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Increasing Social Awareness of the Lecturer on the Backchannel Backstage

Filter out of the Box

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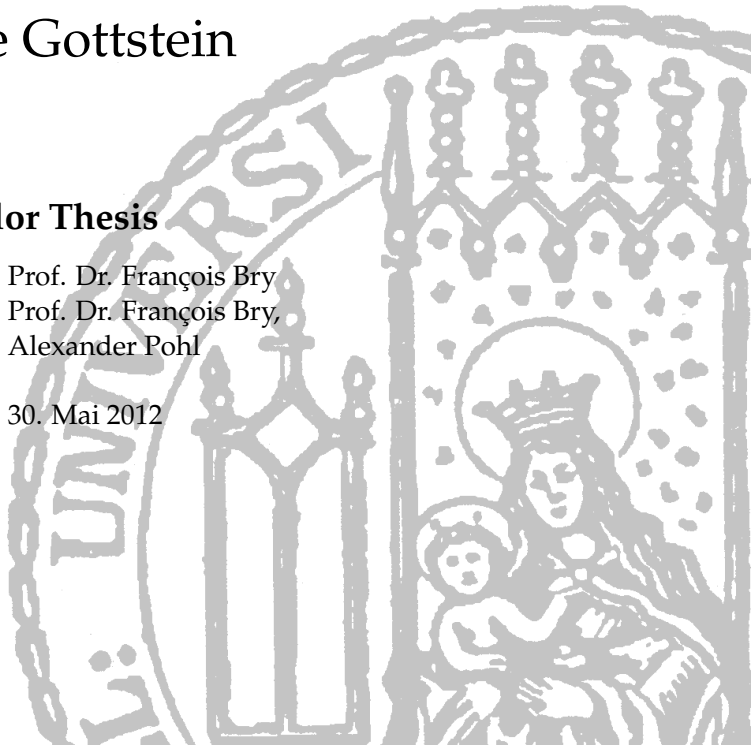

Bachelor Thesis

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Betreuer	Prof. Dr. François Bry, Alexander Pohl
Abgabe am	30. Mai 2012

Acknowledgement

First and foremost, I want to express my special gratitude to Prof. Dr. François Bry for giving me the opportunity to work in such an interesting research context. I am very thankful for the stimulating advices and the possibility to combine the work on the thesis with an international environment.
Furthermore, I would like to thank explicitly my advisor Alexander Pohl. He guided me through the thesis with a lot of enthusiasm, motivation and inspiring ideas. Despite the difficult circumstances of the physical distance, he supervised my work carefully and was always available when I needed support.
I am also very grateful for the participants of the prototype study, who gave me new insights. Special thanks also go to my family and friends for their understanding, support and editing skills.
Last but not least, I want to thank my friends and colleagues Jeannette and Max,who wrote their theses simultaneously to mine, for the constructive and humorous work sessions in our *Bachelorette office*.

Erklärung

Hiermit versichere ich, dass ich die vorliegende Arbeit selbständig verfasst habe und keine anderen als die angegebenen Hilfsmittel verwendet habe.

Sevilla, den 30. Mai 2012 Marlene Gottstein

Abstract

Large classrooms decrease the interactivity between students and the lecturer enormously. The impersonal atmosphere and the risk to talk in front of many people prevent the students to engage in the lecture. The result is, that the lecturer is less informed about the actions of the students and especially about their comprehension of the lecture's content.
Digital backchannel are used to increase the social awareness about the actions of the others to set a context for the own actions. Therefore, the size of the classroom gets compensated and the engagement of the students gets promoted. The challenge exists in integrating the lecturer in the conversation. The mass of messages makes it impossible for the lecturer to observe the information stream and give the lecture at the same time. But it is highly important, that the lecturer is informed about upcoming confusion of the students.
The thesis discusses the problems of the lecturer and possible solution approaches, further it presents a concept that tries to increase the awareness of the lecturer through constricting the information stream down to the relevant messages. An extended filter mechanism, provided through integrated slides in Backstage, enables the lecturer to filter for areas on the slide. The concept provides substantial mechanism to filter for high quality messages and to organize the messages for a insightful recapturing of the lecture.

Zusammenfassung

Große Vorlesungsräume verringern die Interaktivität zwischen Studenten und Professoren enorm. Die unpersönliche Atmosphäre und das Wagnis vor vielen Menschen zu sprechen hindert die Studenten daran sich an der Vorlesung zu beteiligen. Dies führt dazu, dass der Professor wenig informiert ist über die Handlungen der Studenten und vor allem, ob der Vorlesungsinhalt verständlich ist für die Zuhörer. Digitale Backchannel werden genutzt, um das soziale Bewusstsein über die Aktionen der anderen zu verbessern und somit einen Kontext für die eigenen Handlungen zu schaffen. Dadurch wird die Größe des Vorlesungsraums kompensiert und die Beteiligung an der Vorlesung gefördert. Die Schwierigkeit besteht jedoch darin, den Professor in die Unterhaltung im Backchannel miteinzubeziehen. Die Menge an Nachrichten macht es für den Professor unmöglich, während der Vorlesung den Informationsstream zu folgen und gleichzeitig die Vorlesung zu halten. Jedoch ist es von Wichtigkeit, dass der Professor über aufkommende Verwirrung während der Vorlesung in Kenntnis gesetzt ist.
Die Thesis diskutiert die Probleme des Professors und mögliche Lösungsansätze, sowie stellt ein Konzept vor, das durch Beschränken des Informationsstreams auf relevante Nachrichten das Bewusstsein des Professors verbessern soll. Ein erweiterter Filtermechanismus, bereitgestellt durch Vorlesungsfolien integriert in Backstage, ermöglicht es dem Professor, nach Orten auf der Folie zu filtern. Das Konzept stellt dem Professor umfangreiche Mechanismen zur Verfügung, um qualitätsvolle Nachrichten zu filtern und die Nachrichten für eine aufschlussreiche Nachbereitung zu organisieren.

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CHAPTER 1

Introduction

Nowadays, it is not uncommon to find overcrowded lecture-rooms at universities. Lectures visited by more than hundreds of students belong to everyday life. As a result of large audiences, the students feel as if their participation and presence do not matter. They are only one of many. This increases the fear to disgrace in front of the other students [8]. As a result, the students withdraw and behave passively during the lecture.
Besides the problem of large audiences, the "*students have changed radically. Today's students are no longer the people our educational system was designed to teach.*" [18]. Every student has access to wireless networks on the campus. Instead of following the lecture, there are more opportunities: surfing and checking e-mails are only some of them [21]. In fact, the lecturer's awareness about the students' activities decreased dramatically.
Computer-mediated communication tools like instant messaging (IM) and microblogging enable a secondary communication channel in the background of the lecture, a so called digital *backchannel*. The backchannel enhances the conversations on the frontchannel by encouraging the participation and interaction of the audience. The frontchannel is the single, primary focus of attention of the audience. In universities the frontchannel is created by the lecturer [21, 12]. William W. Griswold puts the backchannel in a political context. The backchannel allows a democratic role relationship between lecturer and students. The lecturer has less control over the audience [11]: the backchannel changes the dynamics of the audience from a one-to-many interaction to a many-to-many interaction.
Today's lectures benefit from a digital backchannel, since it allows to ask questions without interrupting the lecture. For a shy student, it is a minor barrier to ask students in the background, possibly anonymously, than to turn to the whole audience and the lecturer with her question. It allows a wider spectrum of discussions to take place and the fear to say something wrong and embarrassing decreases. Further, a social bonding takes place. The backchannel facilitates it to connect to other students in large courses. Another positive aspect is, that the information can

be enhanced and archived by adding comments, notes and external information to the presenter's slides. It is possible to review and analyze the information after the event.

1.1 Awareness of the Lecturer on a Backchannel

In computer-mediated communication, awareness is considered as the consciousness about and understanding of the activities of others providing the social context of one's own activities [5, 19]. If the audience creates a backchannel discussion, the lecturer's awareness is enormously restricted. Often a backchannel is created in silence and without her knowledge. The lecturer has no information about the ongoing discussion in the background. In its follow, she loses understanding about the activities of the audience. Distraction, which is easily evoked when the audience pays more attention to the backchannel than to the frontchannel, is not comprehensible to the lecturer. She has no chance to control the backchannel or to respond to the interactions on it, as she cannot monitor them. As a result, her guidance of the audience is very limited. This could motivate the audience to gang up against the lecturer. As the lecturer is not aware of the backchannel, the audience could make use of her inability to respond. Also, it is much easier to be rude, when you are not visual present or when messages cannot easily be associated to a person. A backchannel allows to say things about or to the lecturer that people might never say directly to her. Probably, the students will not behave this way, but we cannot exclude, that this situation might occur.
In conferences, where the use of digital backchannels during presentations has been established since Twitter[1], some presenters experienced the negative side of the backchannel. The most famous example is danah boyd, who discussed on her blog[2] how she lost the attention of the audience and how helpless and disqualified she felt with the ongoing communication within the audience.
A lecturer may be interested in lecture-relevant conversations on the backchannel. The experiment of McCarthy using a digital backchannel at an academic conference yielded that several presenters were confused by the mass of people attending to their notebooks, not knowing if they engaged in the backchannel or did other tasks [12].
It is obvious that presenting with a digital backchannel is challenging. To better support the lecturer it is necessary to integrate the lecturer in the backchannel interactions, so that she gets aware of it and is able to react to it. Since the lecturer is mainly busy with maintaining the frontchannel, the lecturer's attention for the backchannel is a scarce resource. Thus, making the backchannel comprehensible to the presenter is a salient issue to be dealt with. A demanding backchannel would distract the presenter enormously and the lecture would suffer from it. That is, why Olivia Mitchell advises to hire a backchannel moderator who filters the information stream during the presentation [13]. However, this solution is very costly

[1] www.twitter.com
[2] "*spectacle at Web2.0 Expo ... from my perspective*", November 24th, 2009
http://www.zephoria.org/thoughts/archives/2009/11/24/spectacle_at_we.html

and not scalable. If a lot of messages occurs in the same time, a backchannel moderator would be overwhelmed and would loose the overview. It is necessary to add a filtering system to the backchannel which does not distract the presenter and represents her interests best.

1.2 Backstage: A Digital Backchannel for Large University Classes

Since the situation in modern universities described above requires a rethinking of the educational system, Pohl et al. developed the concept of a digital backchannel to promote the awareness of the audience and the speaker in large audiences. The project called Backstage aims to increase the participation of the students in the lecture. Via microblogging students are able to ask questions without interrupting the frontchannel discussions. A message consists of only a few words to enable fast writing and reading of messages. Thereby the student is forced to concentrate on the important. In order to put the messages into context, the slides of the lecture are integrated in Backstage. The student can easily drag the message to the related point on the slide. Instead of writing a redundant message with the same content one can rate the existing messages. The ratings get aggregated and build a top-k ranking to give both, the lecturer and the audience, an overview of the most relevant messages on the slide. Backstage is customizable by the lecturer to a great extent. The lecturer can predefine a set of categories, where messages are assigned to.
Cogdill et al. declares five different forms of communication on a backchannel: process-oriented, content-oriented, participation-enabling, tangential and independent communication. Process-oriented communication deals with the analysis and steering of the frontchannel discourse, e.g. pace of lecturing or acoustics. Content-oriented communication deals with the public frontchannel and backchannel discourse, e.g. critics or appraisal. Participation-enabling communication is about supporting users to participate in the backchannel or frontchannel discussions, e.g. questions about the instruction of the backchannel or language barriers. It is mostly a private communication. Tangential communication transfers a conversation from the frontchannel into the backchannel. Independent communication refers to discussions unrelated to the frontchannel [4]. These different communication forms provide a precise differentiation between the messages.
More features of Backstage are declared in [17, 7, 2, 3].

