Evaluation of a Social Awareness System: Panorama

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ABSTRACT
Evaluation of social awareness is a relatively new area of research in the field of Human Computer Interaction. In this paper, a system called Panorama that supports social awareness among co-workers of a computer science department is evaluated, to see how it supports awareness and how the users experience it. Observations and interviews are used to see how users respond to the system, as well as the Repertory Grid technique to capture the user experience in a more quantitative way. It is shown that participants think of Panorama as a social, public system that stimulates interaction between people by provoking curiosity. Colleagues gain new knowledge about each other by the things they see and more importantly, by the interaction that is sparked by the content. In this way, social awareness is supported.

Keywords
Evaluation, user experience, social awareness, Panorama, Repertory Grid Technique

1. INTRODUCTION
Being socially aware at work means that co-workers know who they work with and what keeps them busy, though this awareness does not necessarily have to be work related. Bodker and Christiansen [2] explain that work is incredibly dynamic these days: new people join groups or projects, companies hire, fire or close and work is carried out in a variety of settings such as offices, homes and airports. Especially in large companies, awareness is often neglected because of tight schedules and high work pressure. As a consequence, workers lack a sense whether colleagues are in or out of the office, when they are available or even where to leave them a message. Because of these flexible settings, people are often unsure about who to bond to. Furthermore, being aware of others is important because it can help in learning [11]. For example, it can help students who are working in similar projects to share their knowledge with each other in an easier way.

Playfulness and affectivity can be important properties of systems that support social awareness. As described by Huizinga [7], play teaches people how to act in different social settings and it allows people to learn new things while playing, without fear of negative social consequences. Gaver [5] explains that play is not mindless entertainment, but a way for engaging with and learning about the world around us.

Evaluation of affective and playful systems is a relatively new area of research within Human-Computer Interaction (HCI) [4]. Evaluation commonly involves formal user studies, in which the efficiency or usability of a system is assessed through a list of heuristics. In quantitative evaluations, a list of metrics can be produced to check if the system meets the developers’ expectations. But when interactive systems rely heavily on user experience and when the developers’ meaning of the system can be determined by the users themselves, the traditional methods of evaluation might not suffice. Höök et. al. [6] states that this is especially the case in interactive art systems, because the artists believe that HCI methods do not measure any aspects of interactive artworks that are of interest. The greatest challenge when evaluating affective systems is to capture the full user experience and to figure out what kind of deeper values the users attach to the system for reasoning about these experiences and affective qualities [3].

Boehner [1] argues that technology is bound by the ineffable, which refers to that what cannot be fully known or understood through explanation but must be experienced. Classification of systems within HCI by defining, modeling and measuring the ineffable often leads to the discussion that important details of the user experience are left out. Furthermore, Sengers and Gaver point out that openness and self-expression are very important aspects of evaluation in HCI [13] and that the amount of interpretations (from both the developers and the users) depends on the application under consideration. They argue that designing for a single, preferred interpretation is not right or wrong, neither to design systems that are completely open to interpretation. Instead, they suggest to allow the constraints and openness in interpretation to become part of the ‘design language’ available to HCI developers.

For this research, an evaluation of the Panorama system will be carried out. Panorama is a large screen display that was used at the computer science department at the University of Twente. It was meant to enhance social awareness in a playful way by displaying non-critical and non-work related information about co-workers.

The aim of the research is to evaluate the Panorama system, to find out whether or not it supports social awareness and if so, how it does that. To achieve this, a suitable evaluation method has to be found that captures the users’ experience. The results of this research might serve as a framework for further research on this part of HCI.

The main research question for this paper can be stated as follows:

“How can technologies that support social awareness be evaluated?”
To answer this question, some sub-questions are proposed that deal with the different aspects of social awareness and evaluation of a system which supports this.

- **How does Panorama support social awareness?**
  The answer to this question will provide some background information about the Panorama system. The results of the evaluation could possibly reflect on this.

- **Which types of evaluation methods can be applied to a system such as Panorama?**
  As described above, one has to pay attention to the methodology that will be used when evaluating affective systems.

- **How do the users experience the Panorama system?**
  The results of the evaluation will hopefully give detailed insight into the feelings the user has about the Panorama system.

The Repertory Grid Technique is an evaluation method that produces qualitative as well as quantitative results by eliciting the interesting aspects of a system from the user. This technique is combined with user observations and interviews, to get a complete view of the user experience while using Panorama.

