Do I know where I am going and why?
Connecting Social Knowledge for Governance and Urban Action

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ABSTRACT

This paper seeks to expand our focus to understand how communities can assemble and manage knowledge to support more rational decisions regarding government services and actions in the community environment. We focus on the knowledge transfer interface between communities and urban councils, with a view to extending theoretical understanding of such transfers, and the socio-technical knowledge support systems interfacing between action groups and councils.

Utilizing theory from several previous domains we discuss how science does not exist in a vacuum. It is surrounded by philosophy, theology (although not always popular to recognise today) and art as a beginning. These diverse areas have undergone parallel developments and as they do so the tools and techniques to investigate and explore these areas have also progressed in parallel. Following the movement of the modern western world this paper utilizes a broad comparison using science, branches of mathematics, philosophy and art, with additional comparisons with theology.

Knowledge management - an often abused expression - is more than just data collection, in- formation presentation, or simple pathways beyond this. Rather it involves the efficient juxtaposition of background information and the value adding of presentation to enhance explicit understanding in a dynamic manner.

This paper goes one step further than normally considered, by investigating approaches to cognition in the data management areas and human cognition requirements and advantages. As society evolves, the requirements for successful presentation of data evolve, and yet the raw data amounts can also be effectively presented in new and more compressed manners. So the total information presented can actually increase exponentially and may become easier to understand.

Finally explicit modern examples are utilised to demonstrate the effect of the

altered approaches through the distinct time periods and a simple juxtaposition of the technological tools available in each period are utilised to enhance the data presentations. The end results are considered and the effect that the technology may have made to the recording and use of the data and it's transmission as data, information or knowledge evaluated, and a suggested model for overall efficiency of knowledge management presented in conclusion.

1. Introduction

In a world facing global warming and growing scarcities of water, power, mineral and food resources, there is reason to be concerned with the design and practicality of socio-technical systems for multi-level governance. These systems form the interface between people's urban systems and their physical environment. These are complex systems that are co-manage with constrained activities typical of urban and regional administrative juggernauts. The work is informed by several years' experience researching theory, technology and practice of building and managing tacit and explicit knowledge in hierarchically complex organizational systems. This paper discusses the trialing of Google Apps as knowledge management tools for community action groups creating links within, between and beyond groups and their networks with a view to understanding practical connectivity, crucial for sustainable social networked structures.

2. Background

Humanity's growing population makes ever increasing demands on limited resources of our planet that we need for survival, more and more people are moving into urban environments where their impacts on the world environment are greatest. Folke (2006) emphasizes that human societies with their interconnected economies rely on what are called ecosystem services and support for survival. According to Folke "a major challenge is to develop governance systems that make it possible to relate to environmental assets in a fashion that secures their capacity to support societal development.... It will require adaptive forms of governance". Brondizio (et al. 2009) makes the case that such adaptive governance needs to be multilevel to build and maintain capital assets necessary to manage and sustain environmental affordances over time. Such capital assets are physical (i.e., built infrastructure), human (i.e., acquired knowledge and skills), and social ("value of institutions as a form of social capital formed through diverse processes involving the development of trust, norms of reciprocity, and networks of civic engagement, including the rules and laws within and between levels of organizations"). In the framework summarized by Brondizio et al's "social capital" is adaptive knowledge embodied in the connections and capabilities of multiple levels of organizational structure, i.e., what Nelson & Winter (1982) called "organizational tacit knowledge". Berkes (2009) makes many of the same points and stresses that multiple levels of social organization need a knowledge sharing framework that allows all levels to be rationally involved in "co-managing" the resources. The research discussed in this paper has been concerned with the analyzing and designing of knowledge sharing frameworks that would make co-management possible and effective.

