Shared Design Space

The contribution of augmented wiki hypertext to design collaboration

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Abstract: Collaborative design activity that involves remote multilateral, multidisciplinary communication has become more commonplace with the electronic means to communicate across any distance in real time. The communication itself can be both an important repository of project information and an important part of the process of conceptualisation and design development. This research has explored the apparent shortcomings inherent in commonly used means of communication and how these impact on the design process. This paper describes research that has taken as a starting point the analysis and observation of actual design communication from the archive of an internationally published collaborative project involving disciplinarily diverse and globally scattered participants. Through the analysis, we have identified characteristics of communication tools or information environments that would address the particular issues found to impede collaboration while fostering those aspects that support it. The findings have been used to inform the design, specification and implementation of collaborative information spaces based on wiki software.

1   INTRODUCTION

Multilateral communication between designers collaborating remotely poses particular challenges to the design process especially when they are contributing from different discipline backgrounds. Many of the challenges can be seen as more widely applicable to collaboration and communication than just to architecture or design. However the latitude that is afforded to conceptual shifts in the process of design and the many different sets of parameters that are brought to bear in moving towards a shared "solution" or more detailed, better understood model, make this a most demanding subset of collaborative enterprise.

 "Design stands midway between content and expression. It is the conceptual side of expression and expression side of conception" (Kress and Van Leeuven 2001).

For this reason, collaboration-in-design places unusually onerous demands on modes and media of communication. For genuinely 'collaborative', as opposed to 'cooperative' , multidisciplinary- design activity the schema must be kept fluid in order for the holistic model or conception to assimilate the different design inputs developing on the basis of different expertise and creative insights. (Kvan, 2000) It appears that this fluidity with regard to maintaining an extensive design space and deferral of formal, technical, or architectonic commitment is also manifest in the development and use of terms in design communication.

We analysed the email archive of an internationally published design project with diverse participants and highly speculative ends. Employing a constructionist *participant observation* approach, we observed the development of a sometimes volatile project language (Crotty 1998). It included many evocative metaphorical terms, which once created, had a meaningful role in fostering the collective imagination. They sometimes endured or reappeared through the life of the project, sometimes faded out of communication very quickly and sometimes altered their meaning in the course of use. We also identified significant events in the history of the project through the archive and developed '*thick descriptions*' of the lead up to these (Geertz 1998). The thick description is a history of events complied by a researcher immersed in the process, in this case reconstructed after the events from the record in the emails but by an individual who had had intimate knowledge of the project. These are not objective studies but rather a record drawing inference and constructing meaning from the communications.

Through this process we could generalise two areas of communication that impacted on design collaboration. They are distinct but closely interrelated. The first is structural and the second ontological. This approximates to form and content. (Fairclough 1995). The graph of communication routing and the way in which the communication archive functions as a repository for shared project knowledge and information are both in the structural category. The barriers put up by discipline specific- or skewed- terms and notation and the development of a 'project language' that evolves with the collective conception are examples of ontological issues, that is issues about the things that exist in the communications and the relations between them. There are other phenomena that fit loosely into the ontological category such as misunderstandings caused through over familiar colloquial "empathetic conformity" which is ambiguous out of social context and modal problems, for instance the same information understood differently when presented in different modes, whether these are textual, graphical, mathematical, filmic, sonic etc.

This understanding has formed the basis for developing performance specifications for tools to support communication in collaborative design. These tools are in development based on wiki software.

2   WIKI

The name Wiki has two principal definitions. "A Wiki or wiki is a website (or other hypertext document collection) that allows a user to add content, as on an Internet

forum, but also allows that content to be edited by any other user.

The term Wiki can also refer to the collaborative software used to create such a website" (http://en.wikipedia.org/wiki/Wiki).

Further to the second definition, "Wiki is a piece of software that allows users to freely create and edit Web page content using any Web browser. Wiki supports hyperlinks and has simple text syntax for creating new pages and crosslinks between internal pages on the fly" (http://wiki.org/wiki.cgi?WhatIsWiki 2002).

2.1   Comparison with Web based threaded discussion lists

The open access and edit-ability of wiki documents distinguishes this hypertext from weblog environments and email list management which, while they archive material for future access do not typically allow open access for deletion, editing or reorganisation of earlier postings. In this sense wiki does not create an indelible history but a completely dynamic space with potentially negotiated or tacitly developed rules. Mailing lists and list servers tend to be more rigidly ordered and rule bound in this respect. An example is the understanding that postings should stay on topic and that a new topic requires the creation of a new list. Wiki is a genuinely shared environment in which any reader can generally not only post comments but edit, format and restructure existing documents and groups of linked documents. While there is tacit protocol and etiquette as in any shared formal space, the space itself can be used in numerous ways.

