
Topic Maps for polyscopic structuring of information

Tommy W. Nordeng*

Cerpus AS, 8342 Alsvåg, Norway

E-mail: tommy@cerpus.com

*Corresponding author

Rolf Guescini

Department of Linguistics and Scandinavian Studies,

University of Oslo,

Oslo N-0316, Norway

E-mail: rolfbg@grace.uio.no

Dino Karabeg

Department of Informatics,

University of Oslo,

Postbox 1080 Blindern,

Oslo N- 0316, Norway

E-mail: dino@ifi.uio.no

Abstract: In this paper, we argue that information overload is caused by fragmented information with no high-level information helping to assemble the fragments into meaningful wholes. We argue that a methodological approach is needed to propose the Polyscopic Modelling as a possible way to organise information into meaningful wholes. We also look at how polyscopy could be implemented by using Topic Maps (TM) and discuss the possibility of creating design patterns on the basis of the proposed methodology to help the everyday users in their informing.

Keywords: Topic Maps (TM), information design; polyscopy; contextualisation; Semantic Web; flexplearn; e-learning; e-portfolio; BrainBank Learning.

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Biographical notes: Tommy Nordeng is the CEO of Cerpus AS, a small Norwegian company (<http://cerpus.com>). He holds a PhD in Molecular and Cellular Biology from the University of Oslo and has post doctoral experience from Harvard Medical School. In addition, he has pedagogical education and experience. Cerpus has developed BrainBank Learning, the first pedagogical learning tool and ePortfolio system based on the new Topic Maps standard.

Rolf Guescini is a graduate student in the Department of Computer Science and Linguistics at the University of Oslo. He is working in the field of Information Design and e-Learning, specifically with the use of Semantic Web technologies and Topic Maps.

Dino Karabeg has a doctorate in Computer Science (Algorithm theory) from the University of California at San Diego. Since 1992, he has been an Associate Professor in the Department of Informatics, University of Oslo, where he is developing a methodological approach to the use and creation of information.

1 Introduction

Information overload is a familiar anomaly to motivate the polyscopic structuring of information. This is not a new concept. In 1945, Vannevar Bush realised that we were going to drown in poorly structured and detailed information created by everyday information (Bush, 1945). Until now, the internet and most information providing channels have proven him right. The amount of information has increased dramatically (Lyman, 2003) and we have not yet found an adequate solution to this problem (Wurman, 2001).

A parallel with the early history of computer programming suggests an approach to handling information overload, which is advocated in this article. Early software development projects resulted in thousands of lines of 'spaghetti code', called so because of their chaotic, spaghetti-like structure, which led the industry into a state of crisis. The solution was found by creating programming methodologies, which provided guidelines for structuring programs (Dahl et al., 1972). Based on these methodologies, high-level programming languages were developed, which supported suitable modular program structures. The generic go to program control instruction, which led to the spaghetti code by allowing for arbitrary jumps from one context to another, was replaced with structured control statements such as REPEAT WHILE, etc.

The similarity between these two situations, the information overload and the 1950s crisis in the software industry, is quite striking. Now a new technology emerged, which allowed the people to overproduce in both volume and complexity. Now the ways of handling things, which were created for smaller volumes, no longer work for larger ones. We are overproducing poorly structured information (Wurman, 2001). Furthermore, presently we have no underlying metaphor or methodology and no systematic structuring methods or constructs. Indeed, it is not difficult to see, from the point of view of our parallel, that the hyperlinks are similar to the go to, in the sense they allow for arbitrary jumps from one context to another. The consequence is that the internet information is usually ill-structured (in a spaghetti-like manner), similar to early computer programs.

There is one significant way in which our analogy fails. When a team of programmers can no longer make use of a programming strategy (they are familiar with) to write a program, this situation is easy to detect: the program will not run on the computer. Then, different programming strategies can be tried until they find what really works in practice. However, a generation of people can no longer understand or make

use of the information they have inherited and/or produced, the situation is not so easy to discover and even less comfortable to experiment with. If possible, we should learn from the history.

