Re-Place-ing Space: The Roles of Place and Space in Collaborative Systems

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Abstract

Many collaborative and communicative environments use notions of "space" and spatial organisation to facilitate and structure interaction. We argue that a focus on spatial models is misplaced. Drawing on understandings from architecture and urban design, as well as from our own research findings, we highlight the critical distinction between "space" and "place". While designers use spatial models to support interaction, we show how it is actually a notion of "place" which frames interactive behaviour. This leads us to re-evaluate spatial systems, and discuss how "place", rather than "space", can support CSCW design.

Keywords: space, place, media space, virtual reality, MUDs, metaphor.

1 Introduction

We live in a three-dimensional world. The structure of the space around us moulds and guides our actions and interactions. With years of experience, we are all highly skilled at structuring and interpreting space for our individual or interactive purposes. For instance:

- The objects we work with most often are generally arranged closest to us. Computer keyboards, current documents, common reference materials and favourite pieces of music might immediately surround us in an office, while other materials are kept further away (in filing cabinets, cupboards or libraries).
- Physical spaces are structured according to uses and needs for interaction. An office door can be closed to give independence from the space outside, or left open to let us see passers-by. People's offices are more likely to be sited near to the offices of their colleagues.

Observing the way that space structures actions and interactions—the "affordances" of space [Gaver, 1992]—many designers have used spatial models and metaphors in collaborative systems. The desktop metaphor of single-user systems has been extended to a metaphor of desks, offices, hallways and cities. These systems all facilitate natural collaboration by exploiting our understandings of space—the properties of the three-dimensional world in which we live and interact every day.

In this paper, we will critically explore the use of space as a basis for CSCW design. We will argue that the critical property which designers are seeking, which we call appropriate behavioural framing, is not rooted in the properties of space at all. Instead, it is rooted in sets of mutually-held, and mutually available, cultural understandings about behaviour and action. In contrast to "space", we call this a sense of "place". Our principle is: "Space is the opportunity; place is the understood reality".

Place is a fundamental concept in architecture and urban design, and we can learn from those disciplines how to think about place in collaborative systems. Place derives from a tension between connectedness and distinction, rather than from three-dimensional structure, and we can see this at work in a variety of collaborative systems.

We will begin, in the next section, by looking at the current use of space in collaborative systems, and how it is exploited to structure interaction. Next, we will introduce the related notion of place, and compare their roles in existing systems and consequences for future designs.

2 Space in Collaborative Systems

The use of spatial metaphors and spatial organisation has become increasingly popular in a collaborative systems over the past few years. We will describe some systems, and then look at the properties they exhibit.

2.1 Spatially-based Systems

Collaborative Virtual Reality. Most demonstrably, experiments with collaborative virtual reality systems, such as DIVE [Carlsson and Hagsand, 1993] and MASSIVE [Greenhalgh and Benford, 1995], use virtual spaces to manage distributed multi-user interaction. Both of these systems use a "spatial model of interaction" [Benford and Fahlen, 1993], in which participants' awareness of each other, and opportunities for interaction, are managed through spatial extensions of their presence, attention and influence called "aura", "focus" and "nimbus". These mechanisms are designed as computational equivalents of real-world patterns of awareness and interaction in these virtual spaces. Related mechanisms extend these interactional spaces for collaborative work, such as collaborative information retrieval [Sawyer and Mariani, 1995], using spatial metaphors to visualise users in an information landscape.

MUDs. At the other end of the technology spectrum, the explosion of interest in the Internet has been accompanied by a huge increase in the popularity of MUDs and MOOs [Curtis and Nichols, 1994]; text-based (or simple graphical) interactive environments. Collaborative systems based on these technologies [e.g. Curtis et al., 1995] have also emphasised the use of "real-world" spatial metaphors to support collaboration. MUDs structure their virtual worlds into separate locations ("rooms"), and allow participants to move from location to location, selectively participating in events, activities and conversations. The spatial metaphor runs all the way through the MUD model of action and interaction.

Multimedia Communications. The same principles have also been at work in other communicative systems. Like collaborative virtual realities, these have drawn upon analogies with the spatial organisation of the everyday physical world to structure aspects of multi-user interaction. For example, the original design of the Cruiser media space system [Root, 1988] used a metaphor of "virtual hallways" as an organising principle for interaction and participation in an AV-mediated communication system. The Vrooms system at EuroPARC [Borning and Travers, 1991] used spatial proximity in an interface to control connections; and recent work on the Toronto Telepresence project has introduced multiple cameras into a single media space node to reflect the notion of different views from the office doorway or across the desk of a colleague [Buxton, forthcoming].

The basic premise which lies behind these varied uses of spatial models and metaphors is that, in collaborative settings, designers can exploit our familiarity with the spatial organisation of our everyday physical environments. In particular, they wish to exploit the ways that space structures and organises activity and interaction.

