On the social organisation of space and the design of electronic landscapes *

Andy Crabtree & John, A. Hughes, Sociology Department, Cartmel College, Lancaster University, Lancaster, LA1 4YL, UK. e-mail: {a.crabtree; j.hughes}@lancaster.ac.uk

Jon O'Brien, Xerox Research Centre Europe, Cambridge Laboratory, 61 Regent Street, Cambridge, CB2 1AB, UK. e-mail: jon.obrien@xrce.xerox.com

Tom Rodden, Computing Department, SECAMS Building, Lancaster University, Lancaster, LA1 4YR, UK. e-mail: tom@comp.lancs.ac.uk

Abstract. This paper reports on-going work in the eSCAPE Project (Esprit Long Term Research Project 25377) directed to the research and development of electronic landscapes for public use. Our concern here is to elucidate a sociologically informed approach towards the design of electronic landscapes or 'virtual worlds'. We suggest - and demonstrate through ethnographic studies of virtual technologies at a multimedia art museum and information technology trade show - that members sense of 'space' is produced through social practices tied to the accomplishment of activities occurring 'within' the locations their actions are situated. Space, in other words, is socially constructed and shaped through members' practices for accomplishing situated activities. We explicate, by practical examples, an approach to discovering social practices in and through which a sense of space is constructed and outline how such understandings may be used to formulate requirements for the design of electronic landscapes. In explicating our ethnographically informed approach, we outline how future technologies may be developed through the situated evaluation of experimental prototypes in public use.

Keywords. The social organisation of space, designing virtual worlds, ethnography, experimentation, situated evaluation.

1. Introduction

The development of electronic landscapes, virtual worlds or cooperative virtual environments (CVEs) is of burgeoning technical, social and commercial interest, promising substantial benefits to organisations of all kinds in overcoming 'real world' constraints of time and space. Despite a notable degree of 'hype' (Hemmings *et al.*, 1997; Tolmie *et al.*, 1998; Hughes *et al.*, 1999), practical research in the field has nevertheless resulted in extensive developments of such environments (see, for example, Benford *et al.*, 1997), studies of their use (e.g. Bowers *et al.*, 1996) and the development of commercial initiatives (e.g. Contact, 1999). Although the use of such systems is growing, there has been little consideration of the *social* construction of space.

A similar situation existed in the introduction and development of early distributed interactive systems. In the case of these systems a number of significant failures were attributed to a failure to attend to the sociality of real-world environments (Grudin, 1988; Page *et al.*, 1993). A similar failure to attend to the social construction of space and activities for virtual environments is likely to result in usability and use falling considerably short of expectations (Hughes *et al.*, 1998). Without offering a universal panacea, or 'silver bullet', to problems of development and use, this paper reports on a sociologically informed approach to the design of electronic environments. In particular, we suggest that the design of electronic spaces needs to be informed by an understanding of the ways in which

* © The authors, 1999. This work is posted here for your personal use. Not for redistribution. The definitive version was presented at the Proceedings of the 11th Biennial Conference of the Society for Philosophy and Technology, San Jose State University, Silicon Valley, CA, July 16, 1999.

space is socially constructed in the real-world. This is not to suggest that electronic spaces should replicate real spaces but that they need to draw attention to common issues that need to be addressed if electronic spaces are to be usable spaces. For example, in both real and electronic space, users must be able to find their way around, or establish where they are, who else is there, co-ordinate their actions with others, and so on.
These everyday activities and actions rely on common, social practices such as following signposts in way finding through a landscape. As mundane as the example is, it nevertheless serves to point out that 'space' and 'spatial arrangements' are essentially tied to social practices in everyday life. Thus, an understanding of the real-world, real-time social practices in and through which members construct a sense of, and thereby organise (or order), space seems essential in the effort to develop virtual technologies and integrate them into the myriad settings and activities of everyday life. The aim of this paper is to consider these understandings and demonstrate their applicability to the development of cooperative virtual environments.

Underpinning the practical approach to development we propose is an understanding of the social nature of space. Before we consider the use of these virtual environments we consider in the following section what we mean by the 'social organisation' of space. The aim is to 'sensitise' those concerned with the design of electronic landscapes to a distinct aspect of space and spatial arrangement – situated practice - integral to the uptake of virtual technologies. Following this we describe, by further example, how ethnographic study of situated practice may inform the formulation of concrete features of virtual environments.

2. The social organisation of space in everyday life

A common claim of many virtual environments is that they exploit and build upon the everyday and natural skills of users in understanding spatial arrangements (see Benford *et al*., 1994). The developers of virtual environments use the phrase *"everyday understanding of space"* to refer to the way in which people are able to understand and interact their everyday physical world. Developers believe that the skills inherent in understanding physical space can be exploited and built upon in the development of virtual environments that can support a number of users. In this section we wish to consider the nature of space in terms of how it is understood and shared between group of inhabitants and how the social organisation of space is exploited in everyday life.

By 'everyday life' we do not refer to some theory of social action but to the world as experienced by the society's members in the normal, natural course of conducting their ordinary, everyday affairs. We thus refer to the world as understood by ordinary persons, the taken for granted features of which are used as a resource for 'going about' their daily business. Under the auspices of everyday life we presume, as a condition of the organisation of our daily lives, that people, objects, places, etc., are distributed spatially and intimately connected temporally. 'Space' and 'time' are mutually related and coupled with our sense of practical matters such as 'how long will it take to get to London from here?', 'how long have I got before the last train?', or 'what time are we eating?'. Space and time are not worldly abstractions then, but embodied in, and integral to, the accomplishment of the activities we *do* (Sudnow, 1972; Lee & Watson, 1991; Hughes & O'Brien, 1998).

Previous sociological treatment of space has largely been subsumed under the rubric of urban sociology and social geography (Park, 1926). The concern here was with charting the geographical distribution of various social characteristics: income, industries, classes, religion, ethnicity, population types, mental illness, and so on. On this 'ecological' view, space is effectively construed as an arena 'within' which members construct their courses of action. This is a commonsense notion of space conveyed by expressions such as the 'environment', 'surroundings', 'territory' etc. Space and spatial arrangements become, as it were, the settings within which social activities of various kinds occur. This view is consistent with the mundane observation that, within social life, certain spaces, or places, are tied to the performance of particular activities: classrooms are organised for teaching, restaurants for eating, libraries for storing and retrieving books; roads for the orderly movement of vehicles, and so on. There is, then, a strong sense to the notion that particular spaces and their arrangements are tied to particular activities - that spaces are *institutionalised* as it were (Goffman, 1961).

