

Coalescing medical systems: a challenge for health informatics in a global world

Andrew STRANIERI¹ and Stephen VAUGHAN²

*¹Health Informatics Laboratory,
Centre for Informatics and Applied Optimisation,
University of Ballarat, Australia*

²Grampians Integrated Cancer Services, Ballarat, Australia

Abstract. Patients in many nations increasingly access diverse medical systems including Western medicine, Traditional Chinese Medicine, Homeopathy and Ayurvedic medicine as globalisation advances. The trend toward co-existence of medical systems presents challenges for health informatics including the need to develop standards that can encompass the diversity required, the need to develop software applications that effectively inter-operate across diverse systems and the need to support patients when evaluating competing systems. This article advances the notion that the challenges can most effectively be met with the development of informatics approaches that do not assume the superiority of one medical system over another. Argument visualization to support patient decision making in selecting an appropriate medical system is presented as an application that exemplifies this stance.

Keywords. Complementary medicine, argument visualization, health informatics

Introduction

Medical systems including Traditional Chinese Medicine (TCM), Western Medicine, homeopathy and Ayurvedic medicine differ considerably in their religious or philosophical underpinnings, the way illness is perceived and the categories of diagnoses and kinds of therapies available. However, as globalisation advances, patients in most localities across the world have ready access to physicians practising within diverse medical systems. For instance, evidence is clear that the use of complementary medicine is currently quite prevalent in Western nations [1][2][3]. Conversely according to [4] some 60% of the population in China regularly access Western medicine. Similar trends are reported by [5].

Health informatics (HI) is currently tightly linked to that dimension of Western medicine that places emphasis on the quantitative and codifiable. Most nomenclature, messaging and clinical standards have been developed for Western medicine, clinical decision support systems are largely in the Western tradition, and progress toward electronic health records do not obviously accommodate other medical systems. Although numerous recent initiatives in complementary medicine aim to enhance

¹ Corresponding Author: Andrew Stranieri, CIAO, University of Ballarat, University Drive, Mt Helen, Victoria, Australia, 3363. E-mail: a.stranieri@ballarat.edu.au

terminological standards (e.g [6]) little work has been done toward the application of health informatics to the practice of complementary medicine.

Although there is no dispute that health informatics is transforming the practice of health, the continued development of health informatics exclusively along Western lines without consideration of how developments can accommodate complementary medicines, runs the risk that change will occur in ways that will be increasingly inconsequential to patients. The non quantitative aspects of Western medicine such as the those approaches that emphasize narrative may suffer the same fate. The ultimate end point can be seen to be a health system characterised by fully computerised, interoperable Western medicine quite separate from complementary medicine practice that has minimal technology or interoperability, despite being equally prevalent.

It is important that IT implementation in health does not privilege a particular tradition or part of a tradition unless a compelling and explicit argument is made for that exclusion and alternate mechanisms are made available outside the IT system to accommodate patient choice. This should be the ultimate criterion for medical system development if patient centredness is to have real meaning. In this article, we assume health informatics designed to encompass diverse medical systems is preferable to innovations linked solely to Western medicine for four main reasons:

- The trend toward co-existence of systems is unlikely to abate. China and India both have well established non-Western medical systems and as these economies continue to rapidly develop, their socio-political and economic influence can be expected to advance.
- Alternative medical systems as practiced in the West arguably provide greater empathy and empowerment than Western medicine so their popularity will continue to increase there. Conversely, fast and often more immediately effective treatments offered by Western medicine can be expected to continue to be popular outside the West.
- Given that each medical system has distinct religious and/or philosophical underpinnings, linking one system more closely to informatics presents as a version of cultural superiority quite out of place in the modern, global, information based society.
- Aside from any other consideration, patient expectations may drive a unification of health informatics across medical systems as patients continue to access multiple systems at the same time and increasingly demand seamless information technologies.

In the next section, we discuss the expectations patients in any medical system can generally be regarded to hold in order to illustrate that patient needs can be regarded to be universal at a basic level of abstraction. We then discuss the link between health informatics and Western medicine before offering an illustrative example of a health informatics application that does not assume the superiority of Western medicine; the adoption of argument visualization as a decision aid to support patients to select a medical system?

1. How do patients select physicians ?

The perception of illness and wellbeing, the tolerance for discomfort and the cultural context of medical practice varies between cultures and medical systems [7].

