FROM FACE-TO-FACE TO VIRTUAL LECTURE HALL
PRINCIPLES FOR PLANNING AND DESIGNING OF
STREAMING MEDIA LECTURES

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1. INTRODUCTION

How can face-to-face lectures be transformed into streaming media lectures? What decisions have to be made considering design and organisation to utilize the technical potential of streaming media? Consolidated design guidelines for streaming media lectures are not yet available. Nevertheless design guidelines are needed for the transformation of face-to-face lectures, for the presentation and organisation of information under multimedia and hypermedia aspects and the mediation of information regarding instructional aspects. In order to find a starting point for creating the design of streaming media lectures, the transformation of previous theoretical and empirical findings from multimedia, hypermedia and instructional areas into the streaming media lectures is necessary. Furthermore experiences from previous projects should be taken into consideration.

In the following, decisions from the research project “e-learning with streaming media lectures” at Aalen University, Germany about planning and designing will be considered. They create a frame for a learning environment with streaming media lectures.

2. DEPICTION OF FACE-TO-FACE LECTURES

Teaching and learning at traditional universities usually takes place as face-to-face lectures and especially in the most common form of classroom lectures. This is the most common form of instructing big groups of learners, which has been used in higher education for more than two thousand years (cf. Gagné, Briggs, & Wagner, 1988). McLeish (1976) named positive reasons for this form of instruction. The lecturer can inspire listeners in classroom lectures, forward research areas and activities to students and other interested persons and connect theory and research with practical problems.

Learners in classroom lectures are seated towards the blackboard. The lectures last up to 90 minutes (depending on the lecture) whereby the teacher is the centre of attention and influences the major part of the lecture.

From the didactical point of view, classroom lectures correspond to the teacher-centred approach, since the teacher instructs and guides the learners verbally. The learners receive a mostly standardized curriculum. The auditorium may, depending on the lecture, include several hundred learners. The learning matter is mainly taught thematically, which means, that knowledge about a certain subject is transmitted for a better orientation in the subject (Flechsig, 1996).

The learning environment concept of classroom lectures includes a frontal seating order which enables the teacher to keep an overview over all learners. Additionally it is characterized by plain equipment like black board, flip chart, overhead projector and or PC/Notebook with DV-projector and a projection field.

The teacher uses different media to present the content of subject by using pictures, diagrams, tables, demonstrations or by working out a concept on the blackboard. The learners listen to
the teacher and take notes on paper, books or subject scripts (cf. Flechsig, 1996, p.97ff; Gagné et al., 1988, p.281ff). These identified elements need to be transformed into the surface of streaming media lectures.

In face-to-face lectures the learners take the role of the passive observer. They react on the questions of the teacher and occasionally act individually by posing questions or making suggestions. The teacher is the central figure of face-to-face lectures and receives all attention. The teacher is expert in the subject, information giver, organizer, advisor, evaluator and role model (Flechsig, 1996).

In order to transform a face-to-face lecture into a streaming media lecture, the above has to be considered. However it is necessary to keep in mind that the transformation results in a new application which relates to a face-to-face-lecture but is mainly influenced by the circumstances in which the application is embedded. For example, the streaming media lecture is not limited to time and place, whereas a face-to-face lecture is bound to this basic condition.

3. GENERAL DESIGN DECISIONS FOR PLANNING A VIRTUAL LECTURE HALL

The (media-) didactical design of the streaming media learning environment has to be planned before the technical transformation can be considered. This will be the second step in which technical and infrastructure questions will be included (cf. Meier, Wahl, Lindhorst, & Holzschuh, 2003).

In this context, the term design includes planning, developing and creating of a streaming media lecture learning environment. This embraces the theoretical knowledge, social-pedagogical viewpoints and practical knowledge, the pragmatically, technological viewpoint (Reinmann-Rothmeier, 2003).

Designing the e-learning-environment, three levels of didactical decisions about design have to be viewed (Niegemann, 2004, p.71ff).

On the first level, seven dimensions of characteristics need to be identified. These dimensions are based upon the theoretical analysis of various ID-Models about learning and cognition and form the basis of general principle decisions. The dimensions have to be viewed between two extreme angles – the cognitivistic and constructivistic approach. A middle position has to be chosen in order to realize a pragmatic transformation (Reinmann-Rothmeier, 2003).

On the second level, design decisions have to be made about the structure of the learning content, the system of symbols used in the streaming media lecture, the pedagogical method, technology, interaction and motivation design.

