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The effect of awareness information on online behavior: A field experiment

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Abstract: This paper explores how access to synchronous, non-verbal awareness information influences the usage of web-based systems. The results are based on a field experiment that utilizes a web based art exhibition enhanced with an awareness module. The results show that users that are aware of other co-present users spend significantly longer time in the gallery. However, the awareness information does not seem to affect the users´ navigation pattern.

Key-Words: Usage, Collective Systems, Awareness information, Community, Online behavior

1 Introduction

Use of information and communication technologies has been studied from a number of different perspectives. Factor-oriented approaches such as the Technology Acceptance Model (TAM) (e.g. [1, 2]) focuses on how the individual user perceives ease-of-use and usefulness of a system. Other theories and frameworks introduce aspects such as adaptation [3] or domestication [4, 5] to stress that usage should be understood as a process over time. However, collective technologies (communication and/or collaboration systems) differ from individual technologies in the sense that usage can not be understood solely from the perspective of a single user. Instead use becomes a concern for a community of users that jointly needs to develop use-patterns and shared understanding of the system. In research on the introduction of groupware technology in knowledge intensive organizations, it has been found that adoption and use is influenced by a number of organizational factors such as incentives and reward systems [6]. Furthermore, introduction of technology has been found to be a dynamic and evolutionary process where technology is contextualized, structured [7], negotiated [8] and domesticated [5] in use. Consequently, it is important to acknowledge that communication and collaboration technologies should not be perceived as neutral delivery systems, but rather as agents for change [9, 10, 8, 11]. This paper will bring forth a discussion on the role of social awareness information with respect to collective technologies (e.g. web-systems). More specifically the paper addresses the following research question: *How can awareness information affect the usage of collective web-systems?*

The argumentation is based on a field experiment where a web-based art gallery was enhanced by an awareness information module that visualized co-present users and afforded them to communicate through a chat. The results show that access to information of co-present users significantly increases the time spent in the gallery. However, access to awareness information does not appear to affect the users' navigation patter in the gallery. The next section provides an overview of related research on social awareness information. Section three presents the field experiment, the Awareness information module and the web-gallery. In section four the results are presented and analyzed. The paper concludes with a discussion and suggestions for further research.

2 Theoretical Background

Awareness is a multifaceted phenomenon, containing aspects such as being able to see other people, interpret their actions and eventually act upon them. Dourish [12] states that: *"The primary role of awareness information is to make one's activity visible to others."* The importance of awareness of others in collaborative computing environments has been addressed in several articles throughout the last decade (for examples, see [13, 14, 15, 16]). Results from such studies often show increased effectiveness in groupware applications where awareness information has been present. Gaver [17] argues that general awareness is a necessary foundation for higher levels of co-operative work such as serendipitous communication, division of labor and focused collaboration. Ackerman & Starr [14] advocate the need for including social activity indicators in groupware. This is based in the assumption that the people use knowledge of other people's activities in shaping their own actions and motivations. Gutwin & Greenberg [15] presents results indicating that users of a groupware system with awareness support were more effective than users using a system lacking awareness support, as well as being more satisfied with the

awareness enhanced system. On the other hand, too much awareness information can result in awareness overload where as with information overload the amount of information can become negative [15]). A careful selection of what awareness information to provide is thus needed.
This paper utilizes an awareness framework proposed by Nilsson et al. [18] (see figure 1). The framework was derived from a study of several awareness applications and their functions, and presents four different modes of awareness.

	CURRENT	HISTORICAL
VERBAL	Instant message	Annotation
NON-VERBAL	Presence	Footprint

