## Configuring Action in Objects: From Mutual Space to Media Space

Christian Heath [a]
[a] King's College London.

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# Configuring Action in Objects: From Mutual Space to Media Space

Christian Heath and Jon Hindmarsh
*King's College London*

It has long been recognized that the material environment is an essential feature of the organization of social action and interaction. It is only recently, however, that we have witnessed a burgeoning body of empirical studies, from within both the social and cognitive sciences, that has begun to delineate the ways in which objects are socially constructed and feature in social relations and activities. Despite this growing interest in the object in social life, there remains a paucity of research concerned with how objects are reflexively constituted in and through social interaction. In this article, we consider how aspects of the material environment are rendered momentarily intelligible in and through interaction and the ways in which objects provide a resource for the recognition of the actions and activities of others. We examine interaction in both conventional working environments and new experimental spaces created through advanced telecommunication and communication technologies to reveal the ways in which the sense and significance of social actions and activities are embedded in, and inseparable from, the local ecology.

In doing sociology, lay and professional, every reference to the "real world," even where the reference is to physical or biological events, is a reference to the organised activities of everyday life. (Garfinkel, 1967, p. vii)

And since the organism and environment determine each other and are mutually dependent for their existence, it follows that the life-process, to be adequately understood, must be considered in terms of their interrelations. (Mead, 1934, p. 130)

## INTRODUCTION

In recent years, we have witnessed a growing body of research concerned with the object and the ways in which the material environment features in human action and perception. These developments have emerged in various disciplines and fields within the social, cognitive, and computer sciences and reflect a wide diversity of analytic commitments and substantive concerns. They have been driven by theoretical debates, conceptual innovations, and empirical findings, which powerfully expose the disembodied character of social action conventionally found in the human sci-

Requests for reprints should be sent to Christian Heath, Work, Interaction and Technology Research Group, The Management Centre, King's College, University of London, London SE1 8WA, GREAT BRITAIN. E-mail: christian.heath@kcl.ac.uk

ences (see, e.g., Callon & Latour, 1992; Clarke & Fujimura, 1992; Latour, 1988; Lynch & Woolgar, 1990; MacKenzie & Wajcman, 1985). They have also arisen in the light of the rapid development of information and communication technologies, tools, and artifacts that provide new ways of capturing, presenting, connecting, and re-embodying material realities (see, e.g., Benford, Greenhalgh, & Lloyd, 1997; Dourish & Bly, 1992; Finn, Sellen, & Wilbur, 1997; Gaver, Sellen, Heath, & Luff, 1993). Despite the richness and variety of these developments, we still have relatively little understanding of the ways in which objects, be they highly complex representations or simple artifacts, feature in social interaction, that is in the talk and bodily conduct of individuals in their dealings with each other.

In this article we wish to consider the ways in which objects and other aspects of the material environment are momentarily and reflexively constituted within social interaction. In the course of the discussion, we examine two interrelated issues that are of relevance to our understanding of the ways in which actions and activities are embodied in, and simultaneously embed in, their immediate physical environment. On the one hand, we address how individuals momentarily make reference and mutually orient to some aspect of the local environment, thereby giving some-"thing" its momentary significance and intelligibility. On the other hand, we consider how occasioned properties of the environment provide resources through which participants make sense of each other's actions and activities. In a sense, therefore, we are interested in how participants themselves constitute material realities as both "topic and resource" in the developing course of their action and interaction. In this way, we hope to reveal how the sense and significance of particular objects are inseparable from the environment in which they are located and the specific courses of action in which they figure.

The fragments discussed in the article are drawn from video recordings of social action and interaction within various environments. In the first part of the article, we discuss fragments drawn from more conventional work settings and in particular the line control rooms of London Underground. The thrust of the observations is to demonstrate ways in which participants rely on, and mutually constitute, properties of the immediate setting in the course of particular actions and activities. In the second part of the article, we consider a very different environment—an experimental "media space" in which two offices are connected through multiple cameras and monitors providing participants with access to each other, artifacts such as documents, and more broadly the offices themselves. Media spaces are cutting-edge developments concerned with providing remote participants with the ability to engage in (object-focused) collaborative work. Taking one example, we reveal the ways in which this particular media space fragments ecology and action and thereby undermines the ordinary ways in which participants configure and invoke objects and the material environment. While focusing on the details of interaction within these very different environments, we share an aim with much research on the object, that is, to demonstrate that social action and interaction are inextricably embedded within the material setting.

Before discussing a number of fragments, it is perhaps worthwhile to mention one or two additional issues that bear upon our current research and more generally studies of the material environment. In recent years, we have witnessed the emergence of a growing body of empirical research concerned with work, interaction, and technology. This corpus of research, commonly known as workplace studies, is one, among a variety of developments, that has helped place the object, in particular technical artifacts, at the heart of the analytic agenda for both sociology and cognitive science (see, e.g., Goodwin & Goodwin, 1996; Harper & Hughes, 1993; Heath & Luff, 1996, 2000; Hughes et al., 1988; Hutchins, 1995; Suchman, 1996; Whalen, 1995; Zimmerman,

1992). This body of research, primarily naturalistic studies of work in complex organizational environments, is beginning to provide the resources through which we can reconsider and respecify more traditional understandings of human–computer interaction and in particular reveal the ways in which technologies are embedded in, and dependent upon, socially organized practices and procedures. We hope that this article contributes to such studies and more generally our understanding of human–computer interaction. In particular, we wish to demonstrate the ways in which individuals rely upon socially organized practice and reasoning with which to notice, look at, consider, see, and interpret information presented on screens and electronic displays and how these "noticings" and "observations" emerge within the real-time interaction of participants.

Activity theory, as inspired by Vygotsky, also has a long-standing concern with the material aspects of social life. Studies in activity theory have been directed at an exploration of the relations between material artifacts, everyday practices, language, social systems, and cultures. Indeed, the recent application of activity theory to topics and issues in human–computer interaction and computer-supported cooperative work have focused on the use and development of new technologies while promoting their conceptualization within broader social systems of coordination and communication (e.g., Bodker, 1991; Engeström, 1993; Kuutti & Arvonen, 1992).

The observations discussed in this article also bear upon a related body of technical and social science research. The emergence of new computational and communication technologies has given rise to a range of complex systems designed to support real-time collaborative work among individuals located in different physical environments. Videotelephony and videoconferencing are the early precursors to these developments, innovations that include telepresence, media space, and collaborative virtual realities. Alongside these technical innovations, we have witnessed the emergence of a range of empirical studies in both the social and the cognitive sciences concerned with the characteristics of "interaction mediated through new technologies" (see, e.g., Finn et al., 1997). Although such studies have provided a rich body of findings concerning new and changing forms of interpersonal communication, they have not as yet explored how the dislocation of action from a common habitat can undermine the ability of interactants to produce and coordinate their conduct. This article therefore reflects on how a consideration of the ways in which individuals refer to and embed objects in action in conventional environments may provide some insights into problems that could emerge in more futuristic, virtual environments.

