

Narrative Approach to Educational Multimedia

A case study: Pro Healthy Life multimedia about environmental health risks



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1. INTRODUCTION AND BACKGROUND

Educational multimedia is a field where the methods and theories of the digital culture, pedagogies, and media research intermingle in an interesting way. The constructivist theory of learning and, in particular, the theory of cognitive psychology, have traditionally been used in the planning of multimedia and its interfaces (Feng-Kwei Wang, 2001). Multimodality as part of constructivist learning has been strongly discussed already in the 1990s (Kanninen, 2003). The theoretical history of constructivist learning is part of the structuralist school and multimodality of the post-modern project. My personal background lies within photography and film, and thereby I have been involved in the planning of several multimedia productions through which I have looked for new ways to realise edutainment content production. In my own production I have used the traditions and ways of motion picture narrative when popularising scientific texts and other non-fiction into digital media.

In the summer of 2000, Tampere-based HiQ visual Oy (where I am the principal owner) got a call for bids from the Turku University Centre for Extension Studies to plan a multimedia on the risk management of environmental health. In addition to Turku University, the project involved Kuopio University, Karolinska Institut from Stockholm, and Tartu University. Once the points of departure for the planning and the timetable requests had been studied, we replied to the call for bids. At that time I worked as the media producer for the production company. The multimedia was to be used as basic teaching material in universities and vocational high schools, and also as background material for experts. The expected point of departure for the educational multimedia was the three-fold structure of the target audience: on the A level, the basic level university students; on the B level, teachers using the multimedia as supplementary material; and on the C level journalists, decision-makers of municipal and other administrative bodies and health centre staff using the multimedia like an encyclopaedia. The initial plan was to use four languages: Finnish, English, Swedish, and Estonian. The planning of the multimedia followed the guidelines provided by constructivist pedagogies.

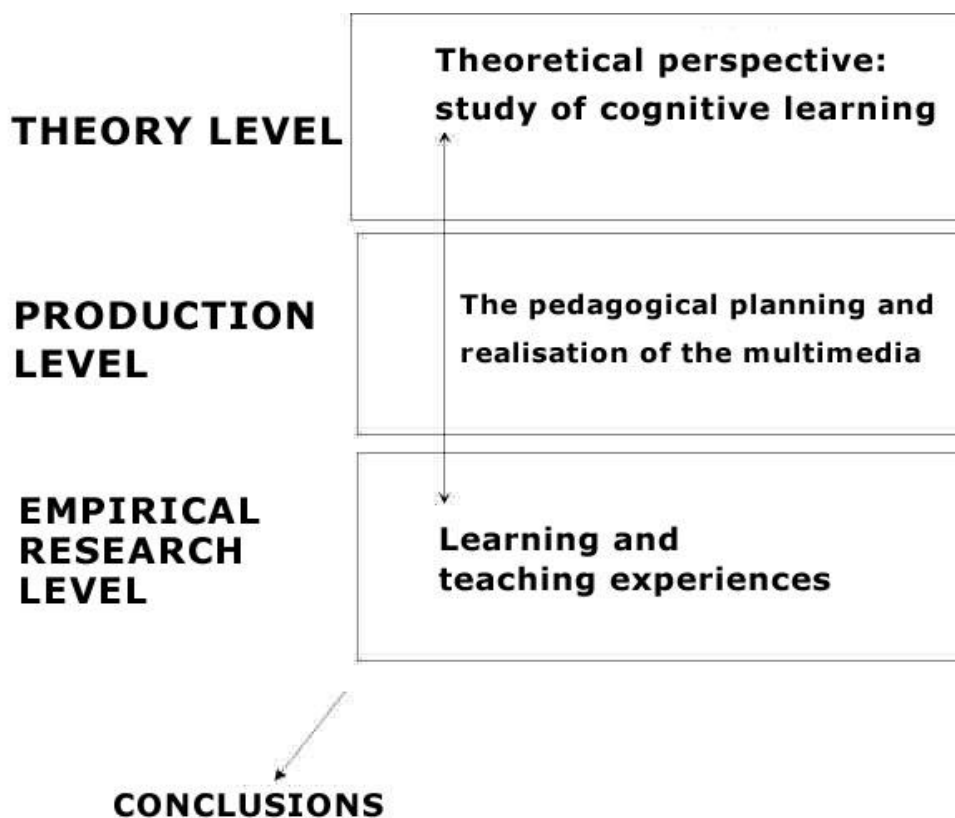
1.1. *The structure of the thesis*

My thesis is structurally divided in two. On the one hand I analyse the impact of the

pedagogical and multimedia points of departure during the production stage. On the other hand, I look at how they can be assessed now that the product has been used in teaching for more than two years. In addition to the multimedia product itself, the research material of the production stage consists of the correspondence between the production company HiQ visual and Turku University Centre for Extension Studies, the HTML manuscript and memos 2000-2001. The actual empirical section consists of user experiences of students, teachers, and other users. I formulate the core of the research question in the following way:

What has narrative meant for the planning of the Pro Healthy Life multimedia that started from pedagogical points of departure, and how has it been realised from the users' point of view?

- The points of departure of the thesis:



My research is attached to the constructivist idea of learning, which was one of the factors underlying the clients' planning work, and to narrative as a dramaturgical tool for the multimedia. In particular, I analyse the operational possibilities of narrative within the context of digitalised scientific material. How does narrative work in multimedia especially as part of scientific education? Narrative is generally linked to stories, where the audience experiences a

narrative journey with a beginning, middle part, and end. On the other hand a story is always also a chain of events that can be organised from a personal point of view where the sequencing (or montage) creates the connections (van der Meij, 2005, 93).

2. THEORETICAL FRAMEWORK

The reader of the hypertext is not safe; instead, he/she has to make choices. The choices involve risks: which sounds will not be heard, what will not be seen and what will not be read. The reader of the hypertext is a gambler who gets lost and finds hidden paths (Aarseth, 1997).

One of my theoretical points of departure is the constructivist theory of learning, which I use as a wide umbrella term and whose characteristic features are active and purpose-oriented construction of knowing, the transference of the learned to new situations, the context of the learning situation, and the cognitive social interaction (Vosniadou, 1997).

My other theoretical point of departure is the narrative framework, by which in this context I mean the kind of narration familiar from film and television – narration applying cuts, i.e. the montage theory. In multimedia and web media, cuts are made from one material to another, from one media element to another, from one link to another. The continuum created by these cuts is different for different users, but some of dramaturgy's tools can be applied to its structure and transitions: i.e. embedding, raising of symbolic values, turns, interludes, and rewarding. Dramaturgy can be defined as shaping a story or narrative elements into a form that can be acted. Dramaturgy gives the work or the performance a structure. More than actual writing, a dramaturge's work can often be defined as designing. The concept of narrative stems from Latin, where the noun "narratio" means a story and the verb "narrare" means telling. In English, the root words have transformed into the noun "narrative" and the verb "narrate".

Previously in the 1990s, multimedia used for education was assessed on the basis of the technical functions' development stage, with much less attention to the pedagogical valuation principles or narrative possibilities. After the turn of the millennium the focus of the research has been moved: the media is not considered a transmitter of methods, but a transferor of information construction and meaning (Olkinuora et al, 2001, 26–27.). One theoretical framework could be hypertext theory, like Aarseth's ergodicity (Aarseth, 1997), but then the gravitation point of this paper would turn into textuality, linking and interactivity (Gunder, 2001). However, these texts has helped me to outline the theme and to define the research area.

The research on the learning event's conceptual change (Vosniadou, 1997) is linked to the

multimodality of multimedia's pedagogical use. It pays attention to the learner's previous knowledge, everyday theories, and cultural prejudices. This kind of "advance information" can sometimes prevent the adoption of new information, in other words the transfer is negative. In order to bypass this trap, we use a dramaturgical tool, the cognitive conflict (Vosniadou, 1997). The goal of the method is to create a collision between (false) prejudices and the results of science and to help give birth to more profound conceptual models. The means of multimodal simulation of our senses in multimedia are suited to create this conflict. Quizzes and small games also deepen the cognitive absorption of the information.

In the multimedia process analysis, used as a tool to help the planning of PHL, attention is paid to combining the everyday concrete information and the abstract theoretical information. The cognitive conflict provides the learners with an opportunity to learn through practical problem situations and helps them discern the concepts and theoretical models related to those situations (White, 2000). In multimedia, the cognitive conflict may also mean that things are not explained "thoroughly" but some things are consciously left open or to be complemented.