While accepting commonsense notions of space, we prefer to adopt a rather more interactionist attitude towards the end of seeing how space and spatial arrangements are interwoven with and in conduct. That is, seeing space and spatial arrangements as inextricably embedded in and produced through courses of human action and the reciprocal construction of the observable scenes and events of everyday life. Seen from the point of view of social action in everyday life, spatial arrangements are *intelligible* arrangements essentially tied to the performance of particular activities. The intelligible character of spatial arrangements consists of two related and generic features:

1. They are manifestly *visible arrangements* and are constructed for their visibility.
2. Spatial arrangements are *public and widely or commonly known*.

The *visibility of* spatial arrangements is a precondition of their sociality. For the ordinary member of society matters to do with spatiality - walking, shopping, displaying intimacy, driving, finding the bathroom etc. - are not deep mysteries only open to adepts, but practical matters consisting of 'what anyone knows' about the organisation of the world in which they live. That is, the ordinary world *of* members is an intelligible world *for* members; a world that is encountered as recognisable, observable, reportable, publicly available and accountable, a world in which spatial arrangements exhibit a *mutual* intelligibility. Thus, in everyday life we can recognise places where we can catch buses or trains, places where we can eat, places where we can report crime, buy groceries, go without invitation, drive, not drive (etc.), and perform a huge variety of social activities with which a sense of space and spatial arrangement is intimately connected, and interwoven, as a readable feature of the settings those arrangements make visible.

Social action is, furthermore, always action in space and requires for its production collaboration and cooperation with others. As such, the competences providing for social action are shared and constitutive of a world known in common. Knowing a world in common presupposes a *reciprocity of perspectives* whereby members orient to conduct in adopting the stance that the 'world as I see it' is the 'world as others see it' for all practical purposes in *this* setting *here* and *now*. Take, for example, 'driving in traffic'. Driving in traffic *trades on* the presupposition of a world known in common: on members knowing which side of the road to drive on when going in a particular direction; on knowing that traffic lights are signals which convey instructions which have to be obeyed if sanction (if not accident) is to be avoided; on knowing that flashing lights on cars indicate the direction in which drivers intend to turn; on knowing that other lights on cars are brake lights, and so on. Thus, the 'world' of driving, like any other aspect of the real-world known in common, consists of common understandings of, and orientations to, the *social practices* of driving through which the orderliness of 'driving in traffic' is produced. The social practices for the production of social action are essentially

tied to the space and spatial arrangements 'within' which *that* action takes place. For example: 'indicating' is a social practice *and* spatial arrangement for conducting the orderly flow of traffic in-the-space-of-the-highway. Spatial arrangements are known in common, essentially tied to, and displayed through, social practices for producing spatially situated activities then.

This brief examination of the social organisation of space suggests that understandings of these spaces are produced in practice and the properties of these spaces are developed *in practice* by their inhabitants rather than from some more theoretical design principles inherent within the space. In order to design future virtual environments we suggest that rather than focus on more theoretical views of spatial arrangements (e.g. Benedikt, 1992) attention needs to be paid to the situated practices in and through which spatially situated activities are produced in the development of electronic landscapes. In the following sections we provide a practical example of what such an attention consists of in details of investigation and design. We start by considering in the next section the means by which users move between electronic environments. This is followed in section four by a consideration of how users actually engage with and use virtual artefacts.

3. Discovering the real-time, real-world social organisation of space and informing the design of electronic landscapes

One of the major problems to contend with as virtual environments become more common is the diverse nature of these environments and the need to support movement between, and engagement with, a potentially vast collection of heterogeneous virtual worlds. Development along these lines has already started to emerge with on-line environments although there is a marked lack of consistency making it difficult for users to understand these environments. We believe that the disparate nature of current environments hinders their widespread use by a diverse set of users. To achieve a more intuitive and intelligible design of electronic landscapes, thereby encouraging use, we have undertaken ethnographic studies of social practices members employ in moving between, and engaging with activities in, real and electronic spaces in order to inform design.

Although we do not want to labour the notion of ethnography too much here (as much has been written elsewhere on the matter)[1] it should be said that the approach first and foremost requires the immersion of a researcher into a particular setting and the activities that daily occur there. The point and purpose of this 'immersion' is to arrive at an appreciation of the activities observed as they are understood by parties to their production and explicate – or make visible – the social practices performed by participants *in producing* their activities. In other words, ethnography as we advocate it (and there are other kinds of ethnography than ours which seek to provide empirical justifications for, and elaborations of, theoretical convictions) is concerned with uncovering the situated practices productive of spatially situated (and distributed) activities. Without further ado, it might simply be noted that it is just this attention to the embodied and locally accomplished practices whereby activities are produced that has provided the approach its purchase in systems development to date (Shapiro, 1994).

In order to satisfy our objective of developing more intuitive and intelligible means of moving between and engaging with heterogeneous virtual environments we undertook an ethnographic study of activities at a multimedia art museum, where a number of diverse electronic environments were presented to a wide variety of users. The rationale at work here was that parallels could be drawn between visitors to the museum moving from one installation to the next and on-line users of an electronic landscape travelling from one virtual world to another. Observations of this movement in

[1] See Suchman (1987); Harper *et al.* (1991); Hughes *et al.* (1992, 1993 and 1994); Kensing & Simonsen (1997); Crabtree (1998); Crabtree (to appear); Crabtree *et al.* (to appear); for example.

the real-world provided insight into the practices employed by a heterogeneous group of people in dealing with a diversity of real-world electronic environments. Insofar as the museum may treated as a proxy for a large-scale universe 'containing' different smaller environments, ethnographic studies serve to illuminate social practices whereby people navigate between, and elect to engage with, various spaces. As such, the studies served to inform the formulation of requirements providing for the interconnection of the next generation of virtual worlds.

3.1 The study: situated practices of movement between, and election to engage with, a heterogeneous collection of electronic environments

The centre for art and media technology - ZKM, Karlsruhe, Germany – is an active partner in the eSCAPE project, providing the opportunity to explore the relationship between art and technology design. The museum houses exhibitions of interactive multimedia art by local and international artists. At the time of the study (1997) there were around thirty works on show.[2] In very different ways, these works explored the properties of multimedia environments: the nature and affordances of cyberspace; the relationship between the interface and the interactivity of the installations; the role of electronic technologies in our society. All these and more are topics that were, and still are being, examined at both a conceptual and interactional level.

