

particular group's interests and activities. Any Apple™ user will argue that the near monopoly that Microsoft™ enjoys in the marketplace does not reflect that the “best” operating system has been adopted. Therefore, proposes Wiebe E. Bijker in his 1995 study, social and economic power dynamics shape the processes that produce new technologies to be adopted and defined as “working,” and the potential adoption patterns of those technologies across different user groups. Technology adoption discourses also assume that the technology is stable as a material and symbolic configuration: that there is closure of the technology. This assumption is not necessarily warranted: Sometimes in the process of the adoption a technology is adapted both materially changed, in terms of modifications or rebuilding, and certainly symbolically reconfigured, as the imagined and intended meanings and uses of the technology are reworked in different settings. In other cases, such as computers and cellular telephones, rapid changes in versions and models disrupt a smooth diffusion curve, as new features render technologies apparently obsolete, and closure and compatibility are not achieved.

#### TECHNOLOGY AND COMPATIBILITY

The issue of compatibility points to the complexity of the adoption of technology in varying social contexts. In all contexts of technology adoption, a new technology must fit within existing manufacturing and use infrastructures, meet perceived needs, be nominally affordable, and be convergent with important cultural ideals. Each of these five elements presents different barriers to adoption in diverse cultural, particularly international, contexts. A technically functional technology that disrupts important social processes or relies on scarce resources will not be adopted. This is part of the reason that patent offices are full of descriptions of technologies that “work” in a technical sense, but are not adopted and are not seen as “working” by their intended users.

**SEE ALSO** *Luddites; Productivity; Solow Residual, The; Technology; Technology, Transfer of; Technophobia*

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*Jennifer L. Croissant*

## TECHNOLOGY, CELLULAR

Japan developed the world's first analog mobile phones in 1979. They spread rapidly, outstripping the world's land-line systems within fifteen years. By 2006 the majority of the citizens of Europe, North America, and the wealthier nations of Asia, Africa, the Caribbean, and Latin America owned mobile phones. The United Kingdom had more mobiles than people, and there were 207 million users in the United States. More than twenty manufacturers produced them, and most nations had converged on GSM transmission, which was designed for European compatibility, although it coexisted with CMDA and iDen standards in the United States, Australia, Japan, and South Korea.

Most innovations have come from Japan, where a dense population that commutes to work, a high-tech industry long focused on miniaturization, and conducive social and consumer relationships led to early adoptions of camera and video phones, GPS (global positioning systems), text messaging, Internet, and music player capabilities. In Japan third-generation (3G) systems were the norm by 2005. Europe, South Korea, Taiwan, and coastal China are said to lag behind Japan by eighteen months, and North America lags three years behind. Elsewhere, developing nations rejected landlines in favor of cheaper mobile systems. The rollout of 4G systems is anticipated in Japan around 2010.

Mobile phones are not without problems. Many studies confirm the higher risk of auto accidents while using mobiles, even hands-free systems. Some scientific evidence shows increases in cancerous tumors among heavy, long-time users. Transmission towers are unwelcome sights in residential areas. Mobiles are also used in identity theft and credit card crime, in the coordination of terrorist attacks, and as detonators for bombs. Due to possible radio-wave interference, their use is banned in airplanes, hospitals, and some high-tech facilities. Theft of mobiles is common, with black markets on the Internet and in major cities.

Despite their problems, mobile phones have changed human communication profoundly, freeing it from the ancient constraints of physical proximity and spatial immobility. They have been rapidly adopted across cultures, age groups, and literacy and income levels, though in polyvalent modes. Mobile use initially was similar to the use of pagers by doctors and business people. Later mobiles became status items, especially among teenagers, who engaged in a “personalization culture” that included the use of faceplates, hand cords, stickers, and ringtones. For adults, status shifted to broadband Internet access.

Mobiles have become a basic technology of emergency response. Drivers use them to report accidents,

police and fire departments use them as a back channel in disasters, and the elderly carry them “just in case.” Australian studies show that high percentages of mobile users are “cellular Samaritans” who use their phones to summon help for those in difficulty. Camera and video phones allowed instant reporting on the 2005 Indian Ocean tsunami and Hurricane Katrina. Japanese users can even be informed of impending earthquakes.

Sociologists have noted across cultures, genders, and age groups an increase in “grooming calls,” by which members of a family or group show concern and “nearness.” These short, frequent calls reinforce bonds of affection. Immigrant families and diasporic clans in particular do this. However, the “universal availability” of mobile users also allows the reinforcement of hierarchy. Bosses call employees outside work hours, parents monitor children, and couples monitor each other: “If you are without a mobile phone it means that no one depends on you for urgent direction” (Bautsch et al. 2001, p. 3).

The location of mobile use is problematic. Mobiles have been banned from theaters, religious institutions, funerals, airplanes, and many restaurants, and their use is frowned upon in museums, bookstores, trains, and buses. A dynamic of “civil inattention” has arisen in which bystanders pretend to ignore mobile conversations and speakers use vague or euphemistic language. Mobiles are also used as symbolic bodyguards in public areas to ward off unwanted attention or to refuse to participate in public space: “Public space is no longer lived in all of its aspects, stimuli and prospects, but is kept in the background of an itinerant cellular intimacy” (Fortunati 2000, p. 11).