Nevertheless, patients in general, can be seen to seek out physicians in any medical tradition for reasons that can be grouped into four categories listed here and described in detail below:

- **Treatment Effectiveness.** Patients select a physician for effective treatment. Methods to assess effectiveness are controversial and depend in part on the primary focus of assessment ie whole person or aspect of disease.
- **Empathy.** Patients select a physician for reassurance, consolation and empathy within the context of an interpersonal relationship.
- **Empowerment.** Patients select a physician who can help them understand their experience and initiate their own actions toward recovery or acceptance.
- **Practical considerations.** Patients select a physician for reasons of affordability, availability, convenience and high ethical standards.

Although medical systems are underpinned by diverse religious and philosophical ideologies, a key rationale for seeking the services of physicians is to obtain treatment that is effective. However, assessing the effectiveness of treatments is far from straight forward. According to [8], the evidence based medicine (EBM) movement emerged in the 1970's following criticism that many systems of medicine, including Western medicine, did not rigorously collect evidence for the effectiveness of treatments. EBM specifies levels of evidence for the effectiveness of treatments and places randomised clinical trials at the highest level and anecdotal accounts at the lowest. EBM's systematic approach aims to add rigor to the measure of effectiveness but may be too heavily based on a narrow concept of Western medicine to accommodate other systems of medicine accurately [9]. Further, some care is required in applying EBM to complementary medicines. For instance, in TCM as described by [10] central assumptions implicit in randomised clinical trials EBM assume the notion that a condition has been definitively and accurately diagnosed. This is difficult in conventional TCM because physicians identify *zheng* or patterns that, as described below, do not signify diseases in the same way symptoms characterize conditions in Western medicine. Studies that attempt to measure the degree of consistency between TCM practitioners surveyed by [10] typically follow a conventional experimental design where the same group of patients is seen by many practitioners whose assessments and treatments are compared. This design is consistent with the scientific tradition but seemingly sidesteps the TCM principle that an imbalance manifests in many ways. Different practitioners are not expected to notice the same sets of signs.

The second reason patients consult a physician is for reassurance, acceptance and consolation. This is regarded as a manifestation of the psychosocial need for social inclusion and acceptance described by many perspectives on personality including the needs hierarchy advanced by [11]. A consultation with a physician can be seen to validate the patient's experience. Oncologists parochially refer to this effect as a 'dose of doctor'. The extent to which a physician imparts empathy varies between medical systems. Ayurvedic medicine illness is viewed as an imbalance in the core energies of *vata*, *pitta* or *kapha*. A diagnosis involves an assessment of the extent to which an individual has a predisposition to each energy. This requires some appreciation of the whole person and requires at the very least, an extensive consultation. However, in practice, patients tend to remain with the same physician for years so that their physician is well known to them. A general practitioner consultation in Western medicine in most countries has little time to practice empathy or reassurance.

Traditional Chinese Medicine as practiced in Australia, typically involves a consultation and dialogue that often spans many aspects of a patient's experience. TCM practitioners in China typically see very large numbers of patients per day so engagement with each is minimal.

A third reason patients consult physicians is to understand their own experience and initiate their own actions toward recovery or acceptance of their illness. The extent to which patients are empowered to be active in their own recovery varies among medical systems. General practitioners following the Western medicine tradition in Australia, typically do not encourage patients to self diagnose or actively make decisions regarding their treatment. Patients can be quite passive and accept prescriptions without question.

In addition to reasons based on treatment, empathy and empowerment, patients select a physician for a raft of practical reasons. The shortage of medical workers in rural areas of Australia is well documented so the availability of a physician may dominate all other considerations. The cost of consultations and treatments, and access to health insurance rebates is also relevant in practice. The ethical codes that underlie the behavior of physicians in the western tradition are largely based on a concept of individual autonomy not fully shared by other belief systems.

In summary, patients can be regarded to select physicians practicing in one medical system or another for reasons that derive from one of four main categories. However, specific reasons for a particular patient can be numerous and the relative importance of the reasons can be quite complex. In the next section, the way in which health informatics development have emerged and are based on Western medicine will be discussed. Following that, methods deployed to visualise arguments are introduced to illustrate a sample information technology application that does not presume the superiority of Western medicine.

