Lutz Maicher
Jack Park (Eds.)

Charting the Topic Maps Research and Applications Landscape

LNAI 3873

First International Workshop
on Topic Maps Research and Applications, TMRA 2005
Leipzig, Germany, October 2005
Revised Selected Papers

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Preface

The papers in this volume were presented at the workshop "Topic Map Research and Applications 2005" held on October 6-7, 2005, in Leipzig. TMRA 2005 was the first workshop of an annual series of international workshops dedicated to topic maps in research and industry.

As the motto "Charting the Topic Maps Research and Applications Landscape" suggests, the aim of TMRA 2005 was to identify the primary open issues in research, learn about who is working on what, bring together researchers and application pioneers, stimulate the systematic tackling of such issues, and foster the exchange of ideas in a stimulating setting. Besides the scientific track, open-space sessions were foreseen as playgrounds for visionaries. A report from this look into future is added to this volume.

TMRA 2005 was organised by the Zentrum für Informations-, Wissens- und Dienstleistungsmanagement Leipzig to support exchange of experiences, results, and technology in the field of topic maps. The 24 papers (1 invited, 17 full papers, 5 work-in-progress reports, and 1 report on the open-space sessions) presented at TMRA 2005 and in the present volume were selected from more than 35 submissions. Every submission was carefully reviewed by three members of the Program Committee. Before publishing, the editors introduced an additional editorial loop after the workshop to ensure the highest quality and latest insights.

We would like to thank all those who contributed to this book for their excellent work and their great cooperation. Susanne Bunzel deserves special gratitude for her great effort and perfect work at the workshop site.

We wish to acknowledge the substantial help provided by our sponsors: Emnekart Norge, the Medienstiftung der Sparkasse Leipzig, Ontopia, and Jubik.

We hope all participants enjoyed a successful workshop, made a lot of new contacts, held fruitful discussions helping to solve current research problems, and had a pleasant stay in Leipzig. Last but not least we hope to see you again at TMRA'2006 which will be held in October 2006 in Leipzig.

December 2005

Lutz Maicher (Chair)
Jack Park

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TMRA 2005 was organized by the Zentrum für Informations-, Wissens- und Dienstleistungsmanagement (ZIWD) in Leipzig, Germany.

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Topic Mapping: A View of the Road Ahead*

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Abstract. Topic mapping plays several important roles in augmentation of human cognitive capabilities and relational thinking. We summarize three such roles as resource indexing, culture fusion, and modeling. Based on a working hypothesis that combinations of technologies can benefit topic mapping capabilities, we sketch a proposed marriage between Conceptual Graphs and the TMRM variant, Subject Maps. The marriage of technologies is shown to be one of several ways forward for topic mapping.

1 Introduction

> *When we seek for connection, we restore the world to wholeness. Our seemingly separate lives become meaningful as we discover how truly necessary we are to each other.*
>
> – Margaret J. Wheatley[1]

In this talk, I propose to briefly sketch three use cases for topic/subject maps. My goal is to paint a kind of picture of the present state of the art. I will then form a working hypothesis from which this talk will imagine a path, one among many possible paths, for future developments in topic mapping. The largest sense in which this talk paints a story is that knowledge work, a problem solving human endeavor, is an exercise in *relational thinking*. We create and manipulate information resources, some of which represent static phenomena and objects, those which almost never change. Some of those information resources represent dynamic phenomena and objects, where subjects change, relationships between subjects change, and some changes occur relatively slowly while others occur at a rapid pace.

Relational thinking is based on the principle that, to understand any network of entities, we need to understand the relationships between the nodes in that network. I would add to that *text book* definition of relational thinking that we need, also, to pay attention to the nodes themselves in the sense that we always agree on the identity of the subjects those nodes represent. That's unadulterated *topic map speak*, something that permeates the rest of my talk. Indeed, topic maps represent a class of knowledge representation schemes, among the simplest possible architectures, that facilitate

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* Keynote address presented to the International Workshop on Topic Maps Research and Applications, Leipzing, Germany, 6 October, 2005.

[1] Wheatley quote: In *Leadership and the New Science,* Barrett-Koehler Publishers, San Francisco, 1999.