The analysis begins by examining how participants can encourage each other to examine the environment to look for a specific object and, on finding it, reveal its location. It then considers how actions may be entailed in objects, such that a participant responds to the environment rather than the action of the other. We go on to consider how individuals may have a coparticipant notice something they themselves have noticed and the ways in which the physical environment can provide resources for interpreting a colleague's conduct. Finally, we examine how a particular type of media space, known as Multiple Target Television, can undermine collaborative activity by fragmenting the action from its environment.

## OBJECTS IN THE WORKPLACE

Because a number of the fragments are drawn from a particular setting, namely the Bakerloo Line Control Room, it might be helpful to introduce the environment and highlight some of the features that lend themselves to the study of objects in action. The Bakerloo Line Control Room is a com-

plex multimedia environment that includes a range of technologies such as closed-circuit television (CCTV) screens, digital line displays, touch-screen telephones, and input monitors, and running the whole length of the room is a fixed line diagram showing the position of the all the trains running up and down the Bakerloo Line between Elephant and Castle in the south to Queen's Park in the north.

Therefore the objects in question are primarily textual information screens, diagrammatic displays, and CCTV images. The diagrams show, in various ways, sections of the line and the location of particular trains. They can show different sections of the line or different representations of the same section. So, for example, whereas the fixed line diagram provides an overall view of the line, the screens display more detailed diagrams of particular sections, including the actual numbers of individual trains. The CCTV screens provide views of platforms, including both passengers and trains in each station. Views are selected, and only one view of one platform can be provided at any one time. In consequence, one can look at various representations of the "same thing," such as a station. The immediate environment therefore consists of various objects, a number of which provide representations of phenomena (trains, passengers, signals, stations) that lie outside the control room.

In the course of the discussion, the data to which we refer are transcripts, diagrams, and pictures based on video recordings of work and interaction in these various settings. In each of the settings, we undertook extensive fieldwork and video recording; the material discussed here is, of course, extracted from a tiny fraction of the data we collected.

The setting involves close, ongoing collaboration between various personnel who are responsible for the day-to-day running of the line and developing a coordinated response to the problems and emergencies that inevitably arise in the operation of a rapid urban transport network. The personnel are seated at two consoles (see Figure 1). At the one console is the line controller and a colleague know as
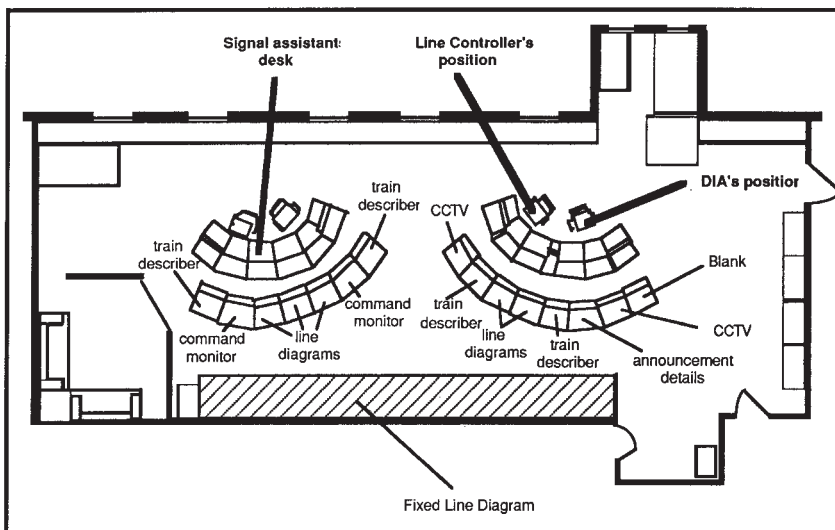


FIGURE 1    The Bakerloo Line Control Room London Underground.

the divisional information assistant (DIA), who is principally responsible for providing information for passengers. At the other, are seated the two signal assistants, who oversee the operation of the computerized signaling system and who reschedule trains and crews when the occasion demands.

These sort of work sites have some very interesting features with regard to the relation between action, objects, and the local environment, and it is perhaps worth mentioning one or two that may be relevant to the discussion. Although information that is presented on screens and diagrams vary according to the changing circumstances, particular types of information are associated with particular sources. So, for example, the CCTV screens on the line controller's console can only be used to provide images of station platforms; also, on the fixed line diagram, the position of stations in relation to each other does not vary. Moreover, it should be added that the personnel largely remains in specific locations within the control room itself and tools and information displays are seen as "belonging" to certain individuals. There is, therefore, a certain ecological stability that allows experienced participants to know where colleagues are looking and, on occasion, what they might be looking at. So, for example, it is possible to tell which station a colleague may be looking at when he or she is looking at the fixed line diagram.

Secondly, information on particular monitors, or the use of particular tools in the domain, is often associated by personnel with certain activities. For example, the input signaling monitor and keypad are routinely used to reschedule trains when the vehicles are out of timetabled order. Or, for example, although the CCTV may be used for various sorts of purposes, they are routinely referred to prior to delivery of public announcements to a station. There is, therefore, an interesting relation among certain sorts of activities and particular sources of information or tools within the domain, and this relation can be oriented to and exploited by colleagues in making sense of each other's actions. None of this is to suggest that the interpretation that participants make of each of other's conduct within the domain is independent of the developing activities in which they are engaged, but rather that they can exploit the relative stability of the environment and its relation to certain sorts of actions and activities.

In considering the ways in which participants render aspects of the local environment visible to each other in the course of their work, we consider various sorts of activities from searching for something, to pointing out mistakes, to making jokes and revealing problems. In considering these sorts of activities, we begin by examining occasions in which one participant explicitly characterizes the object to be found within the local environment and end by addressing occasions in which one participant simply encourages a colleague to notice something that he or she has noticed. In this way, we hope to provide a sense of the delicacy with which individuals who are working together are sensitive to each other's orientation to the environment of objects and its implications for action and interaction in the workplace.

## SEARCHING TOGETHER

Within the control room, personnel often receive calls from remote colleagues requesting information. This information can often be provided without recourse to any visible information source. At other times, however, personnel must search through the array of technologies and documents to answer the query. The technologies and documents present images, text, numbers, diagrams, and the like—objects that themselves are "representations" of trains, crews, sections of line, and the

like. On such occasions, participants explicitly orientate to particular aspects of the local environment and, in various ways, objects feature in action.

