The Implications of 'Experience' for HCI

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This paper was written in 1998 as the first draft of an invited paper for Jack Carroll's *HCI Toward the Millenium*. It lacks references and all the usual scholarly impedimenta. The purpose of circulating it among friends now is solely to mark a set of issues and problems which we were preoccupied with at the time it was written. In the event, the pressure of other things prevented it from being completed.

ADVICE TO THE READER

We make no bones about it. This chapter is hard. It was hard to write and will undoubtedly be hard to read.[1] Moreover, we fully recognise HCI researchers' and designers' impatience with what they dismiss as 'pointless philosophising', 'mere semantics', or 'useless theory'. However, this brisk pragmatism and the associated proclivity for usable results and applicable findings may no longer be as secure as they once were. As we will see, recent developments within HCI itself may be leading to unforeseen complications and the need to re-visit old, tried and trusted assumptions. Getting these assumptions out in the open, the better to have a full and reasoned debate about their continued applicability is the major part of our intent. Accomplishing it will be slow and laborious. The arguments are complex and the topics slippery. In the end, though, we feel the field has little choice but to ask itself these disturbing and difficult questions.

SMALL EARTHQUAKES

For a little while now, we have been watching some interesting developments within the broad discipline of HCI. Individually none is revolutionary, but taken together they could well herald very profound outcomes. In what follows, we will first identify the specific changes and trends we have in mind. We will then step back and try to draw out the deeper implications, themes, and tensions we see at work in them. Finally, we will summarise (as well as surmise) some of the broader adjustments within HCI which, if we are right, will probably be necessary to realise the potential of these transformations.

The flirtation with ethnography: This has been going on for quite a while and looks to be getting more and more serious. Certainly within the CSCW sub-genre of HCI, but also in the mainstream, the attempted use (but not necessarily understanding) of ethnographic methods, approaches and techniques has been fairly widespread. Although the rationale for calling upon ethnography has not always been that clear, generally one could say it was an interest in getting access to and analysing the detail of activities as they are encountered *in situ* in the workplace, the home, the school and leisure group and elsewhere. This access has been sought because of a growing dissatisfaction with traditional methods of requirements capture for interactive systems and a gradual appreciation of the limited mapping between the controlled experimental context in which much user testing is done and the working world in which technologies were to be deployed. Ethnographic approaches, then, were seen as an insightful complement to traditional methods.

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[1] We realise we are violating the first canon of user centred design (and, as a friend advised, reader centred writing too) namely "Keep It Simple, Stupid". However, the KISS admonition really only applies when the aim of design (or writing) is to make its technical infrastructure (its mechanics) invisible in the service of getting the job done or, by extension, shepherding the reader quickly to the conclusions we want to have drawn. In our case, this invisibility is precisely what we do not want. We want the reader to trudge along with us; to be aware of our every step, consider every twist and turn, to feel all the bumps and dips on the way. We realise that this will make for a hard slog and, as with all arduous journeys, some, perhaps many, will not make the trip.

The re-thinking of cognitive processes: This development is closely allied to the first and has broadly taken three forms; the socialisation of cognition, the distribution of cognition; and the externalisation of cognition.

At the Institute for Research on Learning, first Jean Lave and Barbara Rogoff, and more recently Etienne Wenger and other colleagues, have made a determined effort to counter what they see as a predominantly individualistic and abstracted conception of cognitive processes in the mainstream of AI. Drawing heavily on cultural anthropology, this intervention has sought to provide a "practice-based" conception of cognition together with a model of learning as apprenticeship. Since traditional AI models of cognition have formed part of the conceptual infrastructure of HCI, this challenge was found to be extremely significant for the design of tools and interfaces. At first, it was accommodated within HCI as a distinct genre emphasising the distributed and shared character of cognition while at the same time retaining the internalist and representational motifs. More recently, the invocation of cultural anthropology has helped to strengthen to visibility and perceived value of ethnographic approaches. Perhaps the most extensive example of the confluence of these two is Hutchins' *Cognition in the Wild*.

A profoundly different intervention which also drew force from its emphasis on the disjunction between disciplinary approaches to cognition and our common sense encounters with people, technologies and objects in the world, was built around Gibson's ecological theory by Don Norman and others. Here the claim is that the resources for cognitive effectiveness are not merely (or only or even importantly) internal representations but the properties (called "affordances") which those artefacts and objects have.

The impetus for community-based systems: The key concept in the social cognition argument is "community of practice".[2] In its turn, this notion has become something of a term of art within the HCI and organisation design communities. The "discovery" that workplaces, schools, local organisations can be viewed as "communities of practice" has encouraged designers to create a whole new class of systems to support them. Such systems have two main emphases: first, an intent to support active learning and information sharing among the various types of member of the community of practice; second, a predisposition to organise such learning through interaction. Collaborative systems have even been designed to create "virtual" communities. Some of these systems are aimed at more traditional communities, age groups and environments. Others are "communities" in an extended sense. In any case, attempts to provide support for all these communities has turned out not to be as straightforward as might at first be thought. Those who have reflected on their experiences have often alluded to the importance of "the tacit dimension".

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[2] As with all such portmanteau terms, CoP contains more than appears at first sight. The conjoined concepts are, in fact, *stretch versions* of their correlates in social science or ordinary usage. The consequence of such unwitting commitments is drawn out below.