It is not before the third level that more concrete decisions about the actual design like layout, stylistic-aesthetical and software-ergonomic aspects are defined.

On the third level several tasks have to be solved, after the design decisions on the second level have been made and it is known, that streaming media lectures are to be used for the transmission of information. On the one hand, the multimedia design of the user-surface has to be created. Hereby the arrangement of several elements like audio/video picture of the teacher and control elements has to be determined. On the other hand, the hypermedia design of the information organisation has to be identified. The segments of the streaming media lectures have to be embedded into the overall structure of the e-learning-environment and the interactive, temporal control within the streaming media lecture sequences have to be arranged. Furthermore the utilization of streaming media lectures enforces a detailed planning for the filming of the teacher. This includes the camera and light setting and adjustment, duration of a sequence, background design and more. Decisions on upper levels have to be considered unchangeable on lower levels. For example, the decision „learner control“ on level
one within the dimension locus of control influences the integration of various interactive, temporal control tools within the user surface of the streaming media lecture, which then gives the learner control of the application. The streaming media lecture could not include any control tools at all, which would then mean, the lecture is based on „teacher control“. The learner would thereby be forced to attend lectures from the beginning till the ending, since he cannot stop, interrupt or navigate the lecture in any way. By that it becomes clear, that an unconsciously or consciously missing decision on a lower level influences functions on upper levels, as in the case of the control tools and the connection between level one and three. Overall it can be said, that decisions made on different levels and their characteristics relate and depend upon each other. Therefore the described model is to be understood heuristically.

The decisions to be taken on level three of the design process of streaming media lectures can be summarized in the following four points.

- Level 3-1: Design of the filming sequences of the teacher
- Level 3-2: Multimedia design of the user surface for presentation of information within the streaming media lectures
- Level 3-3: Hypermedia design of the information organisation for an interactive, temporal control of the streaming media lectures
- Level 3-4: Hypermedia design of the information organisation within the overall structure

These four points can be taken as sublevels of level three. The sublevels of the design of streaming media lectures will be described in more detail in the following.

### 4. PLANNING AND DESIGNING OF THE FILMING SEQUENCES

Planning and designing the film sequences and the filming of the teacher, several decisions have to be taken in order to ensure a homogeneous embedding into the user surface and the streaming media lecture. This includes areas like the duration of sequences, background design, camera and light settings. Nevertheless some decisions, like the duration of a sequence, can be influenced by the circumstances. For example when filming a face-to-face lecture the duration of the sequence is determined by the lecturer. The sequence does not include any breaks and cannot be influenced from a third party until a post-production is made, in which the lecture can be divided into segments. This will then influence the duration of the sequence.

Further conditions like the light and background in a lecture hall can only be influenced partially and have to be taken as given. The design principles therefore represent an ideal case of filming a face-to-face lecture, in which the circumstances can be influenced to reach the best result possible for the final streaming media lecture learning environment.

Furthermore it becomes clear, that some technical aspects need to be considered in the first step. Since the sequences will be converted into a streaming format later on in the production process, it is important to consider the format of them already in the planning and design process. For example, if camera movements are made too fast while filming, it will influence the quality of the video picture in the streaming format after being compressed. The video picture would start bucking after the compression (cf. Jans, 2005, pp.29-52).

The relation to multimedia and hypermedia design levels has to be taken into consideration as well in this level. Aspects like background colours in the video picture will relate to and are basically determined by the colours of the streaming media lecture surface. Likewise the time steps within the streaming media lecture are determined significantly by the number of slides the teacher uses within the lecture.
4.1. Principles for Designing Filming Sequences

In the following the principles for filming lectures will be summarized. The principles are not exhaustive, but represent the experiences made throughout the research project and the knowledge gained from discussions with teachers and producers.

(a) Camera Movement

**Camera Position:** The camera should be positioned to ensure, that the subject (the teacher) stands related to the slides, which are later added in the user surface of the streaming media lecture (cf. e.g. Wetzel, Radtke, & Stern, 1994). The teacher should therefore look into the direction of the later added slides. It could be helpful to place a notebook next to the teacher while filming, which will then lead the view of the teacher in the preferred direction.

**Zoom and Panning:** Zoom or movements of the camera should be avoided as much as possible and if necessary, the movements should be made very slow. Following compression of the video sequences movements easily result in bucking pictures (cf. e.g. Wetzel et al., 1994). Placing a teacher's desk and a notebook for the teacher, the movement radius of the teacher is already limited and fast camera movements are avoided.

