LOCATING KNOWLEDGE THROUGH AUTOMATED ORGANIZATIONAL CARTOGRAPHY [AUTOCART]

Mounir Kehal, Sandrine Crener, Patrice Sargenti
CSITDS Research Group
International University of Monaco
Monte Carlo, Principality of Monaco

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Abstract: The Post-Globalization aeon has placed businesses everywhere in new and different competitive situations where knowledgeable, effective and efficient behaviour has come to provide the competitive and comparative edge. Enterprises have turned to explicit- and even conceptualising on tacit- Knowledge Management to elaborate a systematic approach to develop and sustain the Intellectual Capital needed to succeed. To be able to do that, you have to be able to visualize your organization as consisting of nothing but knowledge and knowledge flows, whilst being presented in a graphical and visual framework, referred to as automated organizational cartography. Hence, creating the ability of further actively classifying existing organizational content evolving from and within data feeds, in an algorithmic manner, hence potentially giving insightful schemes and dynamics by which organizational know-how is visualised. It is discussed and elaborated on most recent and applicable definitions and classifications of knowledge management, representing a wide range of views from mechanistic (systematic, data driven) to a more socially (psychologically, cognitive/metadata driven) orientated. More elaborate continuum models, for knowledge acquisition and reasoning purposes, are being used for effectively representing the domain of information that an end user may contain in their decision making process for utilization of available organizational intellectual resources.

1 INTRODUCTION

Approaches to manage knowledge have been largely based on various combinations of business practices, management strategies, and subject related research. Examples of these approaches are innumerable and include organizational learning, the learning organization, total quality management (TQM), business process re-engineering (BPR), quality circles (QCs), and so on. Of more recent times, especially in the last decade or so, Knowledge Management (KM) has started to emerge as multidisciplinary area of interest in academia and business worlds. We cover and provide a framework of how knowledge may be modelled; thus specified, for the development of information systems supporting attempts to manage knowledge.

2 KNOWLEDGE MANAGEMENT LITERATURE SYNOPSIS

While definitions of any subject matter can be helpful in regard to clarifying the scope and depth of the subject under consideration, they can also be notoriously difficult to articulate. Some authors in the field have tried to provide a significant and diverse range of definitions for knowledge. Hedlund, for example, used ‘knowledge’ and ‘information’ interchangeably and although he acknowledged that they should be distinguished, his use amounts to treating them as identical (Hedlund, 1994). Nonaka and his colleagues describe knowledge as ‘a meaningful set of information that constitutes a justified true belief and/or an embodied technical skill (Nonaka et al, 1996). We may consider Knowledge Management as a framework providing the ability to utilize the available knowledge resources effectively, and in a timely

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manner, for organizational benefit and advantage. Essentially, it may be evident in organizational processes, the combination of data and information sources, the processing capacity of IT solutions, people, and the creation and innovative sharing of knowledge throughout the organization. Such framework would inevitably lead to a true managing of knowledge, on a contextual basis that maximizes the utilization behind available know-how, -why, -what, -when, -where, -who.

2.1 Knowledge Category Models

Such types of model categorize knowledge into discrete elements. For instance, Nonaka's model is an attempt at giving a high level conceptual representation of KM and essentially considers KM as knowledge creation process. Figure 1 shows Nonaka's knowledge management model reflecting knowledge conversion and dissemination modes.

From \ *To*	Tacit	Explicit
Tacit	Socialization	Externalisation
Explicit	Internalisation	Combination

Figure 1: Nonaka and Takeuchi's Knowledge Management model (Nonaka et al, 1995).

As can be observed from the figure above, knowledge would be composed of two constituents, Tacit and Explicit. Tacit Knowledge is defined as non-verbalized, intuitive, and unarticulated. Explicit or articulated knowledge is specified as being formally structured in writing or some pre-defined form. Nonaka's model assumes tacit knowledge can be transferred through a process of socialization into tacit knowledge and that tacit knowledge can become explicit knowledge through a process of externalisation. The model also assumes that explicit knowledge can be transferred into tacit knowledge through a process of internalisation, and that explicit knowledge can be transferred to explicit knowledge through a process of combination. In relation to the *knowledge conversion model* transcribed in Figure 1, we believe that knowledge creation undergoes a nested set of computerized processes [explicit] and accompanying practices [tacit], allowing as well for its interlinkages and cross levelling to diverse specialist areas of expertise and to those it would tend to restrain, as knowledge would be considered as highest level available for awareness on the object of concern. Hence, aim is rather to *acquire automatically*, *represent visually*, and *reason collectively* on textual content contained. Thus, a computationally mediated tool is conceptualised upon subsequently, being referred to as AUTOCART, *AUT*omated *O*rganizational *CART*ography, supporting knowledge evolution studies, knowledge sharing and corresponding flow representation.

