EMBEDDING EXPERT USERS IN THE INTERACTION DESIGN PROCESS

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ABSTRACT

This paper describes an evolutionary approach to interaction design. We describe how embedding an expert user in a project facilitated the software development process. The paper details a user-centred design process involving a group of expert users to develop an application which enables the search, display and filtering of email data beyond the standard functionalities available in conventional email software. It describes a multi-methodological approach in which one of the expert users adopted the role of 'embedded researcher' to undertake user research, persona development, task analysis, competitor analysis, as well as paper and electronic prototyping. The process is part of an iterative cycle of interaction design emerging from the Virtual Communities project at the Australian Co-operative Research Centre for Interaction Design (ACID).

DEFINITION OF TERMS

Interaction design (user-centred, pliable)

Participatory design

The expert user

INTRODUCTION

The project was established as a joint development between Australian Centre for Interaction Design's (ACID) and Company 1, an IT company, which served as an organisational testbed.

The project presented an opportunity to experiment with the interaction design process. How might interaction design be done with a group of highly technical users? Although all directors are very skilled users of computers and designers of technical environments, only one director has knowledge of interaction design issues, having studied interactive media at a postgraduate level. Although Company 1 had agreed to be a testbed environment, the level of participation that could be committed to the project was uncertain at the beginning. Would the organization merely act as the client on the project? Would all directors represent Company 1, and if so, would they all be accessible?

Author 2 is a Chief Investigator on the project, and an experienced IT project manager who teaches interaction design at a university. Author 3 is a Senior Research Associate with expertise in interaction design and software development. At a minimum, Authors 2 and 3 could have designed and built an application that responded to a brief set by Company 1 acting as a client. In this sense, there would have been a collaborative user-centred interaction design process, but it would not have been participatory.

Author 1, the company director with interaction design qualifications volunteered to become the intermediary between the organization and the other two members of the project team, Authors 2 and 3, who work in a university. Her involvement meant that there was user representation in the design process, and easier access to users and information about contexts of use. This enabled the interaction design to be far more user-centric, participatory and collaborative than would otherwise have been possible in a conventional client-designer relationship. This project illustrates the possibilities of having the client in the role of interaction designer working as part of a team with other interaction designers.

BACKGROUND

Company 1 was set up in 2001 when a previous company which had employed all of the directors closed its Sydney office and was going to abandon all the clients that it

had supported locally. Company 1 was established to pick up and fulfil these abandoned contracts. It was envisaged that the company would continue for about 3 years before the clients would move onto other technologies. Over the years, Company 1 continues to be contracted to support many of these clients as well as do further development on their systems. Thus, the company began with a short-term view of itself which negated the need for a long-term knowledge management strategy.

Company 1 is extremely distributed: all of the seven directors work from home, although all are Sydney-based and there is no physical shopfront for the company. Only one of the directors works full-time for the company, the others generally work part-time. The client company work-base is also very distributed: all are airlines and cargo companies and none, except for Qantas, are based in Australia. All correspondence is with the head offices of airlines in their home countries.

The organisation's 'bread and butter' income is the provision of support to their clients in the use of software developed by Company 1. Directors are rostered to provide 'on-call' support to clients for periods of two weeks. According to Company 1, ninety percent of communication between clients and directors of the company is through email with support requests coming through a central email address. It is the responsibility of the director currently 'on-call' to respond in a timely manner. However, with all seven directors working from home, there is no centralised system for logging support requests and the respective responses given. Therefore, efficient knowledge management is restricted by the direct relationship between a client and the director who is 'on call' at any one time, and the minimal interaction which occurs between the directors.

Whilst all directors on support have extensive technical experience of many computing environments, some directors have more specialised knowledge of particular protocols. They are often able to draw upon this expertise to quickly fix a technical issue. Such quick fixes, because they seem natural and obvious to the expert, are considered unworthy of documenting. This has led to a problem of no

electronic, central repository or reference point for problems or solutions that may have previously occurred that an ‘on-call’ director can access. The support process is dependent on the company knowledge base of the directors remaining constant.

While Company 1 operated within a highly technical environment, its disparate structure was not amenable to managing and archiving of knowledge (contained in email support correspondence) within the company in a way that allowed it to be easily accessed or transferred. Therefore, one of the key areas identified for improvement is knowledge sharing and management within Company 1.