The collectivisation of applications: This is closely related to the above since community-based systems are aimed at what social scientists think of as institutionalised "collectivities". These may be schools, work groups, leisure groups, age cohorts, peer groups and the like. In being drawn into the workplace and other institutional settings, HCI has had perforce to address the broader environment within which technologies are deployed. It has, therefore, had to engage with the variety of what are sometimes referred to as "stakeholder interests". The lists of stakeholders often provided are the familiar ones: users, managers, owners, customers, suppliers, etc. etc. The point is that these interests are usually organised around (and expressed through) institutionally defined relevances (e.g. those defined by business and work) which is one of the reasons for the flirtation with ethnography. Institutional relevances operate on a larger scale than the individual or the local group and hence HCI has had to engage with global or collective processes such as the organisation of product and service provision, the management of the value chain, the management of information, and so forth.

The troubling potential "invasiveness" of HCI research: Although the main domain in which researchers in HCI struggled over their relationship to their subjects was undoubtedly in the use of video recording as a form of data collection, the central, critical questions have been taken to be broadly relevant. What should our attitude be toward research which could result in the exploitation of individuals or the invasion of their rights? Alongside the role of video data could be put technologies such Active Badges and similar monitoring technologies, autonomous agents, information repositories, data mining, VR, knowledge management and interactive e-commerce. What kind of science and/or engineering justification should be offered for researching such systems? Are commercial interests enough or must supervenient claims to improvement in quality of working life, reduction in transaction costs, and so forth be invoked? In the case of video data, it appears that the arguments have been dropped rather than resolved. Indeed, ACM's current ethical policy still lacks a strong sense of what "informed consent" can mean in the HCI world.

The fascination with "the tacit dimension": We have indicated that HCI researchers began to take an interest how work is actually organised. That interest led to a concern with how roles are learned and processes managed. Fairly soon, it became massively apparent that behind the formal procedures and processes depicted by traditional requirements capture, lay a whole world of informally known and regulated ways of doing things, bodies of knowledge, and forms of communication. The notion of a "tacit dimension" has become the (somewhat misleading) short hand for this complex. Clearly the challenge to HCI is simply that if the tacit dimension is so important for the effective functioning of any working community (not just work communities), how can HCI acknowledge and take advantage of that fact? In many ways, it could be said this is the *only* challenge to the burgeoning field of Knowledge Management. Perhaps its failure thus far to demonstrate just how it will be answered is also its key weakness.

The pursuit of the pliant: The encounter with the world of work focused attention on the "effort" and "flexibility" bargains that were being forced upon users. In almost all cases, the onus of

accommodation and adaptation was placed on the end user. It was the end user who had to adapt working patterns and processes. It was the end user who had to work around the inflexibilities of "the system". The consequence has been the growth of a small but highly articulate research interest in "adaptive" systems and their design. This effort goes much deeper into the core of Computer Science than HCI (Brian Smith). The motivation, however, is always strongly connected to the experience which users have of the systems we give them and the metaphors, representational structures and related images which elucidate improvements in the design of such systems. Thus for instance, much recent interest has been shown in the promise of Alexander's notion of a "pattern language"

Embodiment as a UI modality: Almost everyone in HCI is tired of the desktop metaphor and its kin. At the same time, almost everyone is convinced that to replace it we will have to define (or stumble over) an equally compelling metaphor. One contender has its basis in the use of multiple media to "augment" our ordinary capacities through the creation of extended and virtual realities. In VR research, for instance, there has been a concern to try to replicate aspects of bodily co-presence as the basis for interaction. On the other hand, advances in miniaturisation have now made it possible to talk in terms of "embodied computation" and "wearable computing" either in the PAN sense (IBM's personal area network) or the MIT emotive computing sense.

READING THE RUNES

Across the bric á brac of ideas and initiatives we have surveyed, we think we can discern three main themes. They are:

1. A rejection of the disjunction between HCI models of use and usage and the ways in which all of us ordinarily encounter and interact with technologies in our daily lives. This disjunction was forcibly highlighted by the use of ethnographic methods and the rejection of traditional models of cognition.
2. A concern for adequate complexity. The disjunction referred to above derives from the need when modelling use and the context of use to eradicate many characteristics of acting in the world which, as members of ordinary society, we are fully aware are important. Examples of such features are, for instance, the importance of the surrounding social environment and the primacy of our bodily engagement with physical artefacts.
3. A respect for social embedding. The "socialisation" of technology and cognition was not simply the addition of another set of factors to be instrumented alongside other "critical parameters". It was, rather, the recognition that technologies are defined in and through the relationships which users have with them. Technologies are first class citizens of the social world.

These three themes are probably most easily visible in the shifts in vocabulary and imagery throughout the past decade. More and more we find designers talking of *immersion* in a *flow* of work, of *engagement* in a social setting, of *awareness* of the environmental gestalt. These changes in phrasing mark a radical step and constitute no less than a move from the management of

representation to the organisation of *experience* as the central defining problematic for HCI research.[3] Teasing out the implications of this shift is what will occupy the rest of this paper.