Making use of many different modes of presentation offers promising learning results, but also has its risks. The control of several modes and tools of presentation is demanding, an often it requires the change, or at least development, of the learning strategy. The limited human reception capacity and maintenance of attention also set their own limits. The problems can be avoided by diminishing the input load of the senses (for example the amount of animations, links, and automatic functions) and by leaning on the old and familiar repetition. One additional problem is the limited nature of the computer as a bodily interface; i.e. the mouse and keyboard and sound/picture/text as the learning environment.

2.1. The constructivist theory of learning

Underlying the teaching process there is always some conception of how the mind and thinking of the student work and how he/she ought to be guided. The point of departure of the constructivist theory of learning is the idea of learning as an individual's active construction process of research and information. The emphasis in addition to informational significance lies on the importance of social processes. Learning is research where information is being organised co-operatively and reflexively and new understanding and information is created

communally.

According to the constructivist view, interactive multimedia improves learning results because it a) provides access to large amounts of informational material, b) the learner studies databases independently, c) the learner defines his/her speed and path of studying, d) multimedia holds the attention, e) multimedia presents information in a natural way from the viewpoint of human memory (Olkinuora et al, 2001, 18.).

Multimedia in itself cannot assume responsibility for the learning; learning is always the responsibility of the learner. Media is a tool for personal learning, a part of the learning process and learning environment. A key question here is multimodality. Many presentations supporting each other illustrate things better and help linking them to abstractions, so multimodality supports the learning process and the construction of mental models in general. Underlying multimodality is Paivio's theory of double-coding, according to which the memory imprint strengthens when the information to be remembered is presented both audibly and visibly (Paivio, 1986). On the other hand, the traditional repetition of the things also enhances the birth of long-term memory.

Constructivism as a theory of learning has divided into personal and social constructivism. The theories of Ernst von Glaserfeld and Jean Piaget study the construction of personal observation and memory processes. Social constructivism pays more attention to construction in groups, e.g. in the works of Lev Vygotsky and Albert Bandura.

The constructivist learning event contains the following (Scheepers, 2000):

- The content is not predefined conclusively; it is constructible by the learners as part of the learning event. The information is incorporated into the learning path.
- The content is presented through different senses.
- The problem-solving makes possible individual ways to act.
- The learning takes place through finding, experience, and modelling.
- The learner acts as an agent in relation to the learning material and the use of time.
- The problem-solving requires comprehensive thinking.

- Discussion between the learners is encouraged and multiple perspectives are emphasised.
- The teacher supports the combining of the conceptual and the practical.
- The learners participate in the evaluation of the learning results.
- Failure signifies the need of assistance to the learning process.

The constructivist view on learning has gained a stronger and stronger foothold while educational practices have become more individual and flexible. In constructivist learning the emphasis is on learning instead of teaching, the learner instead of the teacher, and the personal construction of information on the basis of previous experiences instead of learning “prefabricated” facts. The learner has many opportunities but on the other hand bears the responsibility of his/her own learning.

Ideally, the learner does not gain merely new information and technical rules but new ways of thinking, in which case the knowledge gained is quite different and on a different level than the basic knowledge gained from books. In this way, “authentic” skills needed in the information society are learned as well. The open questions make the learner/learners themselves/in cooperation sort out what should be known and to come up with their own attempts to solve/explain, to look for missing information, to evaluate its relevance and the reliability of the source. It does not suffice that the factual content “by and large” corresponds to what was being asked – the learner himself/herself notices how bad information can veer the whole learning process off course or how its handling in the least uses up the available resources needlessly. The information (one’s own information and the new one) has to be linked to the problem and its meaning understood before it can be useful in terms of solving the problem.

2.1.1. Constructivism and the computer

The relationship of constructivism to computer-aided learning has been positive to content expectations like those above. Multimedia in particular realises the possibilities of cognition, simulation, illustration, and activation in learning. On the other hand there has been criticism related to developing the social and communicative aspects. Similarly, the facts that the learners should be sufficiently mature and able to handle the equipment makes the everyday

use of multimedia more difficult, not to mention the high cost of its production.

Computer-aided learning has produced plenty of equipment that supports the constructivist theory of learning, starting from various databases, forms of hypermedia and information objects to web learning environments and simulations, not to forget virtual environments or games.

In practice the principles of constructivism are being realised especially in distance learning and self-learning, where the learner's self-orientation is of great importance for the success of the studies. The new learning environments are based on constructivist and cognitive theories, which does not imply that web studying would automatically be "constructivist" merely because it is organised in the web or because it applies problem-based learning.

The point of departure for problem-based learning is always some real problem that the teacher has loosely defined. The problem may be limited to the curriculum subject in terms of its topic, or it can be interdisciplinary – the essential thing is that it is so vaguely defined, open to interpretations, unorganised (it is the learners' task to organise it into a more specific question setting) that the learners can not have an "already learned" correct solution (views and opinions they can and do have!). The "correct" answer to the question should not be any research result or theoretical view to be found from the school book, teaching material or elsewhere in literature (these apparent problems – of which school homework most often consists – are called diagnostic problems, not real ones). It is also essential that the students can not easily deduce on the basis of their basic knowledge and everyday conceptions the correct or sufficiently good and justified solution or explanation. If the students feel they have immediately solved the issue, there will not even be any problem-solving process. Narrative may be the means to bring forward the problems and to make them interesting.

2.2. On narrative

Narrative is linked to all narration and communication. It is in itself analogical, progressing in time, but it is largely based on the capacity of the human brain to create an unbroken story even from small pieces. Therefore also multimedia's fragmentary way of presentation may create story paths and thereby facilitate the dramaturgical effect in the use of the multimedia. In the planning of PHL, the narrative was most strongly linked to the presentation of the A level cases from real life and on the other hand to the planning of the overall structure.

Underlying the narrative there is a thousands of years old tradition of oral narration where a story has a beginning, introduction to the characters and journey through events, often through some teaching. The mood of the story can be sad, happy, it can be funny or tragic, even frightening – the main thing is that it has a beginning and an end. The developers of the theory in addition to Aristotle (350 BC, 1997) could be Vladimir Propp (1970), Mikhail Bakhtin (1973), Roland Barthes (1974;1975), Seymour Chatman (1978), Gerald Genette (1980), Gerald Prince (1982), Mieke Bal (1985) and Monika Fludernik (1996). The national representatives could be for example Pekka Tammi (1992) and Matti Hyvärinen (2004).

The story developed into the theatre, where it is presented through the actors. The various forms of drama emerged, as well as the laws of dramaturgy Aristotle writes about in his *Poetics* (Aristotle, 350 BC, 1997). While assessing the different forms of narration, it should be kept in mind that pictures, like dramatic cave paintings, were a part of narration already in its prehistory, although picture, sound, and story were not seamlessly combined before motion pictures. The cinema has two mainstreams: the drama movies inherited from the theatre, and films relying on documentary elements (even though the story may be fiction).

A narrative is temporal, dramatic, plotted, selective, general, and at the same time unique. To emphasise narrativity is to pay attention to the receiver; the narrative creates the framework and the receiver completes the experience. On the other hand narrativity makes it possible to slip propaganda and subtle manipulations into the story just by the choice of perspectives and stereotypes. These narrative elements are experienced as imperceptible, self-evident, and they can't be assessed from behind the immersion. Narratives include always models of organising lives that some culture offers. (Barthes 1974, 18-20, Saarikoski, 1999)

Is interactive story-telling a paradox that prevents identification and immersion? Researchers have several contradictory ideas about this, and it may be that interactivity is not suited to all people; it requires narrative “awareness” and willingness to solve problems (Wand s. 167-170). The shifting perspectives of interactive media make it selective in terms of narrative. Espen J. Aarseth writes "... hypertext fiction calls into question only the idea of hypertext story and plot, not story and plot as such."(Aarseth, 85.) Aristotle has his idea about drama as an organic whole where all parts are needed and this is quite the opposite in many computer games and especially in educational multimedia (Laurel, 1993, 49).

The narrative model for educational multimedia can be, for example, a detective story or a spy

story. In these story types too, the choices (of the narrator, the protagonist) are important in terms of the progress, and maturing, growing, recovery, often serve as the psychological momentum in the background (Berger, 1997, 90 – 95, 127). Here we must remember that all stories are linear to the user/experiencer.