The installations invite visitors to interact in and with electronic spaces, making the museum an ideal candidate to study people's reactions to, and practices for managing, innovative ways of transposing familiar features of everyday life 'into' electronic environments. The majority of the works at ZKM are interactive multimedia art installations that project images onto a screen. In order to ensure the quality of this projection many of the installations are situated in an enclosed space or room. Unlike the visitor to a traditional art gallery who is face-to-face with the exhibits while being within a public space, the visitor to this museum enters a succession of small, dark enclosures in order to see the works. Importantly, through the design of the *outer 'shells'* of the rooms, some first clues *about what is 'inside'* are conveyed. Visitors use these clues as a resource in their movement through the exhibition. That is, the use of 'shell' designs as a resource in moving around the general space of the museum is a practiced use. Most effective are designs that allow people to *get a 'glimpse'* of the installation *from the outside*, as the following extract from the field notes illustrates:

> **Reconstructed fieldnote extract #1.** A man is leaning into the 'Beyond Pages' installation through a window in the wall. A couple strolling up from the left turn to face the window, and stop to peer in. He looks through the window over the man's shoulder; she glances in the direction of the entrance and sees people coming out. She turns and walks towards the entrance, followed by her partner. The man, peering in the window is joined by a friend. They watch, both leaning on the windowsill. About thirty seconds later, the couple return. They all watch the activities inside the installation through the window. Then the couple move on towards the next installation.

The couple's movement into what might be called the 'informational radius' of this installation allows them to formulate some initial impression about it. Formulating an impression is a practiced activity. In this case those practices consist of 1) 'noticing' (and being able to notice) that someone else's curiosity has been sufficiently caught to make them stay and watch for a while; that there is something here that might be interesting as indicated by other peoples interest. Over the man's shoulders, for example, the couple see a group of people gathered behind and around a table where one person is interacting with a virtual book. 2) A window, a gap in the wall, or other structural arrangements, allow people not only to 'glimpse' the content of an installation, but also establish a clear sense of its popularity, and the general character of the experience it provides. 3) Moreover, such permeable

[2] The fieldwork at ZKM was conducted by Monika Büscher and reported in the technical report *When Worlds Collide: Supporting Collaboration Across Shared Virtual Environments* (Büscher *et al.*, 1998).

structures afford the visitor an at-a-glance availability of the 'queue' inside the installation. The queuing system that regulates access to the installation is displayed to the passer-by through the position and orientation of people in and around the installation. Visitors can watch events in the installation as the 'next in line', they can be 'spectators', or they can be 'floaters' – 'peeping in', in order to decide whether they want to stay, return, or skip this installation on their tour around the museum. This queuing system, displaying the 'flow' of people through the exhibition space as a whole, furnishes part of the information visitors rely on, and look out for, in *making decisions* over where to go and what to do. Thus, in addition to being able to get a sense of what is 'within' a particular space, at-a-glance visibility of other people's activities 'around' and 'within' that space is an important resource for people's orientation in a setting that requires them to choose between different places among a string of possible events.

3.2 From social practice to systems design: supporting movement between and engagement with virtual worlds

On the basis of the study of visitors moving between exhibits and their interaction with different installations, we began to formulate potential kinds of support to aid navigation between different virtual environments, and the election to engage within any particular environment. Predicating design on the 'formal features' of the study – on the practiced use of design shells in formulating a sense of what is 'inside' the environment; of noticing (and being able to notice) the activities of others around the environment; of structural arrangements affording a glimpse of the popularity and character of the environment; and of the an at-a-glance availability of things - one of the principle technical issues we wished to consider was the need to provide a means of moving between environments that enables users understand the environments in ways compatible with their natural practices thus supporting not only consistent navigation but also decision-making. In this section of the paper we wish to outline an initial set of properties that allowed us to provide for the performance and accomplishment of this work. It should be noted that these properties are used within an environment we have developed to allow a number of worlds to be joined together (Trevor *et al.*, 1998).

The problem with generalising aspects of CVEs is the range of possible types of CVE, from 1D text to 3D worlds. Our approach to this essentially thorny issue relies on providing small and simple set of visual indicators of environmental properties. These indicators reflect different properties of the environment. They do not aim to categorise environments in any absolute sense or build some form of taxonomy but rather, aim to provide information about a particular environment in ways supporting users natural practices of moving between and electing to engage with virtual spaces and to help them learn about the CVEs they encounter. In effect, the indicators provide users with a 'rough idea' of an encountered CVE, rather than a full description, thus providing insight into the CVE from the 'outside'.

The indicators were formulated in consideration of situated practices at ZKM, and in light of the variability of the properties of the environments within the museum and existing on-line environments. They are not intended to be exhaustive but rather, aim to convey a publicly intelligible sense of the character of particular cooperative virtual environments. Each indicator has an associated scale consisting of five or less categories:

Structural indicators: These are intended to convey a clear sense of *dimensionality* - how many dimensions is the environment presented in (1D, 2D, 3D) - *orientation cues* - cues as to how users should orient themselves 'within' the CVE (is the CVE a cityscape, planet-based, etc) - and *physical*

laws - how strongly does the CVE enforce physical laws (can users collide with objects in the CVE, can they pass through them, is gravity at work, etc.).

Abstractness and urbanity: These properties aim to convey the extent to which the world represents a *facsimile* of existing physical environments or is an artificial environment of an *abstract* nature such as bibliographic record. The two complementary scales reflect differing arrangements.

Scale and complexity: This set of properties seeks to convey the character of the environment. As such, scale indicators convey a sense of *size* - how big the CVE is terms of the *scale* used internally within it (does the world represent a large country or an intimate dinning room). Associated with the issue of scale is complexity which seeks to convey how dense or complex the environment is in terms of the *density of objects* within it (is this a city crowded with many buildings or a wide-open dessert with no objects in it). Complexity is also reflected in terms of the relation to other environments by considering the *connectivity* of the environment which indicates whether or not the CVE is connected to other CVEs. Similarly, *population* – conveys how crowded the environment is and *media* – reflects what media the CVE exploit (such as text, video, audio, etc.).

Persistence indicators: This set of indicators conveys the extent to which the environment *remembers* things and is likely to change between visits, indicating whether or not the CVE *grows and evolves* and *if changes to objects are permanent* or will be *reset* the next time the user visits.