Consider the following fragment drawn from the signal desk, in which John (J) receives a phone call asking him where a train, Number 225, is currently positioned.

Fragment 1

    J:  Hello there.
        (3.2)
    J:  Two Two <u>Fi:</u>ve:: Let me have a look for it.
        (0.4)
    J:  <u>Two</u> <u>Two</u> <u>Fi:ve:::</u>? (.) He's around here somewhere
    G:  Two Two Five:s at er: (0.6) It's up there?
        (0.3)
    J:  Oh he's in the <u>shed</u><he's in Queen's Park (.) *hh <u>Sou:th</u> Sheds:.
        (1.2)
    J:  Indeed he is:.
        (1.2)
    J:  Okay then?
        (.)
    J:  Thank you:

The utterance of particular interest is John's turn, "<u>Two</u> <u>Two</u> <u>Fi:ve:::</u>? (.) He's around somewhere. " Although the utterance is spoken into the handset, John simultaneously looks at various screens along the console. The first part of the utterance is emphasized, (hence the underling), and the word "five" is stretched (indicated by the colons) and has a rising intonation (represented by the question mark). Following a brief gap "(.)" of roughly 0.1 sec, John continues with "he's around here somewhere." During the utterance, John turns and looks at the monitor to the left of Graham (G; see Image ii), a monitor that shows the timing of the trains over the section of line for which Graham is responsible (south of Piccadilly Circus).

Fragment 1: Images i–iii

G                          J

(0.4)

i

J:  <u>Two Two Fi:ve:::?</u> (.)

ii



J:  He's around here somewhere

iii

As John turns toward the monitor to his left, Graham follows his gaze and they look at the screen together. So John has not only encouraged Graham to help him look for something that moments ago was not explicitly relevant, but encouraged him to look at and momentarily inspect the information on a specific screen, in a certain way. As John turns away, failing to find the train and uttering the word "around," Graham continues the search by first looking at the fixed line diagram and then at the monitor directly in front of John. Uttering "Two Two Five:s at er: (0.6) It's up there," Graham points to the image on the screen directly in front of John and at which John is now looking:

<u>Fragment 1: Image iv</u>

G                         J



G:  It's up there?

iv

John responds with "Oh he's in the shed<he's in Queen's Park (.) *hh Sou:th Sheds:.". So John finds the object in question, Train 225, by virtue of Graham's search and point. He informs the caller where the train is and simultaneously displays to Graham that he has both found the object and located its "exact" position.

John's original turn that elicits Graham's help in the search not only establishes how the object might, if found, be presented to John, namely revealed rather than simply informed, but also sets the very parameters of the search itself. The utterance identifies the object to be found, and the accompanying inspection of the monitor and scan of the console specifies the domains in which the object may be located. This turns out to be wrong, and in fact the train is right under John's nose, but all the same, Graham initially organizes his search with regard to John's looking. By pointing to the object and having John look at it and display he has seen it, and seen such that he can answer the question, the participants momentarily and collaboratively constitute the sense of particular feature of their local environment: the location of a particular train presented on a visual display unit.

The object itself, the details displayed on the screen, is perceived at that moment in a particular way; it gains its determinate sense or intelligibility within the activity at hand and, in particular, the search for the train in question. The caller, and the query he raises, provides resources to John with which to inspect the local milieu, and, in turn, John encourages Graham's participation. The actual location of the train on the railway, as portrayed in various ways on displays and monitors, is unknown at the beginning of the search; indeed, how the train might be portrayed, even represented, in part is dependent on the where it is actually found. John's initial turn and accompanying bodily orientation provides the resources through which Graham constitutes a range of potentially relevant features of the local milieu, ranging from the train listen monitor to his side, through to the fixed line diagram, and finally the diagrammatic monitor showing Queen's Park.

The scene is shaped, rendered intelligible, with regard to the resources provided by John and the sequentially appropriate activity, discovering and displaying the position of the train in question.

The sense of the scene, and the mutual recognition of the object in question, is momentarily established and forms the basis of subsequent action and activity. Graham's search for and discovery of the train is itself responsive to John's preceding actions—the point encourages John to look at a particular feature on the monitor and display appropriate recognition to his coparticipant. Simultaneously, its mutual discovery and constitution provides the resources to enable John to give the sequentially relevant response to the caller, that is, a description of where the train is currently located. We can, therefore, begin to see how the local environment, and a particular object momentarily, "mediates" the interaction and is itself constituted through that interaction. Successive features of the environment are made visible by virtue of the resources provided by John, and the position of the train is mutually and interactionally discovered and constituted. More generally, discovering and seeing the object, or rather constituting one aspect of the physical environment in a particular way, engenders sequentially relevant actions by both John, Graham, and presumably at some later date, by the caller himself.

The activity of responding to the query and of searching for the location of the train informs the way in which the workplace environment is discerned. In other words, the search provides for the realm of relevancies with which the two participants inspect, make sense of, and "respond to" successive features of the environment. These aspects of the environment, screen displays and diagrams, are reflexively produced and rendered intelligible in terms of the ongoing search. Although the participants confront the scene as a physical reality, which constrains where and

how they look, their actions and interaction constitute that physical reality in a particular way. The object that forms the focus of the search, and which is discovered and mutually recognized, is produced and rendered intelligible within the interaction.

Furthermore, the object in question, the position of a particular train as displayed on a monitor, gains its determinate sense with regard to its location within the surrounding collection of objects and artifacts. Its sense is constituted in part through its relation to other potential sources of information. As successive features of the environment are inspected, they are in turn "ignored" until the relevant information is discovered on a particular screen. The image appearing on that screen, and its relation to other displays, informs how the query will be answered. The search involves discriminating a range of potentially relevant sources of information in the control room and, through a series of lookings, discovering the object in question: the section of a diagrammatic and textual display revealing the location of train '225.' The object provides the solution to the search and the basis for answering the caller's query. It is the answer to a puzzle, a puzzle that is part of the practicalities of dealing with traffic management on London Underground.

## EMBODYING ACTION IN AN OBJECT

Within Fragment 1, the object is characterized prior to its discovery. The participants know what they are looking for—the 225—but need to find where it is within the local terrain of information. However, an object may stand in a rather different relation with regard to the actions of particular individuals. In other instances, for example, individuals encourage a coparticipant to look at an object. In doing so, they give a "flavor" of what the object is and how it might be responded to. In this way, an individual may embody an action in the object itself.

