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Supporting creative 3D computing in the art and design community

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Abstract
This paper follows the experiences of the Networked Virtual Reality Resource Centres for Art and Design (NVRCADs) project funded by the JISC Technologies Applications Programme (JTAP) to introduce the VRML and Java into art and design education in Britain. It considers the difficulties that the project encountered not only in teaching VRML but also, somewhat unexpectedly, with 3D computing in general.

These problems range from institutional problems through to problems with using 3D software not specifically written for art and design - specifically, students perceived problems with the language and concepts within the software. The paper considers the approach that the project has taken to attempt to solve these problems. In particular, the paper discusses the CDROM that the NVRCADs have written which attempts to reconcile the students' conception of three dimensionality with the engineering and programming based concepts of VRML thereby providing students with knowledge they can easily map onto their own. The paper asks whether this approach could not be more widely used in 3D computer teaching within art and design.

Keywords: CD-ROM, computer supported design, creativity, 3D modelling, student learning

Networked Virtual Reality Centres for Art and Design (NVRCADs)
The Networked Virtual Reality Resource Centres for Art and Design (NVRCADs) came into being in 1996 funded by the JISC Technology Applications Programme (JTAP) (see acronyms list for more information). Its remit is to help Art and Design faculties in British Further and Higher Education Institutions to become familiar with 3D Internet technologies such as the Virtual Reality Modelling Language (VRML). Now in its third and final year of JTAP funding, it is possible for the project to draw conclusions, not only about the specific use of technologies such as VRML by its target audience, but also about the current wider use of computers for 3D work in art and design education in Britain.

Through direct contact with members of the art and design community in workshops, conference days and teaching at individual institutions, we have seen that the problems facing those wishing to teach 3D computing in art and design were of a more complicated nature than had been anticipated in the original project proposal. Whilst the original bid recognised that the art and design community seemed unwilling to utilise 3D technologies or its members to collaborate with each other, we had little initial knowledge to enable us to understand exactly why this should be the case. As the project progressed, however, a pattern emerged which seemed to indicate that although our remit seemed simple enough, in fact we would continually find ourselves dealing with problems of a quite fundamental nature caused by creative computing having been grafted onto an existing educational philosophy in a less than successful manner. As the project draws to a close at the end of 1999 we have found ourselves refocusing the project to concentrate on strategies to deal with these fundamental problems, rather than simply attempting to teach VRML within art and design. This paper outlines the problems that we have encountered and our attempts to solve these problems in a lateral manner. In particular, it will consider our development of a CD-ROM whose structure we feel, whilst addressing the teaching of VRML in particular,
could also be used in other areas of teaching within 3D computing in art and design.

When the NVRCAD project first commenced in December 1996, we began by undertaking a survey of art and design courses in FE and HE in Britain in order to find out what computers and software they used, if any, and crucially whether they had any experience of VRML. Whilst we found it quite difficult to contact the right people and elicit answers from them, the respondents could be roughly placed into two groups with regard to their knowledge of VRML. Firstly there were those who knew what it was and were beginning to experiment with it and secondly those who had no knowledge if it at all. Members of the latter group were by far in the majority.

It seemed then that we had to formulate a strategy to introduce the lecturer and student to VRML. This strategy had to recognise not only that knowledge of VRML was virtually non-existent but also that what we were dealing with was a scripting language. We had therefore to carefully gauge any actions and events so that they focused on what we saw as the potential of VRML as a 3D modelling language on the Internet and not too much on the intricacies of writing it. We decided on an integrated and progressive set of workshops. The first was called ‘3D on the Internet’ in order to deliberately avoid the use of the terms VRML and Java. This workshop showcased the technologies as they were then being used in art and design. The second workshop did however progress to considering how it might be possible for the artist/designer to cope with writing VRML. The third workshop considered how VRML and Java had begun to be taught in art and design in Britain and featured speakers sharing their experiences of doing this.

