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Ethical Issues in the use of Embedded Social Protocols to Resolve Technical Problems

Toni Robertson
Faculty of Information Technology, University of Technology, Sydney, AUSTRALIA
toni@it.uts.edu.au

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Abstract

The relations between various computer applications and the social and organisational behaviour they are intended to support are not natural or pregiven. They are always constructed and always the result of decisions made somewhere. This paper takes a fragment of shared design work and considers some solutions to one of the technical problems that arise when technology is used to support similar work over distance. The argument is made that some of these solutions are better than others because they enable human interaction in different ways. Some solutions enhance the possibilities for human agency, others diminish it. Since human agency is about capacities and powers to act in specific situations, and ethics is about action, then there are ethical issues associated with the particular solutions to technical problems, as well as the particular representations of human activities, that we choose to embed in the technology we build.

1. Introduction

> Experience has taught us that developments set in motion by technological acts with short-term aims tend to make themselves independent, that is, to gather their own compulsive dynamics, an automotive momentum, by which they become not only, as pointed out, irreversible but also forward-pushing and thus overtake the wishes and plans of the initiators. The motion once begun takes the law of action out of our hands, and the accomplished facts, created by the beginning, become cumulatively the law of its continuation. Granted then that we can "take our own evolution in hand", it will slip from that hand by the very impulse it has received from it; and here more than anywhere else applies the adage that we are free at the first step but slaves at the second and all further ones.
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> Hans Jonas, (1984), *The Imperative of Responsibility*. p. 32.

In a discussion of human embodiment and ethics, Gatens (1996) argued "we are accountable for the present in that we are responsible for those present possibilities that become actual through our actions" (p. 105). The crucial point for technology design is that as present possibilities become what actually 'is', they also become embedded, over time, not just in the technology itself and the social and organisational protocols surrounding its use, but in the specific embodied histories, capacities and powers of particular people. Designing technology is designing the work of those who use the technology. Designing for 'the whole person' ties us to the recognition that particular living people have both specific histories as well specific futures. We are all in the process of becoming the people we will be in the future. Particular people are formed not just by their own physical characteristics and dispositions but as much by the contexts within which they have lived their lives. Who whole people can actually be in the future depends very much on their present contexts and their options for action within them. Information technology designers, who are committed to participatory design (PD) and other phenomenological approaches to technology design, have been motivated by the recognition that when people use technology in their work there are fundamental relations between the usability and usefulness of the technology and how it is possible for people to 'be' as they live their working selves.

The underlying assumption of this paper is that, in technology design practices, some ways of thinking about and representing human activities such as work, interaction and cognition are better than others in the sense that they enable people to act and interact with others in ways that enhance what is important in their lives. Some ways of designing and building information technology are better than others for the same reason. Understanding the differences, and the reasons for them, means we can improve our chances of designing technology and work practices that promote the full range of human skills and activities. Most importantly, we can acknowledge and deliberately minimise the risk of designing technology and work practices that reduce human agency by limiting its development and expression.

The focus of this paper is a specific issue of interaction design—managing multiple inputs—in a particular kind of Computer Supported Cooperative Work (CSCW) technology—shared drawing applications. I describe a fragment of shared design work in shared physical space and then consider one kind of software application that could support similar kinds of work if it needed to be done over distance. Here my purpose is to illustrate how different solutions to a technical problem can produce different possibilities for interaction for those who use the technology. My aim is to separate the social issues from the solutions to technology design problems so that some basis for choosing between these solutions can emerge. I conclude the paper with a brief discussion of why such choices matter.

2. Managing multiple inputs in shared drawing applications

Shared drawing applications can provide a shared workspace for designers who are working in different physical spaces. They exploit the metaphor of a shared drawing surface such as a drawing pad or a whiteboard. Participants using these applications can draw or write on their own screen and whatever they draw or write is visible on the screens of the other participants. People who are in different physical spaces are able to both see and change the same thing at the same time and base their ongoing work around whatever is represented on this shared workspace. Shared drawing applications need to support input from each of the participants in the shared work.

Some of the participants gestures can be represented in the shared workspace by the use of telepointers. These are cursors, visible to all the participants, that identify the individual controlling each one either by different symbols or name labels. The cursors indicate which parts of the screen each participant is working on and can be used to represent indexing gestures. For example, when one participant says "that yellow box needs to go there", they can use their cursors to indicate which yellow box and where "there" is. Participants can use video links and/or telephones to enable their conversation.