L. Maicher and J. Park (Eds.): TMRA 2005, LNAI 3873, pp. 1 – 13, 2006.

representation of subject identity combined with representation of relationships among subjects.

Consider a recent news item[2], due to which our understandings of the mechanisms of immune response are now subject to possible revision. The news item suggests that, with ever improving sensor technology, a new mechanism within the immune system has been discovered. The discovery is that tunnels are formed between immune cells, for which we have few, if any, theories, models, or present understandings. Present immune response theories speak in terms of message passing among immune cells by means of various cytokines secreted by one cell and binding to the receptor sites on other cells. The new discovery suggests that molecular messages might be sent through tiny tunnels forged between cells. The number of subjects related to immune mechanisms has grown, and new relationships among those subjects now exist, while other relationships may have changed in other ways. This news item animates a primary motivation behind my talk, that we are in the midst of ever-changing, ever more complex relational situations, about which we need to maintain our organizational and inferential capabilities. For a brief look at scholarly work that influences this talk, I'll turn now to the story of one individual who saw these changes coming and spawned a new line of thinking that provides a means by which we can think about discoveries such as those revealed by improvements in sensor technology.

Nicholas Rashevsky, in his 1954 paper "Topology and Life: In Search of General Principles in Biology and Sociology" [10], said that we had neither sensors sufficiently powerful nor the representational mechanisms appropriate to formation of models of complex systems in sufficient detail to fully understand them, much less create and manipulate life itself. Rashevsky launched a program we now call *Relational Biology*, which argues that we need to evolve ever more powerful tools of relational thinking. Shortly, I'll show how Robert Rosen continued the inquiry started by Rashevsky. The field of relational biology grew at the same time that humans were beginning to recognize the need to think of complex systems as something other than machines; there began a shift away from simple Newtonian mechanics as a means of thinking about things toward a more holistic approach, a relational approach. I hope to convey the message that I see augmented subject maps as useful contributions to the emerging armamentarium of tools for relational thinking.

How do we presently conduct relational thinking? It is said[3] that *language* is the longest running open source project in the universe. With language, we tell stories, we communicate, among other means, by conversation. If we consider our day-to-day activities with productivity tools as *dialogs* with those tools, then we can cast our thinking in terms of *conversation theory* [11] due to Gordon Pask[4]. Conversation theory models speakers and listeners engaged in dialog. Each participant has a *domain model*, a knowledge base from which all speaking occurs and in which all interpretations of incoming information streams occur (Fig. 1 illustrates a conversation).

Each participant has a *listener model*, a kind of knowledge base that provides guidance in selection of ways from which the speaker chooses to present information to the listener. If the listener is a child, words chosen are those appropriate to some imagined vocabulary that is different from the vocabulary appropriate to an adult listener.

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[2] News Item: http://www.sciencedaily.com/releases/2005/09/050929083640.htm

[3] I attribute this assertion to Patrick McKercher.