**Camera Section:** The subject (teacher) should be as big as possible within the camera section. This is necessary, since the video picture will later on be scaled down in order to ensure the integration into the user surface. Otherwise the teacher’s image would be difficult to see.

(b) Light

The light should be set up in a way, that the subject (teacher) is entirely illuminated and without shadows (cf. e.g. Wetzel et al., 1994, p.123). This is especially important, since otherwise the quality of the video will deteriorate after being compressed (cf. Jans, 2005, pp.29-52).

(c) Background and Teacher

**Background of the Teacher:** The background behind the teacher should be homogeneous and fit into the multimedia design of the streaming media lectures. This includes the adaptation of colours as well as the removal of disturbing items. In this context is has to be considered, that colours also evoke emotions. For example, the color red should not be used, since it stands for danger (cf. Holzinger, 2001, p.123; Wetzel et al., 1994, p.124).

**Clothes of the Teacher:** The clothes of the teacher should as well fit harmonically into the overall picture of video and user surface. This should be discussed before the video is taken. The teacher can then prepare accordingly.

As a matter of principle, the recipient (learner) can capture and memorize seven to nine elements at the most in one sequence. Otherwise information is absorbed incompletely (Wetzel et al., 1994). Unnecessary and disturbing items should therefore be avoided: Less is often more.

(d) Filming Sequences

**Duration of the Recording / Modularisation:** The duration of one sequence should be aligned thematically to the content. (cf. Chapter 5). In order to ensure this, the segmentation of the content should be defined, before the sequences are filmed. Thereby the content is modularized. These modules represent independent, didactical unities within the overall context. The advantage of these modules is that they then can be combined and connected with each other in the hypermedia learning environment and reused in a different context. The duration of the sequence should therefore align according to the principles of modular content production (cf. Meier et al., 2003).
Duration of Sequences for the Teacher: Filming a sequence, especially in a studio environment, should not take longer than 15 to 20 minutes. Otherwise the teacher will lack concentration, which results in mistakes in speaking and unwanted breaks. The quality of the presentation would suffer from this as well as the transmission of the learning content. Furthermore it can be said, that the teacher behaves differently when speaking in front of a camera than in front of a class. This might result from the fact that the filmed sequence is for conserving the spoken word. If the sequence or lecture is filmed in a usual classroom environment, the behaviour of the teacher is more similar to a normal face-to-face lecture.

(e) Audio Recording

Recording the spoken words of the teacher, it is important to receive it in best quality without disturbing noises (cf. Holzinger, 2001, p.148ff; Niegemann, 2004, p.125ff). A streaming media lecture cannot be viewed without sound – on the other hand one could listen to it without seeing the video sequence. When streaming data are transmitted, the audio signal is preferred. If there was a bottleneck while transmitting the data, the transmission of the video suffers before the audio signal is affected (cf. Chapter 3).

When the principles of design were discussed, such topics like film cutting and switching cameras were consciously not mentioned. It is not recommended to film a face-to-face lecture in one sequence, just to avoid cuts. Rapid changes within the film sequence can provoke difficulties in the cognitive processing of the learner (Niegemann et al., 2004, p.150). Cutting films also cause additional expenses within the planning and post-production process. Short sequences minimise cutting. Continuous camera switches and the resulting continuous change of perspectives for the learner could result in distraction or cognitive overload (cf. Jans, 2005, pp.73-88). It could be helpful to brief the auditorium with a short introduction at the beginning in order to give the learner an impression of the lectures.

4.2. Implementation the Filming Sequences at the Aalen System

In order to visualize the design principles, the realisation of this research project will be explained in the following. The face-to-face lecture was filmed in a studio. Thereby all conditions could be influenced and controlled.

Figure 1: Typical situation of filming a teacher in a studio
Figure 1: shows a typical situation when filming a teacher in a studio. The teacher holds the face-to-face lecture in front of the learners and presents the content in the form of slides (MS-Powerpoint). Thereby he works with a notebook and projects the slides on the wall (not shown in the picture above). The production team records the lecture. The lecture is not streamed live. We are producing an asynchronous streaming media lecture.