3. The Framework - Theoretical and the Practical

3.1 Framework Background

The theoretical and practical framework has emerged from an "invisible college" (Kuhn 1970) interested in the Theory, Ontology

and Management of Organizational Knowledge (TOMOK). TOMOK's theory combines evolutionary epistemology and autopoiesis to understand knowledge in hierarchically complex (i.e., multilevel) systems. The project and case study frameworks, have to date, combined three major threads of TOMOK's work approach:

- *Theory*: e.g., Hall (2005; 2006) Hall (et al., 2005; Hall et al. 2007) Nousala and Hall (2008) Hall and Nousala (2010; 2010a) Nousala (2010) Vines (et al 2010).
- *Case study and practice*: (Nousala 2006; Nousala (et al. 2005; 2005a), Hall (2006a), Hall and Nousala (2007), Nousala & Tersiovski (2007), Nousala and Hall (2008), Nousala (et al., 2009), Hall (et al. 2009), Hall and Nousala (2010), Nousala (2010), Nousala (et al. 2010), Vines (et al. 2007;2010)
- *Technology implementation and practice*: Hall (2001; 2001a; 2003a 2006b, 2010a,), Hall (et al. 2002), Hall (et al. 2002a), Hall and Brouwers (2004), Hall (et al. 2010), Hall and Best (2010).

The research and projects focused on what interfaces were required between urban and regional governing bodies and community groups (where local community knowledge may be transferred and used by decision makers to produce better results). The work also focused on emergence and the roles of communities in generating and sharing tacit knowledge, and making it explicit within larger organizational structures. Finally, the research focused on the pragmatic design and implementation of collaborative authoring systems in hierarchically complex organizational environments.

3.2 Theoretical Framework Discussion

The Nobel laureate Herbert Simon (1947; 1979) argued administrators can never make perfectly rational decisions. Rationality is bounded by cognitive limits on how much knowledge/information a mind can acquire, hold and process in the limited time available to make decisions. The best that can be done is to maximize the availability and quality of information to produce the knowledge needed and minimize overloading decisions with irrelevant information. However, it is the nature of administrative systems that decision makers are often hierarchically and geographically far removed from problem situations they manage. In other words, committees or individual administrators making decisions about local issues affecting people often have too little appropriate knowledge, and what they have is probably out of date and/or irrelevant. On the other hand, local inhabitants encounter problems directly and probably either have or can easily acquire the kind of detailed local knowledge for proposing solutions, which need to be incorporated to be effective. Unfortunately, existing bureaucratic systems provide few effective links between decision makers and sources of real-world knowledge they need to maximize the rationality and effectiveness of their decisions. Similar arguments can be made regarding the implementation of administrative decisions in the environment. With appropriate administrative support, local individuals could apply solutions, or at the very least be apart of the process.

3.3 The origin of things - digging deeper

In English the word "orient" originally meant, "to face east". The original meaning is recalled in now older use such as "Orientals" to mean Asians, or even the original full description of P&O, "Pacific and Orient" In fact some early maps started off with east being "up", rather than the "north" of current standard practice. Others, primarily from Moslem cultures saw south as up, and some had Jerusalem as the centre of the world, primarily for theological reasons.

But this is not the only change that has occurred with maps, the initial combining of

disparate maps into Atlases, and their "more modern" offspring, street directories. In fact we are suggesting that the changes that have occurred in the map world are explicit demonstrations of information packaging in both past, present, and future, and they hold promise to demonstrate how to effectively present information to humans for easy absorption and use.

Homer is often presented as a blind minstrel. Yet centuries later his epic song is still "known," of sorts. While knowledge of the original (which was not actually ever directly recorded, even on paper,) is sketchy, Greek, Latin and English, amongst other versions exist. What Homer does is present, as entertainment, a (questionable) history and allows us to travel with the tale without moving.

Humans have a limited number of inputs, often called senses. The 5 classics are Sight, Feel, Taste, Smell, and Hear. Sometimes "developed" additions are included, such as intuition. Intuition is probably an evolutionary survival adaption allowing the formation of conclusions from an incomplete data set by triggering "memories" with a bypass of signals through the amygdala (Damasio, 1994)

3.4 Oral Travel and it successor, travel books

Most of us are familiar with instructions like "travel down beyond the house with the white picket fence and then turn down the 2nd street on the left." This is the basis of oral travel or instructions, and the precursor to visual maps and travel instructions like maps We mean precursor in two distinct ways, one is prior to actual maps as a scientific guide, and the other is prior to specific maps as the recordings of travelers have been used to develop specific guides and maps. Homer's stories allowed travel through the recipients imagination, as well as presenting details of a world picture and possible routes to specific places – real or imagined.

