Author(s): Pekkola, Samuli; Isomäki, Hannakaisa

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Application

Please cite the original version:

Pekkola, S., & Isomäki, H. (2006). Evaluating End-user Support : Validating the Use of Multiple
Media in a CSCW Application. In R. H. J. Sprague (Ed.), Proceedings of the 39th Annual Hawaii
International Conference on System Sciences : abstracts and CD-ROM of full papers : 4-7
January, 2006, Kauai, Hawaii. IEEE Computer Society Press. Proceedings of the Annual Hawaii
International Conference on System Sciences. https://doi.org/10.1109/HICSS.2006.162

Evaluating End-user Support:
Validating the use of multiple media in a CSCW application

Samuli Pekkola
Dept. of Computer Science and Information Systems, University of Jyväskylä, PO Box 35, 40014 University of Jyväskylä, Finland
samuli@cc.jyu.fi

Hannakaisa Isomäki
Department of Research Methodology University of Lapland
PO Box 122, 96101 Rovaniemi, Finland
hannakaisa.isomaki@ulapland.fi

Abstract

Human-centred views on information systems are gaining more and more attention in IS community. The need to evaluate information systems from such a perspective is thus evident. In this paper, we exploit our earlier developed theoretical framework for evaluating end-user support in information systems, and demonstrate its usage in validating the use of multiple communication and collaboration media in a CSCW application. The evaluation is performed in terms of user perception in ISD process, users' role in organizational information processing, and users' behavioural nuances. Our study shows that a context specific theoretical framework is useful in validating the empirical results of systems use and in helping one to concretise and identify different viewpoints that are relevant for human-centered information systems development.

1.   Introduction

At present, as human-centredness is becoming a hot topic in the information systems community [2], it is necessary to discuss how the users are considered in information systems development (ISD).When comparing different perceptions of users in ISD with development projects, it is interesting to realise that the projects often incorporate only a certain single perception. For example, users are seen as experts in the requirements specification phase [15], or as resources in the design and testing phases [4], or even as integral participant in the whole development process [26]. This kind of congregated focus is evident as each approach has its benefits. For example, participatory approaches, e.g. participatory design, can provide realistic feedback for the developers throughout the

development process but reciprocally require resources and intensive involvement from every actor [1, 8]. On the other hand, requirements engineering approaches focusing solely on the requirements specification phase disregard the active user involvement during the whole project. Consequently, they require fewer resources and simultaneously minimise the chances for conflicting requirements (c.f. [1]). However, grounding the development of IS on a single type of user perception does not guarantee a 'human-centred' outcome for the project. As Isomäki and Pekkola [14] argued, users possess various roles and inherent characteristics that should be taken into account in ISD, and thus, a holistic view of users needs to be embedded into the process of ISD in order to facilitate a comprehensive analysis of the various ways that people interact with information, technologies, and tasks. A particular type of IS applications requiring a holistic approach are CSCW (computer supported co-operative work) applications supporting communication and collaboration among a group of users.

Technologies to support different work practices, communication and co-operation between people are numerous. They range from individual-oriented tools such as word processors and spreadsheets into group support tools such as text chat and audio communication to shared whiteboards and co-editing systems. Further, applications combining multiple media are common. For instance video conferencing systems combine audio (oral communication tool) with video (visual communication tool), sometimes even a shared whiteboard (collaboration tool) is incorporated. Collaborative virtual environments (CVEs) often support audio and textual communication, and representation of spatial relationships between users, and between users and objects [3, 28]. Instant messaging applications support textual messaging and provide awareness information of other users online. Even a mobile

phone can be regarded as a multiple media device; audio and text-based communications are both supported. Essential is the problem of how to connect the features related to users and their tasks into the properties of the technology. Shackel [27], for example, states that a good design depends upon solving the dynamic interacting needs of the four principal components of any use situation: user, task, tool and environment.

