional cameras for reporters do more than passively take a picture. They automatically add to the picture spatio-temporal co-ordinates (when and where the picture was taken) using GPS and UMTS technologies, in order to provide an instant layer of metadata to images. This principle needs to be extended across the board to image capture devices and become a part of everyday practice. As such at least one significant layer of metadata could be automated and integrated into our visions of GPS, GIS and UMTS.

4. Link Digital Physical World with Knowledge

Implicit in such new tagging procedures is a transformation in the use and potentials of what have traditionally been capture technologies (cameras). In the past, the camera obscura and later the camera were passive objects. They captured and recorded images of the world. The dramatic rise of sensors and image recognition technologies is opening up a whole new realm of possibilities. In technological terms, this implies a new convergence of methods. Today we have OCR and other image recognition technologies. We have cameras and capture technologies and we have Radio Frequency Identification (RFID) technologies. These are being integrated to some extent for surveillance and everyday tracking purposes: e.g. in order to follow a valuable shipment as it moves by truck from country to country and passes tollbooths on the way. This trend needs to be extended into the world of learning and knowledge

Three phases suggest themselves. In a first phase, capture technologies (cameras, camrecorders, film cameras and sensors) can be linked to standard databases of the natural world. Hence, when a tourist comes to Brazil and sees an unfamiliar tree, the camera records the image as usual. It then sends the image to a database of trees, determines that the image entails a Jaka tree and sends the user information about the Jaka tree.

In a second phase, this process goes beyond simple identification. Once the camera "knows" that this is a Jaka tree, then it can search knowledge bases about Jaka trees and provide a person with the state of knowledge about the Jaka tree. Admittedly life would soon become overwhelming if we were confronted with the entire history of knowledge of every object that we see. So users would obviously need to define the limits of what they wish in order to filter the incredible amounts of knowledge. Often the concern may be very pragmatic. We are

collecting mushrooms and want to know if the one in front of us is edible. In the past, we would have needed to open a large book and try to find the species in question. Now the camera serves as a dictionary of mushrooms and tells us that this particular species is edible-or not.

In the case of social, mental and metaphysical “objects” this quest is more elusive. We cannot simply tag points in the mind. But we can tag the images that have been drawn of mental and metaphysical worlds. Just as historical records do not cover all that has happened, recorded instances of the mental and metaphysical do not cover all that has been thought. Even so, systematic access to this great corpus that exists marks a great step forward.

The potentials of this approach are remarkable and point to a third phase. The US military is creating a 1-1 scale model of the entire earth. Microsoft’s Digital Earth project aims to do the same thing. In isolation, this extends a trend already familiar in Google Maps whereby one can zoom in to see an image of a friend’s home. However, if this approach is connected with knowledge bases then the entire physical world can potentially become an entry point into knowledge. In the past, we went to libraries to study the world around us. Now, potentially, we can use the world around us to study the knowledge in libraries. This will transform our notions of interactivity, especially with respect to interfaces. In some senses everything around us will be an entry point into knowledge. In Rome and during the Renaissance there were artificial memory theatres to help persons remember things. Now, the natural world itself can become our entry into things remembered and things yet to be discovered. Shakespeare’s “All the world’s a stage” now becomes, “All the world’s a learning interface.”

5. Levels of Reality as Search Criterion

Current systems provide no glimmering of distinctions between different levels of reality. Admittedly, Google does provide alternatives between regular searches, images and maps, but much more is possible. In knowledge systems, there are many distinctions between levels of reality. A simple set would include 5: metaphysical, mental, physical, man-made and social. Historically complex systems easily include 33 levels to link 33 vertebrae, 33 levels of initiation, 33 heavens etc. To tag every object anew on these lines would be a nigh impossible task. Fortunately, these categories have defined the categories for our academic disciplines, such that religion and philosophy entail the metaphysical world, grammar the mental world, geography the question where in the physical world etc. So we can use our existing knowledge that has been classed and ordered in terms of disciplines to identify the levels of reality of what we are studying. Hence, search engines can divide findings along these lines such that a scholar interested in answers to metaphysical why questions will mainly get hits in religion and philosophy and not be distracted by vast amounts of extraneous materials.