The next chapter describes some examples of affective systems. Their methodology and key aspects are compared to the ones used in this paper. After that, the used methods for evaluating Panorama are explained. The fourth chapter elaborates on the results of these methods. The research as a whole is discussed and conclusions to the research questions are drawn in the final two chapters.

### 2. RELATED WORK

Related research in the field of playfulness in communication has been done recently by Lindley, Harper and Sellen [10]. A field study of Wayve: an interactive portable drawing device that can be used to send handwritten messages and drawings to friends and family. They explain that if research on playfulness is done at all, it is done on the functional benefits of such communication (for example, bringing grandparents nearer to their grandchildren). Instead, technologies that support play and their benefits are studied in this paper. A relevant conclusion is that new technologies should allow playful activities to unfold separately from the world of work and productivity (as described in section 1, user provided content of Panorama is not necessarily work related either). In the evaluation of Panorama, we try to show how playfulness in communication can be supported in work situations, instead of family relations, and how this can be seen as a part of the social interactions that support awareness.

In [11] it is explained that virtual environments that support social awareness can be used for learning communities. Social awareness creates continuous occasions for sharing knowledge with others, but a lack of it can have negative impact on learning, according to Prasolova and Divitini. This lack can be caused by a limited social network, which for example makes it hard for a student who is working in a project to find help from other groups in similar projects. Virtual worlds can help to overcome physical barriers between students, so knowledge sharing becomes easier. In the virtual world, people can leave traces of information for others to see, just as in Panorama. In this research, we try to show how Panorama helps people to share their knowledge with others in work situations, to support meaningful and valuable experiences.

The Affector is a digital translucent office window, developed Sengers et. al. [12]. The idea was that the wall between the offices of two colleagues limits their awareness of the other. The Affector is a ‘window’ that communicates a sense of emotional presence between the colleagues. Evaluation of Affector focused on whether the system could support the users in understanding, interpreting and experiencing emotion in its full complexity. It was shown that affection can either be built into the system’s representation or situations can be created where the user is likely to have new experiences of affection. In a similar way, Panorama tries to create situations for the user where he is stimulated to explore new activities out of curiosity and to initiate interactions that lead to an increased sense of awareness. The main thing we are interested in during evaluation though is the effect of Panorama on new knowledge that people gain. So while evaluation of the Affector is only focused on interpretation and meaning making of the system during the interaction, we are in our research interested in the direct results of affection as well (for example, what new knowledge people gained about colleagues).

### 3. METHODOLOGY

As described in chapter 1, to thoroughly evaluate the Panorama system, a method has to be found to capture the users’ subjective experiences of interacting with the system. As described below, the Panorama system was developed to enhance awareness among co-workers (see Figure 1). A few evaluation methods will be used to assess the qualities of the system. First, the users are made familiar with the system by running it in its natural environment. At the same time, the users are observed for interesting interactions and activities. A drop box is used to gather comments about the system in general.

After the first session, the users are invited for personal evaluations in small groups. The user’s experience and personal meanings are captured with the Repertory Grid technique. Afterwards, the users are asked some questions in an open interview.

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**Figure 1. The Panorama system**

### 3.1 The Panorama system

Panorama is a system that was developed at the HMI department of the University of Twente in 2007. Panorama is an intelligent, large screen, large screen display. It transforms explicit and implicit inputs from co-workers to create a social environment within the department. It was not intended to provide work-related information, but rather the personal cues and traces. Co-workers can send in their personal messages, such as news or announcements to the system. Panorama can
also use system-initiated content, such as a real-time video stream or information from motion or audio sensors. The user-submitted images, videos and text messages are presented to the users on multiple sliding 3D planes. It resembles a digital gallery: the images slide along the floor and wall in a continuous cycle. At the bottom of the screen, some previews of upcoming content are shown.

3.2 Observations
To see how Panorama would perform in its ‘natural habitat’, the system was set-up at the Rappa, the lunchroom of the HMI department (see Figure 2). This room is often visited for routine activities, such as collecting mail or using the photocopier. In addition, people gather here for social activities such as eating lunch and having informal chats with co-workers or celebrating an employee’s birthday. Vyas et. al. [14] explains that they have put the Panorama in this room as a starting point for social interaction among co-workers and to improve the interest in exploring different activities in the environment.