2. Health informatics is designed for Western Medicine

Tensions between adherents of diverse medical systems have been attributed to ignorance of respective medical systems, a concern that some systems are not well regulated and a fear that science will be ignored or diminished if systems co-exist [12]. Along a similar vein, [13] claims that conflict between allopathic doctors and alternative medicine practitioners derives from each group's biases and prejudices against each other and is the greatest barrier American hospitals have in implementing a complementary medicine program. In contrast, many physicians in one medical system become familiar with other approaches and even enlarge their repertoire with the use of techniques from outside their first practice. For instance, approximately 30% of the physicians registered with the Australian Acupuncture and Chinese Medical Association to perform acupuncture are qualified general practitioners in the Western tradition. Despite this, tensions do exist between some practitioners in diverse systems, and, these tensions extend to the design and implementation of health informatics advances, to a considerable degree.

In this section we illustrate how major advances in key fields within health informatics have been developed within a Western medicine framework and are not necessarily easily adaptable to a landscape characterized by multiple medical systems. The health

informatics advances that we examine relate to the development of standards and technologies surrounding the electronic health record.

The global development and adoption of standards is regarded to be critical for the design and implementation of extensible applications in health informatics. Standards for nomenclature, image formatting and message passing have arisen as a direct result of the advancement of information technologies in recent decades. Nomenclature standards such as ICD-10 (<http://www.who.int/classifications/icd/en/>) and SNOMED (<http://www.ihtsdo.org/>) provide a common vocabulary of medical terms and enable a level of terminological consistency and accuracy not possible without their universal use. Currently, SNOMED encodes over 300,000 medical concepts organized in a subtype-supertype hierarchy. High level concept categories are based clearly on Western medicine and include *body structure*, *clinical finding*, *event*, *pharmaceutical product* and *organisms*. Semantic richness is provided by the use of attributes that link concepts in one part of the tree with those in other parts.

The survey of health informatics in China by [14] confirms that considerable information technology advances have been introduced in recent years in that country. International nomenclature standards ICD-10 and LOINC (<http://loinc.org/>) are in use and the HL7 messaging standard is being adopted. However, significant obstacles to their widespread adoption still exist. Further, standard terminologies for TCM (eg [6]) have only recently been assembled and have not been integrated into SNOMED or ICD-10.

More work needs to be done to assess the extent to which SNOMED is extensible to medical systems not in the Western tradition. As [10] explains, the key diagnostic feature in TCM is *zheng*, a pattern of aggregated signs and symptoms that signify sickness. To use his example, liver-kidney depletion is a pattern that may manifest in the disease called *wei* (wilting). Some diseases correlate with Western diseases but others do not. Further, patterns are sometimes not differentiated from diseases. A physician makes a diagnosis by discerning patterns using the examinations of inspection, smelling and listening, inquiry and palpation. Physicians typically identify a number of patterns but experienced physicians are adept at discerning those that are most significant. Meridian lines of acupuncture represent a phenomena quite different to the *body structure*, *clinical finding* or any other basic SNOMED category. Indeed, [14] found that integrating TCM concepts with SNOMED for the development of a clinical data warehouse for Chinese hospitals proved exceptionally difficult. However, SNOMED is clearly flexible and very expressive so the inclusion of concepts from other medical systems may be quite feasible, even if relating concepts across medical systems is not fully achieved.

Messaging standards such as Health Level 7 (HL7) encode a transmission from one computer system to another regarding a health related matter. HL7 version 3 deploys a stronger underlying medical model known as the Reference Information Model (RIM) than HL7 version 2. The encoding of a TCM message using the RIM is feasible according to [14], however this has only been achieved to a limited extent. More work needs to be done to assess the extent to which the RIM is capable of encoding a full range of TCM messages. Archetypes from the openEHR (www.openehr.org) movement may have the additional flexibility required however no studies have been found reporting on this.

Ultimately, the development of standards in health is motivated by the desire for all medical events a patient undergoes to be recorded in an easily accessed, electronic health record. Few nations have implemented an electronic health record on a wide

scale and challenges related to privacy, security, inter-interopability of computer systems and cultural change are formidable. However, a question is entitled to be raised involving the suitability of an electronic health record outside a medical system that is not as commodified and institutionalized as Western medicine is. The claim that an electronic health record will enhance the quality of health care provision by reducing treatment errors that arise from inaccessible records, is laudable however, its impact is reduced if the electronic record does not enhance empathy, empowerment or convenience.

The existence of an electronic health record can conceivably contribute to empathy by freeing up a physicians time to engage in dialogue with the patient. Further, applications can be imagined that summarize the patient narrative from the electronic record prior to a consultation again freeing physician's time. However, these manifestations of an electronic record toward empathy seem somewhat minimal. Can the electronic health record empower patients? And if so, does the extent of the empowerment vary from medical system to system? In our view, the vision of an electronic health record can only obtusely be seen to enhance empowerment, though this can conceivably be verified empirically with appropriately designed studies.