3 ORGANIZATIONAL CARTOGRAPHY AND KNOWLEDGE MAPPING

According to Oxford English Dictionary, *Cartography* is the drawing of charts or maps. Our aim is to generate cartograms representing stored content attained from specialist data feeds. Figure 4 represents, the characteristics by which 'information in context', knowledge, is dealt in the process of its acquisition. From internal to external sources, and from being data that is interpreted, to one that models certainty with intent to validate its semantics by knowledge workers.

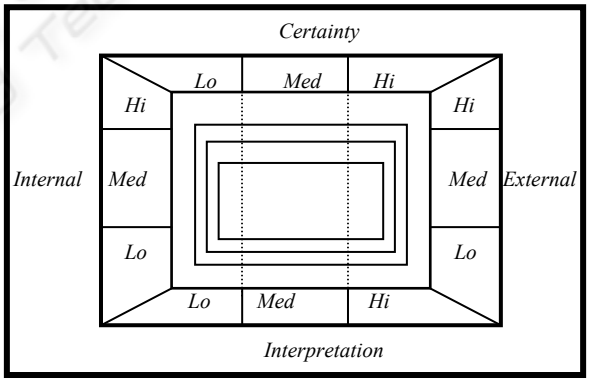

Figure 4: Knowledge Acquisition Spectrum.

Hence from Figure 4, Certainty, Internal, Interpretation and External are all knowledge instances attained by means of capturing tacit and explicit knowledge, with possibly varying values, states and roles, from knowledge workers, and the levels of processing achieved by a mediated computation. Figure 5, below reflects the nature anticipated by such processing in a framework that models parameters of consideration from which knowledge may be viewed, or rather represents and

embeds itself in the form of an [intangible object] action, thinking, [tangible object] archetype, human.

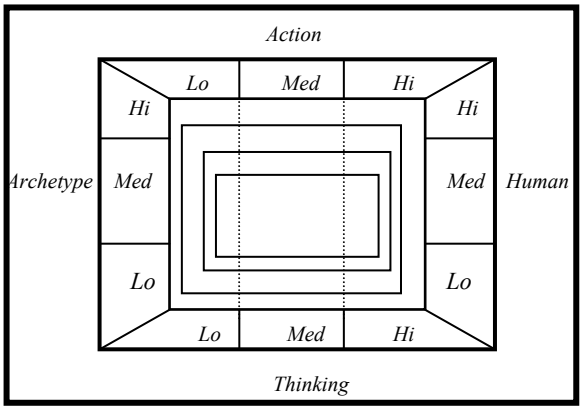

Figure 5: Knowledge Conversion Spectrum.

4 SYSTEMATIC VIEW OF AUTOCART

The knowledge spectrum models covered above would provide us with a framework for the development of AUTOCART, represented at a finer degree of abstraction in Figure 6 AUTOCART Meta level model, by use of dependency relationships and associations among processes and/or instances of objects. The Relationships and associations are stereotyped as <<refine>>, in accordance with the UML (*Unified Modelling Language*) notation (Booch et al, 1999).