![Figure 2. Panorama in use during observations](image)

Knowing the ‘peak hour’ of activity in the Rappa, observations were performed during lunch time. The system was running in the back of the room while people from the HMI department could walk in and leave whenever they want, as they usually would. On the opposite side of the room, behind a filing cabinet and some large sight-blocking panels a place was created to observe activities in the Rappa while Panorama was running. The observer sat quietly at the back of the room with just enough space to view the people in the room and the system, but obscured enough not to disturb the activities in the room. A sound recorder was connected to the laptop of the observer, to ensure that interesting details of the interaction between people are not left out. Furthermore, notes were taken at the same time of the amount of people in the room and of the interesting interaction between Panorama and the people in the room.

The HMI employees were encouraged to send in photos and videos through email. This could be of past HMI events, but personal content as well, such as holiday pictures and everything else they want to share with others. For the first day, when the user submitted content was still minimal, photos and videos from projects were taken from the HMI website to serve as content. The amount of user submitted pictures ranged from about 30 at the first day to 300 at the end of the observation sessions. The sequence of the series of photos was randomized and distributed over the ten available sliding containers in Panorama. During the first two days, a webcam was attached to display a real-time video stream of the Rappa on the Panorama screen.

Observations were performed over a total of four days, spread out over two weeks. An estimated total of 30 people visited the Rappa while Panorama was active, consisting of HMI employees and visitors from outside the department. Their reactions to the Panorama system, interactions and conversations served as input for the observations. An average of 10 people were present at the same time in the Rappa, each day at the ‘peak hour’ during the lunch breaks.

3.3 Drop box
During the observations, a cardboard box was placed in front of the Panorama system with a pile of paper and a pen on top of it. The idea was to allow people from the HMI department to leave a comment on Panorama whenever they felt like it. An open question was at the top of each comment form, to encourage the users to express their feelings about the system. Sadly, no comments were submitted by the HMI group.

3.4 Repertory Grid Technique
The Repertory Grid Technique (RGT) is a method that can be used to address the affective qualities and the user’s experience of a system. RGT is based upon Kelly’s personal construct theorem [9], a theory from the psychological research field. Kelly explains how people make sense of the environment around them by forming certain constructs that are bipolar in nature. These constructs are used to find similarities between two phenomena, so they can be distinguished from a third. This means that while evaluating a system, the user describes the system in his own personal words, sparked directly by his experience.

These bipolar constructs can in turn be used determine how a single element of a system relates to them on a certain scale. This means that the qualitative constructs and elements of the system together produce quantitative results. Together they represent the user experience [8].

The Panorama system uses the ‘awareness’ aspect to support meaningful and valuable experiences by enhancing non-work related social awareness [15]. Vyas et. al. further argues that social awareness can only be felt and cannot be seen or measured only quantitatively. So Panorama is a system that supports personally meaningful, playful and sociable experiences, instead of providing productivity related information. RGT is a both qualitative and quantitative method that can be used to capture this experience.

A total of 15 people from the HMI department participated in this session (9 male and 6 female), whose ages range from 20-29 (60%), 30-39 (13,3%), 40-49 (13,3%) to 50-59 (13,3%). The majority of the participants experienced Panorama for three or four days during their lunch break, a few of them only for one or two days. In a short questionnaire, 10 people rated themselves high (4 or 5 out of 5) on their capability in the field of computer literacy. 3 people rated themselves 3 out of 5 and the remaining 2 rated 1 out of 5. 9 people indicated that they are often daily exposed to audiovisual devices, such as the systems described below. 5 people rated themselves 3 out of 5 and one person 2 out of 5. Each session (including interview) lasted for about 30 minutes.

The goal of this session is to learn more about the user’s experience while using the Panorama system. The user will be presented five different systems: Panorama (coded as D1, for
device number one), television (D2), Nintendo Wii (D3), digital camera (D4) and mobile phone (D5). They are chosen for the fact that all of them are electronic devices with a screen display that most people are familiar with.

As described above, the user is shown six different combinations of three of these systems and is asked to think of a construct for each of these groups. Only triads that contain the three systems on a seven-pointed scale. After construct elicitation, the user is asked to rate all five systems on a seven-pointed scale.

3.5 Interviews
After the Repertory Grid session the user was asked a few final open questions about Panorama. They were specifically asked for examples of new knowledge they gained from using the system and, moreover, how well they think Panorama supports social awareness. The goal of this session is to find out about the user experience in greater detail. This also provides the opportunity to explore other aspects of the Panorama system, such as privacy related issues. The interview was audio-recorded if the participants agreed to it and notes were taken on paper.