In each case the workshop raised important questions for us. Firstly, if there was such a positive response to a workshop as there was to our ‘3D on the Net’, why did this enthusiasm lead to nothing more? Contacts made and entusiasms shared went no further. Secondly, why did the workshop showing how to make VRML elicit little response? Thirdly, why were practically all the speakers at the workshop teaching VRML in art and design education teaching it only on programs which mixed art/design with computer science related courses?

We began to find answers to these questions as we attempted to undertake the next stage of our project, namely teaching in other institutions. We attempted to visit as many as possible but uptake was slow. Invitations to teach barely reached double figures. At those institutions that we did visit we were often taken aback by the problems that we encountered. Some of these problems were of course with the technology of VRML itself but we encountered other problems which are too numerous to list but included a lack of technical support for lecturers, lack of software, students’ lack of understanding and/or fear of computers. Our first thoughts had been to write common tutorials which could be taken to any institution. We soon realised that this would prove unworkable as the situation was slightly different in each case. We often had to resort to teaching students HTML or how to use the Internet or to watching videos of VRML. Could it be that lecturers, enthusiastic at our workshops, were simply up against too many problems to think about working with us?

Further consideration of the problems led us to categorise them as institutional and disciplinary issues. Both ultimately led us to believe that we had found some serious problems with 3D software and its use in art and design. We found that, institutionally, lecturers wishing to introduce or broaden teaching of 3D computing within art and design face a lack of technical support, a lack of time and a lack of money. There is often some amount of conflict between technical staff servicing the computers and those lecturers who use, or which to use them to teach. Lack of time was doubly problematic. Firstly, as the curriculum becomes more and more explicit in universities it becomes difficult to innovate and to introduce new methods to the point that it becomes difficult even to fit us in as guest lecturers. Secondly, even where these constraints are not present
the lecturer does not have the time to learn, let alone to teach, new software due to other pressures.

In most cases the software market was a major contributing factor to the time issue. Technologies currently develop at a rate which outstrips the users' ability to continue learning so it becomes more and more difficult for the lecturer to learn, teach and keep up to date with new technologies. Increasingly it seems this causes not only a lack of innovation but the introduction by default of what one might term ‘unofficial’ and ‘official’ industry standards. In the ‘unofficial’ case a piece of software becomes an unofficial standard across many art/design departments due to peer pressure, financial and time issues. Either that or students have only the experience of using the ‘official’ software of the future industry in which they wish to gain employment. Whilst there is of course nothing wrong with equipping a student with the skills that he/she will need to know on leaving university, in some cases this situation seemed to have been imposed by external pressure rather than sought.

These institutional issues seem further compounded by disciplinary problems with the 3D software itself. When attempting to teach art/design students VRML it became clear that even if they had experience of 3D modelling packages they found the concepts within it extremely hard to grasp. It seemed that perhaps a lack of experience of different software, because of the reasons detailed above might be to blame, but more likely was that somewhere along the line students were not learning 3D computing in a manner which enabled them to transfer their skills from package to package. This seemed like an oversight considering the pride, within art and design education, about transferable skills. This pointed to deep problems within 3D software. How was it possible that intelligent people could not transfer skills as readily as it would seem possible to do? Whilst the interfaces to 3D modelling and scene description tools use a common set of concepts to describe space, objects, light, animation and interaction these concepts, well within the grasp of the visually and spatially literate designer, are not understood. Students remain fastened to one piece of software and cannot adapt to emerging tools.

This is because 3D software uses concept and language which have not evolved from art/design but rather from an engineering and computer programming base. The concepts of space, objects, etc. are seemingly never taught to students when using the software and there is a conflict between the art/design student and lecturers' conceptualisation of space, for instance, and the interpretation of it within the software. This results in students being taught instead a range of “tasks” that they can perform to achieve known targets. Neither do they necessarily grasp the language of 3D software. Time and again we found that students could not understand us if we used terms such as ‘geometry’ or ‘point of origin’. ‘Make a box’ by contrast was an achievable task as they could learn by repetition how to do this. This resulted in a situation whereby the student could not truly exploit the software and its capabilities. It became interesting to note that VRML, for instance, was being used in situations where many of the students did have computer programming backgrounds. Perhaps mixing art/design students with these IT literate students helped overcome some of these problems? It would also go some way to explaining why we had a lack of interest in our second workshop and in our teaching. What we were attempting to teach seemingly had no basis in experience for the average student or lecturer.