Consider the following fragment. It is drawn from a different work setting, namely the control center of a provincial police station. On the afternoon we join the action, the center is staffed by two police officers, Debi (D) and Susan (S). Debi and Susan are seated alongside each other typing. As she types, Debi notices something and bursts out laughing. "*thhhthhhhh" captures a lengthy in-breath through the teeth, which in this case is part of her displaying but withholding her laughter. Moments later, Susan also begins to laugh, marked by "*hhhhh."

Fragment 2

```
    Debi and Susan are typing
    :
• D:  Heh heh
    (1.2)
  S:  What you doing now::?
  D:                    *heh
    (0.3)
  D:  *thhhthhhhh
    (1.3)
  D:  *heh heh
    (0.6)
  D:  I meant to put a han::dle: *hhh
```

```
          (3.2)
  • S:  *hhhhhh
          (0.4)
 (D):  (*hhh)
          (1.2)
    S:  *hh hhhh
    D:       he heh
          (0.6)
    D:  Heh
```

As she bursts out laughing, Debi doubles up and looks at her monitor, as if overwhelmed by the joke that she has noticed on screen (see Image i). Although her outburst is not addressed to Susan, it serves to invite her colleague to find out what's made her double up in laughter. Moreover, the outburst not only gives a flavor as to what it is that Debi's noticed, namely it is funny, but also as to where the humorous thing is located, namely on the screen.

Fragment 2: Images i and ii

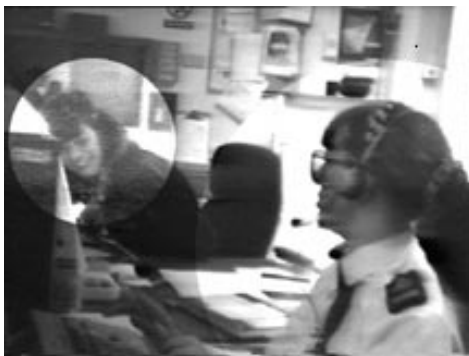D                          S



D:  Heh heh
    (1.2)

i



S:  What you doing now:::?

ii

The actions successfully elicit an inquiry, "What you doing now::?" and as Susan turns toward her colleague she finds Debi with her face on the screen smiling and laughing. As Susan speaks, Debi

turns and looks at her monitor and then swivels it toward Susan to enable Susan to see for herself just what so tickled Debi. As Susan turns toward the swiveled monitor, Debi points to the relevant line of text and says, "I meant to put a <u>han</u>::<u>dle</u>: *hhh."

So rather than tell Susan what she has found, Debi encourages her colleague to see the joke for herself. Her original outburst, bodily conduct, and subsequent description not only give a sense of what the object is (something funny), but also pinpoint where it may found (in the text on Debi's screen). She provides the resources through which the object can be found and perceived.

It takes some time for Susan to find the object in question, and by the time she begins to laugh, Debi is almost doubled up in excitement. Susan's response is beautifully designed. She bursts out laughing and points to the object; thereby producing the sequentially appropriate response. The response displays both her discovery and her appreciation of the joke. Debi's original outburst, her "uncontrollable" laughter at the mistake that she made, not only encourages Susan to find out what has happened, but provides the resources through which she eventually discovers the source of the joke.

The fragment reveals how individuals may distinguish between describing an object from having a coparticipant experience the object for themselves. Rather than inform Susan of the mistake she made, Debi provides her colleague with resources to discover the object and to experience the joke for herself. It is as if the error in the text is intrinsically funny, an object that, in its own right, would serve to engender laughter from the participants. As we have seen, however, Debi goes to some trouble not only to encourage Susan to abandon the activity in which she is engaged and look at the materials on her screen, but to provide her with the resources with which to see (constitute) the object in the relevant way. Through the ways in which it is revealed, Susan experiences the joke and produces a sequentially appropriate response, namely laughter. The success of the joke hinges on the ability of Susan to find for herself what is funny about the object that she confronts. Indeed, she must find the joke almost independently of the ways in which it has been revealed.

The object therefore achieves a momentary visibility and significance it would not otherwise have. It gains a certain interactional relevance or sequential import. Susan laughs at the mistake that Debi has made. Debi presents her computer screen such that Susan encounters the object almost independently. The very ways in which Susan is led to perceive and experience what she sees serves to cast sequential import into a physical feature of the local environment. It is as if Susan's experience and response is engendered by the object itself rather than the ways it has been constituted by her colleague. Indeed, her laughter does not seem responsive to Debi, or even the way in which Debi has portrayed the object, but rather to the intrinsic qualities of the object itself (the mistake in the text). The object itself, or rather the error in the text, is constituted as essentially or intrinsically funny and engenders their laughter and enjoyment. The object and its perception is separated or fragmented from the very ways in which it is rendered noticeable, and thereby stands before the participants as an "objective order of social fact." They respond to the particular feature of the local milieu as if it is independent of their actions and the interaction. Yet, in doing so, they simultaneously and actively constitute that feature.

## RENDERING AN OBJECT "NOTICEABLE"

In the fragments discussed so far, one participant builds a characterization of an object. The characterization may consist of a train number or something funny. The characterization informs the ways in which the environment is inspected by the coparticipant and how the particular object is

discovered. It also informs how the coparticipant experiences and subsequently deals with the object. The precharacterization projects what the object may consist of, where within the local environment it may be found, and how it should be responded to or dealt with. The sense of the object and the ways in which it is constituted turns on the way in which it is introduced, invoked, and precharacterized (c.f. Goodwin, 1996, on "prospective indexicals").

Even in Fragment 2, as Debi's outburst encourages Susan to discover and experience the joke for herself, she nevertheless sets the ways in which it should be treated, namely as a joke. On some occasions, however, one participant may wish to have another notice something within the local environment without characterizing either what the object is or how it should it be perceived. One individual may simply attempt to render something "visible" without providing the coparticipant with a sense of what it is or why he or she should look at it. In rendering an object noticeable in this way, an individual invites a coparticipant to discover for him or herself why it has been drawn to his or her attention, to provide an account as to the potential relevance of the object to the here and now. It is for the coparticipant therefore to discover, retrospectively, why the object might have been brought to his or her attention. It is interesting, phenomenologically, in that an individual is encouraged to search the world for something that is unknown to him or her as he or she undertakes the search, but obvious once he or she has found (produced) it.