From the technologies point of view, it is distinguishable to realise that the technologies are actually separated. If an ambulance controller wants to talk to the ambulance driver, she uses telephone. And if she wants to check the status of an ambulance, or to monitor the incident stack, appropriate computer displays are observed [5]. In this example only, three independent, separated technologies were utilised. Assumable, for an experienced user, this separation is not an issue. One utilises the technology, or a set of technologies, which one finds the most appropriate for one's current need. The person also moves smoothly from one technology to another if the subsequent one is regarded more suitable for one reason or the other (cf. [7, 10]). But when considering less experienced or random users, the separation becomes an issue. A user does not need to learn to use just a technology, but several. This makes it more difficult not only to adapt to use new tools but also to identify their benefits and apply them effectively in everyday works. After all, users want to accomplish their work tasks and primarily not to use the technology itself [9, 19]. It is common that experts utilise multiple technologies to accomplish their works (e.g. [11, 12, 16, 23]). Consequently, it is important to understand how the systems are developed so that they can support various users in a holistic manner. Yet, there are only a few studies which validate their results both empirically and theoretically. Usually one or the other is underemphasised already by the development methodologies (c.f. [17, 18]). This is pointed out by Venable and Travis [30] who stated that in design sciences it is essential to validate research results by constructing "utility theory" that fits into the context of developed system.

In this paper, we go beyond the technical issues and analyse the value of a multiple media application from the users' point of view by utilising a theoretical framework constructed in our previous research [14]. We analyse the interactions of a CSCW application – VIVA – and end-users during an ISD project in order to find how the system is supporting users from the points of view of user perception in the development process, users' roles in organisation's information processing, and users' behavioural nuances. We first present the theoretical framework of ISD methodologies capabilities of supporting different end-user interactions. Then we present a description of VIVA and a case study of its introductory use in two distinct organisations. Third, we analyse the findings of VIVA's introductory use against the theoretical framework, and discuss how VIVA was found to support different end-user interactions regarded essential in the theoretical framework. In this way we aim to validate both the findings of the case study and the theoretical framework.

2. Theoretical framework

In order to evaluate the way an application utilising multiple media can holistically support end-users, we need a framework that conjoins the essential features of user support that have been used over decades in ISD. For this purpose, we utilise a framework that we developed in our earlier analysis for capturing the essential human-centred features of the methodologies and approaches developed in the IS field [14]. This framework illustrates how the future system is supporting users from the points of view of user perception in the development process, users' roles in organisation's information processing, and users' behavioural nuances. Also, those approaches usually study both social and technical systems from the organisation cultural viewpoint. Correspondingly, the soft systems methodology origins from socio-cultural studies but its ideas on cultural analysis in a certain context have been utilised both in participative design approaches and in usability engineering.

The comparison between our approach and for example Iivari et al. framework of ISD methods [13] depicts a typical ISD methodology approach; usually the methods do not explicitly focus on humans but technologies instead. If the methods focuses on the user, the approach is commonly managerial or organisational, i.e. the user is seen as a target subject that is going to use the system as specified by managers or designers. However, as already the early studies on CSCW point out, this is a completely wrong approach – users always find out different ways to (mis)use the system in another way than specified in the design [20, 24, 25]. On a way to IS designers' increased awareness on the user and his or her behaviour in a certain context for which the system is designed, we believe it is important to explicitly list out the approaches and their position towards the user. This is accomplished in Table 1.

Table 1. Theoretical framework for analysing human-centred features of some IS.

