User preferences for virtual information retrieval : a qualitative study

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Abstract: This paper presents results of a piece of research conducted in order to determine user preferences as to the nature of virtual worlds to be used as an environment for information retrieval. A study was carried out amongst postgraduate students and staff at Robert Gordon University, using a Grounded Theory methodology. Over one hundred interviews were carried out, in three cycles of interviewing, analysis, and integration with literature. The findings revealed that user preferences were determined less by structural features than by affective factors, such as familiarity, organisation, assistance, and quality of information and presentation.

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1. Introduction

The study arose from an interest in the novels Neuromancer, by William Gibson (1984) and Snow Crash, by Neal Stephenson (1992), both of which centre on virtual worlds. A review of literature on the topic, such as that by Card, Mackinlay and Robertson (1991) appeared to show little evidence of user input to the design of existing virtual worlds, and the question arose, if virtual worlds were to be designed for use as devices to facilitate information retrieval, what should they look like? There is an argument that designers, particularly those in highly technical fields, tend to create things which they perceive to be "cool", rather than focussing on what users actually want, and, given the fact that current increases in bandwidth and computing power make multi-user virtual worlds a real phenomenon, it appeared timely to seek out some user input before a "fait accompli" situation arose, where users were again constrained to adapt to an environment designed by people with priorities other than usability.

2. Aim and Objectives

The aim of the research was to discover user preferences for the design of a "virtual world" for accessing information, and the factors influencing those preferences.

The objectives of the research were:

- To conduct user interviews, using a "grounded theory" approach, to elicit user preferences for designs for 3-dimensional "virtual realities" for accessing information.
- To draw from these interviews conclusions as to common elements and recurrent designs.
- To construct "worlds", used to demonstrate different designs as vehicles to develop further depth of understanding of user requirements and preferences.

- To analyse user preferences with particular attention towards affective responses, which might be indicative of the influence of non-structural features of the "worlds".
- To draw conclusions as to possible factors influencing user preferences.

3. Methodology

A deliberate effort was made to avoid influencing user decisions by constraining their selection in any way, so it was decided that the worlds tested by the users, and on which their views were sought, should arise from the input of the users themselves. An earlier piece of work had sought user reactions to pre-constructed worlds, but was abandoned when it became evident that these worlds had been chosen arbitrarily by the researcher, and that the research methodology was in fact doing the very thing which it was now important to avoid.

The study was a type of naturalistic enquiry, a study of the reactions of a distinct group of people to a given set of circumstances. According to Linton, Joy and Shafer (1999 p.132), naturalistic enquiry "involves studying real-world situations as they unfold naturally in a non-manipulative, unobtrusive, and non-controlling manner, with openness to whatever emerges and a lack of predetermined constraints on outcomes. The point is to understand naturally occurring phenomena in their naturally occurring states".

It was decided that it would be appropriate to use a "grounded theory" methodology for data collection. This methodology takes as input data gathered directly from participants, and develops theory arising from that data. The process is iterative and recursive – as a theory develops, it is tested against the data, further data is gathered, the theory is refined and developed, and this cycle proceeds until such time as no further relevant data emerges , at which stage "saturation" has been reached. This methodology, developed by Glaser and Strauss (1967), and Strauss and Corbin (1990) appeared to be ideally suited to the collection and analysis of essentially qualitative data, and to the also cyclical nature of the experimental process.

First, interviewees were asked, with no constraints put upon their imagination, what their picture would be of an "ideal world" to use for information retrieval. These responses were analysed, and common factors were found. Next , four "worlds" were designed, based on these common factors. Another group of interviewees was asked to test these worlds, and to share their responses to them. The worlds were then redesigned in response to that input. Finally, another group of interviewees was asked to test the resultant worlds, and to discuss, based on this experience, what their ideal worlds would be like.
The process thus moved from unfettered imagination, through development and refinement of practical models, back to imagination, but this time based on experience.

Although the continuing availability of the same students over the course of the research would have been problematic if an extended quantitative study had been the methodology of choice, the grounded approach meant that there was no particular requirement to interview the same individuals several times - just to interview individuals, although sessions were therefore slightly longer, to allow for "scene-setting". As long as the necessary information was acquired,

there was no necessity to repeat interviews. The development of the theory, and of the research instrument itself, takes place independently of any development in knowledge or skill on the part of the interviewee. For this reason, the methodology, like the literature review, was treated in a sectional, or sequential, manner. Grounded Theory allows, and indeed expects, that the theoretical structure will be developed through "rounds" of, in this case, interviews, and that each round will be both founded on previous rounds, and an attempt to reflectively develop a research instrument of greater precision than in the previous round. It is therefore considered more meaningful to show this development as the rounds progress, and the theory's development changes accordingly. As shown in fig. 1, the overall structure has a cyclical pattern, as older material is revisited and reviewed in the light of more recent material.