1.3 Classification of the Lecturer's Awareness in Backstage

In Backstage, there are different components implemented to provide the lecturer with a high degree of social awareness. The awareness components are ranking of messages, a topical overview and explicit referencing.
Ranking increases the awareness of the lecturer about the messages considered most

relevant by the students. It highlights the messages which probably have the most interesting content.
The *topical overview* gives an overview of the participation in the different categories and other conditions of the lecture like the amount of messages and students registered in the lecture. They both provide aggregated information to provide an explicit overall awareness. The components give helpful feedback, but they do not stand in relation to the actual context of the lecture.

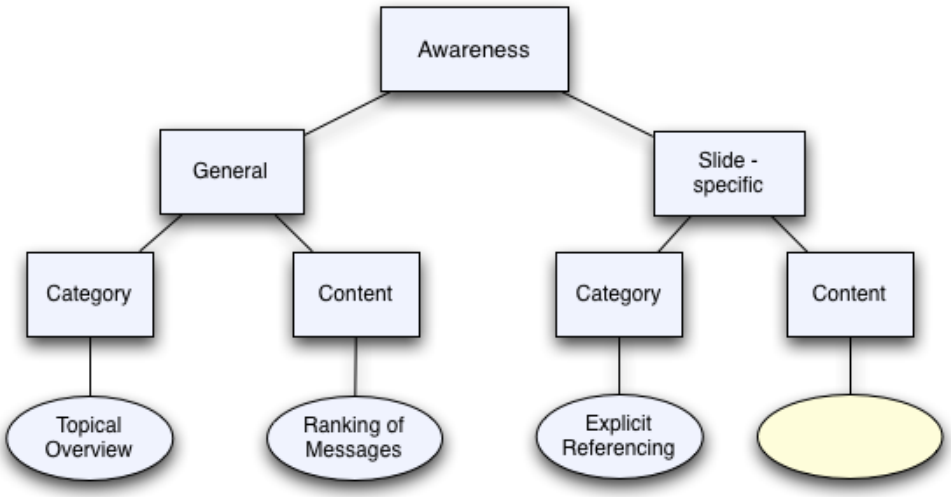

Figure 1.1: The taxonomy of awareness integrated in Backstage

Explicit referencing[3] sets a message into semantic context to the lecture.The category icon linked to the message gives information about the kind of message set on the slide and thus shows in which context the message are posted. Figure 1.1 illustrates the taxonomy of awareness integrated in Backstage and Figure 1.2 shows how the components are integrated in Backstage.
This thesis elaborates an awareness component for the lecturer, which offers the lecturer information about the slide-dependent content.

1.4 Motivation and Scope

"We are drowning in information but starved for knowledge."[14]
There is a vast amount of data on the backchannel. There is enough information available, but it is difficult to find the relevant information. There is a need of infor-

[3]Explicit referencing is a mechanism for enabling deictic gestures in computer mediated communication. A deictic gesture points to a location to draw the attention of the communication partner to the location. It aims to refer to the location or to something linked to the location like an object, person or event [16]. We assume that the students position their messages on the slide where their content matches the most with the content of the message. The position of a message gives information about the content of the message.

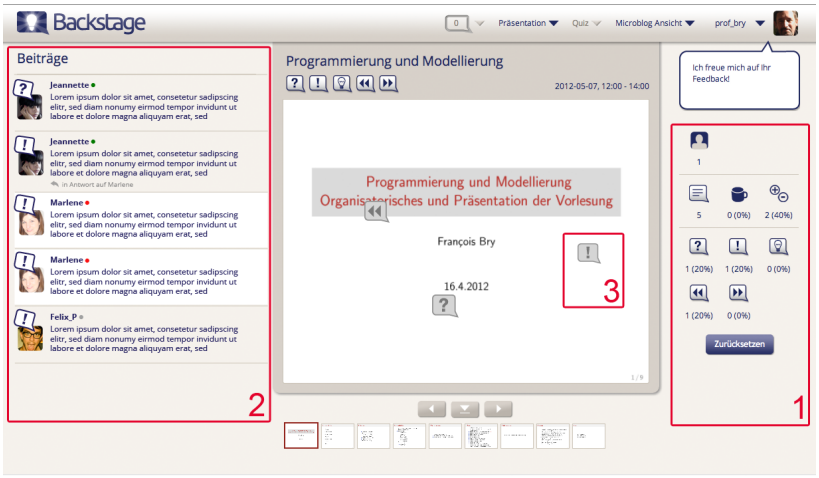

Figure 1.2: (1) The topical overview provides aggregated information about the percentage of the student's participation in the different categories, the average quality of the messages, how many students are registered to the lecture and the amount of messages. (2) The ranked list of messages shows the lecturer which messages are considered particularly relevant by the students. (3) Explicit referencing shows at a glance the distribution of messages to the categories in a specific context.

mation management and filtering. Similar to a backchannel moderator, the thesis aims to design a filtering system for the lecturer with the following requirements:

- **Customizable**: The lecturer is capable to adapt the filtering system to her needs and to the requirements of the lecture
- **User-friendly**: The lecturer is capable to use the system easily and efficiently

We intend to increase the awareness of the lecturer by constricting the information stream down to the messages that are of the lecturer's interest.
Furthermore, this thesis gives an overview of the previous research to increase the lecturer's awareness, shows the design aspects of the concept and how it is implemented in Backstage.

CHAPTER 2

Filter out of the Box

Section 1.3 describes the awareness components of Backstage. Particularly interesting are the slide-specific awareness components. So far, Backstage has only a category overview implemented. Explicit Referencing informs to which category a message is associated to in which context. Besides a general overview of the backchannel communication a highly lecture and context specific overview can be provided by the lecture slides and explicit referencing.

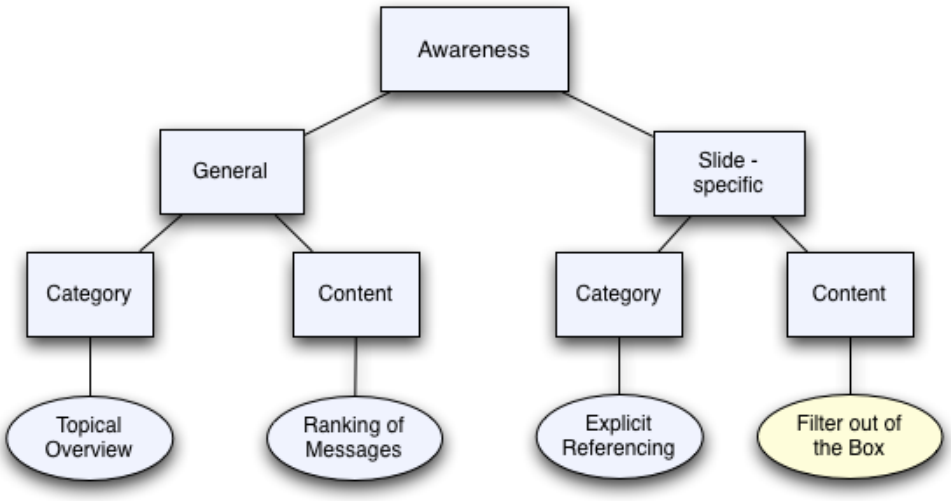

Figure 2.1: The taxonomy of awareness with the new designed component "Filter out of the Box".

We developed the filtering mechanism *Filter out of the box*, which is composed of two different filters:

- **Location filter:** We assume that the students position their messages on the specific location of the slide, that matches the most to the content of the message, setting the message into semantic context. The position of a message gives information about its content of the message. That is why we can use the location of a message to filter for content (see in Section 2.1).
- **Message filter:** Since the location filter is directly associated to the content of the messages, the message filter accounts for the quality of the message's content. The message filter specifies the attributes of a message, which could be important for the lecturer (see in Section 2.2).

2.1 Box as the Location Filter

To specialize an area of interest and therefore the location filter, we assume the most intuitive and easiest way is to draw a rectangle around the area where the lecturer expects the most interesting and important messages. Only the messages inside the rectangle are shown at the lecturer's message stream.

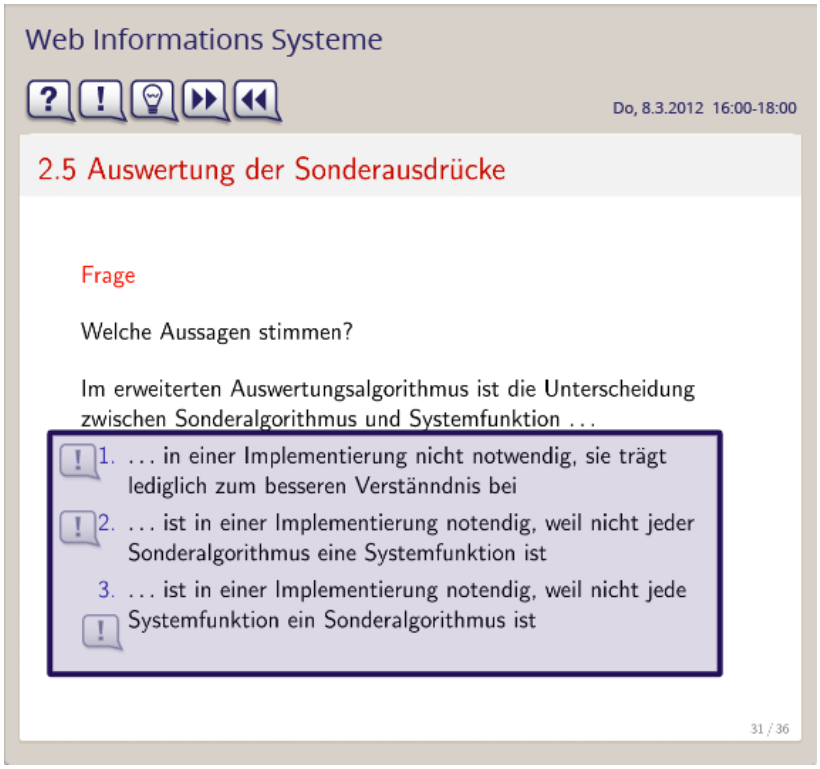

Figure 2.2: The purple box surrounds the area of interest of the lecturer. The messages inside the box are filtered, the others are filtered out and not presented to the lecturer.

Whereas explicit referencing corresponds to pointing at an interesting place on the

slide, the rectangle corresponds to highlighting a special area of interest on the slide. In this thesis, the drawn rectangle that specifies the location filter is named the *box*. The *box* refers to the metaphor from the common phrase *thinking out of the box*, which is to think differently and in a new perspective. Provided through the slides, this filter mechanism is two-dimensional, different to usual filter mechanisms which filter only on textual layer. Moreover we want to withheld the possibility for future work to extend the concept to a third dimension like the dimension time, but see more in Chapter 5.
Combined with the *message filter*, it composes the *filterbox*. Figure 2.2 shows how *Filter out of the box* practically works.

