Designing an Interface for a Digital Movie Browsing System in the Film Studies Domain

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Abstract

This article explains our work in designing an interface for a digital movie browsing system in the specific application context of film studies. The development of MOVIEBROWSER2 follows some general design guidelines based on an earlier user study with *film studies students at Dublin City University. These design guidelines have been used as an input to the MOVIEBROWSER2 system design. The rationale for the interface design decisions has been elaborated. An experiment has been carried out among film studies student, together with a one-semester trial deployment. The results show positive feedback and a better performance in the students' essay outcome with higher perceived satisfaction levels*

Keywords*: Interface Design, Digital Video Application, Film Studies*

1. Introduction

Nowadays, the use of technologies in teaching and learning are always in demand. Numerous applications have been applied at school levels or higher with the aim to enhance learning. In film studies, for example, the use of applications that incorporate technologies for automatic video content analysis might provide faster movie access and deeper insights into the movies, and thus, strengthen the overall learning process. Such applications could provide richer interactions with larger data sets or archives for navigating and browsing video sequences. A number of work have been done utilizing the underlying techniques for video content analysis as described, for example, in [11][12][13], and working systems have been developed particularly related to movies, such as MovieBrowser [1], Videana [6], and a project at the INRIA laboratory [7]. These are among the many research projects with mainly a technical perspective in demonstrating the use of content analysis techniques in the context of particular usage scenarios in mind.

With the growth in management tools for digital video and its potential valuable usage as a learning tool, digital video can offer exciting ways for students to study in better ways, especially in the context of film studies where the medium to be studied is itself video. The development of application tools that incorporate the use of technology in learning is thus becoming more important. Goransson et al. [2] mentioned that it is important to bring the field of software engineering and HCI closer together in contributing better impact on developed systems or products, and also suggested that software development needs to move towards a user-centered approach. This is the approach that we have considered in our work.

In this paper, we describe our work in designing a digital video browser application by following design criteria based on a user study conducted in the context of students of film studies. Our main contribution is the development of a software tool, following guidelines in which, to our knowledge, not many applications have involved real users in the design and development, especially in the early user requirement stage. We also report an evaluation of our application, which has been carried out with real students in a real-world scenario.

2. The User Study Method

The initial user study that we carried out is based on a standalone movie browsing system called MovieBrowser developed at Dublin City University (DCU) [1]. MovieBrowser is mainly focusing on technical perspectives of automatic video analysis and was developed to demonstrate automatic movie segmentation and detection and classification of movie events into dialog, exciting, and montage shots. The work was not evaluated from a user's perspective, and the system itself was not designed, neither the interface nor the functionality, with users in mind, merely to showcase the underlying analysis technology. We used this as a starting point for our work.

The main objective in our user requirements stage was to understand how students analyze video content (movies) in the context of film studies. In the film studies module taught at DCU, each student is required to perform an in-depth or close analysis of the scenes in certain films and critically interpret and analyze this in the form of writing an essay. As the conventional practice, students would borrow a DVD from a library or other source, such as renting from a DVD shop. They would actively watch the DVD and try to identify and focus on interesting parts/scenes in the movie based on a topic given by the lecturer. Students will *read* the video content and interpret the surrounding context of a specific movie and then produce a written text essay on the topic.

Our study took 3 months to complete. A limitation to the initial MovieBrowser system is that the access was restricted to only 40 PCs on campus as it was a standalone system, and it was installed in one of the students' laboratories.

The methods that we used for data collection at this stage were observation, usability testing of the current system, and focus groups. Students from the *Ireland and National Cinema* (CM272) module were chosen as targets and made up a real-user group. These experiments were conducted during Semester 2 of the academic year 2006/07, and a total of 65 undergraduate students at level 2 took part in this study.

Observations - We carried out observations to understand the way in which students were taught, lectured, and assignments were completed. A consistent observation was made for the whole semester by attending the students' classes where we observed how the whole class was conducted by the lecturer.

