media/rep/

Repositorium für die Medienwissenschaft

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The future of mobile in the 3G era
2005

https://doi.org/10.25969/mediarep/1253

Veröffentlichungsversion / published version
Sammelbandbeitrag / collection article

DFG Deutsche Forschungsgemeinschaft

Philipps Universität Marburg

The future of mobile in the 3G era

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Introduction

Predicting the future is problematic. It is unseen, unheard and un-known. However, emergent themes and their connected possibilities are perhaps identifiable. We already find ourselves within certain technological landscapes wherein our journeys through them are apparently set in motion. One such landscape is the Internet. One such journey is the evolution of mobile technology, now in its Third Generation, or 3G. Given such starting points, plus knowledge of the rhythms of technology cycles, such as the lifespan of GSM, a consideration of the next ten years seems reasonable. I shall not describe specific services or technology roadmaps, such as processing power and battery power-weight curves. I shall suggest general *mobilisation themes* that will characterise the next decade of mobilisation. However, I shall examine a few technological developments, but within the context of the posited themes, as possible points of synthesis. It is not hyperbole to say that the process of mobilisation will affect our *lives*, not just our phone habits. Therefore, a discussion of the possibilities is a potentially important process in shaping our mobile futures.

Before outlining the likely themes for the forthcoming decade of mobilisation, I would like to make a couple of general points about the environment of mobile technology in what I am calling the *3G era* (a term I shall explain shortly).

Convergence as transformation

Firstly, I would like to comment on the often hackneyed and ineffable topic of *convergence*. As my book *Next Generation Wireless Applications* describes in some detail[1], the mushrooming mobile cosmos is going to be much bigger than the sum of its mobile-technology components.

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1. Golding 2004; see my website for more details: http://www.paulgolding.me.uk.

Second generation (2G) mobile, such as GSM, was essentially a convergence of relatively few technological developments, mostly from the radio frequency (RF), telephony and real-time processing fields, which includes the colossal, crucial, and often overlooked contribution of silicon integration. A multitude of diverse technologies are already jostling for entry into the 3G mobile arena. These come from a wide gamut of technological possibilities, such as trust, security, payment, reputation, location and so many more. The possibilities are potentially overwhelming.

Technology is *transformative*, not merely additive[2]. Adding a drop of red dye to water does not result in a drop of dye and some water, it becomes something different. After the printing press, Europe did not simply become Europe with the printing press; it became a different Europe. Similarly, America, and later the world, became a different place after the telegraph. Our world is changing again, this time thanks to mobile. In the midst of technological evolution, the changes can seem gradual because they are ecological and we adapt to the evolving ecosystem. Marshal McLuhan said about immersion in media, "fish don't know water exists until beached" (McLuhan 1970: 191). Take a mobile away from many people today and they will begin to grope for its umbilical connection within hours, if not minutes. People notice and report the loss of their mobiles far quicker than the loss of their purses or wallets. It is perhaps not an exaggeration to think that some social mechanisms would falter, or even collapse, without mobile.

3G as era, not technology

Undoubtedly, 3G is a set of transformative technologies[3]. The essence of 3G is *not* its high-speed data promise. Rather, it is the myriad possibilities for *convergences* that it enables, totally unlike 2G, each with its own transformative potential. In essence, the real 3G—the *era* and not the mobile technology—is about an incredible convergence of various technology growth curves, many at their tipping points[4], spanning manufacturing, networking, processing and information technologies. It is a completely new set of possibilities.

In the early Nineties, most of us could not see the need for a mobile phone. Today, that notion is almost preposterous. In the 3G era, we shall see that carrying (wearing) a mobile device will become a pre-

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2. For a complete discussion of this point, see Postman 1992.

3. Besides the general point I am making about convergence potential, 3G itself is actually a suite of technologies far more extensive than GSM and telephony. See the 3G Partnership Project for more details at http://www.3gpp.org.

