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The phone of the future

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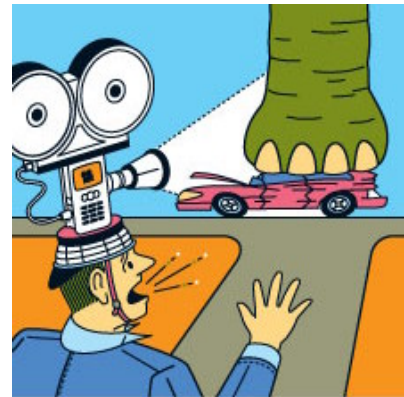
From The Economist print edition

Communications: The phone has had a splendid 130-year history. What will it look like in future? Will it even be called a phone?

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AT THE 1964 World's Fair in New York AT&T unveiled the Picturephone. In the future, the world's biggest telecoms firm pronounced, people would communicate via round, black-and-white screens that plugged into the wall. That prediction, like so many others about the future of communications, was wrong. The majority of today's phones are mobile handsets, not fixed-line ones, and although the technology for video-calling is widely deployed, hardly anyone uses it.

And yet speculation about the future of phones persists, and no wonder. The telephone has changed beyond recognition since its invention in 1876, and is now both the most personal, most social and most rapidly evolving technological device. So to imagine the phone of the future is also to imagine the future of consumer technology, and its personal and social impact. What mobile phones will look like in a year or two is easy to guess: they will be slimmer and probably will let you watch television on the move. But what about ten or 15 years from now?



The remote control for life

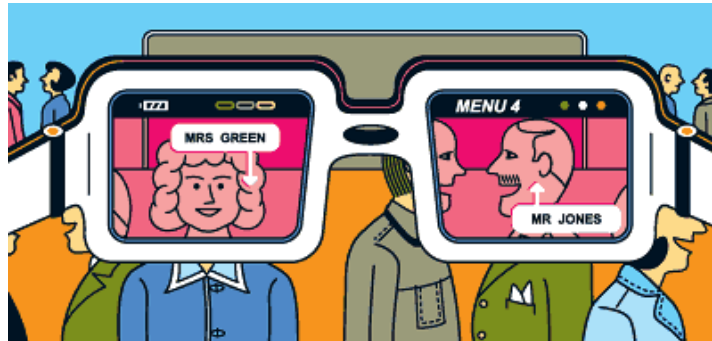
Making such predictions is a dangerous business, but it can also be informative and entertaining. The chances are that phones will not only look very different—they may not even be seen. They may be hidden in jewellery or accessories, or even embedded in the body. They will undoubtedly have a host of additional features and novel uses, and users will probably interact with them in new ways, too. And even if they are still called “phones”—a word derived from the Greek word for voice—making voice calls may no longer be their primary function.

“The cellphone is not a telephone. It is a—I don't know what it is. A communications device? A tool I carry in my pocket?” says Don Norman of the Nielsen Norman Group, a consultancy, and author of “The Invisible Computer”, a book that predicts that computers will eventually be so integrated into everyday items that they will vanish. Bruce Sterling, a science-fiction writer whose future caught up with him, and who now writes books about contemporary design and technology, believes phones will be “remote controls, house keys, Game Boys, flashlights, maps, compasses, flash drives, health monitors, microphones, recorders, laser pointers, passports, make-up kits, burglar alarms, handguns, handcuffs and slave bracelets.” In short, he believes that the phone will be “the remote-control for life”.

One thing that is clear is that phones will pack a lot more computing power in future, and will be able to do more and more of the things that PCs are used for today—and more besides. Mats Lindoff, the chief technology officer at Sony Ericsson, a leading handset-maker, points out that the processing power of mobile

phones lags behind that of laptop computers by around five years. Furthermore, studies show that people read around ten megabytes (MB) worth of material a day; hear 400MB a day, and see one MB of information every second. In a decade's time a typical phone will have enough storage capacity to be able to video its user's entire life, says Mr Lindoff. Tom MacTavish, a researcher at Motorola Labs, predicts that such "life recorders" will be used for everything from security to settling accident claims with insurance firms.

Researchers at Nokia, meanwhile, speculate that within a decade, the cost of storage will have fallen so far that it might be possible to store every piece of music ever recorded in a single chip that could be included in each phone. It would be necessary to update the chip every so often to allow for new releases, of course. But this could open up new business models that do not depend on downloading music over the airwaves; instead, the phone could simply exchange brief messages with a central server to unlock purchased tracks or report back on what the user had listened to for billing purposes.