Awareness of these lines of tension and transition has created a flow of traffic between the broad streams constituting HCI: the research community with its academic and disciplinary concerns and the engineering community with its much more instrumental ones. The more visible, surface shifts have often first appeared couched in instrumental terms. They have then been responded to in more disciplinary-relevant ways.[4] However, as the provenance of the instrumental has become more widespread, so the recourse to the academic has had to become less piecemeal. General considerations and questions are thrown up. Principled positions are asked for and defended. What we believe we now see is the confluence of these principled positions. In the rest of this discussion, we will attempt to describe first what this confluence consists in and second what it might require of HCI.

One popular way of summarising the general tenor of the transitions just outlined has been to talk of them as "a turn to the social". And, indeed, it is true that in almost every case, social scientific research and thinking about social life has been an important resource. But, the turn to the social is in many ways simply a convenient slogan justifying the rejection of what was felt to be a restricted (not to say impoverished) conception of the character of ordinary, everyday life. What designers and researchers turned to the social for was not a whole slew of new phenomena (though that was in the end what most of them got and got fascinated by) but new ways of thinking about the phenomena which were already under their hands, namely technology in use. These phenomena were the modalities of interaction with computational and other technologies. Within HCI, these modalities were almost uniformly viewed from within a tool-based perspective. Users of systems used tools to interact with their resources and applications to achieve the goals they sought. This *instrumentalism* seemed massively at odds with the findings and descriptions brought back to design by those who ventured into the workplace. True, people did get work done and did accomplish tasks. But rather than applying tools and completing tasks they seemed to become one with their work processes. In that sense, the world of work was equally *expressive* as it was instrumental. In organising their work, people oriented as much to such intangibilities as "awareness", their "co-presence" with others, their sense of space, place and time as they did to task organisation and technical functionalities. To put it another way, and hopefully more clearly. Researchers and designers have become increasingly dissatisfied with systems which only addressed one dimension of working life. To remedy this, in small and limited ways, and often inadvertently,

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[3] Although we think we are probably the first to have made the argument in quite this way, many others have circled around the same concerns. Perhaps the most prolific, certainly the most articulate, and maybe the most eclectic has been John Seely Brown. In his writings he has traversed AI. HCI, Design, Cognitive Psychology, Sociology, Critical Theory, Pragmatic Philosophy, Post Modernism, and Management Science, at each point seeking to illuminate the bundle of transitions we have our eyes on.

[4] The treatment of ethnography is an excellent example of this, but so too is the whole discussion of tacit knowledge.

researchers and designers have begun to grapple with what it would be to make the category of "experience" available for HCI design.

LOOKING BACK UP THE MICROSCOPE

The radical break with the central problematic of HCI has many aspects. As we have already indicated, they are displayed in each of the trends we have picked out though in different weights and in different forms. However, attempting the transition (let alone accomplishing it) has not been and will not be easy. In attempting to reconfigure their research and design around "experience" members of the HCI community have found themselves increasingly at odds with the constraints imposed by HCI's commitments to:

- Formal modes of idealisation

- Inductive strategies of generalisation

- Explanatory reduction

- Disciplinary super-ordination

This struggle amounts to nothing less than a rejection (or at least expression of severe discomfort with) the fundamental architecture of HCI's research programme as that was transferred from its home domains in cognitive science, mathematics and engineering. This architecture acted as a Trojan Horse for a number deeply embedded and taken for granted principles and orientations which are only now being surfaced as problematic. However, and the researchers concerned may take some solace in this at least, these very same concerns have been raised about almost every other contemporary scientific endeavour, even those which appear to be the most secure (and indeed are taken as paradigmatic for science in general).

Formal modes of idealisation

To see what is at stake here, let's go back to IRL's rejection of the Cartesian model of cognition. What the researchers concerned were taking exception to was the way in which AI, in its attempts to model cognition, systematically filtered out all the characteristics which made thinking, problem solving, perceiving and interpreting, readily recognisable everyday activities. Instead, cognition was idealised as a form of abstracted information processing. This idealisation, of course, allows AI to represent cognitive processes in a strongly formal notation which "models" them in consistent and systematic ways. The problem was that the processes the models were modelling (i.e. cognition in the world) seemed not to be recognisable from the models themselves. The concern, then, is not to refuse abstraction and idealisation of any kind. Rather, it is to understand the costs and benefits of particular forms of idealisation. Most importantly, it is to try to fend off what could be thought of as "the fallacy of the Kelvin wedge". This has two parts. First there is the claim that unless knowledge can be represented in numerical terms, it does not really constitute knowledge. That's

the wedge. Second, and this is the fallacy, since *ex hypothesi* science is definitive of knowledge, then all scientific knowledge must be expressible in numerical terms.[5] The Kelvin Wedge results in the elimination from HCI of most of the knowledge we have as ordinary members of our culture of the ways we interact with technologies.

Inductive strategies of generalisation

The value of the idealisation is of course that it allows general comparison of instances through the exercise of specific usually statistical manipulations. The results of experiments and studies are compiled and compared by "model fitting". However, it can easily seem that the pay-off from the resulting models is solely their generality rather than the efficacy as representations. These concerns can be seen in the ready acceptance of work process analysis (work practice analysis) as a means of representing workplace activities (re to the ACM issue) in contrast to the work-flow and process based models that were and are deployed elsewhere. The formal and formalised depictions of process models, state transition diagrams, GOMS models and the like seemed thoroughly distanced from the welter of activity when getting things done in the workaday world. Moreover, the mappings required to get back to that world from the formalised models seemed more and more tenuous.

