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Adding interaction analysis to the user research portfolio

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Abstract

One practical consequence of turning from cognitive to social theories of computer use is an increased propensity to use and benefit from new methods of user research which are sensitive to the social and interactional dimensions of human computer interaction. In this paper I suggest that existing methods of user research might be supplemented with Interaction Analysis (IA) which provides information on the sequential organisation of technologically and socially mediated activity. This argument is illustrated with reference to an ongoing requirements study of interpersonal communication at work, using IA within an applied industrial setting.

1. Introduction

A large number of methods are now used routinely in the research of user behaviour, needs and reactions in the development of interactive computer systems. They tend to be used at different stages of the system development cycle, as shown in Figure 1. In this paper I would like to argue for the addition of another method to this research portfolio, in the area of requirements engineering (see again Figure 1). I will refer to this method as Interaction Analysis (IA) and indicate some of the practical problems and benefits of using it within an industrial context.

The paper begins with a definition of IA and a set of reasons suggesting why it is a useful compliment to other methods of user reasearch. It then describes the practicalities involved in its application with reference to an ongoing study of interpersonal communication at work. The possibility of extending the approach to naturalistic system evaluations is discussed in the concluding section.

2. Interaction Analysis

Interaction Analysis is an emerging method of analysing videorecordings of naturally occuring talk and activity. As a field it is new. It has no agreed definition, no established training courses and no track record of application within the computer industry. Rather it is comprised of a small number of practitioners who share a common interest in the dynamic and interactive dimensions of cognition and action and a common approach to collecting and analysing video-based records of interactive activity. Very recently, Jordan, Henderson and Tatar (1993) have offered a characterisation of the field which I will draw on to describe elements of the method I have been using in my own work and wish to promote in this paper.

The current emergence of IA within the human sciences is part and parcel of another trend in the computer industry for interface research and development to reach out through the interface towards the work setting (Bodker 1991, Grudin 1990). For example, Grudin shows that the focus of interface development has moved from the hardware in the 1950s, to the programming task in the '60s and '70s, to the terminal and the dialogue in the '70s and '80s, and now towards the work setting in the 1990s. The convergence of communication and computing technology may partly underlie this trend which also appears to be bringing together work in Human Computer Interaction and Computer Supported Cooperative Work. There is now growing appreciation of the fact that individual computer use is embedded in social and material settings which not only affect its usability and usefulness but also substantially determine what kinds of things users will buy and how they will use them together. IA is part of this movement insofar as its underlying assumption is that "knowledge and action are situated in particular social and material ecologies", (Jordan et al), and as many of its practitioners have begun to study the use of technology in social settings (e.g. Suchman 1991, Luff, Heath & Greatbatch 1992, Goodwin & Goodwin 1992).

The way in which IA is practiced owes most to its roots within conversation analysis. Stretches of naturally occurring talk and activity are recorded and at least partially transcribed to allow the analyst to examine how various sequences unfold, turn by turn, during the episode (c.f Sacks 1984). The aim of the analysis is to uncover, describe and ultimately explain

something of the order and organisation by which people interpret and interact with each other and with the things around them. A key resource for the analyst in this process is the so called proof procedure utilised by participants in the interaction. The proof procedure refers to the way each turn in an interaction serves as a display, or proof, of understanding of the prior speaker's talk or activity. Each local display of understanding gives the participants themselves a way of checking, and if necessary correcting, the effect of their behaviour on the other parties, and the analyst a way of monitoring the participants' developing interpretations of the situation without explicitly asking them. Within conversation analysis, attention to this micro-organisation of actions and their interpretations by recipients has led to a range of findings on the fine structure of mainly verbal interactions (Drew 1992). Interaction analysis can be seen as an extension of conversation analysis to examine visual as well as verbal conduct in technologically rich settings in order to understand the influence of other things as well as people on personal and interpersonal behaviour.

3. Reasons for using Interaction Analysis in system development

The main reason for using IA in system development is that it has the potential to overcome a range of problems and difficulties inherent in other methods.

Consider again the current methods used to study work practice shown in Figure 1. Traditionally, ethnographic fieldwork has involved real-time observation, in-depth interviewing and the collection of documentary materials but not extensive videorecording of work practices. Such work can yield only approximate characterisations of interactional practices and will be over-reliant upon participants reported, rather than actual, reasoning and behaviour. In fact all methods which rely exclusively on what people say about what they do and why they do it are vulnerable to the problems of people producing post hoc rationalisations of actions, forgetting or incorrectly estimating aspects of behaviour, expressing ineffective attitudes, and generally lacking insight into the tacit procedures underlying much of their activity. These include all forms of interview surveys, focus groups and questionnaires. Methods of logging the use of equipment or the nature of activities engaged in over time begin to address these problems but give no indication of the reasons underlying events nor of the sequential development of individual events themselves.