4. By which I mean points of inflexion on the adoption (or growth) curve.

requisite for living in contemporary society, in which increasingly we shall live in information space, not just physical space. We can debate this point, but besides the evident IT revolution well underway, I refer to the likes of "management guru" Peter Drucker (and many like him) who consider that we are entering an age of "unprecedented change in the human condition", where "substantial and rapidly growing numbers of people […] will have to manage themselves" (Drucker 2000). If true, this self-management ("survival") in what Covey calls the "Knowledge Age" (Covey 2004) implies a high degree of engagement ("24 x 7") with the information world. Information immediacy will demand mobility.

Essential themes—The four Cs of connectedness

At this juncture in the evolution of mobile, paradigm confusion is evident. The name "mobile *phone*" is increasingly problematic. Alternatives like "personal communicator" are more revealing, but still insufficient to describe its future eclectic role. In the prelude to *Next Generation Wireless Applications* (Golding 2004), I portray an imaginary character and her interaction with mobile devices[5] during a short lunch break. During the break, she does the following:

- *Organises* lunch with friends
- *Feels* messages notifications via her wrist "sleek device"
- *Finds* a popular meeting place
- *Sends* video clips
- *Locates* the meeting place
- *Hails* a taxi
- *Senses* a "friend of a friend" in the area
- *Compares* shopping prices (via barcodes)
- *Finds* somewhere to eat based on recommendations
- *Shares* the restaurant bill with friends
- *Pins* feedback about the eatery in mid-air
- *Announces* phone calls with an introductory tag line
- *Diverts* a voice call to a colleague's Instant Messaging client

Notice that the multifarious tasks (the verbs are in italics) are everything but talking (phoning)! This is illustrative of the convergence explosion and of the radically different nature of the *3G era* from the 2G one. Thinking about such mobile tasks, I believe that it is possible to

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5. I assume, quite reasonably I feel, that we shall have more than one device in the future, which in this example includes a wrist-device, a pendant and a main "personal gateway" as per the Personal Mobile Gateway concept forwarded by companies such as IXI Mobile (http://www.ixi.com).

identify some fundamental themes for the next generation mobile experience, essentially from a user perspective[6]. The four themes are *communicating*, *consuming*, *communing* and *controlling*.

Communicating

The overwhelming function of a mobile device has been, and still is, to phone people in order to communicate via voice. The introduction of other modes, like video, is really an extension of this theme, nothing substantively new. Mobile devices are unavoidably and very essentially personal. Greater intimacy is hard to imagine, although the physical progression of devices is already unfolding to give us wrist-based, pendant and other wearable forms. Within the mode of personal accessory, or attire, devices are increasingly an expression of our aesthetic tastes. Fashion and personal expression have undeniably become parts of the mobile experience[7]. However, this is mostly a marginal theme in terms of any substantive revenue generation from mobile services[8].

The *person-to-person* (P2P) nature of mobile connectivity will remain a dominant overarching theme. Much of the development in mobile will be products and services that increasingly fold and embed P2P modes of interaction deeper into our daily lives. We can think of talking as being one mode of P2P interaction that we can assign to a super-category of personal *exchange*. The 3G era will be largely about services and devices that enable exchange to take place: exchange of ideas, contacts, thoughts, tastes, news, money, lists, preferences, opinions, interests, intelligence, intentions, and knowledge and so on, whatever digital form these take. The increasing digitisation of our personalities in the "Knowledge Age" will render the mobile an important instrument of exchange. I will mention some concrete examples later in the chapter.

Communication, or exchange, shall continue to develop through convergence and newer device possibilities. However, convergence is what makes the other themes possible. The Internet will play a central role in the convergence process and in all themes. Here I caution that the common notion of "Mobile Internet" as a kind of shrunk-to-fit ver-

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6. It is worth stating however, that user perspectives for enterprise and consumer activities are different. Although various overlaps exist, our main concern in this chapter is the more horizontal consumer experience.

7. When the likes of Samsung and Vogue announce a co-marketing partnership, as they recently did, then we know that mobile-as-fashion has "arrived".

8. Although it is known that for some users there is a relationship between aesthetics and amount of usage.

sion of today's Internet is far from the mark. "Internet 1.0"—Berners-Lee's original vision for document sharing (now "content" sharing)—lacks the convergence power needed for the future of mobilisation. We need "Internet 2.0"—notably the *Semantic Web*[9].