Explanatory Reduction

Idealisation and generalisation have provided the form of HCI models. Explanatory reduction provides their scope. Following the decompositional logic inherent in classical natural science, HCI sought to factor down accounts of its phenomena to their most elementary levels. As with the natural sciences, inevitably these were held to be physiological (and eventually physical in form). Activity at the interface was ultimately to be accounted for in terms of elementary biological and psycho-physical laws. This reduction was both exhaustive and complete. Nothing was left over and nothing left out.

Disciplinary Superordination

Buttressing the logic of decomposition is an epistemological inverted caste system. The low caste disciplines offer the highest order explanations. Such explanations accord most with our ordinary experience. As one moves further and further from common sense so one moves up the disciplinary status rankings. The highest castes of all are those whose formulations are furthest removed from daily life and offer the least generalising accounts. This hierarchy of disciplinary knowledge is, of course, characteristic of Positivism in its best (i.e. Comtean) sense and being at the heart of AI and Cognitive Science was transferred into Cognitive Psychology and HCI without demur (and certainly without reflection).

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[5] The corollary is obvious. Any disciplinary knowledge which cannot be so expressed, cannot be science.

As we say, HCI is gradually loosening its ties to these tenets. But what is being put in their place? Across the ranges of topics described earlier, we would like to draw attention to the following.

Specification through informal description of cases: where the purpose of idealisation is to enable abstraction and formal representation, we now see an increasing emphasis being placed on engagement with identifying detail of particular cases and what can be learned from them. This identifying detail is, obviously, unique to each case and, thus far at least, has been best rendered in non-formal or at best quasi-formal modes.[6] Thus we find reports (especially those directed to studying the workplace but elsewhere as well) replete with extensive transcriptions of protocols, descriptions of the specifics of events, and with colligations of types.

Securing conviction through evocation: although this is not the place to argue it, there is a strong case for treating generalisation (especially *statistical* generalisation) as a very particular and historically contingent means of securing the plausibility of an account. Within HCI, it is not the demise of statistical validation which we are noticing (though that might well be in train), but the emergence of an alternative way of securing the acceptance of a proposed hypothesis, analysis or account. We think of this as plausibility through evocation[7]. The organisation and use of examples and data which are described in ways which we, as researchers and ordinary members of society can recognise and orient to, provides a plausibility structure which is entirely different to statistical validation. The stories and vignettes carry conviction just because they carry "the ring of truth". We see in them what we recognise all around us. *We* , rather than some formalised method, provide for their generalisability.

Explanatory autonomy and the provision of the emergent: The "turn to the social" has accentuated an interesting and important issue within HCI. This is the relative informality of theorising. As we have seen, traditionally in HCI, theoretical strands are, by and large, related to one another through a presupposition of global decomposition. We call this mode of theorising informal because the meta-rules required to provide for the assumed tranformations as the explanations move up and down levels have never been elucidated nor specified. The infusion of social science in HCI has thrown this issue starkly into relief. Within academic discourses, there is a long running, conventionalised and non-converging dispute concerning the relative theoretical autonomy of "social phenomena" and the validity of reductive theorising. Resonances of this dispute were imported into HCI with the turn to the social and took shape in discussions over the scope and descriptive validity of cognitive models of use, users and learning. Along with ethnographic methods as a means of data collection, HCI researchers found themselves increasingly being

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[6] Verbal protocols and video data are instances of quasi formal modalities.

[7] We owe the evocative modality and the place it plays in anthropology to Marilyn Stratern's *Partial Connections.* We have stretched it a bit further than Strathern would probably like but the deployment of ethnographic methods in HCI provides some measure of license for this

committed to the theoretical autonomy of social phenomena and hence of social science theoretical objects (see below). This theoretical autonomy rested on a conceptual structure designed to create the possibility of emergence. In other words, alongside the conventional downwards explanatory thrust, researchers found themselves constrained to theorise upwards. Individual phenomena were re-cast as social. The user became a-user-in-a-context; and individual learning became apprenticeship in a community of practise.[8]

Ecumenism as a modus operandi: contentions such as that between the individuating and the collectivising tendencies in HCI alluded to are replayed in various ways and at various levels. Their apparent recursive and antithetical character are often defused by defining them as alternative "paradigms" or "perspectives". This is a comforting strategy since it seems to legitimate an ideology of inclusiveness. However, although all paradigms may be said to be equal, there is no doubt some were still taken to be more equal than others.[9] The difficulties to which such a view obviously and clearly gives rise have, more of less, been treated with benign neglect. However, the adoption of an explicit perspectivalism, particularly in debates over the character of work flow or the nature of tacit and articulated knowledge, is increasingly likely to force the adoption of some alternative *methodics*.[10]. This is the philosophy of investigation. As the comfort of "perspectivalism" has become less and less appealing (that is, as we have begun to ask ourselves hard questions such as 'How do workplace studies cumulate their findings?' 'How do you describe the parameters of a community of practice?'), so investigators have sought to interweave paradigms on an ad hoc basis. It is time, though, to give such framework plying serious attention.

