6
Design Strategies for Future Wireless Content

John Kelly

1 Introduction

If you keep an eye out for the handiwork of mobile device and services marketers, especially in Europe and Asia, it is hard to miss visions of media pouring out of tiny gadgets. Bus stop posters, magazine ads, and signs in store windows show all sorts of exciting things happening on tiny screens: singers crooning, soccer players kicking, jazz artists trumpeting. Musical notes float out of mobile headsets, and the celebratory cry of "Gooooooooaaaal...." meanders from a cell phone earpiece right across and off the edge of the page. To be sure, you also see images of happy people with phones to their ears, presumably talking to happy friends and family on the other side. But it is hard to escape the idea that if all you are doing with your mobile phone is making voice calls and (outside the U.S.) sending text messages, you can look forward to doing something much cooler with it.

This is of course precisely the idea this marketing strategy is trying to convey. The entire mobile telephony industry has a big stake in consumers opening their wallets to pay for a ride on the advanced mobile services bandwagon. To justify powerful new devices and networks with greatly enhanced data capacity, consumer adoption of high-bandwidth services must happen. And in the absence of clear precedent, the easy answer to the question "what will consumers want?" is "content."

So what is the of future of "wireless content?" Is the principal challenge we face how to get Paula Zahn's reportage or Britney Spears' vocal stylings onto our cell phones? Will we be reading the New York Times or Oprah's Book of the Month on our PDA's? Should we view mobile wireless devices principally as little, un-tethered TV sets, stereos, computer screens, and so on, in other words, a new channel for the distribution of content made for traditional and Internet platforms? Or, do we need to consider mobile devices (and the network behind them) as a new and different medium, with its own properties and potential?

I argue the latter, and in this article will address some of the key issues to understand in the design of new content applications for mobile devices.

After looking at key issues, we will consider some examples of advanced functions and services that might point the way to what the future holds in store. These are concepts, some in the lab, some in the imagination, some in trial deployments or limited commercial distribution, that embody the elements likely to come together as advanced mobile platforms mature.

But first, we must try to get underneath two dangerous assumptions common in the communications industries. The first is the old saw that "content is king," and the second is that high bandwidth is the necessary enabler of advanced services.

2 Challenging Assumptions

In his paper "Content is Not King," Andrew Odlyzko (2001) makes a compelling argument that while traditional content (i.e. professionally produced media) has a high profile and mind-share, it is dwarfed in revenues by connectivity (i.e., person-to-person communications). While content gets the glitz, one-to-one communications generate the real money required to support infrastructure on the scale of telecommunications networks.

And beyond revenues, connectivity also dwarfs content in terms of importance in people's lives. For example, if faced with a choice between giving up the web and giving up e-mail, people overwhelmingly report that they would give up the web (Katz & Aspden, 1997). And those who quote statistics to show that web data outweighs e-mail data on the Internet should consider carefully the difference in "attention value" between one bit of personal e-mail (expensive) and one bit of a banner ad graphic (cheap).

For our purposes, the main point here is that people are much more willing to pay for connectivity than for media content. For the most part, content is not something consumers buy. Quite the opposite, it is something advertisers use to buy access to consumers' attention. And if you consider the types of content that consumers do buy, little of it is the sort of thing that has any real prospect of a wireless play. People generally want to watch movies on the biggest TV sets they can afford or accomodate; eBooks are not doing well; and despite some industry excitement about the idea, individualized wireless downloading of high-quality music is unlikely to be feasible for a variety of cost, efficiency, and usability reasons. And as for advertiser-supported media, interruption based ads upset consumers, who consider their mobile devices to be very private, personal accoutrements. (There are good opportu-

nities for contextual advertising, as will be discussed later, but only on an opt-in model that is designed around consumer needs and not likely to be tied to a media play.)

This argument stands the strategy of many wireless operators on its head. These operators see wireless content as a high-margin business that will justify the expense of deploying the advanced, higher-bandwidth networks required for multimedia. They think that consumer demand for media content will save them from being in the uninteresting and presumably less profitable commodity business of providing "dumb pipes."