Semantic description of digital information will allow convergence to deliver powerful services that exploit the P2P potential of mobiles that we have been exploring. Today we could stand in a shop and browse generic product information on our mobiles, albeit clumsily. Tomorrow, we shall ask our communicators questions like "which product in this store would Mr X buy?" where Mr X is some valued friend, guru, advisor or expert in the context of the question and to whom we can establish a P2P link, if only by asking this question. For the question to have meaning and for a meaningful answer to become available, the very substance of meaning—semantics—is required and needs to be digitally accessible. This is what the Semantic Web promises.

Computers are generally clumsy at figuring out what we want to do. Users can often overcome this by attempting various approximations to get what they want. However, mobile devices are even clumsier, so we need more precision or smarter interpretive technology. The Semantic Web can potentially offer both, which is why it seems a natural fit in the mobile ecosystem. Returning to Mr X for a moment, his purchasing records, wish lists, product reviews, web hits, web searches, and all manner of interactions within information space leave a digital trail. Gaining access to the trail and its semantics implies having permission to do. Thus, in addition to having the means to form P2P links, mechanisms are also needed to establish digital identity, trust and security. These are important sub-themes in the 3G episode.

This kind of P2P interaction will be possible and likely. Besides the infrastructural ingredients, like the Semantic Web, certain device interface developments will also serve to absorb this type of interaction into our daily routines, some of which I shall discuss later. The characteristic of these mobile P2P services is *information immediacy*. The sheer empowerment of immediate access to multifarious P2P networks and their content will be utterly compelling. Metcalfe's Law of networks is in play and the future of mobile is about increased and inescapable dependency on networks. A device being "always on" is not the point. We need it "always networked", with information being "always available" and "always relevant". Already, many broadband adopters have gravitated towards an *information-grazing* lifestyle. Broadband is not a fat pipe, but an information environment. The 3G era not only extends

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9. See http://www.w3.org/2001/sw/ which contains a link to a paper by Berners-Lee first published in Scientific American, May 2001.

this experience, but also adds many new dimensions through its own convergence potentials. Once this process starts, we shall become like McLuhan's fish.

Consuming

Consuming is an obvious theme, especially with our increasing reliance upon digital information in our general patterns of consumption. New patterns of consumption might emerge because of mobile, but I focus here on supplementing existing mechanisms, in particular the monetary aspects of consumption processes.

Consumption involves financial transactions, a key component of which is personal authorisation of transfers. Today, all purchases are in effect authorisations. Handing over notes and coins is actually an authorisation. Credit cards and other forms of electronic transfer are clearly about authorisation. Substituting our wallets with some equivalent function on our mobiles is a seemingly natural progression. Various *m-payment* initiatives are surfacing, such as Simpay[10]. With the move by card vendors towards PIN authorisation at the counter, there is now no reason why a mobile cannot become a card substitute. Let us not worry here about various agendas for *m-payment* schemes. I am interested here in the end-user possibilities and the technological implications. The potential advantages of payment via "smart" mobiles versus "dumb"[11] cards are enticing for end users. Among them are the possibilities for financial management, budgeting, proxy-spending, group-spending, authorisation deferment, spending-controls, purchase logging, foreign exchange, loyalty schemes and so many more. In short, the user gains more control. This is central to Drucker's thesis of "self-management".

If the mobile is to take a major role in financial transactions, then reliable and secure connectivity is essential[12]. With the development of 3G, WiFi, Bluetooth and other emerging solutions, the 3G era will eventually herald an age of *perpetual connectedness*. This means we can deploy services with the cast-iron assumption that all active members of society are perpetually reachable via a network or networks.

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10. Although in 2005 the Simpay initiative was ended by the participating network operators.

11. Modern chip-based cards are not entirely dumb, but compared to mobile phones they have extremely limited processing power and capability.

12. Note that it is not necessary for credit authorisations to go through the mobile's connection, but in some instances this is useful.