	User perception in ISD process	User role in organisational information processing	Behavioural nuances
Structured methods	User is consulted only about the inputs and outputs of the system.	An 'object' whose task is to be supported.	Not considered
Prototyping and evolutionary approaches	An evaluator of the design decisions.	Task is considered through professional role in the organisation.	User performs certain tasks.
The socio-technical approach	ISD process is divided into two separate systems, social and technical, that are supposed to be integrated (only) at the end.	The needs for organisational information processing are considered comprehensively consisting of both individual and organisational points of views.	In principle, the user is considered as a psychological, emotional and social actor. However, the human-centred issues might be overlooked.
Soft systems methodology	ISD process as a whole is disregarded. SSM emphasises only the early (analysis) phase of the development.	Organisational performance is dealt through social norms and power relations.	User is considered as a social, cultural and political actor.
End-user computing	ISD process as a whole is disregarded. EUC focuses on the utilisation of the system.	Organisational issues are omitted, individual users' preferences are emphasised.	User is regarded as a computer expert.
Participative approaches	The connection between ISD process and participative approaches is weak.	Scandinavian approach attempts to combine user's information utilisation to organisational objectives. In European and American approaches, user role is weaker and only consultative.	User is domain expert that performs certain task.
Human-computer interaction in ISD	Process models are many, but their use in practice is questionable.	Individual users are emphasised in terms of their own information processing functions.	User is seen as a cognitive and collaborating actor.

Here, instead of investigating different communication and collaboration media's technical features, we focus on the impacts of individual and group preferences towards their choice of media, and analyse these preferences and choices against the theoretical framework presented above.

3. VIVA – virtual reality virtual office application

VIVA, virtual reality virtual office application, was based on the findings from CSCW research [21]. The application was introduced into and developed in a participative manner with two organisations where it was evaluated by both qualitative and quantitative research methods. This means; the system was developed in an iterative and evolutionary manner with active user feedback in terms of observations, interviews and workshop participation (more about those

later). The user interface includes the following main features:
- ability to open multiple interactive communication/co-operation channels (media) with other people/places independently from other media, i.e. there is no need to open a medium to be able to use some other medium
- ability to maintain multiple simultaneous media (audio/ video/ VR conferences/interactions, remote video streams, file access)
- ability to attach comments, post notes, send email
- ability to set personal 'boundaries' for each medium (text, audio, etc.) separately. E.g. in general, video 'glances' are relatively widely acceptable [6], while open video or open audio links are much more sensitive.

Figure 1 illustrates an awareness view. It shows the users online, the medium they are using or are willing or able to use, and what is their availability or status. For example, looking at Figure 1, there are eight users

logged in to the server at the moment. One of them is not willing or able to use any medium, since his media list is empty. Colour codes[1] represent whether a medium is in use; if it is not, the appropriate letter is green, otherwise it is either red (in use) or black (not available). Consequently it is an indicator of accessibility. However, new inquiries or requests are allowed regardless of stated accessibility. This allows multiple simultaneous conversations and multiple open media windows. From the eight users online, three are explicitly online, one states to be busy, and the status of four is unknown ('idle'). The 'idle'-status illustrates that a user might be online, but has not touched the mouse for a while, or is 'away', but has forgotten to change to the appropriate status. The 'Idle'-status changes automatically to 'Online' immediately after the mouse is activated.
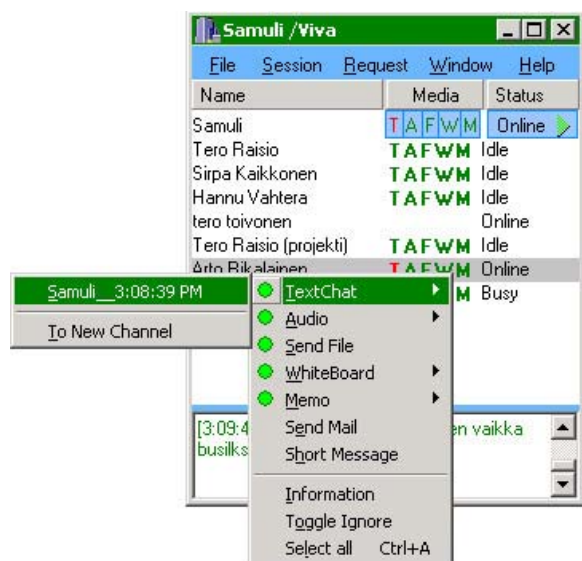

Figure 1. The VIVA user interface.