There is a certain circular logic here. To build advanced networks, one needs the higher profits (supposedly) available from being in the less heavily regulated content business. And to deliver content that consumers will pay for (directly, or indirectly through advertising), one needs high-bandwidth networks. But the failure of the Internet as a "content" medium should be a lesson to those thinking about wireless in similar terms.

If we consider the landscape of wireless platforms' capabilities in two dimensions, bandwidth and "social scope", it is easy to see how lower bandwidth services not only form the core of the revenue base, but have the strongest still untapped potential for advanced mobile data services. In terms of bandwidth, current systems easily handle voice, of course, plus data services that can be accomplished with even less bandwidth. EMS and MMS do not require vastly more bandwidth than voice EMS could use less. 2.5G would be good enough for these services. Most communications can be accomplished with low data rates, and those that cannot, like broadband quality video, really need the much higher bandwidth of WiFi (also called 802.11, or WLAN) to be feasible.

In terms of "social scope" of the communication, we can distinguish personal, one-to-one communications on one extreme—like phone calls—and one to many, mass communications on the other. In the middle are the increasingly robust one to some communications typified in the old days by community and interest specific newsletters, mailing lists, etc., and exemplified today by online chat, online interest groups, listservs, family, community and interest-specific websites, and so on. It is important to note that even as online media plays are dying off, these one-to-some "community" features are thriving on the Internet, and could prove successful in the wireless domain as well.

If we accept Odlyzko's argument, that the traffic and revenues needed to support a communications infrastructure can only come from the more personal communications, we should recognize that these are also the ones most easily accomplished at lower bandwidths. In the traditional, one-to-many domain of "content" the only current examples cited as wireless suc-

cess stories are screen graphics, ring tones, and wireless alerts. Of these, we would argue that only wireless alerts actually function like traditional content. Screen graphics and ring tones are more about saying "check this out" to your friends, a "social application" more than a "content" one.

So a question for operators is whether there will be sufficient consumer demand for media-rich, one-to-many applications to justify the enormous cost building high-capacity networks, not to mention the time and money spent trying to build a media business on top of a communications business. Unfortunately for mobile operators, 3G is too limited for truly compelling media applications, and overkill for basic services known to be useful and in-demand. It would be better to move beyond the idea of mobile devices as media players.

The objection that the future may bring applications we cannot foresee has the virtue of always being true. But it is weakened by two considerations. The first is that the potential for compelling low data-rate mobile applications has hardly been tapped. There is a long way to go in exploiting the value of the bits we can send at 9.6 kbps, and no reason to think that those bits will become more rather than less valuable when they can zoom around at 3G speeds. Using Java and other ways of making the ends of the network (mobile device and back-end) more intelligent, even very low data rates can generate compelling, rich experiences.

The second, related, consideration is the rich history of the mistaken belief that if people like something now, they will like it a lot more if you "improve" it—even if they are not asking for the improvements. HDTV, Quadraphonic sound, and the video-phone (particularly relevant here) all leap to mind. This is not to say that there aren't "killer apps" out there to drive adoption of mobile data, just that adapting mass media for wireless distribution is probably not one of them.

None of this should be taken to mean that today's 2G systems are perfectly adequate and need no improvement. But among the technical advantages of 3G networks, the "always-on" feature of packet-switched systems is significantly more important than the higher bandwidth. In this sense, "2.5G" networks (e.g., GPRS) may be good enough.

There is, however, an analogy between the unforeseen benefits that could lurk in the deployment of advanced mobile networks and the real benefits of wired broadband over dial-up. Despite marketing that emphasizes rich multimedia content, broadband adoption in the U.S. has principally been driven by consumer frustration with slow page-loads and a desire to save time (Rappoport, Kridel & Taylor, 2002). In other words, for the most part people pay for broadband to better enjoy principally text based web pages, not video, animation, or other rich media. Similarly, high speed wireless networks could

succeed mainly by making low data rate services already available on current networks function better, and perhaps less expensively. The latter point is significant, since with the exception of SMS, the high cost of even very low data-rate services is a major inhibition to consumer adoption in Europe (Jupiter MMXI, 2002).