There are links between the memory functions of the brain and the ways a story is built. In our past it was useful to remember all the landmarks and different phases of a (food gathering) journey (Lehtonen, Hyvönen & Ruokamo, 2005, 153 - 159). In interactive multimedia the journey feeds memory step by step and deepens learning of facts, like in PHL board games (Environmental accident).

2.2.1. On montage theories

In literature narration has been since long a familiar theme for research. Austrian Franz Stanzel set out to derive a comprehensive typology of all conceivable narrative structures. His intent was "to systematize the various kinds and degrees of mediacy." (Stanzel, 1985/2002) that result from the shifting relationship between the story and how it is being told. Stanzel says that his project is to show how novels and short stories "render their mediacy." and thus affect the structure of the narrative. "Render" is the translation of the German verb gestalten and connotes the act of in-forming and shaping. These "rendering" steps in a short novel narration are close to the cuts from one image into the other in a film.

Combining different things with each other without mediating explanations is the basis of montage, where, according to Sergei Eisenstein and Dziga Vertov, two mutually alien elements combine and yield through comparison a third, separate conclusion or experience. Underlying montage is also the more recent physical theory about the blink of the eye as the moment of the cut. A cut from one thing to another resembles the normal thought process, one thought switching to the next, and humans tend to signal the switch by blinking their eyes. A common example is the rapid move of the gaze from, say, an interior painting to a window, when a human being usually always blinks his/her eyes during the rapid motion (Murch, 62-63). Montage essentially resembles the transitions of the multimedia, albeit that the transitions, via links, require action by the user. Montage is always an interpretation or rendering of a situation.

The smallest unity normally referred to in film is the "shot". The smallest unity in multimedia I refer to is the "node" (a term from hypertext systems). A node is a unit of information: text, graphic, sound, image or video clip which can be connected by "links" in the montage.

In his essay, 'A Dialectical Approach to Film Form', Eisenstein articulated the doctrine which underlies many of his theories relating to montage: Art is always in conflict: (1) according to its social mission and (2) according to its nature.

According to its social mission because: It is art's task to manifest the contradictions of Being. To form equitable views by stirring up contradictions within the spectator's mind, and to forge intellectual concepts from the dynamic clash of opposing passions (juxtaposition).

According to its nature because: Its nature is a conflict between natural existence and creative tendency. Between organic inertia and purposeful initiative. Applied to cinema, this 'stirring up' of contradictions and forging of 'intellectual concepts' is achieved via two (not necessarily related) shots which, when juxtaposed, function to create a new state of feeling or thought in the spectator. A useful equation for this dialectical montage (or what Eisenstein also describes as the 'montage of attractions') would be: Thesis + Antithesis = Synthesis. (Eisenstein, et al. 46).

Links are explicit connections between works and parts of works. Metaphorically speaking, a link is a thread with a beginning and an end, which the user may grab and follow like a guiding line. To follow a link is to be guided from one place to another; from the sentence in the main text to a specific footnote, from one web page to another, from the first page of a book to a certain page. (Gunder, 2001) Links can create new ideas and new emotions by combining the information of two nodes and in that way formulate the Eisensteinian synthesis.

2.2.2. Creation of a world

The topic of the narrative can be anything, for example a bus trip in the morning or a coffee break. The narration organises our experience and life. Usually stories start with an orientation sequence, during which the world of the story is created as the arena of the events. Orientation answers the questions who, when, what, and where. In terms of educational multimedia or learning environment, orientation is used to create the atmosphere of the work and the general rules of its use, i.e. the general operation modes of the icons and interfaces. In

multimedia (or games) orientation may also involve a separate instruction sequence where opportunities are offered through identification. Orientation can also be dispersed to different parts of the work, depending on the possibilities offered by the structure of the work. The world of multimedia grows from the available material and its requirements.

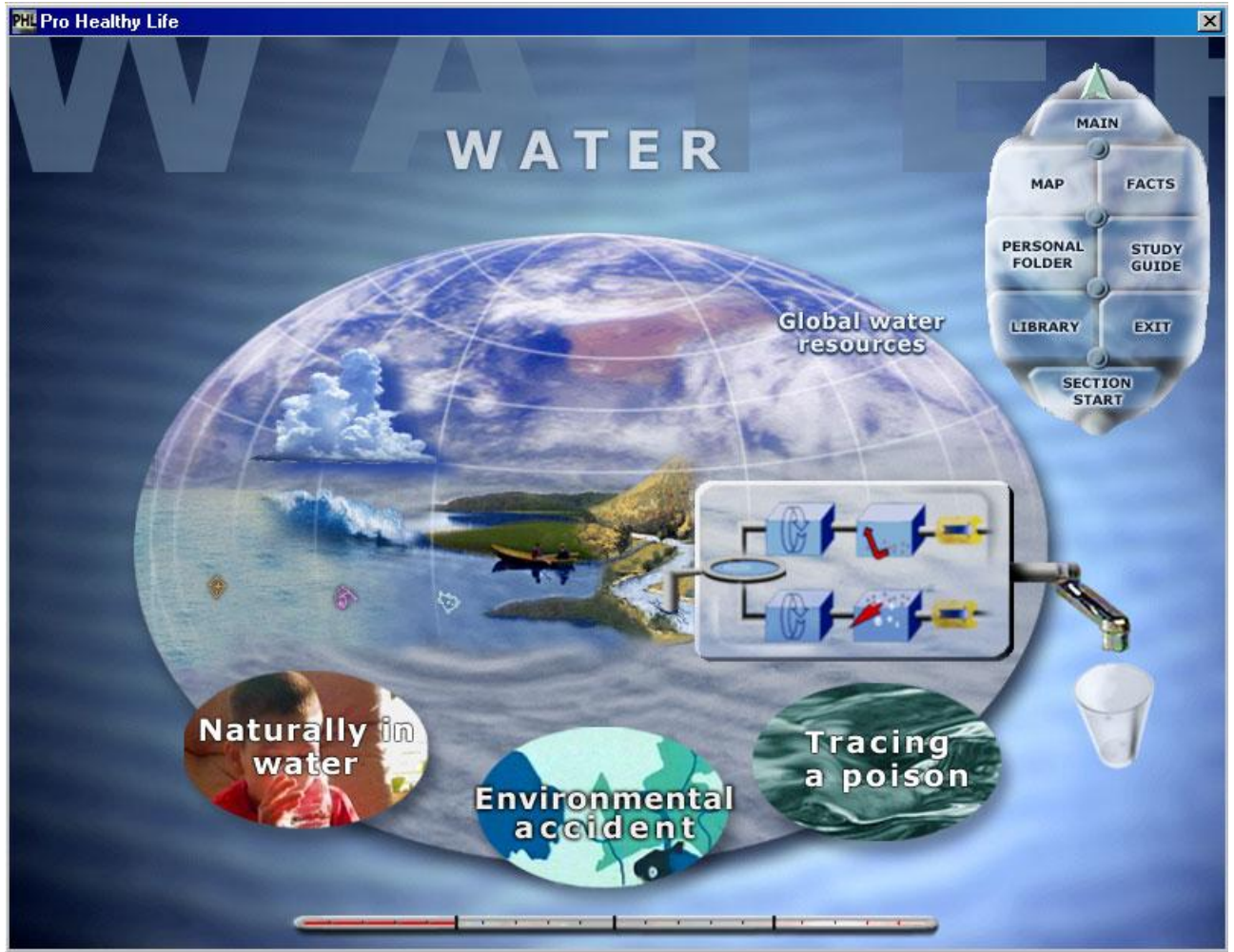


Image 1: The Earth as a metaphor in Water interface

In multimedia like PHL the creating (mise en scène) starts from the moment the application starts: how it starts, what sounds and graphics there are and what kind of interactivity there is available. The graphical style and expectations are created during the login. One part of the planned world creation is the main interface, which resembles the earth as a graphical form. This spherical form then continues to all main part interfaces (Food, Air and Water). My intent in the planning phase was to give an opportunity for immersion in the Study Guide where a group of students are starting their first lesson.

2.2.3. Planting

Planting is one of the cinematic tools, where some detail is given a symbolic meaning through repetition and action. For example an alarm clock near the edge of a table can be shown first. In the second picture the clock is grabbed by a sleepy hand that turns off the ringing clock and moves it still closer to the edge of the table; in the third picture its meaning is realised when the clock crashes loudly on the floor when the sleeper's knee bumps against the table. In the same manner in multimedial learning environments recurring visual or other signs get symbolic weight on which it is possible to construct small events. In PHL the planting is part of the narrative cases, stories about real life like "Happens in a house" in Air-part where a house (also a doll house) is used as a metaphor in several places.