Addressing these issues required creative problem-solving through an intervention in the organisation’s techno-structure (Tan 1998). But before any kind of technical solution could be proposed, an understanding of the organisational processes, the individuals working in the organisation and the factors which constrained improved knowledge management was required. In other words, it was necessary to be clear about how human-to-human interaction worked within Company 1, before any software application facilitating human-computer interaction could be designed.

THE MACRO INTERACTION DESIGN PROCESS

From the beginning of Author 1’s agreement to be the client and user representative on the project, weekly meetings were organised and attended by Authors 1, 2 and 3. These weekly meetings were similar to models of collaboration in architecture in which teams of architects work on the same building project (Geddes 2006: 57). Likewise, this project brought a team of interaction designers together. On the other hand, another collaborative model in architecture is to involve other design professionals from different disciplines (such as landscape design and urban planning) on a building project. It could be argued that the project followed this model as well in that each team member had other roles and identities aside from interaction designer. Author 1 was also a client and instrumental in designing a landscape of adoption and use of the proposed application. Author 2 was also a project manager

and thus concerned with designing methodologies of practice. Author 3 was also a programmer and therefore, directed the technical design of the proposed application.

‘Most interaction design is done by multidisciplinary teams…One of the benefits of bringing together people with different backgrounds and training is the potential of many more ideas being generated, new methods developed, and more creative and original designs being produced.’ (Sharp et al 2007: 11)

In any case, the weekly meetings were essentially for the purpose of discussing design (be it interaction, visual, or technical) rather than client liaison or education. Furthermore, the meetings took place at the university, facilitating a culture of experimentation that was only possible when conducted outside the organisation. Indeed, Tan (1998: 29) maintains that creative outcomes can be more objectively facilitated by external stimuli: often this is a consultant brought into an organisation to motivate staff members to participate in the design process. In this case, the university provided an entirely separate environment for design and discussion to occur between the project team.

Although interaction design is defined as the design of ‘interactive products to support the way people communicate and interact in their everyday and working lives’ (Sharp et al 2007: 8), the design process begins long before the application or interface is even considered. This is what we call the macro interaction design process because it involves understanding the environment in which a proposed application would be used and the people who would be using it. It is not focused on the application itself. For this project, it meant understanding how Company 1 operated through methods such as contextual enquiry; undertaking user research; and examining available products which may fulfil the needs of Company 1 or provide some inspiration for a tailored solution.

Contextual enquiry

The distributed nature of the organisation meant that ethnography or any kind of contextual enquiry as recommended by Gaffney (1999b) and Kuniavsky (2003) proved to be challenging. The distributed nature of the organisation made studying

users *in-situ*, in their working environments problematic. It also meant that a participatory design process which involved all users – that is, all directors of Company 1 – was difficult.

However, as a representative of the other directors, Author 1 was able to able to answer questions posed by Authors 2 and 3 about how the company operated. These unstructured interviews took place at the weekly design meetings and provided a detailed insight into the organisational culture and practices described in the 'Background' section of this article. Authors 2 and 3 learnt that efficient knowledge management in the company is restricted by the direct relationship between a client and the director who is 'on call' at any one time, and the limited interaction which occurs between the directors on a day-to-day basis. Following this, the design team concluded that any proposed application had to leverage the most common mode of communication both within and outside of the company: email. Thus, the key questions the project sought to address included:

- How can email be leveraged for knowledge management?
- What value can be added to a standard email search function?

The design of an application that facilitated better knowledge management within Company 1 had to:

- Compile a history of client email support correspondence from distributed sources
- Allow this historical archive to be accessed in a distributed way.

User research

Again, because she was one of the directors of the organisation, Author 1 had greater access to other directors than the other authors and was in the best position to undertake user research. In this sense, she was an 'embedded researcher': a user researching other users. This is somewhat different to her role as 'client

representative' when informally interviewed by Authors 2 and 3, as it required active discovery beyond what she already knew about the organization.

Author 1 conducted semi-structured interviews with directors about how they approached solving problems for clients. The interview data enabled the design team to identify user needs accurately, resulting in the development of two main personas and user scenarios as recommended by Brown (2006) and Kuniavsky (2003):

- Persona 1: tends to rely on recollection of past experiences to solve problems 'on-the-fly'.
- Persona 2: tends to defer to notes, documentation and past emails to tackle a problem.
- Scenario 1: Client experiences an urgent problem and contacts Company 1 by mobile.
- Scenario 2: Client experiences a non-urgent problem and contacts Company 1 by email.