[4] Gordon Pask: http://www2.venus.co.uk/gordonpask/

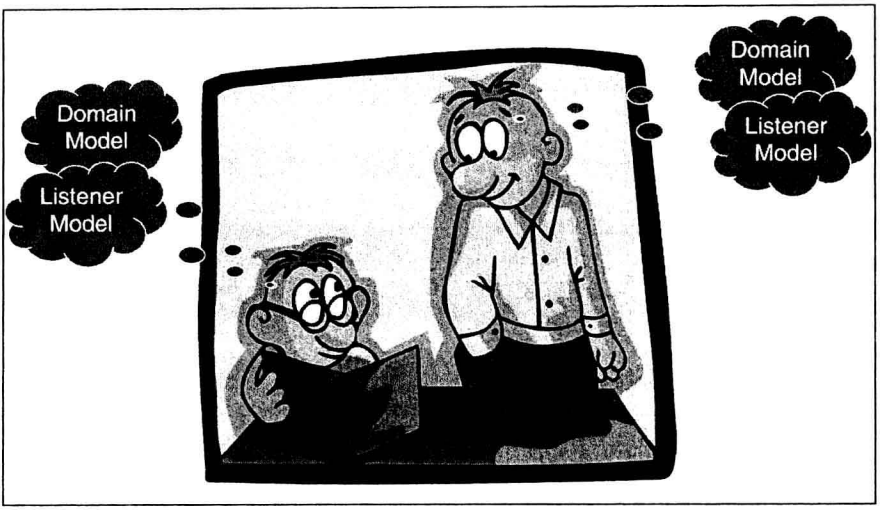

Fig. 1. A Conversation

If we allow that one participant in a conversation is sometimes a computer program, a productivity tool, it follows that there is an opportunity to turn our productivity tools into the kind of listener/speaker with which we would otherwise prefer to converse. Indeed, it remains a seductive notion[5] that if our relational thinking tools *behave* more like humans during our interactions with them, they will prove even more valuable. This implies implementation of domain and listener models, at least to the extent that our productivity tools can *behave* in a fashion appropriate to the conduct of conversations. The domain of discourse in which productivity tools operate varies. Each domain involves possibly large quantities of possibly heterogeneous information resources, all sorts of document types, media types, and so forth. Topic maps, and their more recent counterpart, *subject maps*, provide us with a means by which we can organize information resources associated with various subjects according to the needs dictated by different users playing the role of listener when querying the map. If the map is a component in a productivity tool, then we have taken a first step in augmenting human cognitive capabilities by adding relational thinking tools to the conversation.

Let thoughts of conversation theory, relational thinking, and topic maps serve as a framework for the rest of this talk. That framework is based on the notion that one logical direction for future research and development in the topic mapping community is that of augmentation of human cognitive capabilities through improved productivity tools.I will offer a proposal for a means by which our tools for relational thinking can be improved. I will start with a sketch of three use cases for subject maps within such tools. From those use cases, I will propose a new direction of research,

[5] Seductive notion: Thanks to Lutz Maicher for reminding me of this notion in personal communication, 28 October, 2005.

one in which we consider the marriage of subject maps with other tools known to support relational thinking. In all that follows, the diagrams and words I offer represent my own interpretations of the TMRM specifications as variously offered and continuously evolving.

1.1 Use Case: Indexing Information Resources

Indexing information resources is the original use case for topic maps. This is the classical *back of the book* indexing approach implemented, first, in SGML topic maps, and later in XML topic maps [5] using the XTM standard[6]. More recently, the TMRM [1] is evolving to create a flexible version of the topic mapping paradigm, now called subject maps.

In this use case, the key elements of topic mapping, topics, associations, and occurrences are applied to the indexing task by creating a topic map that resides completely *outside* the information resources, just as the index at the back of a book resides outside the content of the book, providing pointers into the book's contents for each subject indexed.

By way of contrast, the TMRM, subject mapping as implemented in the Versavant[7] reference platform, uses a *subject proxy* as its key object for performance of the same indexing task. It is outside the scope of this talk to discuss the implementation details of the TMRM, but some aspects of that implementation will be illustrated in Section 2 below. To anticipate, a subject proxy serves as a container for all of the properties associated with a subject. Properties include those which serve to *identify* the subject, and all of the other properties, including *castings* of the subject into roles in defined relationships.

1.2 Use Case: Culture Fusion

> *People are human Rosetta stones which can (but don't always) bridge universes of discourse.*
>
> –Patrick Durusau[8]

> *If a person wants to allow his/her ability to serve as a Rosetta stone for multiple (always specific) universes of discourse to be exploited by as many other people as possible, and without constantly answering the telephone and/or e-mail, she/he can codify her/his Rosetta stone-ness as a TMA.* [Topic Map Application].*Thus, the subject maps paradigm shows a way to make *human* understandings about *human* universes of discourse widely machine exploitable.*
>
> –Steven R. Newcomb[9]

I like to think of this use case as a second *primary* use case for topic/subject mapping. Culture fusion implies codifying personal Rosetta stones, personal world views, into a

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[6] XTM: http://www.topicmaps.org/
[7] Versavant: http://www.versavant.org/
[8] Durusau quote: Personal communication, 23 September, 2005.
[9] Newcomb quote: Personal communication, 23 September, 2005.