4. RESULTS
For this section, the voice recorded data from the interviews and observations was joined together to form a large pile of information that contains all the reactions from the employees of the HMI department. The next task was to order, categorize and analyze all these statements and conversations. The second part will describe the results from the RGT sessions.

4.1 Observations and interviews
The qualities and interesting aspects of Panorama can be described in a few categories that will be explained below with a great number of examples. A lot of quotes from the observations and interviews are directly cited as examples of these categories.

4.1.1 Stimulating curiosity
Sometimes people get curious by the content they see on Panorama, so they start asking questions. Especially if the contents of the pictures are unknown to them. The usual reactions of the employees includes sentences as “Where was this picture taken?” or “Who is that person?”. In an interview, one person answered: “Of some pictures I do wonder where they are from, who took them and who are on them, because I don’t know them. There’s a great difference between pictures of events that you did attend to and those that you didn’t. For example, the pictures of Hannah’s wedding, that was nice to see, because I didn’t know about it and she’s not here often. And those of Maral as well, I think.”

One of the employees worked in this department only for a short time, but she did send in pictures of her marriage for the Panorama system. These were shown during the first few days of the observations and received a lot questions from the people in the lunchroom.

Other examples are those where the Panorama user was present at the concerning event, but might just not know that any pictures were taken that day. In that case the user can ask others to exchange these pictures:

“Who’s photos are these? Did you send photo’s?”
- “No”

“There are some photos I don’t have, these I don’t have. It’s from the spring school.”

In the interviews, people indicate that they also get interested by content they sent in by themselves. The mostlogical explanation for this is that they have some point of recognition when they see a picture they made themselves showing up on the system. They also might want to see the reactions of others on their content.

A common response in the interview is that a person’s attention is drawn by things that are moving on the screen and “my own content. Not the things that I see myself, but the things I made myself. I know I’ve made them myself, so if Dhaval takes them from somewhere [if a person takes pictures from a website to show them on Panorama], I recognize them easily.”

For some people this supports their curiosity while watching Panorama, because “if you see only a few pictures you don’t know, the urge to ask other people about it would be bigger than when you don’t know anything about most of the content”. So it can be stated that there has to be a balance between content that the user knows something about and content that is completely new to him. If he knows everything, there is no reason to keep watching. But if all content is unknown, then the user might lose interest because he cannot relate to the content in any sense.

Another reaction from the observations, to relate to the example given above, shows that people do notice new content:

“Now all the wedding pictures of Hannah are out, that we saw yesterday all the time.”
- “Maybe they get changed every day”

The simple fact that images are moving on the screen and keep getting interchanged with other pictures draws a lot of attention from the users. But Panorama does not completely pull them from their daily routines to forcibly look at the system. So it does draw the attention, but it is not too distracting: “It stays on the background, because it’s only visually active. Today we had some long discussions and that thing was just running on the background, so we didn’t even discuss it. That would probably be related to the news value as well. You’re watching it now and then, but not constantly. So if you put in some new pictures it might lead the conversation a bit. But then it has to draw attention again, somehow.”

Series of photos slide over the screen in a predefined way, but the fact that there are 10 series of 30 pictures each makes the sequence look random. Because it is hard to predict the exact sequence, people keep looking for new content. The randomness of Panorama supports the curiosity of people: “Maybe because the content drops in randomly, you have to keep looking if something new is happening.”

4.1.2 Learning new things
If the questions that are caused by their curiosity get answered, then Panorama users might actually learn something about others. In nearly every interview, the example of the married girl is named as something that colleagues learned about each other:

“There was one example, where our colleague, Hannah, was married, she’s not been here for a long time.”
- “Same example for me. Most things you see you already know, but you can see examples of events or hobbies of people.”

“If you see different sides of people, it helps a lot, normally you only work with them and now you see holiday pictures and
such. so you know more about their personal things, such as their partners and hobbies.”

“Who’s the girl holding that snake?”
– “No one knows, it’s a secret”
“It’s your girlfriend?”
– “Yes, so now it’s not so secret anymore”

Some examples of the specific topics that people learned about were holidays and events that people of the HMI group attended to: “It’s fun to see old pictures of trips and to see the differences of people who were there and who are still at the department.”

A lot of content that was sent in by the HMI employees featured trips to cities and other events, such as conferences or celebrations. A reaction to which aspect of Panorama draws most attention: “I think holiday pictures or funny pictures, that are different from the working environment.”

