iVideo – Interactive Videos as an Instrument for E-Learning and Knowledge Construction

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Abstract

As a multitude of studies has already revealed, illustrations can be profitably used to convey knowledge. While the importance of videos continues to increase on the internet, we notice major changes in usage patterns. In addition to the pure perception of pictographic material, interactivity - especially in e-learning - is considered to become more and more important. Although professional tools for creating interactive videos already exist, they hold serious disadvantages. Besides high licensing fees, it is almost impossible for a non-professional user to handle these tools due to their complexity. Therefore the aim is to develop an open and scalable tool for creating interactive videos, which is easy to use. The user shall be enabled to interact with videos directly and also to produce interactive videos without professional help. Within this paper the idea and realization of a tool for generating interactive videos is presented and discussed.

Keywords: Interactive Video, Hyper-Video, E-Learning

1. Introduction

Images support the construction of mental models and the comprehension of complex relations (e.g., in assembly instructions). Moving images are even better suited for this purpose. They benefit users' information processing by sequencing information and by reducing cognitive load from inferring relations. Moreover, learners might get additional concept formation guidance from slow motion, freeze frames, repetitions and the overlay of letterings. The benefits from visual materials can be maximized by using interactive materials. Interactivity – which is not be confused with random access to information – can increase the efficiency of learning programs and thus support the individual learning process by providing individualized and motivating learning. Especially learners with little prior knowledge and suboptimal learning strategies benefit from a well-structured learning environment, whereas for students with good learning strategies the degrees of freedom are substantial for successful learning. However, many contemporary systems neglect interactivity. Current video applications in e-learning include basic learning support (e.g., recordings of lectures), training support from video analysis (e.g., recordings of training sessions and matches), or depicting complex objects (e.g., in machine design); yet, these formats tend to push learners into a passive role.

2. Learning & interactivity

Ever since the concept of direct manipulation (Shneiderman, 1983), which is used synonymously with the modern human-machine-interface, the terms interaction and interactivity gained great importance in scientific literature. Interaction derives from Latin inter (between) and "agree" (to act) and means mutual influence and interdependence. Interactivity is to be understand as deduced term, which offers the user miscellaneous possibilities to interfere and to control in the context of computer systems (Haack, 1995). There are many attempts to define this term, which often consider vaguely the user's active part as well as the variability in the choice of contents.

The difficulties of drafting a consistent definition result from the fact that interactivity indeed is an attribute but this only can be grasped on a scale. “We must conclude that the point is not: interactivity yes or no. The point is: more or less. All the named characteristics of interactivity gradients” (Jaspers, 1991). It remains to adhere that the term interaction stands for communicative, social actions among each other. The term interactivity on the other hand means the user’s manipulative actions with hard and software – this may include the contents of the depict objects. In the range of e-learning the interactivity of learning objects is focused because herein is seen an especially high importance considering the motivation in the acquirement of knowledge.

Research has revealed “…that interactivity – if it is not understood as random access to information but as possibility to interfere into a didactic offer – can increase the efficiency of learning programs and therewith support the individual learning process” (Schwer, 2002). Moreover the interactivity can be divided into various degrees, as it can be seen in the following chart (Schulmeister, 2003):

level	level of interaction
1	examine the learning object
2	vary the form of represe ntation of the learning object: contemplate different presentation methods
3	modify the content of the learning object: choose or calculate other contents, or
4	combination of criteria 2 and 3: vary the form of presentation and modify the content
5	construct the learning object by yourself: use editors or simulations
6	obtain feedback from the learning object

Figure 1: Interaction levels

This implies that interactivity offers a broad spectrum of possibilities to motivate the student and get him interested in the learning object. Thus, interactivity represents a efficient tool for the creation of learning contents, which should be used.

A study ordered by the Federal Ministry of Economics and Technology e.g. found that: “generally online learning is criticized for not paying enough attention to interactivity […]: The student devotes himself only to pre-programmed learning steps. Just 27% of online education is arranged interactively […]” (c.r.i.s. International, 2001). The study also proves that interactivity provides an individualized as well as motivating learning. The latter shall be understood as the active inclusion of the student into the learning process.

Individualized learning occurs if the interactivity of a learning program offers (range/selection/) a choice and presentation of information which meets the student's interests and needs at a certain point in the learning process. The ATI-research supports this thesis. It revealed that users of multimedia programs differ in their need of support. Research showed that especially learners with less background and suboptimal learning strategies, in a certain domain, benefit from a well-structured learning environment, whereas for

students with good learning acquirements the degree of freedom is substantial for a successful learning process.

3. Case scenarios for the application of interactive videos in e-learning

Following, some scenarios for iVideo-projects shall be presented to illustrate the application fields, the domains and the possible ways of interaction.