2.2 The Features of Space

There are many aspects of the "real world" which can be exploited as part of a spatial model for collaboration:

Relational orientation and reciprocity. The spatial organisation of the world is the same for all of us. "Down" is towards the center of the earth, and "up" is towards the sky; we recognise "front" and "back", and understand what that implies for our field-of-view. Our common orientation to the physical world is an invaluable resource in presenting and interpreting activity and behaviour. Since we know that the world is physically structured for others in just the same way as it is for ourselves, we can use this understanding to orient our own behaviour for other people's use. This is what lets us point to objects, or use spatial descriptions to establish reference. Referring to "the document on top of that pile" or "the person standing by the bookcase" relies on mutual spatial orientation. Reference can also depend on our shared experience of what it's like to be in a space, such as when we tell someone, "the door is on the left just as you come around the corner".

Proximity and action. In the everyday world, we act (more or less) where we are. We pick up objects that are near us, not at a distance; we talk to people around us, because our voices only travel a short distance; we carry things with us; and we get closer to things to view them clearly. Similar properties are exploited in collaborative virtual spaces. Understandings of proximity help us to relate people to activities and to each other. When we see a group of people gathered around a meeting table, we understand something about their activity, and we know that another person standing off to one side is likely to be less involved in their activity.

Partitioning. Following on from the notion of proximity and activity is a notion of partitioning. Since actions and interactions fall off with distance, so distance can be used to partition activities and the extent of interaction. MUD systems, for example, use rooms or locations to partition activity. MUD rooms provide a restricted view into the set of interactions currently in progress in the system overall.

Presence and awareness. As we move around the everyday world, it is filled not only with the artifacts, tools and representations of our work, but also with other people and with signs of their activity. The sense of other people's presence and the ongoing awareness of activity allows us to structure our own activity, seamlessly integrating communication and collaboration ongoingly and unproblematically. Similarly, spatially-organised collaborative environments present views of other people and their actions within the same environment which represents activity and holds the artifacts of work.

3 Appropriate Behavioural Framing

The real-world value of the features listed above is that they give critical cues which allow us to organise our behaviour appropriately (such as moving towards people to talk to them, or referring to objects so that others can find them). Collaborative virtual spaces exploit aspects of space (spatial mechanisms, such as providing identity, orientation, a locus for activity, and a mode of control) which can be powerful tools for the design. But these spatial metaphors carry with them some decidedly non-metaphoric aspects—spatial behaviours—that emerge from our everyday experience of the physical world.

So, what is being supported by spatial collaborative models is a way of *ongoingly managing activity* in collaborative settings. We call this *appropriate behavioural framing*. The implied rationale is that if we design collaborative systems around notions of space which mimic the spatial organisation of the real world, then we can support the emergent patterns of human behaviour and interaction which our everyday actions in the physical world exhibit. In other words, spatially-organised systems will support spatially-managed behaviours.

Our argument here is that this model is too simplistic. It needs to be examined and studied further before it can be put to use in systems design.

4 From Space to Place

The properties outlined above define the notion of "space" which we will use in this paper. Space is the structure of the world; it is the three-dimensional environment, in which objects and events occur, and in which they have relative position and direction. The properties of space are those which derive from that definition, as we showed above.

We argued that features of space have been exploited by system developers in the attempt to regain the sense of appropriate behavioural framing which we observe and encounter in the real world. However, in everyday action, this appropriate behavioural framing comes not from a sense of *space*, but from a sense of *place*. Our key principle describes the relationship between the two: *Space is the opportunity; place is the understood reality*.

So, what is place and what does it do for us?

4.1 Place and Behavioural Framing

Physically, a place is a space which is *invested with understandings* of behavioural appropriateness, cultural expectations, and so forth. We are *located* in "space", but we *act* in "place". Furthermore, "places" are spaces that are valued. The distinction is rather like that between a "house" and a "home"; a house might keep out the wind and the rain, but a home is where we live.

A conference hall and a theatre share many similar spatial features (such as lighting and orientation); and yet we rarely sing or dance when presenting conference papers, and to do so would be regarded as at least slightly odd (or would need to be explained). We wouldn't describe this behaviour as "out of space"; but it would most certainly be "out of place"; and this feeling is so strong that we might try quite hard to *interpret* a song or a dance as part of a presentation, if faced with it suddenly. It is a sense of place, not space, which makes it appropriate to dance at a Grateful Dead concert, but not at a Cambridge college high table; to be naked in the bedroom, but not in the street; and to sit at our windows, peering out, rather than at other people's windows, peering in. Place, not space, frames appropriate behaviour.

Conversely, the same location—with no changes in its spatial organisation or layout—may function as different places at different times. An office might act, at different times, as a place for contemplation, meetings, intimate conversation and sleep. So a place may be more specific than a space. A space is always what it is, but a place is how it's used.