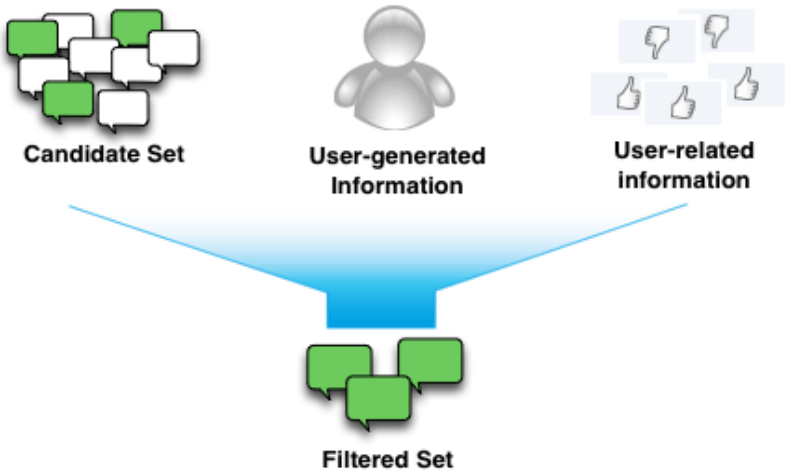

Figure 2.3: The candidate set, i.e. the messages posted on a slide, is constricted to the filtered set through the conditions of the user, i.e. the location and message filter, and ranked by the rating given by the students.

The filterbox constricts the candidate set[1] to the set of messages, that are located inside the box. We also consider the slide to be a box, since it restricts the whole information stream to the messages set on the current slide. Hence our concept is already implemented in Backstage, however we extend filtering to work on a finer level.
Figure 2.3 shows which components compose the filtered set. The filterbox is generated by the lecturer and returns a set of filtered messages. The filtered set might be sorted by the aggregated rating values of the messages given by the students. In general, our concept integrates itself in the concept of flexibility and customization of Backstage's components. Thereby the lecturer can decide by herself if she wants to see the filtered messages in ranked order or sorted by age.

[1] The candidate set consists of all public messages written in a Backstage session, e.g. a lecture. Private communication is not filtered.

2.2 Message Filter

The filterbox enables the lecturer to filter for certain areas on the slide. But we cannot be sure that a message passing the location filter is actually relevant. Also, it is possible that a student positions her message in the wrong location or the message is simply of low quality. Therefore, we introduce the second filter, the *message filter*. The message filter extends the filterbox. A filterbox always consists of the location filter, but it does not need a message filter. The message filter is composed of a set of conditions, that enables to control the output of the filterbox.

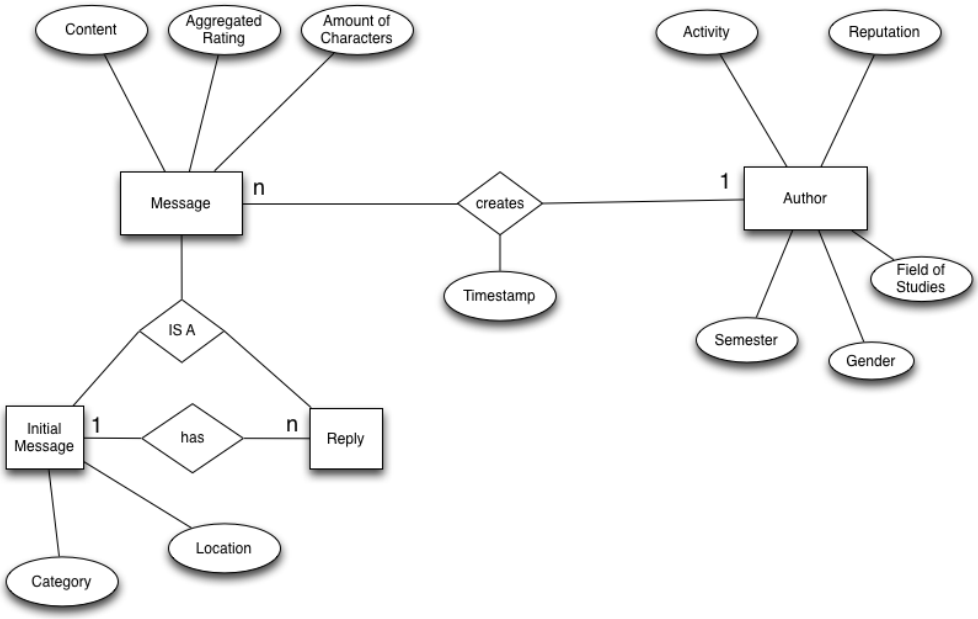

Figure 2.4: Abstracted Entity-Relationship-Modell of Backstage

To find appropriate parameters for the conditions we examine the entities of Backstage, therefore see Figure 2.4. Possible parameters are:

- **Keyword:** There are different filter methods possible using the keyword as parameter:
  - **Full text search:** Determining if the message text contains a specified keyword, which expects the lecturer in relevant messages, might be a suitable extension to the filterbox. Messages which are mistakenly placed inside the box although their content does not match the area on the slide can be filtered out with the full text keyword search. However, since a lecture usually treats a topic deeply, it might be difficult to find keywords that specify the content in detail, e.g. in a lecture of *Introduction to Programming* about the Hoare Calculus the majority of messages might have "Hoare Calculus" as keyword. Also it may be possible that actually relevant messages not containing the specified keyword are filtered

out, since it is not necessary anymore to describe the message's topic with a keyword when using explicit referencing. The restricted length of microblog messages may make a full text search useless.

  - **Tagging:** A student can tag a message with one or many keywords, which she chooses by herself. She can create her own tags or use the ones prepared by the lecturer. The lecturer can filter for the tags of the messages.

- **Category:** In Backstage, the lecturer is able to compose a set of categories according to her own preferences. The category classifies the message. Categories are very useful parameters in Backstage.

- **Message length:** It could be useful to filter messages according to length. Since the lecturer is engaged to guide the frontchannel discussion, she has only limited time to dedicate herself to the backchannel discussion. Therefore it is not suitable to show long messages to the lecturer. She could be interested in filtering for messages with a small amount of characters. She would have time to study longer messages after the lecture. A Backstage message of 140 characters is already very short. However, it depends on the lecturer: maybe she needs more time to read a message and she prefers messages even shorter than 140 characters. It could make sense to give the lecturer the possibility to decide between two or three options which amount of characters integrates perfectly into her lecture style. Options could be *less than 90 characters*, *less than 120 characters* or *no limitation*.

- **Relevance score:** The relevance score is given by the aggregated rating for a message. It informs about the degree of relevance of the messages. It may be, that the lecturer is not interested in an entirely ranked list, she only wants to see messages with a high relevance score.

- **Author:** Every message has an author. An author has properties outside of Backstage and a behavior within Backstage.
  - **Properties of a user:** These properties describe the person in the real world and are currently not implemented in Backstage or not necessarily indicated. It may be suitable to implement them in the future to use them as parameters. Therefore the students have to specify the data in their profiles.
    * **(Pseudonymous) name:** In other filter systems it is useful to filter for the name of the author. In Backstage though, it is not guaranteed that the name is given. Usually, the lecturer does not know the majority of her students by name and every student shall be treated equally. However, it may be that the lecturer discovers a great match between her and a student. Therefore she might be interested in contributions by a particular person. For that, it is necessary to identify a user. A nickname may be sufficient for that.

    - **Field of study:** The lecturer may be interested in the field of study of the student. Since many students of different course of studies are attendant, the degree of prior knowledge of the students varies. It may be important to know which topics cause problems to which field of study. Especially students who have the lecture as minor can have major problems of understanding when they do not know the basic concepts.
    - **Semester:** Similar to the parameter *field of study* it may be informative to know in which semester the student is to estimate prior knowledge of students in this semester.
- **Behavior of a user:** These parameters describe the backchannel activities of a user in the system. Both, activity and reputation status of a student may be determined separately for each message category predefined by the lecturer.
    - **Activity:** The activity of a student in a category may be a parameter the lecturer wants to filter for. She may be interested in messages of students who give many answers or in questions of students who are shy and do not often post questions.
    - **Reputation:** The reputation of a student in a category is informative concerning the quality of the contributions of the student in this category. For example, questions asked by a student who has a good reputation in this category and who's quality is thereby verified, may be more important.

The message filter consists of a set of one or many parameters. Parameters can be combined through logical operations AND, OR, NOT with the set of parameters.

Exemplary filter requests are:
The lecturer wants to see questions by students in the fifth semester or lower OR from students having the lecture as minor.
The lecturer is interested in messages of students rarely raising questions, because she thinks that their questions are better thought through.

2.3 Reciprocity

The lecturer is forced to give every created message and location filter a name identifying the content of the filter. For example a box surrounding content about Hoare Calculus might be named "Hoare Calculus". The name of the location filter also serves as a tag and is reusable for several boxes. A name for a message filter explains the target group of the messages, which should get filtered. For example a message filter composed of the conditions, that the messages should belong to the category questions and be asked by good students, could be named "good Questions". The names of the message filter

and the location filter are then combined in order to form the description of the related filterbox.
This results in a reciprocal effort. The students are motivated to drag their messages to the matching location and the lecturer creates named filterboxes, which enable to form message groups and thereby, searching for messages by group name. A message group results of the conditions of an filterbox. Messages passing the conditions of the filter of the selected filterbox belong to the message group of this certain filterbox.
Both sides profit, the lecturer's awareness is increased through the students' effort dragging the messages on the matching position. In return, they get a themed overview of the messages.
Furthermore, the lecturer shares her knowledge about her preferences and the topics she considers the most important ones. After the lecture, the students can check if the lecturer saw their messages during the lecture and learn which topics are the most important and therefore necessary to study.

2.4 Typology

We divide the workflow of the lecturer into three different phases - the *preparation phase*, the *session phase* and the *post-session phase*.
During the preparation phase the lecturer creates filterboxes for the upcoming lecture. There are no immediate time limitations to think about the slides and the content she wants to filter for. Therefore, she can specify the filters in a detailed degree. In the ideal case, the lecturer defines the filter accurately, thus matching her interests exactly, so she does not have to modify them later on (see more in the Section 3.2.1).
During the session phase, i.e. during the lecture, the lecturer is focused on the presentation and has only a limited degree of attention for the filter. In the ideal case there is no need to change the settings of the filter, but it may happen, that the lecturer is not satisfied with the filter settings. They may be too generalized or too specified or set on a falsely location as the students may interact on the backchannel in an unexpected way. That is why she should be able to adjust the filter during the session phase.
There are two different approaches:

a) No solution is supported for the described case since we assume that the lecturer created a filter of high quality.

b) It may be possible, that the lecturer has to react on current interactions on the backchannel with adaptations, thereby avoiding an exclusion of the backchannel discussions because of her filter settings.

We assume that the approach b) should be considered since no lecturer can predict the interactions on the backchannel. In order to overcome the challenges during a session, making adaptations is only possible in a limited way. In regards to the time and the usability, the lecturer will not have to pause the lecture, just to change some settings (see more Section 3.2.2).

The last phase is the post-session phase. It occurs after the lecture and is for reworking the lecture's events. The lecturer has time to change the filter settings and she also has all the information about the messages set on the slide. She may extend the filters with some specified requests (see more Section 3.2.3).

It may be useful to show multiple boxes at a time, but likewise handling and comprehensibility become worse. Since the lecturer only has a limited amount of attention she can pay to the backchannel, she may only be able to focus on one box after another. Also, to simplify matters, filterboxes are independent from each other, i.e. there is no chaining of filters and thus no intersections or unions of filter results. We try to keep the concept as simple as possible to eliminate distraction and to keep the results intuitive. Many different boxes displayed or unioned boxes would not increase the awareness, it would on the contrary be hard to overlook and thereby create distraction. It is impossible for a person to concentrate on a lot of boxes and contexts at the same time.