Scenario 1: learning support based upon video: In the range of e-learning the application of videos is used more and more. Some basic approaches of e-learning are solely based on videos in order to support learning and transfer learning contents. In most cases, especially in areas close to university, learning videos are not produced professionally but are created out of recordings of lectures and speeches. This form of e-learning pushes the consumer into a very passive role. The user of the iVideo Authoring Software is now able to create interactive learning contents in a simple way, on the basis of the existing "passive" video material. Especially in videos of lectures and speeches you can identify clear thematic blocks, which can be annotated by means of the iVideo software in separate scenes. Diverse descriptions as well as thematic additions can be added to an entire scene as well as to segments or points of time. Based upon this annotation an interactive table of contents can be generated, which provides a good overview about the issues dealt with as well as making it possible to jump immediately to a wanted scene. Based upon the descriptions and key words of the single scenes, a search function can be integrated into the table of contents, which enables the user to find different contents easily. The splitting up into single scenes makes an adaptation of the chronology of scenes to the knowledge of the single viewer possible. An advantageous application would be the arrangement of different sequences for viewers with previous knowledge as well as viewers with basic knowledge and those who are only interested in details. Especially tests on the learning success represent an important possibility for feedback to tutors and students in e-learning.

Scenario 2: description of complex objects based on video: Descriptions of complex objects in conventional training materials often are difficult to understand. This is why nowadays learning contents based on videos are preferred. In short clips e.g. complex machines are intelligibly explained from diverse perspectives. Interactive elements can support the learning process in an appropriate way. By means of the iVideo software you can underline specific sections and enrich them with additional videos, animations or textual information. Thereby you can easily recognize a clear relation between descriptions and the related area or scene in the video. The visualization of the object helps to understand complex relations, while detailed additional descriptions in the video can be reached easily whenever necessary.

Scenario 3: Distributing iVideo production in social networks: As shown by numerous video platforms in internet, the community thinking is our world today is essential. More and more users are ready to actively participate in the production of contents or even to fully produce these. That the qualities of these "community contents" are excellent could already be proved by Wikipedia and other Wiki-applications. A web-based version of iVideo Software should, especially in big iVideo projects, give the possibility to use the potential of the community. Similar to Wikipedia many different authors can work on the production of the interactive contents, not only to keep these updated but also to minimize the individual realization expenditure.The production of larger interactive videos and complex E-learning videos could be made easier through the "community abilities" of the software. Analogue to Wiki-thinking, different authors independent from one from another could devout themselves to one iVideo project. Drafted on the rich supply of videos from diverse portals, this project could be extended indefinitely. In this way, arranging the

linear passive video clips to interactive and multi dimensional videos without having to produce the entire content.

4. The iVideo Tool

Our projected started from the premises that interactive videos would be used more widely if authoring tools became available that are easy to use for learning content authors even without an extensive digital media background. Therefore, we developed the iVideo tool for the production of interactive videos. Based on available standard technology, the tool allows for economic video production and guarantees connectivity by storing projects in an intermediate language; only upon finalisation will media be made available in a specific format. In this way, iVideo projects stay independent from propriety format and are fully convertible into different formats. iVideo offers full Flash support and thus ensures wide public accessibility with minimal hardware and software requirements.

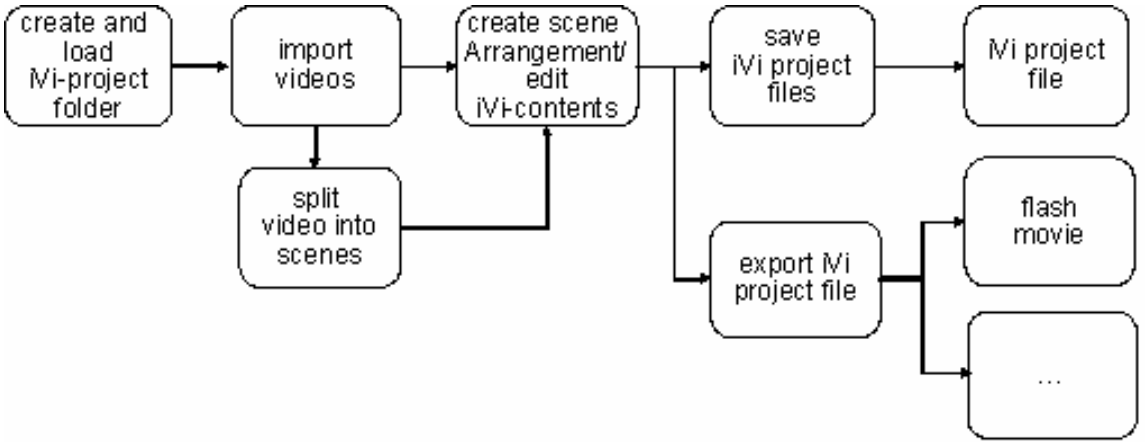

Figure 2: Production of interactive Videos through iVideo

Core functionality includes Video Import, Scene Creation, and Scene Sequencing (cf. Figure 2). This latter feature allows for connecting scenes into optional sequences through user interaction branching. Authors may use a variety of functions to enrich videos with interactivity. Scenes can be annotated at different points in time and in different areas. Possibilities range from simple additions (e.g., texts, diagrams) to rich media contents. Buttons may be superimposed in video clips to get users' attention. Through the same mechanism menus can be realized for branched-out action sequences or tables of contents.

