If you asked people 20 years ago what they could do with their phone, they would’ve simply said, “Call people.” Today, a reply would not be that short and easy. The transformations this device has undergone over the last two decades are tremendous. The mobile phone has evolved into a sleek multifunctional marvel. However, the versatile new models aren’t as good as the old ones when it comes to clear reception. Also, mobile phones’ additional functions eat up battery life, so there’s less talk time. Here, I’ll look at how mobile telephoning has turned into mobile media-based information exchange and the turmoil this transformation has caused.

The mobile phone paradigm

Digital wireless and cellular roots go back to the 1940s when commercial mobile telephony began: provide people with information in an audible form where it’s needed and—because they’re on the go—make the information mobile, too.

First generation

Towing, taxi, and trucking services used the first mobile communication systems, which involved a dispatcher at a central base station communicating to business radio systems. These simplex systems only let one party talk at a time. I see 1978 as the start of what we think of as traditional, mobile telephony, when the Bahrain Telephone Company began operating a commercial cellular telephone system. If I recall correctly, the two-cell system had approximately 250 subscribers, 20 channels in the 400-MHz band, and used entirely Matsushita equipment.

The first multinational cellular services in Europe debuted in 1981, when the Nordic Mobile Telephone System, or NMT450, began operating in Denmark, Sweden, Finland, and Norway in the 450 MHz range. In 1985, Great Britain started using the Total Access Communications System (TACS) at 900 MHz. Later, the West German C-Netz, the French Radiocom 2000, and the Italian Radio Telefono Mobile Integrato/Radio Telephone Mobile System (RTMI/RTMS) helped form Europe’s nine analog incompatible radio telephone systems. (See the history section of Global System for Mobile Communications, or GSM, at http://www.gsmworld.com for further statistics and information.) This situation was nearly as clumsy as the first portable units, which were really cumbersome and thus used mainly as car phones. However, technology and users’ expectations were in sync and the mobile paradigm lived.

Second generation

The situation changed at the beginning of the 1990s when the European Conference of Postal and Telecommunications Administrations (CEPT) introduced GSM, a cellular-structured but fully digital, open, and nonproprietary system. GSM’s great strength was and is its international roaming capability, allowing consumers seamless and same-number contactability. This opened the accessibility and acceptance of mobile telephone technology to the business world and the average Joe.

However, the most successful, and indeed surprising, service that GSM provides is the short message service (SMS), where users can transmit a single short message of up to 160 characters of words, numbers, or an alphanumeric combination. This service also supports non-text-based short messages (for example, in binary format) such as selecting phone ring tones and displaying logos.

SMS was basically a technology first adopted by youths, who tried to overcome the problematic man–machine interface. The service’s relatively high learning curve actually served as an advantage because it meant that parents, teachers, and other adult authority figures were unlike-
ly, unable, and unwilling to use it. SMS has influenced language, resulting in a whole new lingo. People attempted to say as much as possible with as few keystrokes. Timesaving abbreviations such as “C U L8er” for “See you later” sprung up and turned into language icons for coolness. Similarly, character-based icons, better known as “smileys,” emerged to indicate the author’s mood with a few characters. Thus, SMS showed the first successful media mix for the mobile phone—mainly because text and voice didn’t interfere and the type of shared information remained the same.

Today, simple mobile phones are no longer just for teenagers—SMS is widely accepted. The Guardian/ICM poll showed that the ownership of mobile phones in Britain in the age group of 40 to 54 is even higher (81 percent) than among 18 to 24 year olds (79 percent). For more details see http://media.guardian.co.uk/newmedia/story/0,7496,837686,00.html.

However, changes in the perception of what information is and how we should access it, as well as declining profits within the mobile industry, have led to mobile phone technology developments.

### Web Resources

Here’s a list of mobile phone-related links that might be of interest.

**Mobile phone resources**

The following links provide access to relevant standard bodies devoted to the development of mobile communication technology:

- Global System for Mobile Communications Association (http://www.gsmworld.com/index.shtml)
- Open Mobile Alliance (http://www.wapforum.org/)

**WAP-enabled museums page**

- Jacco van Ossenbruggen designed this wireless markup language (WML)-enhanced page (http://www.cwi.nl/~media/wap/) to demonstrate how multimedia content will appear on a mobile phone.

**Mobile games**


As I would prefer not to emphasize any particular game provider, please search for mobile phone games, Java phone games, or mobile games and you will be amazed at what you find. Of course you can always try any of the mobile phone companies—they sell games too.

### Third generation

The Web’s popularity and the increasing use of digital audio–visual media in everyday life—either to convey information or to entertain—additionally influenced mobile phone development. The idea is still the same as it was 20 years earlier—access to mobile services, decisions, and interactions should happen here and now.