Tang's (1989) classic study of shared design practice emphasised the importance of the shared workspace to the work done within it. He concluded that:

> gestures, the process of making artefacts, the fluent intermixing of workspace actions, and close proximity to the workspace, all contribute to maintaining effective communication and collaboration. Communication plays a major role in the design activity, and the workspace was found to be a key communication resource (p. 98).

Tang's recommendations were used as the basic requirements for several early shared drawing applications developed to support shared workspace activity including Commune (Bly and Minneman, 1990; Minneman and Bly, 1991); TeamWorkStation (Ishii, 1990) and GroupSketch (Greenberg et al., 1992). He insisted that the workspace itself matters in so far as it supports and/or enables the activities that happen within it. This is an important point for the concerns of this paper because it acknowledges that technology ought not be judged on its own terms, but according to how people are able to use it and what it enables them to do.

Reflecting on the findings of many years of shared workspace research, Heath, Luff and Sellen (1995) emphasised the importance of a shared workspace to cooperative processes.

> For example, much collaboration is undertaken side by side where the individuals are continuously sustaining a shared focus on an aspect of a screen or paper-based document, such as a section of an architectural drawing. Collaborative work relies upon individuals subtly and continuously adjusting their access to each others' activities to enable them to establish and sustain differential forms of co-participation in the tasks "at hand" (p. 89).

2.1. An example of shared design work

Figures 1. to 6. and the fragment of interaction that follows them are taken from 45 seconds of video footage from an ethnographic field study of shared design work (interested readers can find detailed accounts of this study and its findings in Robertson 1996; 2000; in press). The participants were designing an interactive learning application. The example is from the final design meeting before the prototype was built. It was chosen from many possible examples of shared use of a drawing pad from the study largely because it was small enough to include in this context. In this fragment, each designer had notes from previous meetings on the table in front of her. On the table between them is a writing pad with some roughly sketched screen designs and explanatory notes that have been made during the current design meeting. The designer on the left, Dorothy, has made these notes and sketches and the writing pad is oriented towards her. The designer on the right, Susan, is offering a suggested solution to a particular design issue.

Figure1.

Figure 2.

Figure 3.

Figure 4.

Figure 5.

Figure 6.

Susan. Up, I guess, pops (draws a screen in the air and then adds bits to it, Figure 1.) for this place. So . . . it's the building itself, and some details (looks at Dorothy who is watching her drawing in the air, Figure 2.)

Dorothy. Mmm.

Susan. You know a little, perhaps a, um. . . (picks up pen and turns to table behind her looking for something to draw on, Figure 3.)

Dorothy. (turns meeting notes so they are equally facing both of them and pushes the notes towards Susan, Figure 4.) You're allowed to draw on here. Keep it all on this and then I'll just have one lot of notes to worry about. I mean

Susan. OK. Yeah. All right. (starts filling in details on the top screen of the second page of meeting notes, Figure 5.) OK. So maybe the . . .they've popped on that building and here's the (laughing) here's the little symbol of it. And perhaps

Dorothy. It looks like an ear.

Susan. there's a , there's like a window and, and maybe there's . . . I don't know . . . the others that were involved in this place etc. (writing and drawing on screen representation)The, um . . .

Dorothy. People.

Susan. people themselves. (writing)

Dorothy. Newspaper clippings.(leaning forward and highlighting the place on the screen where they would be Figure 6.)

Susan. Yeah the clippings, and the stuff. (writing in place Dorothy had indicated) Um . . . What else?

In Figure 1., Susan draws a computer screen in the air and in Figure 2. is drawing details of the screen, also in the air, as she continues her explanation of the possible solution. By Figure 3. drawing in the air is no longer towards her in Figure 4. and by Figure 5. she is drawing on the writing pad. In the final Figure both designers are writing or drawing on the same screen sketch.

There is nothing particularly remarkable about this smooth negotiation of access to the shared writing pad. There are many examples of such smooth negotiation in the data from this study and from other studies of shared design work (e.g Tang 1989, Minneman and Bly, 1991). But the designers lived in different cities and could only work together in this way when one of them was visiting the other. They wanted to be able to do design work together at other times and hoped that CSCW technology could help make this possible. A shared drawing application could act as a substitute, of sorts, for the shared writing pad the designers are using.