Fig.1 - The awareness framework

These modes are subsets of two categories; verbal vs. non-verbal and current vs. historical awareness (see Figure 1). In the verbal mode, the current type is called "Instant Message". In this type of communication, messages are ephemeral and communication can only occur with two or more people sharing the same chat system at the same time. The historical verbal type is called "Annotation". With this form of communication, users do not have to share the system at the same time. Messages entered are stored and are thus more static in nature. In the non-verbal modes, the current type is called "Presence". In this type, users sharing a system can get a notion of others in the same system at the same time. Research in this area has two main focuses, what to visualize and how to visualize. The question of what to send as awareness information is complex. A solution would be to send as much awareness information as possible, but as Gutwin & Greenberg [19] states, this could result in awareness overload, and a difficulty in separating important and unimportant social information arises. So selecting what to send and what to leave out is an important issue. Regarding how to visualize presence, Erickson & Kellogg [20] categorizes visualization techniques into three groups - realist, mimetic, and abstract forms. The realist form displays real-time events captured by for example a camera to spatially dispersed people. This form can be said to just transfer human behavior and social cues of information over computer networks through video captures. The mimetic forms use avatars to mimic the social cues of real life. The avatar is a representation of ourselves in the virtual world that contains social information about its owner. The avatar can be smiling and active, representing the on-line version of the real-world person's current state of mind. The abstract form uses various abstract models to symbolize social interaction and social information. Here, much research has been made as to how these models of visualization should look like. It is easier to visualize large amounts of people with an abstract representation, such as an increased amount of dots representing visitors, and their colors might for example represent the mood of the person behind the dot.
The non-verbal, historical part of the framework is called "Footprint", and is comparable to the field of social navigation research. Social Navigation is focused on various ways to visualize human activity on web pages. The idea is to make visitors aware of other visitors' activities on that particular web page. When moving in "the real world" we consciously and unconsciously leave marks, "footprints" which succeeding visitors are able to see. By taking part of other people's decisions, habits and experiences, we navigate through information spaces. The way other people navigate guide us in the way we navigate. As can be seen in the above overview of awareness research, there seems to be an undisputed acceptance of the positive aspects of awareness information. But as Gutwin & Greenberg [15] points out, too much awareness information can turn it into something negative instead, much like information overload. A careful selection of what awareness information to provide is thus needed.
Awareness information in online settings must also be related to the social dimensions that implicitly follow as a consequence of being aware of others and their activities. A rich body of literature has discussed this in terms of virtual communities, which Rheingold, [21] defines: *"Virtual communities are social aggregations that emerge from the 'net when enough people carry on those public discussions long enough, with sufficient human feeling, to form webs of personal relationships in cyberspace"*. Erickson [22] criticizes the use of the community metaphor as a generic description of on-line discourse. He supports his critique with several examples of social phenomenon on the web where fundamental aspects of a community, such as membership, shared value, commitment and interpersonal relations, makes little or no sense. Instead he proposes a genre approach to the understanding of on-line discourse. Wenger [23] presents an important contribution to the understanding of community processes. He stresses the situated nature of a community and argues that any community must be understood in relation to its common practices. Wenger identifies negotiation of joint enterprise as a core process that involves the duality of reification and participation. Furthermore, mutual engagement and typified and shared repertoire are other central aspects of a community of practice.

3 The Field Experiment

The research presented in this paper is a part of a larger project that aims at understanding the role of IT in relation to the Experience Industry in general and in particular (See [24, 25, 26])

3.1. The Art Gallery and the WebAwareness Module

The Awareness module included a traditional chat system that was augmented with functionality that kept track of and visualized all co-present visitors of the gallery (see fig. 2). The gallery consisted of 12 pictures, with each picture residing on its own web page on the website. The website was made in the form of a tour, where you enter the gallery at picture one and exit at picture twelve. During the tour you have at each picture a navigation tool, giving the visitor a choice of either go back to the previous picture, to go on to the next picture in the gallery or to exit the gallery and go back to the main page of the website (fig.3.). The visualization information was displayed using a minimalistic approach [20] where a simple counter indicated how many co-present users there were in the gallery. When choosing to log in, the users stepped out of anonymity in the sense that her name was shown in a listing adjacent to the chat area.

Fig. 2 - The WebAwareness module

Since access to the social information displayed by the WebAwareness module required users to be simultaneously present at the web site, the system provides only current awareness information (fig. 1). The system logged a rich amount of data about the usage of the gallery, such as when visitors came, their ip-number and all (if any) messages they entered in the chat part of the WebAwareness module. This made it possible to track individual visitors of the system as they went through the gallery.