Regarding the three different phases of the lecturer's workflow and the fact, that there is only one filterbox presented to the lecturer, we evaluated two different types to integrate *Filter out of the Box* in Backstage.

2.4.1 Transient State of the Filterbox

There is one filterbox provided, which has only one state for the whole existence. A state is the constellation of the two introduced filters, the location filter and the message filter. The state is transiently saved and only serves the lecturer to organize the ongoing interactions on the backchannel. In this case, a preparation phase is not necessary and a filterbox can only be modified matching the current situation. It is important to make the adjustment of the filterbox as easy as possible, while providing all combinations of message filters. This approach can be seen as a metaphor for a magnifying glass running over the slide and emphasizing the overseen details, in this case matching messages.

2.4.2 Persistent State of the Filterbox

The state of the filterbox is saved persistently. That means that there are many different states of the filterbox for one lecture. This enables the lecturer to save many different constellations of both filters, since she may be interested in many areas of the slide. She may be able to prepare them before the lecture begins and, since they still exist after the lecture, modify and extend them in the post-session phase. To provide a minimum degree of distraction, the functionalities are limited in the session mode. The filterboxes may be modifiable, but only to a certain extent - there is only a special set of message filters provided.

It has to be distinguished between the following two approaches:

- **one visual representation for multiple boxes:** Only one of the filterboxes is presented at a time.
- **multiple visual representation for multiple boxes:** Every filterbox has its own visual representation.

Both approaches give the same result, since we only want to show one filterbox at a time. However, they differentiate in the implementation. The first approach has one instance, which visualizes the state of the current filterbox. In the second approach, every filterbox instance has to care about its visualization by its own. That makes the implementation more complex, but would provide the possibility to represent multiple boxes at a time. We will continue with the first approach, since we do not assume, that the lecturer can pay attention to more than one box at a time.

2.4.3 Evaluation

We established four criterias which we evaluated using the values *low*, *medium* and *high*.

- **flexibility:** The application shall be flexible and customizable. The filterboxes shall be modifiable and extendable, especially during the lecture.
- **combinability:** The amount of different filter combinations shall be sufficient. All filter combinations of the lecturer's interest shall be covered.
- **distraction:** *Filter out of the box* shall not distract the lecturer from the frontchannel. She shall not have to pay a lot of attention to the filtering procedure. Distraction factors can be the presentation of information, the adjustment process of the filterboxes and the navigation between the filterboxes.
- **effort:** The time effort to create filterboxes shall be minimal.

Some of the criteria influence one another. Especially the variety of filter combinations and the distraction during the lecture depend on the effort the lecturer put into creating the filterboxes. Effort has to be invested either way, but it differentiates in the benefit the effort brings and time frame.

	Transient State	**Persistant State**
	Preparation Phase	
flexibility	*low*	*high*
	No functionalities.	All filter combinations can be created and filterboxes can be changed easily.
combinability	*low*	*high*

	Transient State	**Persistant State**
	It is not possible to use the filter mechanism and prepare a filterbox.	In the preparation phase, the lecturer has no time limitations. She can create complex and detailed filterboxes. Also, all possible filter combinations are provided in this phase.
distraction	*low*	*low*
	No distraction.	Since there is no frontchannel, the lecturer is not distracted and can fully concentrate on the creation of the filterboxes.
effort	*low*	*high*
	No effort. The lecturer does not have to prepare the lecture.	The effort is very high, since the lecturer has to prepare all filterboxes in this phase.
	SessionPhase	
flexibility	*medium*	*medium*
	The complete functionality is available. However, the limited time during lectures makes it difficult to actually make use of all functionalities. Too much functionalities can reduce flexibility by making handling of boxes worse.	The lecturer can change all created boxes. However, she can only change the location filter and a special set of message filters.
combinability	*high*	*high*
	The lecturer can create all possible filter combinations.	There is a high degree of combinability, since the lecturer had the possibility to create complex filters in the preparation phase.
distraction	*high*	*medium*

	Transient State	**Persistant State**
	The distraction is very high, since the lecturer has to choose the different filters during the lecture. If she wants to create complex message filters, it takes a lot of her attention and makes it impossible to hold the lecture and change the filterbox in the same time. Everytime when the lecturer wants to filter for another area on the slide, she has to change the filterbox.	The distraction is very low while adjusting the boxes, since there are only small or no changes to do, when the lecturer prepared carefully for the lecture. Distraction also occurs, while navigating between the boxes. The distraction is very low compared to the *transient type*.
effort	*high*	*low*
	The lecturer has to pay much attention to the filterboxes and has to do many changes if it is important for her to have reflected her interests on a high degree.	Given that the lecturer has created the filterboxes carefully, she has practically no or only a little effort changing the boxes.
	Post-Session Phase	
flexibility	*high*	*high*
	All functionalities are provided.	See *Transient State*
combinability	*high*	*high*
	All filter combinations are representable.	See *Transient State*
distraction	*low*	*low*
	Since there is no frontchannel, the lecturer can concentrate on the adjustment of the filterboxes.	See *Transient State*
effort	*high*	*low*
	The lecturer needs a lot of time to manipulate the filterboxes, since there are no filterboxes saved.	The lecturer does not have to do a lot anymore.. The filterboxes created during preparation and changed during lecture still exist. She can always evaluate the given information.

A filtering system which does not demand a preparation before lecture and which provides detailed filtering results during lecture is tempting. However, it is not possible to focus on the lecture, while using a complex filtering system. With the type *Transient State* the lecturer would get distracted by using the filtering system or would stop using the system. We want to increase the awareness of the lecturer about the actions of her students. Hence, promoting such behavior would conflict our goal. Furthermore, the transient character of the boxes complicates recapturing the lecture and defers time-consuming creation of filters from the session phase, in which time is a critical parameter. The other concept enables the lecturer to filter very detailed during the lecture. She can filter very qualified messages depending on her interests. We assume, that the lecturer is willing to make the effort and prepares the filterboxes, as by constricting the information feed of the students to qualified messages she gets the opportunity to increase her awareness.

CHAPTER 3

Realization

Backstage is supposed to be usable in every lecture. Still there are lecturers with varying computer literacy. Some lecturers may be more familiar with tools that include the use of a computer than others, who e.g. mostly present with overhead-projectors. Furthermore, lecturers are usually older and have not grown up with the world wide web and computers in every household like the younger generations. That's why it is very important to increase the usability to ease the use of the tool and to satisfy the lecturer. Jakob Nielsen defines usability as "a quality attribute that assesses how easy user interfaces are to use" [15]. The success and the integrity of Backstage in every lecture is dependent on the usability of Backstage. If the lecturer does not know how to use the tool, she gets frustrated and will not use it again.
Nielsen defines five quality components for usability: *Learnability* measures how easy it is to accomplish basic tasks the first time the user encounters the tool. *Efficiency* measures how quickly experienced users can perform their tasks. *Memorability* defines the expenditure to renew proficiency after not using the tool for a longer period. *Errors* measures how many errors a user makes, how severe these are and how easy they can be recovered. The last component *satisfaction* measures how pleasant the user is when using the interface. In the realization of the concept *Filter out of the Box*, we want to regard the mentioned quality components. By following the eight golden rules by Shneiderman [20], we want to provide a high degree of usability.

3.1 Panels relevant for Filter out of the Box

We introduce three new panels relevant for our concept. They may look different in each mode, therefore see Section 3.2.

3.1.1 Slide Panel

The slide panel already exists in Backstage. The students can drag their messages on the slide. Now, also the lecturer is able to draw the box to filter for the location on the slide.

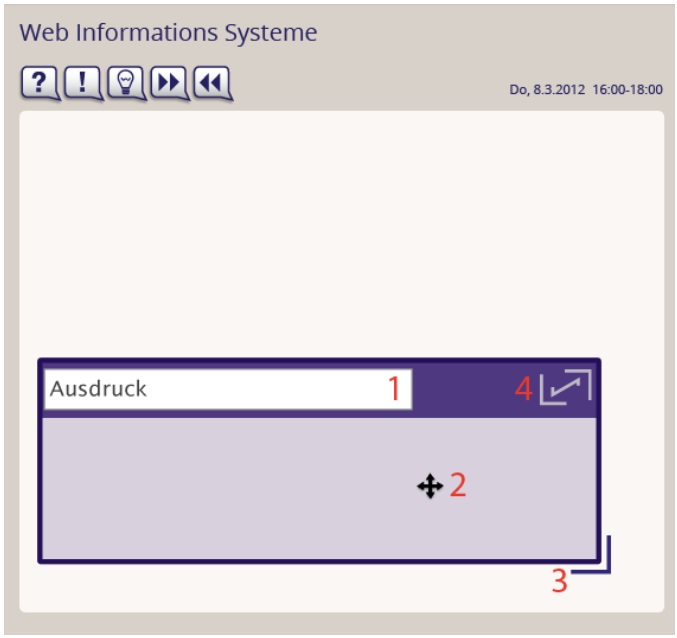

Figure 3.1: Backstage provides common interactions to manipulate the box. In a textfield, the user has to write the name of the box (1). A cursor symbolizes that the box can be moved (2). The box can be scaled up and down (3) and a button as shortcut enables to enlarge the box with one click to the size of the slide (4).

A drawn box can be scaled up and down, moved to another position or be deleted. Common icons from other graphic editors symbolize the actions that may be done. See in Figure 3.1 for the icons. By using common mechanisms, it facilitates the learning process. To simplify the modifying of the box procedure, we introduce easy interactions - double clicking on the slide moves the box to the clicked point and clicking a button enlarges the size of the box to the size of the slide. To increase speed while using the application, Shneiderman declares intuitive shortcuts as one of the golden rules for a user-friendly design [20]. The interactions with the box change depending on the situation of the workflow. See more in Section 3.2.

3.1.2 Message Filter Panel

The user configures the message filter in the message filter panel. It is a flexible component that enables the user to create filters that are customized to her interests - complex and very specialized but also simple filters. The user can create a new filter, therefore she has to give the filter a new, unique name. Moreover, she can also select an already created message filter out of the drop down list. Furthermore, she can also modify a selected filter, but then she has to rename the filter. The drop down list for the name consists of a text field, so the lecturer can enter a name for the filter or select a filter. The already created filters are sorted by date of the last use. We preferred to sort the list by *last used* than by *most used*, as the lecturer may want to use a specialized filter for many filterboxes on the slide, since their content is similar. Thereby, she does not have to search in the list for the filter and can easily select the filter. We assume that filters, which are often used, stay in the upper part of the list and therefore easy to find.