Similar problems are to be found in the methods used to refine designs and study their effects in the use of designed artefacts. For example, interviews, questionnaires and focus groups are used extensively in early market research to ascertain the needs of potential users and their likely reactions to future products. These methods are subject to the shortcomings mentioned above. Simulations and prototypes of new products presented to users in controlled settings give only limited feedback into the usability and utility of the proposed system, by virtue of separating users from their ordinary working environment and ignoring the connections between the proposed system and all the other 'systems' being used. Conceptual evaluations of designs and devices are particularly suspect, because they tend to deal with idealised interactions which bear no relation to the details of actual interactions in real-world settings.

Thus the strength of IA is that it deals with the actual details of technologically mediated interactions and allows technology developers to see exactly how existing technology fits (or doesn't fit) into current working practice. IA also exposes the practical reasoning activities of

participant's themselves in a way which avoids them having to remember, justify or even know what they did. This effectively indicates how people think and make sense of technology they are using, moment by moment, in the performance of some task.

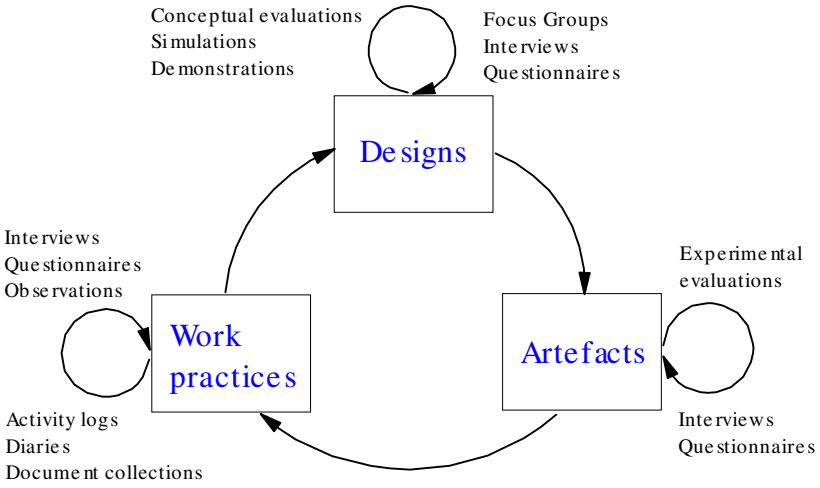

Figure 1. User studies in the system development cycle

However, like all the other methods IA has its own limitations. It can only deliver findings on problems with current work practice and technology. These cannot be taken at face value to predict reactions to future technology as some attitudinal data often are. Predictions can be made regarding opportunities for new computer support but these are made as statements of faith based on the creative interpretation of present-day problems in relation to technological capabilities. In addition, IA is extremely time-consuming to do and can only really be carried out on small numbers of people. This means that it is unsuitable for providing quick answers to very specific design questions and for assessing the needs and behaviours of diverse groups of people. In this last respect the generality of its findings may need to be established by other means.

Overall, there is a strong case for using a range of user research methods in any system development enterprise and for adding IA to this collection to compliment rather than replace any of the existing methods. At Hewlett-Packard Laboratories Bristol this is exactly what I am trying to do in the context of a naturalistic study of interpersonal communication at work. The study is intended to supplement other work on office work practice collected through interview and questionnaire surveys, and to feed into the design of new office technology within the company. In the rest of this paper I report on my experiences to date in applying IA within this study to illustrate some of the practicalities of realising the potential of the method in an applied industrial context.

4. A case study in applied Inteaction Analysis: Communication at work

4.1. Introduction

I am currently engaged in a video-based study of long-term communication behaviour. This involves shadowing a small number of mobile professionals for about a week each, in order to record as much as possible of their written and spoken communication behaviour. Large amounts of video, audio and other sequential data are being collected and analysed in order to understand the organisation and limitations of present day practices and identify opportunities for future support.

The study is therefore exploratory in character and valuable precisely because it might yield surprising findings not originally looked for at its outset. However, the very unpredictability of exploration makes it difficult to justify and exploit in settings where research 'findings' must be applied to pressing practical problems. What is required is a way of controlling exploratory data collection and analysis so as to maximise the chances of discovering relevant and useful things.

4.2. Methods

Here are some of the ways in which I have sought to control the framework or style of exploration in the study. Many of these seem to reflect general patterns of activity in the conduct of Interaction Analysis.