Engagement information: In addition to indicating the properties of virtual environments to users we also wish to reflect the means by which users can interact with them. We represent the manner by which users can engage with a virtual environment in terms of three different characteristics for determining interaction and presence within the space:

- *view of the environment* – how is the virtual environment displayed to the user and what control do users have of their view of the environment.
- *action point* – how do users interact with the virtual environment and how do they cause action to occur within the environment.
- *position* – where are user placed within the virtual environment how is this position reflected to them and other users.

Interactional affordances: indicate hardware/software capabilities of the devices used to present that environment to users and to allow them to interact with these environments. For example, does the environment require an immersive head mounted display and tracked glove or a more traditional desktop PC display and mouse.

In order to support natural practices of navigation and selection we need to make these properties dynamically accessible from outside any particular environment. A number of approaches are possible to presenting this information externally and certain approaches are more suited to particular environments. To address this issue we have developed an extended CVE session control model and system we have developed to support the connection of CVEs (see Trevor *et al.*, 1998 for technical detail).

Virtual environments can be visually presented to users in a variety of ways. In normal virtual environments, ‘gateways’ transport the user from one environment or world to another. This transportation is performed when the user interacts with the gateway in some fashion (clicking on it, walking through it etc.). In order to support natural practices of movement and election, and to

support learnability, we have developed 'annotated gateways' displaying indicators (thereby) furnishing users with an at-a-glance sensibility of the world on the 'other-side' of the gateway. An example of an annotated gateway to a 3D CVE displays externalised properties of the world as icons around the portal as shown in Figure 1. below.

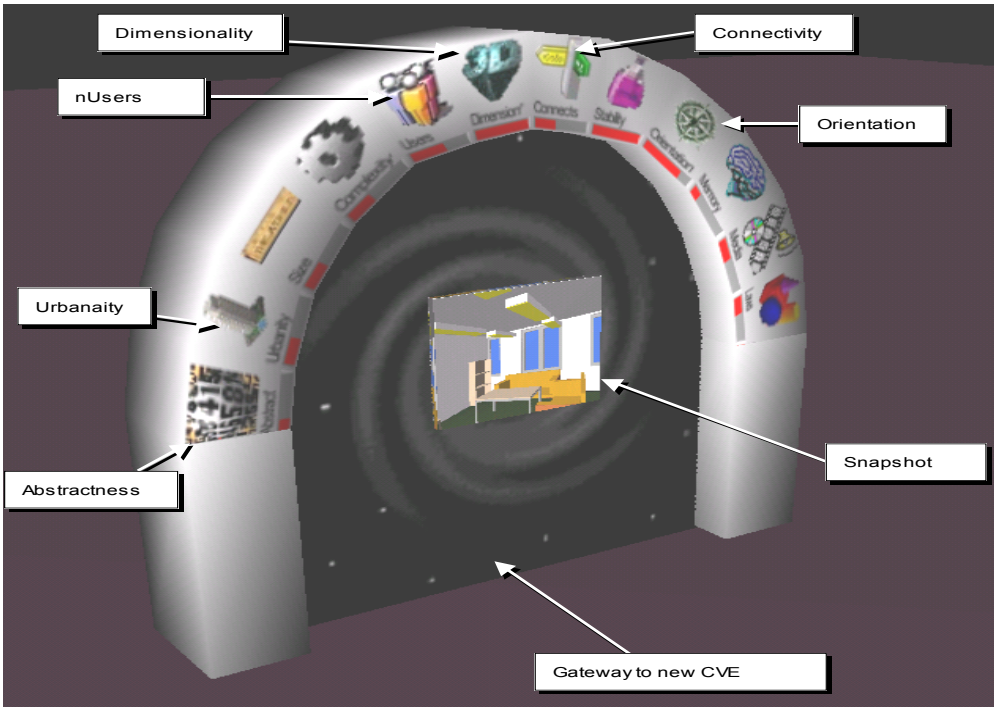

Figure 1. An annotated gateway

On viewing the annotated gateway, the relationship between embodied navigational practice and the design of virtual technologies becomes apparent. We can see, for example, that the gateway affords users a glimpse inside the virtual environment from the outside in providing an assortment of visual indicators informing the user as to the character and popularity of the environment, and we can see that the annotated gateway affords all of this at-a-glance. Thus, among other things, the indicators embedded in the gateway enable users to 'notice' that the environment is multi-user and currently populated; that it is a urban 3D world; that audio and video media are employed 'within', etc. Furthermore, the snapshot provides a structural arrangement affording users 'a glimpse inside'. Navigation and decision-making is further supported through the information furnished by the other indicators elaborating engagement information such as hardware/software requirements.

An annotated gateway may lead directly to a new CVE, or for more novice users, may lead to a more elaborate 'reality lock'. Reality locks are inhabited spaces that link CVEs together. Much like the notion of annotated portals, these can be considered as drawing directly from the use of the spaces surrounding the exhibits within the ZKM study. These locks provide access conduits that highlight and teach users travelling between two CVEs about the changes and differences between the source CVE (the one they have just left) and the destination CVE (the one they are travelling 'into'). For example, consider moving from a virtual world using a city metaphor to an environment exploiting an abstract visualisation of information. In this case the lock would attempt to show that the new CVE no longer presents a facsimile with navigational clues that mimic the real world, but instead contains large amounts of abstract data in a three dimensional space.

One reality lock is associated with each *pairing* of CVEs. For example, all users travelling from CVE *A* to CVE *B* will enter a particular reality lock, whereas all users travelling from CVE *C* to CVE *B* will enter a different one. The reason for different locks connecting to the same CVE is that users may be travelling from very different environments to reach the CVE, thus requiring very different property changes to be imparted.

The inhabitants of locks may be real-users that happen to be travelling between the same CVEs at the same time, or automatons that interact with users to provide particular information. For example, 'tourist guides' who provide information about the environment. In addition to presenting the differences between the CVEs, in an iconic form, reality locks can also provide tools which teach users useful skills in the new CVE or convey these using some form of animation. A simple example of this is an animation showing how users navigate through the environment or initiate some environment specific action. Reality locks provide the opportunity to *train* users in the use of engagement properties thus supporting the transition from potential user to user. In other words, reality locks provide the opportunity and support for users to *become* users.