Having people discover an object for themselves not only allows coparticipants to experience an object "raw" or "uncontaminated," so to speak, but also provides an opportunity for someone to point something out without committing him or herself to a particular characterization, or claim to the relevance, of the object in question. It allows individuals to almost conceal that it is they who have had you notice something. So, for example, if it turns out to be unimportant or irrelevant, then they are not seen as foolish or to blame. It also, in workplace environments, allows individuals, for example, to subtly bring to the attention of their superiors things that the superiors themselves should have noticed and have been dealing with. And of course more generally, we find an example of the way in which individuals can keep an eye out on the world with regard to the interests of their fellows and delicately bring to their attention events that may be of relevance to their interests, responsibilities, and activities (cf. Sacks, 1992).

The following fragment is a long and complex piece drawn from a moment in the life of the Bakerloo Line Control Room. We join the action as one of the Underground staff (Vic [V]), who is visiting the control room is telling the controller (C), a story about the then Minister of Transport turning up to a function rather the worse for wear, or "pissed" (a colloquialism for "drunk"). In the course of the story, the DIA appears to notice a potential problem emerging at Waterloo that the controller might have to deal with, but is reluctant to interrupt the story-telling. He tries to bring the problem to the controller's attention without interrupting the tale or committing himself as to whether there is indeed a problem.

Fragment 3

   V: Carrying on the <u>st</u>ory wer (.) with the three p: (.) <u>th:r</u>ee
   V: (part most of the to ner), four <u>par:t</u>
•                   ((Ding Dong))
      (0.8)

• V:  <u>Vic</u>toria Line at Ri<u>ck</u>mansworth, (0.6) on Mon:day <u>nigh</u>:t^
       (0.4)
  V:  an he:(r): like (.) The Minister of Transport <*Lipton (it is) turns <u>up</u>^ (0.5) at er::
       (0.4)
• V:  Rickmonsworth to see the: (0.6) the Waterloo <u>Tr</u>ain,
       (0.8)
  V:  they've fin<u>ish</u>ed there: >then immediately go back to
       Claphham hehhhhhsss heh heh
  C:                              they <u>finis</u>hed on frhhom
       therheh <u>he</u> <u>h</u> heh
  V:                 (*heh heh)
• C:                         Bril<u>liant</u>
  V:  (That was)
  C:  Brilliant
       (0.2)
  V:  He <u>really</u> was <u>pissed</u>.
       (1.8)
• C:  That Thirty <u>Thr</u>ee at Waterloo?
       (0.6)
 DIA: Yeh.=
  C:  =He's (time:) >no he's tight
 DIA: Fif<u>teen</u>::^
  C:  Yeah

The controller is physically orientated toward Vic, who is standing to the rear of the console. The DIA is facing forwards, looking at the timetable. As Vic tells his tale, the doorbell suddenly rings and momentarily interrupts the story. The DIA looks up at the fixed line diagram, resets his CCTV monitor to Waterloo (see Image i), and as the image emerges, turns to the controller (see Image ii) and then immediately back to the monitor (see Image iii).

<u>Fragment 3: Images i–iii</u>

           V         C       DIA

i

V: <u>Vic</u>toria Line a Ri<u>ck</u>mans-
workth, (0.6)

V:  on Mon:day nigh:t^

ii



V:  (0.4) an he: (r) : like (.)

iii



The selection of the image by the DIA, and his shift of gaze to the other and then the monitor, encourages the controller to look at the screen (just noticeable on Image iii). The DIA's actions appear to point to the screen and encourage his coparticipant to inspect the scene for a potentially relevant event. So, the DIA's actions momentarily render a particular feature of the local environment of potential significance to the other. The controller looks at the screen for a couple of moments, and then, either because he is unable to see anything of any importance or simply due to Vic's continuing tale, he returns his gaze to the speaker.

A little later, Vic once again pauses, delaying the words "the Waterloo train." The DIA seems to exploit the break in the story. He once again turns to the controller, then to the CCTV monitor.

The DIA's shifts in orientation once again encourage the controller to turn from Vic and look at the screen with his colleague. The break within the developing course of the story provides the DIA with the opportunity of rendering a particular object within the local milieu noticeable; the DIA's glance to the controller and then the monitor encourages his colleague to inspect the very same scene as the DIA. As Vic continues the story and utters "Waterloo train," both the controller and the DIA are looking at the same image; curiously the image on the screen is a train at Waterloo station.

It looks, therefore, as if the DIA encourages the controller to look at, and notice, a particular object within the local environment. The object in question is a CCTV picture of a platform; itself a representation of part of an environment that lies beyond the walls of the control room.

Why the image or the domain is brought to the controller's attention is not available within the ways in which it is pointed out. Indeed what "it" is and why he should be looking at it is unknown

to the controller. It may be the case that there is no need at all for the controller to look at the image, and yet then, within the confines and enjoyment of a story, he finds himself orienting to an image, one image among many displayed in this highly complex environment, trying to find a reason as to why he should be looking at it.

The controller decides to exit from his conversation with Vic and find out whether difficulties are emerging at Waterloo, the scene that he has been encouraged to look at on the monitor.

His response to the story, "Brilliant Brilliant," is nicely designed to display his appreciation, while simultaneously allowing him to step out of the conversation with the visitor. As he utters his appreciation, he turns away from Vic and re-orientates bodily toward the console. As he re-orientates, he turns first to the CCTV monitor and then the fixed line diagram, looking in the area of Waterloo, and utters, "That Thirty Three at Waterloo?" The query is designed to discover more about what may happening at Waterloo and in particular which train it is that is standing at the platform.

As the controller helps bring the story to completion, therefore, he is already sensitive to the possibility of a problem in the running of the service and where that problem might be. In consequence, as he exits from the story, he initiates a sequence through which he attempts to identify the train at Waterloo and then goes on to make various changes to the running times and numbers of a series of trains. His inquiry to determine the number of the train derives from the ways in which some aspect of the immediate environment has been rendered noticeable and potentially accountable by the DIA. In making his inquires, the controller does not know what the problem is, or even whether there are definitely difficulties arising with the service, just that a colleague appears to have noticed "something" at a particular location on the Underground. Rendering something noticeable appears to make it potentially problematic and worthy of further inquiry. In a very different vein, Sacks (1972) makes a similar point:

> For Western Societies at least, being noticeable and being deviant seem intimately related. The notion that one is suspect whose appearance is such that he stands out, have the deepest foundations. Indeed, in Judeo-Christian mythology, human history proper begins with the awareness of Adam and Eve, that they are observable. The next bit of social information thereupon we learn is: to be observable is to be embarrassable. (pp. 280–282)

Whether the DIA knows what the problems is, or whether he is simply sensitive to something not being quite right at Waterloo, is unclear. However, as Vic delivers the story, the DIA exploits potentially vulnerable breaks within that story, namely an interruption and later a pause, to produce and display particular actions. Although the actions in which the DIA engages do not disrupt or interfere with the continued production of the story, they serve to display to the recipient of the tale, the controller, that something may be noticeable. In particular, in resetting the CCTV monitor, and in turn glancing at the fixed line diagram, the controller, and then to the screen, the DIA displays that he himself has noticed something happening at Waterloo and that it may be relevant to the controller. The DIA's actions render a feature within the local environment, noticeable, worthy of attention, and by re-orientating to and from the controller, displays that whatever is on the monitor may be of interest to his colleague.