Highlighting the user's name selects them so that a media dialogue can be opened (see Figure 1). From there, appropriate medium (text chat, audio, file transfer, whiteboard, send email, and a short message) can be activated or detailed information about the user observed. Windows for file transfer, email and short message are temporarily opened for user input and closed immediately after the activity. The activation of text chat, audio, whiteboard and memo (a document-sharing tool) opens some windows for perpetual communication or collaboration. With them, once

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1 Unfortunately the colour codes are not clearly visible in the black and white snapshot and print-out.

both the medium and the channel (multiple participants are allowed to be invited to the same channel) are chosen, an invitation is sent to the receiver(s) for their acceptance to communicate and collaborate in the chosen medium. Because of privacy, a channel cannot be joined without an invitation from a user already on the channel.

The logic in short messages differs from all the others. Instead of sending requests and waiting for them to be acknowledged, short messages are written and then sent to receivers immediately without asking their permission. Upcoming messages are shown either in a dedicated window and/or in a log-view (at the bottom-most dialogue behind the media dialogue, see Figure 1), depending on the receiver's configurations. If the window is opened, the receiver may reply to the message simply by pressing a reply button. Short messages allow both easy and instant ad hoc communication, and communication with offline users, who will then receive the message when they log in next time. Short messages thereby combine the features from both synchronous and asynchronous communication.

A text chat follows the usual IRC-schema with a list of participants, a section for conversations and a field for text input. Memo is a tool to assist meetings (taking the minutes and sharing them to others) and whiteboard a method to share and collaboratively work on drawings or pictures. All of these tools provide awareness information about the other users' presence and their activities by showing e.g. an exclamation mark in the front of a user name.

4. Development of VIVA and case organisations

To investigate the use of VIVA in real work situations and to gain feedback on its use and different requirements, altogether seven different prototype versions were introduced into two distinct organisations. Accordingly both organisations were studied individually as a collective case study [29], where cases might

"… be similar or dissimilar, redundancy and variety each important. They are chosen because it is believed that understanding them will lead to better understanding, perhaps better theorizing, about a still larger collection of cases."

[ibid., pp. 437]

This kind of setting of two isolated sites has the potential to provide increased and richer usage resulting use both in different situations and by people with

different expectations, skills, experiences and intentions. The organisations were a pulp and paper machine manufacturer (later just the Company) and the University premise where the application versions were tested for a seven-month period. In the Company the users formed a closed community (i.e. the system was used in the company intranet) while the University provided a public site for anybody to register a user account and to start to use the application.

In the Company, one of its software and process development groups was appointed as a test group, which consisted of 15 employees and managers developing software for other teams of the Company. After using VIVA for three to four weeks, 12 persons were interviewed for future development directions and necessary new features. After four months of infrequent use, another group of seven persons, which provided maintenance and administration services to the Company customers, was asked to join in the us-

age of VIVA. A second round of interviews was performed four months later, when the total numbers of 18 persons were interviewed to find out how they had used the system. 11 persons participated in both interviews. Totally there were 22 active users in the Company and 25 at the university among which both the study was performed. There were also many other users (9 in the Company and 26 at the University), who had created an account but were excluded from the analyses because of only a few log-ins.