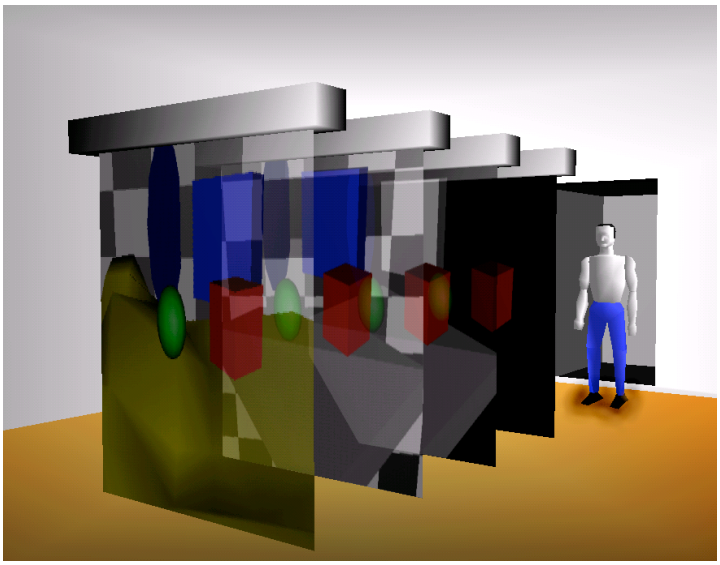

Figure 2. A simple reality lock

4. Supporting engagement: experimentation and situated evaluation

In the previous section we considered how users might experience a heterogeneous collection of environments and understand their relationship with those environments. In doing so we took it for granted that users of these environments existed and provided little indication as to the nature of these users. Rather than consider these users as having always existed, in this section we wish to focus on the means by which a general citizen might become a user of a virtual environment.

Supporting potential users in *making the transition from* potential users *to* actual users seems to us to be a primary issue in the design of electronic landscapes and the attempt to integrate emerging technologies into the myriad activities of daily life. Again, we exploit ethnographic study as an *aid to* design, this time in assuming the role of 'situated evaluation' of experimental prototypes which allow members of the public to get hands-on the future towards the end of elaborating future requirements here in the present (Grønbæk, 1991; Mogensen, 1994; Grønbæk, *et al*., 1997) and again we elucidate

the approach by practical example.[3] The example provided here is of 3D environment – the Legible City (Shaw, 1998) - exhibited at an information technologies trade show.

4.1 The study: towards an evaluation of the Legible City in public use

The Legible City was exhibited at the Information Society Technologies conference 1998 (IST '98) in a large public auditorium at the Austria Centre, Vienna, between the 30th of November and 2nd of December. To persons attending the conference, the Legible City was described by conference organisers in the official guide thus:

> *'Created in 1989, the Legible City is generally considered to be the first computer-based interactive art installation ... The Esprit eSCAPE project has developed the installation from a single to a multi-user version that can show new possibilities of visual and vocal shared experiences in an artistic virtual environment ... At IST '98 a 21" monitor is mounted on a modified exercise bicycle ... The cyclist wears headphones and a microphone ... the installation is connected .. to two other remote locations (the 'surroGate' exhibition at the ZKM Media Museum, and the V2 gallery in Rotterdam). The cyclist can explore the Legible City's virtual text formed cities, meet cyclists from the other two installations and talk to them to imprint their own text architectures on the virtual environment.'*
>
> (IST 98, *The Guide:* 130)

The Legible City was one of a number of other demonstrations in a conference exhibition and had its own demonstration area that was manned by a demonstrator responsible for showing it to passing visitors. The Legible City was invariably described by the installation's sole demonstrator in the course of interaction with visitors as an 'artwork' which 'you can ride through', 'meet people' and 'talk to others'. The demonstrator was not present at all times and visitors were, as such, left to their own devices (Murray, 1999). Insofar as the demonstrator was present, then all visitors were encouraged to *become users* of the Legible City in the same *practiced* manner.

The ethnographic study below explicates the natural practices whereby visitors became users of the Legible City. Particular attention is paid to the demonstrators' work of 'explaining' to visitors 'what's going on' as it is in *doing the work* of 'explaining' that visitors came to engage with the Legible City and (thus) became users of a novel electronic environment. The purpose of attending to natural practices of engagement is not to assess the efficacy of the Legible City in a real-world, real-time context[4] but to explicate the kinds of natural competences people ordinarily employ in getting future technologies to work in, and notably *as*, the course of *becoming* users of such technologies.

4.2 The Legible City in use

In approaching the Legible City, potential users – persons displaying a curiosity or interest in the installation, or passers-by otherwise solicited - were typically invited 'to try a bike ride'. Acceptance of the offer resulted in the visitor mounting the bike and donning the audio headset, usually without prompting, and immediately starting to pedal. From this point, the exhibitor starts to introduce the installation, explaining, as part and parcel of this description, that the installation is connected to other installations in other locations. The rider stops pedalling and treats the talk instructively as elaborating

[3] It might be noted that the notion of situated evaluation we employ here is not derived from the Scandinavian tradition of Cooperative Design practiced by Mogensen, Grønbæk, and others, although it does complement their activities and arguably goes some way to resolving the problem of involving end-users in the commercial design process (Grudin, 1991).

[4] What *measures* for efficacy? That is, in what ways could the Legible City be considered efficacious? For what purposes? By whom? To what ends? Why? Could it not be considered otherwise? A veritable confusion of tongues. We elect instead to let the artefact 'speak for itself' in details of its use – let practice be the measure and arbiter.

the character of the virtual world: that he is connected to others located in other places. From this very brief and general description, the exhibitor proceeds to show the rider the connected others. The exhibitor 'pulls up', and at the same time points out the operation for 'pulling up', the 2D installation map. Having 'pulled up' the map, the exhibitor describes the map's features: where the connected others on the map, where the rider is on the map, and which others the rider may 'interact' with. Again, the rider treats the description instructively. That is, a set of instructions providing for engagement with the world and its content:

Fieldnote extract #1.

Exhibitor: hi . would you like to try the bike ride
Potential rider: yeah (gets on bike, looks at earphones and mic.; puts them on, starts to pedal)
E: so you're basically riding through an artwork call the Legible City
Rider: OK (slows down pedalling and looks at exhibitor)
E: it was originally created in 1989 er . by Jeffrey Shaw and its . its on exhibition in the media museum at the ZKM at Karlsruhe .. and we just took the idea and created three of those installations like this .
R: (stops pedalling, looking at exhibitor)
E: and they're all connected you know .. so [inaudible] press a button and [inaudible] map (presses button and pulls up map: Figures 3)
E: you see there are other little dots here and that's yourself (pointing to dots on map, showing which dot represents the rider and others: Figures 3 & 5) . and there are other bikes just like that . there's people out there .. in this case we have only this one [inaudible] in the museum (points to other bike's representation on map: Figure 5) .. er . and you can interact with them . you can meet them in the space you know . and talk to them

Fig. 3 Pointing out the map button

Fig. 4 Pulling up the map

Fig. 5 The map (circled in red)

Further description is offered to render the installation intelligible for purposes of interacting with it and its content. The rider can meet the connected other already 'pointed out' and 'explore the world together' with that other. In preparing the rider for engagement with the installation through describing the installations workings, the rider is instructed that he may talk to the other if close to him or her, just like in the 'real world'.