The focus of the project then began to change subtly from simply ‘teaching VRML’ to attempting to find acceptable strategies to achieve this. The problems of concept and language seemed to be the aspects of the problem that it seemed most realistic to attempt to solve since we were not in a position to be able to ‘reinvent’ 3D software to correspond with the art/designer conceptual model of their work. We needed instead to find a way of mapping this conceptual model onto existing software models.

We decided to produce a CD-ROM which begins with a tree structure of questions which
attempt to identify the interests of the user rather than simply teaching VRML 'at' them. These questions do not attempt to define the user by discipline or by reference to the tools that they usually use. It would be wrong for instance to solely point a product designer in the direction of 3D geometry information, assuming they wish to display these objects in three dimensions when in fact they may wish to create geometry solely for the purpose of printing out for 2D presentation work. Instead the CD-ROM attempts to make the user define what they wish to achieve in terms of concepts they understand. The first question is extremely important, asking the user if they see themselves as 'student' or 'lecturer'. These 'titles' are qualified by the information that if one chooses student it is because one is interested in developing one's own work. If lecturer is chosen it is because one is interested in teaching others. Whilst both paths subsequently follow the same route, this is an attempt to be able to point the lecturer in the direction of project briefs they may wish to use and ways of assessing 3D computer work that consider what the student has achieved in terms of concept rather than computing. Subsequent questions ask the user, for instance, to decide between 'display' or 'process', making them consider whether they wish to use 3D as a presentation tool or simply as part of the working design process. Asking the user if they are interested in 'interaction' or 'object' asks them to consider if they are interested in what they can make an object do, or in producing a fairly realistic looking model of an object. Once these and other concepts have been considered, only then is the user pointed to related concepts in 3D geometry and software and thence to the relevant base level information, here VRML.

It has taken us some time to understand fully the problems faced in teaching creative 3D computing and the NVRCAD project has had to reposition itself from teaching VRML to addressing more serious problems in creative computing which we had not expected. Although administrative, financial and software market problems are not within our grasp to change we have made some attempt to address the concept and language problems involved in teaching 3D. In some senses we have moved full circle from our first workshop, '3D on the Net', which avoided the use of the term VRML to our CD-ROM which attempts to use language and concepts based on the experience of our target audience, not that inherent in the software. Technical and 3D computing concepts are reached only in the last stages of its use. Whilst our remit is to concentrate on VRML in art and design, we have found ourselves, of course, using and teaching other 3D software. New technologies such as Java3D appear at an incredible rate. If the lecturer or student is to fully grasp these technologies, attempts must be made to grasp common concepts in order to be able to exploit 3D computing to the full. Learning by rote how to achieve particular effects or objects should not be seen as the way forward. Many people within art and design are indeed attracted to the abstract qualities within VRML and related technologies but are not only unsure how to begin but currently find themselves unsupported. We feel that although our CD-ROM concentrates on VRML, it attempts to provide a general support structure based on the art/design users' experience. The CD-ROM may be a starting point for using software in a different way. Perhaps in the future 3D software may be designed with different users' conceptual models in mind.

Acronyms
JISC: Joint Information Systems Committee
JISC exists to:
‘...stimulate and enable the cost effective exploitation of information systems and to provide a high quality national network infrastructure for the UK higher education and research councils communities.’

For more information see: http://www.jisc.ac.uk

JTAP: JISC Technology Applications Programme
This is a directed programme to investigate the impact of technologies on higher education and develop applications in support
of the JISC’s strategy.