2.2.4. Twist

In a story the twist is the spot where the successful hero is almost killed but drags himself away wounded to think about his situation, which is followed by another twist, and so on. Within the multimedia there are small stories into which twists can be built. Similarly, it is possible to try to make the whole structure so that transitions from one section to another always act as some kinds of twists. The twist can be a change of time, place, rhythm, or the topics at hand (Leiwo 1996, 154.). The turning point is used in most of the narrative stories in PHL (Happens in a house 6/9 or Naturally in water, 5/8) as part of the process solving where the problem is finding ways of resolution.

2.2.5. Interludes

The arc of the drama always requires a slow interlude after a sequence of rapid action so that the viewer can think, to internalize that which was experienced. The same goes for the planning of multimodal teaching material – the rhythm of the offered information and its absorption has to change through the varying requirement level and style of the different sections and/or pages. The interludes after problem solving are needed and this means in PHL the partly entertaining links, like Risk O'Matic.

2.2.6. Rewarding

In good stories, the happy ending is the prize the reader/experiencer receives. In learning, particularly in terms of interactive self-studying, feedback is important in order for the learner to be able to somehow keep track of the development of his/her own situation. Educational multimedia is a path with many branches that tempts and guides its user towards comprehensive command of knowledge. The rewarding can, as in the case of the PHL multimedia, take place in many different ways: examples are study books, rewarding stars, dots, smile symbols, chances to go further, different levels, and automatically appearing praises.

2.3. Differences between linking and montage

In multimedia linking creates the line of continuity while cinema (and video) is using montage. There are similarities between these two, but also many diversities. The principle of continuity is not only related to the question of fluency or feeling of flow, but it is also related to the construction of meaning (Fibiger, 2003). The production of meaning is primarily derived from contextualisation - and that what montage deals with. Many computer systems are organized as scenes. In a computer system a scene is made by objects, tools, and a set of interactions from the user.

Linking changes the possibilities for immersion (in film) into interactivity. Anna Gunder describes many different kinds of links (Gunder, 2001) :

—————	visible unconditional link
-----	hidden unconditional link
.....	invisible unconditional link
—c—	visible conditional link
---c---	hidden conditional link
.....c.....	invisible conditional link
→	unidirectional link
↔	homoancoral bidirectional linking
↔	heteroancoral bidirectional linking
	dig. = digital
	ana. = analog
	int. = internal
	ext. = external
	cat. = categorized
	uncat. = uncategorized

The state of mind is different in interactive browsing from that in immersive browsing (like in computer games) and it depends on the linking type. Immersive (montage type of) linking is more embedded into the visual and multimodal environment than normal types of linking.

2.4. Narration summary

The theoretical patchwork in my thesis comes from pedagogical, literature, cinema and multimedia research, which all have a different attitude into the possibilities of narration in their own fields. Aristotelian drama theory lies behind all this and I like to point out once again his idea about the organic wholeness of the narrative form. This means in educational multimedia (and all other content) that the overall feeling of "wholeness" should be present in the production. A summary for educational multimedia could be that the style and embedding of linking into the material is what counts for the narrative approach, added with the contact surface with the users own life. This helps the user to make his/her own story from the material linked to the educational path or narrative frame. What the designer needs is the ability to create all kinds of ways and means for contact with the users emotions.

3. THE PLANNING AND PRODUCTION STAGE

"In new media the relation between production tools and media objects is one continuity; in fact it's hard to establish the boundary between them."
(Manovich, *The Language of the New Media* 258.)

The planning of the multimedia took place as a co-operation between four universities. The material was gathered from around twenty researchers and professors representing those departments, and a team of three people edited the texts at Turku University Centre for Extension Studies. The finished texts and pictorial material were delivered to us in Tampere in electronic form. I wrote the manuscript in HTML form (appendix file folder: PHLhtml) directly into the web, so that all participants could keep track of the project's development and comment on any possible mistakes. Furthermore, some pictorial material was received through TV1, which was also a co-operative partner in this Leonardo da Vinci EU-project.

The writing of the manuscript took almost a year, and during that time there were two larger group meetings: one in the Turku archipelago and the other in Tartu. There were several smaller meetings of the core team in Turku and Tampere. The problem right from the start was the Swedish Karolinska Institutet, which did not participate in the meetings much and was always late in delivering the material. Neither did the Swedish translation, which was their responsibility, ever get finished.

3.1. *The objectives of the planning group*

The criteria questions the Pro Healthy Life team defined in the early stages of the planning:

1. "Addictiveness"

How does the multimedia catch and hold the learner's interest – why does the learner regard the teaching material motivating, interesting, and challenging?

2. Interactive status

What level, grade and type is the interaction between the multimedia and the learner?

3. Adaptability

How closely has the multimedia paid attention to varying equipment and learning environments and user groups – the functional and contextual compatibility and differentiation?

4. How well are the multimedia elements adapted to their purpose

How do the links and media elements (text, photographs, video, animation, sound, commentary) work in a functional way – is a sufficient amount of information available when needed?

5. Form and style of interaction

In what kinds of situations and in what way is interaction possible between the learner and the teaching material?

6. Quality of interaction

Does the interaction between the teaching material and the learner stem from the needs of the learner – precisely the right kind of interaction at precisely the right spot?

7. Quality of interface

What is the teaching material's interface like: easy-to-use - colours - icons - language – visual status, intuitive status (links from one content to another)...?

8. Learning styles

What learning styles does the teaching material support, and is the learner able to choose the way to proceed?

- a. Independent studying
 - b. Self-education
 - c. Self-orienting studying
 - d. Research-based study
 - e. Studying based on experiences
 - f. Learning by doing, functional learning
 - g. Co-operative learning
9. Observation and evaluation techniques

How does the multimedia provide feedback on how the learner is learning?

10. Intelligence

Does the program remember what the learner has already "learned" or done?

11. Sufficiency of the material supporting learning

Does the multimedia contain a sufficient amount of material supporting learning, pictures, graphics, self-evaluation ...?

12. The suitability of the teaching material to private, group, and shared working

Can the multimedia be used in a group in an interactive way?

13. Usability in terms of acquisition and delivery costs

How much do the consumer and the partner have to pay for the multimedia? What rights and conditions will be recorded in the agreement between the coordinator and the partner?

14. Important strengths and fascinating features

What is important: content, interaction/resemblance to computer games, beauty,?

15. Important limitations and deficiencies

Is it possible at this stage to analyse the possible deficiencies of the partner work, in order to avoid possible deficiencies in the multimedia?

16. Marketing

How to invest in the distribution and marketing of the multimedia?

The planning's points of departure were used especially during the first group meetings, where the basic structure of the multimedia – Food, Air, and Water – was constructed and tasks suited to the needs of teaching were devised.

3.2. Different user groups: A, B, and C level users.

A = student at the beginning of studies, B = teaching support material, and C = used like an encyclopaedia by a frequent user.

Initially the planning team attempted to build into the manuscript a three-stage structure leading from one stage to the next. However, the structure was abandoned, because it would have prevented the different users' different ways of accessing the material. Subsequently the plan was to create a more open and multi-faceted structure for the different user groups.

For the A level user we designed stories, "cases", based on real environmental problems. The cases make the basic issues familiar and lead the user deeper into the concepts of environmental health already through the links and the learning tasks.

We expected the B level users to be teachers and researchers in the field who could use suitable parts of the multimedia as supplementary material in their teaching, for example to liven up their lectures. For them, for example the library contains video and presentation material. Another excellent servant for users of this level is the web link library where the user can add new links (saved user-specifically).

The C level users could be journalists writing on environmental health issues, municipal decision-makers and medical centre staff in need of fast and easily accessible additional

information about certain substances and environmental health risks. They are served by the multimedia's dictionary-like word search and detailed maps of the sections.

3.3. Guiding, observing and rewarding the learning: Help and study book

Especially for the A level users we made an extensive user guide which is a part of a three-part teaching tutor: it contains a user guide, a teaching guide and learning tasks here gathered in one place. Fast help is also provided by the F1 key, as is customary in many multimedia products. User guidance is important for adult students who do not have much experience about the effective use of multimedia.

An important and at the same time entertaining section is the study book resembling the old study book used in universities; it automatically records the path through the content in the form of credits, as it were. It functions both as a personal section rewarding the A level student and as an observation tool for the teacher (if there is an agreement about it with the student). Another reward tool is the "body-temperature thermometer" at the bottom where red colour is added according to usage.