The rider is then instructed to 'experiment' a little. The exhibitor takes it that he has described, and thus furnished sufficient instruction, for the rider to begin engagement with the installation and its contents. The rider starts pedalling and shortly encounters a practical problem: he can't see where he's going. That is, he can't see the way to the other. The exhibitor instructs the rider to pull up the map and describes both the rider's and connected other's location. This description 'pin-points' the two positions precisely and traces the route from the rider to the connected other. The description is a specific in-action instruction as to the maps features and their uses: this 'triangle' is you and you go in

that direction so you can meet the connected other. Such descriptions are repeated until the rider gets the point and provide for the next action necessary to successful engagement from this point. Thus, the description reads as an instruction to pull up the map to see where you are going, that you are just here and the connected other just there, and the that the way to go in order to meet the connected other is along this route from here to there (which means, in this case, that the rider must 'turn around'):

Fieldnote extract #2.
R: OK
E: and explore together the world .. so
R: so it depends if there's another one on the bike or
E: yes yes . you can also talk to each other if you're close together . just like in the real world .. meet each other before you can talk
R: OK .. and is it possible to see all the time
E: yes
R: where the other one is . er
E: yeah . you can always pull up the map
R: if you don't like the person you can avoid him . er

Fig. 6 Pointing out the rider's position on map

Fig. 7 Pointing out the other - tracing the route

The rider proceeds to follow the instructions, using the map. Constant use of the map goes against the 'spirit' of engagement from the exhibitor's point of view however. He instructs the rider to stop using the map, describing what he takes to be a competent mode of engagement: just 'go along' the streets, - which the exhibitor 'points out' very specifically. The rider proceeds to the place 'pointed out' without the aid of the map. He starts to become noticeably disorientated. The exhibitor instructs the rider to check his position using the map. The rider pulls up the map. This instruction serves to demonstrate competent use of the installation's features in the course of acting.

Achieving competent use: pointing out directions and using the map to check

The rider proceeds, using the map to 'check' where he is in relation to the other. He can see by the map that the other is close. He cannot see the other in the virtual world however. Again, the exhibitor provides further instruction, directing the rider to a specific point in space by 'pointing' it out. This is followed by a description of details providing for the accomplishment of the objective: engagement with the connected other, established by 'talking to them'. The provision of situationally relevant descriptions/instruction providing for collaborative engagement is followed through as the rider attempts to locate and meet the connected other. Description here consists in the exhibitor pointing out where to turn 'to meet' the connected other. The two riders talk briefly and then quit the installation.

4.3 The embodied performance formally considered

Analysis of the situated talk produced by parties (exhibitor and rider) in, and indeed *as*, the course of practically accomplishing engagement with the Legible City, displays members' worksite-specific practices providing for the achievement of use. Of central importance here is the temporally *sequenced* production of situationally relevant descriptions, which are understood and treated by recipients (novice users) as instructions for interacting with the virtual environment and its content. Situationally relevant descriptions are of *unique* and *methodical* character and elaborate the following phenomenon constituting the achievement of use.

1) *Doing introduction*. A precursor of use consists of the potential user being introduced to the environment and its features. Introductions are descriptive and the user treats such descriptions as elaborating the character of the environment and the kind of operations that may be performed 'within' it ('so you're basically riding through an artwork call the Legible City ... there's people out there .. and you can interact with them . you can meet them in the space you know . and talk to them').
2) *The indication of key features*. Accompanying introductions, engagement features are 'pointed out' or ostensively defined and their use described. In the case of Legible City, the demonstrator instructs the user to pull up the map in order to interact with the environment. The demonstrator demonstrates *just what* to do here, pulling up the map by pressing *this* button and describing relevant features of the map ('you see there are other little dots here and that's yourself'). Thus, the demonstrator instructs through description *and* action just how to *begin* engagement.
3) *Demonstration-by-showing-and-doing*. In real-world, real-time settings, becoming a user of novel technology observably relies, in addition to the 'pointing out' of engagement properties in and as the course of beginning engagement, on the taken for granted and reflexive method (or practice) of demonstration-by-showing-and-doing. Demonstration-by-showing-and-doing follows and accompanies the 'pointing out' of engagement features and their operations. The method displays for members doing engagement just how to 'go about' using 'pointed out' properties in accomplishing the work of the site (meeting connected others in this case). Its application enables users to 'fill in' the irremediable practical 'gaps' between instruction and action.[5] Instructions are always incomplete in and as of themselves. That incompleteness is experienced and manifest as practical troubles - '*just how* is *this* or *that* done?' Through the method of demonstration-by-showing-and-doing - that is, through instructed action *walking the user through* details of use - you [the user doing engagement] 'see' that *this* [using the 2D map to find and meet a connected other] is done like *that* [by pushing this button to pull up the map and by assessing your position by comparing the relation of your dot to the other's], for example.

The natural practice of demonstration-by-showing-and-doing is accompanied by the natural practice of emulating-demonstrated-doings. That is, of following the instructed action(s) in details of their embodied and witnessed performance. Instructions for engagement and demonstration-by-showing-

[5] See Garfinkel (1967; 1996) for a discussion and treatment of the irremediable incompleteness of instructions in practical circumstances of everyday life.

and-doing are members of what might be called a «lebenswelt pair» (Lynch, 1983).[6] Analogous to this pair is the pair «normal, natural troubles and emulating-demonstrated-doings». The first pair «instruction-instructed action» may be treated as a designers' pair. The second pair «practical trouble-following instructed action» may be treated as a users' pair. The pairs are connected in and as of practice, and practical gaps between instruction and action (thereby) bridged, through instructed action and the following of instructed action.

Insofar as instructed actions are performed for purposes of resolving practical troubles of engagement (such as achieving competent map use) then they may be, and often are, repeated until the user acquires the 'knack', competence or *skill* of doing the action.