Subsequently, a step-by-step task breakdown incorporating both personas and scenarios was developed:

1. Support request received by email or phone.
2. Email is sent to client to inform them the problem is being addressed.
3. Send email to request more information if required.
4. Perform a system check to see if there are problems in the code.
    4a. Recall past experience of similar problems.
    4b. Refer to notes taken from previous cases.
5. If problem cannot be solved:
    5a. refer to past emails.
    5b. ask other directors.

These insights into users and contexts of use defined the 'problem space' for

Competitor analysis

Experimentation began by examining other applications which visualised textual data, such as Visual Thesaurus and Enronic, the second of which specifically works with email data (see Murphy 1998; ThinkMap 2007; Heer 2004; Trampoline 2006). This kind of competitive analysis provided departure points from which experimentation could begin with:

- more sophisticated means of filtering emails than current applications allow
- greater microscopic representation of email data
- better temporal depiction of email data.

THE MICRO INTERACTION DESIGN PROCESS

Emotional design

Furthermore, the application had to be designed to entice interaction from the directors. Because directors were used to operating without any knowledge management tools, the application was designed to inspire a change in the interaction culture of the organisation so that directors would be motivated to contribute to a centralised email archive.

Interface designs: initial paper prototypes

At this point, it was possible to begin visualising the application through a series of paper prototypes, which fulfilled three main purposes as articulated by Houde and Hill (1997): firstly, to demonstrate its functionality or role in the lives of users; secondly, to indicate the look and feel of the artifact; and thirdly, to articulate how the design will be implemented.

During weekly meetings, sketches were made in notebooks, on whiteboards, and uploaded to the project blog for comment. Author 1 would attempt to visualise these ideas on paper.

Initial sketches were concerned with a macroscopic view of the data which showed relationships between people by email activity over time. In this sense, paper prototyping was beneficial in workshopping ideas for interface design.

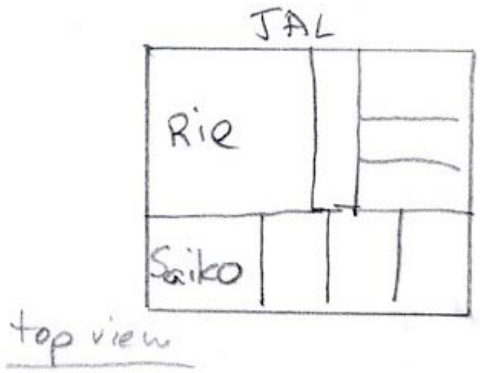


Figure 1 - 2D view of all emails received organized proportionally according to sender

Beginning two-dimensionally, all emails received from one client organisation were depicted proportionally in terms of individual senders, giving a visual snapshot of key staff members who have sent or received the most email correspondence in relation to support requests. This style of display is known as a treemap (Shneiderman 1991) (see Figure 2).

In considering how each organisation and their employees sent and received support-related emails *over time*, it was necessary to think three-dimensionally (see Figure 3). Therefore, the organisation was visualised as a column constituted by smaller columns represented by staff members, with the height of each column depicting time. Although individual email messages would not be seen in this view, the conceptual design suggests that emails would be ordered within each column from the most recent (at the top of the column) to the oldest (at the bottom of the column).

