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Since its beginnings in the middle part of this century, the field of computer science has maintained close allegiance to its roots in traditions of analytic philosophy, mathematics and the physical sciences, and in the associated arts of engineering. This heritage has provided a background of starting premises and acceptable methods which the field has adopted, for the most part uncritically, as its own. At the same time there has emerged a small but growing countermovement within the field, and it is as a leader in this alternative line of development that Morten Kyng has made his contribution. This alternative is characterized by two central orienting premises. The first of these is that computer science is involved with the *design* of computer artifacts, not primarily as a matter of the application of theory to the construction of machines, but as the imaginative creation of artifacts useful to others. Viewed as a design practice in this sense, the center of gravity within the field and its allegiances shift. Specifically, the center moves from inside the community of academic computer science out into the sites in which computational artifacts are to be put to use. More profoundly, the enterprise of designing computer artifacts is no longer seen as the application of general theory by technical experts employing systematic methods. Instead, it is redefined as a deeply contextual practice requiring the crafting together of various resources into useful configurations of skilled work and associated technologies. This in turn involves diverse knowledges including, most crucially, those of workers who will be the artifacts' users.

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The second orienting premise of the alternative which Morten Kyng has helped to define is that designing computer artifacts is an inherently value-based activity, deeply implicated in longstanding political struggles of the wider society in which computer science is embedded. Rather than viewing this fact as a breakdown in what should be a disinterested project, this alternative position embraces the place of systems development as a critical arena for the expression and enhancement of values of industrial democracy. This political awareness and willingness to speak directly to the contests that surround the development of new technologies is one of the most important and innovative contributions that the Collective Resource Approach (CRA) has made to computer science and systems development internationally.

My comments here are offered from the position of one who aspires to follow the lead that Morten and his colleagues have set for us, to help in building contextual approaches to the design of computer artifacts within the United States and internationally. Computer science and systems development within the United States are viewed as strictly technical and commercial arenas, dedicated to the advancement of technology and improvements to business productivity and profitability. Technical expertise is considered the necessary, if not sufficient, form of knowledge required for the design of computer artifacts, which is subject to increasing pressures for reductions in cost and time-to-market. Computer artifacts in turn are subject to increasing commodification, resulting in generic packages of hardware and software with minimal commitment by vendors to their integration into working systems. Under these circumstances the distance between designer/developer and end-user grows, as developers work to ever-tighter schedules of code delivery and end-users are defined by ever more decontextualized and simplistic stereotypes. With few exceptions, there is no discussion of issues like the rights of workers to set new technology directions, or to participate directly in system design.

Until the mid 1980's, there was little alternative to this model for the production of computer artifacts. Some few critics in the U.S., working from within academic and industrial research, were attempting to intervene by challenging the underlying premises that legitimized technologists' exclusive control over design, including the adequacy of formal, information-processing models as a basis for it. Our arguments were powerful, I believe, but they suffered from two basic limitations. First, we worked primarily from the position of critic, questioning existing practice, with little in the way of a well-developed alternative approach to offer. And second, our arguments remained in some sense within the technical frame, going along with the implicit and unquestioned assumption within U.S. research and development that there was no place for values or politics in discussions of technology design.

It was from within this situation that researchers in the United States encountered the work of Morten Kyng and his colleagues, and it was just such an alternative that their work provided us: a vision not only of what was wrong with existing premises and practices of system design within the U.S., but also of how it could be different. The difference turned,

first, on alternative, work-oriented and cooperative design practices – what Morten has identified as design-in-context. And it turned, secondly, on alternative contexts for design; specifically, situations in which computer science and system design acknowledge their values and politics, and incorporate them critically into practice. These positions provided to myself and my colleagues both inspiration and strength, by identifying a positive alternative to which we could point, and toward which we could begin to work.

Design in context

Morten Kyng has subtitled his paper "A contextual approach to the design of computer artifacts." All of the words here are carefully chosen. Among them, the term "contextual" carries two basic meanings in his usage. The first sense, implied in his discussion of "design in context," refers to something like the specific environments in relation to which artifacts are designed and used, including places, participants and working practices. The second sense, suggested by "contexts for design," emphasizes more the arrangement of resources and interests that either make design in context possible or, alternatively, pose obstacles to it. The first sense of context motivates a commitment to a design practice located within the sites of an artifact's intended use, in cooperation with those into whose working practices the artifact should fit. The second identifies a commitment to creating political and economic circumstances that would make design in context possible, including, in his words, "strategies for supporting users' democratic influence through design-related activities" (p. 9).