In addition to the above, the achievement of use also relies on taken for granted knowledge of common objects. On confronting the map (be it through instruction or natural experimentation) users do not orient to the map as any map. The map is intuitively understood as a map of the Legible City and thus, without second thought, it is a map to aid navigation of *just this* place: the Legible City. Oriented to as a situational map it displays for users situationally relevant features. That is to say, that an integral feature of situational map use is that any map presented as being situationally relevant is presupposed, as a *modus operandi* and feature of its use, to display situationally relevant features. Thus, from the point of view of an engaging user, the map must (if it is not fraudulent) display features relevant to the task at-hand even though that task is not (necessarily) known. Seen as such, the 2D map displays, at-a-glance and insofar as the user knows that he or she is 'in' a city, an abstract urban layout or streetplan 'on' which the purple circles – the only outstanding features or 'marks' on the map – assume a distinct significance. Those marks are may be rendered meaningful by the demonstrator (as in the case above) or by audience members or experimental acts of interpretation in absence of the demonstrator (Murray, 1998).

The point here is not to labour map use – which is a fascinating and relevant topic to the development of electronic environments – but to draw attention to the affordances of common objects (maps, bicycles, audio headsets, etc.) and also taken for granted organisations of space as a resource to designing readily learnable and (thus) usable virtual spaces. Nowhere can the affordance of the *organisation of space* be better observed than in the very 'layout' of the Legible City itself. Although not particular visible in the video stills above, as the official description points out the Legible City is a 'text form' city. Buildings are not represented architecturally but textually – by letters and words which may be cycled *through*. Nevertheless, users undertake cycling as they would in real-time by cycling 'down' the city streets and 'around' the buildings regardless of the fact that the urban space is constituted by textual representations rather than facsimiles of real-world structures. This behaviour displays *a natural attitude* towards engagement with, and understanding of, particular spaces that may be studied under the auspices of situated evaluation and exploited in iterative design.

Engagement sequences may be similarly developed. The designers pair consists in the development of situationally relevant techniques

- Instructing users in the concrete character of the environment.
- Ostensively defining engagement features and their use.
- Walking users through the use of engagement features by the natural methods of demonstration by-showing-and-doing.

[6] It might be noted that this is a 'creative mis-reading' of the notion of a lebenswelt pair. The purpose of this mis-reading is to highlight endemic features of embodied technology usage in a way affording potential support through design.

- Iterating the specific in-action use skills required for using, and coordinating the use of, engagement features.

These 'formal features' of situated practice in accomplishing engagement are generic – applying to all *publicly available* electronic environments. Unlike in large organisations of work, ***training*** cannot be assumed in the development of virtual worlds for public use. Just how users are to become users is a significant problem to be reckoned with in the effort to develop electronic landscapes for public use then. Formal features of the sequential organisation of public engagement with existing prototypes specify usability criteria to be satisfied in future developments. Of course, the particular features of any environment that require instruction will depend on that environment. Nevertheless, appropriate engagement sequences may be developed through the construction of experimental prototypes; through making prototypes available to practical experimentation by members of the public; through the situated evaluation of experimental prototypes in public use; and through implementing and refining the designers' pair «instruction-instructed action» on the basis of situated evaluation thus incorporating into design instructive courses of training-by-doing providing for the accomplishment of engagement. This latter finding provides novel insight for us and as yet to be implemented in actual design.[7]

5. On the social organisation of space and the design of electronic landscapes

In conclusion, we have attempted to convey a sense of how the design of electronic environments may be informed by a distinct sociological perspective that pays unique attention to the social organisation of space and spatially situated activities. Conventional sociological approaches treat space as a container 'within' which activities take place. Alternately, we place emphasis on seeing space and spatial arrangements as being interwoven with, and constructed through, the performance and accomplishment of situated activities. Situated activities are ordered or organised in and through social *practices* for their production and it is to such practices that we draw particular attention in the effort to develop electronic spaces.

Examples of movement between a number of heterogeneous electronic environments in a multimedia art museum and the achievement of use of an advanced 3D interface at a trade show have been employed to elaborate the relationship between practice and space. Thus, we have seen how space and spatial arrangements are intimately and essentially tied to the practiced accomplishment of situated activities.

In explicating cases of specific developments we have also sought to show by practical example how ethnography, employed in the study of situated activities, may be used to inform the design of electronic spaces. Undertaking ethnographic study in design is not a straightforward matter and so, in addition to elaborating the nature of ethnographic inquiry and, reciprocally, what we mean by the 'social organisation of space', we have thus outlined a particular approach towards informing design. That approach recommends:

- undertaking ethnographic studies of real-world situations and settings *relevant to* design in order to develop a detailed appreciation of the social practices in and through which space is constructed.
- constructing prototypes and placing them in public settings of use so as to enable end-users to get 'hands-on' the future thereby informing design in the present.

[7] Although this may appear to be an impossible or extravagant task, we need go no further than (and for practical example) a large number of Playstation™ games to recognise that it is both a desirable and achievable task. While the adequacy of a great many engagement sequences may be questioned, the point is clear and as the evolution of the games elucidates, subject to continuous development and refinement.

- situated evaluation of experimental prototypes displaying and analysing the practices, practical problems, confusions, and solutions members employ in becoming users towards informing further iteration and refinement.

These activities are pulled together in an evolutionary process of design and bring competences from social science, computer science, and a members' expertise together in the construction of virtual environments.

References

Benedikt, M. (1992) *Cyberspace*, Cambridge, Massachusetts: MIT Press.

Benford, S. D., Bowers, J. M., Fahlén, L. E., Mariani, J. and Rodden, T. A. (1994) Supporting Cooperative Work in Virtual Environments, *The Computer Journal*, 37 (8). Oxford University Press

Benford, S., Greenhalgh, C., Snowdon, D., Bullock, A. (1997) Staging a Public Poetry Performance in a Collaborative Virtual Environment, *Proceedings of the Fifth European Conference on Computer-Supported Cooperative Work (ECSCW '97)*, 125-140, Lancaster, UK: Kluwer Academic Publishers.

Bowers, J. O'Brien, J. and Pycock, J. (1996) Talk and Embodiment in Collaborative Virtual Environments, *Proceedings of the 1996 Conference on Human Factors in Computing (CHI '96)*, 380-389, Vancouver, Canada: ACM Press.

Büscher, M., O'Brien, J., Hughes, J., Trevor, J., Rodden, T. (1998) *When Worlds Collide: Supporting Collaboration Across Shared Virtual Environments*, Lancaster University, United Kingdom: Computing Department

Contact (1999), The Contact Consortium Webpage, http://www.ccon.org/

Crabtree, A. (1998) Ethnography in Participatory Design, *Proceedings of the 1998 Participatory Design Conference (PDC 98)*, 93-105, Seattle, Washington: Computer Professionals for Social Responsibility.