Panorama was of some interest to PhD students who were new to the HMI department. Panorama provides especially for them as an extra opportunity to learn about other people: “I can imagine when new PhD students see pictures of the married girl, that they have no idea who she is”.

There is however a limit to the amount of information that people want to share through Panorama with their colleagues. This is where the privacy issue comes in. Some people indicate that they would send in anything they want and if there is any kind of censoring. This issue will not be explored any further, because it is outside the boundaries of this research.

So Panorama can give people from the department new knowledge about others by the content they see, but maybe even more important, by the interaction that is caused by what they see.

4.1.3 Initiating interaction

The things people see on the screen might spark a conversation, though not necessarily about something that is unknown. This might be one of the most interesting aspects of Panorama, because while people are watching the system, a conversation might be started out of curiosity, which might lead to new knowledge for them. In this way, Panorama might support social awareness.

This category is closely related to the previous categories, curiosity and teaching people new things. The amount of context information available to the user plays a crucial role for initiation of interaction: “But you do miss that a bit, if you don’t know where they are from. Especially if you don’t know the pictures. Like when someone asked “why is there a picture of a giraffe” and then someone starts explaining.” As explained above, if the user doesn’t have all context information about some content, he can get curious and start asking questions, which might lead to conversation.

One person explains that sometimes context information is lacking: “Then you would like to see more content. But then people start explaining automatically if they recognize the pictures. Like the thing where Henry fell and broke his wrist while ice-skating, as an example.”

One very interesting instance of a conversation during the observations was the one where a person says he would want to see the pictures he sent in of him dancing. A colleague responds that he has the same hobby and didn’t know this person also likes ballroom dancing. They continue this conversation for a few minutes.

The amount of content that leads to conversation can in fact be very minimal, ranging from a certain topic of a picture to an aspect of the system itself. In the next examples, the interaction is caused by the fact that the system itself is there during lunch and by the opportunity it provides for conversation. Someone sees pictures of himself on the screen:

“Everyone is ignoring me a bit today”
– “That’s the only thing that doesn’t change because of this screen”
“Normally nobody looks at me”
– “But I said hi to you the other day at the bar”

And afterwards they continue conversation about meeting colleagues at a bar.

One person talks to someone who submitted photos: “So you submit your photos, then you have lunch here and just wait until it’s on the screen? Or do you have nothing else to do?”, as a response, the person talks about his activities and study progress.

At a certain moment during observations, people came in to look at the specific pictures they sent in. One person invited a guest to show him the pictures she sent in. People sit in direction of the screen, so they can watch Panorama while they eat.

Although interaction with the Panorama system itself is minimal, it did create some playful situation during the observations. A webcam was connected to the Panorama system that showed a live video stream (recorded in the same room) on the screen. At first, people did not like the fact that a camera was pointed at them. But already the first day people started moving around the camera and eventually it pointed at a piece of paper stating “Frans is crazy”, as a practical joke. Some technical issues caused the video stream to pop up more than usual on Panorama. This joke kept being repeated a few days in a row while people were in the Rappa eating lunch.

4.1.4 Technical issues of Panorama

This category is for the technical problems that Panorama had while it was in use. Panorama was developed a few years ago, as a system that can support social awareness for co-workers at the HMI department. At that time, a prototype of the system was developed that had somewhat limited functionality, though the system as a whole was complex. It made use of very specific (and currently outdated) software libraries to render the content on the screen and to apply particle effects and filters to the photo- and video streams. This caused the system to display the sliding content in a stuttering way, which was experienced by the users as annoying at times. Near the end of the observations, some of these issues were solved and the users appreciated the smoothness of the system.

4.1.5 User suggestions

Quite a few users suggested implementing some new features for the system. A lot of them included increasing the interactivity of Panorama, focusing on a specific picture or pausing the screen to focus on something. Some annoyance was caused by the speed of the rotation: “It can be a bit annoying that pictures suddenly get interchanged with others. It gives you the feeling that you miss the picture. Distortion of the picture because it moves backwards is a bit annoying”. Furthermore: “It doesn’t distract too much, but it would be nice if you could look at it longer. If you want to show something to someone, it might be gone. Some option to pause it or something.”
Some suggestions for other content were made as well. Ideas ranged from daily international news to comics. The consequence of repeating content is that the user might lose interest if he keeps seeing things that he has already seen. During the first day of observations, only limited content was available on Panorama and the users noticed this quite rapidly. People like to see new content every day, otherwise Panorama “loses its news value quite fast. Then it doesn’t attract attention at all. That might improve if new content is added. But only at the beginning, I think”. A few people indicated that they would appreciate it if submitting content to Panorama was easier.