Fortunately, with information overload we are in a situation where we can learn from the history. In these two situations, being in every regard similar, it seems reasonable to expect that similar ideas and similar techniques might work. The first and most important idea is to base the information organisation on a methodology, which can replace our habitual ways which no longer work. What is needed a collection of structuring principles and techniques, analogous to the ones introduced by early programming methodologies. As an initial, prototype solution we propose the Polyscopic Modelling methodology.

2 The need for a methodology

An information design methodology is a written convention whose purpose is to orient the creation and use of information. To demonstrate the possibilities of the methodological approach to information, a prototype methodology called Polyscopic Modelling is developed at the University of Oslo (Dahl et al., 1972, Karabeg, 2003a).

2.1 Why do we need to bring structure to information?

It is not difficult to see that at present the web information is as poorly structured as the early programs were. If one opens a typical commercial website in a browser, one will find that it is organised as a collection of fields representing information capsules more or less randomly assembled together. Some of them are moving and blinking to attract attention, but there is practically no overall structure, no overall organisation. The organisation of the web as a whole is even worse. We have hundreds or millions of websites existing as dislocated units, as points in an enormously large space, with no structure that would connect them and organise them together. These websites are, of course, occasionally connected with each other via hyperlinks. But these hyperlinks are strikingly similar to the old go to: you click on one and you are transferred to another website, where you can also find hyperlinks which can take you somewhere else. After several such clicks the chances are that you will not know where you are and why you are there, a situation often referred to as cognitive overhead; the additional effort and concentration necessary to maintain several tasks or trails at one time (Conclin, 1987).

We have produced too little 'high-level' information. High-level information is needed to tie all our dispersed information together. Information is fragmented because there is nothing on the higher level, which binds and unites information of the same subject domain together. Also, to tell us on a higher level the essence of each of them, so that we know, for our lives or for our purpose at hand, whether the information in question is necessary or not.

2.2 Bringing structure to information

As Bush saw that the sequential presentation of information did not map how the human brain actually functions when advocating what can be seen as early hypertext (Bush, 1945), we could use the same type of analogy for our problem. Our body and our senses

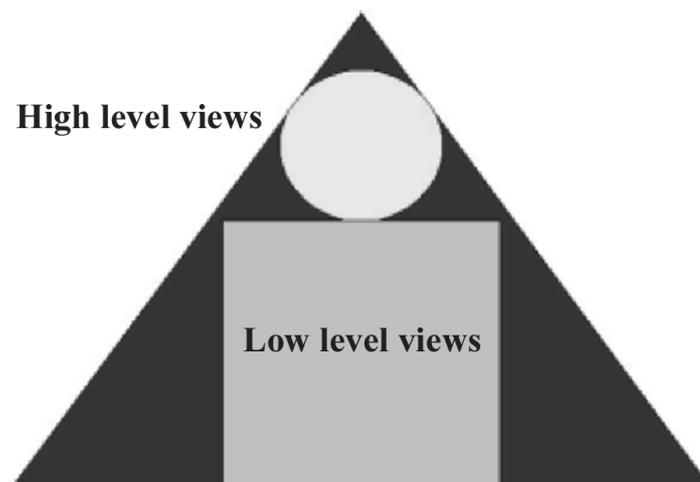
give us a clear intuitive idea of our current position and a way of looking at any point of time, and thereby also an intuitive distinction between what is large and central and what is small and peripheral. One of the main challenges in polyscopic information presentation is to retain this awareness also in the virtual world. This practically means that we need to organise the information in such a way that the reader has a clear intuitive idea of the scope, as if he/she were walking on a mountain, having a clear view in all directions.

2.3 *The vertical dimension*

One of the gravest problems of information overload would be the fragmentation of information. As the amount of information grew, to deal with it, people had to specialise. They would create furthermore information within their own subfields and thus creating virtual 'islands' of information. We have too little meta-information, which would connect our islands together and which would give us an overview. In other words, the root of our problem is that we have too little information on the higher level.