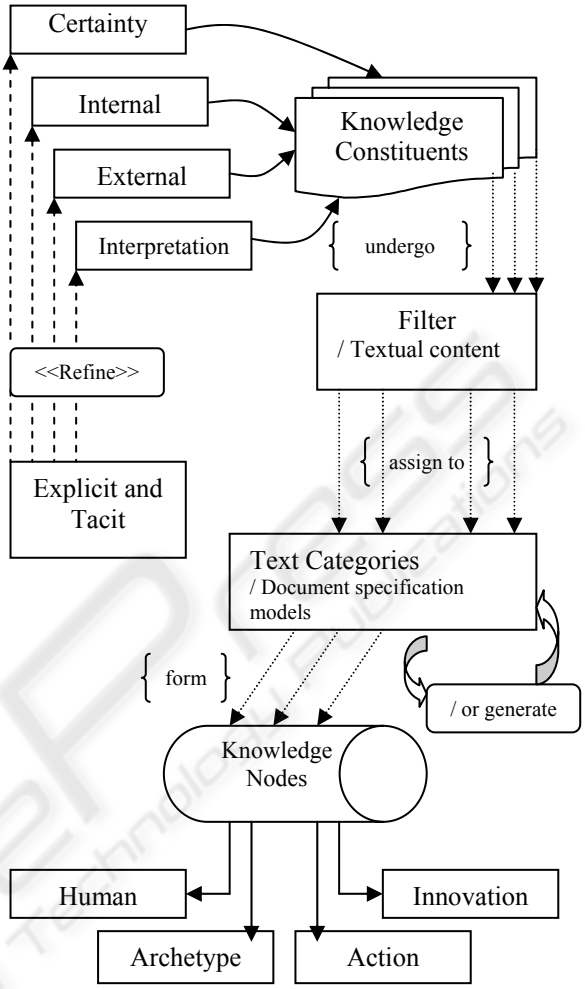

Figure 6: AUTOCART, Meta Level model.

These dispositions of knowledge comprise parts of the *Knowledge Constituents*, which embody the 'raw' material of the organisation in question. Therefore, a generalisation relationship is used to depict the more specific kinds of knowledge elements in relation to the 'whole'. Knowledge Constituents undergo some form of filtering, based on criteria derived from the document specification model and partly determined by the textual content. These functional processes are modelled in the next model, Figure 7, which focuses on functional requirements at a lower level of processing. In like manner, each knowledge element, texts in this case, is assigned its textual category, primarily determined by its textual contents opted for in a pre defined algorithmic manner, using principles of *Kohonen Nets*, for instance; and directions towards an automated learning environment through

induction and hence possible alterations in terms of activation and threshold functions deterministic weights, leading to toggling between unsupervised and *system*-supervised learning for a networked representation of data. To establish the textual category is vital in classifying textual content and, among with characteristics such as links, directly added from the filtering process, forming the basis of a knowledge node, being interlinked using a generalisation relationship, following the notation of UML (Booch et al, 1999).

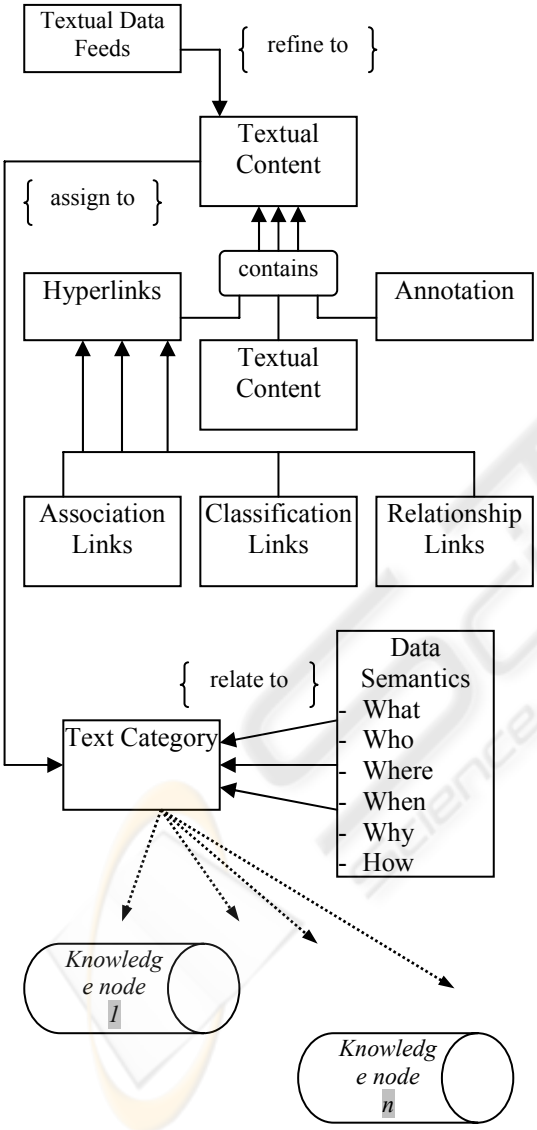

Figure 7: AUTOCART, process level.