Benjamin of Todelo (Adler 1907, Benjamin of Tudela 1840) was a major 12th century traveler who was on the road from around 1159 to 1173 C.E. (Benjamin of Tudela 1840) and so approximately 100 years prior to Marco Polo. He was the first European traveler to write about China although there is some doubt if he actually traveled to China or just reported on the travels of others there.

Benjamin's work gives us clear demographic detail such as key personalities, community sizes, and skills and economic status of persons and communities he met, as well as secondary reporting of others information (in such a form as to distinguish between original and hearsay information!) (Benjamin of Tudela 1840)

Marco Polo spent approximately 24 years traveling to and in Asia and China, and following his return to Venice in 1295, he was captured by Genoan forces and imprisoned. At that time he dictated his story of travels to Rustichello da Pisa, an author of romantic fictions, and Fra Mauro picked up, these details amongst other sources in his significant map of the known world in 1540.

3.5 The significance of maps and communities

The history of cartography probably is well founded in pre-history as sand/dirt drawings and also cave drawings placing location of objects and places in perspective. (4,5) Harley and Woodward notes "Maps are not natural, self-evident 'statements of geographical fact produced by neutral technologies'. The hand of the mapmaker is guided by a mind located in a certain time and place and sharing inevitably the prejudices of his or her surroundings." (6) Edney goes further and suggests that maps

not only "...just show the world. They show our conception of what the world ought to be."(5) Maps are depictions of the earth's surface scaled and un-scaled with or without a defined projection, limited in content to the extent of technology and the knowledge, wish and, or wants of the cartographer or person or the purpose for which the maps were produced.

Maps are used as tools to convey all sorts of information, the list is endless: political, historical, topographic, ethnic, religious, economic and military to name but a few. Today we often think of maps only as tools for navigating from one point on the world's surface to another. If we stop and look at all the maps that we are bombarded with every day we can see that maps are much more than navigational tools. Advertisers, governments, journalists, academics and everyday people, use them for a myriad of reasons. Maps have a great visual power capable of conveying information with incredible authority whether real or illusionary.

"The medieval world map (Mappae Mundi) conveyed little useful information for the traveler, it wished to convey the beauty and clarity of God's world, as described in the psalms "Nach Zahl, Gewicht und Maß hast Du alles geschaffen." For this reason Jerusalem is placed in the centre with the rest of the world divided in the continents Asia, Europe and Africa, showing the settling of the world through Noah's sons; Sem, Japhet and Cham. The map emphasises the reach of God's work by showing that the graves of the apostles can be found in the farthest corners of the World," (Einführung 2002)

Of course maps up to and into the late 15th century were sometimes, like Homer's records, a record of real and imagined countries and facts. But sometimes the discrepancy between accurate and imagined is not arranged chronologically. The Fra Mauro map was made around 1450 by the Venetian monk Fra Mauro and his assistant Andrea Bianco, a sailor-cartographer, under a commission by king Afonso V of Portugal. At least significant sections such as Africa and parts of Asia and Japan are recognizable to the modern eye.

Compare this with Vopel's Terrestrial Globe with Armillary Sphere, of 1543, produced in Cologne Germany. It illustrates terrestrial and celestial globes and armillary spheres were important educational tools for illustrating the Ptolemaic, or earth-centered, cosmic system. The series of eleven interlocking and overlapping brass rings or armilla, some of which are movable, that make up the armillary sphere are adjustable for the seasons and illustrate the circles of the sun, moon, known planets, and important stars (http://www.1worldglobes.com/History/historyofmaps.htm) .

Ironically this was the same year that Copernicus's theory of a heliocentric universe was published, a theory that greatly changed the design of armillary spheres. (http://www.1worldglobes.com/History/historyofmaps.htm). Other forms of information such as perspective and colour were also developing, although with only a few exceptions, maps were not printed in color until the end of the nineteenth century. The "lines" are those that form the image and are normally black or black-brown. (http://www.phil.unipassau.de/histhw/tutcarto/english/index-hiwi-karto-en.html Last accessed: 10 June 2011).