Figure 2 shows a section of the video sequence showing the teacher. The position of the camera is placed in the way that the teacher leans slightly towards the right side. That is where the slides will be later in the user surface of the streaming media lecture. Zooms and camera movements are not necessary. A desk and a notebook are installed for the teacher’s convenience and in order to limit the teacher’s movements within the picture. It also directs the view of the teacher on the notebook. The teacher takes up a big part within the video picture. The upper part of the body is visible, which makes it possible to film hand movements. It seems reasonable since the body language would otherwise get lost. The light is set up in a way that the teacher is fully illuminated and shadows are not shown. The background is integrated through a “blue box” with a soft, inconspicuous blue colour that corresponds with the surface design of the streaming media lecture. The clothes of the teacher are unobtrusive (not bright) but nevertheless natural and silhouette against the background. The duration of the sequence was defined before the video sequence was taken, which in this case took less than 20 minutes.

Figure 2: Video picture of the lecturer from the recording

5. MULTIMEDIA DESIGN FOR PRESENTING INFORMATION

5.1. Elemental Design Principles for Multimedia

Streaming media lectures represent a multimedia environment, where information in the form of audio or video text is combined with pictures, charts, tables etc. (Astleitner, 2002). The audio/video sequences are linear. Mayer and colleagues (Clark & Mayer, 2003; Mayer, 2001; Mayer & Moreno, 1998; Moreno & Mayer, 2000) formed empirically proved design criteria for video or animation sequences, which are based upon research in cognitive psychological
fields (cf. Jans, 2005, pp.73-88). The following basic principles can be concluded from the theories for the multimedia design of streaming media lectures.

(a) Presenting streaming media lectures in combination with audio/video pictures of the teacher aligned with a presentation of the lecture’s content is more effective than an audio/video picture of the teacher alone. Therefore it does not seem appropriate to transform and offer a face-to-face lecture without any additional presentation of the content. (Multimedia Principle)

(b) The presentation of the video picture with the teacher and the slides with the lecture’s content should be arranged in a manner that the learner can attend both sources of information at the same time. He should not be forced to split up his attention between the two media. Therefore the information on the slides should not be too complex and the design should not be too extravagant. This ensures that the learner picks and processes information before the next slide comes up and without losing track of the lecturer’s presentation in the video picture. Designing of the video sequences, the design proposals in section 4.1 could be helpful. These include no fast camera movements, homogeneous design of the background in order not to overload the learner with new attention catchers. Furthermore side noises in the audio signal should be avoided. (Split-Attention Principle)

(c) As a matter of principle, a verbal (audio) explanation of the visual content presentation (slides) is often better than explaining it through additional text on the screen. Graphics or pictures should therefore not be explained with an additional text but by the teacher. This is particularly important in the case of fast switches of slides. This is especially true for a simultaneous presentation of text and graphics in a slide, not so much for text itself. The text in the slides should conform with the spoken words of the teacher and only key words should be used for text in the slides. Alternatively the slides should provide an illustration while an accompanying voice provides explanation. (Modality Principle)

(d) When explaining the content of slides, it should be avoided to present both the words as narration (verbal) and the identical text as graphic (visual) at the same point in time. If graphics are presented in the slides, they should be explained by the teacher and not through onscreen text that duplicates the audio (sub-titles). An exception could be made, if the teacher gives the learner enough time to view, read and understand the information or if there is no pictorial presentation. This exception is also acceptable for the case, where it might be easier for the learner to read an explanation instead of listening to it. This could be fact, when the lecture is not held in the mother tongue of the learner. If working in a second language there is a strong case for providing the spoken words as sub-titles. An expensive post-production could even provide sub-titles in foreign languages. This is also an important issue for hearing-impaired users. (Redundancy Principle)

(e) All elements of a streaming media lecture should be integrated in one and the same user surface. Presenting them in additional windows is not recommended. (Spatial Contiguity Principle)

(f) The verbal and visual information should be temporally synchronized rather than separated in time. This means that the spoken word or rather the visual action of the teacher (audio/video picture) should be temporally synchronized with the presented information (slide). (Temporal Contiguity Principle)

(g) In the streaming media lecture only relevant information should be integrated in the form of pictures and sound. Irrelevant information in content presentations (e.g. irrelevant graphs in slides) and in the user surface of the streaming media lecture should be avoided. This also includes irrelevant internal (on the sound track) and external (noises within the
room) noises. Additional explanations by the teacher that do not directly relate to the content of the presentation should be avoided as well (cf. Mayer, Bove, Bryman, Mars, & Tapangco, 1996). (Coherence Principle)

(h) The teacher should communicate the information in the lectures in a personal and friendly and not so much in a formal manner (cf. Reeves & Nass, 1996). In order to achieve this, the teacher should feel comfortable when the lectures are filmed and behave as naturally and authentically as possible. (Personalization Principle)