4.2 Place is *In* Space

One reason that it can be hard to see the separation between place and space is that, in our everyday experience, places largely exist within spaces. (Later, however, we will describe some space-less places.) A place is generally a space with something added—social meaning, convention, cultural understandings about role, function and nature and so on. The sense of place transforms the space. As a space, the brick porch outside EuroPARC where smokers gather is uninviting; but it is valued as a place for relaxation and gossip. It's still a space, even though place is what matters.

Since our world is spatial and three-dimensional, notions of space pervade our everyday experience. Everything in our world is located in space, and so "place" is tied up with it too. It is part of the very metaphoric structure of our language. Tuan [1977] points out that even spatial relations are loaded with meaning, with "high" being good and "low" being bad. Lakoff and Johnson [1980] label this an "orientational metaphor" and give a long list of examples. Spatiality runs throughout our experience and our thought. Places derive much of their meaning, then, from their spatiality.

However, the sense of place is dependent on much more than simply the spatial organisation of our surroundings, and more than the three-dimensional arrangement of artefacts. Places also call up cultural understandings which help us to frame our behaviour.

4.3 Place in Social Analysis

Analysts of social action have been concerned with notions of place, and with the settings which convey cultural meaning and frame behaviour. Goffman [1959] uses a theatrical metaphor, where "frontstage" and "backstage" distinguish different modes of behaviour and action in interpersonal interaction. He points explicitly to "regions" as one of the elements which contributes to the framing of these different styles of action. However, behaviour can be framed as much by the presence of other individuals as by the location itself; in other words, the "place" is more than simply a point in space.

Giddens [1984] adopts the term "locales" to capture a similar sense of behavioural framing. Again, these are more than simply spaces; he observes, "it is usually possible to designate locales in terms of their physical properties... but it is an error to suppose that locales can be described in those terms alone." For Giddens, again, the critical feature of these settings is the way in which "features of settings are [...] used, in a routine manner, to constitute the meaningful content of interaction". In other words, what these analysts point to in human action is the how it is framed not only by spaces, but by the pattern of understandings, associations and expectations with which they are infused.

4.4 Place in the Built Environment

Place, as we have described it here, is a central concern for architects and urban designers. For example, Whyte [1988] provides detailed descriptions of the life of the street in a modern city. His comprehensive descriptions of the use of the street-side plazas highlight the issues between places which "work" and those which do not; whether or not people want to be there. Similarly, while Christopher Alexander's [1987] "patterns" ostensibly describe principles of physical design, the focus is less on the *structure* of buildings and cities, and more on the *living* which goes on in them. He comments, "Those of us who are concerned with buildings tend to forget too easily that all the life and soul of a place, all of our experiences there, depend not simply on the physical environment, but on the pattern of events which we experience there." [Alexander, 1979]

So, architects and urban designers are concerned not simply with designing three-dimensional structures (spaces), but with *places* for people to *be*. For them, the idea of place derives from a tension between *connectedness* and *distinction*.

Connectedness is the degree to which a place fits with its surroundings, maintaining a pattern in the surrounding environment (such as color, material or form)—or responding to those patterns, even if it does not maintain the patterns explicitly. It is when these relationships are broken down that we say that something is "out of place".

One measure of placeness is the degree to which a place reinforces—or even defines—the pattern of its context. But to be a place is also to be distinct from its context. How is it possible for a place to be both "part of" and "apart from" its context? The tension is addressed by defining the *distinctiveness* of a place in terms of the surrounding context— and vice versa.

This model of place, in the tension between connectedness and distinction, will turn out to be a valuable way to think about and design places in computational space as well as physical space. First, though, we will present work from media spaces, to illustrate the distinction between place and space, and to ask, how do we make spaces into places?

5 Making a Place in Media Space

We have experimented with these ideas of space and place in research over the last ten years into "media spaces" [Gaver et al., 1992; Bly et al., 1993]. Media spaces integrate audio, video and computer technology to provide a rich, malleable infrastructure for workgroup communication across time and space. This work—especially recent reports bringing a long-term perspective (e.g. Harrison et al., forthcoming; Dourish et al., in press), presented in examples below—vividly illustrate the distinction between place and space.

It's no accident that these experimental audio-video environments are called Media *Spaces*, not Media *Places*. Placeness is created and sustained by patterns of use; it's not something we can design in. On the other hand, placeness is what we want to support; we can design *for* it. Media spaces were intended to provide the structure from which placeness could arise, just as places arise out of the space around us. They were not designed as places themselves, but for people to make places in them.

To understand how this works, we need to spend some time thinking about how people turn a space into a place.

5.1 Adaptation and Appropriation

One critical element in the emergence of a sense of place and appropriate behaviour is support for *adaptation* and *appropriation* of the technology by user communities. This applies to physical places as well as technological ones. We make a house into a home by arranging it to suit our lives, and putting things there which reflect ourselves. People make places in media spaces with just the same ideas of adaptation and appropriation. Like tacking pictures to the walls, rearranging the furniture or placing personal artifacts around a room, these are the ways that people can turn a space into a place.