And perspective and projections were developments from a renaissance world coupled with developments in both geometry and philosophy.

A popular start date for the renaissance involves the competition in 1401 between Lorenzo Ghiberti and Filippo Brunelleschi for the contract to make the Florence

Baptistery doors won by Ghiberti. Of note in this art piece is the development of perspective and elements of implied distance, prerequisites for maps that are trying to impart data about distance and relationships on a single page.

3.6 Discussion on practical frameworks

Past studies of various knowledge-based groups have been known as "communities of interest" or "communities of practice" and are found within larger organizations. In the urban or governmental domains such emergent communities are often known as "action groups". People in action groups have or can easily acquire significant amounts of personal knowledge and documentation relating to their areas of concern (Smith 2010; Smith and Nair 2010; Hocking and Wyatt 2010; Kuruppu 2010). Organizational knowledge managers need to work towards implementing social and technological systems that help collect, transform and make such knowledge available in usable forms for decision makers. The literature survey suggests that most research into relationships between government and community groups have had a top-down focus, i.e., where governments seek to push information (e.g., on health issues) into the community.

Another example of the nature of usability of pooled personal knowledge comes in the form of communities or action groups. In the field of cultural heritage, actions in the 80s and 90s utilized digitalization of artifacts as a method for preservation and transferring cultural information to the public and a multitude of interested groups. A decade later, and with the benefit of hindsight, more is understood, and its local knowledge and interaction that enhances these cultural collections that act as a focus for virtual communities of practice.

4. Field Work

The field work involved working with community action groups to identify the kinds of knowledge they were actually holding (Nousala and Jamsai Whyte 2010 Smith 2010, Smith and Nair 2010, Vines et al. 2010) and tested for utility of social technologies such as Google's cloud applications for community knowledge building and sharing (Hall 2010, Hall and Best 2010, Hall et al. 2010). This work followed experiences from 2007-2008 in building a knowledge base to support reference literature and working drafts for the TOMOK group, using a collaboration platform known as BSCW (OrbiTeam's Basic System for Collaborative Working). The BSCW platform was abandoned due to hosting and server issues. In January 2010, following the announcement that Google Docs could manage all kinds of document file formats, TOMOK was subsequently successfully transferred. TOMOK's extensive knowledge base as a wiki using Google Apps, proved so successful that a subsequent trial (also successful) used the tools as a support system for a knowledge intensive community action group (Hall et al., 2010). The demonstration template (Hall and Best 2010) offered a range of capabilities to support community action: e.g., data collection with the capacity for imaging and geo-tagging, data aggregation, building knowledge bases from specific literature, collaborative authoring with document tracking capabilities, presentation development, social networking, membership management, financial tracking and the like.

5. What has been learned so far…

Urban councils and their delegates are responsible for providing services necessary for civil life, maintaining peoples' health and amenities. To do this functionaries need to know who, what, where, when, why and

how-to relate to problem areas. Hall, Nousala and Best (2010) discuss epicyclic knowledge acquisition through building and acting in urban environments. Figure 1 shows the epicyclic knowledge concept built on from ideas from Hall (2003; 2005), Nousala (2006), Vines (et al 2007;2010) and Hall and Nousala (2010a). Figure 1 illustrates the theoretical application of the epicyclic knowledge framework to illustrate the acquisition, of building and acting in the urban environment. The knowledge related concepts in this paper have been informed by knowledge-based autopoietic systems at least three nested levels, highlighted by the discussion in the accompanying text of figure 1:

- *Individual people ("**I**").* When concerned about a problem individuals are motivated to collect explicit knowledge eg; documents, images, maps, records, etc building personal knowledge in the process. . This knowledge building may involve cycles of **O**bserving, **O**rienting, constructing **T**entative **T**heories, and acting to **E**liminate **E**rrors (Hall et al. 2010).

