User Participation in Design: Techniques for Dialogue

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Summary

Many projects in which users participate in the design process are merely examples of professionals communicating their ideas to their clients. Conventional computer systems can be powerful tools for helping designers to present design information to lay audiences, but when combined with computer modelling and simulation, they create opportunities for users to construct their own sequences of images and thus explore designs from their own viewpoint.

Building on extensive experience of traditional methods of user participation, this paper explores the use of narratives to create dialogues between users, designers, and computers. The concept of "design stories" as a route to fully shared creativity is explained. The paper also argues that this approach is needed to bring into focus design issues that cannot be described or resolved by computer modelling alone.

Résumé

Nombre de projets incluant une participation des usagers ne sont en fait qu'exemples dans lesquels des professionnels communiquent leurs idées à leurs clients. Les ordinateurs conventionnels peuvent être des outils puissants, aidant les architectes à présenter des informations à un public non-spécialisé; lorsqu'ils sont utilisés avec des programmes de modélisation et de simulation par ordinateur ils fournissent aux usagers l'opportunité de créer leur propre séquence d'images et donc d'explorer des projets à partir de leur propre point de vue.

Cet article se fonde sur l'abondante expérience que nous avons des méthodes traditionnelles de participation des usagers pour examiner l'utilisation de récits permettant de créer un dialogue entre usagers, planificateurs et ordinateurs. Il explique en détail le concept de 'récits de projets', celui-ci pouvant être utilisé pour développer une démarche créative totalement partagée. Il soutient aussi le point de vue selon lequel ce type d'approche est nécessaire si l'on veut examiner de plus près des problèmes qui ne peuvent être décrits ou résolus par le simple emploi de modélisation par ordinateur.

1. Introduction

Continued reductions in the cost of computing technology, together with technical advances in computer graphics, modelling and multi-media, have guaranteed a future for computers as tools for visualising and animating building designs. Until recently computer applications for design replicated functions which could otherwise be performed by other tools, or manually. However, the development of highly interactive

software packages and more intuitive graphical user interfaces has opened up new possibilities for using computers not only to present completed design solutions but to analyse partially developed designs at different stages in the design process. The central purpose of this paper, therefore, is to explore the opportunities these advances create for using computers to assist user participation in design.

The paper is intended to lay the ground work for a programme of research into user participation in design in the Centre for Architectural Studies at the Queen's University of Belfast. Appropriately, therefore, what is presented here is largely specu-lative but should nonetheless identify promising areas for research and experimenta-tion.

The paper begins by reviewing the main developments in the field of participa-tory design in the UK. Objectives are discussed before considering modelling tech-niques. Potentially useful computer applications are discussed, and issues in computer representation are identified. The paper concludes by examining the scope for using "design stories" as vehicles for informative interaction with models in general, and provides some limited examples of the kind of interaction which might result.

2 . The Need for User Participation in Design

The idea of user participation in design has grown out of libertarian concepts of participatory democracy in the 1960s. Following from this, in the UK as well as in many European countries, social and community movements have demanded greater say in the planning of their environments. In the UK there are many examples from the 1970s and 80s of projects, particularly in housing co-operatives, where user groups have taken on the client role, or been allowed by housing organisations to take part in design decisions (Ravetz 1989; Jack, 1986).

In more recent years, Conservative Government policy in housing has been aimed at dismantling the social and public sector and encouraging greater private own-ership. Implementing this policy has involved recruiting tenant support to undermine the role of public housing authorities, building on existing consumer dissatisfaction. The Government has promoted concepts such as "tenants' choice" and the "citizens' charter" and tenants have been encouraged to vote for housing action trusts and housing associations to take over public housing. While the degree of tenants' control resulting from these changes is largely cosmetic, expectations for greater participation in design, development, and management have been raised and often acceded to by new landlords.

Similarly in Northern Ireland, the N.I. Housing Executive has to contend with very powerful community groups with strong territorial loyalties. Here again, for largely pragmatic reasons, tenants involvement in design is officially encouraged and many schemes could not be implemented without local community consent.