The fact that the study "evolved" into a series of "rounds", with a theory emerging and undergoing modification during the process, is in keeping with Grounded Theory practice, in that the theory "emerges" iteratively from the interviews, and is tested at each successive stage.

The interviews were transcribed, and analysed using Nvivo software, which allows significant words or phrases in documents to be marked up, and assigned identifiers. The identifiers can be the words or phrases themselves – this is "in vivo" coding, from which the software takes its name – or can be decided in advance by the user.

4. Findings

The first round of interviews, series A, produced a very wide range of ideas for virtual worlds, ranging from deep sea diving to space, with buildings, forests, car parks and a fun-fair also featuring. The first feature which became apparent was that there was a division between worlds which might be described as "realistic", and those which seemed more "imagined", or "fanciful". Even within realism, though, it seems that there are degrees – a "real" library seems firmly grounded in reality, especially when it has models of computers to access online resources. However, a mansion of branching rooms, laid out in a classification order, is concrete, but has a fantastic element.

A similar "fanciful" element seems to apply to the instances of a world of "bubbles", and the ones which relate to galaxies, planetary systems and "space" – these are real entities, but are used in an imaginative way, to serve an information access function which they would not normally have. It is true that planetary models have an internal "logic" – that of gravitational forces and the resultant orbiting behaviour – onto which an organisation of information might be mapped, but there appears to be an element of abstraction in these cases, where one order is being superimposed on another.

It seemed at this stage that the worlds could be categorised into four types, in a way which would also include the large number of more "idiosyncratic" worlds, by treating them as being split between realistic and non-realistic, and also between organised and un-organised.

The theory at this stage was that: **All worlds could be classified into one of four groups, and that people would tend to prefer using a world typical of**

one of these groups. This allowed the next stages of the testing to be carried out using a practicable number of demonstration worlds.

The next stage was the development, then testing, of the representative models. The worlds were created in the Virtual Reality Modelling Language (VRML), initially using Microsoft Notepad, a text editor, and later using a specialised VRML editor called VrmlPad. The process is iterative, consisting of writing world files, testing them in by viewing with a web browser and VRML "plug-in" application – Cortona and BitManagement VRML clients were used – and then returning to the edit stage, to make corrections. Four worlds were created, with the intention of representing the major classes which had been found in the series A interviews, i.e. a) concrete and ordered, b) concrete and unordered, c) abstract and ordered d)abstract and unordered. Two worlds were "concrete" – a town, which was taken to be "unordered", in that there was no obvious rationale behind the placing of information, and a library, which was "ordered" in that the stock was arranged according to the Dewey Decimal Classification scheme. Two were "abstract", in that they were representations of real things, but of things which would not normally be considered as sources of information. The forest was unordered, in that the trees had no particular arrangement, whereas the space world was ordered by Dewey Decimal Classification.

The second series of interviews was carried out as the interviewees moved around in the four "worlds" which had been constructed to represent the most popular images from the first series. The worlds were accessed from an introductory web page, and it was necessary to close the world scene after each world had been tried out, and to return to the introductory page. The links to the worlds were labelled "Forest", "Library", "Space" and "Town". The worlds themselves were very simply constructed, and contained only sample resources.