Focus Groups - Focus group comprised an interactive group setting to more actively elicit students' opinions on the course topics as they discussed among themselves, agreed, and disagreed during the sessions. The objective of the focus group was to extract as much direct information from the students on their requirements, needs, and specifications in their film studies. A total of eight participants were recruited, comprising four females and four males, from the Ireland and National Cinema (CM272) module.

Six main questions, related to participants' close analysis and their environments when studying the film studies module, were asked during the focus groups. They were asked about the typical approaches that they used in solving problems when working on the tasks given by the lecturer. Questions regarding the resources they used, problems they faced in accessing resources, information needs, and learning goals were among the other topics of the discussion. The last sections in the focus group were a section called "designing with the users," where we took a brainstorming approach to sketching out a design to meet their requirements. They were asked about what features they would like to have if there were tools that could help in their studies, particularly in analyzing film sequences. The proposed interface designs were sketched on a whiteboard.

Usability Testing - In the usability testing experiment, 14 students volunteered to participate, comprising 8 males and 6 females. A total of 12 films were stored in the initial MovieBrowser database. This application was developed to provide three ways of locating events in a movie, namely to browse by keyframe, to browse already-detected events, and to perform a manual search for a particular chosen movie. Figure 1 shows the initial MovieBrowser system interface.

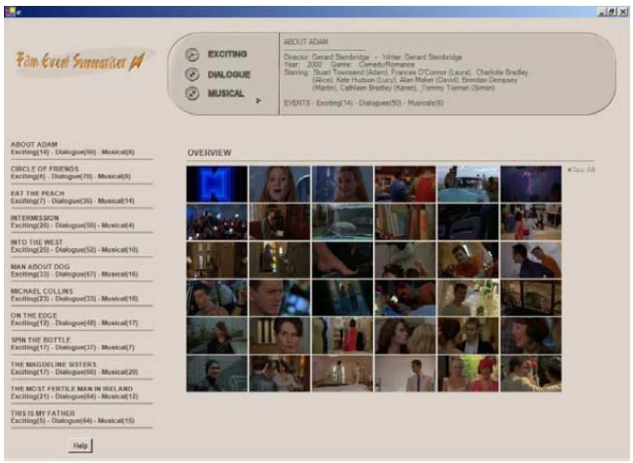

Figure 1. MovieBrowser interface

The findings from the preliminary user study helped in our subsequent system redesign. The basis for our design direction was to provide implementation of basic features, but to consider a richer interaction, particularly on the viewing sequence of the film and, at the same time, improve on previous usability problems. The design considerations were divided into the following parts:

- Online technology – The DVD was the most important resource for movie access but had the limitation of access, and hence, an online version was proposed instead of a standalone DVD player system;
- Scene event categorization – Movie content broken down into events will remain in the redesigned system with some enhancement on the interaction;
- Navigation – A dynamic timeline feature interface that can provide a strong temporal orientation to navigation and better visualization of the three movie event segment categories (*dialogue, exciting, and montage*), and the scene-based keyframe view might be useful to enhance the movie analysis;
- Movie playback features – We found that the movie viewing process is an important activity. A better playback feature that has functions, such as play, pause, fast-forward, and rewind will be incorporated in the tool with better screen layout design;
- Note-taking information – We included note-taking features to provide a facility to make notes on specific movie clips to help users while they engage with the watching process.