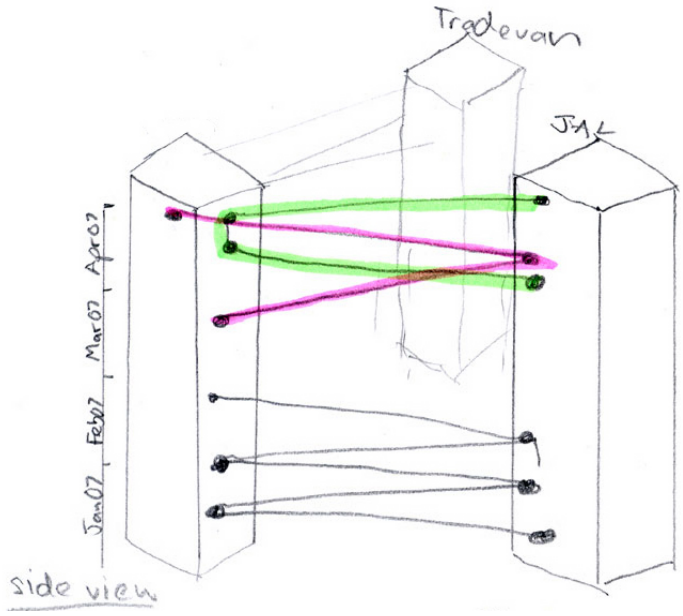


Figure 2 - 3D view of emails sent and received over time between organizations

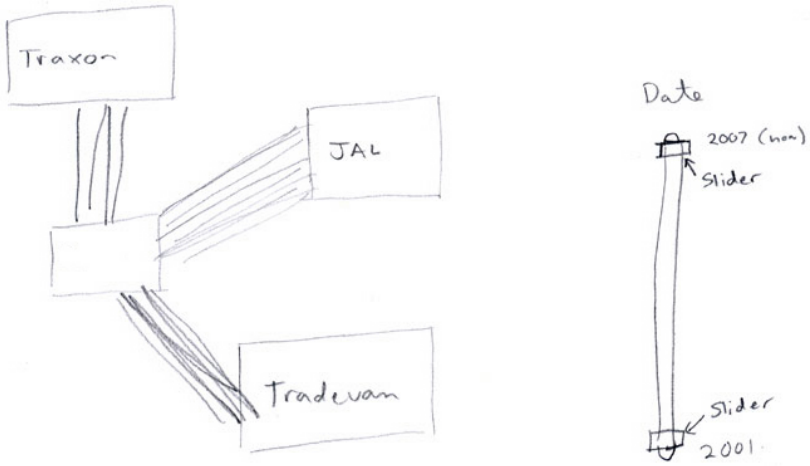


Figure 3 - 2D 'top down' view of email relationships between organisations

Furthermore, within this 3D view, the relationships between organisations could be shown by a plotting of chains of emails sent and received. Users would be able to move between the 2D and 3D view, as well as specify the date parameters with a range slider as recommended by Heer (2004). User interaction with the range slider would visually change the relationships between columns: in 2D view, this would translate as a change in the thickness of the lines joining each column (see Figure 4).

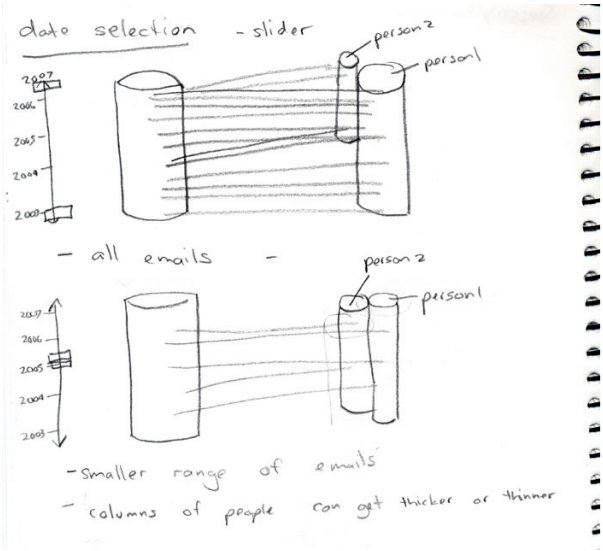


Figure 4 - Variation in number of email 'lines' shown according to date range

In 3D view, the number of lines connecting people/columns would vary according to the date range selected (see Figure 5).

Columns would lengthen if a short date range had been selected, allowing a better close up of emails.

In terms of the relationships between people/columns, it would be necessary to show the directional movement of emails. The use of arrows was preferred over and above the use of colour to indicate emails sent and received (see Figure 6). Indeed, the size of the arrows could be proportionate to the number of emails being sent in any given direction. For example, an equal number of emails sent and received between two correspondents would have similarly sized arrows. However, where a person is doing most of the sending to another person who is doing most of the receiving, a larger arrow would depict the stronger flow of emails in one direction.