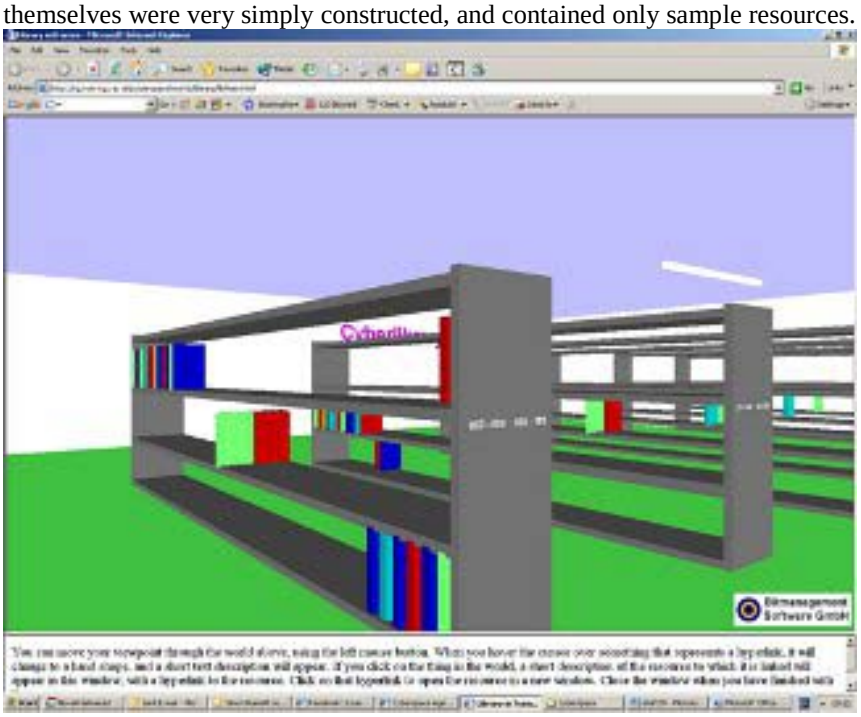

Fig 1 The library

In this series, interviewees were not asked about ideal worlds, but the interviews were concerned with moving around in the worlds, and the interviewees were encouraged to comment on whether the worlds were more or less what they had expected, whether they found any features particularly easy or difficult to use, and whether they thought they might be able to use the worlds to access information.

The testing immediately showed up some basic flaws, suggested some "low cost" improvements, and helped shape the "interview technique". The plan at this stage was just to introduce each model – forest, town, space and library, and to let the subjects use each in turn, whilst observing and recording them. These interview tapes are long and there are long pauses, people do not say much, and tend to polarise into very enthusiastic or very unimpressed (mainly the former). There was also more criticism of minor features than was expected, perhaps due to a failure to communicate properly the prototypical nature of the worlds.

This material was interesting in view of a) it being the interviewees' first reaction to seeing this type of 3D information world, and b) their responses while moving around and interacting with the worlds. The worlds thus functioned as vehicles for the discovery of user preferences within a quite restricted set of options.

Part way through the series B interviews, modifications were made in response to feedback, which resulted in the worlds being positioned together, to allow for greater ease of navigation amongst them, an in having resources open in new windows, to remove the necessity to "restart" a world from the starting position each time. The resultant world is shown in Fig 2. A memo at this stage notes the interviewer's negative reaction to criticism of the initial worlds, and successful adaptation in the light of that criticism. Two points of interest emerge here, Firstly, the approach of the methodology, with its cyclical nature, means that frequent examination of the data can provide insight to the interviewer's reactions, as well as to those of the interviewees. Secondly, the approach taken in the introduction to the interview can be adapted, as could the content of more structured interviews than those used in this study, to reflect changes in emphasis appropriate to different stages of the study.

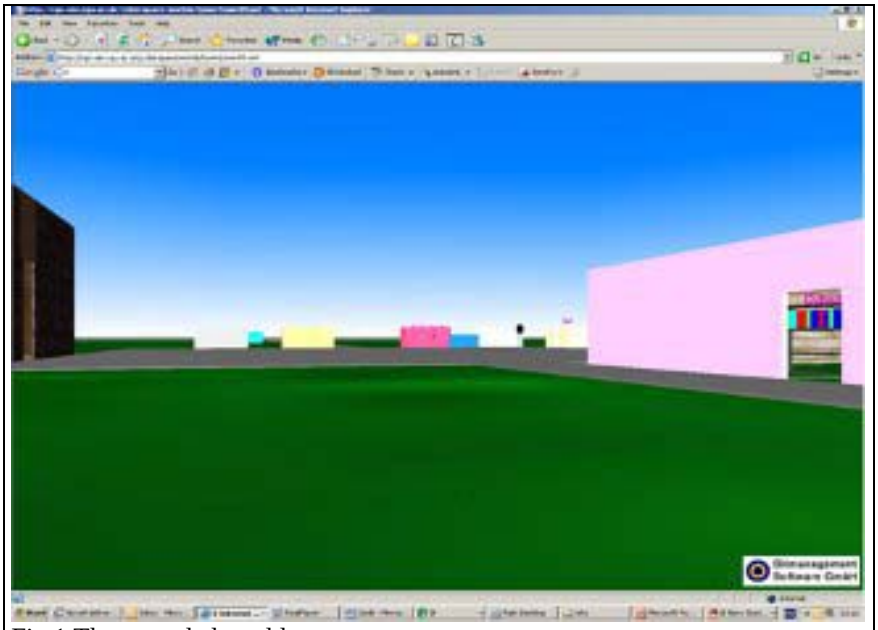

Fig 1 The amended world

The addition at this stage to the overall theory is that **there is generally an enthusiasm for the idea and the potential of using 3D virtual worlds for accessing information, but that this is tempered by reservations as to the practicality of using them in this context.**

For the third round of interviews, staff members of Aberdeen Business School were interviewed. The decision to use members of staff is, in grounded theory terms, an example of "theoretical sampling" – finding a sample who are the best to explore a particular aspect of the research question. What was required at this stage was a group who had the same common "universe of debate" as the first two, but who were more experienced in accessing information, and also more experienced as communicators, and who could add to the depth of description of their chosen worlds.

