Workspace Learning Project: Designing Parts of a Puzzle.

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Abstract: Through new demands, working space and learning space are merging more and more. To consider the experiences and the needs of the employees, data was collected at a papermill through narrative interviews and a workshop in the range of the project "Learning for production" (university of Klagenfurt). We experienced that learning in the working environment of a continuous shift-run company we needed a special design of the Microcontent. Highly complex contents have to be available at short notice and need to be absorbed in equally short time. The requirement is an intuitively playful access with simulations being a helpful instrument.

0. Introduction

How is the designing of parts of a puzzle related to with Microlearning? I suppose that question can only be answered by asking another question, namely: What is a puzzle game?

To puzzle means "to be uncertain, to deal with difficult problems, to rack one's brain". A "puzzle" is a *game* in the course of which out of hundreds or thousands of pieces, all of them small individual components, a picture is constructed. The learning process is quite similar – at the beginning the subject is a mystery, uncertain, confusing and the learner has to cope with fastidious problems, while acquiring knowledge. In the same way a "sculpture of knowledge" is constructed out of small fragments of knowledge.

My paper is based on the experiences with the project "Learning For Production"TP[1]PT. It is about the development of the idea, that it should be possible to design small learning modules in a way that it is possible to consume them in a very short period of time despite of the fact that the modules represent complex knowledge. In order to be successful we need a playful approach for the development of learning contents.

[1] The project „Learning For Production" is done in cooperation with the paper mill of the Mondi Packaging Frantschach AG at the Institute for media and communication at the university of Klagenfurt since November 2004. It is managed by Univ.-Prof. Dr. Christina Schachtner and coordinated by Mag. Gabriele Frankl. Angelika Höber and Ewald Romé are student project assistants.

1. Learning Playfully

As 2005 is celebrated as 'the Schillers year' I think it is fitting very well to start with a quote of Friedrich Schiller's writings about aesthetics:

"[…] man is only quite a man when he plays […]" (Schiller 1795/1934, 35).

Almost a hundred and fifty years later Johan Huizinga, in the thirties of the last century, reminds us again of the significance of games. Nevertheless there is little space for the ludic principle in our western, primarily rational oriented society. "The child is allowed to play, the man has to work" Thomas Leithäuser cites a skilled worker (Leithäuser 1997, 82).

An approach of the game as a counterpart to work neglects the fact that the game does not end in itself. It is submitted to it's own regulation – the rules of the game which apply to spatial and time compactness and limitation, in which the game takes place. The one who disregards those rules is a spoilsport.

In this ambivalent binding and freeing from everyday lives responsibilities and norms lies the attractiveness of the game: The game is exciting and catches someone's attention and concentration and it furthers concentration. It does not at all release you from obligation to perform. It is rather the rejoice on service provision, through diligence, in order for the game to succeed. Specific experience of success leads to admiration and appreciation by others (cf. Huizinga 1938/1997, 19ff. and 61). And this is motivating. The player is experiencing her/himself as qualified and is acquiring competences. S/he is learning by playing the game playfully. Playing and learning are connected inseparably and this is good so, because why should not it be great fun to learn?

2. Learning and Working

By means of narrative interviews, discussions and a workshop with the skilled workers of the paper mill in the range of the project "Learning For Production", we learned once more that learning and working are merging more and more.

Routine jobs are in decline in western countries, while at the same time the disposition and willingness for lifelong learning become more and more important. As Peter F. Drucker (1994) described, the industrial worker is displaced by "someone who works both with hands and with theoretical knowledge." Even if Drucker neglects the value of experience, which Christina Schachtner points out in her paper, the majority of todays workers need "qualifications the industrial worker does not possess and is poorly equipped to acquire. They require a good deal of formal education and the ability to acquire and to apply theoretical and analytical knowledge. They require a different approach to work and a different mind-set. Above all, they require a habit of continuous learning."

In order for the working environment to become a studying environment, different conditions have to be fulfilled.

Like a puzzle learning requires *time*. Time in particular, however, is missing in the production industry, as the skilled workers of the paper mill pointed out several times. Even if time can be found there is a *lack of silence*, because "everything happens under stress, I mean, everyone is under time pressure " (foreman of the paper mill, LFP). It is never known at which point the next disturbance or failure will happen, but when it occurs, decision making has to be done as fast as lightning: "When there is a case of emergency, I have no time, [...] I have to decide within two or three seconds, which button I have to press or which action I have to perform" (foreman of the paper mill, LFP). Furthermore the workers are *not used to learning*.

These basic parameters require great demands of the preparation of learning material: Small, catchy parts of a puzzle, which are easy to add to and to insert to the overall picture, which draw the learners' attention to themselves and which are motivating to continue with playing, seems to be ideal here.