(i) The learner should be able to affect and control the streaming media lecture. Therefore the surface of the streaming media lecture should include control units and dynamic hyperlinks (table of contents) which ensure temporary and interactive control and access to the sequences. (Interactivity Principle)

(j) The teacher should try to influence the attention of the learner by accentuating especially important facts. Such information could additionally be enhanced in the slides through separate colouring with signalling colours. The accentuation of spoken and written words can be synchronized in order to strengthen the desired effect. (Signalling Principle)

The design principles concluded by Mayer and colleagues have been put in concrete terms for streaming media lectures. The principles for the multimedia design should be understood as basic design strategies without being exhaustive. Since the principles are empirically founded, considering them will help the learner understand better the multimedia presentation of streaming media lectures. This again influences the satisfaction of the learner and thereby supports the learner’s motivation. It became clear, that the multimedia and film design are connected with each other and therefore the principles should be attended before and during the filming process of the teacher. If irrelevant picture and audio information are filmed or recorded, like disturbing background noises, they cannot easily be removed afterwards and unfortunately have to be accepted.

5.2. Composition of the Elements in the User Interface and their Graphical Design

Another important principle decision concerning the design of a multimedia lecture is the composition of the elements from a face-to-face lecture in the user surface of a streaming media lecture. These principal elements of a face-to-face lecture are basically the teacher in the means of presenting the lecture’s content (cf. Jans, 2005, pp.13-27). These elements have to be integrated and arranged in the user surface. A relational composition of the teacher and the presentation like in a face-to-face lecture seems most comprehensible. Reeves & Nass (1996) postulate in their Media Equation Theory, that the learning environment on the PC should be made as close to reality as possible, since the learners principally show the same behaviour when learning with media as when learning in traditional ‘real’ learning environment. Reeves & Nass demonstrate this with the results from several empirical research studies.

As a conclusion from this it seems recommendable to place the teacher on the left side and the presentation on the right side of the user interface in order to get as close as possible to the real environment of a face-to-face lecture. Nevertheless this is an assumption without empirical proof, though most of the given examples (cf. chapter 1) lean towards this principle of design – intended or not.

If the learner shall be enabled to use the streaming media lecture interactively (learner-centred approach), at least two more elements have to be integrated in the user interface. These are dynamic hyperlinks (Table of contents) and control units. Since both interactive elements
relate directly to the audio/video picture (Streaming audio/video) of the teacher, it seems reasonable to place them underneath (cf. Dix, Finlay, Abowd, & Beale, 2004, p.191-224).

Altogether four basic elements can be recommended for a streaming media lecture:

(a) The audio/video pictures (streaming audio/video) in order to follow the content of the lecture and the teacher.
(b) The presentation of the content (slides) in order to visualize the information given by the teacher.
(c) The control unit for starting, stopping or interrupting the lecture.
(d) The dynamic hyperlinks (table of contents) in order to switch between the sequences or chapters of the lecture.

Figure 3 shows schematically one alternative composition of the basic elements of a streaming media lecture on the user interface.

Figure 3: Schematic Depiction of an alternative composition of the basic elements of a streaming media lecture on the user interface

It has to be considered, that the graphical design of the audio/video pictures (Streaming audio/video) is influenced already at the process of filming the teacher (cf. Jans, 2005, pp.53-72). Furthermore the visualization of the content presentation does not have to be limited to the already existing slides of the teacher. Many teachers, especially at traditional universities, still use a blackboard for presenting the lecture’s content. In this case the written concepts on the blackboard could be filmed as well (e.g. Mertens & Rolf, 2003; Müller, Ottmann, & Zhang, 2002; e.g. Pomm & Widmayer, 2002). Brusilovsky (2000) developed an overview and comparison of systems for composing streaming media lectures, which shall be referred to at this point. Another possibility for visualizing the presentation of a lecture’s content are animations (cf. e.g. Meier et al., 2003).

The user interface of the streaming media lecture should receive a significant graphical design, the so called Screen-Layout (Thissen, 2003, p.142ff) in order to assure that the diverse elements in a lecture are perceived as one unit. In the Screen-Layout the sizes, the placement and relations among the elements as well as the colours used have to be defined (Hasebrook, 1995; Thissen, 2003). If already existing slides from the teacher are meant to be integrated as
digitalized slides in the Screen-Layout, they have to be adapted to the defined graphical design.