These interviewees were shown how to navigate in the world, given time to experiment, then asked, , "Now that you've seen examples of different worlds, if you were having a world designed for you to use for accessing information, what would it look like?". Interviewees typically first discussed their reactions to the models presented in the "amalgamated" world. They usually selected one or two of the "component" worlds – planets, town, forest and library – as their favourite, and justified this choice either by mentioning features they liked about that model, by mentioning features they did not like about other models, or both.

Not all interviewees discussed the models directly, or mentioned a favourite, but those who did not would sometimes use points about the demonstration models when discussing their ideal model.

Since these responses were not solicited on a user-by-user, world-by-world basis, their main value is impressionistic, in that they convey the stronger and

more commonly held reactions to the demonstration worlds. This would be of value, should any of the demonstration models be developed further, but the principal use of the responses in this series of interviews is in revealing more about the interviewees' reasons for selecting their ideal worlds. It was not intended that the interviewees be asked to select their favourite model at this stage, rather that the models be used as a seed or an inspiration to give context to discussions of the desirable and less desirable features of virtual worlds.

It was during analysis of this series of interviews that an interviewee introduced the concept of "assistance" – that having a character to help would be useful in retrieving information. It then transpired that the idea had also appeared in other interviews, as a market trader, a librarian, a "cybrarian", and a shop assistant. The idea of assistance as an influential factor in assessing worlds led to the analysis looking more deeply for affective responses, whereas the focus had previously been on structural elements.

This change in focus, taking, as it were, a different slice through the data, started to produce persuasive results. It transpired that what influenced people in selecting or proposing a world was not structural factors so much as qualitative ones. People wanted worlds which had an element of familiarity, which had high quality presentation, in which they could get assistance when necessary, and which were recognisably ordered. This shift in perspective came about entirely because of "immersion in the data" – recommended in grounded theory as a means of increasing theoretical sensitivity.

Grounded theory is subject to criticism which appears to take three main forms. First, is that of interpretation, expressed by Bryman (1988 p.73) as "how is it feasible to perceive as others perceive?" Respondent validation, or "member checking" was carried out both at the level of establishing accuracy of transcription (with all groups of respondents) and at the final level of checking the validity of the researcher's interpretation for an academic audience, with respondents who were themselves also part of that audience.

The second question relates to whether research can be conducted in a theory-neutral way, and with specific regard to Grounded Theory, whether it actually provides theories, or simply generates categories. In this research, it would be true to say that the theory, substantive rather than formal, was arrived at during the transcription, rather than the collection phase, although the direction of the collection phase had been influenced by the development of the theory.

The third question is whether theory based on a study in a single setting, of a particular case, or of a particular group, can be generalised outside that setting. Rather than attempting to defend the questionable position that the (interpreted) experience of a specific group can be generalised to a larger population, as a quantitative survey might generalise quantifiable data about a rigorously sampled group of participants, grounded theory encourages the generation of formal hypotheses, which are open to testing against other contexts.

Grounded theory must be seen as flawed in some degree – it is doubtful whether it can really be theory-neutral, there is a question about interviewees' intentionality, there may be some constructivism, and there are also questions regarding the validity of interpretation. However, in this study, the use of

grounded theory techniques has opened up an area of user experience which would have been very difficult to explore using a quantitative methodology, which in itself would have fundamentally changed the relationship between researcher and users. Grounded theory may not be able to live up to all the claims made by its supporters, but it remains the best tool for an investigation of this type.

5. Conclusions

This study approached the question of designing virtual worlds from a user-centred perspective, which appears to have been missing from other treatments of the subject. It found that it is possible to derive from interviews a set of properties which are distinct from, and complementary to, those considered in other publications. For example, it is widely acknowledged that "intelligibility" is a positive factor in the design of 3D worlds, but it does not appear to have been considered that "familiarity" of an environment might also play a significant part in the acceptance of the world as a "place" in which to work.

It was found that the properties of **familiarity, organisation or structure, mediation or assistance, and quality of presentation** were those deemed to be important by the participants in this study. It is felt probable that these properties, rather than the tendency to select a particular design, will be transferable across different groups of users, and that these findings can help to determine the course of further research and design work in the area of 3D worlds for information retrieval.

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