6. Goals as a Tool for Search Criteria

As the rabbit in *Alice in Wonderland* pointed out long ago where one wants to go, what one wants to do has a great impact on one’s actions and by implication on one search strategies. A tourist typically wants information about museums, churches, hotels and restaurants. A business agent typically wants company address. Admittedly we already have tourist guide books for the one and yellow pages for the other. Such tools could become invisible dimensions in our search strategies so that a tourist automatically gets the range of hits relevant for them. On the surface this would pose a threat to the online directories market. In

practice it simply means that the agreements of this sector have to be shifted into a less physical, more virtual realm the underlying realities of which are invisible to the end user.

Many attempts at personalization assume that once one learns a user's goals or discovers their so called profile one can then feed them with the irresistible materials which they did not realize they wanted. This is the marketing angle and fully understandable. In a scholarly context a more open approach is possible. If a scholar's goal is to study religion, they are offered the lists of Who (Pope, Cardinal, Bishop, Priest); What (Sacraments, Mass, Prayers, Cathedrals, Churches, Monasteries, Shrines); Where (Pilgrimage Places) and so on. Hence, the system begins by filtering the Library of Congress Subject headings or an analogous system that are appropriate for the goal at hand. More precise goals can generate more precise subject headings. In this approach, the system does not provide an instant list of results. It offers a set of subjects appropriate to the goal so that users have the field specific categories that will allow to search and find with much greater precision.

7. Thesauri to Augment Personal Terms

Implicit in our discussion of goals above is one of the seminal problems in searching: knowing the precise name of that for which one is searching. In the past century, this has led to great concern with authority files. For a time there was a conviction that only those who learned the arcane rules of professional terminology should be taken seriously. This is a reasonable approach if there is a single profession to which a person dedicates their life: e.g. a person who has not learned the few thousand basic names of human anatomy is not a doctor.

One of the consequences of the explosion in knowledge of the past century has been a trend to require knowledge in multiple disciplines. To describe this a number of terms have been coined: multi-disciplinary, interdisciplinary, trans-disciplinary, and integrative studies. A practical consequence of these often exciting developments is that no individual can be expected to master all the terms in 10, 20 or more interconnected disciplines. Fortunately each of these disciplines have their own carefully defined thesauri – or ontologies to use the jargon of computer science at the moment. So the challenge lies in bridging the undisciplined personal terms of an outsider re: a profession with the disciplined controlled vocabularies of those in the profession.

Today ontologies are often treated as fast track aids towards the promised land of instant information retrieval. Our approach expands considerably the role of ontologies. They are not just to create a single method whereby their solution will replace previous ones. Rather they offer tools for bridging between/among specialized field of knowledge such that individuals can now use their imprecise personal terms as an entry point into precise, disciplined vocabularies. As a result, even non-experts can have access to the official terms in the field and thereby are able to search much more precisely. To take a very simple example. A user is interested in apples. The system “knows” that apple is the everyday name for *Mala Domestica*. It can then invite the user to choose among the 1200 varieties of apples: McIntosh, Delicious, etc. and also permit a user to browse related fruits via botanical taxonomies. In this way, the non-expert can search as an expert without mysterious expert systems. A single non-technical word takes us to the core of technical apple terms. This applies equally to other fruits, to the rest of botany and ultimately to all disciplines which have ordered classes of knowledge.

8. Historical Classifications and Thesauri

While knowledge may seem to be a static object, it is in fact a cumulative process. We need merely look at how the classification system of Linnaeus has changed in the past two centuries. So ultimately we need access not only to today's lists but to lists of the past. The value of this dimension will obviously depend on our needs and on the depth of our study. If I want to check whether the mushroom in front of me is edible I hardly need to know the history of names and categories that it had in the past. On the other hand, if I am trying to understand why the constellation of Orion, which was once called the Central One, and which has some stars that still link it to Gemini, then a modern star catalogue will be relatively useless and I will need to study the meanings of the stars in Latin, Arabic, Persian, Sanskrit and Chinese repertories.

When the notion of on-demand learning evolved in the 1970s, it was largely in terms of having access to specialized practical knowledge for the repair of automobiles, planes and objects such as phone switches in remote places. The developments of the past decades suggest that this notion of on-demand knowledge to be used at any time, any where can be expanded to include theoretical as well as practical knowledge, not only at any given moment today but covering any given moment of the past – for which there exists such knowledge.