Controlling

Somewhat divergent from the overarching P2P theme is the idea of machine control, essentially remote control. As with "digital wallets", the control theme is mostly about substitution whereby personal devices assume the role of existing devices. *Personalisation* will be important, as well as *continuity* or *fluidity*. To give an example, consider the remote control of a home multimedia entertainment system, by which I mean a digitally networked television and audio system. Currently, such systems have dedicated remote control devices. It is an obvious substitution to use a personal device in place of the existing remote control, probably connected via Bluetooth. The remote control emulator on the device, perhaps displayed via the television, will invoke *personal* preferences and tastes, not generic ones, and on a per user basis. It will summon *personal* play lists, film reviews; content broadcast times and so on. The personalisation attribute is perhaps obvious, but what about the attribute of *continuity*?

Continuity is how a common networked device for all remote control applications will allow personalisation parameters to flow fluidly from one environment to another. For example, whilst listening to some audio content on the move, that same content will flow with us onto our home systems, available at the exact point of departure from our engagement in the car, train, or wherever. The control theme can include any machine. A machine might be a piece of medical apparatus in a hospital, a barrier at a subway station, or a baggage check-in machine at an airport. Desktop computers are machines too! Imagine never having to fill out forms again—whether ourselves or via some desk clerk at the hotel. The mere co-presence of a device will allow essential parameters to flow from it into whatever digital receptacle awaits them: online form, cash machine, car-park barrier, washing machine, vending machine and so on.

The notion that our personal device represents a kind of digital heartbeat is a powerful metaphor, with data-flow as our digital lifeblood. Just as the heart traditionally denoted the seat of the intellect in many ancient traditions, the digital heartbeat is its proxy in the virtual realm, a kind of digital *alter-persona*. It is our digital core. With a digital heartbeat, it will be easier to interface with machines. This is a new dimension to the mobile experience. We shall return to this theme later when we look at virtual kiosks and spatial messaging.

Communing

Community and social networking has already become a much-discussed and apparently important theme on the Internet. Indeed, the

very definition of community is arguably undergoing transformation as it extends further into the virtual world. For this discussion, I take communing to be the bringing of people together with *common* agendas and interests and consider what the 3G era heralds for such activities. The strong P2P nature of mobilisation in the 3G era will inevitably put people in touch with each other on many levels. It will be much easier to "bump" into other people with common agendas and interests, both physically and virtually.

In training classes, I have often presented the concept of co-detection whereby one person detects another in physical proximity with a common interest. The initial reaction, perhaps not surprisingly, is usually one of apprehension. Aside from lack of experience to give insight, students envisage "frivolous" applications—not that we should condemn frivolity, otherwise perhaps much of the texting phenomenon would be outcast. Interestingly, when encouraged to think of a specific "non-frivolous" context, such as a conference or exhibition, co-detection seems more interesting and a sense of its potential emerges. Currently, a socialising tool such as this is unusual, but that does not mean it will be unlikely. The readiness of people to network online via tools like LinkedIn and Ecademy[13], suggests a willingness to try new means for an old game.

Possibly the greater potential for communing exists virtually, courtesy of the powerful P2P nature of the 3G era. The trend towards greater and richer modes of exchange—the communication super-category mentioned earlier—is such that people will inevitably come into contact more often in the virtual world. P2P exchange of information implies that increasingly we shall become content producers. We have also hinted that the semantic labelling of information will enrich this process. If I post a review on Amazon about a book on carpentry, it becomes accessible in the virtual world as a review. However, with semantics, it becomes the source of a potentially much wider conversation than a review page.

Imagine that I maintain a list of favourite carpentry tools. With semantic labelling, this list becomes implicitly connectable to my review. Returning to the shopper example earlier, imagine that I am now Mr X. The shopper, who hitherto has never met me, can connect to my tools list via my review. With mobile connectivity and semantics, a new P2P network can instantly form. The shopper could even attempt direct contact, which I can accept or deny via a multitude of communication means, such as voice, video, text etc. The process might cause my list to be amended or expanded, which enriches the potential for more P2P conversations of this ilk. This example is contrived and the details glossed over, but the 3G convergence process makes this type of *com-*

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13. http://www.linkedin.com; http://www.ecademy.com.

muning immediacy possible, which is still consistent with the overarching P2P theme.