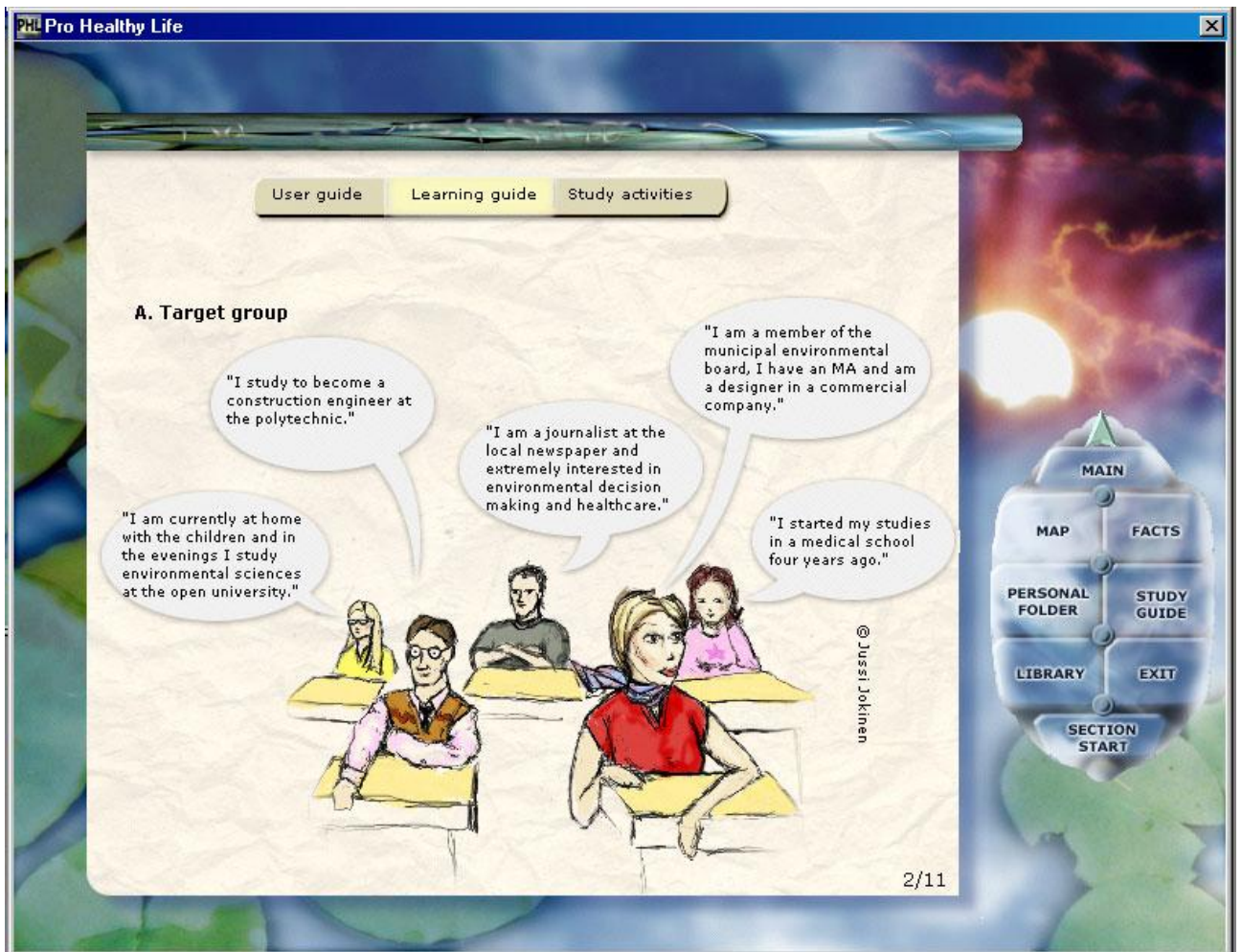


Image 2: Start page from Learning guide, where user can select his/her "protagonist"

The Learning Guide was also a good place to make the user feel at home: to see familiar images and to meet familiar studying questions and to give all the needed advice beforehand for the fluent use of the multimedia. The Study Activities are important for group meetings and for teachers (like Themes for Essays).

3.4. The possibilities of dramaturgy: multimodality; quizzes, simulations, immersion

While planning multimedia in general, I have always been interested in applying dramaturgy to a challenging, fragmentary media. There is always the possibility of multimodality, i.e. the possibilities offered by picture, video, sound, text, and transitions. Furthermore, the multimedia environment should preferably contain surprises, variation and activating activities such as quizzes or simulations connected to the learning process. For the quizzes we developed the quiz engine Risk O'matic that can also be opened directly via the maps or provided with prearranged questions in different sections. The limited budget was the major

factor affecting the use of simulations and actual game-like means.

In addition to interaction, i.e. learning at one's own pace, I wanted the multimedia also to contain small chances for immersion, which again requires a different type of story-telling. For that purpose, the multimedia includes, among others, the board game like Kärkölä-case and the thrilling process of the MX research. I would have been happy to devise more similar sections, but the obstacle turned out to be the researchers' and professors' lack of time on the material gathering and acquisition front. The deliberate use of cartoon-like elements in some stories (like Radiation) was a part of making use of the target group's, the students', cultural background.



Image 3: MX-story, the interface and map

3.5. Help tools: web search, word search, library, content maps, languages

The Internet is a part of daily data search in several different occupations. Experts gathered a rather large link file for the users as an alternative to the use of search robots. Important features of the finished link file are that links can be added or removed and that the link function can be closed when needed; a part of the links are placed inside the text, and although the cursor changes at the web link, unnecessary connection to the Internet should be avoided, especially for those using a modem.

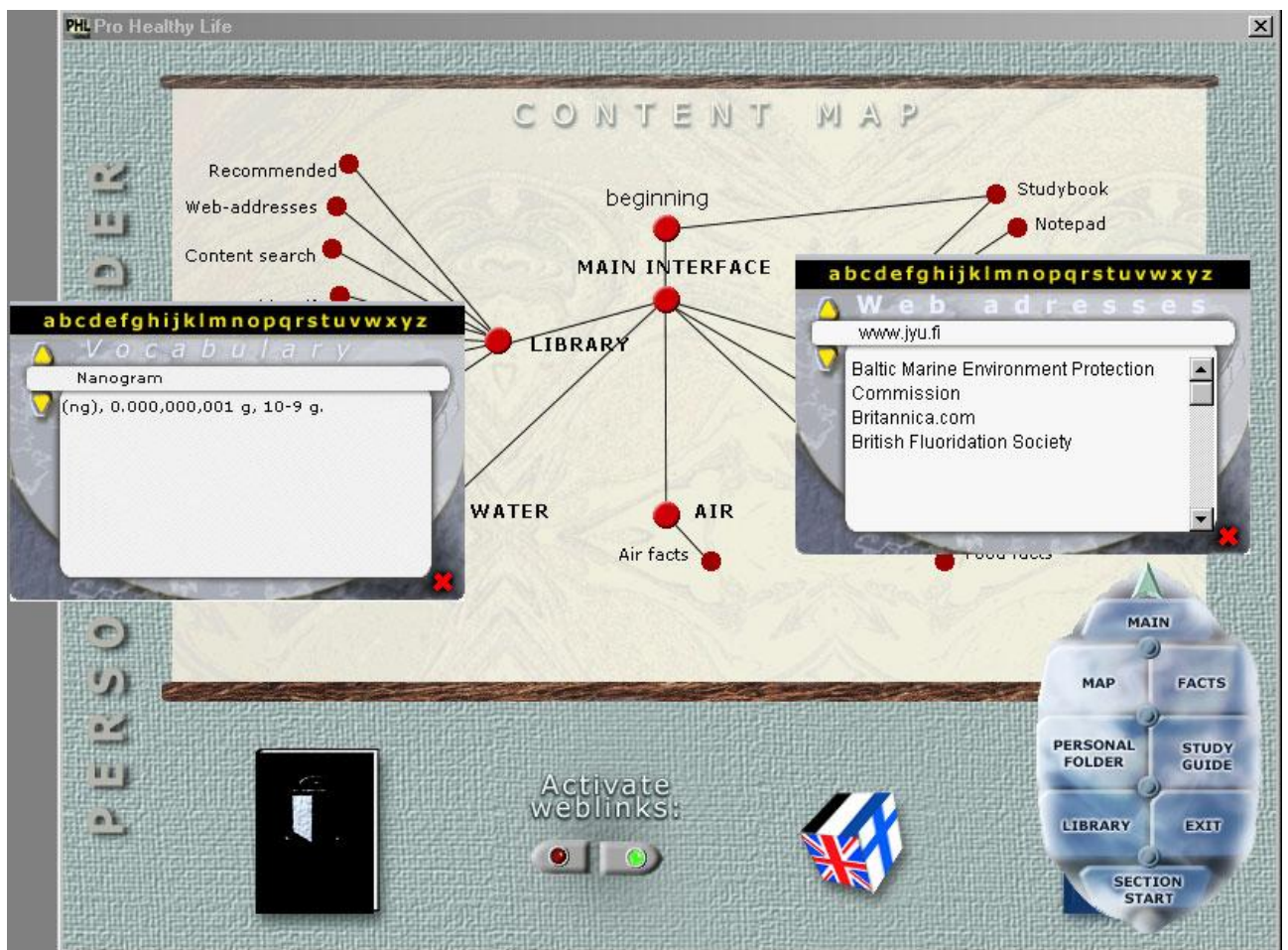


Image 4: The Users own pages with some of the encyclopaedic help tools like Vocabulary