Thus almost unintentionally there are greater opportunities for user participation in design in the housing field than ever before, though often the professionals and clients involved have little or no experience or training in participation techniques, nor do they have access to facilities such as full scale modelling or centres of expertise. Thus they re-invent the wheel in each project (Woolley, 1989).

The other main area of need for user participation has been fostered by the con-tinued growth of the community technical aid movement. The Association of Com-munity Technical Aid Centres has 100 members and is partially state funded. Local Community Technical Aid Centres (CTAs) work with community groups on a wide

variety of social buildings and projects and user participation in design is an essential part of this work. However as CTAs operate on shoestring budgets working for low income groups, again the expertise in design participation is poorly developed.

3. Strategies for Design Participation

The starting point for design participation is the general goal to enable users to play a decisive role in the design of the environments in which they live, work and play. For us, as researchers and designers, the principal research goal is to devise strategies for design participation that will involve users in all key design decisions, and help them to articulate their concerns and needs at any level, ranging from the design of kitchen fittings to the structure of their communities. An onerous task indeed. But even at this early stage in our research we can formulate general requirements and anticipate the most severe obstacles we are likely to encounter.

For users to engage in dialogue about design-related issues they will need to be able to understand design proposals and the implications of specific decisions on their interests. Here the choice of media is critical. But regardless of the medium there are methodological problems that need to be addressed if we are to gain any purchase on design participation. A brief exposition of these is sufficient to indicate the magnitude of the problem.

Firstly, designing and constructing buildings today has become an increasingly complicated business. One of the main problems of design participation is this complexity of the design process and the difficulty of lay people in understanding the jargon, methods and processes that are familiar to professionals. Apart from understanding the actual manual process of design such as drawing plans and elevations, lay people rarely understand the impact of external factors such as funding pressures, the plethora of approvals and regulations, the range of standards and constraints, the expectations and ambitions of the designer and the limitations of other client bodies which act as intermediaries. Often these can overlay confusion on what is already a difficult task and one of the main objectives of design participation should be to demystify these and to also create space for participants to express their own ideas instead of responding to all the external pressures and constraints (Woolley, 1985).

To date, not enough is known about the difficulties of helping lay people to understand the complexities of building design in a way that fully allows them to express their own ideas and desires. It is necessary to understand the psychological problems of perception, the complex relationships between people and the constraints within which participation usually takes place (Woolley, 1988).

Modelling Tools and Techniques

A wide variety of techniques and tools have been used in design participation projects, too numerous to describe in detail here. Some such as "Planning for Real" have become quite well known in the UK even though their efficacy may not have been independently evaluated (Institute of Housing, 1988). Analysis of examples of case studies will show that no one technique is perfect and that successful projects usually use a variety of approaches. Full scale modelling, while looked on in envy by those who do not possess such facilities, still has limitations, on the other hand, more traditional methods of sitting around a table with pens, paper, overlays and so on has been shown to put too much power in the hands of professionals (Woolley, 1987).

The claim of the Weller Streets Housing Co-operative that their architect "merely held the pen" is a piece of self-delusion (McDonald, 1986).

At present we see little prospect of getting the finance to experiment with full scale modelling in Belfast, but we are able to see how we can employ computers to aid design participation. They are more easily transported to public meetings and we already have investment from the University to support research in this field. Furthermore we want to explore how we can build on techniques already used in training work on design participation. This training work has made use of role playing, gaming and group interaction with an approach drawn from psychotherapy. This approach has been intended to improve communication and an understanding of relationships so that professionals and participants can exchange their ideas more freely. By helping people build on their own experience and perception they should be better able to take design decisions.

4. Computers as Tools for Design Participation

For the reasons outlined above, which are largely pragmatic, we have decided to explore the potential of emerging techniques in computer visualisation and interactive animation as tools for communicating design concepts and intentions to lay users. In this section of the paper we review the currently available computer software which seems to offer the most powerful features for our purposes.