2.2. The "Problems" of Floor Control and Object Ownership

The technical problems involved in maintaining a shared file between a number of different places are considerable and their solutions are not trivial. In distributed systems there is always a time delay associated with the use of shared files and there can be synchronisation problems if there are a number of inputs arriving from different participants. The technology needs to be able to detect a change made on one screen and ensure that these changes are made on all screens. These concurrency control problems have spawned numerous papers in the CSCW and distributed systems literature as researchers consider different technical solutions to enabling multiple, distributed inputs into a shared file.

In shared drawing applications, these solutions have included floor control mechanisms and the notion of object ownership. Floor control mechanisms exploit the metaphor of an individual "having the floor" in a meeting environment. In object ownership the system enforces certain rights of access and control to the person who created a particular object, for example a drawing, in the shared space. These mechanisms are used to control the various kinds of access to the shared space so that any simultaneous input from different people does not scramble the system.

The important point here is that both of these approaches resolve technical problems by embedding social metaphors and their related protocols in the technology itself. The problem, for those wanting to design for the whole person, is the slippage that follows when technical problems are recast as social ones. For example, the following passage is from a paper that presented algorithmic solutions to various kinds of floor control options.

> Access control is an indispensable part of any information sharing system. However there has been relatively little work done in controlling access to the collaboration. Most collaborative systems give all collaborators the same rights to all objects and expect access to be controlled by social protocol. Thus, they do not provide computer support for preventing mistakes, conflicting themes or unauthorised access (Shen and Dewan, 1992, p. 51).

Underlying this statement is the implication that systems that do not enforce participant behaviour in collaboration are somehow lacking and that technological control of what is essentially a social process is both natural and desirable. In a paper discussing different approaches to controlling the synchronisation of input to shared drawing systems, Greenberg and Marwood (1994) wrote:

> If care is not taken, a distributed groupware system can suffer concurrency control problems due to events arriving out of order, leading to inconsistencies in the image, the underlying document, and the group's mental model of what is actually going on (p. 207).

Yet later in the same paper the authors explained that their own shared drawing prototype ignored concurrency control altogether. Not only were there no complaints from users, but apparently no one noticed.

> The point is that, in many groupware applications, concurrency conflicts may be rare because people mediate interactions themselves. When conflicts do occur and slight inconsistencies appear, they may not be problematic in practice. Finally, if people do notice conflicts and problems, they are quite capable of repairing their negative effects and consider it part of the natural dialogue (p. 211).

Lu and Mantei (1991) explored a different approach to the management of multiple inputs in an experimental shared drawing application, CaveDraw. They argued “Ideas have creators and thus, owners. Any time a sketch is modified by other participants in the group, ownership preservation becomes an issue” (p. 107). In their application a user could specify that they owned a particular drawn object. Other people could not change this object without permission from the object's owner. The researchers based this design decision on a single example from one study of shared drawing activity. On that occasion, a dominant participant was observed to erase another's sketches without permission. This action, quite understandably, undermined the success of the collaboration. Implementing ownership of drawings and parts of drawings was intended to prevent such behaviour. But the authors observed: “although CaveDraw supports design ownership, its support has some drawbacks. Designers can ‘sign’ their work but the decision to make a particular design private needs to be made at tool selection time” (p. 108).

In other words, when using this system, people need to decide before they act whether the result of that action is to be publicly available within the ongoing cooperative process. Moreover, the implementation of object ownership had detrimental side-effects on the perceptual resources available to the participants in the interaction. Most importantly, in this example the agency and the responsibilities, of each of the participants in the cooperative process to successfully manage that process, are rendered irrelevant by the implementation of object ownership.

2.3. Who is managing what?

Issues of floor control and object ownership have a presence in the research literature that belies the ease with which these issues appear to be resolved by ordinary social behaviour, such as that depicted in the fragment of cooperative design work considered above. Floor control protocols and object ownership protocols are examples of proposed solutions to the technical problems of managing multiple distributed inputs to a shared file. They demand that the participants in a cooperative process structure their interactions around social protocols that have been designed from a technology focus, by people outside of the interaction, and then embedded in the technology itself.

In this fragment of shared design work discussed here, and in every single one of the many occasions where an object was shared throughout the entire design process, issues of access and ownership were smoothly negotiated by the designers. Negotiating access to objects "owned" by another was essentially polite social behaviour. None of the participants appeared to have the slightest problem in performing or interpreting such behaviour. Access was not assumed, but always offered. This would indicate that the problems of shared object ownership and shared use, within CSCW systems, requires a social rather than a technical solution. The fragment of interaction demonstrates how social negotiation around object use was constitutive of the cooperative process and contributed to a jointly accomplished solution. Shared drawing systems, that impose protocols or restrictions on any aspect of shared object use, compromise the agency of those using the system to manage, themselves, the social protocols that enable the cooperative process.