9. Images and Visual Dictionaries as Search Tools

In the early 1990s, there were visions of searching Query By Image Content (QBIC). The idea was that, instead of searching for the word Oldsmobile or Cadillac, one could give a rough description of what interested one, in the manner that the police make up profiles of the physiognomy of a wanted criminal, and that the system would then search for the object in question. Major corporations such as IBM and NEC discovered that this goal was more elusive than it at first seemed.

On the other hand, the past centuries have seen the evolution of a whole field of visual dictionaries, evolving to a certain extent directly from the *Encyclopédie* of D'Alembert, whereby objects were annotated with hundreds of names. In industry, this has now become an independent category of parts catalogues. If these approaches were integrated into our search and retrieval methods they would be another example of the trend discussed in 7 above, to provide non-experts with controlled vocabularies in unfamiliar areas. To take an elementary example. I am interested in searching for the parts of trucks in French. My knowledge of French is sufficient that I obviously know that the word for truck is usually *camion*. But I have no idea of the words of brakes, transmission fluid, carburetors, etc. I choose the visual dictionary and see a multi-lingual parts description of a truck. Once I know the specialized term, I can search much more efficiently.

10. Scale as Search Method

In the 1960s, there was a wonderful film, called the Powers of 10, which began with a person on a beach and then viewed that same person from progressively greater distance each time 10 times further away. This idea was taken up by an IMAX film with Donna Cox (NCSA) in the early 1990s. One of the implications of our study of the earliest webs of knowledge is that the microcosm-macrocosm analogy was much more profound than a general figure of speech.

Parts of the body are linked with parts of trees, with parts of temples, with the positions of temples in a landscape, with their relation to stars in the heavens and so forth.

Today we have search engines that search for individual parts of the body, individual parts of trees and individual stars. They give us no hints of possible connections between them. Here two things are obviously needed. First we need to record the clusters of terms that earlier systems developed. In the case of chakra, for instance, we need to know that chakra was both a physical wheel and a metaphysical energy level in the human body; that most systems assumed 7 chakras, although some focussed on as few as 5 and others on 8, 9 or 10. A future system should inform us that these 7 chakras were typically linked to 7 trees, 7 hills, 7 temples, 7 mountains, 7 stars etc. So searching for a single word, brings us to the whole web of links associated with that term.

11. Virtual Reference Rooms

If this approach is to become feasible we need much more than the very handy orientations provided today by systems such as Answers.com. In the old British Library in the great round reading room within the British Museum, there were some 300,000 books on the wall. These were not the main body of the library. They were a reference section to give advanced scholars an introduction to the themes and concepts of the then 11+ million books beyond view. In a world where DNA technologies promise to offer the equivalent of 1 trillion CD ROMS of information in one gram of DNA, the idea of portable libraries takes on a whole new meaning. Technologically, it will soon be perfectly feasible for scholars to carry the entire reference room of a British and other great libraries as an orientation tool.⁴

12. Ways of Knowing and Knowledges

We noted how some of the earliest webs of knowledge created a series of links between the human body, objects on earth, in the underworld and in the heavens. If there were only a single set of links the term cultural diversity would not exist. Already in ancient India there was a distinction between the solar and the lunar races. This was much more than a vague metaphor. Those in the East of India used a lunar calendar and did their reckoning via the moon. Hence, they traced their ancestry to the moon and described themselves as a lunar race. By contrast, those in Western India developed a solar calendar and thought of themselves as a solar race.

As the vision of India as a subcontinent spread beyond local factions, the need for integration through luni-solar calendars evolved. The solar race became linked with the warrior class (*kshatriyas*), while the lunar race became linked with brahmans. So local distinctions involved into competing interests of a kingly versus a priestly class (rajas versus rishis). In the past millennia both sides have made great contributions. In the West, this led to distinctions between the active and the contemplative life, between a worldly approach and a path of renunciation. The rabbit in *Alice and Wonderland* would rightly have noted that these two classes, which led to many sub-traditions, had different goals. Hence, trying to decide which is better, misses the point. Kings and priests are not in real competition although there were moments, such as Canossa when that very much seemed to be the case.