Computer Applications in Design

According to a survey by the RIBA (Ray-Jones, 1990) 65% of architectural practices in the UK now own and use computers. However, it is significant that the most widely used applications are primarily information-handling packages—word-processors, spreadsheets, databases—not directly concerned with the form of designs. These will have little use in design participation. The reluctance to purchase computer aided design (CAD) systems probably stems from the fact that benefits of using CAD systems are debatably slight. Those who have invested in systems have done so again because they provide useful information-handling adjuncts—bills of quantities, schedules of windows, doors, ironmongery. Rarely is a CAD system bought to improve the understanding of formal or spatial properties of designs, or how designs might be used. In design participation we are principally concerned with applications that can better communicate design ideas to users and allow them to interact with computer based models. The requirements of computer systems will be different to those of practice. Table 1 below shows the main types of systems which are likely to be of use in this kind of work. It all also indicates what information or knowledge each system will need to provide a given functionality, and notes how this compares with manual methods.
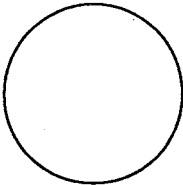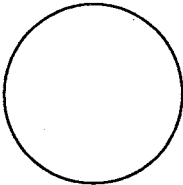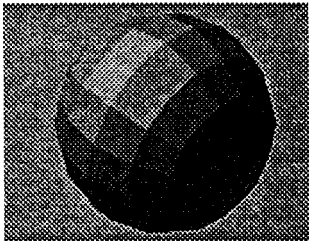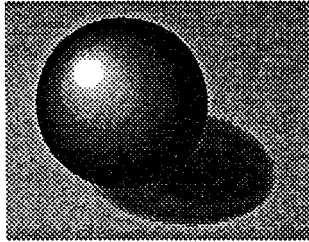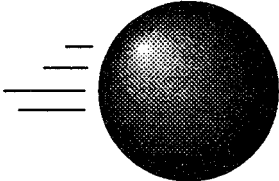
Application	Information required by computer		Functionality
2D Drafting	2D co-ordinates of lines and other graphical primitives		Offers little over traditional manual methods, though possibly faster in skilled hands, depending on the complexity of the drawings to be produced.
3D Modelling	Description of all relevant points in 3D space. Differentiation between solid and void.		Provides a useful means of quickly generating 3D projections which can help non-designers to visualise design proposals. As with 2D drafting there is no intrinsic difference between what computers can do and what can be done manually, though more slowly.
Rendering	Properties of objects and constituent materials: refraction, absorptivity, colour, etc. Description of light sources: position, spectral properties, intensity		Enhances realism of object depiction by simulating effects of lighting, and the texture of various types of materials.
Animation	Time variant properties of objects.		Further 'realism' from movement depicted on screen.

Table 1: levels of representation.

Visualisation and Animation

Today's designers, at least in theory, have access to a vast range of new computer based tools. Geometric modelling of buildings has been possible for many years but it has really been the development of low cost computing power and high quality displays which has provided the impetus for today's popularity for 3D modelling. Computer-based rendering techniques are another area where significant advances have been made. The ability to add colour, shade, and texture information to models has greatly enhanced the use of computer modelling tools. Users of even modestly-priced workstations have access to a bewildering range of colours, can apply 'texture maps' to modelled surfaces, and can simulate the effects of subtle changes in the position, spectrum, and intensity of lights on directly and indirectly illuminated objects in a model. This enables near photographic quality pictures of yet-to-be-built designs to be created.

Almost every currently available CAD package offers the ability to construct animated walk-throughs of modelled designs. Demonstrations of these facilities are invariably designed to impress by displaying architectural icons of current appeal. What is seldom appreciated, when standing in front of these impressive displays, is the amount of preparation, not to mention skill, needed to produce even a short animation sequence. Animations require substantial computing power and they are usually created by specifying 'key frames' at specific points within the building, which are then linked by sequences of automatically generated frames. The process generally requires several hours, depending on the complexity of the model, degree of realism, and performance characteristics of the computer, and will often be done in overnight sessions. The resulting animation is saved in a file and played back in real-time. But this precludes any interactive component.

The animation is usually devoid of any human element. The route through a design is usually dictated by the architectural interest of the form without any connection to what activities may be supported by the building. In short, walk-throughs show what interior spaces may look like but not how they might be used. As a result the viewer is detached from what appears on the screen; because there is no interaction with the model the viewer has little involvement with the sequence of images that comprise the animation. There is no dialogue between the two, no interaction. Some current software packages seek to remedy this by supporting interactive animations using "puppets" that respond to user input in predefined ways. Of course the puppets can only do what they have literally been programmed to do. Any action not anticipated in setting up the interaction requires changes to puppet scripts, which is a specialist's task. Furthermore, even with multi-media systems, interaction is limited to sound and vision; the tactile, the visceral are absent. Here is the major advantage which full scale modelling has over other methods: it offers 'presence', to borrow Steiner's term (1989), in contrast to the abstracted representations and displays of computer technology.