In the next section, we turn to present an illustrative example of a technology that does not assume any medical system is superior and explicitly recognizes patient needs for empathy and empowerment in addition to treatment.

3. Argument visualization to support a patients decision

Consider a patient recently diagnosed in the Western tradition with chronic fatigue syndrome in Australia on the basis of diagnostic criteria published by [15]. A popular form of treatment involves cognitive behavior therapy and graduated activity. According to [16], types of prescriptions for fatigue in the *Pujifang*, a comprehensive TCM prescription text, include invigorating the kidney essence, invigorating the Spleen qi, dispersing the depressed liver qi and invigorating the lung qi. In Ayurvedic medicine, persistent fatigue is treated by the elimination of toxins.

How does the chronic fatigue patient deal with diverse medical systems? One approach is to adopt a tribal stance in favor of one while being dismissive of others. According to [17], Western patients seem to adopt a pragmatic, try it and see attitude to complementary medicine. As a rule, an alternative practitioner is not sought because of a deep disenchantment with Western practices or because of a preference toward alternate philosophies. Rather, complementary medicine is used if it seems effective, promises empathy and empowerment and is practically feasible.

Decisions regarding the type of medicine to pursue, with a pragmatic, try it and see attitude, requires the assimilation of many facts, and often conflicting, incomplete or unclear evidence. The decision can be said to be one characterized by [18] as wicked in that the decision is complex, involves both knowledge and values, and has no correct answer. According to [19], complex decisions can be facilitated with a coalescing of reasoning; the construction of an explicit representation of reasoning from diverse points of view into a single structure. Argument visualization techniques that aim to generate a map of all arguments surrounding an issue represent one technique where diverse views are integrated into a coalesced whole. Coalescing

assists in ensuring reasons for decisions are made explicit and contrasted against reasons for competing decisions in an open, transparent and unbiased way.

For our purposes, argument visualization involves the depiction of arguments in a visual map that serves to organize and summarize complex arguments into a single representation, ultimately to facilitate the making of a decision. Argument visualization methods include Toulmin's layout of arguments [20], IBIS [18], gIBIS [21], GoReason [22] and the generic actual argument model (GAAM) [23]. Perhaps the most advanced visualization approach is the Compendium system described by [24] that integrates document management, information retrieval and other tools into an argument visualization framework.

The Issue Based Information System (IBIS) map is still one of the more intuitive maps to use. In IBIS, an issue and competing positions are identified so that arguments for and against each position can be articulated. Figure 1 illustrates an IBIS map that a well informed Chronic Fatigue Syndrome (CFS) patient may draw to represent the factors involved in a decision about how best to manage the condition. One position involves conventional medicine comprising consultations with CFS and psychological specialists for treatments involving, cognitive behavior therapy, graduated activity, and melatonin to help with sleep. Arguments reflect a variety of criteria drawn from the four main categories presented in the previous section including cost, waiting times and effectiveness as evidenced by studies in the literature.