2.2   Examples of possible ways to structure wiki

The principal distinction between these have been dubbed "ThreadMode" which is effectively conversational and generally similar to a collaborative weblog, and "DocumentMode" where a shared page is honed towards a more definitive, well ordered and well formatted state.   Threadmode can be difficult to edit and refactor subsequently without losing the threads however it is easy to insert links to other pages that have more document-like quality. To create a new link to a page, whether or not that page has yet been created, it is necessary only to observe the convention of typing a wiki name in the editor of the current page. This is a word or concatenation containing two uppercase letters. A prosaic example of a wiki name is "DetailDesign". Typing this name in the hypertext creates a link and the opportunity when the link is followed of creating a page of that name. A page of *this* very generic name might be expected to act as a trailhead to many other pages.

A wiki hypertext presents as a very versatile collaborative environment. The open and collective authorship of hypertext, was pioneered by Ward Cunningham in the Portland Pattern Repository originally as a means to discuss software engineering strategies (Cunningham, 2003). In initial pilot studies with wikis that have been run for this research, they have been enthusiastically adopted by a range of design-based groups and individuals.

3 ANALYSIS OF EMAIL

The principal method used to explore the archive was participant observation to construct a thick description of the events (Geertz 1998; Ryle 1971). This provided rapid identification of particular difficulties in the design process and the characteristics of the communication leading up to these. The thick descriptions were supported by three other activities. The first was the collection and tabulation of lexical data – the occurrence of terms mapped against time and participants using them. The second was to collate simple quantitative data about the archive from the fields in the email client and the third was to visualise the email route mapping. Email communication provides no single definitive exhaustive archive, there are as many overlapping archives as there are participants. We did not have access to all the communication and it was clear that there were whole areas completely absent. For instance communication between collaborating designers, architects, programmers, mathematicians, mechatronics and pneumatics experts was available; correspondence with the client commissioning body was not. Another fundamental of email communication is that identical content can appear and reappear in many emails. While we eliminated all true duplicates in the amalgamated sample archive that we had, there was no means of eliminating duplicate content that appears in numerous missives through replies containing earlier communication, forwards, ccs etc. The study was also limited to the body text and metadata for the emails without the attachments. An advantage of selecting a highly subjective approach was the opportunity for the observer to read between the lines and detect nuance and inference in the communication.

The main issues encountered through observation of the email archive and some of the implications drawn from these for the design of tools to support design collaboration are summarised below.

3.1 Semantic Convergence

People work around disciplinary language barriers by both the use of analogy and by finding shared terms. To some extent the human inclination to invent and use surprising terms to draw attention, help explain aspects of the project and engender a vibrant shared communication space works well for good current communication but challenges the construction and employment of ontologies over terms in the communication for machine reading and explanation to participants. Nevertheless, in a complex process involving many participants, the benefits of being able to reuse information and build on shared understandings that come from using ontologies is very clear (Noy and McGuiness 2001).

3.2 Project language

The creation and combination of project-specific terms appears to be a very important component of the collaboration. This illustrates the reciprocity between

content and expression in design. New terms appear throughout the length of the archive. They cover many stages of the design, prototyping and testing. Some of them endure; some change their meaning or even disappear quite swiftly. In this last case their function has been fulfilled by moving the process forward at a particular point in time. As the communication is part of the creative process, it is important that tools to support communication and collaboration should be low overhead in both use and administration. For instance the collection of ontological information should not interrupt the natural flow of thought or communication or significantly alter workflow. Ontologies should be able to grow and evolve. While there will be static components, language development is part of design development and any useful project ontology should be able to grow and change with possible provision for retiring redundant terms.

3.3   Empathetic conformity and modal issues

Over-familiar colloquial style in language sometimes creates difficulties in communication in a diverse group the members of which have not all met face to face (Maynard 2002). This is related to the targeting of communication and the routing map established in email. Messages paraphrased by a recipient to a third party in later communication or forwarded mail are prone to creating misunderstanding. An open-access, shared environment with greater opportunities to comment and edit the content could improve this situation.