3. MOVIEBROWSER2 System Design

We iteratively sketched a mock-up user interface based on student feedback. The key multimedia analysis techniques used in our new application were scene detection, scene classification, and keyframe extraction based on research done in DCU [1]. These techniques became the main back-end analysis processes in our application. The new system MOVIEBROWSER2 was designed and developed over a duration of 9 months, and incorporates the movie content analysis engine as the main technology component, as described earlier. The technical requirements for the system development are Windows Server 2003 Enterprise Edition, VLC Streaming Server and player, Apache Web Server 2.0.55, PHP 5.1.2, and

Microsoft SQL Server Database. MOVIEBROWSER2 is a web-based system and uses streaming technology to play movies on the users' screens, which can be accessed within the university area and is restricted to students who are enrolled in the course. Among the efforts involved in developing the system was the process of transcoding and digitizing a movie, which was carried out either from VHS tapes or DVDs. The playback format used in the system was MPEG-4.

We followed simple principles in designing the MOVIEBROWSER2 interface. Nielsen [4] suggested that simplicity is a key factor in designing for usability. Many studies have been carried out, which had taken simplicity as their key factor in designing an interface. Karvonen, in [5], presented how simplicity and beauty can affect a user's experience and interpretation of the design, and how perception varies according to cultural background, age, and user experience. In another work that focused on simplicity in design [3], the authors described their ideas in designing an interactive TV system and followed simplicity principles in balancing the complexity of a multimedia information retrieval tool with the usability of the functionality it can provide. They emphasized on the simplicity in the design as their main priority, rather than advanced functionality.

We have described our design rationale of the interface in four major categories:

a. Selecting a movie

In conventional practice, a student will use a DVD player with a TV set or use a movie media player on his/her PC/laptop as a medium for playback of a movie. He/she will search for a particular movie either from the DVD rental shop or from the library by looking for the movie film poster. Irrespective of the medium used for browsing the content playback, the analogy would be the same in an online system. In MOVIEBROWSER2, we adopted the same analogy. Once a student has logged into the system, as shown in Figure 2, they will see a list of movie posters with some other information (i.e. titles, genre, and year) on the left side of the screen. This is similar to movie browsing used in other video libraries, such as the iTunes store. The user can filter from the list by selecting the movie genre and/or director from drop-down boxes at the top.

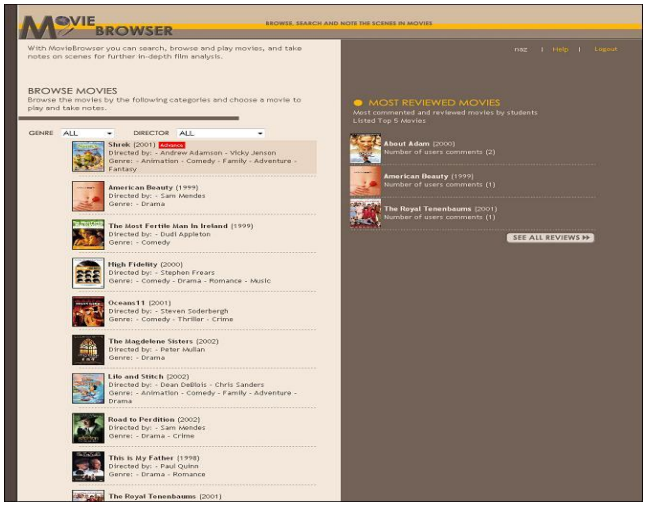

Figure 2. Movie selection interface

Our design rationale – The selection of a movie based on the film poster as a metaphor of choosing a DVD from the rental shop was chosen in our design. A metaphor can be useful for two reasons, according to Nielsen [4]. First, metaphor can provide a unifying framework for the design, and second, metaphor can facilitate learning that can allow users to create their own knowledge. A film poster could be useful for an overview at a glance in the selection as in

actual practice, because people will browse among movie posters while searching for a DVD from a shop or in an online store, such as the iTunes store.