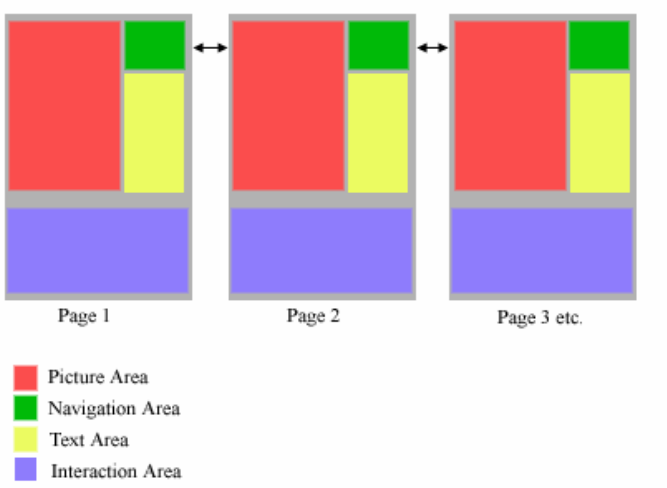

Fig. 3 - Conceptual layout of the gallery

3.2 Data Collection and Analysis

All data collected in the field experiment was derived from the log-files generated by the WebAwareness module. Each interaction with the system (click on navigational object, making a text entry) was recorded in the log-files as a time stamped line. Each line also contains an IP-address that was used as a way to identify and trace a user through the log files, and an entry that registered the number of co-present users at that time. A session started with the first entry in to the gallery, and was judged to be terminated (or interrupted) when no activity was recorded for three minutes or more. The field experiment divided users into two groups.

1. Experiment group: Users that was subjected to information about one or more co-present user throughout the duration of the use-session
2. Control group: Solitary users that had no other co-present users throughout the duration of the use session

Users in the experimental group (n = 16) was chosen at random from the log-files using the following technique: First a random line was targeted in the log file. Then the IP-number of that line was traced backward and forwards in order to find the start and stop of the session. If the user at any time of the session was alone in the gallery the session was excluded from the experimental group. If a user actually engaged in communication with a co-present user, the session was also excluded from the data material. The trivial fact that sessions that included written communication with others would be significantly longer was regarded as nuisance to a comparison between session-lengths in the two groups.

Users in the Control group (n=16) were identified using a similar technique: First a random line that showed 0 co-present users was generated. Secondly the session was traced, and included into the control group if no

other user appeared throughout the duration of the session. In both groups the usage pattern was coded with respect to the sequence and number of pages that was visited.

In summary, the unit of analysis was a "use-session" coded with respect to the following variables

1. Duration of session (seconds)
2. Number of pages visited
3. The sequence in which pages were visited

Fig. 4 - Part of one of the photos in the gallery (The Ecce Homo exhibition, Artist: Elisabeth Olsson)

4 Results and Analysis

4.1 Duration of use-session

The use sessions that were included in the study ranged from a minimum duration of 45 seconds (control group) to a maximum of seven minutes and 18 seconds (experiment group). In figure 5, the sessions are grouped in intervals of 100 seconds. The systematically shorter duration of the solitary users' sessions is also illustrated in figure 6.

Duration (s)	Co-present	Solitary
0-99	13%	31%
100-199	19%	50%
200-299	38%	13%
300-399	19%	6%
400-500	13%	0%
	100%	100%

Fig. 5 - Duration of use-session for experimental group (co-present) and control group (solitary)

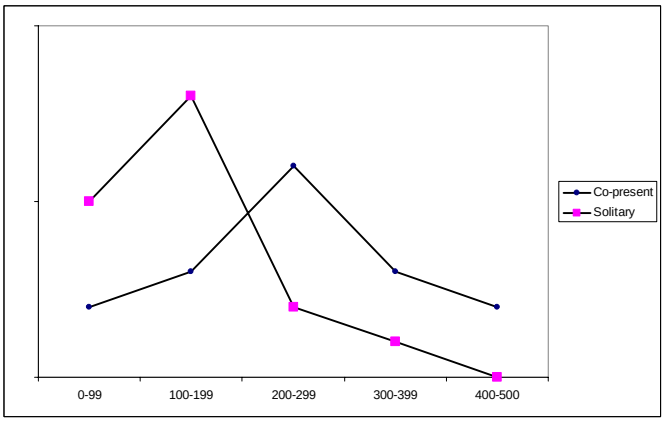

Fig. 6 - Duration of use session in the two groups

This was further underlined through a Student's T-test that showed a significant difference between the two groups, with a p-value of 0,0138. Solitary users spent less time in the gallery than users exposed to the information that there were others in the gallery. In average, visitors with co-present visitors spent 52% longer time in the gallery.