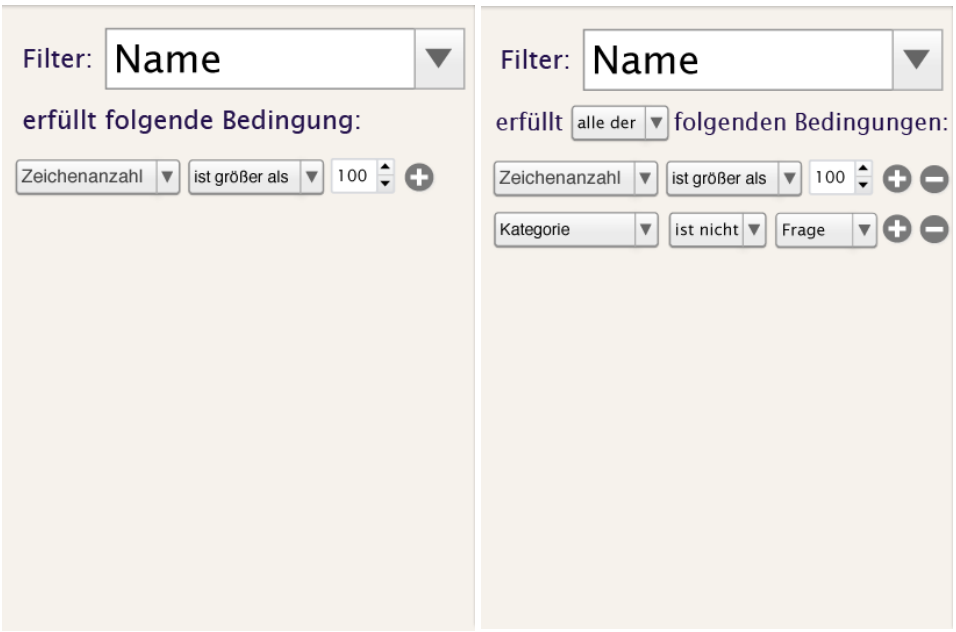

Figure 3.2: The message filter is easy expandable with as many conditions as the user likes. The plus-button adds a condition and the minus-button deletes it. The conditions are dynamically composed of interface patterns suitable to their use. The user can decide wether she likes to have all conditions valid or if only one of them has to be true. She has to give a new filter a name or select one out of the drop down list.

A filter condition consists of a set of interface components, which is divided in three parts: the *parameter*, the *logical operator* and the *value*. The user can select one of the provided parameters (also see in Section 2.2) out of a drop down list. The logical operator represents the relationship between the parameter

and the value. It can always be selected from the drop down list. Depending on the selected parameter, the options of the list change. For example when *category* is picked as parameter, the options are *is* or *is not* the value. When *keyword* is picked as parameter, the options are *is*, *is not*, *contains*, *contains not*, *starts with* and *ends with*. The options are suitable to the use of the parameter. The value component consists of an interface pattern that is suitable to the parameter. For example the component of the category parameter is a drop down list, the component of the keyword parameter is a textfield, the component of the amount of character parameter is a spinner.
The user can add as many conditions as she likes. If the message filter consists of more than one filter, the user has to select if she wants all conditions to be valid or only one of the conditions has to be true. Thereby, the conditions are combined using AND or OR. Although it is not possible to decide for every condition how it shall be linked to the other ones, this approach provides an easy to use interface and within the requirements sufficient combinations.

3.1.3 Navigation Wheel

The navigation wheel consists of the created filterboxes of one slide. When the user sets the message filter and the location filter, she pushes the "save box"-button and the status of the filterbox is saved and attached to the navigation wheel.

Figure 3.3: The navigation wheel includes the created filterboxes. It enables to navigate through the filterboxes and to select one. The check box disables the filtering mechanism. The "save box"-button saves the status of the filterbox and adds it to the navigation wheel.

To allocate the filterbox with a created status, the user only has to choose the right representation of the filterbox. They are marked through a thumbnail representation of the location filter and a name composed of the names of the location and message filter. It is possible to set the representations of the

filterbox in an order matching the lecture's course by drag and drop. When the navigation wheel is selected, the user can scroll through the filterboxes or select one through the cursor control keys of the keyboard (right and left). Confirmation is done by pressing enter. By deselecting the check box the filtering mechanism gets disabled.

3.2 Configuration Modes

To provide user interfaces according to the three phases (see in Section 2.4), we introduce three different filter modes: the *preparation mode*, the *session mode* and the *post session mode*.

3.2.1 Preparation Mode

The preparation mode is only accessible before the beginning of the lecture and is used during the preparation phase by the lecturer.

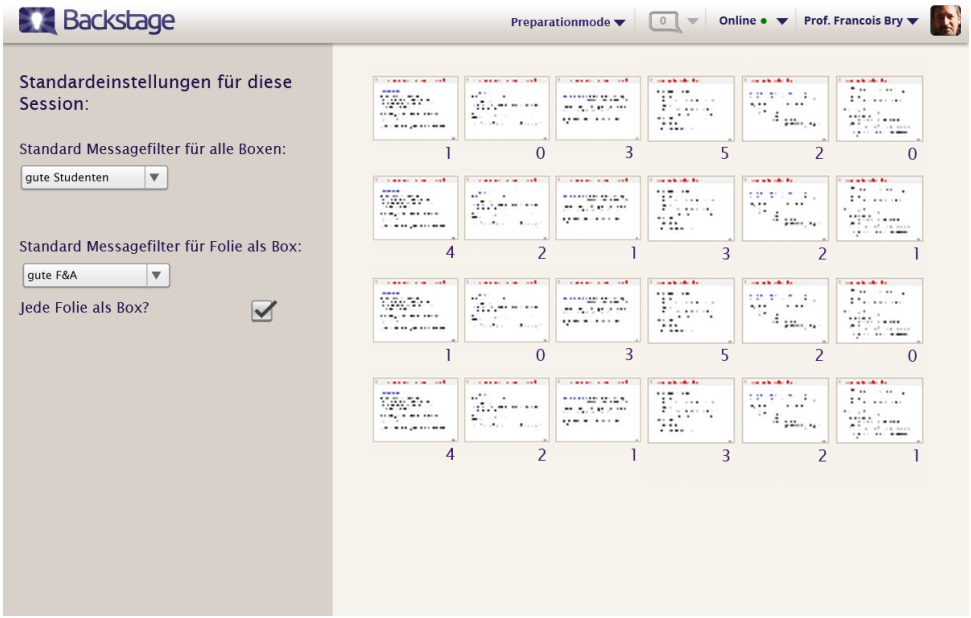

Figure 3.4: The overview of the preparation mode shows how many filterboxes are created on the individual slides and enables to define default settings for the session.

To save time and effort the lecturer can define default settings for the session. She can define a default message filter for all boxes, then she only has to care for the location filter. Furthermore, she can define a default message filter for all boxes, which is stretched over the whole slide, the so called *slide box*. After

defining a default filter for the slide box, she can decide if she wants the default slide box to apply on every slide.
An overview shows how many filterboxes are created for the several slides. By clicking on a slide, the user is navigated to the view, where she can define the filterboxes. The view consists of the slide panel at the center, the message filter panel on the left and the navigation wheel and the topic overview (not illustrated in the figures) on the right. In the preparation mode, the lecturer has time and the full concentration for creating the filter. When she starts preparing the slides a box already exists on the first slide which is in this case a slide box. She can modify the box and adapt it to her interests (see in Section 3.1). If no default message filter is defined or if she prefers a customized filter, she defines the message filter in the panel (see in Section 3.1.2). If she is satisfied with her settings, she saves the created status of the filterbox consisting of the both filters and it appears in the navigation wheel (see in Section 3.3). The two filters keep its settings and the lecturer can decide if she wants to modify both filters or only one. She may be interested in the same location filter but with other message conditions. If she modifies the filterbox, she has to save the status of the filterbox again.

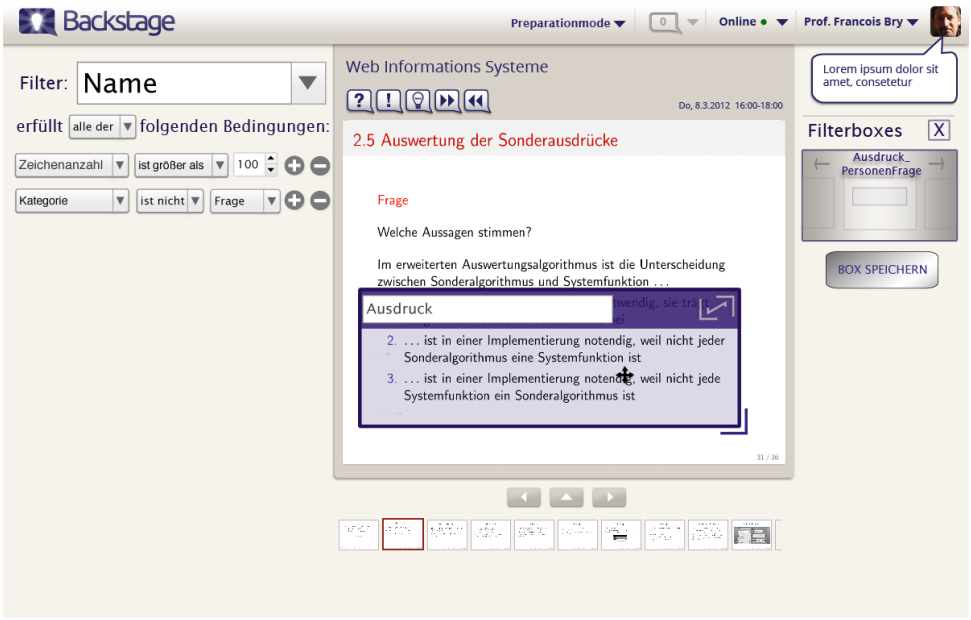

Figure 3.5: The view of the preparation mode allows the lecturer to create complex filterboxes.

After switching to the next slide, the filterbox which is now adjusted still has the status it had on the slide before. If the filterbox remain unchanged, there is no status to save and the "save box"-button is disabled. A message filter of a saved filterbox is saved persistently. The filter appears from now on in the drop down list of the already created message filters and is reusable for every

filterbox.

3.2.2 Session Mode

When the session started, the lecturer enters the session mode. She has already prepared the filterboxes and can concentrate on the filtered messages. On the left side of the view, the filtered message feed presented. There is a description above the messages, that informs about the filter that is applied to the messages. Since the lecturer shall not be disturbed from too much opportunities, so she can pay attention to the lecture and the upcoming messages, the session mode does not provide all functionalities. She only sees where the box is located by default. The only interaction provided in this screen by default is to select the next filterbox in the wheel or to disable the filtering mechanism.

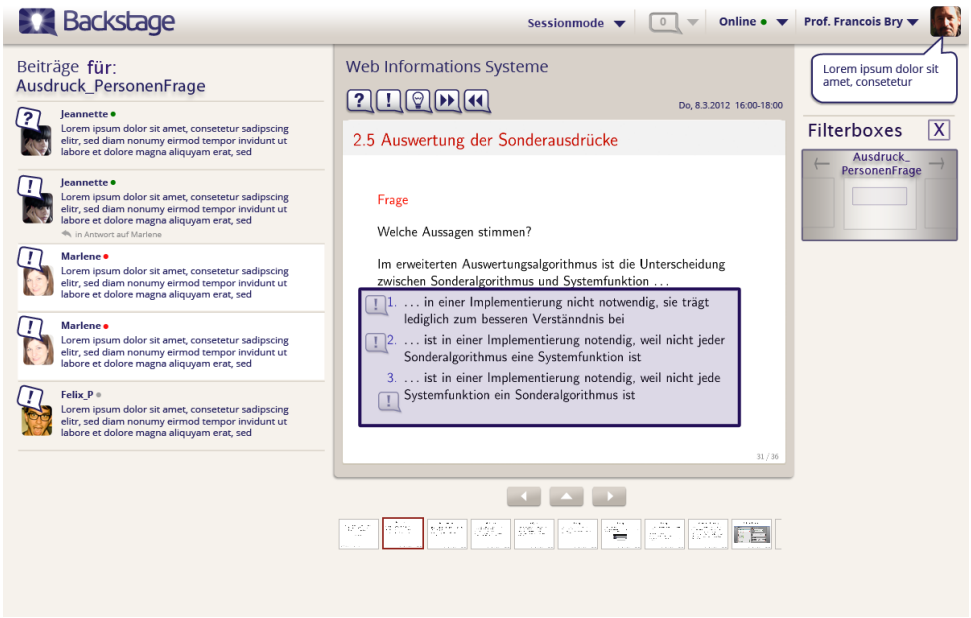

Figure 3.6: In the session mode are the filtered message feed presented.