A GIRDLE ROUND THE EARTH

The themes we have just outlined and the tensions they give rise to are undoubtedly (in the conventional parlance) *meta-theoretical*. They are also *meta-investigative*. Before we move on to the key questions which they raise, it is important to clarify how we should view them. First, by and large they are taken for granted. The form the ground on which much HCI stands. Second, they are mutually reinforcing. Third, if discussed at all, it is the context of their presumed definitiveness for scientific practice. Fourth, they do describe, more or less, the central characteristics of 19th century Physics - but very little else except by extension, analogy or brute force shoehorning.

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[8] The most telling locale for this transformation is the dispute over the supposed productivity paradox. Having chased down all the measures of macro and micro econometric variables, the disputants (Bryjolffson et al) regularly turn to what they call "firm level" effects. These turn out to be "management style", "culture", etc etc. In the end, the productivity paradox dissolves into an argument about the relative causal efficacy of social factors.

[9] There ought to be place for a footnote here on the vehemence of the social rejection of cognitivism and the politisitation of design. This vehemence nicely matched the institutional embedding of its foe.

[10] This is a horrible neologism, but is the best we can do. The term has the same logical status as "epistemics".

None of this should be seen as negative. As principles, they worked very well for as long as they were applicable. Of course, discussions of the philosophical and logical foundations of Physics have long been given over to rendering them less secure. This unbinding of the cluster from Physics was a response to precisely the same discomfort which HCI is currently experiencing. Unfortunately, this unease got lost in the translocation of the cluster to HCI. In one sense, though, this is unsurprising. HCI researchers (and engineers) as we have said are pragmatic and practical of bent. Neither did concern over the rigour of HCI's "concept hopping" matter all that much when the concepts were being drawn from disciplines such as cognitive psychology and cognitive science which shared the same fundamental outlook. Once the social sciences became involved, though, because they are predicated on disputing these very principles, benign neglect would no longer do.

Having identified the key questions, the task now is how to frame them (and no doubt the others which we have not spotted) so that they can be addressed. What is the order of issue that needs to be sorted through, straightened up, clarified, and then resolved? We do not think it is the adoption of some other, further, novel disciplinary matrix, be it post-modernism, Critical Theory, ethnomethodology, activity theory, or distributed cognition. Neither is it an amalgamation of them all. What it requires is a re-consideration and explicit articulation of the principles around which HCI constitutes itself. This is what we termed the architecture of its research programme. What is called for are the articulation of a theory of grounding for HCI, a theory of disciplinary objects, and a theory of investigative mappings which will encompass *both traditional* HCI and those emerging trends which we have been identifying.

A theory of grounding: in textbook histories of the natural sciences, much is made of the scientific revolution of the 17th century. Many figures, but especially Galileo (hereafter we will refer to this as the Galilean revolution and take the metanymic licence of crediting it to Galileo), are credited with having transformed Natural *Philosophy* into Natural *Science,* thereby setting in train the whole course of modern technologically based society. There is no doubt that the invention of modern science was indeed a major revolution. However, it is less often remarked that this revolution was both the creation of something new (the scientific method) and a break with something old (the grounding of natural philosophy in common sense). What Galileo achieved was no less than the *mathematisation of nature*. Nature, as he put it, is written in geometrical forms. From then on, whenever the scientific observer turns to the natural world, then, what are observed are taken to be the expressible in (or sometimes even the expression of) mathematical forms. The task of science is to decipher and elucidate these forms. After Galileo, the grounding of science resides in the axiomatic and axiological character of mathematics and in a variety of methods held to distance the observer from the observed. Behind the local and specific variation in observation lie regularities which can be expressed with mathematical certainty. And, providing the same methods are applied to the same phenomena, the same regularities will be revealed. Galilean science, then, is grounded in observer independence and the constancy of phenomena.

This is the theory of grounding to which, at least implicitly, HCI has held. It is the theory of grounding to which its originary disciplines, computer science (in as much as it had a theory of grounding) Cognitive Science and Cognitive Psychology were committed. However, as reflections on HCI as a bundle of disciplines have recently concluded (e.g. Wendy Mackay's 1997 CHI paper) if the basis of HCI is broadened to include from among the social and human sciences more than just traditional experimental psychology, then this easy assimilation is likely to be threatened. Certainly, if the community presses on towards the humanities and the performing and expressive arts, this will be the case. Notice what we are saying. We are *not* saying that the theory of grounding derived from the natural sciences is untenable, faulty or ridden with conceptual flaws. What we are saying is that this grounding leads to a conception of HCI predicated on observer independence and the constancy of phenomena. To achieve these two, this grounding takes the form of the mathematical (not always quantificational but always formal) transformation of phenomena such as people, events and objects as viewed in ordinary life into data as tractable by science.