5.1.1 Example: Linking Public Spaces

As an example, consider the very different experiences of two seemingly similar uses of video to link public spaces, one at Xerox (reported by Olson and Bly [1991]), and one at Bellcore (reported by Fish et al. [1990]).

Both experiments linked public spaces in R&D office environments with audio and video, to foster informal communication. However, the groups had very different experiences of the successes and failures of their connections. The Bellcore researchers were disappointed with their results, concluding that "the current VideoWindow system lacks something due to factors we do not understand" [Fish et al., 1990, p.9]; the PARC researchers concluded "the media space offered something wonderful to those of us who experienced the Palo Alto-Portland link" [Bly et al., 1993, p. 45].

We believe that one critical factor contributing to the very different patterns of use is this ability to participate, adapt and appropriate. In these experiments, the differences had their roots in the technology used. The Xerox link used relatively inexpensive cameras, which were mounted on wheeled tripods. Anyone could pick them up, move them around and play with them—and many people did. On the other hand, the Bellcore system used a prototype wide-scan camera array and video projection system. The equipment was designed to simulate copresence as closely as possible, with high-quality video and audio, and life-size images. However, the result was that the forbidding equipment, complex and delicate to configure, could not be appropriated by its users. It wasn't theirs, and they could not *make* it theirs. This separation between users and technology could be seen to inhibit the community's adoption of the technology.

It is only over time, and with active participation and appropriation, that a sense of place begins to permeate these systems. The sense of place must be forged by the users; it cannot be inherent in the system itself. Space is the opportunity, and place is the understood reality. Just as space provides the underlying opportunity for a media space, place-making provides its realities.

Since the sense of place takes time to develop within a community, we look for it in studies of long-term use. A number of studies of "virtual shared offices" linked by video and audio over the long-term (periods of two or three years) point to the emergence of place-centric behaviours and characteristics [Adler and Henderson, 1994; Dourish et al., in press]. We found that new patterns of behaviour emerged, not only between the "direct" participants—those whose offices were linked by the media space—but also, critically, by others in physical or organisational proximity. We will discuss this further in our section on "Hybrid Spaces"

6 Place as a Cultural Phenomenon

We have been developing the idea of a sense of place—a communally-held sense of appropriate behaviour, and a context for engaging in and interpreting action. This is essentially a *cultural* phenomenon.

These understandings develop within cultures, and learning them is part of our assimilation and socialisation. Like new members of any culture, new arrivals in our media spaces learn the cultural norms and mores of the media space environments, as part of their enculturation into the workplaces and organisations where they are situated. These norms vary from place to place. For example, Dourish [1993] details the varying views of media space activity in different research environments, and shows how these have influenced the development of the technologies. Similarly, as cultural understandings drift, change and are forged anew, we see the sense of appropriate behaviour change as well.

One illustrative example of cultural understandings of appropriate behaviour in media spaces lies in the varying approaches which have arisen around concerns of privacy and control.

6.1 Privacy Concerns in Media Spaces

Quite rightly, much time and effort, including much of our own, has been devoted to these concerns (e.g. [Dourish, 1991]; [Bellotti and Sellen, 1993]; [Clement, 1994]). It's important to note, though, that the *solutions* to these problems, which arise *in situ* to address local concerns, are different in every setting [Dourish, 1993]. Concerns about privacy, about the balance between control and availability, and potential approaches to tackling the problems, are not absolute. They arise in a mesh of cultural, personal and organisational issues in different locations, and so we see the nature and scope of solutions vary widely to reflect this.

We don't raise this to dismiss concerns with privacy in multimedia environments—far from it—or even to classify them as purely "local" problems. Instead, we want to draw attention to the relationship between ways of acting and behaving and the patterns of cultural associations.

The kinds of ideas generally raised in discussions of privacy in media spaces are, themselves, cultural understandings. Privacy has been a major concern for critics of media space and designers of related projects. However, in general, the debate has not been conducted with a rich view of the meaning of privacy. A place-centric view emphasizes important distinctions: privacy is not the same as private events, nor is it a direct consequence of private places; and in contrast, being seen or even heard is not absolutely and inevitably public.

6.1.1 The Social Construction of Privacy

There are many dimensions to the notion of "privacy"—convenience, turf, control of embarrassment, and control of information. But let us start with the kind of privacy that most people think of first, a relatively recent invention in European cultures. Consider the bedroom. Today, we commonly think of the bedroom as a private place. We believe that the activities we associate with it should be visually and acoustically segregated from other people and other activities. The bedroom is a place of intimacy, and is emblematic of the concept of privacy.[1] This was not always so. The bedroom dates from the end of the Middle Ages when Europe was in a mini-ice age. Up until then, people ate and slept together in large groups in a single room. Then someone invented the bed. It raised bodies off the cold drafty floor and separated people from one another. Enclosing canopies were added that made tent-like rooms and created separate places for the now separated sleepers; these tent-like rooms evolved into bedrooms.