It is suggested that the high-level information should give us an intuitive idea or at least a more holistic view of the information present within a subject domain and allow us to grasp at a glance what the whole thing is about. The polyscopic information is represented by the ideogram in Figure 1. The 'i' in the ideogram stands for 'information' or 'polyscopic information'. The information 'i' is inscribed in a triangle, which represents the hierarchy of scopes and views or the metaphorical 'mountain'. In this way it is suggested that the polyscopic information is hierarchically structured and consists of two fundamentally distinct parts: the high-level part, the big, holistic circle and the low-level part, where the details are organised in terms of aspects. There is a bit more than just an organisation here. One can use the high-level view as a kind of a claim, a kind of a summary or a kind of a point. The circle is the point. You can use the low-level information to explain, establish, prove or justify this main point.

Figure 1 The Polyscopic Information Ideogram

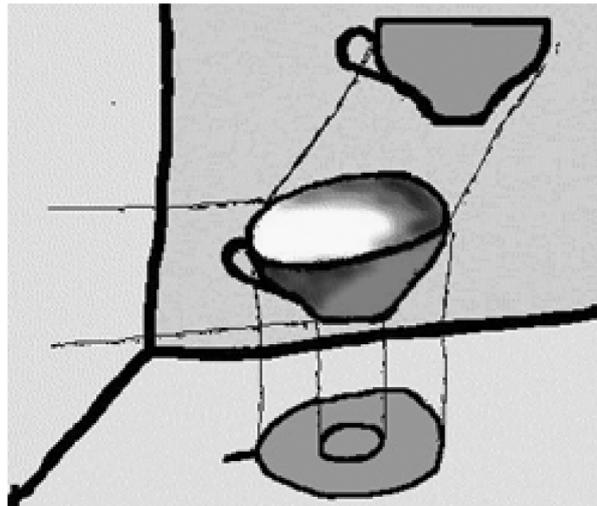


2.4 The horizontal dimension

One of the fundamental principles of Polyscopic Modelling is that the scope determines the view. In our present context of information structuring, this principle demands that the reader or the user of information is given the possibility to choose one out of a number of provided coherent views or modules by selecting the corresponding scope. This gives the reader the control over the order in which information is accessed.

As in the case of vertical abstraction, the aspects also give us a simplified picture. The ideogram in Figure 2 suggests some of the key points about horizontal abstraction. We simplify by doing something which people do when drawing technical objects, namely by choosing an angle of looking or a 'projection plane' and by showing only that which is visible from that angle or within the plane. As the ideogram suggests, when you project the object on a plane, provided that the angle of looking is suitably chosen, you may get a very simple picture. But this picture does not show you the whole. To see the whole thing, you need to use several projection planes or several aspects. So the art of horizontal abstraction, same as the art of technical drawing, will consist mainly in finding a suitable small selection of 'angles of looking' or 'projection planes' or scopes, so that each of them gives a simple side view of the whole and so that together they represent the whole thing.

Figure 2 The horizontal dimension of aspects



2.5 Holistic information

Now let us put these two pieces together the circle and the square. An important message of our Polyscopic Information Ideogram (Figure 1) is that information (i) is not complete if it has only a circle or only a square. Both are needed. Complete information must have both the high-level and the low-level views combined together but distinguished from one another.

Furthermore, as in the ideogram the square serves as the pedestal or the foundation for the circle, so does the low-level information serve as the foundation for the high-level view. For information to be complete, it is not sufficient to give a single point. The point is not really made and the information is not really complete, unless all the relevant views, all the main levels and all essential aspects are given.

3 Coherent modules

To continue the line of analogy with the nature of our mind and body, we could also look to the natural world. There are infinite details have too. The reason why we do not have information overload when we look at the natural world is because we use the scopes and views. The world is structured by our eyes and the mind. The reason why we have information overload in created information is that we have failed to transfer and apply this natural principle. So the world, as we see it and as we conceptualise it, is already hierarchical, it is already polyscopic. All that remains for us to do is to represent it in this way.

Hierarchical organisation is a natural way and according to some (Wurman, 2001) the only way to tame complexity. If you are dealing with the whole thing at once, the whole jungle of detail, the whole universe of information, of course it is overwhelming. But if you are dealing with a small chunk at a time, then of course it is manageable. This is the basic message we have learnt from computer programming to tame complexity, modular, hierarchical organisation is needed. We apply the same very basic principle to information at large.