3. Discussion

When the agency for controlling and defining access to a shared workspace and/or the shared objects within it is embedded in the technology, people have to explicitly recode their interactions in order to work around the rules and procedures designed to prevent concurrency problems. These rules and procedures prevent such problems by not allowing situations where they can happen to develop in the first place, even though those situations are a normal, often valuable and even essential part of the cooperative process. Given how common the shared use of objects is in the cooperative design process, systems that enforce pre-defined sharing protocols can have a significant impact on the interaction itself and the quality of the design communication.

There is a further issue here. Concurrency problems are essentially technical problems. Other problems arise when these are presented in unquestioned and unaccountable ways as social or organisational problems—particularly when these social and organisational problems do not appear to exist in the first place. Studies of cooperative work have repeatedly shown that people are perfectly capable of managing their interactions themselves. Yet the representation of concurrency problems as problems of social protocol make such interactional expertise invisible to the point that systems can be designed that prevent both the expression and development of these and related social and interaction skills. My concern at the long term effects of such systems is the same concern that Jonas (1984) expressed when he wrote:

> Regardless of the question of compulsion or consent, and regardless also of the question of undesirable side effects, each time we bypass the human way of dealing with human problems, short-circuiting it by an impersonal mechanism, we have taken away from the dignity of personal selfhood and advanced a further step on the road from responsible subjects to programmed behaviour systems (p. 20).

An alternative approach to conflicting inputs was implemented by Moran et al. (1995) in the shared whiteboard application, Tivoli. On the very rare occasions when multiple users wish to change the same shared object, Tivoli generates as many copies of the original object as required to support the different inputs. Users can immediately perceive that there has been a conflict and resolve it by negotiation. The approach of the designers of this system is that the role of the technology is to alert the users to conflicting inputs, not to shape their behaviour so that conflicting inputs do not occur in the first place. In this way the rare conflicts that may occur can be used to make the design conversation more robust.

Technology design decisions, large and small, are intricately enmeshed with ethical issues (Wagner, 1993). Once the design decisions are made however, and the boundaries drawn and the objects defined, they are implemented in software products that by various marketing exercises become established solutions to the problems, in this case, of working over distance. Designing systems for whole people, such as Susan and Dorothy, reduces to a shopping problem—the best fit solution to a particular situation of use is selected from packaged solutions available in the marketplace and then integrated into the existing technology infrastructure.

If we accept that human identity is shaped by our interaction with others over time, then we need to ask what kinds of identities particular mediating technology produces. We need also ask what kinds of powers and capacities to act that specific people, whose identities are shaped through their use of particular technologies, will actually have in practice. Or, put more simply, what kinds of human agency are being produced. Whenever people are required to act according to the proscribed behaviour of particular representations of human activity, then there are questions to ask about whether some of these representations, and their associated options for human action, are better or worse than others. There are also questions to ask about who, if anyone, decides which actions are better or worse than others, on what grounds and from what perspectives. Since ethics is concerned with actions these are ethical questions. They are urgent questions because as information and communications technologies are increasingly designed and used to mediate the behaviour and activities of particular people over time, then the technologies themselves increasingly assume ethical significance.

In Science in Action, Latour's (1987) study of how science is made and technology built, he followed the process by which technical prototypes get made and turned into routinely used pieces of equipment, or in our case computer applications. They become black boxes that can no longer be inspected and that appear to become ever more durable as if by their own inner strength. He wrote:

> First it seems that as people so easily agree to transmit the object, it is the object itself that forces them to assent. It then seems that the behaviour of people is caused by the diffusion of facts and machines. It is forgotten that the obedient behaviour of people is what turns claims into facts and machines; the careful strategies that give the object the contours that will provide assent are also forgotten. . . . . The result is the invention of a technological determinism, paralleled by a scientific determinism. The black boxes seem to move even without people, it seems they would have existed even without people at all.

This paper has examined some of the specific choices we can make to solve just a single interaction design issue in the making of just one kind of computer application. Some of those choices can clearly enhance the possibilities for human agency, just as others clearly diminish it. The challenge for those of us who practice and/or teach technology design is to recognise that such choices exist and accept responsibility for those that we make.

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