subject map such that all interested parties can derive shared understandings of specific universes of discourse. Consider a subject map which is designed to *federate* several research databases in some discipline, say, neurophysiology. In the chosen domain, it is known that researchers who develop individual databases may not use the same naming conventions or other terminology to talk about subjects, each of which is also potentially a subject in other databases. Through the flexibility of naming conventions in topic and subject mapping, it is possible that, once subject identities are agreed upon among those workers for which databases will be federated, understanding of the ways in which each research database represents various phenomena and objects will evolve much closer to a kind of consensus reality. In this case, we see personal Rosetta stones being mapped to a common organizing and viewing framework, the subject map, creating and maintaining a kind of *just for me* [8] reality.

"Just for me" refers to the notion that individuals work best when they are able to maintain their personal ontologies and world views, and to record those world views, e.g. names for things and relationships among things, in such a fashion that the *just for us* notion of semantic interoperability is maintained within individual research communities. That is to say, mapping a research database to a topic map may, or may not map highly personal information resources into a public map. Workers using individual research databases do not necessarily share their private view, just those associated with the need to publish their work. Whatever culture exists and is reflected in world views in the database is maintained, not sacrificed to the larger subject map. The example chosen here illustrates the nature of culture fusion: different research cultures federating their results to the larger research community while preserving the individuality of individual research groups. To the extent that each database is federated, bridges between cultures are formed.

Consider a different kind of culture fusion, one in which storytelling permits individuals and groups to share world views. This scenario illustrates a particular marriage of technologies involving topic maps. In this case, the technologies coupled with topic maps are storytelling and dialog mapping[10]. A graphical illustration of dialog mapping is Fig. 2. I call this marriage Augmented Storytelling[11]. Here, stories are substituted for research databases, and a kind of online collaborative discussion arena, dialog mapping, is added to the mix.

A topic map federates stories by mapping them in great detail, the detail being based on fine-grained addressability of information resource available in each story. Here, I am arguing for making, say, each paragraph, each figure, table, or multimedia resource in a given story directly addressable. Thus, it should be possible to isolate an individual paragraph within a story. With that addressability, it is now possible to present each resource on its own webpage, a place on the web where people can congregate and discuss aspects of the resource using a dialog map, and they can richly *decorate* that resource with links to other resources. Links to other resources involve a kind of ontology of link types, precisely what associations in topic maps provide. Thus, each individually-addressable information resources within each story can be a role player in one or more associations other information resources found in the same story or elsewhere on the web – any other addressable information resource.

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[10] Dialog Mapping: http://www.compendiuminstitute.org/