The polyscopic representation is hierarchical and modular. As we use modules to simplify the computer programs, we should use them also with information. We distinguish between the high-level and the low-level modules. The high-level module gives us a big picture. The low-level modules give us the details, usually ordered hierarchically and possibly into further high-level/low-level modules. One essential thing about these modules is that every one of them is coherent. That means we do not mix together the big picture and its details. We make sure that the big picture is presented distinctly in the high-level module, and the details are in the low-level ones and that each low-level module represents a coherent point of view, perhaps by assigning to each a distinct aspect. Maybe one of them will be talking about functions, another one about explanations. So that when you are in each of the modules, you see a simple picture. In this way, complexity is made manageable.

So why do we advocate a whole methodology? Because it is not enough to just put the existing information together in a modular fashion. We need ways to create high-level information. It does not exist. We need a way of thinking about information in a hierarchical way: terminology, criteria and principles.

4 Polyscopic information structuring and navigation

Every computer programming methodology provides a specific organising principle or metaphor from which a suitable set of structuring concepts and methods readily follow: structured programming is based on the idea of a hierarchy of modules, representing the levels of abstraction; object orientation is based upon the metaphor of an object and

the idea of programming as modelling a real-life object by focusing on the object's functions. The Polyscopic Modelling methodology provides a framework for structuring information based on the notion of scope. Structuring information in terms of scopes is easily understood by using the metaphor of a mountain, where each standpoint is a viewpoint or scope.

Abstraction has proven to be the key to tackle the complexity of computer programming. In the Polyscopic Modelling, three kinds of abstraction are given for tackling the complexity of information: vertical (modelled by the notion of levels), horizontal (modelled by the notion of aspects) and structural (implemented by polyscopic document structure and navigation).

These levels intuitively correspond to the levels on the mountain. Like the view from the top of the mountain, the high-level information provides a large picture or an overview, which allows us to comprehend a phenomenon or to choose the way of handling an issue. These low-level views provide the details. The aspects correspond to the angles of looking, reflecting user needs, user categories, distinct aspects of the subject covered, etc.

The overall structure of a document in terms of modules, reflecting distinct levels and aspects, is presented in a visual form and used for navigation. Polyscopic navigation is based upon the principle 'The scope determines the view', which in this context means that the user is given the possibility to select the desired view by choosing among the available scopes. Intuitively, the scope is a control knob for navigating between views. A suitable visual representation of the modular structure, with a clear indication of current scope, serves for orientation.

4.1 The polyscopic methodology criteria

The Polyscopic Modelling methodology orients the creation and use of information by providing explicitly defined criteria (Karabeg, 2003b):

"The perspective criterion states that information needs to allow us to see the described issue or phenomenon as a whole, in correct proportions, with nothing essential left obscure or hidden."

A clear perspective means that nothing is left hidden or obscure, that every part of the whole is visible. This does not mean that all the details are necessarily given in one picture on the contrary. If too many details are given, the perspective is no longer clear. Suitable scope and in particular the right level in the polyscopic hierarchy must be chosen to make a subject transparent. The underlying credo is that the complexity is in the eyes of the beholder and that every subject can be made transparent by a suitable choice of the scope.

"The nourishment criterion draws due attention to subtle ways in which information influences our values, emotions, preferences, habits, etc."

Here 'nourishment' is used as a metaphor. Information, such as food, has hidden but essential effects, which must be consciously taken into account. As food nourishes our bodies, so does information nourish our feelings, ideas and values.

"The relevance criterion states that information must be prioritised according to the purpose that information needs to fulfill."

This criterion advocates a departure from the common belief that every ‘true’ piece of information is also relevant because it is a piece in the ‘reality puzzle’. We live in a world where very many things compete for our attention. There are certain functions which information must fulfil for us. There are also some truly wonderful things that information may do for us. We must consciously secure that the information, which is truly relevant and useful, is given priority.

“The foundation criterion states that information must be reliable and verifiable (or proven).”

Every piece of information needs to be founded as solidly and as broadly as possible. The foundation is broad if it is accessible to many people and if it uses multiple types of judgement. The foundation is solid if it cannot be ‘falsified’, for example, by an expert. Specific methods are being developed for creating information, which satisfies these criteria. It is argued that, to satisfy the proposed criteria, as well as to be able to remedy the information overload and other information-related anomalies, information needs to be structured in a polyscopic way (Dahl et al., 1972; Karabeg, 2003a,b).

