

PARTICIPATORY ERGONOMICS: PAST, PRESENT AND FUTURE

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This article traces the origins and development of Participatory Ergonomics as a macroergonomic approach to Japan in the 1980s. Since that time participatory approaches have evolved to make it a powerful means for ergonomists around the world. Future generations and ergonomic trends are projected using one set of conceptualization. Based on this model four generations can be identified: physical, cognitive, neural and biological. Four trends are projected to become important; one of which will be the need to engage users in other participatory means. This will result in finding an increasing number of new applications based on a finite set of ergonomic principles. This model is consistent with trends in the digital age.

Key words: participatory ergonomics; macro ergonomic approach; future changes

PARTICIPATORY ERGONOMICS

Past and Present

The concept of participatory ergonomics first appeared more than 25 years ago in a workshop (Kogi, Noro and Imada, 1984) that first introduced the concept of using participatory methodologies to implement ergonomics. This workshop was the result of a meeting I had with Kageyu Noro while living in Tachikawa, Japan in 1981-82. At the time, I was interested in Quality Circles and Japanese production systems. He told me of Kazutaka Kogi's work using participatory methods. We agreed to combine our efforts and share our participatory tools at the First International Symposium on Human Factors in Organizational Design and Management in Honolulu. In many ways, this was the first macroergonomic approach. Not long after that workshop, papers were presented at International Ergonomic Association Congresses in England, Australia and France (e.g., Imada, 1985, 1991) and the publication of Participatory Ergonomics (Noro and Imada, 1991) soon followed.

Since that time, the methodology has been successfully applied to a wide range of settings and problems with remarkable success. A special issue of *Industrial Ergonomics* was devoted to participatory ergonomics (Imada and Nagamachi, 1995) and it has also been covered in a special issue of *Applied Ergonomics* (Imada and Carayon, 2008). The methodology has been presented widely at International Ergonomics Association (IEA) World Congresses and Organizational Design and Management (ODAM) Symposia over the past quarter century. This macroergonomic approach was recognized by receipt of the first Liberty Mutual Medal (See Imada, 2002). Kogi and his colleagues have achieved remarkable successes using this approach (e.g., Kogi, 2008). Using checkpoints, small workshops and train-the-trainer techniques, Kogi has realized unprecedented results in spreading ergonomics, most notably in Industrially Developing Countries (IDCs). This work has exposed thousands of workers in small enterprises, home workers, farmers, workers in construction, health care, service and manufacturing to ergonomic principles. In so doing, this work has prevented countless injuries and human suffering, improved productivity and created competitive enterprises. Detailed de-

scriptions for these programs are outlined in various projects including WIND (Kawakami, Khai and Kogi, 2009), WISH (Kawakami, Arphorn and Ujita, 2006), and WARM (Kawakami and Khai, 2010). This is arguably the most successful intervention in our profession.

This same Participatory Action Oriented Training (PAOT) is embodied in a number of publications including: improving working conditions in small enterprises in developing Asia (Kogi, 1985), and low cost ways of improving working conditions: 100 examples from Asia (Kogi, Phoon and Thurman, 1988). Similarly, Ergonomic Checkpoints (IEA ILO, 1999) uses a simple one-page action oriented participatory methodology to make users aware of the principles and engage them in solutions. The second edition of Ergonomic Checkpoints is now in press. Ergonomic Guidelines (IEA ICOH, 2010) uses the same approach to improve occupational safety and health in industrially developing countries where complete ergonomic resources are not available.

During the past 25 years, participatory ergonomics has become a major macroergonomic tool for implementing ergonomic technology throughout the world. What began as largely an industrially based, first world concept has been implemented across a wide range of settings far beyond its origins. Literally, thousands of lives have been changed, countless injuries avoided, enterprises have become more competitive and the human condition has improved as a result.

Future

The future of ergonomics is far from certain. Boff (2006) presented a four-generation model for ergonomics – physical, cognitive, neural and biological. The physical generation adapts equipment, the workplace and tasks to human capabilities and limits. The cognitive generation seeks to harmoniously integrate humans, technology and work to enable effective systems. Neural generation ergonomics involves changing or amplifying human physical and cognitive capabilities to perform through symbiotic coupling with technology. Finally, the biological generation involves modifying human physical and/or cognitive capabilities to maximize human effectiveness and match system requirements. We are already well acquainted with the physical and cognitive generations. This is the work we already perform. Work in the neural generation is emergent and applications are becoming more commonplace (e.g., prosthetic limbs, artificial joints, cochlear implants). However, newer biological alterations using psychopharmacology, nanotechnology, robotics or synthetic biology present unknowns.

These changes will create trends that will affect not only how we implement ergonomics, but also how we work, play and live in the future. These include: 1) how change occurs; 2) what attracts people; 3) ethical boundaries that will be approached; and 4) how to engage people in these changes.

How change occurs

Recent ideas have given us clues about how these generations are likely to occur. First, chaos theory predicts disruptive changes that create bifurcation and system changes. These disruptions can be traced to the “dependence on initial conditions”. That is, how the system starts will influence how it ultimately changes (e.g., Prigogine and Sengers, 1984). Therefore, the initial designs that we create in Generations 1 and 2 will determine what we do in Generations 3 and possibly 4. These changes may not be disruptive, but depend on existing system characteristics.