Some physical aspects of the 3G era

Let us turn our attention to some of the physical aspects of the unfolding mobile landscape. The mobile phone revolution thus far has been quintessentially a physical one, a conquering of physical technology limitations, mostly thanks to the unrelenting march of silicon integration. The 3G era is about conquering information space. However, interaction with information still has physical implications. There are too many device technologies and innovations to discuss in such a short chapter. I have chosen a few that seem significant in light of the aforementioned mobilisation themes, but which also have profound implications in their own right.

The mind's eye—Perpetual visualisation

The mobile revolution is largely thanks to incredible improvements in portable electronics, which also present challenges. Energy supply is one of them, but of immediate concern are device interfaces and ergonomics. Recall the bulky and impractical head mounted displays (HMD) of those early virtual reality (VR) immersions into computer-generated landscapes. Today, a tiny display can be added to ordinary spectacles with little additional weight and cosmetic alteration, as shown in Figure 1. Moreover, price erosion of HMD components suggests consumer viability within the 3G era[14]. Scepticism towards wearing such displays is understandable. However, perhaps the willingness to wear Bluetooth earpieces is an indication of our willingness to accommodate wearable devices. It seems inevitable that the immediacy of information access offered by HMDs might prove irresistible enough to overcome hesitations about wearing them.

The mobile phone has given us *vocal immediacy*. A mobile phone allows immediate fulfilment of the desire to talk to someone absent, a kind of empowerment of the *inner voice*. Even this potential has further to go. Imagine simply talking to a companion at will in order for them to hear your voice, and without any explicit connection process. With IP-based communication schemes, which 3G can accommodate, this is already possible. With HMD displays, we could readily see the *presence state* of fellow conversationalists using pictograms to indicate their

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14. In fact the situation is that volume demand is all that is needed to bring the costs down considerably.

availability. With improvements in signal-processing technology, it will also become possible to talk very quietly, nearly whisper, unencumbered by background noise. Thus, we could potentially communicate within visually and acoustically masked "bubbles" that maintain privacy.

Figure 1: Wearable and affordable displays arrive in the 3G era. Reproduced courtesy of Carl Zeiss.


Visual immediacy will create new modes of interaction. Think of engaging in a conversation with someone whilst simultaneously viewing related information. Imagine that a co-conversationalist mentions a product, event or news item and within seconds, you are viewing its website. Imagine having multiple views, including perpetual web-cam feeds, such as from our homes or favourite tourist spots. The notion of being "here" and "there" at the same time becomes dramatically accentuated.

As well as improvements in voice control, gesticulation is a possibility for input control: using the movement of limbs and the body through definable gestures. The mobile device itself could become a pointing device that works in air, similar to devices already available, such as the Gyration™mouse. MIT Media Lab Europe are already demonstrating these types of interfaces in its palpable machines research program[15]. Of course, HMDs will also be useful for watching digital video, including broadcast modes (e.g. DVB-H), which may ultimately be a key driver for their adoption. As an alternative to wearable displays, portable projectors are emerging that are capable of self-stabilising the image to correct for movement relative to the illuminated surface.

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15. See their project suite "Palpable Machines": http://www.medialabeurope.org.

Using similar combined-sensor techniques, already companies such as Canesta have successfully implemented projected keyboards, as shown in Figure 2. Other technologies, such as wearable or foldable display fabrics are possible. Display and input technologies will always have practical limitations, but the point is that the 3G era will herald solutions to many interface issues that currently seem to limit the imagination for mobile service innovations. In addition, new modalities will emerge altogether.