4.2 RGT

As described in the methodology, each participant of the RGT sessions was asked to elicit six constructs and rate all five systems on a scale from one to seven relative to these constructs. The next sections will describe how to interpret and analyze the data that is produced by this method.

4.2.1 Single user analysis

The result of one RGT session consists of a table containing all the elements as the columns and the user created constructs as rows. Each cell contains the rating of an element for that construct and a low rating (1 out of 7) with the keyword on the left, a high rating (7 out of 7) with the keyword on the right. For example, in Figure 3, the user rates Nintendo Wii as a highly active system (1 out of 7).

![Figure 3. Single user display grid for user 1](image)

To get a better overview of the data, the WebGrid V software has been used to produce a graphical representation of the user data. WebGrid is a tool that can be used for collecting and visualizing repertory grid data [3][16]. One of the graphs it can produce is the FOCUS grid (see figure 4). This table still contains the same data, but all the rows and columns are shuffled and reordered so similar systems and constructs are grouped together. Two elements are related if they have similar ratings for each of the constructs; two constructs are related if they hold similar ratings for each of the elements. At the top of the table, a dendogram (an acyclic graph) is shown in red, that indicates how related the ratings of the elements are, the numbers along the graph show relation in percentage terms. A dendogram for the relation between constructs is shown as well in blue. With this grid, only relationships among elements or constructs based on ratings can be revealed. Though [4] suggests that two constructs or elements that are similar in rating could also hold a semantic similarity. This way, relations concerning the meaning of elements can be uncovered, that might not be noticed when one would only have the data as presented in Figure 3. By further interpretation we can try to understand how the user experiences the Panorama system in relation to the other four.

![Figure 4. FOCUS grid for user 1](image)

From this example it can be seen that the user (user 1 in this case, coded by ‘U1’) relates television to panorama on most points, but he does think Panorama is more active. An explanation for this difference is that this user sees Panorama as a system that leads to interaction between users and therefore is more active than television, but less than Nintendo Wii. Panorama is rated as an output device, which indicates that the interaction with the device itself is low and interaction with other people while using Panorama is high. Panorama is spontaneous, contrary to devices such as digital camera or mobile phones where the usage is planned. The same can be said about the public/private and single/multi user constructs: Panorama is a system that is open to everyone, while mobile phone and camera are more personal. The construct dendogram also agrees that the last four constructs are more related to each other than the first two.

4.2.2 Multi-user analysis

Up to this point, the results of only one person is described. But what about the other fourteen repertory grids? It would be nice to have a method to group the data of all users together, so we can say something about the way HMI employees experienced Panorama. Fallman [3] describes in his thesis how to produce a single grid out of all the user created grids.

All the 90 user elicited constructs are inputted to the WebGrid V software to produce a large unstructured grid containing all data. To see similarities, a FOCUS grid can be produced in the same way as for the single user analysis, but this grid still contains 90 constructs. Fallman suggests to form clusters of constructs where ratings of for this group are mathematically close to each other. The idea behind this is that such coherence in rating could implicate a similarity in meaning as well. A group of ratings can have a specific dimension of meaning in relation to the chosen systems. It is up to the researcher to point out what the semantic meaning of this group is.

The large FOCUS grid is used to find these groups of constructs. Constructs belong to a cluster if their ratings are 90% similar, as can be read from the dendogram. If this
percentage is chosen too high, no constructs would be regarded as similar to another. Likewise, if the percentage is too low, the clusters would become so large that the meaning of the cluster regarding the elements might disappear. A cluster consists of at least four constructs. A second round of FOCUS analysis with a threshold of 85% is performed to see which groups are formed around the existing clusters. Some new clusters are created as well.

This method leads us to 7 groups, consisting of 4 to 23 constructs each. Each group consisted of constructs which ratings grouped them together. Thus, so far the analysis was semantically blind.

From each group, one or two labels were chosen by interpretation that are representative for each one. These can be regarded as new constructs for these groups. One group that had no obvious coherence in meaning was left out. The constructs in this group were: (Common place – New); (User in full control – User has no control); (Usable – Not usable); (Warm – Cold).

Next, a rating for every group was formed by calculating mean of all ratings in a group. What is left of the large and unstructured 90 construct user grid, is a new grid containing the six most significant meanings that represent how the user experiences these systems. These constructs and their calculated ratings are shown in the grids in Figure 5 and Figure 6.