The word search assists the use of the multimedia in an encyclopaedic way. So does the vocabulary, which contains no active links and only brief explanations for different terms. The content maps serve a similar use, as does the Facts section. It is also important for the learners to switch languages as easily as possible: with one key command (shift+e,v,f) the

learners can change the language of the article and check the terms in different languages. One of the help tools is also the Notepad, where the user can make notes and save them in a personal file. The help tools were designed to float, so they can be moved outside the desktop of the actual multimedia, and they all open simultaneously with the F2 key.

3.6. Sections



Image 5: Air interface

Sections Air, Water, and Food were the basic skeleton of the planning, and the linking and navigation functions of the entire multimedia were built on them. At the same time it constitutes the strongest narrative level, where the possibilities offered by multimodality are utilised the most. Each section contains 3-8 short or long stories about some environmental health risk. The stories make use of different narrative means such as cartoons, board games, 3D interface, and literary narrative. The basic level learning tasks and small quizzes are also connected to these stories.

3.7. Production stage

Already halfway through the HTML manuscript I began to plan some of the major interfaces with the help of Photoshop in order to make the ideas of the manuscript clear, both to the client and the authors of the text material. A little later we employed a graphic artist to produce the visual design of the different sections according to the manuscript and my instructions. The actual compiling with the help of Macromedia Director started when the manuscript was nearly finished. Some of my manuscript's functions and simulation ideas were difficult in terms of programming, but everything got solved with the purchase of a few Director plug-ins.

Some of the suppliers of the material did not realise the multimedia's possibilities as an enlivener of scientific material until the interface demos had been compiled and made functional, and this resulted in some enthusiasm and some new ideas, such as the board game like interface in the presentation of Kärkölä's poison case.

3.8. The finishing stage

Due to lack of time, the testing of the product was not as extensive as I would have hoped, but I personally went through all the scripting and behaviours and corrected small programming errors. There are often typos, numerical errors or other small blunders in the lingo script if there is not enough time to finish the project with care. Due to the deadlines of the Leonardo da Vinci project, the client needed the finished product in January 2002, and therefore there are still a few uncorrected errors on the CD-rom. Examples of one of the many correction lists are in the file `viestit/jussintekstit/linkitys.doc`.

3.9. Dialectics of making

In the planning phase of a media production there are always high hopes which will meet the more or less hard reality in the production phase. This I call the dialectics of making where the manuscript is repeatedly changed during the graphical phase and assembly phase in order to meet the production environment needs and also the limitations of the budget. During PHL writing process it became evident that in this kind of academic network that was behind the

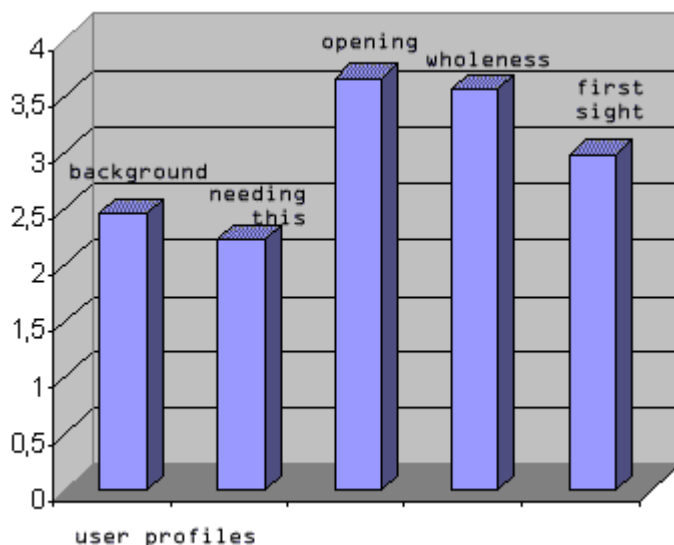
scientific material it is almost impossible to keep timetable and so time became a crucial factor in the decision-making of the editorial group. This was the main reason why the Food part of the PHL is "thinner" than other parts. If the media needs heavy narrative value, the scientific material should be available in good time before the manuscript phase, especially when the materials were distributed in a broad variety of different text and media formats, some with mathematical fonts not available for normal users. Finishing a multimedia manuscript and doing the real production in a dialectical process is hard work – the production group called the process “shovelling”, meaning the cutting, pasting and editing of huge information chunks.

4. USER RESEARCH

During 2005 I conducted a user research among the multimedia users. I tried to find users from all possible age groups, occupational groups, and user groups without forgetting my circle of acquaintances. Initially it seemed impossible to get people to fill the form that was possibly even too extensive (file: phl_arviointilomake.rtf), but after half a year of urging the answers finally began to arrive via the universities of Kuopio, Turku, and Tartu. At the same time I also found forms that had been filled already during the test stage. All in all I got some 60 answers, although I received a few that had not been filled properly, and 55 forms entered the database (file: taulukko1.xls). All the forms contained freely expressed opinions and arguments. I wrote a combination of them for close reading (file: lähiluku.rtf). Important is also the interview with Kuopio University teacher Tiina Pyrstöjärvi, who has been using PHL as part of her basic teaching. (file: OpeCD_rom_kysymyksia2006.doc).

4.1. Assessing the table

In total 12 men and 43 women filled the question form. This is in accordance with the gender division among environmental health students and officials. 29 of them were students, 6 were teachers, and 20 in other occupations. As for educational background, 6 had received vocational education, 7 had studied at a polytechnic and the remaining 41 had studied at universities (file: taulukko1.xls).



Most of the responders already had quite a good awareness about environmental health issues, an average of 2.4 on a scale of 1-4. The average of the need for further information was 2.2 (scale 1-4). The beginning of the multimedia was quite highly appreciated, even up to 5, while

the average was 3.6 (dispersion 2-5), and the overall opinion about the product was also positive, average 3.5. The favourite interface was the interface of the Air section with an average of 4.1, which may be due to the clarity and versatility of the interface and the suitably tranquil animations, which is seen from close reading of the forms. The most well-liked stories were the MX story and the dollhouse-like Indoor Air and its additional stories about radon, mould, and other problems. The progress of the Radiation story was appreciated the most, possibly due to the clear form of the cartoon.