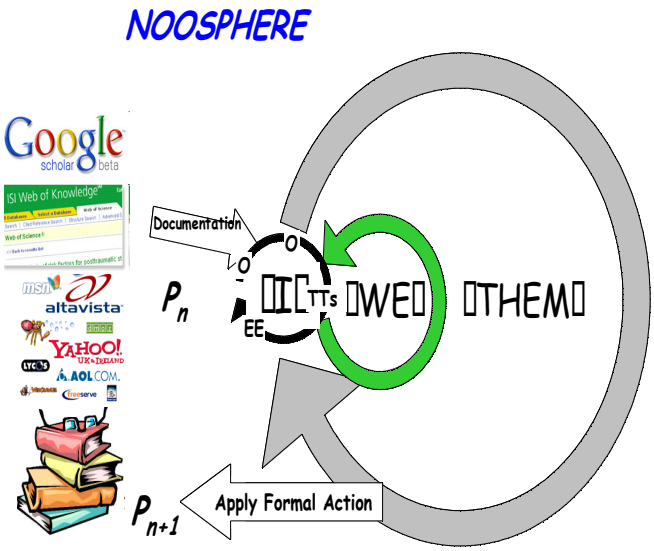

Figure 1. Knowledge cycles in urban governance (derived from Vines et al. 2010). Noosphere is the sum of human knowledge. Individuals, groups and councils all draw from and add to this store of knowledge as consequences of their activities.

- *Community action groups ("**WE**").* Where individuals in the community face similar problems, they may share concerns and knowledge to stimulate the emergence of a community group (Nousala and Hall 2008) to resolve the problem. Group knowledge building may involve sharing personal knowledge and building a group repository of documentation and observations. The success and sustainability of the group will depend to a considerable degree on the success of the personal interactions in assembling useful knowledge and action plans (Hall et al 2010).
- *Councils ("**THEM**").* Councils are complex bureaucracies, organized into departments responsible for problem areas. Decisions to formalize actions tend to be centralized, where the bounds to rational decision making are likely to be the greatest (Hall et al. 2009). Committees or officers making decisions often have little or no personal knowledge of specific problems. Groups close to the problems can play important roles by collecting, organizing and presenting their collective knowledge in formats easily used by functionaries (Hall et al. 2010).

Noosphere described by Krippendorff (1986) as the space occupied by the totality of information and human knowledge collectively available to man. As discussed by Hall (et al 2010) the concept of Noosphere initially emerged from discussions between Valadimir Vernadsky (who also coined the term "biosphere"), Teilhard de Chardin, and Edouard Le Roy. Hall (et al 2010) goes on to discuss how Turner (2005) reviewed to enhance the concept in such a way so as to make it possible to employ it in figure 1, meaning "..the noosphere is the net product of the global diversity of knowledge ecologies…" (Hall et al 2010).

6. The impact of interaction between human cognition and the physical world

6.1 Atlases and Street Directories

In 1570 the Antwerp cartographer Abraham Ortelius published the Theatrum Orbis Terrarum, often considered the first modern atlas.

The key elements of this first atlas were the publication of diverse location maps in one publication.

The addition of multiple maps allows comparisons and the building up of detail in layers. It is also important to recognize that Ortelius also included a vast southern continent, 'Terra Australis Incognita,' supposedly to counterbalance the known northern hemisphere world. (Notes from the State Library of Victoria, Australia associated with the Theatrum Orbis Terrarum by Abraham Ortel published in 1574 Street Directories were not far away. The earliest reference we have found was to a 1650 publication for the City of Albany, New York, USA, utilizing the research of Prof. Jonathan Pearson, of Union College and including the dates of patents and transfers of city lots (http://books.google.com/books?id=ydgRAAAAIAAJ&pg=PR3&sig=b81fhST4ILavF0VDu5YNoR2MKbQ&hl=en Last accessed: 13 June 2011).

In the same year, Henry Robinson produced a directory in London, in this case, a list of names kept in an "office of addresses" available for viewing, presumably on paid subscription. Whilst not a map, it provided detailed background data that in time would become part of the overall street directory (http://en.wikipedia.org/wiki/Henry_Robinson_(writer) Last accessed: 14 June 2011).

Over time, although exactly which year and where is questionable, the data was provided graphically – nominally in line drawings using black ink.

6.2. Layers

In this paper we have made reference to layers several times. Layers are both actual and also conceptual.

Layers allow explicit details to be published having a combined impression and context. We can see geographical information such as streets together with land use information, specialist services, traffic flow and/or direction (such as one way streets or time limited parking zones) and even economic spheres of influence such as "natural shopping zones" for demographic differentiation.