The NVRCADs were one of 53 projects conceived in the first phase of the JTAP and funded to develop the following key technology areas:

- Visualisation
- Virtual and remote environments
- Cluster computing
- Networks
- Collaborative and distance working
- IT to support administration
- Videoconferencing

For more information see: http://www.jtap.ac.uk

References
- NVRCAD project proposal to JTAP, 8th July 1996.
Appendix - The NVRCADs CD-ROM

The NVRCADs' CD-ROM was undertaken as a response to the problems that the project encountered whilst teaching VRML, as detailed in the preceding paper. It was agreed within the NVRCADs that to provide a list of VRML resources and FAQs might seem useful but that many such resources are already available. Not only this, but in our experience, these resources do not address the fundamental questions that we have encountered with the art and design community such as ‘Where do I start?’ and ‘How does this relate to my work and understanding?’. Most, if not all, the existing tutorials and FAQs teach VRML node by node, concept by concept. This is fine for those with prior knowledge of 3D computer graphics or scripting languages, but not so helpful for those in art and design who wish to use VRML. The NVRCADs decided to attempt to create a CD-ROM which bridges the gap between the conceptual model of 3D computer graphics used in the average FAQ or tutorial and the experience and understanding of an artist or designer.

The CD-ROM begins by asking the user if they wish to use either the tutorials mirrored on the CD (for the more experienced user) or the Diagnostic Guide (fig.1). If they choose this Guide they are taken through a series of binary choices which ask them to consider what aspects of the design process they are interested in and what results they are interested in obtaining. There are of course many different combinations of choice. However, picking two related examples illustrates the different potential routes which have been considered by the authors.

Example 1. Student - object - process - image
Example 2. Student - object - display - form

At the end of the path of Example 1, the CD-ROM states that the user is,

...interested in visually accurate representations of objects as a way to develop your work. These representations are two dimensional impressions of three dimensional objects. For instance sketch schemes used to develop ideas about theatre sets or products before they are modelled.

Compare this with Example 2 where the user is defined as,

...interested in visually accurate representations of objects which are finished pieces of work. It is important to you that these objects have an accurate geometry representation.
Both users have chosen ‘objects’ as what they are most interested in but they wish to use and display them in different ways. User 1 wishes to use the object in the design ‘process’ rather than as part of a finished piece of work or ‘display’. They are more interested in producing an ‘image’ of an object than an actual geometric ‘form’.

There are many paths through the CD-ROM but the main points that need to be noted are that firstly the user is not defined by discipline, but rather works their way through a process such as they might employ with media other than computer generated 3D. This has been attempted in order that no assumptions be made about the needs of one particular group. Secondly, notice the use of the word ‘Student’ and the box in Figure 1 labelled ‘Design Briefs’. Very quickly we realised that our approach only catered for those wishing to expand their own practice so we decided to create a distinction between lecturers, who wish to introduce others to 3D computing, and users or students who wish to expand their own knowledge and practice. The terms were not used in the educational sense, but rather to represent a frame of mind and a set of goals or needs. The lecturer path allows the teacher to define the concepts and ideas that they would like their students to explore through the technology and then supplies them with example briefs, resources and assessment criteria. The intention is that the resources we provide give lecturers the confidence to talk about the technology in relationship to their subject area without feeling the need to know too much technical detail.

Thirdly, up until this point there is a determined effort to avoid computer jargon. Once the user has come to the end of the Diagnostic section they then come to the Concepts section. Based on what they have told us about their interests in the Diagnostic section, they are directed to pages which attempt to reconcile the concepts they are familiar with and their equivalents in 3D computing. At this point gaps are bridged in language the user can understand. The user might, for instance, think that any movement around a VRML world counts as interaction. However, to proceed they need to know that in 3D computing it refers specifically to events and behaviours attributed to objects. These differences would be dealt with before the user moves on to the specific aspects of VRML that relate to the diagnostic process they have been a part of.

Since in effect VRML is only the base level of information, it is not inconceivable that this Diagnostic structure could be used for other languages or programs involving 3D computing.

At the time of writing (May 1999) the CD-ROM is in a beta state.