At process level, *Data Elements* within *Knowledge Constituents* are to be filtered and then accordingly classified. The overall aim is to surface the latent semantic structure of the *Knowledge Constituents.* The filtering process is primarily based on a document specification model – incorporated in Figure 6 – which is an aggregate of textual components. These can be identified as being the actual text of the document, annotation apparent in the document and the links present. The latter can be further specialised into *association Links* – pointing to and from related documents – and c*lassification Links*, including domain, project and user specific links, and other relationship links as a build-up of the data semantics is incurred based on semantics of content. Once text components have been determined, each text is assigned a *Text Category*, driven by the cohesive relation between the document specification model and the textual content. In case the category is not readily known, a *Category Generator* is invoked, whereby assigns a category in an algorithmic manner. Effectively, the process of textual categorisation and filtering results in assigning some kind of index to each textual input – in the form of data entries per document – in an attempt to reveal the latent semantic structure underlying the organisational knowledge elements. AUTOCART at process level model, portrayed in *Figure 7*, provides an architectural view of the anticipated processing for generation of *Knowledge Nodes*, mainly through links – obtained from the filtering process – and latent data semantics as determined by specification and categorization of the input data, from designated data streams.

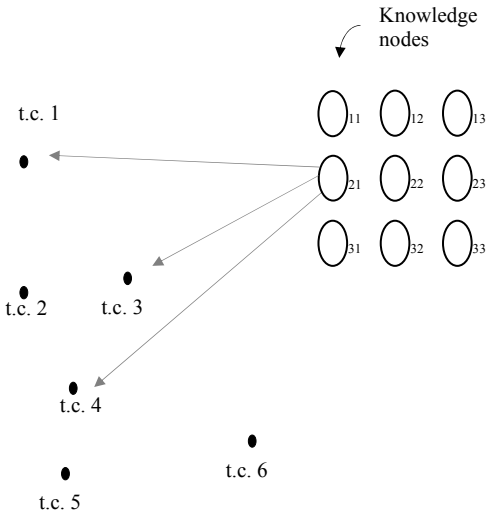

Figure 8: iMap (intermediate state diagram), illustration through Kohonen Nets.

Figure 8 demonstrates the modelling of knowledge nodes generation, after textual content (t.c. = 1…n) have been categorized, following method given by Kohonen Nets, for instance (Kohonen, 1990). The categories of text produced by AUTOCART, in a way illustrated in *Figure 8*, forms the core of the knowledge nodes, accompanied by reference information such as extracted documented experience within the organisation, related communities of practice and referenced expertise. This enhanced structure serves our purpose, which is not only the administration of electronically available information, but also a viable representation of the intellectual environment aiming to make information actionable and relevant within contexts of expertise coverage. Put simply, we aim to combine all valuable reference information in a framework to which everyone can relate to, effectively leveraging the organisational intellectual assets. These knowledge nodes shall be of little value unless presented in an illustrative form. Therefore, it was chosen to generate cartograms to reflect knowledge instances comprising such nodes. Our approach is to be heavily based on the concept of self-organising maps (SOM). Predefined text categories, either domain or project or user specific, play the role of input vectors while knowledge nodes correspond to neurons. The main concept behind this analogy is to place the winner topologically in the text categories space, according to its relevance for containment of the surrounding text categories. Figure 8 is representative of the intermediate step of this approach.

5 CONCLUSIONS AND OUTLOOK

It is believed that automated organizational cartography and knowledge modeling with a computationally assisted model, inline with considerations for its evolution studies, particularly focusing on utilizing inputs and outputs of the processes in strategic decision-making. Would inevitably lead to a creation of an environment by which organizational intelligence and innovation spirals. Technology is symbiotic with what it is conducive of, how are such data feeds provoked to process content, would permeate for its utilization. Consequently inferencing based on what the semantics of knowledge withhold.

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