5 Semantic Web or seamless knowledge

The recent move towards semantic technologies has resulted in two standards for interchanging semantic information: Resource Description Framework (RDF) (Berners-Lee et al., 2001) and Topic Maps (TM) (Park and Hunting, 2002). TM is an ISO standard that originates from work on back-of-book indexes and has much in common with library science tools like glossaries and thesauri. RDF, on the other hand, has its roots in formal logic and mathematical graph theory and is the W3C standard framework for expressing metadata (including taxonomies). The relationship between these two standards has long been a hot research topic, as well as a source of confusion for users. The exact relationship is difficult to pin down, since although their application areas have substantial overlaps, the technologies themselves are very different. Perhaps the biggest difference is that TM approach knowledge representation from the point of view of human beings, whereas RDF takes a machine (or logic) approach (Pepper, 2002).

The design goal for TM is to be able to have advanced indexes that could support information findability via navigation and searching and where the indexes could be automatically merged to create new, more complete indexes. To do this, support for global identity of concepts is needed and TM has this. TM has been variously described as “the GPS of the information universe” and as “the enabling technology for Seamless Knowledge”. RDF, on the other hand, comes out of the W3C attempt to create the Semantic Web and is meant to support global, public knowledge interchange (Berners-Lee et al., 2001).

The organising principle of TM is topics, which represent entities from the application domain (known as subjects). Topics can have types (such as person, organisation, country, ...) and any number of names. The names can have a context attached, so that it is possible to distinguish between default name, obsolete names, names specific to a language, corporate culture or specific technical jargon and so on. However, most of the power of TM comes from associations, which represent relationships between the subjects in the domain. Associations are typed, so that they

can be used to make specific statements like “this person is born in this country”, “this document was written by this person”, and “this city is located in this country”. Associations are, through the use of roles, inherently bidirectional and can support relationships involving any number of topics. Occurrences are used to connect topics to information resources that are relevant to them. The information resource can be any kind of resource, as the topic map references it via a URI. Occurrences are typed and so for a person, for example, one can distinguish between the biography, a portrait and the person’s home page. Occurrences can also be simple properties, which can be used to capture information such as the date of birth, phone number, etc.

Another key concept in TM, hinted at above, is that of identity. Topics can be assigned identifying URIs, which give them a global identity, allowing a topic map system to tell whether or not two topics in two different TM represent the same subject. This is extremely powerful and allows TM to be merged automatically and can also be used to automatically aggregate information from disparate sources.

Obviously, the TM standard provides a suitable language for representing the conceptual knowledge that a student acquires during learning. This knowledge can also be used to distinguish learning resources semantically, by connecting the resources to the concepts in the topic map. To realise their main purpose, indexing information resources, TM embody knowledge, TM are very suitable for representing the knowledge taught in a course unit (oxygen and hydrogen are chemical elements and water is a chemical substance formed from oxygen and hydrogen, etc.) and so including a topic map of the contents of a teaching unit would substantially enhance its value.

6 Combining TM with polyscopic structuring and navigation

The data model of TM is suitable for implementing the polyscopic structuring of information. Any statement in a topic map (such as the assignment of a name, an association or an occurrence) has a scope attached to it. This defines the validity of the statement and can be used to capture differing points of view in the same topic map (Karabeg et al., 2005). One of the strengths of TM is exactly to create the high-level information layer that the dispersed information already lying on the internet desperately needs.

6.1 Implementing the vertical abstraction

If we need to create constructs to implement the vertical dimension, we would have to consider making modules to represent the high-level and the low-level views, respectively. The ‘high-level’ and ‘low-level’ types would have to be created. Then, any module topic would have to instantiate its respective typing topic. Using associations like ‘superclass-subclass’, ‘class-instance’ or some other fitting association types like, that is, ‘part-whole’ or even ‘high-level/low-level’, one can easily create hierarchies and design the underlying structure on which taxonomy-like levels can be based. There is also a question of creating presentations where one wishes to create modules that gradually contain more and more detailed knowledge within a subject domain; this too would be accomplished through the use of some association type like more/less detailed.