Receiving mobile calls is an area without norms. Phones may be on, off, or in message-only mode, as users determine their degree of availability. Users decide whom to give their numbers to, whom to block, whom to answer immediately, and who hears a busy signal. Finnish studies show that men are more likely than women to turn mobiles off to avoid social control. Because calls arrive unpredictably but habit dictates that they be answered, face-to-face conversations and other calls must be “suspended.” Such interruptions cause anxiety for both parties, leading to anomie and difficult restarts. Users must also manage facial expressions and body language for multiple audiences, indicating primary and secondary importance to those present and absent. Such “managed availability,” however, has increased the capacity of parents in particular to coordinate various roles. But managing role conflicts and the discrepant awareness of conversation partners may be difficult for older users, and may promote broad but shallow relationships among younger users.

One alternative is SMS (short message systems), or “text messaging.” SMS patterns tend to follow earlier pager use, though today’s users can communicate through emoti-

cons or delay responses via timers. Finnish studies, however, show that feedback is expected within 15-30 minutes. In Asia SMS users tend to be young and to belong to linguistic subcultures, and they are often killing time in public places or transport. SMS offers friendship tryouts, invitations without risk, and the cost is shared by sender and receiver. Some Japanese teens maintain multiple personae for hundreds of *meru tomo* (email friends), and SMS is the common channel for arranging *enjo kosai*, or paid “dates,” between businessmen and high school girls.

The mobile’s impact on individuality is also an area of concern. Traditional feelings of longing, homesickness, sadness, or insecurity are assuaged by calls and thus leveled out. Mobiles diminish the number of true hellos and good-byes. Lost are reflective periods when people review past actions and plan future ones. This culture of “nomadic intimacy” may portend more peripheral relationships, but fewer deep ones (Fortunati 2000). The deregulation of social life is another implication. “Nights out [are] characterized by endless deferrals and reshuffling of meetings and events which might never occur,” writes Sadie Plant (2003, p. 64), and “freedom from punctuality is permitted by constant ability to update other parties as to your status” (Townsend 2000, p. 94). In Italy the popularity of the mobile “seems to be associated with its support for a spontaneous, disorganized lifestyle that has always reigned among most of the country’s population” (Geser 2004).

The mobile has also made covert information exchange more possible. Some critics call this gossip, but others see it as decentralizing or democratizing. Parents communicate with other parents about children’s attitudes and whereabouts; employees engage in a similar dynamic about bosses; and law officers speak to each other rather than through dispatchers or superiors. In China mobile networks have spread news censored by the government and allowed seemingly spontaneous demonstrations. But studies show that mothers and wives act as the mobile information hubs of most families, so although mobiles may reduce the number of shared family experiences, they seem to be assimilated to traditional roles.

In the future, as the distribution of antennas grows denser, the location of every mobile will be determinable by GPS. In Japan, location within 30 feet was the norm by 2006, whereas in the United States the few GPS-enabled systems were accurate to 300 feet. GPS will be standard in 4G systems and, combined with built-in compasses, will allow users to point phones at buildings to find addresses, businesses, and friends, as well as to navigate roads. One side effect may be a barrage of business advertising. Barcode scanners may also become standard on mobiles, so that consumers concerned about food safety and product origin can “source” their purchases on databases before buying. Pocket-sized mobiles with SIMs (subscriber iden-

tivity modules) will serve as credit cards that can be passed over sensors, like RFID (radio frequency interface devices) tags (Kohiyama 2005). Because SIMs are removable, users may have different mobiles for different occasions; they may even use friends' phones, because their SIM carries their rate plans and caller lists. Batteries may become universally available, recharged, or swapped cheaply at kiosks or vending machines. Increased demand for Internet uses will lead to multilayered rate plans, and SMS will prevail underground on trains and in subsurface rooms. South Korea has announced plans to send out traffic tickets, fines, and even indictments by SMS. All mobiles will connect to nearby workplace, school, or community LANs to make use of the Internet when possible. Future architectural designs will change, allowing for ubiquitous mobile phone niches. World cities such as Tokyo, New York, London, and Paris may consist of people whose work requires face-to-face proximity for deals and transactions, whereas mobiles will allow others to work nomadically.

SEE ALSO *Technology, Video*

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*William Marling*

## TECHNOLOGY, TRANSFER OF

The first humans developed new and better ways of production, and those around them watched and imitated. When the new and better ways became more complex, then the innovator would often teach the innovations to others. Since the beginning the transfer of technology has followed innovation. Technology is transferred from parents to children, from masters to apprentices, from teachers to students, from managers to workers, and from workers to workers. Technology spreads both horizontally (to competitors) and vertically (to suppliers and buyers) from a given innovating firm. It even spreads to seemingly unrelated industries (consider the case of the transistor that was developed for hearing aids but ended up in radios, TVs, computers, and space crafts).

However, the origin of the term *technology transfer* and its study as a separate phenomenon can be traced to the massive gifts of technology from the United States to Europe and Japan immediately following World War II (1939–1945). Many U.S. firms freely opened their doors so that European companies could come and study their production processes. Blueprints and patents were freely shared.

During the cold war between the United States and the Union of Soviet Socialist Republics (USSR), both sides encouraged the transfer of their technology to lesser-developed countries in order to help the recipients develop and to win allies. It was assumed that economic development required acquisition of modern technology. During the 1950s and 1960s, international organizations (such as the United Nations' Expanded Program of