The DIA's actions exploit the controller's ability to notice conduct outside the direct line of his regard. Even though the controller is oriented toward the story's teller, Vic, and is participating as a recipient of the tale in the course of its production, he is sensitive to the DIA's actions and the ways in which those actions are tailored not only to allow the DIA to look at the monitor, but are

simultaneously designed to display those lookings to the controller himself. It is, of course, the display of looking, rather than simply the looking, that renders the DIA's actions and the focus of those actions relevant to the controller. Moreover, it is not simply that the controller is peripherally aware or sensitive to the movements of the DIA, but rather he is able to embed the DIA's conduct within the local environment of objects and artifacts. The DIA's looking is used as a vehicle for the controller to locate a potentially relevant object (the image on the screen) within the local environment, just as the image on the screen provides a resource for assembling the sense of the DIA's look.

Unlike some of the earlier fragments, in the case at hand, no precharacterization concerning the nature or even the locale of the object is provided. The controller is not told what he should be looking for, the reasons he should be looking for it, or even the exact feature at which he should be looking. The resources through which the controller is able to establish mutual orientation with his coparticipant consist of no more than the DIA resetting a monitor and then looking at that screen and the fixed line diagram. Sequentially they emerge within an activity in which they have little bearing. Therefore, although certain resources suggest the general domain of scrutiny, not only a solution but the problem itself has to be discovered by the controller. As he turns to look at the screen that has been brought to his attention, his looking is instructed merely by the fact that something is noticeable and of (potential) relevance to him. Indeed, as he turns, the extent to which the image might engender further action is yet to be determined. So, unlike the earlier fragments in which some next action (answering a query, appreciating a joke, etc.) is embedded in the object, in this instance, the controller himself must determine the relevance of the screen image. He has to decide what to do, having seen the screen. In this case, the sight of the screen image leads the controller to ask for further information about the identity of the train depicted on the screen. Therefore, the meanings of the image on the screen are embedded prospectively in what will turn to be relevant or not. The DIA's actions prefigure their own characterization and the activity in which they may eventually be seen to have initiated. They simply rely upon the controller's ability to notice a noticing and his interest in developing an account as to why a colleague might have noticed that object.

## OBJECTS AND "VIRTUAL" ACTION

> Now it is a basic axiom of any interpretation of the common world and its objects that these various co-existing systems of co-ordinates can be transformed one into the other; I take it for granted, and I assume my fellow-man does the same, that I and my fellow-man would have typically the same experiences of the common world if we changed places, thus transforming my Here into his, and his – now to me a There – into mine. (Schutz, 1962, pp. 315–316)

In various ways, we can begin to see how participants momentarily constitute particular features of the local environment and how such features can gain a certain significance within their activities. The character of these "physical" properties of the local environment is interactionally determined, then and there, in the dealings between the participants and within the developing course of their conduct. It is not simply therefore that something is looked at, but rather by rendering the object relevant, the participants give some feature of their local environment, even if it is itself a window on a milieu outside the domain, a particular significance and meaning. The production of the object, its mutual constitution, is also relevant to the participants' subsequent conduct in various implicating

actions and even activities. The environment, therefore, is not simply the product of the participants' actions, but itself gives sense and relevance to their conduct and the activities in which they are engaged or are about to be engaged. There is, if you like, an embeddedness, a congruence between the environment and the action; the conduct of the participants reflexively constitute the momentary sense and significance of (some aspect of) the local environment, whereas the environment (as constituted) gives sense and significance to the participants' actions. This reflexivity between action and object is critical to production and intelligibility of the participants' conduct.

With the growing interest in developing technologies to support collaborative work among physically remote individuals, the implications of the observations discussed previously may go beyond a sociology of the object. For example, even if we consider basic videotelephony and videoconferencing, we can begin to consider how the interconnectedness of action, object, and local milieu may generate some interesting problems and issues. For instance, if one provides the participants with access to each other, is it necessary to provide access to the objects that the participants might ordinarily rely on when working together. If this type of access is provided, the question is how can you guarantee that the participants can see the object in mutually compatible ways (for the practical purposes at hand).

These sorts of issues informed a series of experiments we recently conducted at Rank Xerox Research Laboratories in Cambridge. The experiments, known as MTV I and II, were designed to provide individuals based in different physical locations with the ability to speak and see each other and to see each others' local environment. The system was designed to enhance, in an experimental setting, the sorts of access that more basic telecommunications technologies can currently provide (see Gaver et al., 1993; Heath, Luff, & Sellen, 1995; and for related studies Dourish, Adler, Bellotti, & Henderson, 1996; Dourish & Bly, 1992; Heath & Luff, 1992). It is merely one example of a burgeoning body of research being undertaken both in Europe and elsewhere concerned with "media space" (computational and video infrastructures that provide support for distributed working). Rather than merely providing a head-and-shoulders view of a remote coparticipant, numerous images of the other were made available in MTV II: a conventional head-and-shoulders view; an "in-context" view of the other in their room; and a desktop view, showing the document or model being worked on. Figure 2 provides a sense of the links and access between the two offices in which we experimented with the system.
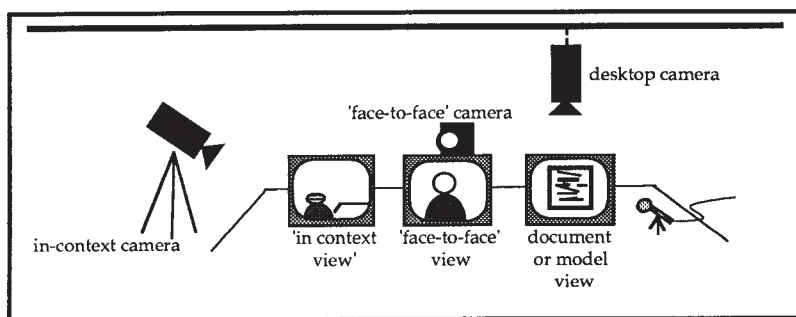


FIGURE 2    MTV II Experiment.