3 Designing Wireless Applications

So how should we think about the future of wireless content? The key is to figure out what the special properties of the platforms are, in other words to focus on what is unique about networked mobile devices rather than how they can act like movable, miniature versions of things we already have. Designers of wireless applications face numerous challenges grappling with this problem. Mobile devices have severe restrictions imposed on form factor, input and display, battery life, processor speed, communications range, data rate, and memory, to name the most obvious limitations. And then there is the big mystery of what people will actually want to do with them.

It is very hard to understand what consumers will want by brainstorming in a vacuum, and consequently it is critical to track, and attempt to leverage, the practices and cultures rapidly evolving around digital technologies. It is also important to understand the key properties of wireless mobile devices, how consumers adapt to them, and the implications of particular business models on both user experience and content development.

Taking a look at the major dimensions, we will now illustrate key opportunities and principles.

3.1 "Anytime, Anywhere" vs. "Here, Now"

In terms of performance and features, mobile devices are inferior to desktop computers in nearly every respect: slower processors, smaller displays, restricted input methods, tiny amounts of memory. As networked communications devices, they offer nothing in terms of features over the PC and phone, if you consider that Instant Messenger, ICQ, etc. are the equivalent of SMS on the PC, and that in Europe at least, carriers are rolling out wired phones that implement SMS for the home or office (Anonymous, 2002). And they are more expensive generally than landlines for voice and dial-up for data—and even broadband data in many cases.

This is all to drive home the fairly obvious point that the only advantage mobile devices have is that they are in fact mobile. They accompany their user everywhere he or she goes, providing ubiquitous personal connectivity. "Anytime, anywhere," as the slogan says.

The "anytime, anywhere" concept is the first dimension of mobile applications, and refers to the idea of extending communications services available on other platforms to mobile ones. It provides social connectivity like SMS, e-mail, and now Instant Messenger, as well as group messaging like that offered by the mobile community enabler Upoc (a service supporting wireless messaging groups, such as New York's popular "nyc celeb sightings"). It also entails things like wireless alerts, news, sports, weather, bank account updates, stock price changes, and so forth. It essentially refers to an extension of cyberspace into the mobile dimension, allowing services you can enjoy by other means to be more platform and device independent. Most mobile services available now fall into this category.

The second dimension of mobile applications is commonly referred to as "location-based services," and means functions that are specifically about "here" and "now," quite the opposite of "anytime, anywhere." But the term "location-based services" is too narrow to capture the implications of devices becoming much more intelligent, about not just where they (and their users) are, but what else is around them, what their users are doing, and other aspects of their proximate contexts. The term "Hypernet" better captures the idea of a vast diffusion of networked devices—mobile, embedded, implanted, and so on, working together to map the power of the Internet onto the real world.[1] One easy way to think about the mobile device in this way is as a "remote control" for life, like the one we all know and love from the couch, but one that comes out and about with us wherever we go.

We probably get a better taste of what the Hypernet will be like by looking at GPS devices, and imagining how far you could go with RFID-based (Radio Frequency Identification, passively powered data chips that can be very small and embedded in just about anything) systems like EZ-Pass (an automated toll collection system), than by thinking about pop-up coupons for the nearby Starbuck's. Consider the Rhino^2, a two-way radio/GPS hybrid from Garmin, that brings features available to the military to the public. As you and your friends tune to the same channel, the radios not only transmit your voices, but also continuously share everyone's coordinates. You can see yourself and your friends on a map as you hike, ski, shop, sightsee, and so forth. Implement the concept on mobile phones and it would be great for families at the mall or amusement park, not to mention giving directions, improving travel, or any number of other things. Clearly, as with E-911, there are technical and privacy issues to work out, as well as important issues of location granularity,

but in the end there are a number of ways for devices to know where they are within margins of error tolerable for a host of compelling applications.