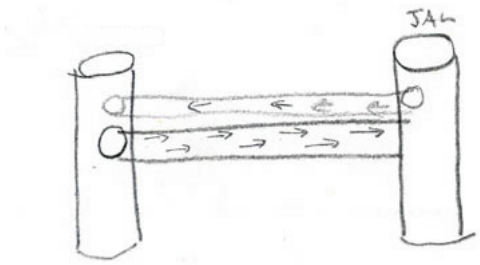


Figure 5 - Indicative representation of directional movement of emails

Pliability through 3D interaction

Early electronic prototypes were merely visualisations with limited interactivity.

The application was initially developed specifically for Suvon. The Suvon mail archive contains messages from only a limited set of Internet domains – one per customer. This means that even when displaying a large number of messages from the Suvon archive, there are only relatively few domain-columns (the grey ones) around the edge of the model. However, if other e-mail archives are analysed with VUE there may be many more domains. For this reason we have added a 'diameter' slider which allows the user to stretch out the model to make room for a larger number of domains.

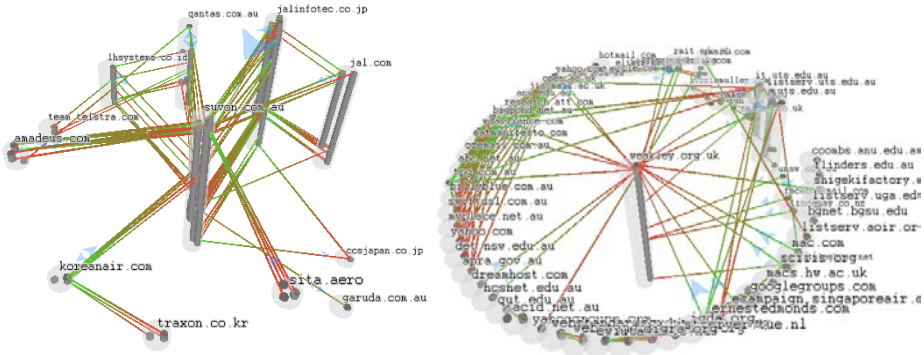


Fig4: A Suvon archive with relatively few domains on the left, other archives may contain messages from many more domains. In such cases the 'diameter' slider is useful.

Accessibility

As one of the company directors is colour-blind, an accessible interaction design was a prime consideration. Research into possible design solutions highlighted colour and contrast to have the biggest impact on whether the application would be usable for a person with colour blindness. People who are colour blind do not rely on colour for information and will often misinterpret images when colour is the main component of the message (Cole and Lian, 2006).

From Hoffman (1999) we adopted the suggestion that a more appropriate mechanism in developing interfaces for people with colour blindness is by using greyscale images. In this way, the brightness of colours will determine if difference can be

perceived. Hoffman furthermore suggested that the contrast needed to be changed if red and green need to be used next to each other. To address this in the application, a light green was used to indicate where the emails were sent from to the dark red to represent the arrival (Figure 12).

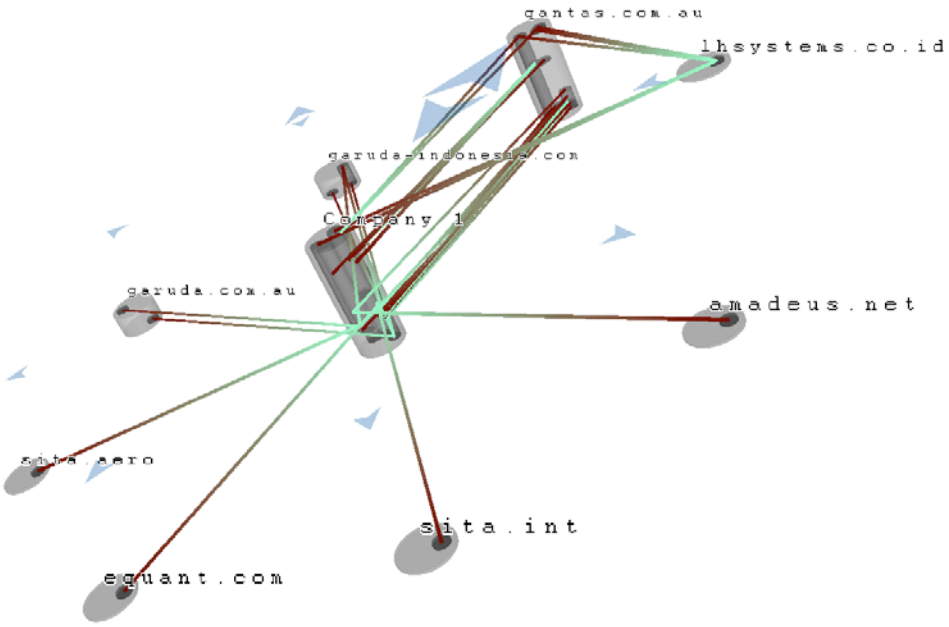


Figure 6 - Fourth Implementation version A. Main company into the centre, different heights for columns with red-green colour contrast