Crabtree, A. (to appear) Talking Work: language-games, organisations, and computer supported cooperative work, *Computer Supported Cooperative Work: The Journal of Collaborative Computing*: Kluwer Academic Publishers.

Crabtree, A. Nichols, D., O'Brien, J., Rouncefield, M., Twidale, M. (to appear) *Ethnomethodologically Informed Ethnography and Information Systems Design*, Journal of the American Society of Information Systems, Special Issue on Qualitative Methodology

Garfinkel, H. (1967) Common sense knowledge of social structures: the documentary method in lay and professional fact finding, *Studies in Ethnomethodology*, Englewood Cliffs, New Jersey: Prentice-Hall.

Garfinkel, H. (1996) Ethnomethodology's Programme, *Social Psychology Quarterly*, 59 (1), 5-21.

Goffman, I. (1961) *Asylums*, New York: Doubleday & Co.

Grønbæk, K. (1991) *Prototyping and Active User Involvement in System Development: Towards a Cooperative Prototyping Approach*, Ph.D. Thesis, Aarhus University, Denmark: Computing Department.

Grønbæk, K., Kyng, M., Mogensen, P. (1997) Toward a Cooperative Experimental System Development Approach, *Computers and Design in Context* (eds. Kyng, M. & Mathiassen, L.), 201-238, Cambridge, Massachusetts: MIT Press.

Grudin, J. (1988) Why CSCW Applications Fail: Problems in the Design and Evaluation of Organisational Interfaces, *Proceedings of the 1988 ACM Conference on Computer Supported Cooperative Work (CSCW '88)*, 85-93, Portland, Oregon: ACM Press.

Grudin, J. (1991) Obstacles to User Involvement in Software Product Development, *International Journal of Man-Machine Studies*, vol. 3, 435-452.

Harper, R., Hughes, J.A., Shapiro, D. (1991) Harmonious Working and CSCW: Computer Technology and Air Traffic Control, *Studies in Computer Supported Cooperative Work: Theory, Practice and Design* (eds. Bowers, J. & Benford, S.), Amsterdam: North Holland.

Hemmings, T., Randall, D., Marr, L., Francis, D., Divall, C., Porter, G. (1997) Situated Knowledge and the Virtual Science and Industry Museum: Problems in the Socio-Technical Interface, *Archives and Museum Informatics*, vol. 11, 147-164.

Hughes, J., Randall, D., Shapiro, D. (1992) Faltering from Ethnography to Design, *Proceedings of the 1992 ACM Conference on Computer Supported Cooperative work (CSCW '92)*, 115-122, Toronto, Canada: ACM Press.

Hughes, J.A., Randall, D., Shapiro, D. (1993) From ethnographic record to system design: some experiences from the field, *Computer Supported Cooperative work: An International Journal*, 1 (3), 123-141.

Hughes, J., King, V., Rodden, T., Andersen, H. (1994) Moving Out of the Control Room: Ethnography in Systems Design, *Proceedings of the 1994 ACM Conference on Computer Supported Cooperative Work (CSCW '94)*, 429-439, Chapel Hill, North Carolina: ACM Press.

Hughes, J. & O'Brien, J. (1998) The Social Organisation of Space, *Presence and Representation in Multi-Media Art and Electronic Landscapes*, eSCAPE Deliverable 1.1, Esprit Long Term Research Project 25377, 5-24, Computing Department, Lancaster University, United Kingdom.

Hughes, J.A., O'Brien, J., Rouncefield, M., Tolmie, P. (1998) Some 'real' problems of 'virtual' teamwork, paper presented at the *Labour Process Conference*, Manchester, March 1998.

Hughes, J., O'Brien. J., Randall, D., Rouncefield, M., Tolmie, P. (1999) Virtual Organisations and the Customer: How 'Virtual Organisations' Deal With 'Real' Customers, *Information Systems: The Next Generation (Proceedings of UK Academy of Information Systems UKAIS '99)*, 199-209, York, England, 7th–9th April: McGraw Hill.

Kensing, F & Simonsen, J. (1997) Using Ethnography in Contextual Design, *Communications of the ACM*, 40 (7), 82-88: ACM Press.

Lee, J.R.E. & Watson, D.R. (1991) *Interim report on the use of public space in urban areas*, unpublished manuscript, Victoria University of Manchester, United Kingdom: Department of Sociology.

Lynch, M. (1983) Instructed Action and Lebenswelt Pairs, *Scientific Practice and Ordinary Action: Ethnomethodological and Social Studies of Science*, 287-299, Cambridge: Cambridge University Press.

Mogensen, P. (1994) *Challenging Practice: An Approach to Cooperative Analysis*, Ph.D. Thesis, Aarhus University, Denmark: Computing Department.

Murray, C. (1998) *Empirical Study of the Legible City*, Working Paper, Esprit Long Term Research Project 25377, Manchester University, United Kingdom: Psychology Department.

Page, D., Williams, P. & Boyd, D. (1993) *Report of the Inquiry into the London Ambulance Service*, Communications Directorate, South West Thames Regional Health Authority, London, February 1993, United Kingdom.

Park, R.E. (1926) The urban community as spatial pattern and a moral order, *The Urban Community* (ed. Burgess, E.W.), Chicago: Chicago University Press.

Shapiro, D. (1994) The Limits of Ethnography: Combining Social Science for CSCW, *Proceedings of the 1994 ACM Conference on Computer Supported Cooperative Work (CSCW 94),* 417-428, Toronto, Canada: ACM Press.

Shaw, J. (1998) The Legible City, *Presence and Representation in Multi-Media Art and Electronic Landscapes*, eSCAPE Deliverable 1.1, Esprit Long Term Research Project 25377, 59-91, ZKM, Karlsruhe, Germany.

Suchman, L. (1987) *Plans and Situated Actions: The Problem of Human-Machine Communication*, Cambridge, Cambridge University Press.

Sudnow, D. (1972) Temporal parameters of interpersonal observation, *Studies in Social Interaction*, New York: Free Press.

Tolmie, P., Hughes, J.A., Rouncefield, M., Sharrock, W. (1998) The 'Virtual' Manager? Change and continuity in managerial work, paper presented at the *Work, Employment, and Society Conference*, Cambridge, September 1998.

Trevor, J., Rodden, T., Smith, G. (1998) *Out of this world: an extensible session architecture for heterogeneous electronic landscapes*, Lancaster University, United Kingdom: Computing Department.