Beyond knowing where people are, the Hypernet includes the idea of knowing about objects in the environment. Behind automatic tollbooth technology like EZ-Pass and some anti-theft tags on retail items are RFID's. Read from short distances by radio waves, RFIDs work like next-generation bar codes. They can identify cars, books, clothing, art hanging on a museum wall, or virtually any solid object. How often do you see someone reading a book and think you would like to have that book too? Now, you need to ask or lean in to read the title and author, remember or write down the information, go to the bookstore or find it online. What if you could just point your phone at it, click "order," and just wait for it to show up at your door? While browsing DVD titles, RFIDs in the DVD case could trigger wireless playback of the film's trailer. Artwork in a museum (or anywhere) could trigger delivery of background information. The concept of the Hypernet takes the power of cyberspace—the abstract, location-less Internet and brings it into the here and now, able to know where you are and what you are doing, see anything that can be made machine-readable, and control anything that can be made machine-controllable. It will take a while to get there, but it is a more compelling vision to build design concepts and business ideas around than "location-based services."

Another critical implication of both the "anytime, anywhere" and "here, now" aspects of mobile applications is that mobile devices will not simply be valuable as end points on a communications network. Of course consumers will want to make phone calls and read their news alerts, but in their "remote control" mode devices can serve as the 'connective tissue' between a host of functions, machines, and transactions in daily life. Mobile devices are likely to grow in this capacity as other systems become increasingly tied together via the Internet. Just as users of ReplayTV's latest digital video recorders can program them from a web browser, a mobile user could hear a song on the radio and use her phone to order it downloaded to her PC or entertainment center at home. Of course most of this is still pretty far out, but the principle is one to remember. Consider that a number of successful SMS-based m-commerce models in Europe work well precisely because they view the phone simply as one link in a chain that ties the physical store, the Internet, and mobile interactions together as a single unified experience for the customer (Klym, 2001).

3.2 Understanding the Mobile User

A complaint about WAP heard in developer circles is that creating applications is too difficult and requires even an experienced web author to learn a whole new bag of tricks. By contrast, creating i-mode sites is easy for anyone with the kind of basic HTML skills any web developer will already have. Part of the problem is that WAP sites must be engineered to work with a bewildering array of non standard devices, with different screen sizes, input methods, and specific capabilities. I-mode, by contrast, has the luxury of working with devices designed specifically for its service. Another part of the problem is that WAP was overengineered to allow the kind of complex interactions possible on the Internet. Whereas i-mode uses cHTML, a simple, stripped down version of HTML, WAP requires WML, a more feature-rich but complicated standard. WAP ignored a cardinal rule of wireless interaction design: Simplicity is king.

Wireless interactions and Internet interactions are very different, and not only because wireless devices have small screens and keypads. The user contexts are different. When using a PC, one is generally at a desk, is expecting to spend several minutes if not several hours in the same spot, and in any case—and this is the important part is focused on the screen as the primary object of attention for a prolonged period. The PC is normally the principal interface of one's primary dedicated activity. This fits nicely with the fact that it has a large screen and good input methods, but it needs to be understood independent of that fact—from the perspective of the user's expectations, purposes, and contexts.

Wireless interactions generally occur in a very different context, one in which the user is out and about and has the world itself as the principal interface of their primary dedicated activity. To make a PC metaphor out of it, the real world is your screen, your hands and feet are your mouse and keyboard, and the wireless device is a tiny little pop-up window that distracts you from time to time or allows you to perform some simple little function off to the side of your main activity. It may sometimes be assisting you with that activity, sometimes interrupting to alert you to something else you need to be aware of, sometimes allowing you to take care of something quickly so you can get back to your main activity. In most cases though, the mobile device is not "the show," it is more like the beeper that goes off while you are watching the show. Mobile interactions for the most part are distracting or assisting interactions.