Another trend is towards phones that double as both fixed and mobile devices, using cellular networks when outdoors and switching to fixed networks, accessed via a short-range radio link to a small base-station, when indoors. In effect, your mobile phone will double as an indoor cordless handset, both at home and in the office. Early attempts to do this have been clunky, but the technology will get cheaper and simpler within a few years. Meanwhile, distance and voice-based pricing are going away too, so that before long many subscribers will probably pay a fixed monthly access fee for unlimited phone calls and data transfers.

Although extrapolating from today's phones by following technology trends can provide some clues about their future direction, the danger with this approach is that it risks overlooking discontinuities in their evolution. For example, if you had been told in 1991 that telephones would double as music-players in 2006, you might have assumed that this would involve some smaller version of CDs. Hard-disk storage was bulky and expensive, and the use of solid-state memory to store music would have seemed outlandish. Similarly, in the era before digital photography, it would have been hard to believe that most phones would also double as cameras. Where would the film go?

No doubt other new functions will be incorporated into phones. But which ones? Given their uniquely personal nature—some people feel naked without their handsets—it seems likely that they might subsume the other two items that are generally carried everywhere, namely wallets and keys. In Japan, phones can already be used to make purchases in shops: a wireless chip in the phone communicates with a special reader at the till. The same "near field communication" chips enable phones to be used as train tickets and office passes, so acting as front-door keys or car keys as well would not be a giant leap. Indeed, the mobile phone may end up acting as a universal controller for other electronic devices of all kinds, suggests Alan Harper of Vodafone, a big mobile operator.

The shape of phones to come

The appearance of mobile phones is certain to change as new features continue to be added. Already, the clear trend in phone design is towards ever greater diversity. The debate over whether the phone would emerge as the digital "Swiss Army Knife" and cram in as many features and functions as possible is over, says Bruno Giussani, the author of "Roam", a book about the mobile industry. Instead, handset-makers now make different devices optimised for particular tasks such as music, photography or e-mail, and combinations thereof. The next step, suggests Stephen Randall of LocaModa, a wireless-services firm, will be a great decoupling, as the screen, keypad and earpiece start to become separate components, or are replaced by

other completely new technologies.

Combining all of these components in a single device, as today's phones do, means that keyboards and screens must be small; make them too big and the phone becomes too bulky and ceases to be a device that can be carried everywhere. Separate earpieces, linked to the handset by a Bluetooth radio link, are already growing in popularity. Some users might choose to hook up separate screens and keyboards when needed, such as when answering e-mail or browsing the web. Already, early examples of such technologies exist.

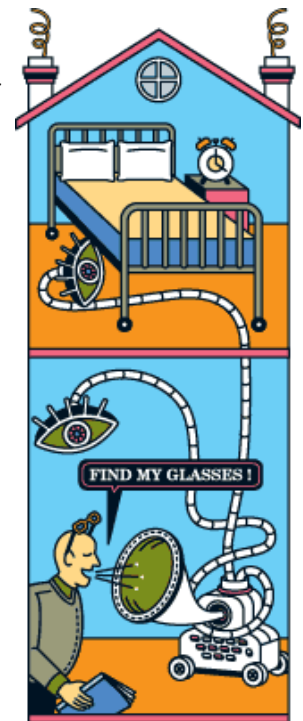
And there are even more elaborate alternatives. Tiny projectors inside handsets could allow walls, tabletops or screens made of flexible materials to be used as displays while on the move, suggests Jeff Wacker, a futurist at EDS, a technology-services firm. Some firms are also developing displays built into glasses, in order to do away with the screen altogether. This approach also makes it possible to overlay information on the real world, which could be useful when giving directions. Your phone might even label people at a party or conference to remind you of their names.

Or perhaps it will discreetly whisper their names in your ear. Today's earpieces may give way to smaller devices hidden in earrings or worn as minuscule patches on the skin near the ear. It would then be possible to listen to your phone or music-player while still hearing the ambient sounds of the environment. Today's earbuds are either in or out; future earpieces will give users the option of adding a discreet soundtrack to their everyday lives.