However, it is always possible, that the students behave unexpectedly and that none of the created filterboxes match to the current student's activity in the backchannel. Therefore, the lecturer is enabled to change the settings of the filterboxes. The location filter can be adjusted, when the user double clicks the box. The instruments to modify the box are shown and usable. When the user moves the curser over the box, the tag name of the box appears. Additionally, a button that navigates to a panel for adjusting the message filter, becomes visible. Is the lecturer modifying the box, the modifications are saved automatically.

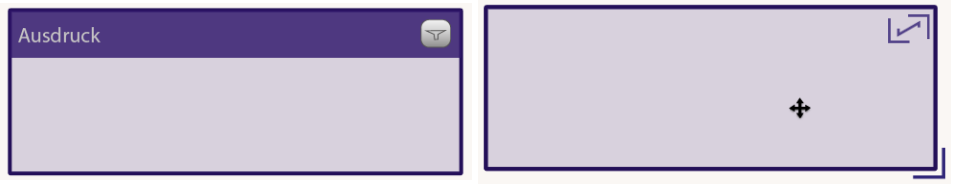

Figure 3.7: When the user hovers over the box with the cursor, the tag name and a button to modify the message filter are be shown (left box). After double click the normal box, the tools to manipulate the box appears and it is modifiable (right box).

The message filter can be adjusted on a panel which appears over the slide panel. The panel to set the message filter is not located on the left side anymore since the messages of the students are presented there. Enabling the lecturer to observe the feed while modifying the filter, the panel lays next to the feed. The influence on the feed through the modifications is live observable. Since the lecturer has not much time during the lecture to modify the filter, there are some limitations. She is not able to set together a condition like in the message filter panel. Instead, she can only change the whole message filter (picking one out of the drop down list) or disable some of the conditions of the message filter. Moreover, the most used conditions are also presented as checkbox options. She can add them to the message filter.

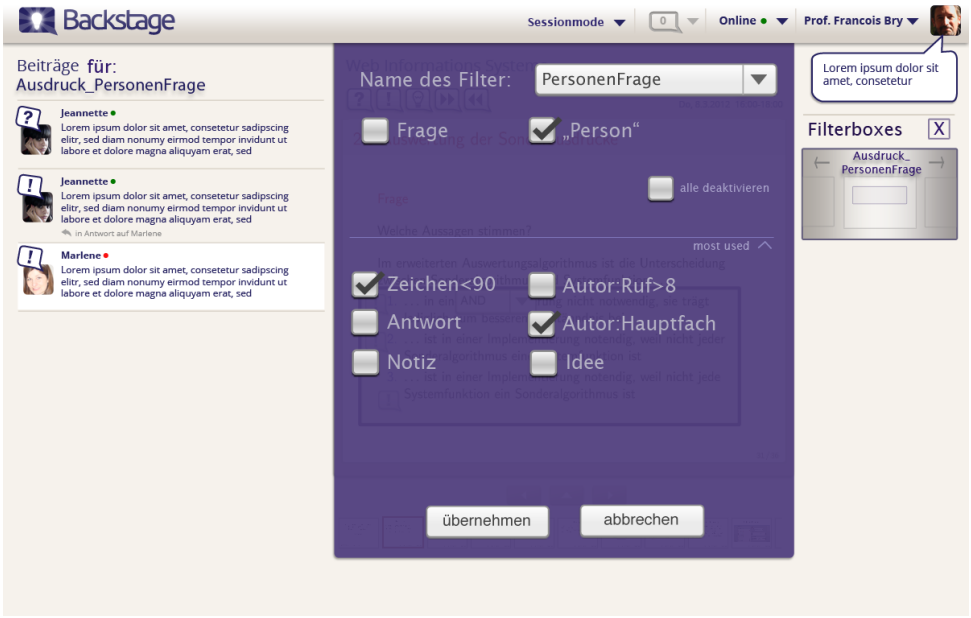

Figure 3.8: The lecturer is able to replace the message filter with a better matching one. She also can extend by selecting some of the most used conditions.

Pushing the accept button, filters the messages with this filter. The modifi-

cations are saved persistently, therefore the lecturer can see the modifications also in the post-session mode and do not have to remember them. The system appends to the name of the filterbox the note *modified-[number]*.

3.2.3 Post-Session Mode

After the session, the messages and filterboxes are still available to recapture the lecture. An overview shows on which slides modifications of filterboxes were made and enables the extraction of selected message groups in order to use them outside of Backstage. A message group results of the conditions of an filterbox. Messages passing the conditions of the filter of the selected filterbox belong to the message group of this certain filterbox. The lecturer is able to search for message groups after the name of the filterboxes. Clicking a slide navigates to the post-session view of the slide.

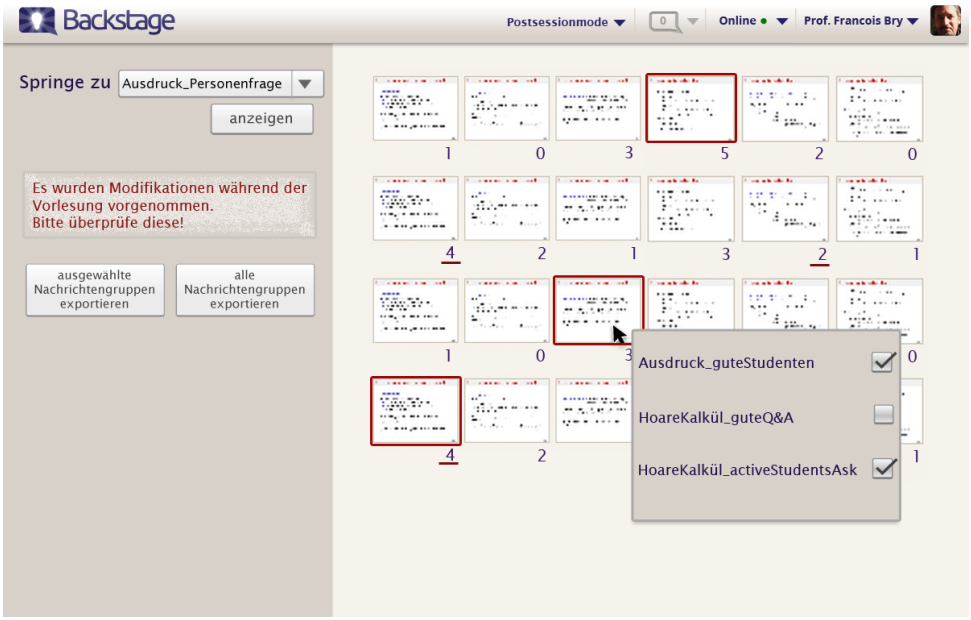

Figure 3.9: The overview of the post-session mode informs whether modifications were made during the lecture. Further it marks the slide were the modifications were made, the label presenting the number of filterboxes on a slide is red underlined. If the lecturer wants to export messages grouped by the filterboxes, she can choose if she wants to export all message groups or only some selected. To select filterboxes, she can select a whole slide (see the red border around the slides) and deselect filterboxes which are not interesting in a window, which appears while hovering with the cursor over a slide. Besides this, she is able to search for messages grouped by a the conditions of a filterbox.

The lecturer is fully informed in the post-session mode. She has the infor-

mation of the slides and the activities on the Backchannel during the lecture. That may cause her to make some changes of the filterboxes or rework the modificated filterboxes for example rename them.

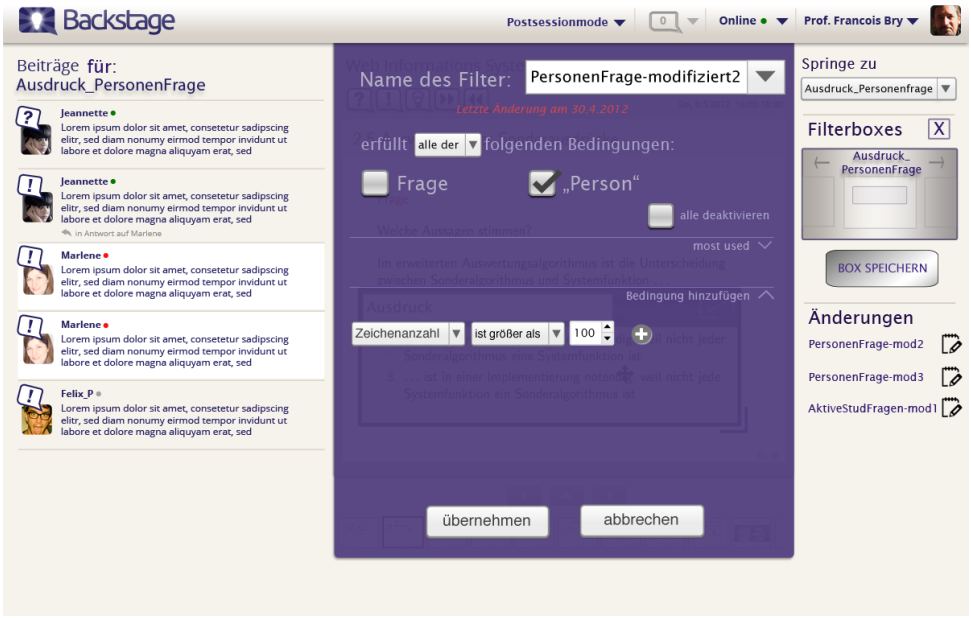

Figure 3.10: The view of the post-session mode looks similar to the view of the session mode. The messages that passed the filter of the currently applied filterbox are shown on the lefthand side as the current message stream. In the middle is the slide with the box or panel to modify the message filter. On the right side, the search functionality for message groups and the modified filterboxes are listed. An "edit"-button is set next to them. To edit the message filter the lecturer can choose to deactivate or activate conditions or to create new ones. The user is notified, when the last modifications were done in order to inform her if she should overthink the name of the message filter.

The modified filterboxes are listed on the right side of the view. After pushing the "edit"-button, the user can change the settings of the filterbox. The shortcuts of the session mode are still available in this mode (e.g. the possibility to deactivate a condition), but the lecturer can also add new conditions like it was possible in the preparation mode. She is also able to add new filterboxes at her convenience. The search functionality over the navigation wheel enables the lecturer from every slide to display the messages of another filterbox located on another slide. Since she has plenty of time after the lecture to rethink her filterbox compositions, this mode provides all functionalities to modify and create filterboxes. Also we do not assume that a lecturer may do that. But the intuitive user interface enables furthermore to succeed tasks efficient.