This means that designing good wireless applications is not a function of miniaturizing web-style interactive experiences. Rather it is about simplicity, usefulness, and clear limits on required attention. The "mobile attention

span" is very short. With m-commerce for instance, complexity is something better built with multiple quick interactions spread over time than with deeper menus or more robust forms (Klym, 2001). In terms of data types it gives text and audio higher value than video. Text is good because it is "on your time," meaning you can read a chunk, look away, and come back to it, usually without missing anything. With audio, like any time-based medium, you are "on its time," but at least your visual attention is free to stay with the world around you—one reason radio is so popular with people driving or working with their hands. Video is the most "attention-expensive" medium because you are on its time and you cannot interleave your attention to it with any other activity. This is not to say that more attention-expensive experiences will have no place on mobile platforms, just that users will engage with them only in a very limited range of circumstances such as the daily train commute that has helped certain i-mode services in Japan. Even entertainment experiences like gaming will benefit by engaging players not just with the device, but with the world around them.

3.3 Learning from i-Mode, European, and U.S. Adoption

The popularity of particular services, the willingness of consumers to pay for them, and the best way to design and market applications will depend on a host of local cultural and market factors. For instance, Americans might get to the point where customized phone face plates are as big a deal as they are in Europe, where every mobile phone store has a plethora of colorful, branded alternatives, and street vendors and trendy back-street shops in major cities like Paris and Budapest sell hundreds of unauthorized custom designs. But they are unlikely to ever go to the extremes of customization and techno-fetishism found among teens in Japan. Similarly, Americans will probably (eventually) adopt texting because of the communicative efficiencies that have led to its success elsewhere, but will not share the added incentive that Japan's high social barriers to verbal and face-to-face communication (often seen as "shyness") give the Japanese. And there are significant user context differences between societies. For instance, Americans tend to spend more time in their large homes (and with their large TVs), while Europeans and Japanese spend more time in restaurants, cafes, and other public spaces. And while many Japanese spend their daily commutes crowded onto trains and needing something like i-mode (or a good book) to stay occupied, Americans sit in cars and listen to the radio.

Looking broadly at international mobile behavior and adoption, as well as online behavior, there are some key themes with implications for the future of

content and services. One is what could be called the "social power" of mobile communications. Another covers a bundle of key issues in the overall usability of services, including a look at the very difficult issue of "walled gardens" versus open environments.

4 Dimensions for Design

4.1 Dimension 1: The Social Power of Mobile Communications

Because mobile devices are such personal objects and typically accompany their users everywhere, they tend to be seen as extensions of self, much like cars or clothing. This is seen most obviously in the case of custom phone faceplates. But the phenomenon extends to custom ring tones and screen animations. While the latter are sometimes described as "content," as though downloading a ring tone would be the same type of consumption experience as downloading a favorite song for your MP3 collection, the value of ring tones and animations is not really in one's personal enjoyment of them. Rather the value derives from other people experiencing them, allowing the phone's owner another avenue of expressing social identity.

Similarly, services or content that play a role as "social currency" have become widely popular, especially in youth culture. In London, a popular youth behavior is sending around little text animations, much like the "ASCII art" that adorned many people's e-mail signatures before embedding custom pictures became a possible (and preferred) means of marking one's identity. Most of the animations are comical visual gags, and a great many are pornographic. The value of these animations is in having them to share and trade, and especially in being able to show them around one's table at the pub. Like having a great joke to tell (or for kids, a valuable Pokemon card to trade), these bits of mobile content fit seamlessly into natural social life. Another great example is big-screen public SMS displays, something gaining popularity in parts of Europe. Youth venues (bars, clubs, raves, concerts, etc.) feature large screens and special phone numbers for the public display of SMS messages, which range from the standard "Jorg luvs Elena" sort of thing, to much more inventive and insider-oriented social ploys. This is a phenomenon that probably stands to gain a lot from the widespread rollout of MMS services.