Each of these unique dimensions will be introduced, analyzed, and discussed both in terms of their origins, their relations to the chosen systems and specifically their relation to Panorama.

![Figure 5. Multi user repertory grid](image)

### 4.2.2.1 View – Create

This construct originates from a group which describes what the users see as the purpose of the five systems. It includes terms such as watch, consume, output and show image versus create, produce, input and capture image. The overall trend is that Panorama and television are rated as devices used for viewing data and digital camera is purely for creating things. Mobile phone and Nintendo Wii are somewhere in between. The overall impression is that elements on the left hand side of the grid, or some variation to it. The most striking thing here is the fact that nearly all users rated the systems equally on this construct, or some variation to it. The most striking thing here is the fact that nearly all users rated the systems equally on this construct. Panorama and television are on the passive side of the grid, but in general, users indicate that Panorama is a little more active than television. From the interviews after the RGT sessions, participants explain that Panorama leads to more interaction among the users and therefore is a bit more active. The overall impression is that elements on the left hand side of the grid are devices that are used in a group for a long amount of time, meant for fun and socializing. On the other side are functional devices that are used individually, where usage is short and planned.

Panorama can be placed in the former category together with Nintendo Wii. Mobile phone and digital camera belong to the latter. Television is right in between. Thus, users experience Panorama as a device that is used in a group, for example, in the Rappa during the observations. Furthermore, it is described as a fun, social and spontaneous device, which corresponds to the meaning of the developers.

### 4.2.2.2 Observation – Communication

The constructs of this group point at the aspect of communication. This is different from the previous construct, because (view – create) explains how much interaction between the user and the system is possible. This construct tells us something about the way a system can convey a message from one user to another or just from the system to the user.

The mobile phone is the only system that is rated as truly meant for communication, which can logically be explained from its function. Panorama is rated as the most observation related system, together with digital camera. The reason for this is mostly the same as the previous construct: this prototype of Panorama is used for observation rather than active communication through the system. Though this construct alone does not tell us anything about communication between users.

Two other constructs included (Images – Acoustics) and (Artistic – Not artistic). They are hard to relate to this group, because both images and sound can succeed or fail to convey a message to a user. Artistic is in this case on the same side as observation, which can be explained that the systems rated as artistic are meant for observation, while the others are more functional.

### 4.2.2.3 Together, Spontaneous – Alone, functional

This group is a mixture of a few different constructs. The majority points at the aspect of using a system together with other people at the same time, versus individual use. Other constructs included spontaneous, long time of use, social and fun, versus planned, short time of use, individual and not fun.

Together, Spontaneous – Alone, functional

The other three systems are on the passive side of the grid, whereas Panorama and television are on the active side of the grid, because they require physical effort to control them.

### 4.2.2.4 Active – Passive

With 23 constructs, this is the largest cluster that clearly describes the contradiction between active and passive systems. Every one of the fifteen participants came up with this construct, or some variation to it. The most striking thing here is the fact that nearly all users rated the systems equally on this construct. Panorama and television are on the passive side of the grid, but in general, users indicate that Panorama is a little more active than television. From the interviews after the RGT sessions, participants explain that Panorama leads to more interaction among the users and therefore is a bit more active. The other three systems are on the active side of the grid, because they require physical effort to control them.

### 4.2.2.5 Mobile, private – Stationary, public

This construct explains how the HMI employees use a device and tells us about the availability and the function of it. Mobile phone and digital camera are regarded as the more task-oriented, mobile and personal devices, whereas Panorama and
television and are on the opposite side and Nintendo Wii is somewhere in between.

It is logical that participants find Panorama to be concerned with stationary and public, because this was the way it was presented to them during the observations. The interesting thing is that they see it as public, in the sense of sharing your personal things with others, contrary to a mobile phone, which is regarded as private.

4.2.2.6 Non-social – Social
Perhaps the most interesting cluster is where the users tell us something about social awareness in relation to these systems, because the Panorama prototype would be regarded as a failure if it were to be seen that HMI employees think that it is meant as a device for informing colleagues about the schedules and work related content. Television is regarded as the least social device, Nintendo Wii and mobile phone as the most. This gives us a point of reference for comparison with the Panorama system, which is rated a bit less social than the Wii and mobile phone, but more than television and digital camera.

