Simplifying complexity

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The capability and power of technology is increasing at an overwhelming rate. To those who are computer illiterate, the world is becoming a more difficult place in which to function with each passing year. Even those who are reasonably technologically savvy may have difficulties understanding and using new features on next-generation products. Take the cell phone, which was undoubtedly a revolution in its day. It can be used to access the Web, e-mail, play games and music, access and edit documents, send a text message and, of course, perform the mundane task of voice data transfer. To call this device a phone hardly seems befitting. But as increasing functionality leads to complexity, so do appealing aesthetics and form lead to usability. That is to say that design is an integral factor. For example, despite the multitude of portable music players, certain companies' devices hold marketshare even though they are more expensive. Arguably, this is because they are visually appealing and their features are accessed almost intuitively.

The importance of design in medical devices and workplaces is becoming recognized in health care as well. User errors here lead to much worse outcomes than the wrong song being played. Device manufacturers have recognized this and seek to design their products so that the technology follows a 'user-centred' design. One example to illustrate the importance of design is public access to external defibrillators. Because survival depends on timely defibrillation in the event of sudden cardiac death, the Heart and Stroke Foundation of Canada has recommended that all Canadians "have widespread access to automated external defibrillators". It seems defeatist, if not comical, to expect a layperson to read the instruction manual for the defibrillator if they are in this dire situation. If the device is not intuitive and exceptionally easy to use, it is destined to fail.

In professional health care environments, the need for the so-called usability testing (also known as ergonomics and human factors analysis) before widespread implementation is even more acute. When technology is introduced in the hospital setting, for example, it tends to remain for a prolonged period of time. Cardiac catheterization laboratory equipment, computed tomography scanners, echocardiographic machines and the like have a lifespan of approximately 10 to 15 years. This means that any poor design elements also become entrenched for that period of time.

Multisituational simulation using multidisciplinary teams composed of device end-users, engineers, programmers, ergonomics specialists and others offers the most exhaustive means of optimizing design. In this regard, the Healthcare Human Factors Group at

Toronto's University Health Network is at the leading edge of innovation. The centre, believed to be the largest of its kind, works not only with industry, but also with ministries of health, academic institutions, health care organizations and even the United States military. The potential benefits of such up-front testing are considerable and include enhanced patient safety through reduced errors, improved efficiency, decreased training requirements, and increased user adoption and satisfaction. From a strictly business perspective, the costs of such simulation may well be justified by reduced exposure to lawsuits from design flaws that lead to medical errors and perhaps even fewer device recalls. Centres such as this also allow smaller companies to remain competitive, because relatively few companies can afford to do in-house usability testing.

Product design is an arduous task, and it would be arrogant for health care workers or the end-users of a device to believe that their opinions are the only ones that count. Products need to be designed for users of varied educational backgrounds. Solutions that allow for error recovery and prevent error in the event of user absentmindedness or distraction need to be incorporated. This can only be done with the help of health care usability experts. In-hospital testing of new products before general implementation may not identify all the major weakness and exposes real patients to risk if staff are unfamiliar with the product. Indeed, the same human factors principles of new device design can be applied to process improvement. In this manner, quality improvement initiatives can start with simulations of current processes.

Ergonomic design improvement initiatives have existed since time immemorial. Even since the time of Hippocrates, when he described how a surgeon's workplace should be designed, has the importance of optimizing efficiency for improved patient safety been recognized (1). In the early 20th century, Frank and Lillian Gilbreth, pioneers in the field of industrial engineering, used principles from their time and motion studies to reduce the number of motions in bricklaying from 18 to 4.5. This improved bricklayers' productivity from 120 to 350 bricks per hour. While change comes slowly to health care, front-line providers must be receptive to ergonomic principles and, indeed, even spearhead new developments. It is our patients, after all, who will pay the price through our inaction.

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