In HCI, this distancing is precisely what motivated the turn to the social and related interventions and what they were designed to counteract. It is also precisely why the introduction of video data into HCI research caused the concern it did. Analysts had developed many distancing techniques such as video coding, compilation, and pixilation to render the sequences as data. When the video footage was first presented in talks, the participants other than the speaker often had no resources to call upon to achieve the same transformation. All they could do was turn to turn to their familiar ways of looking at such material.[11]

The case of video data is but one instance (although a leading one). The same concerns are gradually coming to the fore in research areas which are very remote from multimedia systems. Systems such a knowledge management toolkits, recommender systems, brokering systems, and the like all use information "given off" as well as information given. As such, they pose the same threats to invasiveness, privacy and exploitation as video data was supposed to do. As such they highlight the growing scale of the need to finding an alternative conception of HCI's grounding which will circumvent this problem. Since HCI aspires to be a broad church of "multiple paradigms" (and we say something about this below) then this means it will have to evolve an appropriate theory of grounding which can encompass its membership; those who operate in the Galilean mode and those who do not.

A theory of disciplinary objects: The Galilean transformation provides the form of objects in natural science? Its theory of objects provides for their characterisation. What is it about t table in

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[11] That is the participants at Conferences and symposia had no alternative categorisation to hand other than to treat themselves as "the audience" and the ensemble on the video as "performers". This led to the embarrassing moments we have all been party to with audience guffawing at innocent mistakes of ordinary users. A kind of Candid Camera for HCI.

front of us which holds our beer glasses which is amenable to scientific analysis. Here of course, the immediate point to note is different sciences take different interests. Just so. Different sciences *constitute* their objects differently and this constitution is driven by a theory of objects. So the table we are looking at is not "a formica pub table" on which our half empty glasses stand and around which we are arranged arguing over the relationship of epistemology to ontology in an attempt to write a paper. Rather it is a 3d lattice of differing force field vectors, or a plane of given dimensions and rigidity, or surface with different tribologic properties. The relationships between objects on the table (glasses, mats, keys, pencils) equally are specifiable as points or clouds in a 3d Cartesian world. And so on. Of course, the table is a table in the real world (as we all like to put it) but the table-in-use is not primeordially the table for science. Those real world characteristics are filtered out through the achievement of a concordance between the phenomenon in view and theory of objects in play.

There is an important point to make here. As HCI seeks to encompass the social and human sciences, it will not have to give up idealisation. This is but one of the misunderstandings which has surrounded the introduction of qualitative data collection, especially ethnographic methods. Rather, it will have to develop different principles on which to base its idealisations.

Take the central concept of "the user". Under the traditional HCI banner, the user is defined ("constituted" was the term we used earlier) as a bundle of physiological, psychological and ergonomic "factors" described by various functions. Integrating these functions enabled the derivation of "usability requirements" for design. As the importance of context of use has become more and more emphasised so, there has been an increasing concern to add "social factors" the list. However, social science analysis has not, for the most part, been either interested or willing to make its contribution in this way. In fact it mostly disputes this whole outlook. Instead, the social scientist offers descriptions idealised as various "types"; users as courses of action: users as personal types. Information, findings, data of the user as an ideal type is not immediately and easily assimilated into a set of parameterised factors.

As with "the user", so with "use", "interface", "co-ordination", "task", "effort" "work", "process" and of course "community" and "practice" and all the other critical parameters in which HCI traffics. The unsurprising consequence is, despite everyone's apparent willingness and good will, social science findings and social science theorising concerning those findings, remain recalcitrant in the face of the rest of HCI. There seems to be no good and clean way to model them or to "re-write" them into existing models.

A theory of investigative mapping: if the 17th century brought the mathematisation of nature, the 18th brought the projectability of the experimental method.[12] The experimental method has two aims which are also its criteria of success - isolation and simplification. Under experimental conditions (however we construe these and we are willing to be very flexible), the phenomena under investigation are isolated from intervening and interfering variables (including the observer) and reduced to their simplest forms. "Simple", of course, is contextually determined and should be translated as simple-for-the-purposes-of-this-investigation.[13] The ability (and desire) to control the environment of conditions provides the basis of a theory of mapping between the phenomena-under-study and the phenomena-in-the-world. In the standard methodological jargon, the problem is one of "operationalising" the theory in an investigation.

As the search for "realism" has grown so this operationalist mapping has gradually been weakened. Investigations now are designed to explore "scenarios", "envisionments", "prototypes" and the like rather than conduct experiments. At the same time, the importance of context and in situ analysis has meant that the tenets of isolation must necessarily be under pressure. More and more, we want to try things out (i.e. "stress test") things "for real". Once again, though, the point is not to have to choose between "objectivity" and "realism"[14] but to try to figure out what we would have to provide to have them both.

CATCHING BREATH

So, the claim is this. As it emerged from Computer Science, AI, Cognitive Science and Cognitive Psychology, HCI brought with it a set of orienting assumptions which were deeply embedded in the Galilean framework underpinning classical natural science. This framework shaped approaches to the *representational problematic* which has until recently defined the core of the discipline. Since gaining independence, however, the discipline has gradually expanded its scope, taken up issues and problems, followed lines of enquiry and adopted forms of data collection which do not sit comfortably with the Galilean outlook. While these were on the periphery and somewhat scattered, these distinctions and the lines of tension they set up were not a matter for concern. However, as they move ever closer to becoming core issues, such dis-attention will no longer be tenable. Indeed, adjustments in the face of the constraints felt and issues raised can already be seen. This

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[12] Unlike Mackay (op cit) we do not feel the model of explanation (inductive v deductive) is all that useful nor all that important. Models of explanation(ie their logics) are most often *a posteriori* rationalisations and recognised as such. No scientist would plan a research programme on their basis. As so often in these and similar discussions it is not the claims of science we take exception to but the claims about science (usually made on behalf of and not by scientists).