Information in one mode is poorly understood in another. For example, the implication of a condition communicated through numerical values in the email text is not fully comprehended by some parties. The phenomenon must be experienced visually or aurally. A web interface provides the potential for more multimodal communication.

3.4   Targeting information: structural and ontological links

The routing of communication manifests as the most fundamental cause of miscommunication, lost information and shortfalls in the collaborative opportunity. Misrouting and inconsistent routing of email or tacit tree hierarchies in the map of communication had a role in most of the communication "crisis points" in the design process. Visualisation of the email routing over time with regard to senders and principal recipients revealed some participants at hubs and others in satellite relation to these hubs. Collaborative enterprise benefits from a collaborative workspace or communication environment. While there is a case for limited or differential access to information and communication within large groups, this can better be managed in a way that is systematic and aligned to the design process.

Structural and ontological issues are not entirely separate. For instance, the email routing map is to some extent a symptom of social grouping occurring in combination with filtered use of language. It may be appropriate to combine

ontological and structural tools. Wiki does this in a simple way by creating links based on page names so the structure of the pages and links is to some extent determined by page content. A system of access rules extending the relationship between content and those sharing access to that content would extend this relationship between structure and content and make the targeting and clustering of documents and participants more explicit.

4 EARLY CASE STUDIES WITH WIKI

In early experiments, wikis have been created for academic design groups in both research, undergraduate and postgraduate learning. They have also been employed in academic collaborative projects with design practitioners. The medium has been adopted enthusiastically by the student and teaching community, using it to communicate for group assignments including those requiring distant collaboration between institutions, for conversations and sharing research material, dissemination of material by teaching staff and demonstration and presentation of student design work. This has generally occurred in an open wiki environment. Researchers and research groups have used wiki to communicate, present project work to client and other groups, post meeting minutes, formulate research proposals, collaborate on publications, and collate research objectives, timelines, references and biographical information, as well as collaborate directly on design and modelling tasks. This latter activity has given rise to a number of project or group specific wikis that are often password protected. Together these applications have provided a breadth of feedback on the use of wiki in the design domain.

5 FINDINGS

While wiki has been found to make a very positive contribution to communication in design based collaborations, there are a range of current operational limitations that have been identified through these testing environments. In the academic/practice wiki based collaborations there has so far been a clear trend for the academic participants not only to be the initiators but also principal writers, editors and restructurers in the wiki, a role known colloquially as "wiki gardeners". Clearly this is partly attributable to the pace of profession life for senior architecture, engineering and design practitioners. Phone calls and face to face meetings are continually given preference over any form of written communication where this has no contractual significance. But no time can be given to a less than user-friendly interface. Formatting can be time consuming, and difficult for a general design population unfamiliar with the rules of structured text using the standard editor. There are also currently frustrating inconsistencies in the way that wiki appears in different browsers and locations.

There is a word search in wiki that will find all instances of a term on any page in the wiki which is very useful for tracking subject material. However, this does not

necessarily find similies or wiki names that are unique but carry the same or very similar meanings.

Comments can be added to a page and files can be attached, a useful means of exchange. However these always appear at the foot of the page and have to be edited manually to thread them with the the relevant content on the page. This can be very cumbersome to manage for a long page full of diverse content and it is not uncommon to find a list of orphaned comments and attachments at the foot of the page.

In the structural arena, a wiki hypertext is typically accessible and editable by all. This removes impediments to collaboration, such as the discretisation and the unmapped and unpredictable routing of communication in electronic mail. However it can also deter participants from exposing creative ideas at an early stage of development and inhibit communication in other ways. For instance it is clear in the email archive that use of terms and notation is tailored by authors to recipients' presumed knowledge so open access could potentially either reduce or bar the use of any discipline specific or exclusive means of expression or allow its unfettered use given the possible anonymity of much of the readership. One solution that has been trialled is to create additional wikis with restricted (password) access, one wiki for each small subgroup or project but this is a costly solution: it requires participants to distinguish between and navigate between all the wikis they personally have access to; it requires administrators to construct wikis and their access rules; and it does not account for the movement of content from private to public, or in this case from wiki to wiki. Thus it reintroduces the hazard of important project knowledge and information being out of sight to those who might benefit from access.

This research has led to a proposal that the hypertext could be augmented in ways that address these current limitations (Burrow, 2004).