During the 19th century there was a brief moment, when it seemed that progress was all that mattered, that the new age of industrialization would simply supercede all previous efforts. Accordingly it was the fashion to speak of aboriginal peoples as primitive tribes. The 20th

century gradually discovered that this was too naïve a stance. Accordingly it was a fashion to insist against using terms such primitive and speak instead of post-colonial, post-imperial and sometimes of post-normal and even post-human. In the process, we have begun to realize that many of the patents for new medical drugs of the past decades involve solutions developed in the ayurvedic tradition that often go back many millennia. The so-called primitive tribes had their forms of traditional knowledge and ways of knowing that are still very important in the company of the most modern medicines. Work, especially among aboriginal and native peoples in Australia and Canada has confirmed that there are many ways of knowing.

The deeper lesson of this non-competition is that there are multiple knowledges. There is the knowledge of the worldly kings, of politics and power and there is the sacred knowledge of priests, shamans, monks and all those who follow the contemplative life. As we create future webs, those intent on inventing the future during their power breakfasts must be careful to remember that there are multiple knowledges to be explored, searched, understood and nourished.

Conclusions

As the Internet has evolved from a set of connections among a small group of scientists in high energy physics towards a World Wide Web (WWW), there has been a tendency to treat the system as an almost Platonic cloud of knowing at the extremities of which are a number of IP addresses (URLs, URNs, URIs) that define the entry and exit points of a predominantly closed system. The World Wide Web was predominantly a born digital web. Accordingly the quest to develop a web of trust via a semantic web has been largely in terms of the logical consistency and veracity of the nodes at the extremities of the system in order to ensure that the original trusted cloud is not clouded by untrustworthy links.

In the case of a scientific formula, once it has been properly encoded within the cloud of the Web, no further links are theoretically necessary. In the case of E-Content and especially E-culture, digital versions may call themselves digital surrogates but very few would pretend that a good photo of Mona Lisa replaces the need for storing and displaying her in the Louvre. So culture implicitly requires links beyond the cloud back into the physical world, and also back into metaphysical, mental, man-made and social worlds.

In science, it is typically the claims implied in the formulae that are vital, while the links they might imply are often secondary. In culture, while the claims per se are important, it is the links and connections that they make which are of fundamental significance. With respect to science we need to do experiments in the physical world, but results can largely be stored internally. In culture, we need webs of links between and among different world at different scales, with variant names and variant versions. The first webs created in India millennia ago did not achieve what the web achieves today, but they remind us that there is much that remains to be done to increase the scope of future webs.

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This paper is effectively a progress report on a much larger study which is exploring New Models for Culture. A preliminary series of 30 lectures (45 hours) was recorded in the spring of 2006 at the National Institute of Informatics (Tokyo) with my colleague and friend Professor Frédéric Andres. I am very grateful for his loyal and continuous encouragement and support. The plan is that this larger framework will become the basis for courses at a proposed new European University of Culture – with initial sites in Berlin, Madrid, Paris, Venice and headquarters in Luxembourg. A preliminary website of the database is available at: <http://sumscorp.com/kavai/newmethods/>. Introductory articles can be found at: http://sumscorp.com/new_models.htm

Notes

¹ For the Sanskrit roots of Hera see Alexander Murray, “Mythology and Religion of the Hindus,” Fravahr.org, 2006: www.fravahr.org/spip.php?article186. In the Indian and Iranian traditions the S and H sounds were frequently interchangeable. So Sarasvati the goddess of heaven became Harasvati.

² For a fuller discussion of this point see the author’s: Access, Claims and Quality on the Internet: Future Challenges, *Progress in Informatics*, Tokyo, no. 2, November 2005, pp. 17-40.

³ Hence the Bibliography on Perspective in SUMS (System for Universal Media Searching) is linked directly to the 30+ earlier bibliographies in the field such that persons can trace how knowledge and detailed description of sources grew over time. In the Demo section under New Media there are examples of two books which use the omnilink method. See: www.sumscorp.com

⁴ For a more thorough discussion see the author’s *Understanding New Media: Augmented Knowledge and Culture*, Calgary: University of Calgary Press, 2006.