[11] Augmented Storytelling: http://www.nexist.org/nsc2004/

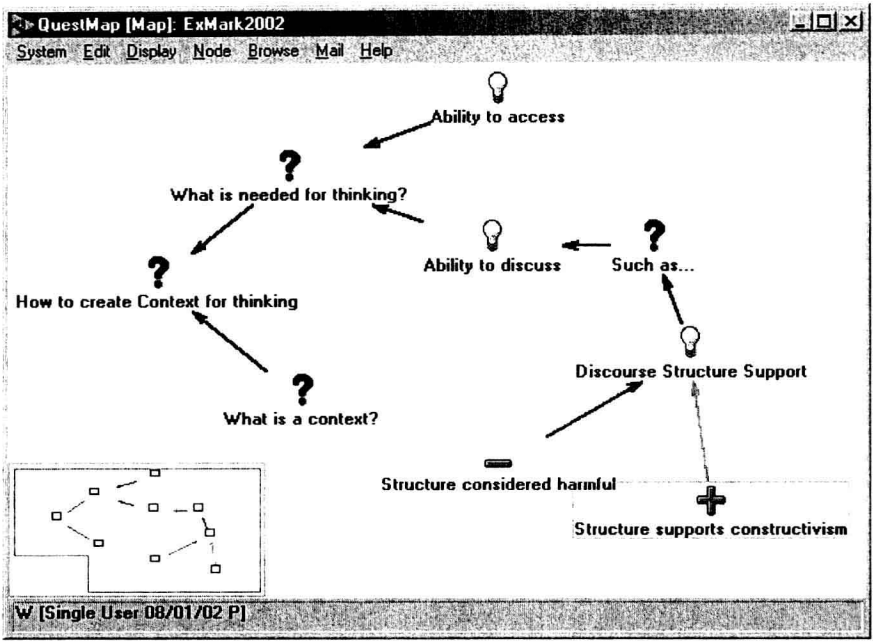

Fig. 2. A Dialog Map of a simple conversation

At the same time, that information resource can be the subject of discussion or debate using dialog mapping. Original authors can take the results of discussions and, where deemed appropriate, edit that resource to suit new ideas and world views, or correct mistakes found during discussions. It should be no surprise that the dialog map turns out to provide subjects for the topic map. Thus, the topic map serves to federate the stories crafted by individuals, while, at the same time, federating the discussions people are having about those stories.

1.3 Use Case: Modeling

When you come to the fork in the road, take it.

–Yogi Berra

Topic mapping is already about modeling domain knowledge as a means of organizing information resources. That's the historical perspective. What does that leave us in terms of a bright and productive future? It leaves us with a fork in the road. Let's take it.

Consider the immune response mechanism mentioned earlier, a newly-discovered tunnel that forms between immune cells and through which molecular messages are passed. We already know how to model such actors (subjects) and relationships (also subjects) in our subject maps. Now, we want to *reason* about those subjects to extend our knowledge and understandings. There is a clear opportunity to use analogical reasoning in order to form hypotheses from which we can design and conduct experiments and produce theories, even therapies that, in this case, involve immune

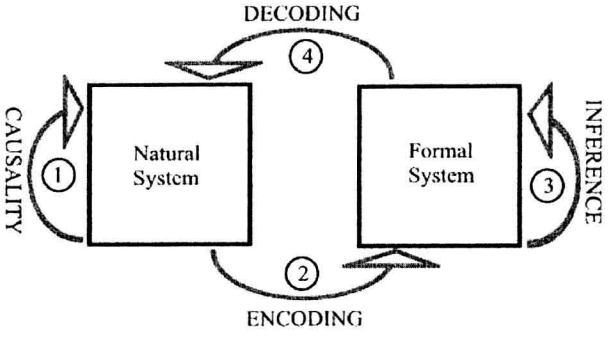

Fig. 3. The Rosen Modeling Relation[12]

response modification. That opportunity exists because similar tunneling mechanisms exist elsewhere in the physiology of animals. Let us now imagine ways in which we can *extend* the existing subject maps modeling tools such that we facilitate forms of reasoning not present in the existing topic maps technology.

My thoughts on modeling return to the relational biology program started by Rashevsky, mentioned earlier. That program eventually led to the work of Robert Rosen [2], and his *modeling relation*. Fig. 2 illustrates Rosen's modeling relation. Rosen continued the Rashevsky inquiry by adapting a topological algebra[13] to the representation of complex, anticipatory systems, of which all living things are instances. As an aside, there are several practitioners of topic mapping who foster the intuition that subject maps might eventually be shown to be similar to that topological algebra in ways that allow topic maps to inherit analytical tools from that algebra.

The kind of modeling I am proposing is that of the *formal system* of Fig. 3, in which we map encodings from *natural systems*, the world 'out there', into a formal system. We tailor the relationships represented in the formal system in such a way that inferences in that formal system mirror, in some sense, causality that exists in the natural system being modeled. In some sense, I am claiming that our subject maps, when suitably enhanced, can play important roles in such modeling activities. Which roles? It is natural to expect that a central role of a subject map is to maintain subject organization and context in which the reasoning systems of our formal models operate.

How might we enhance our subject maps? Below, I will offer a modest proposal, one in which the technology of conceptual graphs [3] is married with subject maps [1]. First, I offer the working hypothesis that animates this talk.

1.4 An Hypothesis

The words for my hypothesis were thoughtfully supplied to me by Bernard Vatant[14]. The hypothesis merely summarizes the kinds of things I have stated above, opening a door through which one path to the future follows.

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[12] Modeling Relation: Copied with permission from http://www.panmere.com/ rosen/ faq mr1.htm

[13] Topological algebra: Category Theory.

[14] Bernard Vatant: personal communication, 30 September, 2005.