1. Lerup [1987] notes that television "soap operas" often set action in bedrooms when characters share intimate thoughts. The bedroom is an icon for the private and the personal.

It is difficult to say whether the concept that is now called privacy was an unfulfilled desire waiting for these inventions or the by-product of keeping warm and displaying status. In any case, the roots of privacy are in *physical form*, not in an abstract notion of the control of others' visual access to oneself and one's property. (Of course, this is not how we see it today.) Privacy is relative, not a set of psychological primitives. Technology (such as walls, doors or permission lists) is not the only way to create privacy, nor is it enough by itself. Social convention gives meaning to the act of visual separation. For example, the PARC Media Space is rooted in the open studio of the architectural office, a place where privacy has a different meaning and is created and used in different ways than in the closed spaces of research offices or the bedrooms of today. The RAVE media space at EuroPARC emerged with a different set of technological and organisational aesthetics, and manifests a different view of privacy again, rooted in a "service" model rather than an "open access" one [Dourish, 1993].

6.2 Cultural and Technological Structure

The identification of "placeness" as a cultural phenomenon—or, at least, one rooted in human social action—results in a critical implication for the design of collaborative systems and technologies. It shifts our focus away from the technology of place, since that technology—doors, walls and spatial distance—only gives rise to "placeness" through the way in which it is given social meaning.

Office doors in our workplaces are typically left open, but some doors carry signs to explain that they're closed to keep out noise, not visitors. The presence of these signs emphasises the relationship between technology and social cues. They reinforce the *social* meaning (availability) even in the presence of conflicting *physical* configurations (the closed door). Technological configurations of private places and quiet ones are the same; they are distinguished by social action, not spatial structure.

The relationship between space and place is social, not technological. CSCW tools and technologies create *new* social places, based on the ways in which their users ascribe new social meanings to new technological features. This observation raises important questions for design. Carrying over technological arrangements which ape the real world, such as spatial organisation, might give us a convenient shorthand for establishing shared social meaning; but is it really the most appropriate means? And, furthermore, doesn't it limit the ways in which individuals and groups can adopt and creatively appropriate the technologies to create their own new meanings?

In the next two sections, we will explore these questions in more detail. In particular, we will explore the relationship between space and place—their dependence and interaction—by looking at two complex forms of places: *space-less places* and *hybrid physical/virtual spaces*.

7 Complex Forms: Space-less Places

The distinction between "space" and "place" is perhaps most strongly demonstrated by examples of the emergence of place *without* notions of space. Earlier, we introduced the concept of place as space invested with social meaning. The spaces can be computational, as well as physical. What remains is the tension between connectedness and distinction which leads to placefulness. As our first "complex form", we present two examples in this section of placeful collaborative action without a model of physical space.

7.1 Placeful Discussion without Physical Space

One obvious source of such examples are USENET news groups and Internet mailing lists. The technology of each USENET group is exactly the same, and yet the resultant groups exhibit very different notions of place. It's not simply that they separate discussion into topics, making certain postings appropriate to one group or another; but that they also make distinctions between styles of posting. Neophyte queries may be more or less appropriate, depending on the culture of the group; so are flames. These styles are relatively independent of topic. Complaints about spelling or grammatical errors are acceptable (or even encouraged) in `alt.peeves`, but they would be inappropriate in `comp.protocols.tcp-ip`.

The different groups serve different purposes to overlapping constituencies and communities; and they exhibit different social norms. They're different places. This placeness builds upon the tension between connectedness and distinction which we raised earlier; but, critically, it emerges *without* an underlying notion of space.

7.2 Placeful Navigation without Physical Space

Dourish and Chalmers [1994] discuss various models of navigation through information, and draw distinctions between "spatial", "semantic" and "social" navigation. Social navigation is navigation through information collections on the basis of information derived from the activity of others. This is a particular case which spatially-based models aim to support [Sawyer and Mariani, 1995]; drawing on the relationship between proximity and activity discussed in section two, these systems allow users to move to areas where others are clustered, to join the crowd and see what's going on. However, as Dourish and Chalmers illustrate, similar patterns of social navigation also occur through "personal hotlists" on the World Wide Web, as well as through interest-matching systems such as Ringo/HOMR and GroupLens [Shardanand and Maes, 1995; Resnick et al., 1994]. Again, this demonstrates that place-based behaviour doesn't need space to underpin it.

The behaviours exhibited here—varieties in conversational structure, and navigation according to others' interests—are the same sorts of behaviours which spatial models try to support. However, as in the examples from our media space experiences, we find that these are not spatially-organised after all; they show people responding to *places*, not spaces.

8 Complex Forms: Hybrid Spaces

Our second complex form is the hybrids of physical and virtual space which technology can create, and the places which emerge.