As for input devices, technology exists to beam a "virtual keyboard" onto a flat surface; a separate sensor then tracks finger movements to determine which "keys" have been pressed. But entering data into a phone might ultimately be done not with fingers but with speech—or even directly by the brain. The keypad is a vestige of the rotary dial, which itself is an artefact of the switch from human operators to direct-dialling in the 1920s. Today, numbers are on the wane thanks to the ease with which mobiles can store and retrieve names and the ubiquity of e-mail addresses and other internet-based identity tags, such as Skype names. Phone numbers may become as invisible to users as the underlying internet-protocol addresses of websites are to people surfing the web.

Voice-recognition systems have improved somewhat in recent years, but are still not reliable enough for entering a text message or an e-mail. But voice may turn out to be an interim technology. Researchers are developing sensors that pick up the subtle changes in the larynx and mouth when words are formed, even if there is little or no air going through the windpipe. So future phones might simply be able to lip-read using a sensor hidden in your collar.

Other researchers are looking into the use of brainwaves to interface directly with machines. One technique, developed by Cyberkinetics Neurotechnology Systems, was reported in the journal *Nature* in July. It involves implanting a chip in the brain which allows paralysed people to move a computer cursor by thinking in a certain way. A less invasive approach relies on electrodes on the scalp to pick up brain activity. Stuart Wolf, a physics professor at the University of Virginia and a researcher for the American military, suggests that within 20 years people will use their thoughts to communicate not only with machines, but also with each other—doing away with talking into phones entirely. Telephony could give way to telepathy.



Unexpected consequences

It is one thing to speculate about the technical possibilities of future phones, but quite another to imagine the social consequences. In the 1980s nobody foresaw that mobile phones would become anything more than executive playthings; and the runaway success of text-messaging took the entire industry by surprise. Similarly, the failure of video-telephony is rooted in social rather than technological causes. It is a mistake, in short, to consider technology in a vacuum. Social factors play a crucial role in determining which technologies end up being adopted, and how they are used.

Marty Cooper, known as the "father of the cellphone" for his work in developing the first mobile phones at Motorola, recalls that he only became aware of the device's full potential as a result of actually using it. His secretary called him on his prototype mobile phone as he was getting into his car to drive to a meeting to say

that it had been cancelled—thus saving him from a wasted journey. But explaining the benefits of being able to change plans on the fly to potential customers was difficult, he says, so the first phones were marketed instead on the basis that they could make people more productive, by allowing them to work while on the move. But today the idea of “approximeeting”—arranging to meet someone without making firm plans about time or place, and then finalising details via mobile phone while out and about—is commonplace.

Just as the benefits of a new technology can be hard to predict, so too are its unexpected drawbacks. Concerns over privacy and security could derail plans to turn phones into electronic wallets or universal keychains, for example. Phones that know more about their owners could do all kinds of new things, but could also raise new concerns. There will certainly need to be powerful authentication techniques to ensure that phones can only be used by their legitimate owners, says Mat Hunter of IDEO, an international design firm. Already, some phones have built-in finger scanners for just this purpose.

Mobile phones have already changed social practices among their users, and seem likely to do so even more in future. The ability to superimpose images and sound upon reality means that future phones will “create layers on our world”, says Pierre de Vries of the Annenberg Centre for Communication at the University of Southern California. Users will always be connected, he says, but in concentric circles of conversations and interactions that range from people right next to them to those far away.

“When I try to make predictions, I don't look at what I see in the technical realm, I look at what I see in the social realm,” says Mr Norman. He has recently been investigating how children interact with each other and with technology. “They are never alone with their own thoughts,” he says. Instead, they listen to music while texting and talking with friends next to them. “We are learning that we never have to be away from people,” says Mr Norman.

Phones could also change how people interact with things, as well as other people. In 15 years' time, when everything from shoes to shirts to sunglasses could well contain tiny wireless chips, people may use their phones to communicate with objects as well as talking to people, suggests Mr Lindoff. You could then use a search engine not just to find information on the internet, but to find objects in your home. “I want to search my home via Google—I want to find my green shirt,” says Mr Lindoff.

No doubt much of this speculation about the future of the phone will prove to be as misguided as AT&T's vision of the Picturephone back in 1964. Indeed, it may be that the whole idea of a telephone comes to be seen as an anachronism, as personal digital devices take on a bewildering range of new functions. Already, researchers at Motorola like to talk about “the device formerly known as the cellphone”. What it will be called in future, and what it will do, remain fascinating questions.