

# Social–Technical Systems

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## INTRODUCTION

### System Levels

Computer systems have long been seen as more than just mechanical systems (Boulding, 1956). They seem to be systems in a general sense (Churchman, 1979), with system elements, like a boundary, common to other systems (Whitworth & Zaic, 2003). A computer system of chips and circuits is also a software system of information exchanges. Today, the system is also the human-computer combination (Alter, 1999); for example, a plane is mechanical, its computer controls are informational, but the plane plus pilot is also a system: a human-computer system. Human-computer interaction (HCI) sees computers as more than just technology (hardware and software). Computing has reinvented itself each decade or so, from hardware in the 1950s and 1960s, to commercial information processors in the 1970s, to personal computers in the 1980s, to computers as communication tools in the 1990s. At each stage, system performance increased. This decade seems to be that of social computing, in which software serves not just people but society, and systems like e-mail, chat rooms, and bulletin boards have a social level. Human-factors research has expanded from computer usability (individual), to computer-mediated communication (largely dyads), to virtual communities (social groups). The infrastructure is technology, but the overall system is personal and social, with all that implies. Do social systems mediated by technology differ from those mediated by the natural world? The means of interaction, a computer net-

work, is virtual, but the people involved are real. One can be as upset by an e-mail as by a letter. Online and physical communities have a different architectural base, but the social level is still people communicating with people. This suggests computer-mediated communities operate by the same principles as physical communities; that is, virtual society is still a society, and friendships cross seamlessly from face-to-face to e-mail interaction.

Table 1 suggests four computer system levels, matching the idea of an information system as hardware, software, people, and business processes (Alter, 2001). Social-technical systems arise when cognitive and social interaction is mediated by information technology rather than the natural world.

## BACKGROUND

### The Social-Technical Gap

The levels of Table 1 are not different systems, but overlapping views of the same system. Higher levels depend on lower levels, so lower level failure implies failure at all levels above it; for example, if the hardware fails, the software does too as does the user interface. Higher levels are more efficient ways of operating the system as well as observing it. For example, social systems can generate enormous productivity. For this to occur, system design must recognize higher system-level needs. For example, usability drops when software design contradicts users' cognitive needs.

*Table 1. Information system levels*

Level	Examples	Discipline
<i>Social</i>	Norms, culture, laws, zeitgeist, sanctions, roles	Sociology
<i>Cognitive</i>	Semantics, attitudes, beliefs, opinions, ideas, morals	Psychology
<i>Information</i>	Software programs, data, bandwidth, memory, processing	Computing
<i>Mechanical</i>	Hardware, computer, telephone, fax, physical space	Engineering

In physical society, architecture normally fits social norms; for example, you may not legally enter my house, and I can physically lock you out. In cyberspace, the architecture of interaction is the computer code that “makes cyberspace as it is” (Lessig, 2000). If this architecture ignores social requirements, there is a social-technical gap between what computers do and what society wants (Figure 1). This seems a major problem facing social software today (Ackerman, 2000). Value-centered computing counters this gap by making software more social (Preece, 2000).

### Antisocial Interaction

Social evolution involves specialization and cooperation on a larger and larger scale (Diamond, 1998). Villages became towns, then cities and metropolitan centers. The roving bands of 40,000 years ago formed tribes, chiefdoms, nation states, and megastates like Europe and the United States. Driving this evolution are the larger synergies that larger societies allow. The Internet offers the largest society of all—global humanity—and potentially enormous synergies. To realize this social potential, software designers may need to recognize how societies generate *nonzero-sum gains* (Wright,

2001). While nonzero sum is an unpleasant term, Wright’s argument that increasing the shared social pie is the key to social prosperity is strong. The logic that society can benefit everyone seems simple, yet communities have taken thousands of years to stabilize nonzero-sum benefits. Obviously, there is some resistance to social synergy.

If social interactions are classified by the expected outcome for the self and others (Table 2), situations where individuals gain at others’ expense are antisocial. Most illegal acts, like stealing, fall into this category. The equilibrium of antisocial interaction is that all parties defect when nonzero-sum gains are lost. Antisocial acts destabilize the nonzero-sum gains of society, so to prosper, society must reduce antisocial acts. This applies equally to online society. Users see an Internet filled with pop-up ads, spam, pornography, viruses, phishing, spoofs, spyware, browser hijacks, scams, and identity theft. These can be forgiven by seeing the Internet as an uncivilized place, a stone-age culture built on space-age technology, inhabited by the “hunter-gatherers of the information age” (Meyrowitz, 1985, p. 315). This is the “dark side” of the Internet, a worldwide “tangled web” for the unwary (Power, 2000), a superhighway of misinformation, a social dystopia beyond laws where antisocial acts reign.

Figure 1. Social-technical gap

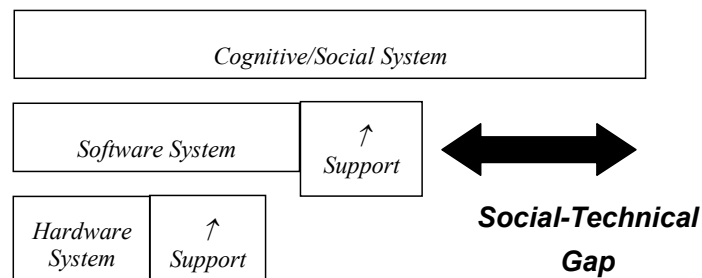


Table 2. Expected interaction outcomes

Other(s)→ Self ↓	Gain	Minor Effect	Loss
Gain	<i>Synergy</i>	<i>Opportunity</i>	<i>Antisocial</i>
Minor Effect	<i>Service</i>	<i>Null</i>	<i>Malice</i>
Loss	<i>Sacrifice</i>	<i>Suicide</i>	<i>Conflict</i>

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