However, to overcome the separation between viewer and computer-based models, new techniques are being developed which effectively place the viewer in the model and allow her or him to direct movement through the modelled spaces with their own body movements (arms, legs, eyes). This degree of involvement with models has spawned a new area of research called 'virtual reality.'

Virtual Reality

In a detailed, and often entertaining, account of the development of virtual reality (VR) systems, Rheingold (1991) traces the origins of VR to the speculative research work pioneered at the Media Lab within MIT in the 1980s. This research group was established in the 1970s and inspired by the vision of Negroponte whose *Soft Architecture Machines* (Negroponte, 1975) established many of the goals in research into computer applications generally, not just in design computing. Nearly 20 years on, it is only now that technical advances can begin to realise that vision; and there is much more work required yet.

Technically VR is not so far removed from everyday CAD modelling systems. As should be evident from Table 1 above, all a machine need 'know' to model design buildings is geometrical and topological information—a highly impoverished "micro-world". This is the core of VR systems. But the major advances in VR have been the development of sophisticated interfacing devices to these artificial worlds. The Data-Glove for example detects movements in the wearer's hand which can then be interpreted by a computer to cause some action on a screen, or even to send signals to the glove which result in virtual objects being 'felt' by the wearer. These devices remain fairly crude at present but there are no conceptual obstacles to increased sophistication; the technology is imminent.

Intelligent Systems

Technical advances such as those which make virtual reality a reality are tractable. The problems are mainly electro-mechanical and so are amenable to well established methods for finding solutions. The difficult problems are conceptual; it is telling that most of the new products emerging from the computing industry have their origins in the development of computer games rather than in fundamental Artificial Intelligence (AI) research. It suggests that the technology may be approaching the conceptual limits; the promise of AI to deliver computer programs capable of convincing human conversational counterparts of their intelligence (the Turing test) seems as far away as ever. Winograd and Flores (Winograd, 1987) offer a cogent account of the difficulties in developing AI systems. Thus, for the foreseeable future, intelligent systems will have little to offer design participation.

5. Implications of Using Computers

Having decided to use computers as our principal medium for design participation we need to examine the implications of this choice. From past research and documented experience of using computers in design and elsewhere we can identify issues which need to be considered.

All models are abstractions of real world systems. Each modelling medium has its own limits in terms of what can be represented, either at all or easily. A useful analogy is with language. Languages is the currency of thinking such that what can be spoken influences what can be conceived. So with modelling media there are unavoidably objects or designs that cannot be represented. As in normal design activity a willingness to abandon the tool when it restricts thought is needed.

For similar reasons, it needs to be remembered that computer technology, with the possible exception of virtual reality systems, depicts designs exclusively as im-

ages, thus placing too much emphasis on appearance. This "tyranny of the images" needs to be balanced by other methods which bring attention to non-visual aspects of design.

Despite advances in the design of user interfaces, computers are inherently diffi-cult to use. They still require a level of training which is beyond most people's sec-ondary education. A study of undergraduate students of architecture conducted by Nielsen *et al* (1991) found that the strongest feeling they shared towards computer technology was fear. If this is to be found in student designers, it seems plausible that it will be more pronounced in those who have had far less contact with computers. One of our major tasks therefore will be to allay any such fears, by de-emphasising the unfortunate aura which attends computer technology. To do this it may be necessary to provide some basic training in using computers.

In his study of the effects of introducing computers to schools of architecture Coyne (1987) highlights the power politics that ineluctably accompany the technol-ogy. Recent observation of design participation meetings in Hulme in Manchester, where there is an extensive "City Challenge" participation programme, showed that use of computer generated images was very intimidating to participants. This was because the power of computer graphics was being used to reinforce the professionals view rather than facilitating genuine participation. Thus any technique or tool is only as good as it is used.