Altogether, the first round of interviews compromised 12 persons (from the Company only) and the second 24 persons (from both organisations). The rounds and interviews were methodologically identical being 40 minutes long semi-structured theme interviews which were recorded on a tape and transcribed later. Interviews and claims made by the interviewees were confirmed, or disproved, by the log-file analysis.
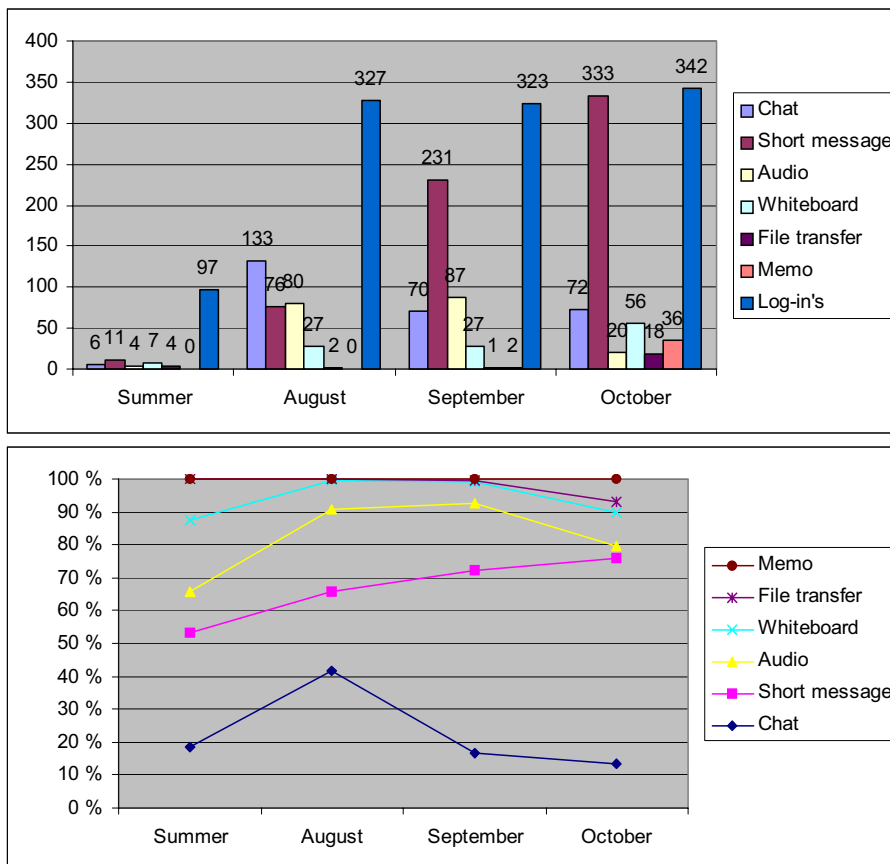
Figure 2. Summary of the use of media during the study; absolute values (above) and proportional division (below).

5. Use of multiple media

Although the time period of the case study was quite long (six to seven months), the users reported that the use was mainly to test the system and its features. However, they used all the media: short messages, text chat, audio, whiteboard, file transfer and memo; sometimes one at a time, sometimes many. Figure 2 illustrates changes in the use of media during the study. Both absolute (number of activations of each media) and proportional values (number of activations of each media in relation to others) of the use of text chat and short messages increased towards the end. The number of log-ins remains approximately the same throughout the study. However, this is slightly misleading, since the number of users at the university increased exponentially in October. Also, those users were very active in communication. If the ratio between text chat and short messages is considered, the use of text chat decreases while the number of short messages increases. This can be explained by several factors. The attitude towards the short messages was informal, while text chatting was considered to be socially unacceptable at work and more formal. Also technical implementation differed so that users had to be on the same channel to be able to chat, while short messages had no such limitation, and short messages could have been sent to offline users. Also, every short message creates an entry to a log-file, while the text chat creates an entry only when the channel is opened. This distorts the division a little by exaggerating the number of short messages at the expense of text chat. The amount of audio usage decreased towards the end dramatically because it was mostly used in the Company, where the number of active users decreased.

Short messages were the most used medium. Every user sent 16.4 short messages in total, which makes it approximately 2 messages in every session they had logged in. They were often used for quick informal comments and inquiries such as "lunch time?", "good morning, are you awake?" and "check this out…". The text chat was considered to be more coercive in participating in discussion and consequently time-consuming and formal. Someone, mainly using short messages, even said that:

"I feel guilty about [text] chatting while I'm supposed to be doing my work."

(HV, univ.)

The same person continued that they often moved from short messaging to text chat when the conversation (consisting of and covering several short messages) turned interesting and/or intensive, because with the text chat, the conversation is much easier to manage and follow. Altogether these two media formed 81% of total media usage.