3. What We Can Learn from Working with Computers

Already in the 1960s Seymour Papert considered the computer a great help for working and thinking (cf. Papert 1994, 171ff.). At that time, which was the beginnings of programming, code was written by stringing together line by line. The resulting so- called spaghetti-code brought along some problems. The program was unconcise, difficult to maintain, modifications were laborious and exhausting and the code was not reusable. It was not clear at which point of the program which function was implemented. Over the years object orientation succeeded in programming. The challenges were broken down into little, manageable pieces, which were put into a solid solution. The advantages of modularization are obvious: reusability, easier extensibility and advanced flexibility.

There is a similar evolution in the area of the design of learning content caused by the computer: in the ancient educational medium, the book, also everything is stringed together line by line. The body is mostly hierarchical, modifications are hardly not possible without going through the whole book to find the appropriate point to fill in. To some extend meta data is available, for example different indexes, but the systematic access to required content is not possible, partly the isolated content is not comprehensible. Most books are written either for beginners or for advancers, you cannot switch the mode to go for basics or to immerse yourself.

A different approach to learning is "Hyperlearning", as Lewis Perelman calls the computer-assisted mode of learning. "Hyper" means, apart from the speed and range of the new technologies, "an unprecedented degree of connectedness of knowledge, experience, media, and brains" (Perelman 1993, 3). Hyperlearning allows to break down complex issues into

little pieces that are easy to digest without separating them from the coherence. Thus there is the potential to split all-embracing problem solving strategies, as they are needed in the production industry, into small, time-sparing pieces, which can be handled step by step.

For the production of these little pieces, may they be modules of a program, parts of a puzzle or microlearning-objects, standards (for example like SCORM in the area of eLearning) are needed to make them fit together and reusable. Also meta data (as MPEG7 for multimedia content, cf. Kosch 2004) is needed to make it possible to find the required content.

In the area of software-development it is self-evident that modules have to work in the intended way, even if the programming is proper object-orientated. Everybody assumes, that the desired image arises by assembling parts of a puzzle. But when designing learning-systems it is often overlooked that it is the *content* which forms the essence. Therefore content must not be short of professional design. In the following I will put the focus on the design of the surface of the puzzle, the content.

Now I am coming to my main question: What kind of characteristics does learning content need in order to present complex issues in short time, so that it can be acquired even under time pressure and that it is committed to the learners' memory with motivation?

Through the rapid changes of facilities – as for example more complex machines, networked processes or high cycle of innovation - learning contents have to be modifiable and adaptable in short time. This is more likely to be achieved by little items such as microlearning-objects. The content, however, has to be designed in a specific way in order to attract attention even in potentially unpredictable situations.

In terms of Schillers idea of a game, an approach to the design of learning content can be found in computer games with regard to their fascination and pulling on users. Whether the learning processes are potentially successful or not, depends, among other things, on the quality of the software and the design of the content.

In order to live up to the increasing demands and complexity it is not enough to intensify approved learning processes or to simply learn harder. New feasibilities of learning should be found, which means facilities of learning smarter.

4. New Dimensions of Learning

When we think of a puzzle, we usually have 2-dimensional puzzles in mind which produce a picture. In the meantime, however, a new dimension has entered the world of puzzles: 3-d puzzles are not built together to images, but to sculptures (see illustration 1).

[BILD: ROBOTER frankl_pic01]

Illustration 1:
Examples for the new dimension in the world of puzzles

Comparable to that is a new dimension of learning through the computer. This new dimension is called Multimedia.

The traditional medium script is only in parts suitable to mediate complex knowledge of coherency and for the presentation of knowledge on the screen. Larger amounts of text can be read on the screen only painfully and slowly. Jakob Nielsen noticed a problem when using text for the design of learning content on websites: “If you have to keep it short, that might be a very good advice for, let’s say, writing an article. But, if it is going to teach people, if it needs to get all the content across – given that people are just not willing to read so much – I think it leads to a completely different approach to learning on a computer than learning in a traditional environment.” (Nielsen 2001)

Multimedia Learning opens up possibilities for learning in an explorative way which is quite close to reality. As Ludwigs stated multimedia makes it possible to take multiple perspectives and to generate multiple contexts. The mix of circumstances, events, solution paths and/or role-ascriptions as well as the reference to the context of contrary material allows the increase of the amount of information and the reflection of processes in particular. Briefing is supported and cohesion is within reach. “Multimedia diversity, when applied appropriatly is able to generate real light bulb moments.“ (Ludwigs 2004, 153f.) With tools like Macromedia Flash it is also not too laborious to develop multimeda contents.

Simulations represent one example for the use of multimedia. Their advantages were identified by some of the skilled workers of the paper mill of the Mondi Packaging Frantschach AG. They based their experiences on a simulation which is used by a papermaker-school in Austria.