When we observe the emergence of a sense of place in media space, a distinction arises between "spatial" features that the technology might provide—visual access, proximity, movement—and the place-oriented aspects of interaction which might arise there—formal and informal discussion, intimacy, a sense of ownership, and so forth.

A key feature of interactions in media spaces (or, more particularly here, interaction over *particular connections* established in media spaces) is that they take place in *hybrid spaces.* A hybrid space is one which is comprises both physical and virtual space. These tend to be less common in other related systems. For example, when my avatar enters a virtual collaborative environment, then not only is the environment (the space the system creates) virtual, but what is *projected* into that space (my avatar) is virtual too. On the other hand, in a media space, while the "space" (the connection between two people) is virtual, the *projections* are not. What I project into a media space connection is a view of me (the real me) and my office (a physical space). My actions and behaviour in my real space are visible in the media space; but in the virtual system, I act only by remotely manipulating my representation.

The reason that this distinction between projection and representation works is that the media space connection reaches out to encompass everything in front of the camera. So there's *more* in the connection than simply the "virtual space" of the two monitors. When two offices are linked together in a media space, then a *hybrid* space is created; it involves not only the virtual space of the media connection, but also the real physical space of the two offices.

8.1 Acting in Hybrid Spaces

Dourish et al. [in press] detail a range of experiences arising out of their experiences with very long-term, semi-permanent audio and video connections ("office-shares") between particular offices. Since these connections were in place for a long time—at least two years, day-in and day-out—the users could observe transformations which the connections introduced, not just in their own behaviour but, critically, in the behaviour of *other colleagues* in organisational and physical proximity too.

Two examples particularly illustrate the importance of hybrid space in these connections.

Shared Office Etiquette. In the first, two office-share participants observed a "shared office etiquette" arise amongst visitors to their offices. When someone arrived in the doorway or office of one participant to talk to him or her, they would begin their interaction by greeting not only the local participant, but also their *remote* partner, "present" across the audio and video link. In other words, visitors would behave in either office—a physical space—as if it were part of a shared office. Neither physical space was shared by two persons, but the shared place which they occupied, and which was acknowledged by visitors, was formed from the hybrid of physical and virtual space in the office-share configuration.

Seeing Out the Door. The second example involves a reconfiguration of physical space for the purposes of managing communication in the hybrid space. When one of the connections was first set up, the cameras were pointed directly at the office-sharers, so each participant could see the other and their immediate working area. However, because of the way one office was laid out, one of the cameras was placed on the end of a desk between the office's occupant and the door. As a result, the view of that office available in the media space was rather like the view into the office from the doorway. While this gave the remote participant could see local office inhabitant, it did not provide a view of the doorway, or into the space beyond which meant that the remote participant could not see people who arrived in the office, or who passed by outside. This turned out to be an important facility.

After a few months, the local inhabitant of this office voluntarily re-organised it, turning it around 180°. This allowed the remote participant to see not only of the office's occupant, but also the doorway (and people standing in it) as well as the public space outside the office. This hugely improved these vital hybrid interactions with office visitors and passers-by (raising interesting questions of ownership and control).

8.2 The Structure of Hybrid Spaces

The hybrid nature of media space connections is a critical aspect of their use. This is why, for instance, media spaces and collaborative virtual environments do fundamentally different things. Whereas I must *enter* a virtual environment (be it a 3-D rendered virtual reality, or a text-based MUD), I use the media space to create a new, hybrid space which *includes* real, physical me.

One of the curious properties of media space is that a place can be made of hybrid spaces. Two people can be what they think of as the same place (like an electronically shared office), but will not be in the same physical space, *nor even will they be the same hybrid space*. My image on your monitor does not interact with your image on my monitor, although we can say the we each of us interact with the other. Each of us is in a separate space; linked, but not shared. In this section, we will talk in more detail about the structure of hybrid spaces, and how to decompose it.

It is not only the structure of the space which we have to decompose. It's very easy to blindly talk about "audio and video" in media spaces as if they were equivalent media, performing the same sort of function. However, when we take the place-centric view—and as we have seen, it's the place-centric view which affects how people communicate and behave—then we can see that audio and video actually provide very different sorts of functions.

8.2.1 Virtual Acoustic Spaces

The critical feature of the "virtual acoustic space" which a media space can create is that it is all-pervasive. It fills the physical space in a way which an image cannot. There are two aspects to this.

First, audio reaches out to encompass the participants; not just those connected, but those around and passing through. The "open audio" aspect of the long-term media space connections described by Dourish et al. was critical to their use for just this reason, and was a highly significant contribution to what they refer to as "communal" aspects of their connection.

Second, the audio space is truly shared; we each speak and hear in the *same* audio space. The sound of my voice carries over the audio connection and invades your space; it doesn't stay in a fixed place until you attend to it. The space which the audio channel creates is one which we share.