It is helpful to follow the elementary multimedia principles for streaming media lectures by Mayer and colleagues, when making decisions about graphical design. In order to consider all eventualities concerning the graphical design it is recommended to write a storyboard which can be referred to throughout the entire process. A storyboard represents the design of the entire learning environment of a streaming media lecture with the standard principles for the production (Schifman, Heinrich, & Heinrich, 1999, p.106).

So far one aspect that is typical for a face-to-face-lecture has been left out: the opportunity of the learner to interrupt the teacher for asking questions or making a suggestion. A face-to-face lecture represents a bi-directional and synchronous communication between the teacher and the learner. This important aspect has to be considered as well in the (graphical) design of the streaming media lecture’s user interface. Integrating a back-channel in the streaming media lecture offers the learner the opportunity to pose questions about the lecture. The simplest form of integrating this opportunity for feedback is an e-mail link, although email has the disadvantage of being a system that is separate from the learning environment. Another possible communication tool could be a synchronous chat room, which can be accessed from the streaming media user interface (cf. Meier et al., 2003), a third possibility is a web-form that uploads questions from learners into a special directory that the teacher checks from time to time. Such web-forms can be built into the streaming media lecture, making a more seamless environment that feels more realistic.

5.3. Implementation the Multimedia Design at the Aalen System

The implementation of the multimedia design principles during the research project is visualized in Figure 4 with an extract from the screen shot from the lecture’s layout. The composition of the basic elements is aligned to the schemata presented in Figure 3: Schematic Depiction of an alternative composition of the basic elements of a streaming media lecture on the user interface. All elements are integrated in the user interface (spatial contiguity principle). The streaming media lectures (grey parts) are furthermore integrated in the e-learning environment WebCT, which are clearly separated. The learner shall thereby be able to keep an overview. Integrating the streaming media lecture in an e-learning environment offers the learner additional functions through several links. The learner can choose several feedback possibilities via the link “communication”, which are for example e-mail, discussion groups, chats or a white board.

In order to keep the attention of the learner on the lecture, both sources of information, the video picture of the teacher (streaming video) and the slides received a simple and non-complex design (split-attention principle) (cf. section 4.2). Furthermore the slides are synchronized with the spoken words of the teacher. The switch between the slides in the streaming media lecture is connected to the movement of the teacher toward the notebook in the streaming video. The content of the slides is reduced to the essential facts and contain key words which only explain the graphics. They are explained in detail by the teacher (modality principle). Basically the content on the slides is not strictly repeated by the teacher but present a summary of the lecture (redundancy principle). If there is an especially important fact to be underlined, the words are coloured red at the moment of mentioning (signalling principle). Since the teacher shall present the lecture in the most authentic way possible, students have been integrated in the filming of the lecture (personalization principle). In order to avoid

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1 It is also possible e.g. to show the output of a computer program, while the voice explains why the output looks the way it does. They might show a crashed car, while the voice explains why the car sustained the kinds of damage shown in the picture, etc. It comes back to the voice “explains” what the slide “illustrates”.
irrelevant audio information, the students have been asked not to pose questions during the filming process (coherence principle).

The learner can control the streaming media lecture through the control units start, stop and break and as well through a table of contents (interactivity principle). The control units are limited to the essential. The learner cannot time line, fast forward or rewind the lectures, since time lags might occur during the internet data processing by the streaming technology, the omission of these control units does not seem to be unreasonable.