The focus on design in context really began with what Morten has named the second generation of CRA projects, in particular the UTOPIA project and the Florence project in Norway. It was through these projects for the first time that an effort was made not only to support workers in having a stronger influence over traditional, management-initiated forms of computer systems development, but in actually designing their own alternatives. As Morten and his colleagues discovered, however, to design alternative, skills-based computer artifacts required alternatives to traditional systems development methods as well. Thus began an extensive and extremely productive effort, continuing today, to create what CRA terms "tools and techniques" that can actually support processes of mutual learning and cooperation between design professionals and relevant workers/end-users.

At the same time, discussions within a larger community of researchers and developers have led to extensions to our conception of "design" along several dimensions. First, design clearly does not refer to some single phase in a linear process of development. A second, related observation is that design does not stop at some point of hand-off of a system from its designers to its users. Rather, design in the large must encompass continued support for maintenance, further customization, and diverse forms of ongoing design-in-use. This means that design in this broad sense must go beyond the creation of demonstration systems that dazzle our colleagues (although surely we all still aspire to that), to computer-based artifacts that are actu-

ally put into use over time within a working practice.

Given this extended conception of design, we can ask just what sense of "design" is encompassed within the "design in context" of CRA projects. In particular, have we managed (and I include here not only the CRA projects but the combined efforts of the larger community committed to related approaches) to address this broader sense of design, putting working systems into use and supporting their continued development? My own sense is that with the possible exception of the FIRE project at the University of Oslo, design in context has centered on somewhat bounded periods of intensive interaction between designers/developers and workers/end-users, early on in an artifact's definition. My point here is not to question the value of our projects, as I think the learning that has been accomplished through them is beyond question. The point is rather to highlight what I think remains one of the most difficult, enduring challenges that we all face; namely, enrolling the additional allies and resources that are required to get CRA-based designs into working use.

Contexts for Design

My second question concerns future strategy for the Collective Resource and related approaches. Morten points out that to realize the potential of CRA requires not only adoption and further development of CRA tools and techniques for design in context, but also the creation of the necessary context(s) for design. He describes, as critical first steps in creating the Collective Resource Approach during the 1970's, the development of a technology *strategy* in the interest of workers, characterized by local worker action based on central union support. Morten also remarks, however, that starting in the mid 1980's he and his colleagues experienced as he puts it "severe difficulties in supporting user/worker participation in design activities proper" (p. 5). Moreover, at present he states that "the notion of worker controlled resources and independent worker activities in combination with negotiations with management, as a strategy for influence, has almost totally disappeared" (p. 12). Not coincidentally perhaps, contexts for design in Scandinavia are coming to bear greater resemblance to those of the United States. This suggests more than ever a need to form alliances and develop common strategies.

For us a central problem is how to avoid the appropriation of design in context to the interests of business strategy and technology promotion, to the neglect of, or at times even in direct conflict with, the interests of workers. We find some relevant words on this problem in the conclusion of the report from the UTOPIA project, included as part of Morten's dr. scient.-thesis:

> The described design process is utopian in a double sense. It reflects the way the design process was carried out within the project. But the preconditions for this process are not present in corporate business as we know it today. Resources for skilled workers, trade union people, computer and social scientists to work together over a long period of time developing tools in the interests of the end users do not generally exist as yet. UTOPIA is not only a challenge to

> design but also to a more democratic working life (1987, p. 278).

Those words were written almost ten years ago, but I believe that they describe quite perfectly our current situation. The question, then, is what does it actually mean today to create contexts for design in the broad sense of design discussed earlier? In what aspects does the changed context for design make the task of CRA more difficult or, alternatively, what new possibilities do these conditions open up?

CRA in relation to other perspectives

My remaining comments have to do with the way in which Morten positions the project of CRA and computer science generally in relation to other perspectives, particularly those from the humanities and social sciences. In his summary paper he differentiates the humanities and social sciences from design by characterizing them as "analytical," enterprises, where design in his terms is "construction oriented." According to Morten, the humanities and social sciences have been brought in to CRA over the years to the extent that they have been needed to support its goals. Similarly, on Morten's account, the field of CSCW was led to incorporate research in anthropology and sociology by the complexities of computer-supported cooperation. As a result of being called in to help, the social sciences, in turn, were confronted for the first time with the requirements of design.

Let me begin with this characterization of history of CSCW. As Morten knows well, few historical developments occur as the result of some single, inexorable logic. In this case, it was not so much that the field of CSCW was driven through its own internal logic to call upon the social sciences, but rather that a few actors, including Irene Greif and myself among others, intervened in the progress of systems research and design and succeeded in establishing the place and relevance of work in anthropology and sociology to CSCW's concerns. Similarly, CSCW came to the Scandinavian approach to systems design not through the intrinsic worthiness of the latter, worthy as I believe it to be, but through the work of a few allies who struggled for its place. Morten's own role in the progress of CRA is another instance of this basic historical process.