One of the more disturbing effects of computer technology is the alienation it seems to produce especially among the young. Joseph Weizenbaum in the preface to the 1984 edition of his seminal *Computer Power and Human Reason* justifies his "cultural pessimism" by observing the involvement of teenagers with computer games:

> "There is no question in my mind now that the computer-game phe-nomenon, at least as it is playing itself out in the United States, powerfully validates the general cultural pessimism which *Computer Power and Human Reason* expresses. Whatever despair our society's use of television induces, it must be doubled and redoubled by the vision of countless youngsters standing hypnotised before computer displays, their hands moving in the manner of those of a shell-shocked soldier. I think that what is happening to young people in the computer arcades and in some of their classrooms is a parable of our time, a sad and disturbing story." (Weizenbaum, 1984, xv).

The problem, therefore, is not a lack of involvement, but too much involvement to the neglect of real world concerns. The "micro-world" represented in a computer game obviously has the power to captivate attention by suppressing all other stimuli. Even if Weizenbaum is over-reacting there remains valid criticism to be answered and considered in using computers for any kind of simulation.

The issues discussed in this section have served to emphasis the more negative aspects of using computers in any field, and it is important that these criticisms are acknowledged. But with careful planning of participation we believe that most can be avoided. To this end we envisage the technology forming just one part of a much larger armoury of methods which can be invoked. Computers, therefore, must take their place within the larger framework of dialogue between users, designers, and designs. How this might be achieved and what the framework might contain are topics for the next section of the paper.
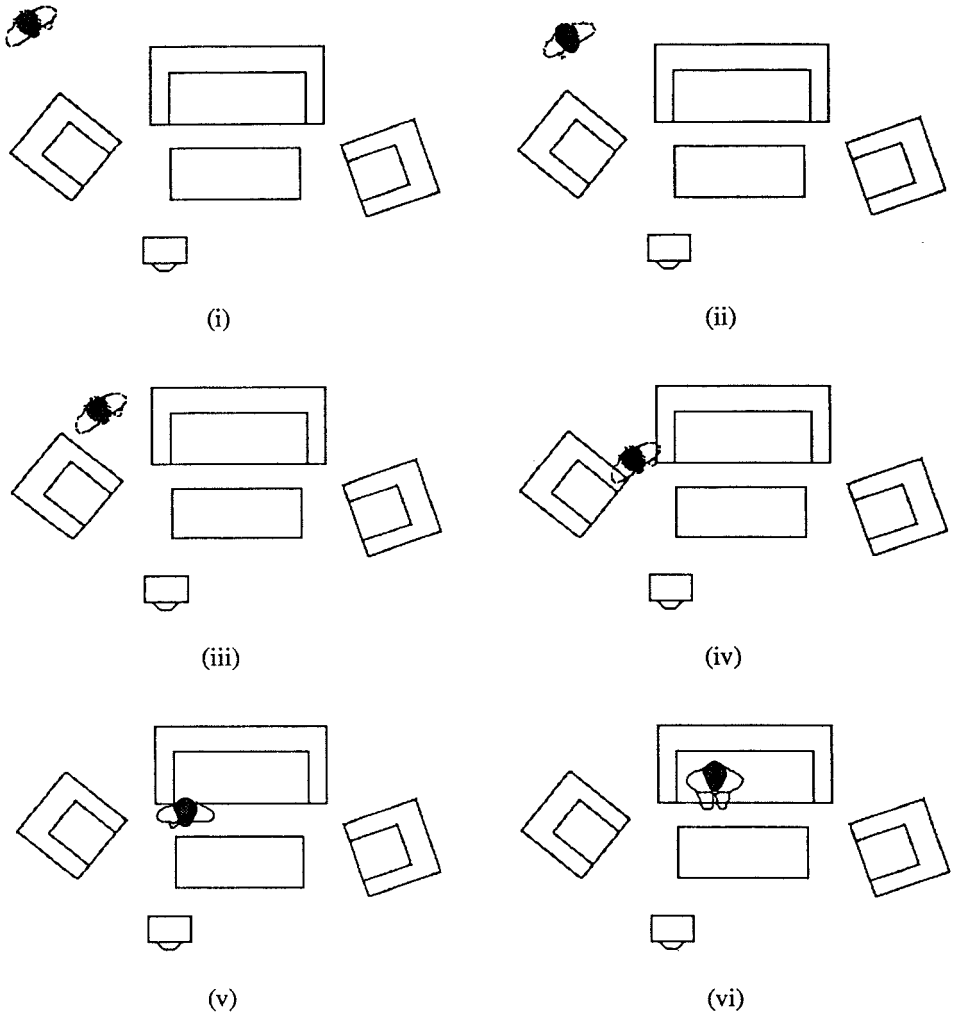
(i)   (ii)