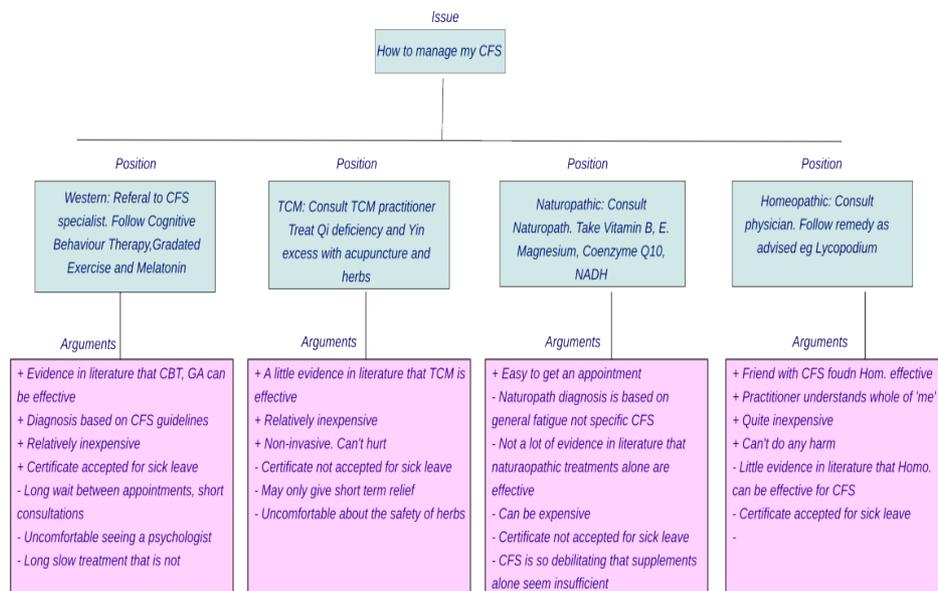


Figure 1. IBIS Map for CFS management decision

The IBIS map does not include any information that represents which argument or position are strongest. That decision involves a weighing up of factors that are likely to be quite idiosyncratic to the patient's circumstances and preferences. Nevertheless, IBIS has been found to be useful in numerous applications since its inception. The generic actual argument model advanced by [23] differs from the IBIS map in that competing positions are not emphasized. Instead assertions that bear on the decision are

coalesced by organizing the assertions and reasons advanced by participants into an explicit, coherent and permanent representation. Figure 2 illustrates a hierarchy of factors known as an argument tree where each parent is inferred from subordinate factors. The inference can be performed with computer implemented mechanisms or left to the discretion of the user.

The coalescing of individual patient maps into an argument map structure so that, in essence each patient is not re-inventing the feasible reasons for a decision about medical systems but is instead informed by the reasoning of earlier patients, is advanced here as a useful application of health informatics in a global world that does not assume the superiority of any one system.

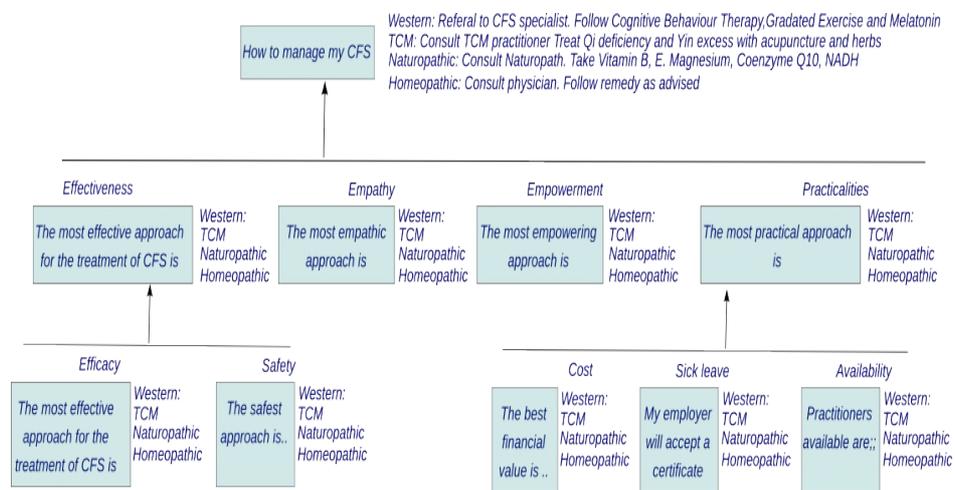


Figure 2. GAAM Argument tree for CFS management decision

4. Conclusion

Numerous studies have confirmed that complementary medicines are widely accessed in countries where Western medicine is prevalent and conversely, Western medicine is increasingly becoming popular in countries such as China as pharmaceuticals become available and affordable. The central assumption made in this article is that the trend toward a co-existence of diverse medical systems is unlikely to abate. Traditional Chinese medicine, Ayurvedic medicine, Homeopathy, Naturopathy, Western medicine and many other forms of medicine will increasingly co-exist. The argument is advanced that health informatics, as currently formulated is heavily focussed on a particular aspect of Western medicine. Health informatics emerged in the West, the main champions of developments are Western governments and national and multi-national corporations with largely Western clientele. Currently, there are very few health informatics initiatives that have been developed for, or clearly apply to one of the complementary medicine systems.

Should HI developments continue to be based on the practice of Western medicine or should a concerted aim be made to ensure developments such as standards or the electronic health record be designed to accommodate multiple medical systems? The

stance adopted in this article is that, given the trend toward co-existence is unlikely to abate, HI applications are best designed to encompass diverse medical systems. The use of argument visualization to support the reasoning a patient may apply in order to decide which medical system is most appropriate in a particular context is described as an illustrative example of an application that does not assume one medical system is inherently superior to others.