3.3 Cognitive Walkthrough

The cognitive walkthrough method is a usability inspection method to evaluate the learnability of an application. It helps to identify the usability problems of an application and remedy them. We conducted a cognitive walkthrough with five persons - one male professor of human computer interaction, two female students and two male students, to identify the usability issues of our concept. The students have different backgrounds of computer usage, but are well known to the application context, i.e. large classrooms and style of lecturing. The women study law and communication science in the fourth semester of Bachelor and have already experiences with using social networks. One male student studies information management and the other physics. Both study in the second semester of Master and are very experienced with computer applications. Also, they already designed and programed their own one.
Therefore, we created a clickable prototype[1] with the mockUp and prototype tool *Lumzy*[2].
We designed two tasks the participants had to do:

- **First task**: the participants had to create a filterbox. The task included the actions:
  - Login to the application
  - Choose the upcoming session of the lecture
  - Create a new filter with the intention to filter by messages of good and active students (value bigger than 8), which are located on the upper part of the lecture
  - Save the filter
- **Second task**: the participants had to modify an already created filter. The task included the actions:
  - Login to the application
  - Choose the ongoing session of the lecture
  - Scale the box up to the size of the slide
  - Modify the message filter through disabling the condition, that the messages have to be questions
  - Save the message filter

Before the participants had to do the tasks, we introduced them to the lecture's context, to the functionalities of Backstage and their role of the lecturer. The participants had to achieve all the tasks by their own. They had to speak out loud what they were doing and why. We only observed the process and

[1] *The created prototype is available here: http://lumzy.com/access/?id=3C4ECD62392C4F738A8F7DA5A53503C2 , date: May 20th, 2012*
[2] *www.lumzy.com, last visited May 20th, 2012*

explained events which could not be provided by the prototype like moving the filterbox. We documented their actions, including wrong pressed buttons, hesitating, confusion, etc. Afterwards, we discussed upcoming issues.

In general, the participants accepted the concept very well. All tasks were done successfully. Especially the action to set the message filter was performed very fast and without any problems. To set the location filter was in the first moment not very intuitive for the participants. All tried first to set the filter in the message filter panel. But after they figured out how to use the box, they adapted the interaction concept very easy. The major point of criticism were that it is a big effort to create filterboxes for every slide. But we assume that when they experience a big lecture hall with many students and therefore many messages for a slide, they would take the effort in purchase. To reduce the effort, we introduced shortcuts, for example the button to enlarge the box to the size of the slide, and the possibility to define default settings.
Furthermore, they preferred to get guided through the process of creating a filterbox. So, the application says which step has to be done next. But we wanted to design the concept as flexible and dynamic as possible and let the user the freedom to decide how she wants to use the tools.
To increase the flow of information, we introduced the overview pages of the preparation mode and post-session mode, which informs where and how many filterboxes are created or modified.

CHAPTER 4

Other Solutions to increase the Social Awareness of the Lecturer in the Backchannel

There are other information systems, which try to overcome the student's passivity in large audiences, by using a digital backchannel. While the most systems have their focus on increasing the interactivity of the students, not many approaches exist that increase the awareness of the lecturer.

Unlike Backstage, many systems use Twitter[1] to facilitate Backchannel discussions and a tool on top to enhance the awareness. Twitter is a real-time information network, which connects the people via micro blogging with their interests. Users can write statements, observations and texts with 140 characters. These so called Tweets are visible for everyone in the Internet. Other twitter users interested in some tweets can follow their author, their are called *Follower*. Hashtags enable the users to assign their messages to a special topic. This makes it possible to create conversations about a topic and therefore a backchannel. Twitter is widespread and accessible for everyone. Moreover, it is available for the most common mobile operating systems. That makes Twitter an appropriate platform as basis for backchannel conversations.

In 2009, Monica Rankin, history professor of the UT Dallas, introduced the *Twitter Experiment*[2] to her enormously large class. Every student had to use her Twitter-account or create a new one. Professor Rankin filtered the messages through a hashtag defining every lecture and presented all messages on a large screen using TweetDeck[3], which aggregates all messages. While

[1] *www.twitter.com, last visited March 27th, 2012*

[2] *The Twitter Experiment - Bringing Twitter to the Classroom at UT Dallas*, April 30th, 2009, http://kesmit3.blogspot.com.es/2009/04/twitter-experiment-bringing-twitter-to.html, last visited on March 27th, 2012

[3] http://www.tweetdeck.com , last visited March 27th, 2012

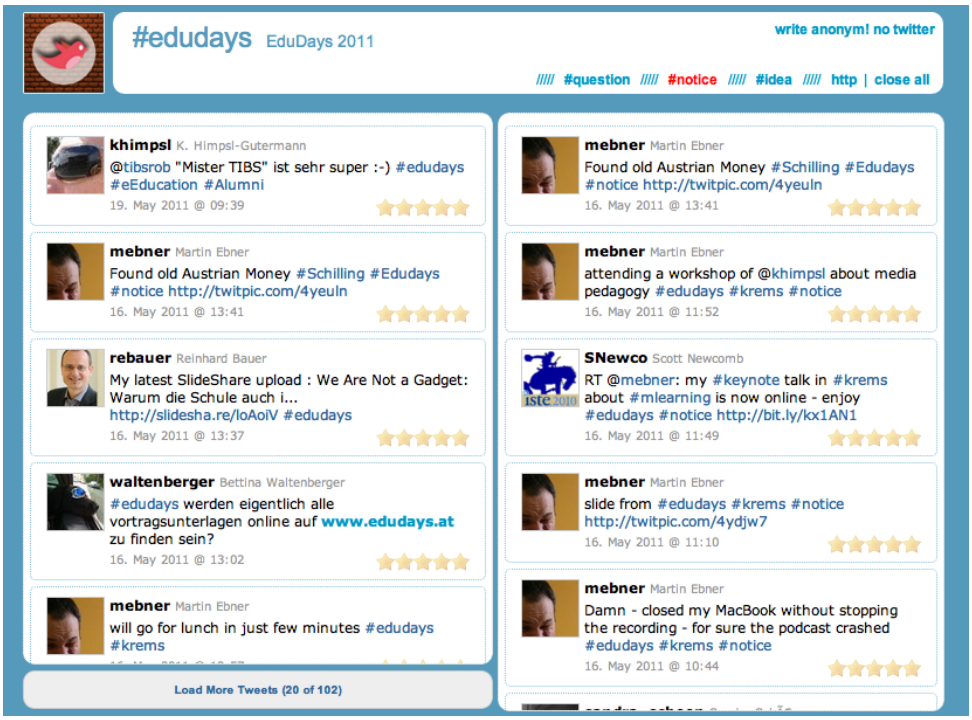

Figure 4.1: TwitterWall of the EDUdays 2011 conference. The Twitter stream is presented on the left side. All messages are associated to the hashtag of the TwitterWall. On the upper right side are the filters, which were created for the conference. The right side shows the filtered messages for the selected filter (see the red marked filter on the upper right side).

Monica Rankin gave the lectures, while a teaching assistant helped her to get aware about the interactions on the Backchannel. The teaching assistant answered the questions, sorted out and surfaced important points to Mrs. Rankin, that she can discuss them with the whole class.

TwitterWall by Graz University of Technology is a backchannel tool based on Twitter. The lecturer predefines hashtags not only to separate between lectures but also to resemble categories of messages. The system enables also to post messages through the web interface of the application, when a student does not have a Twitter account. Therefore, all Twitter posts get filtered by a special hashtag and get presented on the lecture's TwitterWall. But only the messages, that occur during the lecture session, are presented on the TwitterWall. The messages on Twitter are filtered by a time frame, defined by the lecturer. The time frame associates the messages to a single event of the course, e.g. Monday from ten to twelve o'clock. Messages written outside of this time frame are not considered by TwitterWall. In addition to the general hashtag specifying the lecture, the lecturer can define special keywords like *question*, *notice* and *idea* to allow filtering of the saved information stream. In

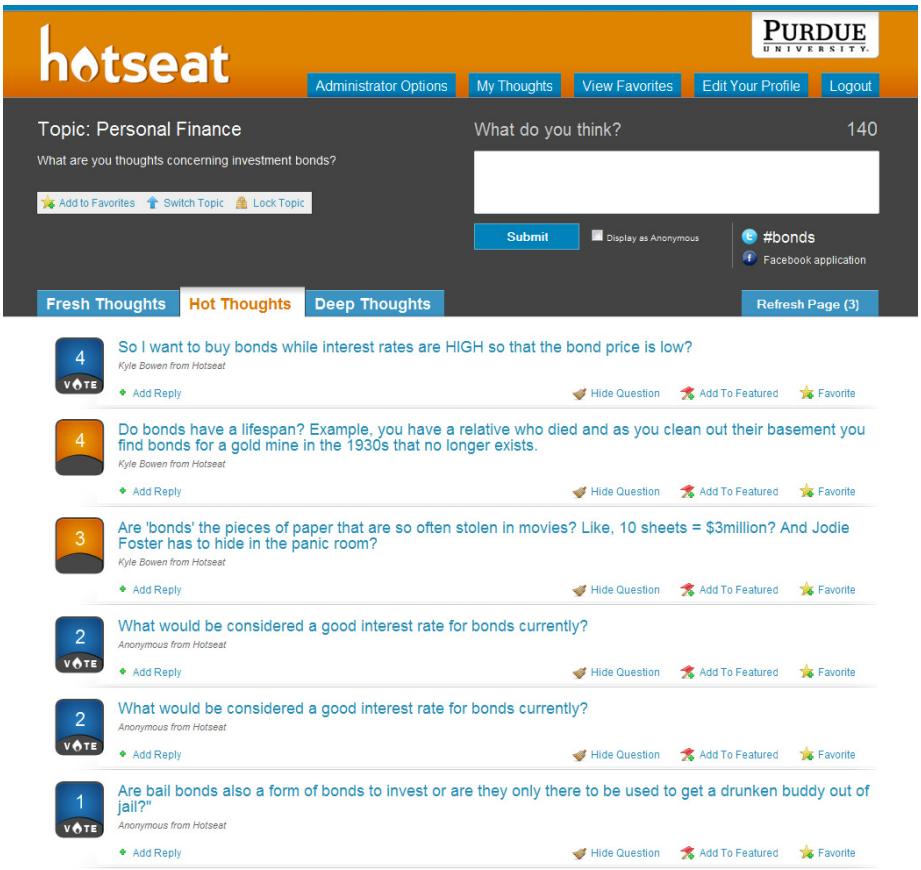

Figure 4.2: Hotseat is a web application which creates collaborative classrooms to provide the lecturer real-time feedback given from the students. The figure shows the user interface of the students using the application. The students can write messages and rate them. The message stream can be organized as "fresh" (most recent), "hot" (most popular), and "deep" (most discussed) messages.

a second window panel are the messages containing the keyword of the selected filter presented.
Other than in Backstage, the filtering system is not very specialized. The lecturer cannot filter for the content of messages. The only differentiation between the messages are made through categories. But there is not any quality management included in TwitterWall. Also, the lecturer has no opportunity to react on the ongoing interactions on the backchannel during the lecture. Therefore, the lecturers, who took part on a three month study using the system, wished to be deeper integrated in their lecture activities and that good didactical concept will be carried out [6].

Using Twitter provides already the message service, but it brings also limitations. It limits the interaction possibilities to writing messages or retweet

them. It does not provide a possibility to rate messages and thereby, it is not possible to aggregate a ranking list. Also, using Twitter for the lecture could let the students feel uncomfortable, since they use Twitter also in their privacy and all followers of them can read the messages, being in the class or not. This could intimidate them in writing messages.