[13] Now, in relation to this, it is often proposed that social phenomena are not subsumable under the experimental method simply in virtue of the Hawthorne and related effects. But this is, in fact, to miss or misunderstand the central and critical point. The reflexive character of social life simply means that the focus of investigation would necessarily shift to reflexivity not that one could not design appropriately controlled experiments.

[14] That old chestnut…..

process of "unbinding" has not been a concerted or principled one, though. Neither has it been easy. Rather, as researchers have felt the need to broaden their remit, adopt new approaches, change their paradigms or just experiment with intriguing ideas, so the piecemeal, often conflicting sometime bizarre, shifts have taken place.

We have now reached a point at which the contradictions, conflicts and tensions are beginning to coalesce. This coalescing is being expressed, or so we would argue, in an increasing emphasis on experience rather than representation as the central category for HCI. The challenge which HCI faces is to form a new framework which will encompass those elements of the Galilean modality which are essential to HCI while at the same time allowing *routine everyday activity* to become the locale of our investigations. In the place of the theory of grounding, theory of objects and theory on investigative mapping brought over from the natural sciences, HCI will have to create its own. In this next section, we hazard some proposals for what this might be like.

EVERYDAY LIFE AS A PARADIGM FOR HCI

Investigative Mapping

Let's start with the characteristics of the use of technology which HCI has decided should be accommodated within its investigations, theories and analytic frameworks. They are three fold.

1. Technology should be treated as *endemically social in nature*. That is, the form a technology takes, its relative distribution, the meanings attached to it all directly affect how we relate and interact with it. Technology, just as much as any other feature of our lives, is embedded in the social world. To say this is not to say, though, that technology is nothing but social. Alongside the social forces shaping its presence and place are other equally important ones, not the least of which are the internal dynamics of the technology itself.

2. To understand just how is deployed, just what its characteristics are taken to be, and what its significance for the social organisation within which it is found, one has to look very carefully at the *context of use*. Looking very carefully means placing critical weight on the local organisation of work processes and practices and how they are managed a routine basis. This emphasis on the local context and its production order (i.e. how it is organised, managed and sustained) is the heart of the contribution which ethnography has made to the domain.

3. The local production order and hence the local production order of technology in use *is co-produced* by those who participate in it. This order is produced and re-produced in the flow of work. This is "the work" of technology use and consists in the reproduction of routine HCI on an ongoing basis as a joint outcome of those engaged on the scene.

To be able to turn to the routine world of technology use and draw out observations which speak to these features, HCI has begun to adopt two crucial framing devices. The first is the notion of *awareness contexts*. The second is *structures of relevance*. Taken together, these two define the nature of our experience in the every day world. Investigating the use of technology as structured by awareness context immediately points the investigator to variety of interests, outcomes and forms of participation and collaboration we can see associated with technology use. To use metaphor from classic psychology, working with and through technology, we are constantly reconfiguring the gestalt of interaction. At one point the technology might be the focus of our attention, and then it merges into the ground as the figure moves to the other we are relating to, the problem in hand, and so forth. This process of reconfiguration is itself reflexive upon the structures of relevance in play at any one point. These relevances define the boundaries (or horizons) of our awareness and interest both in the technologies we use and the extent of the task in hand.

Structures of relevance and their associated awareness contexts provide ways of opening up our routine use of technologies for research inspection. They give us ways of looking, places to look, and things to look for. They also give us ways of organising the things we find. The notions of Community of Practice and legitimate peripheral participation, for example, are attempts to find a middle order category or theory to capture and generalise some of the awareness contexts and relevance structures revealed when one looks closely at the process of learning outside of the classroom.

Theory of Objects

Structures of relevance and awareness contexts are, for want of a better term, the research tools which HCI is beginning to deploy in its attempt to grapple with the problem of characterising experience.[15] They express a particular set of orientations to the features of the social and organisational world. The first is that our experience of the world is centred on each of us as a perceiving subject. The world as I experience it is *my* world. Awareness contexts and structures of relevance as I experience them have me as their focus. Moreover, this is true for all of us. Although it is always possible "to up level", "go meta" or "take an overview", in the welter of daily life these *perspectival framings* very special and very occasional devices. Most of the time, and for most purposes, we find ourselves thrown into a world of experience which we organise for our own point of view.

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[15] The usual leads and lags of any vibrant discipline mean that some researchers have already openly recognised and enthusiastically endorsed these or similar concept. Other have not, and maybe will not. However, our claim is no matter whether they use the terms, this is the way that HCI researchers are and will construe technology use in daily life the better to be able to render visible the features they are interested.

However, we are not thereby radical solipsists. Although we encounter the world as our world, we presume others do too. And, moreover, since we know we are immersed in our own experiences, we assume others are too. The second pre-supposition is that of *inter-subjectivity*. If we are subjective beings, as we have just described, then in being in a social world we share subjectivity. Social life is intersubjective. The crucial move that this makes available to us is the possibility of a reciprocity of perspectives. If you had my structures of relevance, my awareness contexts, you would experience the world as I do. It is this concept of the reciprocity of perspectives which makes possible the idea that culture (and indeed the local production order set out earlier) can be seen as self replicating. The effect which is captured as "the organisation of work practice and culture in the workplace" is the accomplishment of the reciprocity of perspectives as a *fact* of ongoing organisational and working life. Sharing a work practice, being a member of a culture, is no more than knowing how to align experience in institutionalised[16] ways.