References

- [1] M. Dawn and L. C. Upchurch, (2005) Use of complementary and alternative medicine among American women, **15**, Issue 1, pp 5-13
- [2] M. Hastings-Tolsma and M. Terada, (2009) Complementary medicine use by nurse midwives in the U.S Complementary Therapies in Clinical Practice, Volume 15, Issue 4, November 2009, Pages 212-219
- [3] M. K. Lim, P. Sadarangani, H. L. Chan and J. Y. Heng, (2005) Complementary and alternative medicine use in multiracial Singapore Complementary Therapies in Medicine, Volume 13, Issue 1, March 2005, Pages 16-24
- [4] T. Hesketh and W. X. Zhu, (1997) Health in China: Traditional Chinese medicine: one country, two systems *BMJ* 1997;315:115-117 (12 July)
- [5] S. Chua and A. Furnham, (2008) Attitudes and beliefs towards complementary and alternative medicine (CAM): A cross-cultural approach comparing Singapore and the United Kingdom Complementary Therapies in Medicine, Volume 16, Issue 5, October 2008, Pages 247-253
- [6] World Health Organisation (2007) WHO International Standard Terminologies on Traditional Medicine in the Western Pacific Region.
- [7] J. M. Janzen, (1978) The comparative study of medical systems as changing social systems. *Social Science & Medicine. Part B: Medical Anthropology.* **12**, (1978), Pages 121-129
- [8] A. M. Cohen, P. Stavri, and W. Hersh, (2004) A categorization and analysis of the criticisms of Evidence-Based Medicine. *International Journal of Medical Informatics* (2004) **73**, 35—43
- [9] R. P. Thompson, Causality, mathematical models and statistical association: dismantling evidence-based medicine. *Journal of Evaluation in Clinical Practice* **16**, (2010), 267-275.
- [10] C. Zaslowski, (2003) Clinical reasoning in Traditional Chinese medicine: implications for clinical research *Clinical Acupuncture and Oriental Medicine* (2003) **4**, 94–101
- [11] A. H. Maslow, (1943) A Theory of Human Motivation *Psychological Review*, **50**, 370-396
- [12] C. Paterson and W. Peacock, (1995) Complimentary Practitioners as Part of the Primary Health Care Team. Evaluation of One Model. *British Journal of Medical Practice.* **45**: 255-268
- [13] C. F. Ana, (2001). The adoption of complementary and alternative medicine by hospitals: A framework for decision making. *Journal of Health Care Management*
- [14] Y. Zhang, Y. Xu, L. Shang, and K. Rao, (2007) An investigation into health informatics and related standards in China. *International Journal of Medical Informatics.* **76**. 614-620
- [15] Royal Australasian College of Physicians Working Group. Chronic fatigue syndrome (2002) Clinical practice guidelines 2002. *Med J Aust* 2002; **176**: S17-S55
- [16] R. Chen, J. Moriya, J. Yamakawa, T. Takahashi, and T. Kanda (2010) Evidence Based Complementary Alternative Medicine *eCAM* 2010 **7**(1):3-10
- [17] A. Bensoussan, (1999) Complementary medicine -- where lies its appeal? Patients welcome different perspectives for the treatment opportunities they provide. *MJA* **170**: 247-248
- [18] H. Rittel, and M. Weber, (1973) Dilemmas in a general theory of planning *Journal Policy Sciences Springer Netherlands* Volume 4, Number 2 / June, 1973. pp155-169
- [19] J. L. Yearwood and A. Stranieri, (2009) Deliberative Discourse and Reasoning from Generic Argument Structures. *AI & Society.* **23**(3): 353-377
- [20] S. Toulmin, (1958). *The uses of argument.* Cambridge University Press.
- [21] J. Conklin and M. L. Begeman, (1988) gIBIS: A Hypertext Tool for Exploratory Policy Discussion. *ACM Transactions on Office Information Systems*, Vol 6(4), pp303-331
- [22] T. van Gelder, (2003), Enhancing Deliberation Through Computer Supported Argument Mapping in P. A. Kirschner. and S. Shum and C. S. Carr, *Visualizing Argumentation: Software tools for collaborative and educational sense-making*, Springer Verlag, London. p97-115

- [23] J. L. Yearwood and A. Stranieri, (2006), 'The generic/actual argument model of practical reasoning', *Decision Support Systems* 41, 358-379.
- [24] S. Shum, A. Selvin, A. M. Sierhuis, J. Conklin, C. Haley and B. Nuseibeh, B. (2006) *Hypermedia Support for Argumentation-Based Rationale in* A. Dutoit, R. McCall, I. Mistrik, and B. Paech, B. (2006) (Eds) *Rationale Management in Software Engineering*. Springer. Berlin. P111-132