There are other systems like *the ActiveClass Project*, which use their own authentication. *The ActiveClass Project* is a simple client-server application for enhancing participation in the classroom setting via mobile devices. The students can ask questions, answer polls and give feedback to the lecturer. The students and the lecturer can read the messages. The lecturer gets them presented on an extra screen, so she can focus on giving the lecture to the students, and if she recognizes that there is a lot of interactivity on the backchannel, she can switch her attention to the extra screen and answer the student's questions. The students can vote for messages to aggregate a top-ranked list. There are three different categories to associate messages to - *question*, *answer question* and *ask question*. Answered questions can be hidden to clean the information stream. The students posts messages anonymously, but to increase the awareness of the lecturer, she is able to "spy" and find out the name of the author, so she can catch her to give her a notice depending the lecture. The application provides a *save to warehouse* functionality to capture questions to review after the session. If the lecturer feels distracted by the application, she can disable ActiveClass [10].

The information system *Hotseat* by the Purdue University allows the students to contribute the Backchannel in different ways - by Facebook, Twitter, web or mobile application. The students access the application by the standard university login. On the application, similar to Twitter, the students have a limited amount of characters to form the messages with. They can ask questions, respond to messages, vote or save them for later review. Like in the ActiveClass Project, the votes aggregate a top-k ranking. the discussions can be sorted based on posts that are "fresh" (most recent), "hot" (most popular), and "deep" (most discussed). That facilities identifying the most important messages for the lecturer. The lecturer is supposed to take "hotseat breaks" to answer raised questions in the backchannel [1].

Hotseat is improved for the benefits of the students. The lecturer-side of the Backchannel results from the design developed to increase the students' awareness. However, there are no special concepts to increase the lecturers awareness.

Only *GoSoapBox*[4], a cloud-based audience response system, has its focus on increasing the lecture through engaging the lecturer by giving feedback and insights of the students in real-time while encouraging the interaction of the students. In addition to enabling the students to write short messages, questions and answers, like in the other classroom backchannels, there exist sev-

[4] www.gosoapbox.com
last visited on March 27th, 2012

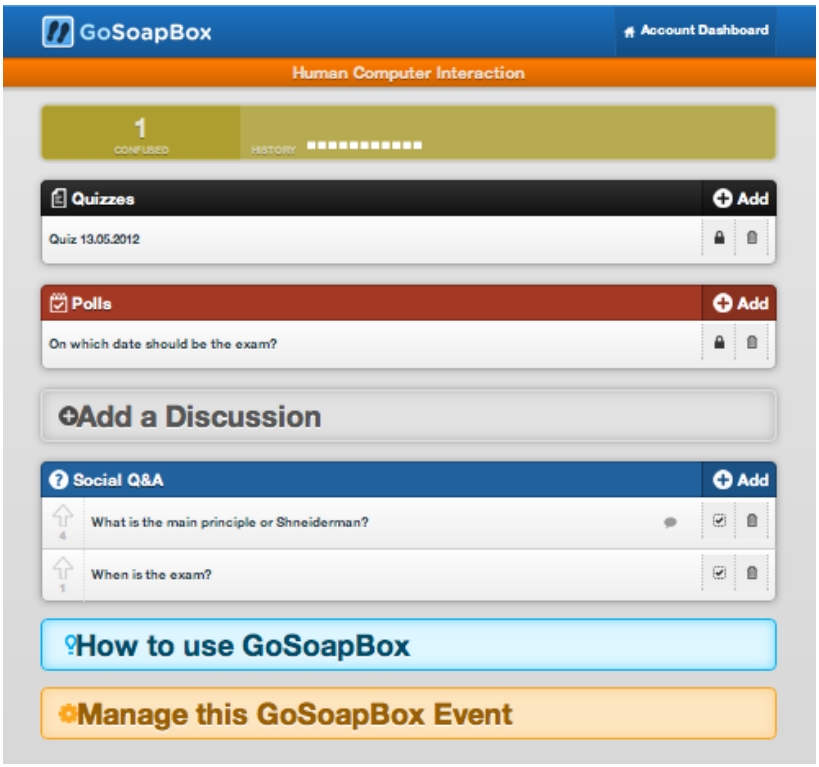

Figure 4.3: The figure shows the lecturer's user interface of the web application of GoSoapBox. The confusion barometer on the upper part shows the amount of students who are temporarily confused. The right side of the barometer, the history, informs about the trend of confusion among the students over time. In this case, the history panel shows that the confusion has not changed over the last seconds. The bars are all on the same level, so only one student is confused and his confusion stayed. The lecturer can maintain his quizzes, polls and discussions and the messages of the students appear in a ranked list.

eral features provided to improve the awareness about the students' comprehension. A confusion barometer, which signalizes the lecturer when students are not on track anymore. It informs also about the trend of confusion: if the students are getting confused or if their confusion getting solved. Quizzes, Polls and Discussions help to organize the course of a conversation.

GoSoapBox includes general static awareness components like the confusion barometer or aggregated ranking through the students.

Almost all approaches provide a top-k ranking or filtering on basic level to increase the lecturer's awareness, like filtering for categories. However, a system filtering for content of the messages is not yet integrated in any of the presented solutions. The filtering possibilities in Backstage are much more detailed and specialized. Furthermore, there is no optimal solution which en-

ables the lecturer to focus on the lecture and the interactions on the backchannel at the same time, without pausing the lecture or distracting the lecturer.

CHAPTER 5

Future Work

Since *Filter out of the Box* is only a concept yet, in the near future it should get its way through the implementation and be evaluable through a user study, which can be conducted in a real classroom environment.
The thesis focuses on increasing the social awareness of the lecturer during the lecture. There has to be done more work about specializing the process of the post-session phase. It has to be discussed about the process of the data export, especially about the data format and the visualization of the filtered messaged and filterboxes. But next to that, the concept allows to to be extended in many ways - increase its usage in Backstage and adapt it to different fields of application or to different media formats.

5.1 Backstage

Further work to increase the filtering mechanism or to use it in an extended way on Backstage.

5.1.1 Automatization

If the lecturer wants to prepare a lecture in detail, it could cost her much time to create all the filterboxes. Therefore, it makes sense to automatize a part of the work flow.
Image processing analyze cluster of text on the slide and draw a box around them. Then, the boxes are suggested to the lecturer, who only has to decide if she likes to filter for this location filter or not.
A text mining tool parses the PDF-File of the slides and analyzes the content regarding words, which are used very often or printed in a big font size.

These words are presumably the heading of a cluster and can be used as a the tag name of the box. If the lecturer does not have to give the name to the location filter, it saves a lot of time.

5.1.2 Social studies

Backstage serves as a social community within the framework of a lecture. It collects a lot of information about the users' behavior. It may be important to use this information for social studies about the student's behavior during the lecture in order to increase the teaching system. The concept already includes the capability to create sophisticated queries to describe the author of a message. With some extensions, for example tools to cluster the behavior of students to groups and compare them, could be obtained high quality information about the student's interactions. A query could be for example to compare the activities of students having the lecture as minor with them who have the lecture as major subject. Students with minor subject always have more problems to follow the lecture and understand the full content, these problems could get identified and analyzed in order to solve them.

5.2 Alternative Fields of Application

Filter out of the Box is also suitable for the usage in other fields of application.

5.2.1 Using Filter Approach for Image Tagging Platforms like Artigo

Artigo is an online game of the Play4Science project of the Ludwig-Maximilians University [9]. The purpose of this game is to playfully collect meta-data in form of taggings for the artwork in order to improve searching in digital artwork catalogues. Two players get the same artwork presented and have to input tags. In case of matches between the players' taggings both players earn points.
With the filtering approach of Backstage is it possible to extend the tagging of a complete image to tagging of areas of an image. In this case, the rules of the game have to be adapted. An exemplary sketch could be: Tags of Artigo are treated like messages in Backstage. A person of authority has to draw filterboxes around interesting areas. The categories and filter parameters have to be adapted. Interesting categories for the tags are for example *technique of painting*, *interpretation* or *content*. From now on, the players earn points for specifying the same tag on the same location. Moreover, if the categories and the tags match, the players earn bonus points.
For Artigo, it could be also interesting to filter for tags of very experienced players or to give more weight of importance to tags, that satisfies certain conditions.

5.2.2 Filterboxes as a Tool to Collectively Estimate Resource demands in Project Management

To manage a software project can be a difficult job. Estimating the time and resources for carrying out a project requires much experience in both, development and management. Rarely, a single person is experienced that way but a group of experienced developers and project managers are. The idea is thus to leverage the collective knowledge by aggregating estimations using the filterbox approach introduced in this thesis.
The project manager publishes (usually diagrammatic) software specifications and creates filterboxes over interesting parts of the design. The developer of the team could post messages with their estimations about the effort of this piece of program. Categories may be *effort of time*, *effort of costs* or *complexity*. The developers can rate and therefore agree or disagree the estimations. Our filter approach could be used to give an aggregated overview of the subsystems. Therefore, the message filter has to be adapted to a more mathematical use. Also for project managing, it could be useful to include the reputation of the developers in the filtering process.

5.3 Extended Approach for Different Media Formats

The filtering approach is also extendable to different media formats despite the slides.

5.3.1 Audio

It could be interesting to extend the filtering approach for an audio stream. Therefore, the time stamp, when the message was send, defines the context of the message. And the administrator defines special periods of time she is interested in. They equal the location filter. Such an filtering approach for audio formats would make sense, when no images can be provided for example for recorded conference calls with many participants. Thereby, the filtering approach reaches more importance in the post-session mode than in the preparation.

5.3.2 Video

It makes sense to extend the approach for video based formats, e.g. for distance teaching universities where only a video lecture can be provided. Also media groups like ProSiebenSat1 Digital GmbH that provides their customers the opportunity to watch tv shows online and comment them could have a big interest in this filtering approach. An extended filtering approach would enable media specialists to analyze the message stream of the customer and to evaluate new trends or reasons of possible lack of customers.

Therefore, boxes can be created around objects. A box is valid for a time period, i.e. it comprises several frames within the video. The same box can have different positions on the image frames of the specialized time period since the marked objects can move during the video. Mechanisms that facilitates creating boxes over many frames and moving objects in the video have to be developed.

CHAPTER 6

Conclusion

Digital backchannels are used to overcome the lack of interaction and the passivity of the students in large classrooms. A useful way to integrate the lecturer in the quiet conversations of the students is not yet developed. Since the discussions can affect the lecture's frontchannel, it is highly necessary to involve the lecturer. The lecturer has to handle the frontchannel and has only a limited amount of attention, able to pay to the conversations on the backchannel. Through organizing the conversations and constricting the information stream down to the relevant messages, we tried to increase the lecturer's awareness of the student's interactions on the backchannel in this thesis.
We introduced the filter mechanism *Filter out of the Box*, that provides the lecturer with a large range of opportunities to specify the messages, she is interested in. Influenced by the importance of time limitations on behalf of the lecturer, we developed an effective and easy-to-use concept, that enables the lecturer to filter by areas on the slide. The three modes of the filtering approach provide the lecturer with the main functionalities for the actual requirements. The lecturer can prepare the filter to save effort during the lecture, can react to ongoing actions on the backchannel and export the filtered messages by groups. The concept offers another advantage. Through naming the filter, the messages get allocated with meta data. That enables the lecturer and students to search for messages. Furthermore, *Filter out of the Box* is suitable for other applications despite Backstage. In the future, a user study shall show, which features have to be improved.

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