We are in our world and in a world of others just like us. And, while we experience it as *our* world we do so in ways that are shared with others. In that sense, our experience is individual and social. This is not a paradox. How we encounter the world, how we experience it, is not made up as we go along. It is given, shaped and provided by our social environment. Thus, the world for us is a world of familiar forms. There are trees, people, buses, and user interfaces. And, while each is unique and experienced as such, the world is shared (and inter-subjectivity achieved) by *constructing types*.

Typificatory structures, inter-subjectivity, and reciprocity of perspectives provide a way of constituting social actors and social action in the social world. Once constituted in this way, the issues of context embedding, co-production and the like framed by awareness structures and structures of relevance, become amenable to investigation and analysis as features of ordinary everyday life. In that sense, if we want to ensure that the focus on experience is firmly based, these or similar concepts will be required.

Theory of Grounding

In the previous two sections, we have been gradually stepping back from issues of the operationalisation of research investigations to those which we termed *methodics*. In place of the strategies of simplification and isolation, we offered framing through attention to awareness contexts and structures of relevance. In place of a separation of underlying mathematical forms and surface contingencies, we offered egologicality, the reciprocity of perspectives and typification. To complete the break with the Galilean modality we will need an alternative theory of grounding to observer independence and the constancy of phenomena. We suggest this could be *thematisation* and *the play of possibilities*.

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[16] This is a short hand for "locally produced and locally recognisable".

The principles of the Galilean modality are those of *methodological naturalism*. The grip that it has over us is in large measure due to its conflation of two very different arguments and their conclusions. One is ontological; the other epistemological. The first tells us how the world must be. The second tells us how we can know about it. In combination, they offer an apparently unassailable account of what we must do to have reliable knowledge in systematic ways. If we choose to depart from methodological naturalism, we do not thereby necessarily depart from either the ontology or the epistemology by which it is secured.[17] Moreover, the reasons for wishing to make that choice are driven by the tractability that is thereby offered us over the phenomena we wish to study. Methodological naturalism processes those phenomena out. Thematisation and the play of possibilities, or so we will claim, allow us to raise them to prominence.

The basic assertion is this. There is no pre-given way that the world must be. Rather, the physical, social, spiritual, whatever world or worlds around us can be analysed and investigated in myriads of different, complementary and mutually exclusive ways. Saying this does not mean that all these ways of analysing the world should have equal standing. But choosing between them is an epistemological not a methodological matter. Methologically, they are logically equivalent. When Galileo first described the movement of planets as following geometrical forms, he created a novel thematisation both for Astronomy and for science in general. Subsequently, the history of the physical sciences has been one where the possibilities inherent in that thematisation have been played through. Now we find it impossible to think in science without rendering those thoughts in formalisations which use mathematical notation. The phenomena of science have become the underlying mathematical regularities depicted in these formalisations.

What thematisation could we propose that would offer ways of playing through the structures of experience as a play of possibilities? How could we ground the theory of objects and theory of investigative mapping just summarised. We suggest this might be best be done by taking *the primeordiality of the life world* as our starting point. This inverts the thematisation of the Galilean modality. Instead of our experience being *accidental* (in the philosophical sense), it is the ground from which we depart when we undertake science, go to the theatre, make music together, or take part in a religious service. In each of these, we "bracket" the world in different ways and allow different principles in play. In the theatre, time is collapsed, relationships condensed, objects always endlessly significant. We engage the world of the theatre in wholly different ways to the way we undertake science, or go to church, or play with the children. We deploy, to use our earlier term, a wholly different theory of objects.

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[17] This is a vital moment. We speak of choosing not to follow methodological naturalism. That these *are* matters of choice is another of the presuppositions lost in the transfer of HCI from AI and Computer Science

CONCLUSION

The thematisation of HCI around the primeordiality of our experience in the life world does not mean that the Galilean modality is rendered useless. Rather, it raises to the fore the methodological challenge of relating and where possible integrating these alternatives. How are the formalisations of experience to be related to our sense of the dynamic of the gestalt of work? This is not a trivial question. Nor can it be easily dismissed. It is the central question to be resolved if HCI is to make any progress as an engineering discipline of socio-technical systems. Our argument has been that the full implication of what it means to call HCI a socio-technical discipline has still to be realised. However, across the discipline in various ways this is happening. As it does so, the local irritations which researchers feel towards the constraints and pre-dispositions of conventional HCI will deepen and become more acute. This in turn will raise issues at the methodological level. In attempting to focus HCI as a socio-technical discipline around the category of experience, it will be necessary to re-constitute what it means to do HCI research. We have proposed grounding this re-constitution in thematisation and the play of possibilities. Alongside the traditional representational and formalisation themes currently used, we propose the exploration of inter-subjectivity, egologicality and typification. The intent is not to displace the traditional motifs but to extend and enhance them. In so doing, we expect a more substantial, effective and satisfying account of the use of technology in daily life may thereby become available.