b. Browse within-movie

Once a movie has been chosen, more details on the selected movie will be displayed on another page with information, such as movie title, director, plot, and cast list. Clicking on the "Play" button on the left side of the screen will start streaming the whole movie from the beginning to the end without any scene categorization (Figure 4). The user can filter the scenes of the movie by choosing the Exciting, Dialog, or Montage radio button options provided on the left side of the screen or from the timeline at the top playback area. A list of selected events category will be displayed as a keyframe list for each event with event category number, number of shots for the event, and event duration. The user can click on the relevant keyframe to play the particular movie clip. Other than navigating from the radio button, the user can also browse using an interactive timeline bar on the upper side of the screen (Figure 3). Each timeline represents a segmented scene of dialog, exciting, or montage, which is identified in each movie based on the techniques used in previous application on scene detection, scene classification, and keyframe extraction [1]. The timeline bar uses different color coding to differentiate between the three major segmented event types. The color is also standardized with the borderline color of the keyframe listed in the keyframe view area.

Figure 3. Timeline visualization.

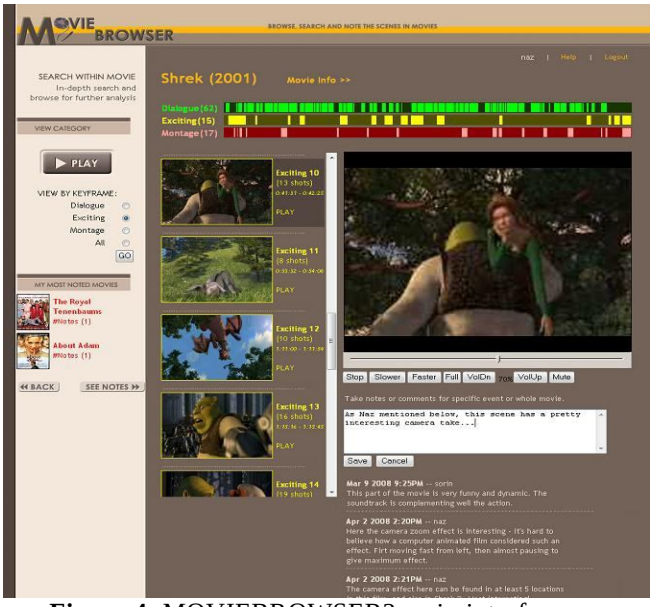

Figure 4. MOVIEBROWSER2 main interface.

Our design rationale for this approach to browse within-movie is quite simple in that it can display the particular movie in more detail. This page provides a content overview of the selected movie. The screen layout was designed in such a way to ease the process of reading the movie because all information on the movie as a whole can be found within one page (i.e. the playback area is located on the same screen). The reason for our layout design was that while the user is doing playback, they could engage with some extra information on screen without having to jump to another page. We thus tried to reduce the granularity level in our screen jumping. The graphic timeline bar features can be used to help students to visualize detected events better with the use of different color coding (green, yellow, and red for different event

categories). The timeline bar can also help the user to visualize the overall structure of the whole movie of segmented events, integrated into the system.

The use of similar color coding in the timeline bar in MOVIEBROWSER2 and the keyframe list will help students to identify the respective location of events in a movie. Browsing within movies is actually done following a well-known mantra of Shneiderman et. al [9], "Overview first, zoom and filter, details-on-demand." We used a calm-mode color theme, which is considered suitable for browsing and playing with a darker background, instead of a bright color theme. In this design, we used a combination of beige-based color coding. The use of bright colors is only for the timeline bar, simply to emphasize or highlight the events in the movie so that it will be eye-catching for the user.

c. Playing a movie

Standard buttons, as can be seen in a conventional media player, were provided for the user to use in MOVIEBROWSER2, such as play, pause, stop, full screen, volume adjustments, and mute. We consider the major activities of reading a film as an active viewing of movie. Thus, playback is an important process in the users' task. The playback area in MOVIEBROWSER2 can be seen in Figure 4 at the right side of the screen.