The required technology is on its way—although none is technically fully established, consumer adopted, or socially accepted. With the introduction of the open and global wireless application protocol (WAP), wireless devices—such as mobile phones, pagers, two-way radios, smart phones, and so on—can access information and interact with Web services. Because WAP works with most wireless networks, such as GSM, it fits well into the existing telephony infrastructure. However, WAP requires that the provided information source is WAP encoded. For the time being this remains a problem for complex multimedia information services such as content inquiries for museum sites (see the “Web Resources” sidebar for an example of a WAP-enabled Web page).
New applications—such as the multimedia messaging service (MMS) for enhancing email messages by incorporating sound, images, and other rich content; multiplayer games; location-based services; and sign language-recognition technology—all require better network solutions.

The current answer is the general packet radio service (GPRS), a packet-based mobile communications system building on GSM. It provides higher-data transmission speeds (up to 114 Kbps), more efficient use of radio resources, and a continuous connection to the network to facilitate more advanced nonvoice services. With GPRS, for example, it’s possible to stream video to a mobile device, as RealNetworks demonstrated at the Streaming Media Europe Exhibition. During the presentation, clips from the film *The Matrix* were streamed on a Nokia 3650 (using a RealOne player that can play back MPEG-4, H263, and RealVideo) over a GPRS network.

However, GPRS availability depends on the network; thus the choice of operator and service provider becomes important.

The future, however, lies in the Universal Mobile Telecommunications System. UMTS, also referred to as wideband code division multiple access (W-CDMA), is a 3G GSM successor standard that’s downward-compatible with GSM, using the GSM Phase 2+ enhanced core network. Having evolved from the GSM/GPRS infrastructure, UMTS won’t arrive on day one but will rather operate as islands on GSM networks. The hope is that the high investment in third-generation mobile phone networks will be repaid by widespread demand over the next 10 years from customers for mobile Internet, voice, and data services.

**The paradigm shift**

The interesting aspect of the development within mobile telephony, however, isn’t the swift technological advances—it’s the shift from a clearly defined tool (for messaging either by using voice or text) to a multifunctional, multi-purpose, multimedia gadget.

The dilemma is that the idea of mobile information access has opened Pandora’s box. Different forms of information merge such as advertisement into infotainment or entertainment and education into edutainment. This blur of media on all levels of content representation and presentation drifts toward personalization (if you are a positivist) or arbitrariness (if you are a negativist) of information use that becomes visible in the design of all mobile devices. The new generation of mobile phones shares capabilities that once exclusively belonged to another tool—such as a PDA. The trend mirrors the same evolution as the merging of media—the aim is convergence. As a result, we need to rethink the access and use of media, which in turn will also reshape our research directions.

On the hardware side, I assume we’ll see a change in tool provision from provider design to user design. This means that in the future users will design mobile devices to fit their needs, similar to what we do today with PCs. For instance, if I decide I want a palm-sized tool because I need the screen size for required data services or because I like to watch videos while traveling, but also need a mobile phone component, then I’ll design it in such a way. Perhaps I’ll have more than one tool, depending on the occasion and what I need. Thus, as multimedia specialists, we should think about the concept of user adaptation (interface), tool identification (composite capabilities/preferences profiles), and storage (central, local, or distributed) in a more flexible manner.

Mobile devices that let users create multimedia messages actually try to facilitate a more personal, versatile, and expressive way of communication. The idea is to communicate experiences. However, for that we need tools that enable these communications. One possibility is an intelligent camera as part of the mobile device that supports framing and adjusts features such as hue, contrast, and so forth, depending on the context the media item will be used in. Another possibility is an editing suite as part of the mobile device that would let users quickly and easily combine various media, such as audio, video, and text collected on the way.

In addition to creating new tools, we have to think about what it means to create, distribute, and store experiences. Keeping the current media-based information blast in mind, we must think about solutions to questions regarding how to...
capture multisensory data during experiences,
represent and adjust recollections in memory over time,
capture context, and
present an experience to the recipient.

In a similar direction, the idea of a mobile, single-user entertainment device might be too simplistic. Games for mobile phones are a big market already (see the “Web Resources” sidebar). However, at the moment they’re mainly single-player games, and they might stay like that for some time as, analogous to video games, the current focus is on improving the graphics. In the future, though, mobile multiplayer games will emerge that might be as complex as a real-time massively multiplayer online role-playing game (Mmorpg). (More information on Mmorpgs is available in this issue of MultiMedia—read Jan Krikke’s news story, “South Korea Beats the World in Broadband Gaming.”)

It’s all in flux
Of course, we’ll encounter more problems and surprises in the mobile device arena, making it impossible to foresee what’s coming. The best we can do as researchers is investigate beyond the level of killer applications. We should find the basic conceptual, perceptual, and processable elements of that volatile thing called multimedia information and get the fundamental framework right so that we can satisfactorily exploit the evolutionary process of mobile multimedia information exchange.

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