We organized a series "naturalistic" experiments where participants were assigned various collaborative tasks that required reference to objects located within their respective environments. It may be worth briefly considering a fragment taken from one of those experiments where two participants were asked to arrange the furniture in a model room, which was located in only one of their offices. In the extract, Kathy (K) attempts to point to the position in which David (D) should place the speakers in the model room. The model containing the furniture is located on David's desk and is visible to Kathy on both her desktop and in-context monitors.

<u>Fragment 4</u>

D:  So: (.) the speakers need to go (0.5) s:(ome) s:<u>ome</u>where: like tha::(t)=
K:  =yeah I would suggest the one on top of the fireplace actually comes down to this:::
      (0.7)
K:  the corner.
      (.)
K:  Actually you can't see where I'm pointing can you *hhh

To show David where he should place the speakers, Kathy points at the corner of the model room as it is shown on her desktop monitor. As she says, "suggest the one on top," her finger points at the model, dropping down to the corner of the screen as if indicating that the speaker should be removed from the fireplace and placed on the floor. She continues to point at the screen throughout the utterance, recycling the pointing emphasis in the gesture with the words "this" and "the corner." She only begins to withdraw the gesture as she begins to utter, "Actually you can't see where I'm pointing."

The coparticipant, David, can see the gesture, though he appears unable to discern where Kathy is pointing. The gesture appears on two of his monitors, and the model at which it is pointing is placed before him on his desk. For David, the difficulty is that although he can both hear and see Kathy, and knows presumably that Kathy is referring to the model, he cannot see the gesture with regard to the object at which it is directed. The best view he has of the gesture is provided on his desktop-view monitor, which shows Kathy reaching across to point. However, as Image iii shows, the target of the pointing gesture (the model room) cannot be recovered from that image:

<u>Fragment 4: Images i–iii</u>



i                                ii                                iii

**Kathy points at one of the monitors on her desk (Image i), which depicts the model under discussion (Image ii). However, the scene available on David's "desktop-view" monitor (Image iii), depicts Kathy's pointing gesture in isolation from the image at which she is pointing.**

His view of the model, as it sits before him, is not simply different from Kathy's, but rather dislocated from his view of her. In other words, David is not simply unable see the world in the way in which Kathy sees the world, but more important, cannot reassemble his view of the model with his view of Kathy and her gesture. The fragmentation of the views undermines David's ability to assemble the actions of the reference and the referent itself.

The fragment also reveals a second, perhaps more interesting, problem. Kathy is able to see David, she knows that the model is located on his desk, and she is aware of the views that he has of her. Despite this, she points to the model displayed on her monitor. She presupposes that David can see her pointing to a location in the model, a model that is actually sitting on his desk. Moreover, in the face of receiving no acknowledgement from David, she recycles the gesture, continuing to assume that it and its referent are mutually visible. It is perhaps only as she begins to describe, rather than show, where he should position the speaker, uttering "the corner," that she begins to realize that David cannot make sense of her actions. For some reason, therefore, the participants assume that if they can see it, their coparticipant can see it in the same way; they presuppose a "reciprocity of perspective" (Schutz, 1962). They design actions that presuppose that the other can see what they can see in roughly the way that they can see it. They assume not only that can they be seen, but that their coparticipant is able to use his or her visual and bodily orientation to determine the character and location of features and objects within their respective environments.

Although the system provides individuals with variable visual access to each other's domain, we found that it failed to support the sorts of mutual reference and pointing that is fundamental to many of the activities discussed earlier. In particular, it was found that though the system provided each individual with views of the other and their respective domains, the fragmentation of the images undermined the participants' ability to find what the other was pointing at and how it was relevant to the activity at hand. Indeed, the system also raised troubles for the people doing the pointing. They were unable to see whether their coparticipant was actually looking at the object at which they were pointing. The separation of the physical environment and the person across a number of screens undermined the individual's ordinary abilities to embed the action of the other within the material milieu in which it occurred. So although the experimental systems provided a relevant set of views, the fragmentation of the scenes undermined the social and interactional relation between action and environment.

In a sense, therefore, the problem derived not so much from what the other could see and could not see, but rather from the ways in which the technology undermined an individual's ability to embed action within specific features of its local material environment.

For the purposes at hand, such technological environments reveal some interesting aspects of the ways in which individuals in copresent interaction rely upon access to each other within their local physical environment. The problem with this and other forms of advanced technologies to support distributed collaborative working is that they allow individuals to assume congruent access to each other while undermining their ordinary abilities to establish mutual orientation. Indeed, they give an individual the sense of shared access to the other's local domain while simultaneously corrupting that access. In particular, by providing limited and fragmented images of the respective domains, the systems fragment the other, and the actions of the other, from the local physical environment in which those actions are embedded.

It also seems that participants find it difficult to reassemble the occasioned relation between action and the local milieu, so that the disembodied character of the participants' conduct undermines the sense and sequential import of particular actions and activities. For example, the

seemingly trivial inability of participants to assess the gaze and bodily orientation of the other with regard to the other's environment, let alone one's own milieu, removes a critical element of the resources through which the participants can momentarily establish the interactional relevance of some object or artifact. And of course, more delicate ways in which a coparticipant can render aspects of his or her local environment visible in the course of, or to initiate, activity simply pass unnoticed. Curiously, however, such systems appear to mislead the users, encouraging them to assume that they have access to each other and their respective environments, only to discover in the course of interaction that their coparticipant is unable to disambiguate their conduct. A cruel media indeed.

## DISCUSSION

An important influence on the growing body of research in both the social and cognitive sciences has been the emergence of new technologies and in particular the computer. In cognitive science, for example, the growing interest in distributed cognition, situated reasoning, and the like has arisen, in part, in the light of the burgeoning critique of human–computer interaction, artificial Intelligence, and its reliance on plan-based, goal-oriented models of human conduct (see, for example, Suchman, 1987). Over the past decade, we have witnessed the emergence of a wide range of research that has attempted to respecify the relations or interaction among human beings, tools, texts, and technologies, and in particular attempted to delineate the cognitive practices through which tools, ranging from the banal to the complex, provide representations of the world and a foundation to action. Although sociology has been less concerned than the "new wave" cognitive science with the indigenous use of technologies in practical situations, nonetheless, through the sociology of scientific knowledge and parallel developments in the sociology of technical systems, a growing body of research has emerged that reveals the ways in which objects and artifacts, tools and technologies, gain their significance by virtue of social organizations that delimit their meaning(s), relevance, and significance.

In one sense, this article and related workplace studies (see, e.g., Goodwin & Goodwin, 1996; Heath & Luff, 1996; Suchman, 1996; Whalen, 1995) can be seen as an attempt to interweave the growing concerns in these very different disciplines, on the one hand to place the indigenous use of objects and artifacts, tools and technologies, and the local physical environment at the forefront of the analytic agenda and on the other to delineate the ways in which their production and intelligibility are dependent on and embedded in social action and social organization.