Figure 2 gives an overview of the iVideo System. Users of the iVideo Authoring software may create interactive learning content in a simple way on the basis of the existing non-interactive video material. Especially in videos of lectures and speeches thematic sections may be marked and then annotated by iVideo in separate scenes. Descriptions as well as thematic additions can be added to an entire scene as well as to segments or points of time. Based upon this annotation an interactive table of contents can be generated, which provides a good overview about the issues dealt with as well as making it possible to jump immediately to a selected scene. Based upon the descriptions and key words of the single scenes, a search function can be integrated into the table of contents, which enables the user to find different contents easily. The splitting up into single scenes allows for an adaptation of the scene chronology to the user's prior knowledge. Scene sequences may be arranged according to learning needs (e.g., different levels of prior knowledge, interest in details vs. overview).

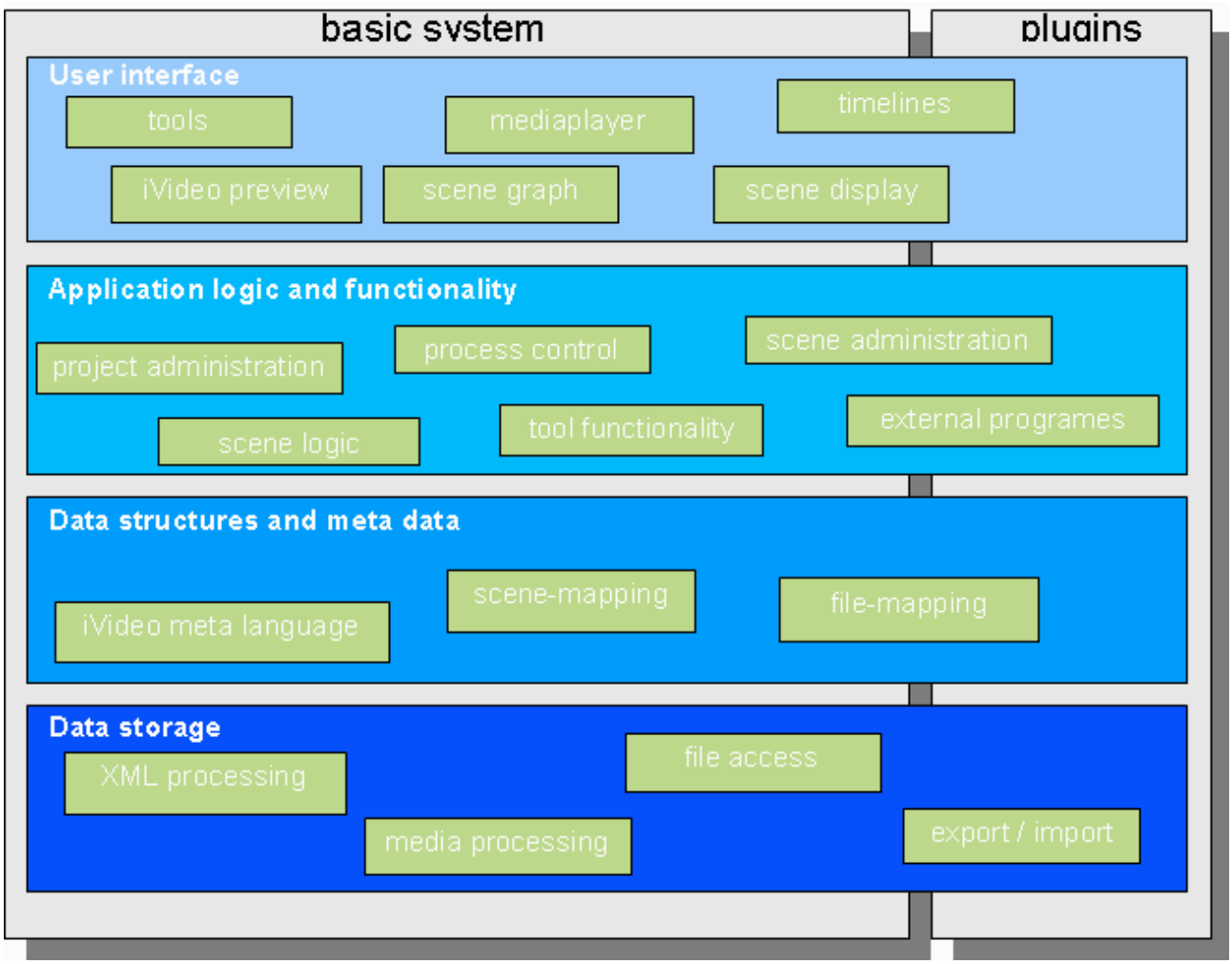

Figure 3: Architectural model iVideo-Tool

5. Conclusion & Perspectives

Interactivity as described above will achieve an ever greater importance for e-Learning. The easy usability of iVideo will enable virtually every content author to produce interactive videos. Outsourcing production to media experts will not always be necessary; learners themselves may even develop their own content. The expandability of the system makes it possible to compile interactive forms independently. Through this flexibility, future connectivity of the tools is guaranteed. New areas of application will become accessible through the plug-in concept.

Currently ongoing experimental assessments of learning success as a function of video interactivity provide valuable insights into ways of giving useful feedback to tutors and students in e-learning.

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