Figure 4: Screen-Design of the streaming media lecture at the Aalen System

6. HYPERMEDIA DESIGN OF THE INFORMATION ORGANISATION

6.1. Hypermedia Design for Interactive and Temporal Control

The audio/visual and multimedia information in the streaming media lecture are organized linearly. The filmed presentation of the teacher is a linear audio/video sequence itself. In order to break up this linearity, interactive control functions and dynamic hyperlinks may be integrated. The result would be a non-linear organisation of the streaming media lecture. The navigation on the time zone of a sequence is possible as well. The learner can select information from the streaming media lecture individually and independently. Generally, an interactive multimedia design is favoured for the positive effects of interactive functions, which are proved by empirical research projects (Park & Hannafin, 1993). Though the phrase interactivity is not yet clearly defined and therefore not always used in the same manner (Jans, 2005, pp.73-88; Strzubkowski & Kleeberg, 2002). Defined or not defined, the most important question in this context seems to be, whether the integrated functions are characterized by a
communication between the teacher and learner, which is similar to a dialogue and whether
this supports the basic principles of teaching and learning or not (cf. Jans, 2005, pp.53-72;
Niegemann et al., 2004, p.110). So far literature has not yet clearly defined any hypermedia
design principles for the interactive and temporal control of streaming media lectures. For
streaming media lectures, especially the interactive components are of great interest, which
support the temporary control of the information flow. Basically all functions of a virtual
video recorder could be integrated in a streaming media lecture through a control unit (cf.
Jans, 2005, pp.13-27). Research studies prove, that tools for the timely control of the
information flow have a positive effect on the learning process (cf. e.g. Shyu & Brown, 1992).
Therefore the control functions should not be limited. Regarding the streaming technology it
has to be mentioned, that functions like “fast forward” and “fast rewind” may lead to
significant time lags and interruptions in the transmission of data, especially when learners
use narrow bands like modems (56 kbps) instead of broadband internet connections. The same
is true for integrated time lines for the video sequences. Since the learner will likely wish to
use the functions like those from a real video player it seems reasonable to consider and
integrate a restricted functionality in the hypermedia design.

Another opportunity for interactively controlling streaming media lectures are dynamic
hyperlinks. They can be compared with static hyperlinks in hypertext (cf. Schweiger, 2001). It
is called dynamic and not static hyperlinks because of the dynamic character of audio/video
sequences and the further temporal dimension. The dynamic hyperlinks enable the learner to
navigate within one sequence or switch to a different sequence. An internal temporary
navigation within one sequence seems appropriate for streaming media lectures. This assures
that the teacher’s information is presented and mediated in the overall context. As a pre-
condition to that, streaming media lectures have to be segmented according to the content (cf.
Jans, 2005, pp.73-88). Internal dynamic hyperlinks represent time-bridges within the
sequences through which the learner can skip, repeat or directly choose parts of one sequence.

Figure 5: Example to illustrate a hypermedia design for an interactive and temporal control of
a streaming media lecture
Dynamic hyperlinks can be designed as visual links, minimized pictures of the presentation (thumb nails) or as written, characteristic descriptions. Dynamic hyperlinks are exemplified in a table of content and ordered chronologically.

Figure 5 illustrates an extract from the d-lecture project (http://www.d-lecture.de), a hypermedia design for an interactive and temporary navigation of a streaming media lecture. The control unit contains start, pause, stop, fast forward, time line and fast rewind functions and additional possibilities for controlling the volume (from left to right). The learner can choose between visualized and written hyperlinks.

6.2. Implementation of the Interactive and Temporal Control at the Aalen System

In the research project, streaming media lectures are controlled with a control unit and a table of contents (see Figure 4: Screen-Design of the streaming media lecture at the Aalen System). The control unit is equipped with the rudimentary functions start, stop and pause. Further functions are deliberately forgone since the streaming media lectures are also provided for a bandwidth of 56 kbps and technical glitches might occur. The dynamical hyperlinks (textual) are integrated via a table of contents. The naming of the links is identical with the slides so that it can connect link and slide. The teacher’s connections at the notebook determine the number of dynamic hyperlinks. When a dynamic hyperlink is accessed, the streaming video skips to the respective sequence on the time bar and the corresponding slide is displayed. All interactive control elements – except for pause – lead to a new connection establishment with the streaming server, which always leads to a time lag during the replay. This constitutes certain deterioration in functionality (cf. Jans, 2005, pp.13-27).

6.3. Hypermedia Design for the Main Structure

The single sequences must be integrated in a global and superior structure in order to access the streaming media lectures as a whole (cf. Jans, 2005, pp.73-88). The organization of the main structure can be linear, hierarchical or in the style of a network (Tergan, 2002). However, there is no recommendation concerning the “best” variation. The selection of the organization structure is largely determined by the structure of the content to present. For example, if traditional face-to-face lectures are recorded live to provide them as streaming media lectures later on, the content is mainly determined and characterized by the curricular rhythm. If the curriculum schedules two periods per week of the semester for the course, the teacher gives the lectures to this rhythm. He organizes the content so that he can impart the learning matter in the available two periods per week of the semester. If these streaming media lectures are then integrated in a main structure, the organization is largely fixed. In this case, a chronological structuring of the streaming media lectures in the form of a flat tree structure would be useful. This form of structure would connect the contents with each other. The depicted example makes clear that this form of recording or production largely determines the structure of the contents and restricts the possibilities of a hypermedia organization of streaming media lectures to a great extent. In theory, it is possible to directly and selectively access single contents in the streaming media lectures via dynamic hyperlinks from outside. Due to the time-consuming postproduction, it can hardly be realized in practice, though. The fact that these contents are then taken out of the context of a lecture and that they neither have a start nor an end must be taken into consideration. Therefore, they cannot generate permanent didactical excitement. It must be doubted that such a form of recording and provision of contents is in accordance with the basic hypermedia idea of the learner being able to control his learning process and search for information himself (cf. Jans, 2005, pp.73-88). In order to approximate to the basic hypermedia idea, a basic determination of the main
structure before the recording and production of streaming media lectures seems to be useful. The learning contents to produce result from this fixed main structure. These learning contents constitute “conclusive” segments. These modules are the smallest units that can be used in isolation and still generate didactical excitement. Based on this modularisation of learning contents, the single streaming media lecture segments can be connected and combined with each other. This also makes a reuse of the segments in a similar or new context possible (Meier et al., 2003). Then, the modularised streaming media lecture segments can be individually and independently organized in the structure of a hypermedia learning environment.