In our weekly design meetings, the suggestion of using patterns and movement as a way of showing patterns in email movement (see Figure 13) was implemented by Authors 1 and 3.

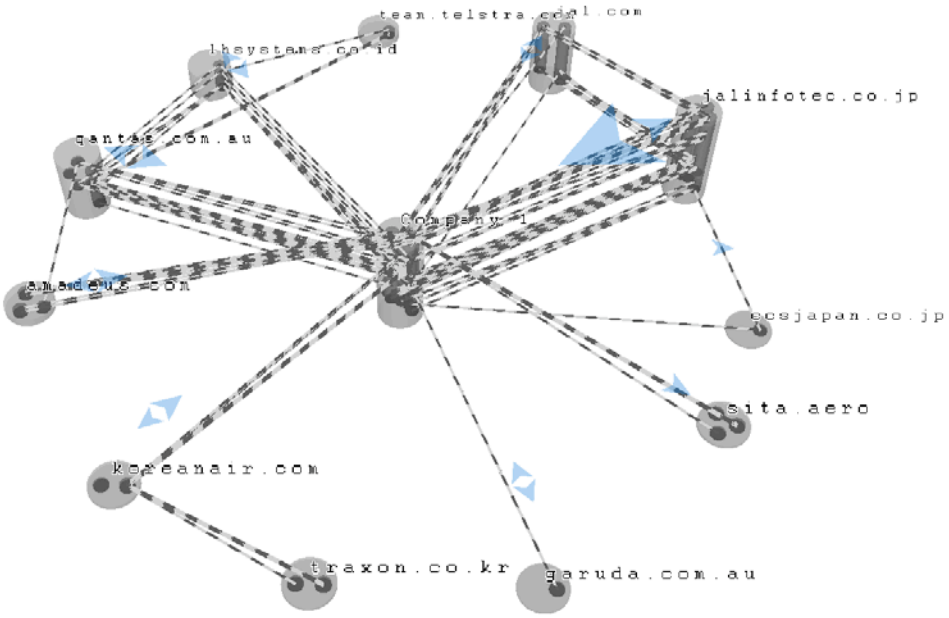
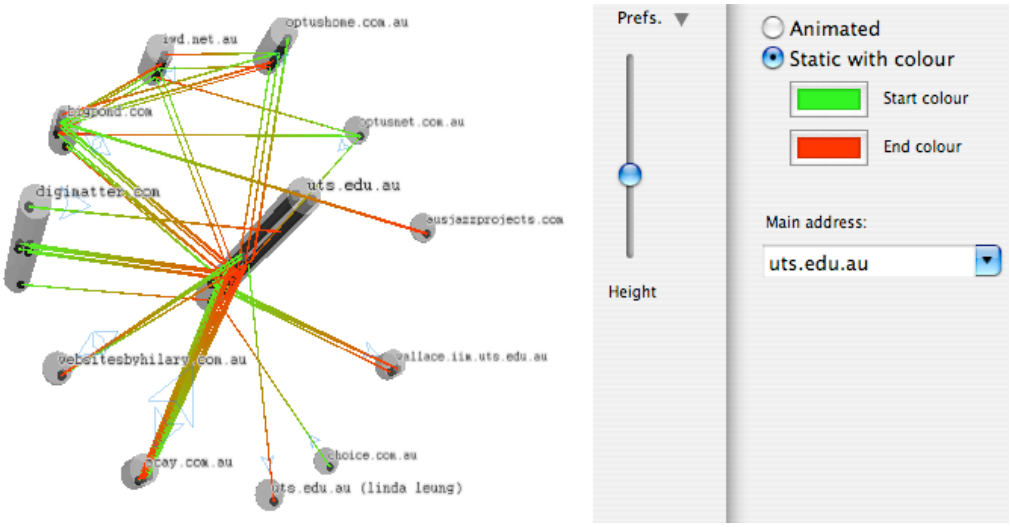


Figure 7 - Replacement of static colours for animation to indicate email direction

Given that there were now two possible options for viewing the flow of email correspondence, customisation of the application was explored. This was implemented as a preferences panel that could be hidden behind the main window (see Figure 7).