Summary of the social science literature in the general press also indicates that changes occur in a viral manner. Gladwell (2002) suggests that social changes can be the result of a social contagion. Like fads and fashions, significant organizational and social changes occur in a predictable pattern with a few early adopters taking the risk to accept the change. This pattern continues slowly at first and then suddenly accelerates as the large group in the middle begins to adopt the change and affects each other as they do. This suggests that ergonomics at each of these stages may occur slowly and either not catch on or suddenly explode to become normal.

What attracts people

Recent works indicates that we are attracted to things for reasons other than purely linear and

logical reasons. Pink's (2005) work suggests that it is not the thoroughness, completeness or comprehensiveness that gets peoples' attention. Instead, people are attracted to things that tap into the emotional, personal and meaningful parts of our lives. We experience these through emotional sensors. The six senses he describes include: design, story, symphony, empathy, play and meaning. A good example of this can be found in information technology. Many of us who remember the DOS operating system can recall the drudgery of the system and how unappealing it was. In fact, the system was more logical and probably easier to construct for the designer. However, when the user is confronted with the morass of information in a way that is not designed for easy use, cannot be customized, and is not appealing, the reaction is disinterest. Today's Graphical User Interface (GUI) presents the user with a design that is appealing, one that the user can customize to include personal preferences, other interests, and incorporates other parts of the users' life into the customization. These elements will attract people to the next generation of ergonomic ideas.

Ethical boundaries

As we approach new generations of ideas we will be confronted with ethical considerations. Technology and options left on their own can lead to perilous applications. These considerations should include our responsibility to apply ergonomic technologies to different groups of people. We are already somewhat comfortable with ideas such as computer aided prosthetics, cochlear implants, and artificial joints. We can anticipate the potential ethical problems of altering humans to match system requirements through psychopharmacology, nanotechnology or robotics. However, we also need to consider the consequences of withholding our ergonomic information, particularly generations 1 and 2, from people who could benefit from our methods. Just as it may be unethical to implement generations 3 and 4, it may be unethical to not apply what we know from generations 1 and 2 to protect lives, prevent discomfort and injury.

How to engage people in these changes

Participatory ergonomics is particularly well suited to engaging people in the implementation of generational changes. This is supported by a model of how discoveries are made that relies less on individual genius and more on the collective power of involved and experienced groups. Ogburn and Thomas (1922) describe "multiples" -- inventions by several people independently. At that time, they identified more than 100 ideas that were invented simultaneously by different individuals. Examples include: the telephone, calculus, color photography and logarithms. One potential explanation is that these inventions are not the product of individual genius, but occur at the right time with the right conditions for the ideas to blossom. Given the right circumstances and environment, these inventions may have arisen without the genius of any particular person.

In the same way, workers and citizens may be able to come up with solutions "spontaneously" given the right circumstances and skills. Users have first-hand experience with the problem. They have the understanding of the work to be done and the discomfort involved. By creating an environment that reinforces their positive ideas, to come up with their own solutions and implement locally generated ideas may be ways of uncovering great ideas.

Appreciative Inquiry (Cooperrider and Whitney, 2005) is a participatory methodology that has been employed in implementing change to a range of situations. It uses discovery, dreams, design and destiny to deliver significant change. As with Kogi (2008) and his colleagues, this approach does not impose outside expertise and solutions. Instead, it allows people to discover their own talents, innate capabilities and desires before embarking on a solution. This participatory method can engage people not only in solutions but also in the genesis of these solutions. Understanding why these technologies are important and how to use them is as important as the technology and solutions. Participatory methodologies will have an important role in implementing future generations of ergonomics successfully. This is especially true in a global community with diverse and distant users.

CONCLUSIONS

There are many scenarios that can describe our future application of ergonomics. The possibilities and unknowns evoke both hope and fear. This is always the case when we experience disruptive change. This disruption may cause different trends or parallel changes. Important among these trends is a greater need to engage people in the implementation of these new technologies. This is the future role of participatory ergonomics.

We are already considering new applications of ergonomics across diverse settings. What we originally intended to be applied only at “work” is now being used to improve human experiences in shopping, working at home, and living in outer space and cyberspace. How can we apply what we know about humans and their capabilities to these situations? We have a set of known facts or principles that we can apply to these different experiences. Can we apply this finite set of ideas to an infinite number of situations? Participatory practices are the keys to this diverse set of applications.

We can find a metaphor in digital examples where users are allowed to design and control how the system is used in a participatory manner. The idea of open source codes in developing computer applications was at first met with skepticism. Today there are systems that allow thousands of users to produce many thousands of applications for devices. What they share are common goals, problems, experiences and solutions. Many of these solutions are offered for free. Participants are drawn to the system because of their personal benefits. In so doing, they become engaged in the community and participate and contribute even more. This participatory model is a promising one for ergonomics. Like the companies that design the products, we have the core technology to create change. Everyone has the interest, problems and desire to use this technology to come up with solutions. By engaging them in the process, we encourage them to come up with their own solutions based on the ergonomic system. Sharing these ideas will draw more people into the system. The future offers many opportunities for ergonomic contributions to improve the human condition. Participatory ergonomics may offer the keys to making this possible.

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