The materials discussed here point perhaps to a more radical and distinctive sociological treatment of the relation betweem objects, including tools and technologies, the environment, and action. They suggest that in the course of particular actions and activities, participants may orientate to a range of features within the local milieu, and the arrangement and interconnection of these objects is an integral aspect of the organization of the participants' conduct. They also suggest that aspects of the immediate environment, for example information and images on computer screens, gain their sense and intelligibility in and through the ways in which they feature in interaction between the participants; interaction that is emergent, accomplished, and unavoidably in flux. The sense or intelligibility of an image on a screen or whatever is assembled by the participants at particular moments in the developing course of the interaction; its significance is bound to the moment of action in and through which it occurs. The screens of information do not provide an

overarching influence on the conduct of the participants or preserve a stable sense or meaning through time and space, but rather are embedded in, and inseparable from, the action and activity in which they arise. The participants do not attribute meaning to a preexistent environment or interpret the scene at hand (although this may indeed occur); rather in the course of their action and interaction, they reflexively produce their surrounding material world.

In a number of the instances discussed in this article, the actual object constituted by the participants becomes explicitly relevant when one of the individuals initiates a course of action. For example, in Fragment 1, a signalman not only searches for a particular phenomenon, the indication of a train on one of the screens, but invites his colleague to help him find that object. In the course of the search, the participants discriminate the scene with regard to the practical problem at hand, the location of the 225, and thereby reflexively constitute the sense of various objects and images. During the course of their very looking, the participants do not simply shift the focus of their attention, but rather, in searching for the object in question, render aspects of the scene both relevant and intelligible. The object, the section of the diagram indicating the location of the 225, stands to the participants as a feature of the local milieu, as an "objective order of fact" with which there can be little debate. And yet, the discovery of the 225, its particular sense or meaning, is embedded in and inseparable from the ways in which the participants have inspected (constituted) the scene and established a mutual orientation toward a particular feature of the environment.

Furthermore, action is embedded in objects in various ways. So, for example, in Fragment 2, we can see how a participant casts sequential import into an object. She encourages her colleague not only to notice something that hitherto was unavailable, but to react to the object in a particular way, as something to be enjoyed as a joke. In this way, the coparticipant is able to experience the object as a joke firsthand, and the object itself seems to engender the appropriate response. Both the discovery of the object and the action it engenders are accomplished in and through the ways in which the line of text is pointed out to the other. The exclamation and the pointing project a relevant sequence of actions by the coparticipant: to discover the object (in a particular way) and to produce the sequentially appropriate response. In this, and many other ways, features of the local environment are rendered momentarily visible and are given a significance within the action that they would not otherwise have.

The examples also reveal how the local environment provides a resource for making sense of the actions of other individuals. So, for example, in Fragment 1, the signal man shifts his gaze across various displays. The sorts of information they embody provides a resource for his coparticipant to make sense of these actions. Both the (inferred) focus of the signalman's gaze, coupled with the order in which he inspects the environment, enables his colleague to embed the talk and recognize that he is engaged in a search. In a similar manner, in Fragment 2, seeing her colleague looking at the screen allows the police constable to recognize just what it is that the other has seen and why she might be laughing. In Fragment 3, one participant has another notice something within the local milieu and render a particular aspect of a scene, a train arriving in a station, visible. Moreover, seeing the other notice that object allows the DIA to render intelligible the controller's glances and subsequent query. Therefore, the actions of individuals are firmly embedded in, and, more crucially, made sense of, with regard to their position in the local physical environment.

In the 1950s, Schutz (1996) discussed the communicative problems that might arise with the emergence of new technologies such as the telephone and television. He argued that such media

introduce limited and asymmetrical access to the vocal and visual conduct of the participants to the interaction, and in so doing may undermine their ability to establish or maintain a reciprocity of perspective, which for Schutz is central to the accomplishment of intelligible social action and interaction. In the materials at hand, we can begin to see how the issues that arise with certain forms of new technologies although they may occasion difficulties in presupposing and preserving a reciprocity of perspective, undermine social action in ways unanticipated by Schutz. They reveal in dramatic form how participants rely upon their abilities to make reference to and invoke features of their local environment, and how, as a matter of course, they presuppose and maintain a reciprocity of perspective. At its most simple, individuals are confronted with the realization that what they have seen may not necessarily be visible to others, and if it is visible, it is not necessarily visible in a mutually compatible way.

But the problem is not simply one of reference and establishing a mutual orientation toward relevant features of the local milieu. Rather, the very ways in which actions are embodied in, or related to, objects within the respective milieus are undermined by the technology so that, for example, the sense of a gesture or utterance can be misconstrued. Participants are unable to use features of the other's environment to read their actions, just they are unable to satisfactorily refer to objects within their own domain. It is the disconnection between action, object, and environment that renders media space and the like such curious and unrewarding domains in which to conduct collaborative activities.

Although all human action and interaction occurs within some surrounding physical environment, the task perhaps for sociology and cognate disciplines is to delineate the ways in which material realities feature in, and are relevant to, particular courses of action. There has been a tendency, at least in sociology to think of the immediate physical environment as a framework in which conduct occurs, and even more recent developments in cognitive science have preserved the idea that physical realities provide a preexistent "domain" that is represented and transformed through human reasoning. In this article we hoped to show how the sense and intelligibility of objects within the local milieu arises within the course of particular actions and activities, and their meaning and relevance does not remain stable through time and space; indeed the character of an object and its significance to an activity can transform within the emerging course of single action, such as a turn at talk (see also Goodwin, 1994).

In this light, it is interesting to note that for the sorts of domains addressed in this article, namely co-located workplaces, the material environment is invoked and rendered relevant and intelligible in and through interaction; it gains its sense and significance with regard to the collaborative conduct of the participants in concert with each other. As one examines such domains, it becomes increasingly clear that to separate language, bodily conduct, and interaction from the physical environment, or vice versa, for analytic purposes can be problematic, because the very production and intelligibility of social actions and activities is embedded in and simultaneously constitutes material features of the local milieu. In attempting to reconceive objects as integral features of mundane action and interaction, it may be the case that we not only begin to throw light on the reflexive properties of human conduct and its ability to produce the very realities that it confronts, but to rethink how we might understand the role of tools and technologies in work organizations. It may provide an opportunity for developing a sociology of the artifact and technology that takes human interaction seriously and begins to reveal how complex systems in the "new institutions" are dependent upon social organized practice and interaction.

## ACKNOWLEDGMENTS

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