Our design rationale for this process is that we consider this to be the most important activity in reading a movie. It is located in a static area on the right side of the screen. We tried to reduce users' eye movements by locating it on the right side of the screen. The other parts of the screen are filled with add-on information regarding the movie. The note-taking area is located underneath the playback area to provide engagement while viewing a movie. By having it this way, browsing and playback are no longer separate processes. We tried to combine the processes (b) and (c) mentioned earlier. The static playback area with the "look and feel" similar to a normal movie player with stop, pause, slider bar, etc. buttons, were designed for simplicity of use.

d. Social Interactions

In MOVIEBROWSER2, we have provided a feature (Figure 5) so that at any point during the playback, the user can make notes by clicking on the "Make Some Notes/Comments" button underneath the playback area and then make a note on an interesting scene or the whole movie perhaps, which can be saved and viewed later and even shared with other students. By clicking on the "Save" or "Cancel" buttons, the user can save or cancel the notes taken. If there are other users already making notes on the particular scene in the same movie, their comments will be displayed with the date and time when they were written.

Figure 5. Note-taking section.

Our design rationale for this is based on our observations from our user study that the classroom was handled as a way of promoting discussions by the lecturer after the screening of a movie was carried out. The lecturer provoked discussion with the students with some topics and the students provided

their arguments. Our attempt for information-sharing on the notes or reviews given on the particular movies sections in MOVIEBROWSER2 is to support these kinds of interaction or discussions. Any interaction through exploration and discussion will lead to deeper student learning, thus would allow for the creation of knowledge. People generally can remember [10]: 10% of what they read; 20% of what they hear; 30% of what they see; 50% of what they see and hear; 70% of what they discuss with others; 80% of what they experience personally; and 95% of what they teach others. The above-mentioned learning stage is very useful and is currently being employed in many social network applications, such as Flickr (www.flickr.com), Amazon (www.amazon.com), and YouTube (www.youtube.com).

4. Evaluation

We deployed our developed MOVIEBROWSER2 system over a semester of 12 weeks duration during the second semester of an academic year at DCU. Our group of real users was students from CM272 *National and Ireland Cinema*, a second year undergraduate level module, and CM135 *Analyzing Media Content*, a first year undergraduate level module. The combined class groups comprised 268 students (CM272 = 76 students, CM135 = 192 students). For the former module, the lecturer mostly used Irish movies as the focus, while the latter module mainly used contemporary Hollywood movies. The collection consisted of 30 movies from various genres (i.e. comedy, drama, romance, action, etc.), ranging from contemporary Hollywood movies to old Irish movies, with production years from 1952 to 2004. Some examples of the movies included are *Shrek* (2001), *About Adam* (2000), *The Butcher Boy* (1997), and *The Visit* (1992). We also administered an online questionnaire at week-13 and week-14 of this trial deployment. Students' usage data logs were captured automatically and saved in our database.

We also conducted another focus experiment during the first semester of the academic year following the previous study, with the goal to determine how much better or worse is the MOVIEBROWSER2 system, when compared with the existing "state-of-the-art" standard movie media player interfaces. Our specific objectives in doing this experiment was to objectively measure the amount of "benefit" that the MOVIEBROWSER2 could provide, when compared with the conventional way of browsing movies, in terms of users' perceived satisfaction levels, the system's usefulness, and general student performance when using the interface. We recruited seven students from another new batch of film studies students at DCU.

The task given to students in this experiment was about how to "read" small sequences of a film. Each student had to produce a small piece of writing based on reading movie sequences (only writing about parts of the clips) and we compared how students perform this task using MOVIEBROWSER2 versions and using a standard PC-based movie player (i.e. the Quicktime player). In this focus experiment, we were only concerned with how the students browse within-movie content and complete their task in writing a short summary essay.

Data captured (quantitative and qualitative) for this experiment were measurements from various resources, including time to complete the tasks, amount of system interaction (i.e. automatic screen logs), video camera footage, and perceived satisfaction levels as measured from responses to questionnaires. Lastly, we measured the quality of answers from the essays, where the rating was given by the module lecturer as "Very Good," "Good," or "Basic".