8.2.2 Virtual Visual Spaces

In contrast, visual space is not shared, but simply *made available*. The image of my office which my camera sends out, and which is displayed on your monitor, remains my image. It carries with it the context in which it was captured, and at your end, it is framed and bounded by the monitor. You can't be in it, or walk around in it. You see me, in my space, and I see you, in yours; but neither of us sees the two of us, together, in a shared visual space.

This non-shared aspect of visual space is reflected by Gaver's [1992] "affordance" analysis of media spaces. A number of the points illustrated there (and subsequently developed in later design work [Gaver et al., 1995]) arise because it is not your space which enters mine, but your image.

The value and interesting use of media space connections which we have observed lie in the *balance* between these features—the shared nature of the audio space, the translocated nature of the visual space, and the melding of virtual and physical space which the media space affords.

We disrupt this balance at our peril. For instance, technology is available to let us digitally process the images from our cameras, and reconstruct them to make it appear that we were sitting across from each other at a virtual "conference table". We would be being presented in a shared visual space. However, this space would belong to neither of us; it would convey nothing about our current settings and actions; and would cut out anyone else who happened by in physical space. It would be a very different sort of experience. In the search for realism, the practical everyday value of interaction in the media space's hybrid space would have been lost.

9 Designing Around Space and Place

As we have gone through this discussion, a number of points have arisen which are worth collecting together as rubrics for design.

Spaces are not places. Spaces and places are different things. We can all think of lifeless spaces in our buildings and cities; spaces that "don't work", that have no sense of place[2]. Spaces are part of the material out of which places can be built. Dealing with physical structure, topology, orientation and connectedness, spaces offer opportunities and constraints. Places, on the other hand, reflect cultural and social understandings. Places can also have temporal properties; the same space can be different places at different times.

2. One reviewer commented, "Yes! The Stanford quad!"

While spaces have up and down, left and right, places have yesterday and tomorrow, good and bad.

Places, not spaces, frame appropriate behaviour. Much of the motivation for spatially-organised collaborative environments is that they can provide the cues which frame and organise appropriate social behaviour in the real world. However, that behaviour is not associated with space, but with place. A community hall might, on different evenings in a week, be used as a rock venue, a sports arena, and a place of worship. On these different occasions, it's not the structure of the *space* which frames people's behaviour, but the *place* where they find themselves.

Places have social meaning. The meanings which places carry are social meanings; they are rooted in the practices and understandings of communities. They arise over time through as practices emerge and are transformed within the groups. This has two consequences. The first is that different groups will have different understandings of similar places and similar concepts, and these will change over time. The second is that places have to be created, through practice and appropriation, to fit into the culture of the group. Placeness can be designed *for*, but it can't be designed *in*.

Different media have different spatial properties. The various media which we might use in creating collaborative environments—streams of text or graphics, high-quality 3D images, audio, video, etc.—exhibit very different properties, and these properties in turn strongly influence patterns of use, adoption and adaptation to media environments. For instance, in the case of media spaces, we illustrated how audio and video embody very different notions of "reach" and of "sharing".

Our basic principle, stated earlier, captures all of these together, and relates the distinction between place and space to our everyday experience: *Space is the opportunity; place is the understood reality*.

9.1 The Utility of Space and Place

The question we must always ask in thinking about design is not simply what *aspects* of space are being exploited in these systems, but *to what end* are they being used? By way of contrast, one significant area of research interest around spatial models in interactive systems is to visualise large bodies of information. Information visualisation techniques shift part of the information retrieval task from the cognitive to the perceptual system. Although the popularity of spatial metaphors in collaborative environments follows their popularity in single-user interactive systems, the purposes are very different. But we can still ask analogously, "What is it that is being made perceptible in collaborative spatial models?"

Place-making, then, would appear to be a complex enterprise. It reflects the *conscious arrangement* of elements to create a space that accommodates activity, and (here is the hard part) the interplay of reflective design and happenstance to give expression to the values of the occupants and their wider community. In other words, as we have observed, a space can only be made a place by its occupants. The best that the designers can do is to put the tools into their hands. Trying to do more—trying to build places—is not our job.

Let us now take a look at how this is and is not carried out in one kind of collaborative system, and how space and place interact.

9.2 MUDs: Designing with Space and Place

Through this paper, we have been talking largely in terms of media spaces. Not only are these the environments with which we are most familiar, but they have also been in use for longer than many other collaborative environments. However, it is instructive to look at another example, to see how the ideas we have been discussing apply. The example which we will look at, loosely, is MUDs.

MUDs employ a strong spatial analogy to manage multi-user interaction. Connected regions (or "rooms") serve as a filtering mechanism; my view of the activities currently in progress in the MUD is largely restricted to those activities in the same room. Different MUDs (not just different implementations, but different services, run by different people) exploit this "real-world" analogy to a greater or lesser extent; for instance, in some systems, characters can "teleport" from one room to another, whereas in others, one must walk to the destination, passing through the points in between.