Another area where we see the social power of mobile communications services is in the emergence of mobile group applications, including games and interest groups. An intriguing example from Sweden is a game called "BotFighters," the first commercially implemented Hypernet game played

over mobile phones.[3] (One could argue that Electronic Arts' "Majestic" has the same claim, but mobile phones were just one of several channels available for playing it, and not an essential component.[4]) In BotFighters, the players set up a "bot" using the web, customizing such elements as weaponry, shields, and special capabilities, and then "battle" one another in and around Stockholm using mobile phones as game controllers. The "game board" is the environment itself, since the network can track player location. Battles require physical proximity. "Health packs" and "ammo" are "picked up" on street corners, in parks and other locations by physically walking, running, or driving over their "location." The game is persistent (meaning the world of the game continued around the clock), and it developed a dedicated group of players willing to jump out of bed at 3 a.m. and drive half-an-hour to join battles.

Some of these "one-to-some" applications, as you would expect, mirror popular Internet applications like dating sites. One of the most popular categories of "unofficial" i-mode sites is for singles "hook-ups." In the U.S., Upoc has introduced mobile group communications services, some of which are building successful ongoing user communities. Upoc allows users to join groups which function essentially like mobile messaging listservs. Users can join public groups, some of which are sponsored, and form private groups for sets of friends or colleagues. In practice, these groups are similar to communities of interest that develop on the web, but support much more location-oriented activities, like arranging nightlife activities. A particularly popular one in Manhattan is for celebrity sightings. Upoc and BotFighters are two examples of how "content" for mobile platforms can flourish in the space between one-to-one communications and traditional mass media.

4.2 Dimension 2: Macro Issues of Usability

Normally, "usability" refers to things like clarity of visual interface, logical navigation, ease of input, the number of clicks or menus one must go through to achieve a desired end. But when looking at the wireless landscape we need to consider what we could call "macro" issues of usability that have dramatic effects on consumer adoption. These are things that frame the entire process of getting to, or deciding to use, any particular interactive service. And here, i-mode has some valuable lessons to teach us about designing a wireless business that puts the user's interest, rather than a defensive business model, first. This is an area where U.S. and European players have failed.

Consider how one accesses services on i-mode. There are two type of i-mode sites, official and unofficial. Official sites are selected a few at a time from among hundreds of applications submitted by third party players.

DoCoMo's priorities in selecting sites are to insure quality and a robust mix of services for their subscribers. Beyond the very early stages of setting up an initial collection of services to launch i-mode, DoCoMo has not attempted to own or develop its own content offerings, or to take an interest in any particular official site at the expense of another. Menu placement on i-mode is like a constantly updated Top-40 list, with the most popular sites floating to the top. DoCoMo opens its billing system to official sites, so that subscriptions and services show up together on the customer's mobile phone bill. However, DoCoMo makes 70% of their revenues on the data traffic generated by i-mode (Lemon, 2001), and takes only a 9% cut of revenues billed through their system. Unofficial sites, which can be created by anybody, are easy to access and bookmark with methods that let the user avoid typing in long URLs on a numeric keypad (as one typically must do with non-featured WAP sites). Unofficial sites do not share DoCoMo's unified billing system, but there are popular, easy-to-use third party billing systems available for many popular unofficial sites.

U.S. and European operators have taken the opposite tack, and consumers have stayed away in droves. By and large they have each created their own walled gardens, with very high walls. Menu placement is on the basis of payment or strategic partnership, not user interest. Unified billing for online content and services has not been successfully implemented, leaving consumers with the need to establish individual billing relationships with vendors and service providers, or to use third party Internet payment systems that are still struggling to achieve mass adoption. U.S. and European operators also seek to extract much larger percentages of revenues from their content and service providers. The key lesson of i-mode that should migrate westward is that to build traffic, the user's interests must be put first (Funk, 2004). (It should be clear as well that 9% of a lot is worth more than 40% of nothing.) An analogy can be made to the different approaches in the U.S. and Europe to mobile competition. One can argue that to maximize consumer interest it is better to standardize platforms, and compete on services.