The whole evaluation process took about a year because it involved different batches of students and a new academic semester year.

5. Results and Discussion

From the total number of 268 students in both the classes during deployment, 107 students (40%) accessed MOVIEBROWSER2. Out of the 107 students who accessed the system, 60 of them (56%) responded to the questionnaires that we administered within week-13–14. Among these 60 students, 56% accessed the MOVIEBROWSER2 from the PCs in their school laboratories, while the rest used

their own laptops (37%) or PCs in the library (7%). It is worth mentioning that MOVIEBROWSER2 could be accessed only within campus for reasons of copyright. This was one of the complaints from many students; however, it was necessary for us to conform to the license arrangements for movie content access, even though these license conditions are clearly being breached in many online sources where illegal downloads of media, such as these movies, are easy. This is where many of our students who did not use MOVIEBROWSER2 went. The consequence was that those students who wanted to work on their essay at home during the weekend or evening were unable to access our system. MOVIEBROWSER2 was also developed for a specific technical environment in which it was deployed (i.e. computer labs in School of Communications), consisting of Microsoft Windows XP, Microsoft IE v6+, and VLC player, whereas the illegal download sites were more multiplatform; these sites obviously do not have the detailed movie analysis similar to that provided by MOVIEBROWSER2. Thus, compatibility with other machines and browsers, when some of the students tried to use their own laptops, was an issue. These constraints might influence the usage.

The timeline visual and keyframe interaction view, which highlight where the *action*, *dialog*, and *montage* scenes in a movie were assessed as very useful. We also collected qualitative data on students' opinions on the overall system's potential; 34% of the participants gave comments on the convenience of access (i.e. the fact that it was a web application) as a major potential benefit. The following are some of the comments made by the students: "*It was very easy to access the movie required and very beneficial. It is far easier than renting a DVD as sometimes people might have taken it out or you can only have it for a few days or sometimes it's not even there, so in that respect it is very good"* and "*The ease of using it rather than searching for DVDs elsewhere."* These comments imply that there are difficulties in the conventional way for students to get movies, such as from the university library or rental DVD shops.

Among these 60 students, 43 of them (72%) said they would use MOVIRBROWSER2 in the future. We calculated the positive and negative expressions of their overall experiences and estimated that 19 of them (32%) gave positive expressions and only 4 (7%) gave a negative tone of expression, while the rest (37 students; 62%) did not express either positive or negative expressions.

From the total of 268 students, 107 (40%) used the application for a duration of about 86 hours during the deployment trial. The access rate for the application appeared low in terms of usage, but when considering some limitations, such as less coverage within campus and restricted to a specific technical environment in which it was deployed (i.e. playback using VLC player and compatible with IE only), these numbers show some great efforts from the students in trying to use a newly-introduced tool in their studies. Comments received from students also reflect this point. Some students preferred to access from home and we examined how these limitations affect the low usage from those students. We believe that this does not indicate a flaw in the experiment with 60% of students not using the system. Researchers had no control over streaming outside the university campus, which was the main reason for some students not using it. In fact, improved access coverage outside the campus for the future was among the suggestions given by the students in this work. Future improvement will consider this accessibility factor.

Being able to write down comments or ideas at any point of a movie was identified as an important and useful feature from the very beginning, when the initial student needs were captured and thus incorporated into the system. Our results show that this was underused during the deployment period according to the interaction log data (used by three students only during the deployed period, which is 1% of the total interaction logs). This demonstrates an interesting mismatch between what our users said would be beneficial and what they actually used in practice. This result that perhaps indicates how conventional usability engineering based on capturing user requirements/wishes is not adequate in developing a novel interface. Possible reasons for this mismatch can be summarized as privacy issues, preference for conventional practice of using DVD, access limitations, and interface design issues [8].

