Rationality and Digital Technology

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With the increasing pervasiveness of digital technology, the computing profession faces new circumstances. Not so long ago, digital technology and computing were just different names for the same thing. Now that digital networking has taken over the communications world, and digital recording looms large in the entertainment world, computation as a numerical activity has been relegated to a quite minor use of computers.

This change forces computing professionals to deal with a much greater variety of digital technologies. While there will still be a need for communications, software, and digital hardware engineers, they will be specialists and will need training focused on their specialty. The more numerous generalists will need much broader training and education, along the lines of the pioneering course at Guelph-Humber (D.A. Swayne, Q.H. Mahmoud, and W. Dobosiewicz, "An 'Offshore-Resistant' Degree Program," *Computer*, Aug. 2004, pp. 104, 102-103).

But computing professionals must be alert and responsive to the wider social implications of digital technology's ever-growing adoption. Further, they must base this alertness and responsiveness on an understanding of digital technology and its role in social change, which is much wider than commonly acknowledged during the education of computing professionals.

> The profession must monitor the development of technology and, if necessary, influence it.

BASIC ISSUES

I found the struggle to succinctly present an encompassing picture of the relationship between society and its digital technology in this column extremely difficult. Desperate, I decided to take my mind off the problem by reading *The Inside of the Cup* (Grosset & Dunlap, 1913), written by an almost forgotten American novelist named Winston Churchill. But rather than distracting, I found the book remarkably relevant. It describes the social effects of the technology in use a century ago. Ultimately, the main character, a clergyman, came to much the same conclusions I reached.

The social effects of technology reflect the contention between rationality and irrationality, and they result from the contrast between personality and authority in affecting the contention. By personality, Churchill meant the taking of personal responsibility for values and actions, which is very much the essence of professionality as far as learned professions of any kind are concerned.

The contention

Rationality is not a straightforward idea. It is often equated to logicality, the idea that—given the facts of a situation or problem—a single correct evaluation or solution will follow by the application of reason.

But we may properly doubt even the "facts" that come into our consciousness from our perceptions and memories. It might be that my perceptions are of a virtual world, fed into my virtual consciousness by some kind of program being run by an unimaginable creature in a real world. I cannot prove logically that this is not so, and the deep philosophical arguments I have tried to read that claim to prove it have not convinced me. Thus, I fall back on a reasonably illogical belief that my perceptions are of a real world.

Similarly, that world, and I and my memories in that world, might have been created by some other unimaginably superior creature last Saturday evening at 7:30 p.m., Australian Eastern Standard Time. Again, even though I cannot prove logically that this is not so, I can reasonably assume that my memories were in fact built up from my perceptions over the past 70 years or so.

All rationality is based on beliefs or assumptions about our perceptions. On the other hand, irrationality springs from impulse and emotion. In human society, rational behavior is overwhelmed by the irrational. A glance at the newspapers confirms this.

The intellectual tradition that praises rationality and decries irrationality is invalid in daily life. In the extreme, an

entirely rational society would consist of automata alone. Joy and sorrow, friendship and enmity are, and always have been, essentially human, and they give society its zest and vigor as well as its tragedy and misery.

The contention between rationality and irrationality determines the quality of society. Professionals must apply rationality in irrational contexts to improve that quality.

The contrast

Technology's tools and techniques develop through the often ardent application of rationality, based on the accumulation of beliefs gained through experiment and computation. A select few people determine the facts of technology, which many others then trust to be correct. My knowing that the speed of light is about one billion kilometers an hour is not knowledge in any absolute sense, but merely a belief. I back this belief by reading about the use of that fact by reputable professionals and by the absence of any persuasive refutation.

On the other hand, technologists do not rationally determine the uses for technology. Instead, the people who control the commercial and bureaucratic processes that exploit technology determine these uses, deciding in an impulsive and personal way just what goods and services technology shall be used to produce.

This is not to say that the technology's exploiters are irrational. The contrast lies rather between the beliefs on which technology is based—scientific beliefs accumulated formally and stringently—and the beliefs on which the exploitation of technology is based—social beliefs made possible by and affecting society's very structure.