(i) Framing the research issues
Perhaps the most important form of control over exploratoration is the act of selecting the territory. To some extent this decision is easier to make in an applied context where initial research questions often suggest themselves. Hewlett-Packard produces personal computer products (among other things) and has a natural need to know about user requirements in this area. We would currently like to know more about natural patterns of interpersonal communication at work. So in this case the initial research questions are quite general ones like how often do people interact with each other atwork?, what forms of interaction do they use?, how are the interactions organised?, and what kinds of problems do people have with them?

(ii) Selecting the participants and settings
Having selected the issues to investigate, it is necessary to decide upon actual participants and settings for the investigation. These choices further constrain the scope of the exploration, and in part, the generality of any discoveries that might be made. Again in an applied context, these choices are derived from organisational and practical concerns. We are particularly interested in changes in working practices taking place today which may affect the needs and opportunities for technology in the future. One such change appears to be the proliferation of communication technology itself and the increase in mobile, distributed and remote working. So I have chosen to follow mobile professionals into whichever settings their work happens to take them. We have other interests of course, which for this study I have chosen to ignore. And there are other decisions I could have inferred from this interest; such as to examine work within a distributed team or within a couple of connected settings. A final set of practical

factors like who and how many people I end up following, when and for how long, will also serve to constrain the ensuing exploration.

(iii) Defining data

Deciding what counts as data in the study is another important control on what might eventually be 'seen' in the analysis. Within the domain of interpersonal communication you might think that some kind of video or audio record of real-time interactions might be sufficient, but what about the role of written communications by letter, fax, electronic mail and notes? Other written materials are used or created in real-time interactions too and decisions have to be made about how much of this material to collect, and from whom, in combination with other records. Furthermore new forms of interaction over text or videoconference systems are available to workers in some organisations. This raises the issue of whether or not to specifically select participants within these organisations in order to 'cover' the range of communications which are possible at work today. In the end, I chose not to seek coverage on this basis but to concentrate on working with subjects who were mobile in different ways. In each case I decided in principle to videotape as many of an individual's real-time interactions as possible, and to collect all associated and additional written materials over a natural time period of a week. This would allow an analysis of relatively long-term naturalistic communication across media, in comparison to most existing studies of short-term communication within a single medium. Note that at this point no actual data has yet been mentioned, although very many controls have already been applied to the kind of exploration it will support.

(iv) Recording data

Even the best laid plans can falter in their execution! In naturalistic studies of this kind many important procedural questions have to be resolved on the fly, with reference to what is acceptable and practicable to do in the circumstances. It soon became clear in my study that obtaining complete and comprehensive records of spoken and written communication was impracticable since certain interactions are too sensitive or personal to record; that not all aspects of an interaction can be caught within a single videocamera; and that actually following someone around affects their interactions with others! A fundamental difficulty underlying the entire study is that it requires the cooperation not only of some targetted subject but also of all those who happen to interact with him or her throughout the recording period.

Within these constraints it has nevertheless proved possible to obtain a good deal of what was planned from two subjects so far. The first subject was a communications manager in a marketing role within Hewlett-Packard itself and the second subject was a consultant surveyor based in Bristol. Videorecording within the office was done by fixing a wide angle videocamera in the corner of each subject's office base and using a radio-microphone to record both in and out-of-office conversations over several days. This set-up allowed me to be absent during periods of naturalistic data collection, but to become present at regular intervals to replace batteries and tapes and talk to subjects about their perception of recent events and general difficulties. These meetings were also occasions on which to obtain document samples relating to specific strands of activity that might be analysed in more detail later. Videorecording outside the office was done by accompanying subjects on selected external visits and manually filming activity as a recognised observer.

(v) Reducing data

It is a mistake to think that very large amounts of data will necessarily involve very long periods of analysis. It all depends on the quality of the data and the level and focus of analysis to be applied. For this reason statistics indicating the ratio of analysis time to raw data time are meaningless, except as a description of how it worked out in a particular case.

While it is true that absolutely all data have an integrity that should be approached with respect, not all data holds equal promise for exploration. For example, in my own study, portions of videotaped interaction lacked a sound track; either because of equipment failure or because the subject had temporarily switched off the microphone. In addition there were periods in which the subjects and myself discussed the procedures to use in the study. These were neither periods of naturalistic activity nor ad hoc interviews about work and communication and so provide little insight into the real concerns of the research. With data from my first subject, I was able to reduce an initial 32 hours of videotape to about 3 hours of 'interviews' and 17 hours of natural activity by simply taking out unpromising data such as this. Furthermore separating natural from artificial activity in this way allows the two streams to be handled differently in the analysis. Only the natural data lends itself to IA with respect to the aims of the study.