One would have to remember though that even if one has made a low-level topic, it is still considered a high-level abstraction for the information fragments being the dispersed

occurrences. A solution would have to be task-specific, where one would have to consider making a ‘high-level’ or ‘low-level’ type of topic to represent the information fragments (occurrences) and then add the fragments as occurrences to that topic or instead just rectify an occurrence as a topic of type ‘low-level’ to attach metadata to it.

6.2 *Implementing the horizontal abstraction*

Polyscopic navigation is based upon the principle ‘The scope determines the view’ and the topic map scopes naturally implement the horizontal abstraction, that is, the Polyscopic Modelling aspects. One way of implementing the horizontal abstraction would be to create scoping topics for every aspect needed in the presentation and attach them to the associations used to implement the vertical abstraction. The filtering that gives the user the possibility to select a view would be dependent on computing (done on the application layer) based on these scoping topics.

```
[high-level = "High Level View"]
[low-level = "Low Level View"]
[aspect = "Aspect"]
[high-low-level = "High Level view"/high-level = "Low level view"/low-level]
[t1-high : high-level = "High level view of topic 1"]
[t2-high : high-level = "High level view of topic 2"]
[t1-low : low-level = "Low level topic 1"]
[t2-low : low-level = "Low level topic 2"]
[aspect1 : aspect = "One possible aspect"]
[aspect2 : aspect = "Another possible aspect"]
high-low-level(t1-high : high-level, t1-low : low-level)/aspect1
high-low-level(t1-high : high-level, t2-low : low-level)/aspect2
```

Trivial topic map to illustrate possible syntactical implementation. Written in LTM for brevity.

Actually, as we have illustrated, the topic map constructs on the syntactical level are fairly trivial. It is on the application layer that the real modelling of the polyscopic presentation takes place, but our goal is to show that the topic map data model is appropriate for implementing the polyscopic model. We could of course have used any markup language for annotating and complete the presentation work on the application layer. However, the topic map data model is as we see it, gives the best possibilities of creating high-level information layers leaving some of the abstraction to the syntax itself. It is also the data model that maps readily and ‘naturally’ to the polyscopic model.

6.3 *Implementing the structural abstraction*

Structural abstraction is about polyscopic document structure and navigation and most of its implementation would have to happen on the application layer. Since one would have to make the difference between high- and low-level modules discernible, this has to be taken care of by the use of topic typing. Each distinct module would have to be typed, upon which orientation within the presentation can be computed on the application layer.

As the application layer is a challenge for any topic map application developer, it would doubly be so for someone who wants to implement a polyscopic information application using TM. This applies especially to the navigation part, which is ridden with

the go to-problem inherited from hypertext links if one makes a web application, making it necessary to create good navigational structures to combat the problem. This is made easier already through the added computability given to us by the directed associations, scopes and topic typing. And, as we see it, it is the combination of the topic map data model and the polyscopic structuring and criteria that will help the developer reach the desired goal of producing a holistic information presentation.

6.4 Do topic map authors use the TM model to its fullest?

The question remains though, does having tools to implement this view of information modelling, assure that topic map designs for one and also for the broader public, the ones that really produce the everyday information actually will use the topic map technology to its fullest extent and capability? Or more importantly, use the topic map model to create holistic information as this paper envisions it? Actually it may really be that the topic map model itself or the programming needed to implement a topic map application is too complicated for the broad user and that one has to make abstractions on top of the model to induce a greater use and production of topic map content.

A study conducted for authors of educational TM using the TM4L Editor shows that authors generally did not have problems selecting appropriate learning content and resources for their TM. The difficulties lie however in structuring the content using the topic map constructs. Topic map authors are often untrained in information classification and work in lack of controlled vocabularies and support from ontology analysts (Dicheva and Dichev, 2005).

Could it be that the creation of some kind of ‘Topic map design pattern’ for polyscopically designed TM could help the information designer in her work? By formalising design insight into a pattern, designers and programmers are able to talk to each other about them, to compare different patterns for a given solution and to develop a reusable ‘tool-box’ (Ahmed, 2003). Then tools or even software like TM4L could be built around these patterns, making it easier for the everyday designer to concentrate on creating the high-level information that is needed. It would also be a great step towards making it easier for these everyday authors to create topic map content easily.