Figure 2: Light-projected keyboard. Reproduced courtesy of Canesta, Inc.
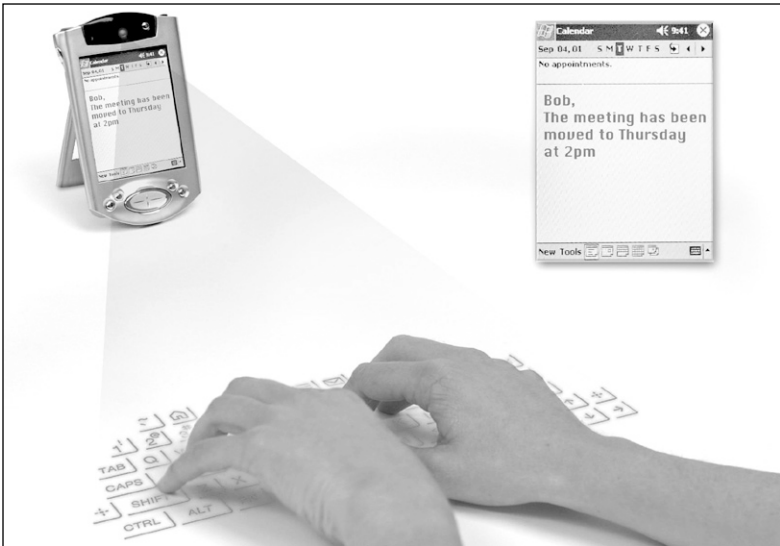
Total recall

In this section I shall look at the implications of high-speed wireless connections and the increasing price erosion of high-density memories. Broadband penetration is encouraging networked services such as networked storage to become more prevalent. Within a variety of contexts, we should expect networked storage to make perpetual archiving models possible, such as some email solutions today that already offer the "lifetime" potential of never having to delete old messages. Consequently, such trends are also encouraging improved indexing and retrieval methods. Any content generated or processed by the mobile could be perpetually stored, courtesy of a combination of networked storage, higher density device memories (e.g. hard disks) and high-speed wireless networks, permanent or nomadic. With camera phones, we shall never have to delete photos, nor explicitly back them up. This

will be possible for all content, and not just the conventional mobile phone formats like contacts, call registers, text messages, pictures, sounds etc. All conceivable content could be stored, such as music files, location history, search requests, financial transactions, and barcode swipes (see later)—our entire digital trail.

More radical storage possibilities will also emerge. With effective voice coding techniques, it is possible to record all of our daily conversations, phone, or otherwise, and store them in the network. Offline transcribing and non-linear indexing methods will facilitate searching back through any conversation. Merged with pictures, location and any other event in the memory bank (e.g. a web search or shop purchase), glued with copious semantic data, an incredible *alter-persona* potential begins to emerge within the 3G era. "Where was I when I said X to Y?" "Who was I with when I took this picture of X?" The possibilities for perpetual memory are dramatic enough, but within the frame of powerful P2P networking and exchange, the transformative potential for this idea alone is difficult to comprehend fully. It is one thing to have a P2P network that connects person X with person Y, or a multitude. It is quite another to add the dimensions of time and memory—and location.

Spatial convergence

With the location-finding capabilities of new devices, we can tag *any* content or event (e.g. financial transaction) with location information. This is yet another dimension to the information landscape in the 3G era. It allows such concepts as *spatial messaging*[16]. A user can leave a message "pinned in mid-air" at any location, even a street corner, which is then accessible to other users, who could be anyone, or those in our chosen P2P or newly formed (even ad-hoc) networks.

Users and content producers can add spatial indexing to pictures, sounds, videos, songs, web links etc. Potential applications and implications are quite astounding, especially when we add semantic information that allows deeper content relationships to form, such as Figure 3 tries to show.

Privacy and authenticity is a concern. How can we leave private messages that are not accessible to unintended parties and how can we be sure that a particular message is authentic in terms of its authorship? This is a Digital Rights Management (DRM) issue. Already, DRM solutions exist that allow content protection against piracy. However, in the 3G era, everyone is a content provider! Therefore, we shall expect

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16. For a more complete discussion of Spatial Messaging, see my online paper "Getting in The Zone with Splash Messaging", August 2003 at http://www.paulgolding.me.uk.

to see DRM technology deployed in a P2P context besides the more conventional "broadcast" modes of content distribution associated with DRM. Legal and ethical issues will arise concerning the blurring of private and public space. Interestingly, the same techniques that can protect and ensure identity in information space (as needed for secure messaging and financial authorisations) could also be used for audit purposes. With "digital fingerprinting", a photo taken by a device could be inescapably traceable to the device that took it. With low-cost biometric interfaces, which are already possible, the photo and the photographer can become indelibly linked. Clearly, these protective methods also have implications for social liberties. Such discussions will emerge during the 3G era and should not be overlooked.