However, in the focus experiment, the findings from the essay outcome revealed that there are slightly improved or better results, which is also supported by the remarks given from the module lecturer, which show that students have more variability (i.e. more opinions, expressions) in their written essay when using MOVIEBROWSER2. This is a better indication that we found from the lecturer's point of view. We understand that a short duration of experiment (an hour) could not precisely measure the performance of a movie browser interface and many other factors need to be included, such as its learnability or memorability. The link between "cognitive" and "pedagogic" learning and any measurement of the deepening of students' perceptions of the audiovisual stimulus,

using technical or structured approaches, are definitely difficult to prove in terms of any direct benefits, especially in a limited time duration. Therefore, we need a longer experiment, such as a longitudinal study.

In our experiment, we found that satisfaction levels are higher after using the newly introduced tool with higher mean scores on all aspects of statements given, when compared with using a conventional standard player. User preferences and subjective opinions reflected from the comments favor MOVIEBROWSER2. All seven students intended to use the software application in their future learning. Besides the expected findings from the focus lab experiment in terms of better performance in the essay outcome and student's perceived satisfaction levels, we also observed a surprising finding – for the majority of students, the time taken to complete the task when using the newly introduced software application was longer than the conventional way. This is an interesting observation that needs to be further explored.

Overall, in designing MOVIEBROWSER2, we followed a set of design criteria that were developed during the earlier stage of this work. These design criteria were then used as an input to the system design. The summaries of the design criteria and future design suggestions are presented in Table 1. Some of the features (i.e. language glossary/dictionary, search function, script/subtitle, and recommendation) were among the user list that we had collected during the earlier user study, but were not incorporated into MOVIEBROWSER2; thus, in the design suggestions column, we have made such remarks. Even though some of these design criteria could not be included in our application, the design criteria that we obtained from our user study could inspire an idea on how a software application for the film studies domain could be enhanced in the future by other developers.

Table 1. Design criteria and suggestions. Note *Y=(Yes) incorporated in MOVIEBROWSER2,N=No

Features		Criteria	Design Suggestions	*Applied
Select movie	Drop-down list	Genre/Director metadata	Access by Genre/Director to be prioritized	Y
Browse within movie	Movie segmentation	Exciting, Montage & Dialogue events	Browse by classification	Y
			Color-coding by classification	Y
	Temporal navigation	Visual timeline	Ability to visualize/navigate events in details	Y
			Color-coding by classification	Y
			Interactivity over the timeline	Y
	Scene based navigation	Key frame view	Color-coded key frame border	Y
			Interactivity over key frame view	Y
	Metadata information	Movie information (i.e. Year, Director, Character, Plot)	Essential for overview	Y
	Language glossary/dictionary	-	From user feedback	N
	Search function	-	From user feedback	N
	Script/subtitle indexing	-	From user feedback	N
	Recommendation (i.e. scene, character)	-	From user feedback	N
Playing a movie	Movie playback	Playback features (e.g. play, pause etc)	Static area to reduce eye movement	Y
			Playback panel for better engagement	Y
Social interactions	Note taking	Comments for discussion	Design for context usage and privacy	Y
General	Overall system	Online access	Web-based strongly preferable	Y
		Movie database (i.e. Irish, Hollywood)	Larger movie database	Y
		Streaming access	High speed access and wide coverage (e.g. outside campus)	Y
		IE explorer and VLC player	Consider compatibility (OS, browser, player plug-in etc)	Y

6. Conclusion

The rationale that we took in the design of an interface to a movie browsing system was elaborated with some design criteria based on an initial user study with film studies students. The fundamental concept of our design was the technology used in movie content analysis, which was built into the

system. A tool such as MOVIEBROWSER2 could be beneficial in the teaching of film studies if more features could be included utilizing the emerging technologies in video content analysis as well as including all these in the design criteria. Further experiments with real users for a longer duration of time would be valuable to capture more accurate data on its usage as well as for further investigation on their learning context.

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