PARTICIPATORY DESIGN

Participatory design (PD) is an approach to engineering technological systems that seeks to improve them by including future users in the design process. It is motivated primarily by an interest in empowering users as well as by a concern to build systems better suited to users' needs. Traditionally, PD has focused on the design of information systems, although the same approach has been applied to other technologies. In order to respect the social contexts in which users work, PD practitioners explicitly consider the practical demands workers must meet to do their jobs, as well as the political relationships that exist between workers, their management, and technology designers. As a design subdiscipline, PD directly addresses both technological and ethical issues in the design of systems. Because of this, some people have argued that PD can be used as a model for the "democratization of technology."

HISTORY

Participatory design has its roots in northern Europe with the combination of two research programs studying the empowerment of workers with respect to technology. It is generally seen as developing from the Scandinavian "collective resources" research program that focused on union empowerment in contract bargaining situations through the education of union officials and members about various production technologies (Bjerknes, Ehn, and Kyng 1987). The other program, "sociotechnical systems design," was pursued primarily by British researchers at the Tavistock Institute and focused on the design of technologies to empower individual workers by enabling and supporting autonomous workgroups (Mumford 1987). Both research programs had in fact grown out of the Norwegian Industrial Democracy Project begun in the 1960s, although the British contribution to PD is often overlooked (Emery and Thorsrud 1976).

The second generation of the Scandinavian approach was marked by the Swedish-Danish UTOPIA project, the first recognized development project. Launched in 1981 and conceived in response to the discouraging results of the earlier trade union projects, which had found that existing technologies limited the possibilities of workers to influence workplace organization, UTOPIA targeted technology development as a prospective site for user involvement and influence. In cooperation with the Nordic Graphic Workers' Union, the UTOPIA (both an acronym and an ideal) project studied a group of newspaper typographers working without computer support in order to develop a state-of-the-art graphics software product for these skilled graphics workers. The objective was to create a commercial product that the unions could then demand as an alternative to the de-skilling technologies available in the market. In doing this, their goals came into alignment with sociotechnical systems research. By 1985 the British and Scandinavian traditions had rejoined under a common banner of democratizing technological systems design. The consequence was a new focus on the participation of workers in technological design discussions, and this was to be the essential feature of the PD tradition from that point on (Greenbaum and Kyng 1991).

POLITICS OF PARTICIPATION

PD has come to be defined by its attempts to involve users in the design of information technologies, and research in the field has examined the various challenges that these attempts have faced. Depending on the different features of the various workplaces that have been engaged, problems of communication, workplace politics, and design politics have received the most attention. The differences in work contexts range across unionized and nonunionized workplaces, democratic and nondemocratic countries, small and large organizations, public and private institutions, commercial and nonprofit organizations, volunteer and paid workers, and various configurations of labor and management. The design projects also differ in the extent to which they try to use existing or off-the-shelf technologies, as opposed to custom-tailored systems. Finally, the roles and responsibilities of design engineers and workers in the process of systems design can vary widely, thus influencing the politics of design.

The principal method used by PD to involve users in design is to have them participate in meetings with design engineers. It is this simple idea that makes the approach "participatory." Participation in this sense is usually taken to mean participation in discussions about a technology, as opposed to actual participation in the construction of a system as engineers or builders. While this might seem simple, it turns out that there are various sorts of problems that arise in these meetings, mainly as a result of problems of communication between people of differing knowledge and perspectives.

Simply allowing users to sit in on design meetings is insufficient to achieve participation because the politics of both the workplace and the design process can intervene. Sometimes managers are considered to be part of the user group, even though only the workers below them will ever deal directly with the technology in question. The politics of the workplace can then impinge on the process to the extent that managers may resist the participation of low-level workers, intimidate them in the meetings, or act to discount their authority, skill, and knowledge. Even when managers are not present, the users themselves may not be fully aware of how best to articulate their knowledge of the workplace or what they need and desire from the new technology, or they may underestimate the value of their own skills and knowledge. The politics of the design process often gives engineers, with their expert knowledge, much greater authority in making design decisions. As such, it can be difficult for users to express themselves and not simply defer to the authority of these expert designers. All these political forces tend to silence the voices of users in the design meetings, and a serious effort must be made to counteract these tendencies.

Design engineers can also find it difficult to communicate effectively with users. Engineers tend to express themselves in technical language, and they usually discuss design ideas in terms of nuts-and-bolts internal operations, rather than how a technology relates directly to a user. As such, it can be a daunting task for an engineer to describe design alternatives in a way that users are able to understand and respond to with informed opinions. As a result of these problems, a great deal of energy is expended in PD to create visualizations and mock-ups of proposed systems so that they can be evaluated by users. It is also common for designers to be sent to the workplace to observe users or even for them to be trained to do the work of the users of a proposed system.