Figure 3: Content, location and semantic links.
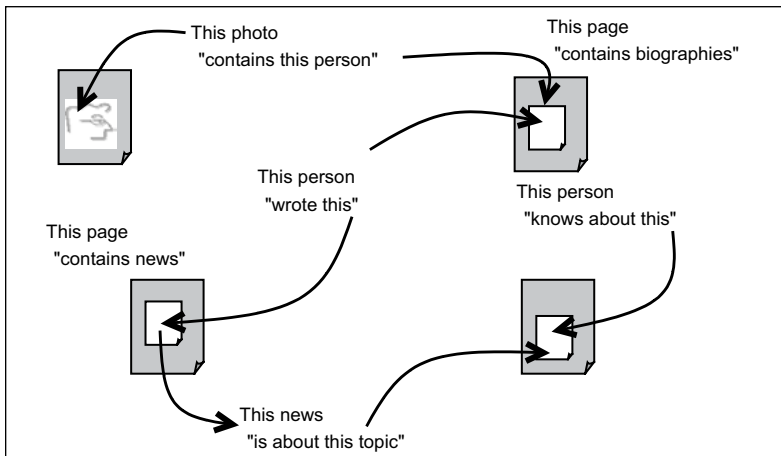
Other forms of spatial-virtual interplay will emerge with the increased usage of mobile-readable tags on products and other objects. It is possible to integrate low-cost barcode readers into mobile devices. Photographic scanning is also possible using the inbuilt camera, although it will not be as reliable as lasers. With suitable devices, we could scan product codes to access online information of all kinds, including web-based searches. Aggregator companies already exist to assemble bar code databases from various product manufacturers based on their bar code assignments.

Tagging need not be restricted to products. It is easy to tag any object and thereby enable proximity-based information access. Thanks to perpetual connectedness, tags essentially become low-cost information kiosks. A user can walk up to the tag, scan it and immediately access a web link. The linked information can take into account the loca-

tion of the tag, if it is fixed. Users could also use tags to post messages back to a co-located virtual pin board. Tags need not be barcodes. They can be radio frequency (RF) based. The current retail interest in Radio Frequency Identification (RFID) suggests that it might figure in the mobile experience eventually, although barcodes still have a long shelf life. Proximity sensing is also achievable without tags. Techniques using Bluetooth or WiFi access-point co-detection are possible.

The overarching P2P theme remains pertinent to location. The ability to leave messages at a virtual "meeting point" will give rise to a vast number of parallel P2P conversations, not necessarily a chaotic splurge of graffiti. Some conversations will be private, some will be public, and some will be both. Merged with perpetual memory and semantics, the implications are dizzying.

Conclusion—The 3G Mobilopolis

I have attempted to predict some of the essential themes for the 3G era. It is an era and not a technology. This reflects the fact that this new age of mobile will be a convergence of variegated technologies, of which 3G—the technology—is only one. These convergences have the power to transform how we live our lives, which is the nature of technological change.

Mobile devices are essentially personal, including their person-to-person (P2P) nature. New modes of usage will greatly empower P2P networks. Today we communicate across established P2P networks. Tomorrow we will easily create new ones and traverse them in information space to *communicate* better than before, as well as *consume* things—real or virtual—*commune* with others and *control* machines: the four Cs of the 3G era.

In terms of experience, to vocal immediacy the 3G era will add information immediacy and communing immediacy, which collectively shall better equip us for the challenges of Drucker's "self-management" era.

Thus far, the mobile revolution has been a physical one, giving an old idea—telephony—a new form. The transformative nature of the 3G era will bring new possibilities altogether, many of which we do not yet have experiential paradigms for, like *spatial messaging*. However, whilst we might not recognise them now, or even think we need them, once in the *3G Mobilopolis* we shall become dependent, like McLuhan's fish. Of this, I am utterly convinced.

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