Another macro-usability issue is how the usability factors on the micro-level can create larger implications for wireless content and services. We have touched on some of this already: Consumers like video, but they seem to like it best on their TV sets. To consumers, the value of broadband connections is not that they deliver rich media; rather, broadband is valuable because the consumers time and attention are not wasted in the process of first connecting and then using the web to do the same things dial-up web users do (namely access text and static graphics). Also, the young will adapt to new interfaces more easily than older folks. All of these things give us parameters for creating appropriate new content.

But also look at the experience of financial services firms, many of who rushed into the wireless space. What some have discovered is that although simple wireless information services (like custom stock alerts) are popular, customers do not want to trade wirelessly. They prefer to do that on a PC with its more robust tools to analyze information and control transactions. The lesson is that unified services that span platforms, and accurately capture the strengths of each platform, are positioned to create total user experiences that consumers will find valuable. And since it may be years before revenue models arise to support pure wireless plays, this offers another advantage to firms that can interface with their consumers across multiple channels.

5 Wireless Application Concepts

Knowing the broad guidelines and parameters for wireless applications, it is nevertheless challenging to envision the kinds of things people will find useful, let alone to predict "killer apps." Initial predictions of future usefulness for the printing press, telegraph, phonograph, telephone, television, computer, and Internet often proved wrong. So in the spirit of playful speculation, here are some concepts for the future of wireless that at least try to incorporate some of the principles we have discussed. They are certainly not meant to be predictions, simply illustrations. Nor are they original ideas, but rather pulled or pieced together from prototypes, test deployments, design demos, ideas for linking existing products and services, discussions with colleagues, and so on.

5.1 Concept 1: Wireless Digital Photography

The largest amount of personal data in a typical American family's home is often its photo collection.[5] Not surprisingly, of all the various digital gadgets available on the market these days, the heavyweight champion of consumer adoption is the digital camera. On the PC front, Apple's consumer oriented iPhoto provides consumer-friendly home digital image archive management. And Sony and Ericsson have teamed up to build wireless devices, including an MMS-enabled mobile phone with detachable digital camera. This builds on what are already a host of camera attachments for PDA platforms, also equipped with wireless connectivity. Wireless digital photography is already here, and the opportunity exists to put all these pieces together into services for seamless multi-platform digital photo management.

5.2 Concept 2: Voice = Value

A mobile phone and a digital voice recorder already share a lot of the same components, and they could be merged into a single device without negatively impacting device size and power consumption. A number of voice recording add-ons are already available for PDAs. The most advanced digital voice recorders have very robust PC connection features that allow for voice file data-basing and automated transcription. Mobile phones could wirelessly link up to similar services from anywhere. Taking advantage of server-side processing, a host of advanced management, transmission, transcription, and translation services are possible. The inclusion of significant memory for audio storage in the device could allow an attractive business in voice-quality audio subscriptions (which would require much less data than music-quality audio files). "Personalized radio shows," audio books, language instruction, and a host of other voice content could easily be available for faster-than-real-time download, seamlessly billed through the mobile operator.

5.3 Concept 3: Picture-to-Text, with Translation

The ability of a wireless device, limited in its onboard processing power, to take advantage of server side processing leads to other interesting possibilities as well. A project out of IBM's Almaden Research Center[6] demonstrates how digital photography, wireless transmission, optical character recognition, and automated translation can work together as a seamless application. A traveler sees a puzzling sign in a foreign language and snaps a picture with their mobile device. The picture is transmitted wirelessly to a service that automatically analyzes the photo for text, runs optical character recognition, translates it into her native tongue, and sends the text back to the device. She is able to look at the screen and see the translated text superimposed over the image. For travelers this could be a common, high-volume tool, if priced appropriately.