Gender poses an additional set of problems to effective participation in design. In many work contexts, the positions traditionally occupied by women are often viewed as being of lower value by management and unions. This undervaluing of women's work easily overflows into inequalities of participation in design activities, especially when combined with social prejudices that view technological design as a masculine pursuit. Moreover, unless gender issues in the design process are recognized and dealt with, there exists a strong possibility of reproducing these gender politics through the technology (Green, Owen, and Pain 1993). Even though PD shares many of its organizational ideals and goals with feminist philosophies and organizations, researchers have found special challenges to using PD in feminist organizations. Ellen Balka (1997) reports that common features of feminist organizations such as decentralized organizational structures, high dependence on volunteer and transient workers, lack of adequate funding and resources, and lack of technological training among organization members pose particular problems for implementing PD in these organizations.

Ultimately, PD does not consist of a set of strict rules or methods for how to go about designing systems. Instead, PD prescribes an attitude of including users, encouraging their thoughtful participation, and being sensitive to the political and ethical challenges facing designers. Specifically, it encourages designs that empower users, respects and encourages their skills and job satisfaction, and protects their individual autonomy as much as possible given their jobs and work environment. It also provides case studies and techniques that have worked to varying degrees in various specific design projects as a resource to draw on in future design projects. Several conferences and journals have brought together the results of many such projects (Blomberg and Kensing 1998; for more on the politics of representing work, see Bannon 1995).

DEMOCRATIZING TECHNOLOGY

Some authors, such as Langdon Winner (1995), have proposed that PD stands as an example of a new kind of technological citizenship. Under the current forms of citizenship, there is very little room for individual voices to shape the design of the technologies that permeate society. Private companies driven primarily by commercial interests produce most of these technologies. PD does not offer universal participation, or democratic control over all technologies, but it is argued to be a step in the right direction by allowing some noncommercial values to influence some technologies.

It is crucial to note that arguments such as Winner's hold out a procedural notion of justice as the political ideal. It is the very participation of people in design that is democratic, just as the right of all citizens to vote makes a government democratic. Thus, democratizing technological systems raises many of the same problems facing democratic governmental systems. Just as the people in a democracy are free to elect a tyrant and the majority might use the system to exploit and repress minority groups, it is not clear that universal participation actually leads to a society or technology that is free or empowering. What PD can do is bring designers, users, and the technology itself into a process through which the technology can develop in useful ways.

A more detailed history of PD and its connections to broader social movements such as the quality of working life movement and total quality management, as well as a consideration of the ethical and political issues it raises can be found in Peter M. Asaro's 2000 article "Transforming Society by Transforming Technology."

SEE ALSO *Design Ethics.*

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Revised bibliography

PASCAL, BLAISE

Mathematician, physicist, inventor, philosopher, religious thinker, and writer Blaise Pascal (1623–1662) was born in Clermont-Ferrand, France, on June 19, 1623, the second of three children of Étienne Pascal, a government official and man of wide learning. His mother died in 1626, and in 1631 the family moved to Paris. His exceptional talents evident early on, Pascal was educated entirely by his father, who in 1635 introduced him to Marin Mersenne's newly founded *académie*, where the latest problems in mathematics, science, and philosophy were being discussed. At sixteen, he wrote an original work on conic sections. At nineteen, he invented a calculating machine, the Pascaline, that was awarded an early form of patent; a series of further machines were built, and a few have survived. There is now a programming language called Pascal. (A possible priority: Some letters were discovered in 1935 and 1956, written in 1623–1624 by the German scientist Wilhelm Schickard, which contained a description and sketch of a mechanical calculator he had developed, but also the news that his model was destroyed in a fire.)

TECHNOLOGY, EXPERIMENT, THEORY

Hearing about Evangelista Torricelli's experiment with the barometer (a glass tube of mercury inverted in a bowl of mercury), Pascal undertook in 1646 to carry out variations of the experiment and then explained the results, showing that atmospheric pressure decreases (the mercury level drops) with increasing altitude. He discovered the basic principle of hydrostatics, Pascal's law: in a fluid at rest in a closed container, a pressure change in one part is transmitted without loss to every portion of the fluid and the walls of the container. (The SI unit of pressure is known as the *pascal*.) He also invented the syringe and the hydraulic press.

These developments had a revolutionary impact on scientific thought, as they refuted the Aristotelian doctrine that there is no vacuum. In *Preface to the Treatise on the Vacuum* (1651), Pascal asserted that, in studying nature, careful experiment and logical thinking must take precedence over respect for authority. In *New Experiments concerning the Vacuum* (1647), he gave a detailed exposition of scientific method, with the following thesis: a hypothesis is false if contradicted by a single experimental result, and only possible or probable if all observations are consistent with it.

A 1654 correspondence of Pascal with the mathematician Pierre de Fermat (1601–1665) concerning a gambling problem marked the birth of probability theory, the study of patterns of chance events and the formulation of laws governing random variation. Pascal solved the problem by means of the arithmetic triangle, a numeric structure that now bears his name, and in the process introduced the binomial distribution for equal chances