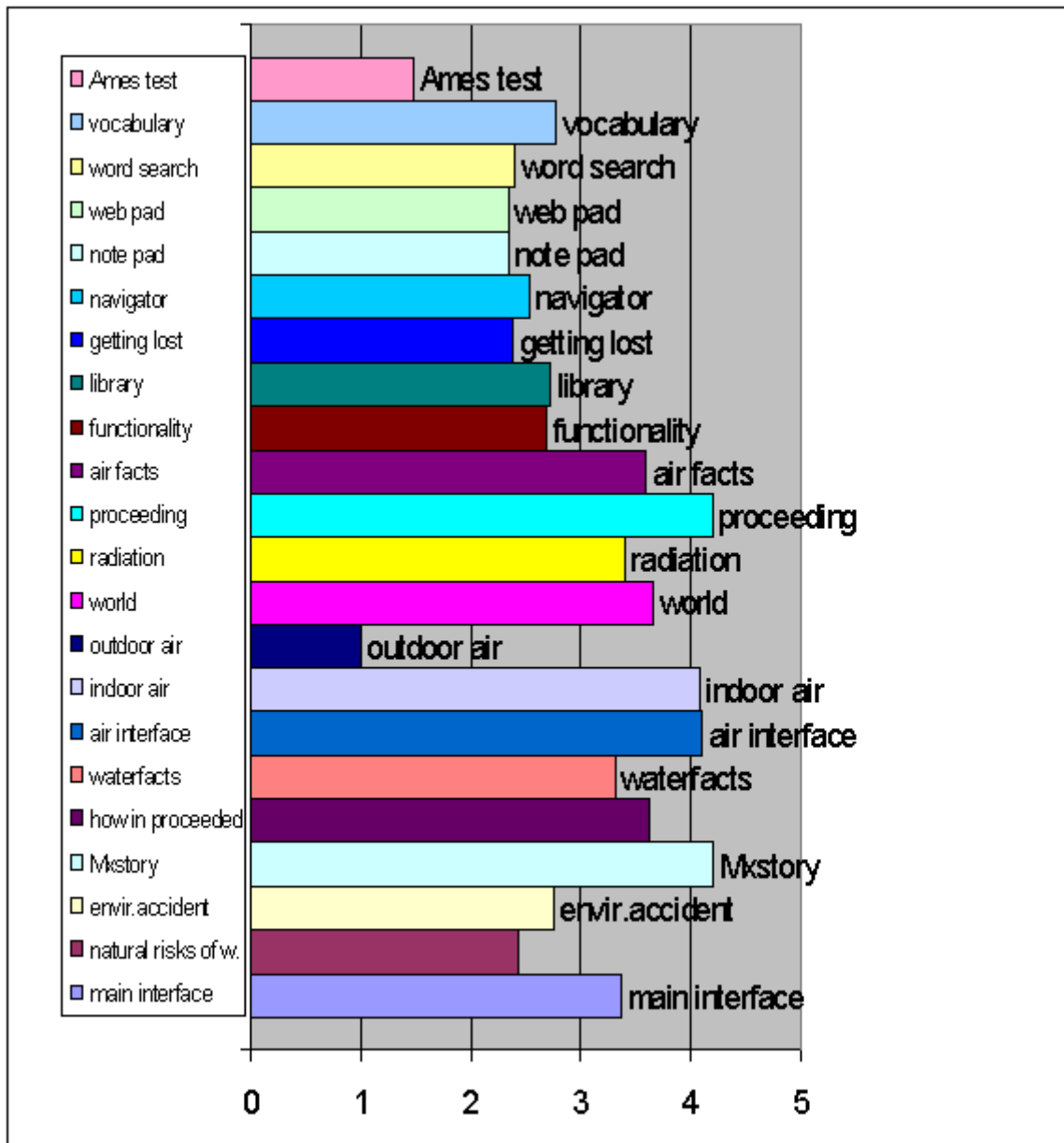


Image 6: A graphical example from the database of answers

Losing one's way was rather rare, the average was 2.4 (values 1-3) and the navigator was also experienced as a good tool for navigation (2.5). The floating additional tools (WWW addresses, word search and vocabulary) also received positive attention. Possibly the only

user experience yielding a weak numeral valuation was the Ames test simulation, which was generally considered too difficult to use (average 1.5). I find this understandable, as the finishing of the simulation was not completed due to the lack of time.

4.2. Close reading the answers

The answers clearly show which multimedia users have much experience about computers and which ones may even have a hostile attitude towards them, and partly this is also a question of age, as some of the answerers note. Especially Estonian students had a positive view of the self-studying opportunities offered by the multimedia. The visual clarity was praised (form 25, Estonian female medicine student): "I like the changing pictures. I am not well educated in environmental health matters, this seems a good way to get more knowledge in this field. I hope to find many human interest stories here. General impression is very good, especially the design, the layout." The thinness and "childishness" of the narrative was criticized, although e.g. the dollhouse setting in the Indoor Air story was on the other hand generally liked (form 24, Estonian female student): "There is a little house full of information about many things we use at home but don't think about. This helps me to think about our house's ventilation."

The style of the interfaces and the major navigational tool, the navigator resembling a pile of rocks or a turtle, gave rise to conflicting emotions. Some thought it was easy to approach, others found it repulsive and always in the way (forms 8-9, Finnish education planners): "An interesting rock navigator. Interface too "fancy", but clear. I criticize the needless technical gimmicking. The first experience was interesting, colourful and interesting stuff."

The Ames test, which was our only more ambitious simulation, received interest and conflicting criticism. "It was fun to get to do the Ames test oneself. A little difficult to use the pipette, but the performing of the test itself is memorable! Why can't the wrong solution be poured on the test bowl?" (form 14, Finnish female student, see also form 17, Finnish female secretary), "Stories could be better described, with problem and a way to the solution. Ames test was good but a little hard to do." (form 21, Estonian female student) The problem of simulations in general may be that lifelike objects and tools have to be handled with the help of the mouse in a two-dimensional cross-ruled space. Similarly, the large number of possible actions makes the programming more difficult.

Some of the users hoped and expected ready answers from the story sections, which clashes with the constructivist principles of the planning. “The links should be more visible in Radiation, as they are essential.” (form 9, Finnish female teacher), “Climate change is an interesting topic. Surprising how many things the climate change affects.”, “I got the whole picture well, even though the story was a bit too long. I think there should be some questions after the story, so everyone can control what did they learn.”(form 45, Estonian female student), “The whole is fragmented, and finding information requires activity on the part of the user.” (form 40, Finnish male, MD)

The wide scope of the target group can be seen in the answers, albeit in a contradictory manner (forms; 34, Finnish male, PhD), “Further thought about the target group. Students will certainly benefit more from the CD-rom. A handy and long-awaited program for the students to use.” The opinion of the frequent users was not very visible, because the questions were answered at the beginning stage of the user experiences.

4.3. The teacher interview

The teacher in Kuopio University (Tiina Pirstöjärvi) has been using PHL multimedia in her teaching since 2002. In the beginning everything went (technically) quite smoothly, but then the administrative rights for computers changed and the use of multimedia directly from the cdrom became impossible in university computers. At home this kind of limitation is not normal and the multimedia has been widely used in different home computers.

The greatest value in education has been the use of cases in small group situations. The library was highly valued especially for its video lectures, which should have been used also in the narrative cases, said Pirstöjärvi. PHL multimedia is not suitable for self-learning or independent virtual learning but needs supporting educational material from elsewhere or can be used as support material itself in normal education.

“Several different learning tools are left quite a lot to the learners own interest (like risk o`matic, library, study book and study activities). In support to our own web material I could best use the stories in PHL and also the main essays in the sections and their linked facts.” (file: OpeCD_rom_kysymyksia2006.doc). Problematic is also the fast development in some areas of environmental research and the ageing of the information in facts. The stories should have been better balanced concerning their volume and scientific value. “But I think it is fine

to have this kind of special material in our use. It gives good starting points and further help in the educational processing and it is usable for many kind of learners. I think the usability is sometimes also a question of age and attitude with computers in general.” (file: OpeCD_rom_kysymyksia2006.doc).

4.4. Assessing the narrativity on the basis of the answers

Narrativity was one of the cornerstones of my planning in the whole project. Judging by the answers, it has been moderately successful, although some of the stories have remained too “thin” from the point of view of identification, human details and possibly narrative twists. In the beginning of the multimedia I attempted to “create a world”, to make the multimedia a certain kind of place – a world with certain rules and ways of being (especially the navigation). Visual quality is highly important in the creation of a world, being distinctive from other computer imagery and on the other hand there being a “familiarity” of things especially as regards the icons and the cursors. The multimedia could have contained more different surprises; now it consists mainly of quizzes and learning questions. Transitions from pages and sections to others were initially planned to contain changing pedagogical “surprises”, but they were omitted due to the lack of time. Similarly, linking simulations and small games into a part of the narrative stage remained sparser than intended. Basic level students in particular have liked the narrative sections, but they have also criticized it if there have not been enough factual links or if they have been placed in bad spots of the story from the point of view of learning. In the pedagogical content it is indeed advisable to bear in mind the learning needs even at the cost of the story’s appeal.

When users feel "at home", they feel comfortable with their practice, the structures in terms of organization, materials, tools and practices are transparent, and they act freely within the boundaries given. The feelings are one of the key factors in creating narrative values in multimedia (or film), likewise social interaction and group dynamics play a part in all educational processes (Lehtonen, Hyvönen & Ruokamo, 2005, *Learnt without joy...* 153 - 159).