6.5 Flexplearn

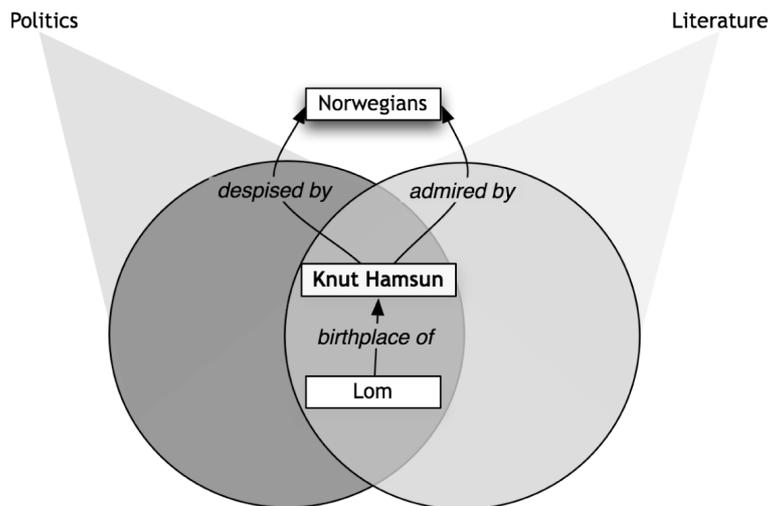
To develop and test polyscopic document structuring in practice, we have developed a prototype application to support flexible e-learning, called Flexplearn and used it in the Information Design course at the University of Oslo (Karabeg et al., 2005). In Flexplearn a polyscopically structured topic map is used for the placement and organisation of various learning resources. A hierarchy of concepts (taxonomy) is used to implement the levels. The taxonomy begins from the ‘top-of-the-mountain’ concept, which is ‘Information Design’ (the subject of the course) and develops through suitable subdivisions. These aspects reflect different types of documents, user categories and needs, etc. By using the taxonomy, the learning resources (books, articles, videotaped lectures, etc.) are assigned suitable levels and associated with general or specialised topics in the Information Design.

7 BrainBank Learning

BrainBank Learning (BBL) (Lavik and Nordeng, 2004) is a TM-driven web application for the learning of concepts and associations (how concepts relate to each other). Topics (concepts) that a student learns during education activities are entered and described. The topics can then be connected by linking phrases to form propositions or associations: the learner creates his own associated network of topics that represents his knowledge. This way of documenting in the learning process is good for the learner's understanding of the area of study (placing knowledge in a context), as well as navigating and overview of the acquired knowledge later on. To further describe topics and associations, digital resources such as documents, pictures, movie clips and sound clips can be attached to the topics. These resources can be either linked to or uploaded to and stored in the BrainBank. BBL is based on the TM standard, including the XML format supporting the TM ISO standard (XTM) (The Topic Maps.org Authoring Group, 2001). As the topic map standard defines an effective way of representing information through topics, associations, etc. (Biezunski et al., 1999), BBL uses this TM technology to represent the data in the application.

A case study has been done to evaluate practical use of BBL and to find out if it helps improve learning to become more effective. The project has been a cooperative effort between Krsitin Bjørndal at PLP (Program for learning and practical pedagogy at the University of Tromsø), Cerpus AS and Alsvåg primary and secondary school. The project has been reported (Bjørndal and Knudsen, 2003) and thoroughly discussed elsewhere (Lavik and Nordeng, 2004). Here, we will focus on a type of request that came from a 14-year-old student: "How can I express that the Norwegian writer Knut Hamsun is both admired and despised by the Norwegian people, depending on the context?" (Figure 3).