Originally layers were produced using a transparent or semi transparent material such as acetate sheets or tracing paper over a fully opaque back sheet.

Today layers are usually electronic in form, and are seen easily in places such as GPS software or versions such as Google Maps where feature sets can be turned on or off.

It should be noted that layer information can be detailed but often requires context to be easily or fully understandable.

6.3 The Psychology of cognition

In this paper the term cognition is not used just to mean thinking but rather the process that includes an ontological examination of terms and processes.

Because cognitive science often tries to understand minds in the same way a computer processes inputs through processing and then to specific outputs we utilize a simplistic but usable model.

The authors also have come into knowledge management from a Engineering and Human Engineering / Ergonomics background and so the when understanding human cognition try and utilize a holistic view drawing on the work of application oriented modeling both within the individual and also within the layered environment between work space and outside world (Leamon 1980, Wilson and Corlett 1991).

So cognition requires sensors to "read" displays – be they visual, tactile or audible, a processor stage, and an effector stage with potential feedback loops to fine-tune processing and ability to effect specific control.

6.4 Memory

In humans, different types of memory have different roles. Short-term memory is involved with processing and comparison.

Miller's (Miler 1956) approaches to 7 +/-2 numbers is an example of short term memory. Long-term memory is sometimes structured into declarative and implicit classes. Declarative memory is that which is recognized and consciously remembered. Implicit memory is used for priming and is also sometimes called procedural memory as actions and activities cause it recall.

Norman (1988) specifically considers human mapping and activities and concludes that where the design of control systems correlate with the human's mental model our ease and accuracy of using equipment is enhanced and made more effective.

6.5 Concrete – abstract continuum

The more concrete a symbol or instruction is the easier to understand and act on. The more abstract the greater the local processing that must be done by the individual. Symbols may be concrete or abstract. Language too is worthy of consideration here as if the language and connotations of language are understood, then we may fast track to understanding context and means of tacking in information, and also of acting upon such information.

6.6 Knowledge Skills Rules

Rasmussen (1983, Rasmussen & Vicente 1989) introduces the ideas of Knowledge, Skills and Rules, and that repetition of acts, activities, or even thinking may make a process evolve from requiring active thought to becoming an automatic activity. This may be demonstrated by rote learning of a route to travel or by rote learning of multiplication tables till they become automatic responses.

The familiarity and use of standard technologies, be they maps or computer programs leads to a repetitive speed and enhanced ability to take in information. It must be highlighted that this is not the same as understanding – the repetition increases speed to do not to understand what is going on as sometimes the data intake is more superficial.

6.7 "Knowledge tools"

Tools are hereby considered as items that enhance our ability to intake information, ensure it is in context, and then potentially ease our ability to act upon such information. They may also minimize repetition without adding significant knowledge or context, and so automate or partially automate our responses to the information.

The use of modern computer programs to place information in a graphical form, and in context of geographical or major numerical factors, such as traffic patterns and activity, alternative route recommendations, and facilities within reach, as well as means of minimizing the need for instruction books (Norman 1988) and allow "the information in the world" to be understood in correct context, is to be desired.

The use of colour and audible tones in a manner consistent with human facilities (be they physical or cultural,) and the use of controls that match human attributes (eg. size of fingers, response times,) increase the usability of knowledge tools, ensuring interaction with the tool is likely to enhance the total experience.

7. Conclusion

Surveying of the literature shows that social technology has most frequently been used to push information from higher-level governance into the community. Very few works were found that demonstrated the social technologies gathering and communication information to higher levels of governance. This included the lack of involvement of community groups in areas of governance that affect them directly. Based on experience to date, the freely available Google Apps have offered a platform for directly interfacing community

action into the processes of urban governance.

Well designed knowledge tools should enhance the total knowledge experience. They need to build upon human attributes, be they physical, cultural or psychological, and they need to ensure knowledge presented is in a context to enhance absorption and to enhance the utilisiation of this knowledge.

Whilst these ideas seem simple the lack of application is regularly experienced and the use of older tools can be reviewed in light of modern understandings of human interaction in a broader world.

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