Text chat and short messages were also used when setting up audio, or other problematic media. Audio was problematic for technical reasons; delay, echo, setting it up, powerless computers for audio, flickering network connections. Similarly to whiteboard, audio was used only in work situations where it was absolutely needed and abandoned elsewhere.

File transfer was very rarely used (25 file transfers in total). This was surprising, since no extra applications need to be utilised to transmit a file. A small amount of use can be explained by several factors. First, other tools exist which are commonly used and with which people are familiar (for instance email, letter, shared document repository, i.e. Lotus Notes, and traditional ftp connections). Second, the people, who might have needed it, were not working with other VIVA users. Third, and maybe most importantly, a document and picture can be observed and discussed immediately by using the whiteboard or the memo, for instance, and then saved locally. These media fulfilled the need of file transfer.

Text chat and short messages were regarded as the most used and robust media for social interactions, while audio, whiteboard and memo were more concerned with work-related activities. This distinction is, on the one hand, self-evident, but on the other hand, strange but still significant. Whiteboard and memo are clearly designed for collaboration, while others are more communication-oriented. Regarding audio as less important for social activities was most probably due to the numerous problems of setting up an audio connection, or on the other hand, that it interrupted one's work more effectively than a tiny short message, so it required active user involvement.

The system operated also on other devices and terminals than PC's. For instance, in one session, there were three participants; one in his office in Finland, another in the airport with a mobile phone connection (9,8kbit/s), and the third one in a customer's paper mill, in Italy. Text chat and whiteboard were used, but audio was not, since it does not operate over the mobile phone connection.

"I was in the airport, alone, waiting for the picture to download [to the whiteboard]… There was a problem that [Italy-end] uploaded such a huge picture. The machine just kept downloading, and nobody could do anything about it. Luckily a text chat was running – that was good, since then I was able to communicate somehow. Then we shut

down the VIVA connection, but it just kept downloading the picture. I was going to check my email too, but I couldn't find the server. VIVA had overwhelmed the connection. It was still pushing the picture. I had to cut down the network connection before it stopped. […]. VIVA somehow invaded and took control, and let nothing interrupt it."

(JH, the Company)

VIVA was most often used as an advanced instant messaging system, which shows not only the users online, but also supports different forms of interactions. Communication occurs most often through text chat or short messages, especially if it has social intentions, but may also require other media. However, there was no clear pattern to be identified. But rhetorically, is there one to be found in group work after all?

Regardless of technical problems and scarce work-related use, VIVA prototype was considered to be a success. Most people already saw it as being beneficial in their work, and proposed further improvements which could make it even better. In fact, the number of proposals increased with the quality (i.e. lesser errors) – just as Prinz et al. [22] proposed. A mid-level manager summarised not only his sole opinion, but also general attitudes toward the system:

"We could work with text chat, since it has been used and tested so much that we know it thoroughly, and know how to apply it to different situations. And with [tele]phone, which does the same thing [as text chat] but only quicker. Audio [in VIVA], however, is good if there are three participants. […]. But after all, I think the added-value with VIVA is the combination of different media."

(MT, the Company)

6. Evaluating the use of VIVA

According to our framework, the issues emphasised as worth pursuing in the tradition of various ISD approaches concern the nature of user perception in ISD process, users' role in organisational information processing and behavioural nuances supported by the process. These features in VIVA and its development are evaluated as follows.

6.1 User perceptions in ISD process

The connection between participatory design and traditional ISD methodologies is usually weak. Consequently it was strengthened in VIVA by the use of

other methods: the users were interviewed several times either individually or in a joint design workshop, members of development team acting as help-desk personnel (and observers) spent considerable amount of time in the Company, and evolutionary prototyping was utilised as a development approach. Findings and requirements from these sessions were brought into the systems design. The design decisions were evaluated and validated several times throughout the development process by introducing new improved software versions or paper prototypes about new features or user interface design. In other words, the user perceptions in the ISD process of VIVA incorporated aspects from prototyping, participative approaches and human-computer interaction.