[BILD: GRAFIK]

Illustration 2: Example for a simulation (paper industry)

One interviewee mentioned the following to the question of must-haves of an e-learning-system:

Such a system has to include "[…] a function about the way that such a paper machine works; how do specific aggregates function, what influence can I take […], what am I able to regulate with my aggregates, what can I regulate with chemicals, what do I cause when operating with an aggregate in a specific way, just cause and effect. This would have to be available without a question. What happens when I press a button […]. Above all cause and effect have to be integrated in such a computer program. […] Such a one-to-one simulation would be the best or the simplest " (Machine operator, LFP).

Simulations in the form of compact containers for microcontent are perfectly appropriate for the illustration of complex interrelationships and of the knowledge about problem solving in an extensive and catchy way, as it is needed these days not only in the production industry. The skilled workers of a paper mill have to know, as the quote above expresses, why something has to be done and what kind of impacts this action has on down streamed processes. "[…] what operates a product or how does it operate, this was not known by the workers 15, 20 years ago" (Refiner, LFP). In contrast to former times the skilled workers of today have to be in a position to think systematically and networked.

To acquire this knowledge gets more difficult because the paper machines are increasingly planked. The regulation of the machines happens through a process control system, which is located far away from the actual machine, as one foreman of the paper mill described. The mode of operation of the machines gets increasingly descriptive and less transparent. Right here simulations can help to offer entangled knowledge about the plant and its operating mode. As "in a [textual] documentation there is point 1, point 2, point 3 […] but there are no personal experiences or mistakes I once made" (Refiner, LFP). Personal experiences and mistakes can only be made by oneself – and simulations make it possible to experience this valuable knowledge. Thereby it is important that the knowledge is transferable to daily business. This goal can be reached, as René Härta (2002, 67) postulated, by a "HtightropeH HwalkH between the reduction of complexity and the mapping of complexity". If that is done, simulations are the right way as also Wolfgang Ebert (2004, 42) stated. He claimed that by means of simulations faulty operations and the resulting potential damages of the machines can be avoided as far as possible.

Simulations do not only offer entangled knowledge in compressed form but have effects on motivation and helpful learning for which Clark Aldrich considers the cyclical content responsible: "With cyclical content, every mistake seems to a player, in retrospect, avoidable. […] Every failure is an invitation to try again" (Aldrich 2004, 25f.). In every circle of the game the qualification of the learner is improved by micro-modifications and the learner makes an effort to improve even more which corresponds to the necessity of lifelong learning.

5. The pieces of the puzzle have to interlock

As regards a puzzle, it must be clear what needs to be done with the individual pieces of the puzzle and what the goal of the game is. The set goal should be evident, operation and control

should be designed intuitively and “quite simply” (foreman of the paper mill, LFP). Since autonomous learning is made possible by simulations, it has to be considered, however, that even people who are not used to learn autonomously and who have no competencies in navigating through complex and hyperlinked contents (Röll 2003, 46 and 74), are able to use the wide range of learning supply. Correspondingly usability resp. accessability and didactical aspects have to be guaranteed simulations, because they are not motivating as such. In addition the individual microlearning elements have to be related to the overall view, so that the learner is not cognitively overburdened by orientation and navigation. The relation between the individual pieces of the puzzle should be recognizable through the picture which they should fit in, by referring to connected elements, like for example in a program a procedure calls another.

The previous knowledge of users plays another role. There are puzzles made of large pieces, which can be put together more easily than puzzles with smaller and a larger amount of pieces. Some puzzles can be solved easily as each part can be arranged according to its pattern. Other puzzles consist of many pieces of the same colour and shape which makes it more difficult to solve the game. Similar to a puzzle a learning system has beginners, advanced learners and experts. The individual learning elements should therefor reveal which target group is addressed, so that the learner can select the suitable content. This classification and indication can be achieved by meta data.

6. Playful learning - learning by working

I am convinced that there are different ways of teaching learning contents adequately. The decision which style of representation should be used, should depend on the given content and purpose and as well on the target group.

For the examination area and the thesis of the project “Learning For Production”, simulations have turned out to be ideal for the representation of knowledge about the run of events and the complex contextual knowledge in a way that it can be internalised during shift work within micro time units.

These processes of internalising knowledge have many similarities to puzzles, which I tried to point out, but there are significant differences too: a puzzle is framed and the number of pieces is limited. (Micro-) Learning means that more and more small pieces can be added and the “sculpture of knowledge” can be expanded further. New motives can be added and old ones can possibly be destroyed. The process of joining together pieces is potentially unlimited in the learning process. The individual “sculpture of knowledge” can easily grow with the pulse of time, it can change and adjust itself.

There is no perfect way of creating learning materials. But with the help of simulations it is at least great fun to find out what kind of learning potential is available. The playful attempt

should represent a first step towards a close to work and human training, a further education which allows the learner to be “quite a man when he plays”.

7. References

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