However, it's a curious sense of geography which MUDs exhibit. They have topology (connectedness) but no orientation; there is generally no real notion of up, down, north, south, back and forward (except in the names of the exits which link rooms). Meantime, most MUDs have no notion of space within a room; I can't be closer to one character than another, or hide behind the sofa.

So, in fact, MUDs do *not* exhibit the spatially-based control which might seem central to them, and which is often appealed to by developers. The spatial metaphor is actually of much less value in controlling interaction, engagement and so forth than might be imagined. Where present, common MUD facilities like teleporting or inter-room messaging undermine it even more. The spatial metaphor—the connectedness of space, and the *geography* of the MUD—breaks down, and only the places remain.

Every MUD has its places—general gathering places, private places, homes, etc.—where the sense of place, established over time, within a community, is used to frame appropriate action. The inappropriate action of new, unenculturated arrivals ("clueless newbies") only serves to reinforce how much the regular characters know about their social norms. But this has almost nothing to do with the "geography" and the familiar spatial metaphor—why, if it did, then the clueless newbies should be able to work it out right away!

MUDs, like more traditional virtual reality systems, are *immersive* environments; users *enter* the MUD, and interact *in* the MUD, rather than using the MUD to link their own, physical worlds in the way that media spaces do. However, in recent experiments, researchers have added audio and video conferencing facilities to MUDs. Jupiter [Curtis et al., 1995] is a multi-media extension to a traditional text-based MUD. It retains the traditional spatial analogy of the MUD—objects and users located in rooms, which filter activity as a whole—and then adds shared graphical objects, as well as audio and video streams. Like typed text, audio and video are available on room-by-room basis; each user can see and hear others in the same room.

However, the result can be quite confusing. Following from the observations we made in section eight, Jupiter exhibits a very mixed metaphor. My virtual presence is in one of Jupiter's virtual rooms, where I share with some other users access to a virtual whiteboard and an acoustic space which extends into all of our real offices. But at the same time, I can also see representations of these people in their offices, typing at their computers. They seem to be in two places at once. The information which their video signal *projects* into the system denies the metaphor which the system is constructed to provide. Since that metaphor is what unifies and underpins all activity in the MUD, the result is confusing.

The analysis of Jupiter in supporting interaction and collaboration in a large research facility is only just beginning. However, from our own experiences, we would suggest that the mixed metaphor results in Jupiter being used much more as a media space than as a MUD, by those who have audio and video connectivity through it. The dissonance of virtual reality and multimedia representations is just too much to bear.

This reiterates a point we made earlier; that, when we think about the difference between space and place, we can see that the various media which might be involved in a communication technology play very different roles. When audio and video are added to a textual interface, the result is definitely not the same sort of system with more bandwidth. Instead, the result is a new kind of medium, and so the sorts of behaviours which people will exhibit are changed radically.

10 Conclusions

What we have pointed to here is the distinction between space and place; and this distinction has important implications for the design and evaluation of collaborative computational environments.

Spatial models are increasing popularity in the design of all sorts of collaborative environments. These designs are based on the assumption that, since many aspects of our behaviour seem to be organised around spatial elements of the everyday world, then we can carry over these patterns of behaviour to virtual environments by designing them around the same affordances for action and interaction that the everyday world exhibits—doors, windows, walls, distance, proximity or whatever.

However, we have argued that, in everyday experience and interaction, it is a sense of *place*, rather than the structure of space, which frames our behaviour. Our sense of place is a cultural or communally-held understanding of the appropriateness of styles of behaviour and interaction, which may be organised around spatial features but is, nonetheless, quite separate from them. After all, as we have seen, *non-spatial environments exhibit placeness, too*.

The placeness which operates in these non-spatial environments—and, we would argue, in spatial ones too—is an evolved set of behaviours rooted in our ability to creatively appropriate aspects of the world, to organise it, and to bend it to our needs. From this, then, we argue that it is dangerous to confuse the notions space and place. By all means, let us design interfaces based on spatial organisation and all that comes with it; but at the same time, we must be wary of claims that this will support place-based "real world" behaviours. In fact, by embedding placeness in spatial metaphors, we can accidentally undermine *the very thing that makes place work*—the shared understandings of appropriate use, and the social interpretation of cues in the physical environment. When my "virtual door" absolutely controls access to my virtual presence in a media space, then the opportunity is lost for an appropriate social interpretation of a "closed door". My ability to appropriate elements of the world and turn the into cues for availability disappears. This is the paradox of design around spatial metaphors.

After all, a virtual world filled with virtual offices and virtual desks isn't populated by virtual people, but by real ones. Drawing contrasts and analogies between, for example, media spaces and the "real world" is unhelpful, because media spaces *are* the real world. Their inhabitants are real people, engaged in real interactions in the course of doing their real work. And, as such, they will engage in the very real *creation* of forms of activity and work, just as they do in their everyday physical environments. This is what it's critical to design for; and this is what is lost when we fail to support the duality of space and place.

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