Preferences panel which can be hidden

The preferences panel allows the user to choose how they would like the directional flow of email to be displayed. The user has a choice of colour or animation. If the user opts for the former, they can also nominate the colours used to depict emails sent and received.

In addition, the user can choose from a dropdown menu which domain name out of all available in the emailbox they would like to be at the centre of the visualization.

Furthermore, the user can adjust the height of the columns. As the height of the columns represent the time over which email correspondence occurred, the slide tool enables the user to focus in on a short period of time. In being able to ‘zoom in’, that is, to magnify the visualization, the user can then select particular emails or email threads (see Figure 8).

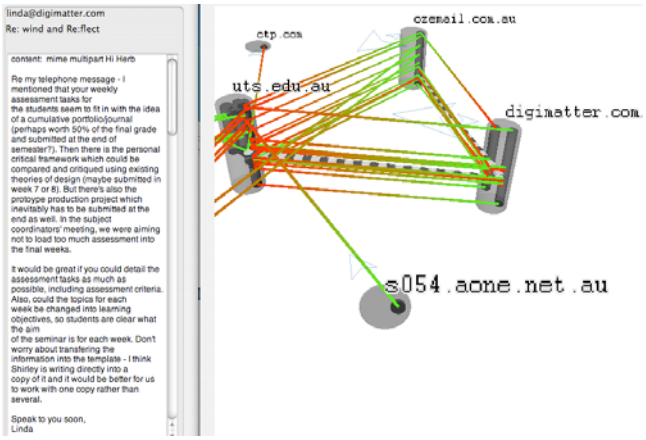


Figure 8. Selected email line displays contents of message in an adjacent window

Once an email line is selected in the main window, it is differentiated by becoming animated (if colour is selected as the preferred way of displaying email directional flow). Conversely, if the email lines are animated, then selecting one will make it coloured. When the selection is made, the contents of the email are displayed in an adjacent window. In Figure 8, an email is selected which originates from the domain digimatter.com and has been sent to two recipients at the domains uts.edu.au and ozemail.com.au. The contents of that email are displayed on the left.

FINDINGS & DISCUSSION

She also undertook to represent the user group and obtain feedback from directors throughout the design process. However, her expertise in interaction design arguably makes Author 1 unrepresentative of the user group, but it also meant that she was able to straddle the user and designer roles, translating design decisions for other users

where this ‘educative’ function would conventionally fall to an external design consultant. Finally, as a representative of the user group, she was better positioned to prepare a culture of adoption than someone external to the organisation.

Usability and accessibility

Mac

The project is unusual in that the user group has a high level of technical expertise in software development. Although all directors are very skilled users of computers and designers of technical environments, only one director has knowledge of interaction design issues, having studied interactive media at a postgraduate level. For this director, also one of the authors of this article, Author 1, there are three levels of participation in the design of a solution to the organisational problem. Firstly, she is involved in the design of research methodologies underpinning the interaction design (including user research and contextual enquiry). Next, she collaborates on the design of creative interaction with and interface for email archives. Finally, she contributes to the design of its technical implementation. This degree of involvement in in all aspects is somewhat of an anomaly in design as typically participatory design processes cater for non-expert users, ‘educating’ them in the discipline of design, alongside developers and business representatives. Thus, a participatory design workshop may involve a group as large as eight or nine people due to the need to cater for business analysts and it specialists from both the design and client companies (Gaffney 1999a). In the case of this project, these diverse representation and multiple roles were occupied by a single individual Author 1.

These levels of participation also require different types of creative responses. At an organisational level, it necessitates creative negotiation of constraints, while the interaction design process requires creative experimentation.

Whilst developing this prototype VUE was shown to the client company directors and their response has been very positive. In particular they felt that the quality of the

image is one aspect of the application that makes it much more attractive as a tool. From the first demonstration the directors quickly understood the depiction of communications between different companies within the client company email environment. As many of the directors also perform work outside the client company environment they could easily see how this tool could also be used with other companies or environments.

REFERENCES

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