My point is not simply to question Morten's somewhat revisionist histories (we know all history is subject to revisions), but to look more closely at how his account of CRA's history and progress characterizes the disciplines and, perhaps more importantly, how it positions Morten's own project in relation to others in the future. To begin with, Morten clearly expresses an indebtedness to certain philosophical traditions or, more precisely, to the philosophical alternatives provided by Heidegger, Wittgenstein and their interpreters such as Dreyfus & Dreyfus and Winograd & Flores. But having briefly acknowledged these contributions to his own thinking, he then draws what to him seems a clear distinction between the so-called analytic enterprises of the humanities and social sciences, and his own interests in design. As I mentioned earlier, he characterizes the former as being inherently non-interventionist, and therefore of little direct relevance to latter.

It is here that I would like to slow things down for a moment and look again at the lines that Morten is drawing. First, and perhaps most fundamentally, he seems to be falling victim to the kind of dichotomous thinking regarding relations between theory and practice, reflection and intervention, that he would otherwise have us avoid. This in spite of the fact that by his own account there are lines of thought within the humanities and social sciences that, in suggesting alternatives to the theory/practice divide, provide a foundation for just the kind of critical design practice to which CRA is committed. Heidegger and Wittgenstein are unquestionnably rich resources in this regard, but there are others.

Within anthropology, to take just one example with which I am familiar, there is the practice of ethnography. Like usability studies within computer science, ethnography began in the service of powerful actors interested in managing relevant others. In the case of ethnography, the powerful actors were colonial administrators, the relevant others the so-called native peoples who inhabited the colonies and provided the work force for, or alternatively, the sources of resistance to, imperialist enterprises. Early anthropologists went out to the colonies on the premise that theirs was a project of objective recording, aimed at bringing back knowledge of native peoples that would be useful in colonial design and administration. But over the years, in part in reaction to this early history, anthropology in general and ethnography in particular have taken a different turn. Specifically, critical discussions and refigurations of ethnography have transformed it from an objectivist enterprise in the service of colonialism to a militant source of radical interventions and critique on the part of post-colonial efforts. A central aspect of this transformation has been painstaking, critical reflection on the so-called ethnographic encounter, specifically the coming together of knowledges and perspectives that are not only different, but differentially powerful, as a part of ethnography's basic practice.

I believe that in all the ways that relations between ethnnographers and their "subjects" bear a family resemblance to relations of designers and users, critical anthropology can be relevant to CRA and related projects of transformation. Feminist research, similarly, has struggled with questions of multiple epistemologies and relations of knowledge and power. And so on and so forth. My point is not to argue that Morten should take up one or another of these positions, but rather to urge that he remain open to engagement with them and to the possibility that these other perspectives could offer new resources for his own thinking. Moreover, just as CRA argues that users should be brought into design as equal partners, rather than as secondary participants whose knowledge is taken up by technical experts for their own purposes, so I believe there must there be equal and respectful interchange between computer science and other disciplines if we are to achieve true mutual learning and cooperation. I am suggesting, in sum, that Morten positions the humanities and social sciences in relation to CRA in something like the way that traditional computer science positions users in relation to its enterprise. I am suggesting further that not only may he want to avoid reproducing such positionings among different knowledges, but that the humanities

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and social sciences may actually offer resources for an alternative stance.

A second, related point turns on what we take to be "intervention." I would like to suggest that there is an important difference between saying that an intellectual project is not aimed at design, and saying that it is non-interventionist. The intellectual projects of recent science and technology studies, for example, may not be aimed at intervening in the conduct of science and technology development in the sense of designing new, improved versions of tools or practices (though some are). Yet they may still be deeply interventionist in their goals of challenging and displacing prevailing conceptions of the social and material worlds, which lend support to and legitimize existing practice. Thanks in part to work in the social construction of technology and related areas of technology studies, for example, we now conceive of technologies not as fixed objects with intrinsic meanings, but as more and less stabilized artifacts, defined in relation to the activities and interests of their production and use. These reconceptualizations open up new strategic possibilities, in the present case for identifying and exploiting the flexibilities that are particularly characteristic of computer-based artifacts.

I believe that the most powerful and inalienable resource that workers have is their own experiential knowledge of how their work gets done. Through an impressive career, Morten Kyng has shown us how design in context aims to build a cooperative design practice grounded in workers' knowledge, which in turn requires new contexts for design that provide independent resources accountable to workers' interests. It becomes increasingly clear that while the first of these will continue to provide a rich and important arena for action within the CRA and related approaches, it is the second, the creation of genuinely new and autonomous spaces for workers' control over technology direction and design, that poses the greatest challenge to us all.

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