In nearly all of the RGT results, Panorama is rated similar to television, because the way these systems are used is quite comparable. As explained in section 4.2.2.1, the system-initiated interaction of the used prototype is minimal, therefore relate television to Panorama and thus a bit less social than Nintendo Wii and mobile phones (where interaction and direct communication are high). The high ratings on the constructs interaction with others and interactive, which confirms to the designer’s ideas for Panorama. Last but not least, Panorama is rated high on improving contact.

5. DISCUSSION
In addition to previous work on Panorama [15] we have shown that Panorama indeed supports social awareness through different properties of the system, such as the content provided by and for colleagues and the interactions that are initiated by the system. Other suggested research topics, such as privacy related issues and increased interactivity were not investigated further, because we focus explicitly on the effects of Panorama on social awareness in this paper and because of technical limitations of the prototype.

5.1 Methodology
Panorama was set up in the Rappa for four days, during the lunch break, to examine the reactions of the users to the system. The presence of the observer during the experiment might hold back the employees of the department to really express their thoughts about the system to others. An alternative approach to this could have been the use of diaries, in which users daily express their feeling and experiences in a notebook. This would allow the experiment to run over a greater period of time, but requires a lot of direct effort from the users to keep their daily log up to date.

The systems used for the repertory grid technique were chosen for the fact that they are home electronics that are well known to the large public. As a different option, one could argue to use only systems that are meant by the designers to stimulate a sense of social awareness among a group of people. The biggest problem here is that the group of system would consist of prototypes of other research projects, that are not readily available to a large audience. These systems would therefore not be well known to the participants of the evaluation and it would require a play test for the users to get acquainted with them and to reason about the meaning of the device and their experience. Besides the fact that this would take extra time in the RGT session, this was the main reason to choose well known electronic devices.

Some of the users came up with some constructs that describe physical aspects of a system, such as (stationary – mobile). One could argue that these aspects are obvious to everyone and have nothing much to do with reasoning about meaning or experience. These constructs can in fact be very useful to the grid as a whole, because they help to describe how the participant uses these systems. If they are related to other, meaningful constructs, they might add a bit of information that is needed to understand the reasoning behind the constructs. Moreover, the creativity of the participant might also be limited, so the user might have problems thinking of six substantially different words to describe their experience in such a short session.

Another improvement to the way RGT was used for this evaluation is to evaluate the results of the single user grid afterwards with the user. The benefit of this is that the user can clarify his chosen constructs and resolve ambiguities, if any. The downside would be the fact that this takes more time from both the interviewer and interviewee, which is too much for a study of this size.

6. CONCLUSIONS
From the observations it can be shown that Panorama supports social awareness through three aspects that are closely related. First of all, Panorama stimulates people’s curiosity by providing content that has a certain news value. It is important that some of the content, for example events or colleagues, that people see on the screen is known to them, because otherwise the viewer can not relate to it in any way and therefore loses interest. This might also occur if all content is already known to the user. The randomness of the picture queue keeps people looking at the screen for interesting new things. The second aspect is the fact that people learn new things from the content they see on Panorama about others, that is not necessarily work-related. This effect is directly caused by the content that people see on the screen. Another possibility is that colleagues learn about each other by the conversations that are sparked by the things that Panorama shows. This is the last aspect that supports social awareness: initiating interaction among co-workers.

Some systems are developed for their artistic value rather than their functionality, in which case the user can establish his own understanding of what they mean; Panorama is an example of
such a system. The rich user experiences that stem from using these systems can be captured using a mixture of quantitative and qualitative evaluation methods. Solely using quantitative methods would miss much of the stories behind the user’s meaning, while quantitative methods tend to produce amounts of data too large to comprehend. Using RGT, observations and interviews gave a complete impression of how the user made sense of Panorama.

Reactions of the employees of the HMI department about Panorama were overall positive. People enjoyed seeing both current and former colleagues on events organized by the department, but personal content such as holiday, hobby and marriage pictures as well. It proved to be a great source of new knowledge about colleagues for both newcomers and people that are well known to the department.

6.1 Future work
When seeing the results of chapter 4.1.5, it might be interesting to examine whether users of Panorama respond differently to the system if interactive features are added and whether this stimulates their awareness even further. Examples of such features are submission of content through online social networks as Twitter or Facebook. As users indicate, this might provide for a constant influx of new content and therefore the news value of Panorama could be increased. Other features are a method for pausing the system to look at a certain picture a bit longer or the addition of sensors that measure the activity in the room and adjust the speed and mood of the system accordingly. Besides extra functionality for Panorama, privacy related issues could also be studied.

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8. REFERENCES