6   PROPOSALS TO AUGMENT WIKI

- The wiki would be enhanced by a template for the interface that is both portable between browsers and machines and editable. Ideally, this would have a hierarchy of information, at one level determining characteristics for the whole wiki, while allowing cluster and unique page design adaptation to take place readily and explicitly. In this way particular projects or groups could easily create their own visual and graphical environments within the wiki, adapted to particular patterns of use and expressive of the users and content.

- An editor that closely resembles word processor controls would overcome the difficulties that general users experience in achieving their desired level of control over formatting and presentation of material using structured text protocol in a simple text editor.

- A system that automatically creates and maintains access rules in response

to browsing and editing of the wiki hypertext would improve the targeting of documents in the hypertext, and identify significant collections of documents and participants. This is important both for protecting early proposals from open scrutiny and comment before they are ready for more public airing and for creating communities and groups of documents within the wiki.

- A more sophisticated semantic search tool could identify related content across the wiki even where non identical names and identifiers have been used. This would make it easy to avoid duplication or near- duplication of content in different parts of the wiki and build a more robust structure of clusters where closely related material is close in terms of links. This is important in the design context so that each design decision is supported by access to all the relevant information and design history already recorded in the wiki.

- A threaded comment system would make the contribution of comments much more relevant to discussion and document development than having them appended. Similarly, attachments in a side panel or threaded with the text in the editor will make the documents more coherent.

- It is proposed that a system of classification could be created for the documents and ontology over document classifications. A single document (wikipage) could collect multiple classifiers, for instance it could be a 1) design development document that 2) deals with particular aspect of the design 3) it has been authored by a participant from a particular discipline and 4) it is of a type that will no longer be current if it has not been edited for a year. The individual documents within the wiki can change their significance and role over the life of the wiki. Some will continue to be added to and edited over a long period and may progress from "brainstorming" status to becoming a formal statement or specification that can be referred to continually. Some will loose their relevance as the discussion or shared activity moves on. Some may be returned to as a source for design development history or presentation. The classification ontology could be used to search the wiki by different criteria, track changes to classification of documents and to keep the wiki current and relevant by automatically backgrounding or archiving obsolete pages. The classifier ontology might have both general (design industry) components and project specific components. The classification system ontology should be dynamic and easily edited.

- Finally visualisation tools could also give immediate understanding of the evolution of the wiki itself. Visualisations of the timelines of access rule change and ontology change could give a window onto the current state of the whole design project and a map of its development to date.(Chi et al 1998)

7   CONCLUSIONS

Working together remotely on a collaborative design project within a wiki is a much more effective way to communicate, develop ideas, create, collect and access shared documents than using electronic mail, mailing lists, web logs, instant messaging or chat. Simple wiki addresses several of the principal issues found through observing the email archive, in particular, misrouting or poor targeting of information and multimodal presentation of information (Section 3). Some of the important differences of wiki compared to email are that a conversation can take place on a single page or series of pages where the sequencing of information is clear and to which all participants have access. In relation to mailing lists or blogs, the information on the pages can be reordered, copied, links added or otherwise edited or formatted by any participant subsequently to keep it readable, current and appropriately connected. In this respect it is much more than a log of communication history. Communication that has been superseded rather than standing alone and possibly being opened after the fact within an email inbox, is seen in the context of what follows, it can be replaced, re-ordered or given a link to more current thinking. Wikis have the advantage over web logs that all the users have access and editing rights. Information that has already been posted can be revisited by the author or collaborators. There is a single record of all the communication that is accessible and can be searched by all. In the prototypical wikis established for this project it is observed that the creation of wiki names for pages is much more considered and content-related than many of the subject lines observed in the email archive. Within wiki there is also the opportunity to change page names and links as part of the ongoing editing of the wiki. In this way the wiki is potentially very fluid and analogous to the design process itself. It is also easy to foreground content, for instance by creating additional links to it as its significance increases or becomes better understood.

There are current limitations for using wiki for collaborative design activity. It is necessary to be able to employ Structured Text rules efficiently to write and format content in the editor. Comments and attachments are uploaded and appended at the foot of the page. These restrictions can be cumbersome and frustrating for users routinely using word processing environments. The wiki can be too open. While it addresses the vagaries and potential divisiveness of email routing, it may feel too exposed for the development of early ideas, or for sharing all the information pertinent to the design. As the wiki grows, it is quite possible for similar subject matter to be covered by different 'wikizens' working in parallel on pages that are distant as measured by links. The identification of these issues has led to current ongoing research and development of augmented wiki for testing and application in design communication.

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