(iii)   (iv)

(v)   (vi)

Fig. 1   Selected still frames from an animation designed to investigate movement around furniture arrange-
ments.
Images tirées d'une animation servant à étudier un mouvement autour de groupes de meubles.

6. Techniques for Dialogue

As the above discussion should make clear, there are important issues which need to be addressed in attempting to employ computer technology in design participation. Our chosen strategy is to experiment with different methods for creating dialogues between users and designers, between users and models, and between models and the real world activities. As an example, Figure 1 shows selected still frames from an animation designed to illustrate movement (on plan) for different activities occurring within a simple furniture configuration. As a first test of one of the modelling/ animating techniques we wish to investigate, this example is extremely simple. But it suggests one area where interactive animations might be exploited.

To locate such techniques in the broader context requires connections between what appears on a computer screen and users' everyday concerns. The principal medium for this is verbal language.

Design Stories

As designers we are used to working mainly with drawings as the means of describing designs, even though we are aware that drawings alone are not enough to communicate all aspects of the design. Text is seen as a necessary supplement to help resolve ambiguities and convey information which either cannot be communicated graphically, or at least not succinctly. The importance of language is underlined by Kühn:

> "…language is an indispensable active force in the definition of architectural design problems, especially if we consider architecture as a "social art" that responds to a variety of social and cultural needs. The discussion and propagation of social and cultural issues is to a large extent carried out in natural language" (Kühn & Herzog, 1991, 2).

In an earlier section it was noted how the dominance of images in computer representation of designs tends to create a detachment between the designs and those interested in their performance—the designers and the users. To overcome this obstacle we propose to develop a methodology loosely termed "design stories." Design stories will provide a framework for interacting with models which will enrich users' perceptions of designs by locating design solutions in everyday activity. Essentially this can be seen as a form of structured simulation which we hope will uncover deficiencies in designs.

Design stories will be used to investigate two broad types of participatory activity:

(1)   scripted interaction with models; games

(2)   post interaction reflection

In the first case we seek to develop scripts which can be used to ask questions of a given model. At the simplest level this may consist of no more than an informal session in front of a computer with a skilled operator. In this scenario, the designer and a user would focus on aspects of the design related to an everyday activity, such as preparing a meal. All this requires is for the user to 'go through the motions' of preparing a meal in an unfamiliar kitchen. Provided the modelling system allows rapid change to the design, this type of simulation should expose any weaknesses in the design.

The second broad area for investigation is the use of verbal description to discover how users feel about a design after it has been studied in some detail. It may be edifying to ask users to write about specific aspects of the design. The choice of scenarios, as with scripted interactions, is critical. This use has some relation to psychotherapy and counselling and therefore demands that we take on board new skills within our research team.

In this proposed use of language we are encouraged by current thinking in the teaching of English (Creber, 1990). Interaction between images and verbal description can be a powerful mechanism for discovering otherwise neglected attitudes to the environment.

7. Conclusions

This paper has outlined an area of research which will explore the use of computer technology in enhancing design participation. Many unresolved issues have been identified as items for a research agenda. Despite the known drawbacks of some aspects of computer modelling we have suggested that it can be used successfully in this area, provided its limitations are recognised and steps are taken to ameliorate them, principally by integrating computer-based techniques within a broader linguistic environment. The intended use of design stories has been sketched and two main areas have been targeted. It is acknowledged that the discussion has barely scratched the surface of the deep issues which need to be addressed, but it is hoped that such a wide-ranging exposition will stimulate debate and prompt responses from others working in this field.

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