Irrespective of the selection of the hypermedia organization structure of streaming media lectures, the learner must be provided with a clear range of information he can cope with. This requires a reasonable and conclusive order of the segments (Cates, 1992). Therefore, the design and linking of streaming media lectures cannot be arbitrary. Only on the basis of careful planning can permanent didactical excitement and useful learning paths be generated (cf. Tergan, 2002). This requires a coordination of the learning objectives. If they are formulated and communicated to the learners, it becomes clear that a provision of streaming media lectures as a substitute for missed face-to-face lectures might be useful, for example. In order to give the learners an overview of the topics of the streaming media lectures, the external presentation of the structure must be designed to give an insight in the contents. This, for instance, can be done by means of concise naming. Revealing the contents of streaming media lectures before the access, for example in the form of a separate window giving a short description of the contents, is also an option (cf. Guimarães, Chambel, & Bidarra, 2000). All in all, the whole design must serve the learner as an orientation so that he is not disoriented in content and conception (Tergan, 2002).

6.4. Implementation the Main Structure at the Aalen System

For structuring and organizing the streaming media lectures, the research project uses the organizational and structural concept suggested by the learning environment. All learning contents are organized with a “table of contents”. The basic structure is similar to a book. Fields that are coherent in content are summarized in chapters. The learners can work through the chapters from top to bottom, which constitutes a kind of learning path. Due to the modularisation in separate segments, the streaming media lecture sequences can be independently used, for example to solve problems. After the selection via the table of contents, the learner reaches a synopsis page concerning the selected topic. Here, he is provided with further information relevant for the topic, like recommendations concerning book pages to read or lecture slides to download. On this page, the learner accesses the streaming media lectures by choosing the desired bandwidth. The organization of the streaming media lectures corresponds to a hierarchical structure of a tree. In turn, the table of contents serves as a starting point for a further access of a streaming media lecture. As the table of contents is integrated in a frameset, the learner can always see the starting point. Other fields of the e-learning environment, for example communication, can be visited as well. This, however, leads to the fact that the streaming media lecture is left and must be accessed again via the table of contents. Therefore, a “brief” visit to other fields is impossible due to the embedding of streaming media lectures in the frameset of the e-learning environment. It is possible to alleviate this problem by using a tabbed interface for example where the streaming media lecture is under one tab and the communications software is under another tab. However this needs a media competence of the learners.

Figure 6 depicts the organization structure of streaming media lectures in the e-learning environment WebCT.
7. CONCLUSION

The Paper depicted the necessary planning and design decisions to be able to transform a face-to-face lecture to a streaming media lecture. Design decisions must be made for recording the film sequences, for the multimedia presentation of information and the hypermedia organization of information. These principles have to be considered so that the streaming media lectures meet the cognitive as well as the instructional standards. There is no such thing as the golden mean. Decisions must always be made with regard to the application of the streaming media lecture. The learner and his individual competences and technical requirements must always be taken into consideration for all design decisions. So far, the examination of the streaming media lectures has been largely isolated and the focus was on the medium as such. Streaming media lectures have to be integrated in a learning environment and must be combined with other didactical media and methods in order to have their full effect (cf. Jans, 2005, pp.53-72). This requires creating a learning environment that makes an
interplay of different media and methods in a socio-cultural context (cf. Bremer, 2001; Kerres, 2001, p.33). In this learning environment, the learners can control their learning process largely themselves and adapt it to their needs and experiences.

Further Project Information you will option under: http://www.medialab.fh-aalen.de/streaming/

8. REFERENCES