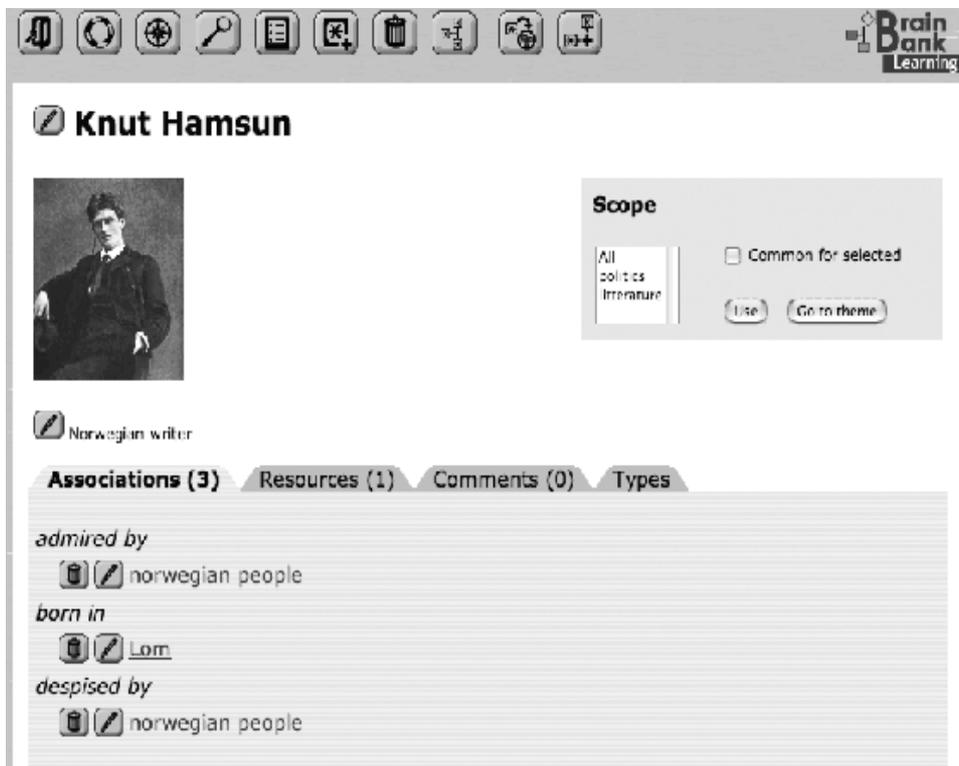
Figure 3 A polyscopic view on Knut Hamsun: when the perspective is literature, he is admired worldwide (he won the Noble Price in literature), but when it comes to politics, he is generally considered a fool (he supported the Nazi during the Second World War). However, regardless of the perspective, he was born in Lom



This request from the 14-year-old student illustrates a different perspective of polyscopy: the learner realises that the world is seldom black white as a *consequence* of learning activities and mental processing. In this case, the need to build polyscopic views comes from the learner, rather than the tutor. The answer to the request is of course to support scopes, but the question is *how*? In the latest release of BBL (version 3.0) we have implemented *theme* and *scope*.

As the learners construct their own TM, they will build themes that can later be used as views or perspectives of the topics that belong to the theme. An example of how a student has utilised scopes in BBL is shown in Figure 4. The two topics *politics* and *literature* have been upgraded to themes and *Knut Hamsun* is a topic that is relevant in both themes. The themes have then be used as scopes to establish the context for the two propositions ‘Knut Hamsun is admired by Norwegian people’ and ‘Knut Hamsun is despised by Norwegian people’. The scope acts as a filter and the user will only see associations (and resources) that are valid for the selected scope.

Figure 4 A screenshot from BBL 3.0 showing a user’s reflection about the relation between the Norwegian people and Knut Hamsun. As shown, the user has expressed the duality in the relation between the writer and the Norwegians (*admired by* and *despised by*). To clarify the duality, the user has put up two *scopes* (*politics* and *literature*) and restricted the associations to those. On the screenshot, associations that are valid for *All* (or none) scopes has been selected



We are now in the progress of combining the Flexplearn Information Design topic map with BBL at the University of Oslo. The idea is to give the student a polyscopic framework for collaborative polyscopic knowledge building.

8 Concluding remarks

To remedy the information overload, the information structuring needs to be based on a methodology. It is not sufficient to just organise existing information without any guidelines. Also, we need a new way of producing information that is adapted to our changing needs, where high-level information is appreciated, consciously created and consciously used. Information methodologies with principles and criteria for the production and organisation of information would have to be developed and based on them various structuring and navigation methods, constructs and tools. With our information design initiatives from the University of Oslo we hope to contribute in this direction and through our efforts and implementations show that we need an adaptive, methodological approach to information design.

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