4.2 Navigational Use-patterns

The data showed a relatively homogeneous usage of the system with respect to navigational use patterns. The typical visitor entered the gallery at the first picture and exited at the last of the 12 pictures. In figure 7, the sessions are categorized with respect to use patterns. The following four categories were used:

1. Back and forth: Users that entered at picture one, accessed all twelve pictures in sequence, and then went backward exiting when returning to picture 1.
2. Full tour: Users that started at picture one, and exited at picture twelve with a maximum of two "back steps"
3. Random Walk: Users that made three or more back steps
4. Incomplete. Users that did not view all twelve pictures

Category	Control group (solitary)	Experiment group (co-present)
Back and forth	0	1
Full tour	14	13
Random walk	1	1
Incomplete	1	1

Fig. 7 - Use-pattern categories

From the table, it is evident that no significant differences could be detected between the navigation patterns of the two groups, and this was further

underlined by a Chi-square test (p = 0,79).

4.3 Reflections on Method

The methodological traditions in behavioral sciences are dominated by controlled experiments. Even though such research designs have a clear advantage with respect to the rigor of the research, we still argue that basic research regarding online behavior and the nature of virtual experiences must also be approached with research designs that have high level of relevance. Laboratory conditions can not mimic the realistic conditions of a user surfing the web. Distractions and other parallel activities that compete with online activities are important in understanding the nature of virtuality and online behavior. However in this case, there is of course also a down-side to using a field experiment in the sense that the users could not be approached and interviewed regarding the use context. Still it seems plausible to assume that the observed differences between experiment group and control group could not be explained by variables not included in the study.

4.4 Reflections on Results

This paper set out to explore how usage of collective systems is influenced by access to awareness information. The strongest and most direct evidence of a link between access to non-verbal awareness information and user behavior is the statistically significant impact on time spent in the web gallery induced by co-present users. An explanation for this dependency cannot be found in the data material. However, we argue that a possible reason for this phenomenon is the fact that the system allowed for interaction between co-present users. In other words, the impact by non-verbal awareness information on time spent in the gallery relies on the possibility for these users to communicate verbally.

The WebAwareness module is focused on current awareness information. As argued by Ackerman and Starr [14] such visualization of ongoing social activity can have positive effects on both individual and collaborative work performances. However, the opposite could of course be equally true. If a user time after time finds herself to be the only one visiting a web site, it might have a negative effect on performance. To address such potentially negative effects it would be interesting to explore how asynchronous verbal (annotations) and non-verbal (footprints) awareness information could be instrumental. Historical information of this kind captures parts of the communities' shared history [8] and are indicators that support social navigation [16]. The most recent historical information does of course display data that is more or less current awareness information. The user that finds herself alone at the web site is probably in less risk of being negatively effected if historical data shows rich footprints of her peers in the near past. In the same manner as verbal historic annotations serve as reification, current awareness information can be seen as what Wenger [23] calls participation. However, participation and reification compared to current and historical awareness can be seen to have a built-in duality. There are participatory dimensions to the historical verbal part of the framework, i.e. the users are participating in the creation of the historical part of the awareness information. In the same manner as the historic verbal part has participatory features, the current part has reification features. Users partaking in current verbal modes of awareness can be seen as participants in the process of reification.

When an awareness module is added to a collective system, the aim is to support the social processes of the user community. As argued above, important characteristics of such a module are to support the creation of verbal reifications that could serve as tools for joint negotiations among members of the user-community.

5 Conclusions and Further Research

Through a field experiment in an online gallery we have shown that access to non-verbal information about co-present users, can significantly increase the duration of a use-session. The results also indicate that such information does not affect the navigational use patterns. The implication of these findings should be valuable to designers of web-systems where social interaction, communication or collaboration is a desired outcome.

The WebAwareness module supports a community where the typical user spends a few minutes on the site together with perfect strangers. In that sense the user community at any given point of time is highly ephemeral and volatile. Further research should investigate if these results are also valid in other types of web-systems (different navigational structure, different categories of web-site purpose etc). We also believe that other approaches to visualization of awareness information should be explored, and as argued above – also the impact of historical modes of awareness information (footprints and annotations) should be investigated.

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