6.2 Users' role in organisational information processing

In the development of VIVA, users were given a central position regarding organisational information processing. Thus, the view inherent in structured methods of users being just 'objects' whose external work tasks are to be supported, remains poor from the VIVA point of view. Instead, users' tasks were considered important through their professional roles in the organisation, as it appears in evolutionary approaches and Scandinavian systems development. VIVA was utilised in work situations and a part of work processes as the findings from the log-files suggest.

The aims of socio-technical approach were also incorporated by gearing the development work to stress the needs for organisational information processing from both individual and organisational viewpoints. This was actualised by a new improved major VIVA version, which was at first eagerly tested by the users. However, when they found out how it works, or can be used for work, the usage started to drop. This can be seen from the number of media requests. An automated updating mechanism that was implemented to lower the threshold of use, which, as a matter of fact, it did, had other implications. Since the system was always 'on', the status-field, the indicator of availability, illustrated whether a person was online and near the computer so that a visit to one's office was worth making. However, the status-field (i.e. the 'idle'-feature) was not automated until the end of the study period, which led to several pointless visits along the way. Users simply forgot to switch the status to the appropriate position, were inexperienced at using it, or did not see it being of any benefit [9]. Nevertheless,

some had learned to practice using statuses actively and utilise its benefits:

> "When I need any colleague to go with me somewhere quickly, VIVA shows me who is present, so I can easily contact him and ask whether s/he would like to join me. "
>
> (MT, the Company)

Noteworthy is, that users remained to be logged in the system, and used VIVA as a background awareness tool of "who are present in the building and are not travelling", as stated by an interviewee. Actual communication, however, usually took place through traditional channels such as face-to-face, email, or phone, although short messages (11 messages per user on average) were actively incorporated at the expense of text chat. Audio, whiteboard and memo, features which were introduced later, were hardly used. Consequently, despite VIVA was aimed to support users' connectedness to organisational information processing, the users themselves withdrew from an active role in participating to the communication at organisational level by remaining just observers of the presence of other organisational actors. In this way the users themselves did not take full advantage of the potential empowerment that VIVA could have provided by lowering the communication-related power relations. Similarly, the aims of soft systems methodology regarding the empowerment of users within the organisational power system were not completely fulfilled. In this way, however, the aims of end-user computing and human-computer interaction approaches were enacted in terms of individual users' preferences within their own information processing functions.

6.3   Behavioural nuances

A proper system design aims also to connect the users to the system in terms of their behavioural tendencies. In VIVA and its development, the users were given credit as performers of certain work tasks, as is often the aim in prototyping and evolutionary approaches. In addition to this slightly 'behaviourist' view, one aim was to provide the users with possibilities to get support to accomplish their own work tasks from their colleagues. As discussed earlier, this potential was not fully utilised by the users. With respect to the essentials of socio-technical systems design, in VIVA development the users were taken into account as psychological and social actors while designing a multiple media communication construct. For example, support for sociality was inherent in the most used media incorporated in the system. Short mes-

sages were often used for quick comments with strong personal associations. The users also moved from short messaging to text chat when the intention of the conversation changed to more formal and purposeful. In addition to supporting casual sociality by facilitating chatting, users were also provided with equal opportunities to participate in organisational communication, which could serve as a channel to participate, for example, organisational decision making. As shown above, this potential remained unused.

The more psychological characteristics of the users were considered when the audio features of VIVA were implemented: text chat and short messages were employed to set it up, since the users had learned to trust them. Audio was problematic for technical reasons thus it was abandoned from activities with a social intention, and used only in work situations where it was absolutely indispensable. An important cognitive feature of the users, shared cognition, became evident in the development of the whiteboard feature. Despite whiteboard dissipated opinions, its use enabled the creation of shared meanings in the organisation. Yet some people considered it very important and useful, some completely useless – depending on their own work tasks and circumstances. One, who had used neither the medium nor the VIVA system much, described the importance of whiteboard, and the VIVA system as a whole, in his work:

> "You can discuss something with them on the phone and email the pictures. The issue is to combine picture and sound into one single device. It does not make any sense to reinvent the phone, because it already exists. I think the new bit here is to achieve a shared meaning through the picture. There are situations when your buddy does not have a picture when he travels. Or you don't have one. Then you can ask him to send it out to you, or ask what that means, and then you can discuss through the picture that that's the point. There it goes. Text [-based communication] already exists in Lotus Notes. It isn't so new. So the issue always comes back to the picture."
>
> (JR, the Company)

The tradition of end-user computing pictures users as computer experts possessing skills for complicated technological situations. In some cases concerning combining multiple media, for example in the utilisation of audio and whiteboard, the use of VIVA reflected technically complicated situations:

> "First we opened a table in Word. Then we edited it so that it fit the screen. In fact, we were quite lucky to fit it in. We zoomed out and took a screen shot using the print screen button. The picture was

then taken to Photoshop, where menu bars etc. were cropped away so that only the table was left. Then we saved it in gif-format, and uploaded it to the whiteboard. To put it mildly, it was complicated. ”

<div align="center">(AA, University)</div>

However, after this situation the group: three persons at one end on the same computer, and one in the other away from others; pointed and drew upon the table, and discussed over the audio. Text chat was used only when setting up an audio connection. Whiteboard drawings were saved in VIVA sessions as back-up copies. No other medium was involved. When asking whether they considered the working sessions to be of any use (because of the extra work to make the work done was enormous), one of the participants responded:

“I think they [the VIVA sessions] were useful. We really achieved some results in those sessions, agreed on certain things, and finished those tables. Certainly we had to type them up and rewrite them afterwards, but yes, it was [the use of VIVA] that helped us.”

<div align="center">(AA, University)</div>

The situation described above reflects well the users’ ability to learn quickly to use multiple media despite the first perceived complexity of the device. In this way the development of VIVA also supported users’ as cognitive and collaborative actors, which is emphasised by the recent efforts of incorporating frameworks from HCI to ISD.

7.   Summary and conclusions

The aim of this paper was to promote end-user support in CSCW applications by emphasizing the validation of results in design research. Here we have discussed the problem of designing applications combining multiple media for collaborative work, and presented a theoretical framework for empirical validation of a CSCW application. Our theoretical framework is composed of the valued aims of the most prominent human-centred ISD methodologies. Within the framework, a successful aim for IS development was evaluated in terms of user perception in ISD process, users’ role in organizational information processing, and users’ behavioural nuances.

A CSCW application - VIVA – was described and the results of its use were analysed against the framework. By doing this we wanted to enhance an evaluation of some technological solutions, and demonstrate the use of the framework. These lend to a utility the-

ory for human-centred evaluation of the system. The framework appears to be successful in terms of articulating the benefits and the weaknesses of a system. Without such an analysis, although the benefits and weaknesses are visible and possible to articulate, they are not theoretically grounded. Consequently their validity can be questioned.

In our analysis, VIVA and its development responded quite well to the aims incorporated in the theoretical framework. From the point of view of the development process, the connection between the users’ participation and the systems design was strengthened by the use of other methods such as interviews, joint design workshops, and evolutionary prototyping. Subsequent analysis suggests that these improvements yielded in more human-centred design that supported users’ behavioural tendencies. The aim of connecting users own information processing to the organizational information processing was implemented in VIVA, but the users did not take the full advantages of this feature of the system.

Our initial conclusions propose that, first, a context specific theoretical framework is useful in validating the empirical results of a systems use. Second, the framework is practically useful as it helps one to identify different viewpoints that are relevant for human-centered ISD. However, the framework itself not completely validated. In the future, there is a need to elaborate it and validate it with a larger collection of studies. In such a way, the framework itself will become a utility theory, a tool, to validate technical design solutions in terms of the actual needs of the users not only in the context CSCW application, but in ISD in general. And third, multiple media, although they were not used as intended, can be utilized beneficially as a part of users daily work activities.

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