4.5. Assessing the constructivist pedagogy planning on the basis of the answers

Cognitive psychology, which is closely connected to the constructivist pedagogy, is generally one theoretical tool of interface planning (Sinkkonen et al. 2002). The following picture illustrates it:

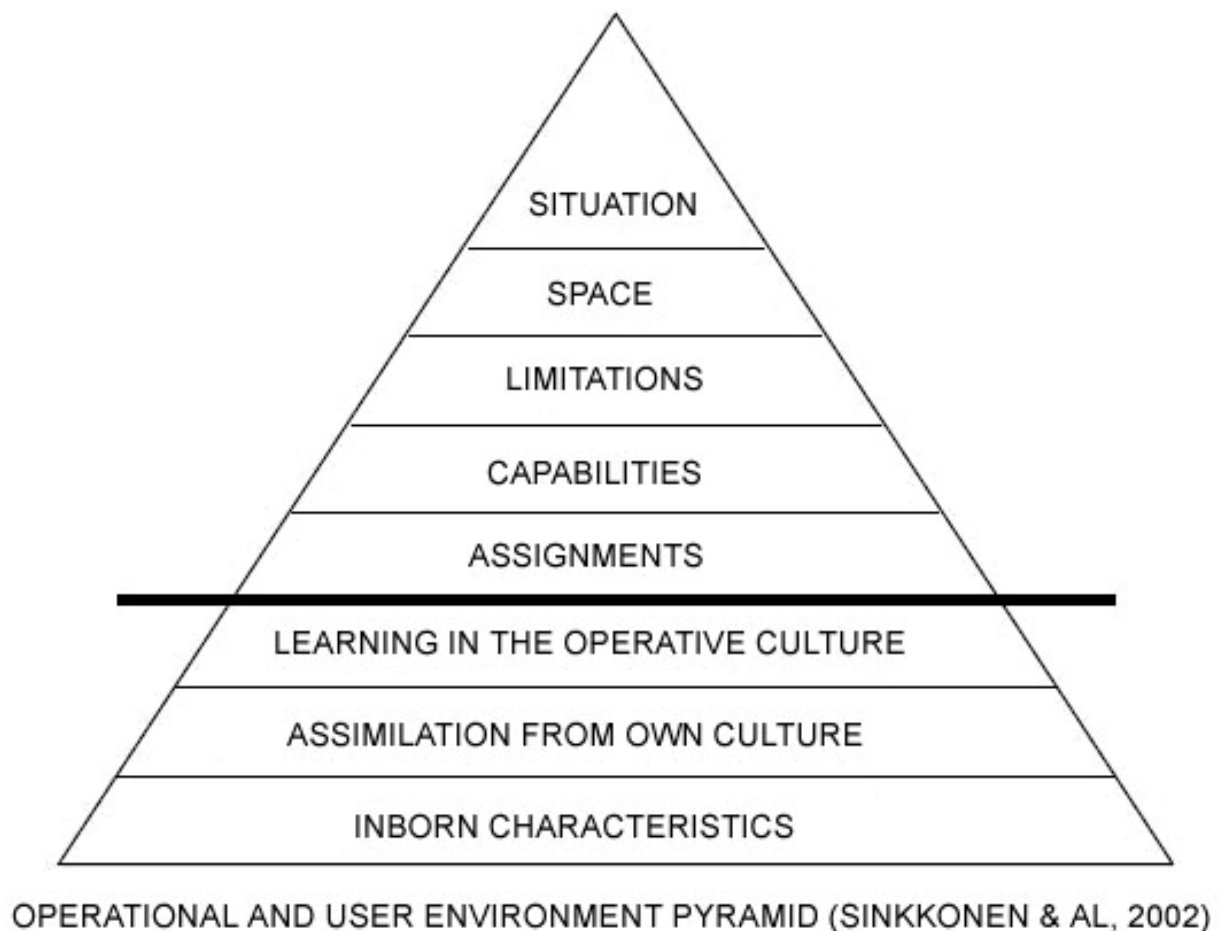


Image 7: Pyramid of the use

Presented in a pointed way, the intention is to make the learner's world clash with new challenges making use of as many contact points as possible. Some of these are more present in our planning than others. In particular there was discussion about learning situations, tasks, and operational cultures, and solutions to these were searched from multimodal stories, tasks related to them, and the importance of team work in learning situations. A part of such learning tasks and narrative leads usually makes at least some students assume a rejecting stance, as it strives to activate and force the students to take the hard path of self-learning. At

its worst, this type of computer pedagogy means futile work for the students and forces them to search for details or do guesswork, which really is not a constructive pedagogical goal.

The stories and the supplementing factual articles were used to create open situations that force the learners to contemplate the overall situation and to respond to it in some way. We also placed quite a lot of faith in the teachers' ability to make use of the multimedia's background materials for the creation of learning situations. In basic level teaching the multimedia is used as an addition to contact teaching.



Image 8: Indoor Air interface

The answers reveal that especially stories containing a possibility for personal identification (immersion), such as the MX story and the comparison between the Indoor Air dollhouse and one's own home, made it easier to learn the facts as well. A story applying a journalistic approach, such as the Kärkölä environmental accident case, did not seem to succeed as favourably.

4.6. Comments on the research method

When I planned the user research I used the same form we used in the test stage of the

multimedia in order to get comparable material. In retrospect, it might have been wiser to devise a new form, more suitable for a freer close reading, for the research. Even now the free comments provided more to think about and to look into than the numeral results. Interpreting quantitative material needs always some background theory or thesis about how to explain all the numbers and in my research the free comments in the papers gave me the indicators for reading.

5. CONCLUSIONS

According to the assessment of user experiences, the constructivist theory of learning that was the point of departure for the planning has been realised in the PHL multimedia, at least on some level. The fact that the difficulty of self-learning is being criticized is a part of the functionality and belongs to everyday pedagogies. The use of narrative also received some positive comments from the users. Having participated in the planning myself, I comment that the use of narrative as a pedagogical tool requires more time preparing the manuscript and the material than was available. Making use of the means of film narrative in the stories could have been taken much further, and developing the game-like elements and quizzes would have served the whole. It would have served the production to make it all for the Internet, but the universities did not want to take the responsibility for updates of the material.

The computer and its applications as parts of the pedagogical environment require, in addition to technical know-how, also expertise in the story-telling tradition and audiovisual planning. Many learning environments and pedagogical applications would function significantly better if their planners would pay attention to these possibilities already during the preplanning stages of the projects. When planning the virtual education of universities and other institutes of learning, all the user experiences gained during the decade ought to be made use of in order to create an attractive and at the same time factual content.

At least personally, my research gave rise to further questions related to the use of the computer as a part of pedagogical environments in general. The computer has been expensively introduced as an ubiquitous part of all levels of education, and the trend is to use it partly to replace contact teaching. The planning and realisation of sensible virtual education requires many special skills as well as time in order to test different pedagogical approaches in the teaching of science. Failed, and yet expensive, pedagogical virtual experiments have possibly already been conducted often enough.

I have no extensive experience as a researcher, although I have had to practice both source material research and interview research for all my multimedia works and documentaries. Through this thesis I have now learned much more about research methods, especially the possibilities of qualitative research. For me the client's pedagogical point of departure – constructivism – has become more familiar through this thesis, although I consider it a somewhat rigid theoretical model of learning in general – it may be suited to many learners,

but not all. Its concept of learning emphasises information. Learning requires that the learner understands the meaning of the information for himself/herself. However, it remains unclear how to create the learner's motivation to learn. In the flood of information it is problematic to make the learner get interested in the specific issues mentioned in the curriculum (Honkanen, 1998). Instead, by my research I am more convinced than ever that the narrative elements are important as parts of the pedagogical practice and especially as parts of virtual learning environments. This is clearly seen in the positive results from the more narrative sections of the PHL. A story as a tool for learning could be subject of more and broader research (more on this topic, see Egan, 1989). At the moment it is particularly used in research related to mental health and life control but it could be in extensive use in all education.

The making of this thesis has resembled the making of a documentary film. Partly I have shot the material myself, partly I have used archive material that has sometimes even been difficult to find. There are tens of hours (or thousands of pages) of raw material, from which I then edited without the help of an editor a finished "film" in five acts. As always, the editing, or compiling process has many times switched the presumed focus of the work. For example from the digitalisation of science education towards the dialogue between narrative and computer, and I can never be certain how it all actually happened – the story has simply swept me along.

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