To a large degree, because the exploiter is an authority employing the professional developer, the responsibility for any social effects of this exploitation might be thought to rest with that authority. Nevertheless, society accepts as a matter of principle that individual professionals must consider the social effects of their technology and personally strive to make these effects socially beneficial. In this perception lies Churchill's contrast between personality and authority.

DIGITAL TECHNOLOGY

Considerations of rationality and irrationality, of personality and authority, acquire much greater strength in the present context of complex and widespread digital technology. Because digital technology is the basis of human society, its social implications can only be properly understood by looking at the way it has developed and how it has affected society.

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The success of digital technology derives from the notion that facts and ideas can be most effectively represented by composition from a set of distinct components and, in present-day technology, from two components, called *zero* and *one*. This simplification means that data can be stored in a tiny space and transmitted in huge quantities, yet it can be reliably recovered in the face of severe deterioration.

Digitality's origins

Spoken language is a digital technology that requires its users to restrict themselves to a limited number of components to communicate facts and ideas. Because it requires perceptions to be classified by vocabulary and can be used to predict and inform, orality facilitates using rationality to improve human interaction. However, oral societies seem almost always to be hierarchical, with a minority using oral lore, often as mythology or superstition, to maintain authority. Personality is controlled or ejected.

Written language, developed in many different ways from simple depiction, adds a permanence to spoken language. On the one hand, this means that facts and ideas can be accumulated and developed more effectively and suppressed with more difficulty, thus extending the role of rationality in human society. On the other hand, by restricting the use of literacy, a minority can use scripture as laws and regulations to inculcate beliefs in the majority that establish the minority's authority. In a society with literate administrators and illiterate administratees, developing an independent personality complete with rational beliefs and values becomes difficult.

Arithmetic, the representation and combination of quantitative data, is the third digital technology. Although number words are part of spoken language—and some cultures extend these words gesturally—the technology became much more important when written language made it possible to use them in commercial interactions.

The gradual development of techniques and tools made all these digital technologies possible. Spoken language depends on having a particular kind of respiratory passage and on developing the neural equipment to drive its various parts. Written language depends on having equipment to write with and a medium to write on. Likewise, tokens, tally sticks, quipus, counting tables, and abaci helped arithmetic develop beyond merely speaking and writing.

Digital machinery

More complex digital equipment has only recently been developed. Printing machinery has a relatively long history, and calculating machinery has also undergone fairly steady development. The mass production of books and newspapers beginning more than a century ago has made general literacy possible in some countries, but the cost of other digital machinery has meant that it is still mainly used by government and business.

Science and technology provide a notable exception. Scientists and engi-

neers have long been trained in the use of measuring and calculating equipment. This has led to the rational accumulation of an immense amount of carefully checked data, which eventually led to the development of present-day digital machinery and techniques. Indeed, the development of science and technology has been made possible by the rational cooperation of many kinds of professional workers in a social subsystem that requires findings and reasoning to be rigorously checked.

Scientific and technical development depends increasingly on digital data gathering and computation. In this field, digital technology can be considered an amplifier of rationality. The use of digital technology outside the professional community is quite another matter. Mobile telephones, the Net and Web, and a host of other digital products and services help administer and preserve large commercial and other social hierarchies while creating and satisfying individual and community needs. In this respect, digital technology can be considered an amplifier of irrationality.

Digital technology has been wonderfully effective in amplifying human rationality and irrationality and will continue to serve in this role. The profession has a responsibility to monitor—and, if necessary, influence—how the technology is used.

It may be that the technology is being ill used. When it first came in, radio broadcasting was hailed as a boon for education and culture. Instead, it became a boon for marketing. The same thing happened when television arrived. Will the Net and its Web see the third iteration of this cycle?

Professionals must consider questions such as this and act on the answers if necessary. Yet, without a broad enough education, they won't be able to do so. Education, and not just professional education, must cover not only technology and its uses, but also its history and social effects.

Human society must blend rationality and irrationality, for the role of digital technology should be to promote whatever is deemed to be the best blend. Who will determine this blend? Authority will naturally press for the blend that would bring the greatest benefit to those in authority, typically expressed as benefits in property. Professionals, on the other hand, must press for the blend that brings the greatest general benefit, typically benefits in personality. ◼

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