(vi) Focussing analysis

Initial reduction of data then can be done on pragmatic grounds related to the quality of the data for revealing phenomena of interest. Further reduction is done on the basis of the content of the data as part of the 'analysis'. This is really where specific analytic approaches and methods become most visible - although they actually pervade many of the previous choices in setting up the exploration itself.

The approach advocated by IA was introduced briefly in Section 2 and involves the qualitative analysis of interactional structure. In practice, this has involved making early collections of phenomena which seem to be important to participants themselves, such as the openings and closings of interactions where people must engage and dissengage themselves with reference to past and future work. This may involve some reconsideration of the research issues of the study in the light of the data that has actually been collected and what kinds of things it seems to contain. Other more straightforward applications of analytic categories at this stage would compromise the exploratory nature of the study and its capacity to deliver surprises. Having said this, I am also making other collections of phenomena that are of specific interest to the company. Each collection provides a focus for the analysis to follow by placing in juxtaposition, events and activities which could not ordinarily be viewed together.

(vii) Transcription and analysis proper

Work on the early collections involves close examination of the organisation of activity in order to discover order and regularity. The transcription of episodes at some level may become part of this work, but should not be seen as a necessary precursor to it (Psathas and Anderson 1990). Initial ways of representing or visualising regularities might be developed and tested out on subsequent episodes, and often these will suggest new schemes, questions and collections to make of the data. The whole enterprise might be characterised as a 'howdunnit', since the analyst operates very much as a detective of methods and procedures used by participants to accomplish various kinds of interactional work (c.f. Wooton 1989). In the context of researching interaction at work I am hoping to uncover fundamental forms of collaboration and conflict and to identify places where they would benefit from new technology.

4.3. 'Results'

This particular study is at too early a stage to report its findings here. However, it is possible to comment on the kind of things which may emerge from this and similar studies.

There seem to be several kinds of 'results' which IA can deliver. The most straightforward kind of result is a finding from the data about some phenomenon of interest, such as a systematic difficulty people appear to have with telephones or messages. The better findings in my own context are those which have direct implications for technology which the Hewlett- Packard Company is already making or could make. In an applied context, the entire study would be justifiable with hindsight if it delivered a single successful product concept based on a previously unknown user need. The method itself would be justifiable if it consisently led to such discoveries.

A second kind of result is the establishment of a data corpus which allows other people to come along later and ask new questions about the phenomena it contains. This might happen to my own data corpus with an unforseen development in new technology. With good indexing it is possible to create new collections of phenomena very quickly and to use them to gain an impression of present day problems and practice in some specific area of work practice which happens to be represented in the data. This might be done in a single data session comprised of several designers, with the Interaction Analyst acting as facilitator. These impressions are particularly good for generating hypotheses about possible product values which might be tested by further IA studies or by other means.

A final form of result is more difficult to define and has to do with the development of a deep understanding of user needs. Within our own company there is a recognition that such understanding is built up as an intellectual resource over long periods of time through a variety of methods, and underpins the capacity to commercialize technology with insight and imagination (Leonard-Barton, Wilson & Doyle 1993). Interaction analysis occupies a potentially important position in this respect if it can be controlled in a satisfactory way and combined with analyses from other methods of user research.

5. Conclusions

In summary I have suggested that the analysis of naturally occurring interactions between people and technology in real work settings could become a routine part of the range of user research methods employed in the computer industry when designing new technology. An emerging form of Interaction Analysis offers a way of conducting the analysis itself and appears to compliment more traditional methods of establishing user needs and requirements (see also Luff, Jirotka, Heath & Greatbatch 1993).

A simple extension to the use of IA in requirements engineering would be to apply it to the evaluation of prototypes undergoing field trials in selected work settings. In fact this is a next direction for my own study in which I will begin to incorporate subjects using prototypes of personal computer products intended to enhance interpersonal communication. This move

would begin to draw together the early and later parts of system development by merging requirements and evaluation research in unified studies of working practice.

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Biography

David Frohlich graduated in psychology at the University of Sheffield, UK, in 1980. After obtaining a PhD in skill acquisition, also at Sheffield, he entered the field of human computer interaction (HCI) as a human factors consultant. He later joined the Alvey DHSS Demonstrator Project at the University of Surrey in 1984 where he worked for 5 years as Research Psychologist on the design of knowledge based systems for public use. He also taught psychology and HCI as a Tutor and Associate Lecturer during this period. More recently he completed a fellowship on the application of conversation analysis to HCI at the University of York, and is currently working on the design of new office technology as Member of Technical Staff at Hewlett-Packard Laboratories Bristol.