5.4 Concept 4: Rich Locations

Because of data-rate and reliability issues that give it a lower quality of service than wired broadband options, 3G is not really capable of delivering high-quality rich media. WiFi is capable of it, given its 10-Base-T Ethernet-level speed, but has a more restricted range. This makes it well-suited as a method of delivering rich media and data services related to a particular location. In a pilot project, visitors to Disney World can get specialized Compaq iPaqs that

know their location and provide simultaneous audio translations of characters' live performances around the Magic Kingdom—in French, German, Japanese, Portuguese and Spanish—as well as information for rides and shows.[7] A text version is available for the hearing impaired. The possibilities for enhancing museums, monuments and historic locations are considerable.

5.5 Concept 5: The "Lovegety" meets Online Dating

The "Lovegety" is a small wireless gadget from Japan that fits on a key chain and is named for its ability to help its owner "get love." The original and its imitators never caught on in the U.S., but are widely available in Asia. In Hypernet terms, it offers a proximity-based service that alerts two suitable singles when they pass within a certain distance of each other, say at a bar or nightclub. An owner inputs a simple personal profile as well as the desired criteria of the other party, and when it encounters another Lovegety broadcasting the right stuff, the devices talk to each other, and then beep or vibrate to alert their owners that they should do the same.

The profiles stored in these devices are rudimentary. But the opt-in proximity alert concept, melded with the more sophisticated profiling and matching capability of today's advanced (and popular) online dating sites, could prove interesting to singles if implemented in mobile phones.

5.6 Concept 6: Persistent Wireless Gaming

As we discussed with Sweden's BotFighters, this one has been done. But it hasn't been done on a very large scale, with sponsored awards, in conjunction with major youth events like music festivals, or in very high-density urban environments like New York or Tokyo. There are a number of ways to take the persistent wireless gaming concept further than BotFighters. Persistent gaming attracts very large, fanatically dedicated players. It also generates a lot of money. According to some reports the virtual world of the largest persistent game, EverQuest, actually generates a per capita GDP of $2,226—not bad for an imaginary place.[8] As with Electronic Arts' Majestic, which failed gloriously due to problems in the games design, persistent games can be accessed via different channels, for instance tying web, e-mail, landline phone, fax, and mobile devices together as a seamless experience, and offering opportunities for cross-channel partnerships and sponsorships.

6 Final Thoughts on Design Strategies

The future "content" of wireless devices will be unlike traditional media content, rather it will consist of applications that take advantage of mobile devices' unique properties. Mobile applications will be able to leverage two different dimensions of usefulness: the ability to extend access to the kinds of services available via the Internet (extension of cyberspace; "Anytime, Anywhere"), and the ability to harness the power of networked intelligence to assist with life out and about in the real world (Hypernet; "Here, Now"). Successful future services are likely to reflect several key aspects.

- *A focus on user-centered design:* Firms must find ways to make money, but users will not be shoehorned into business plans. Success will be more likely when the user's needs are put first, and design is based on a detailed understanding of user contexts. Important factors include the shortness of "the mobile attention span," and the ability to build complexity of interaction over time rather than with complicated interfaces.
- *Communications, community, and information functions:* Content is not king on mobile devices, if we understand "content" to mean professionally prepared media for consumption by an "audience." One-to-one communications are likely to dominate traffic and revenue, and information services (rather than entertainment, although perhaps *about* entertainment) may be popular as well. There are opportunities in the space between these things, where one-to-some (or group) applications can expand their online popularity into the wireless space.
- *From "location-based services" to the "Hypernet:"* Taken together, the ability to pinpoint user location and the ability to "tag" the physical world allow a range of new services that can augment users' abilities in the world at large. A common metaphor is the mobile device as a "remote control for life."
- *Understanding evolving wireless culture:* Interesting cultures and social practices are evolving around wireless devices, just as they have evolved (and continue to evolve) around the Internet. Understanding this evolution is valuable for designing new applications.
- *Meta-narrative and gaming as foci of wireless entertainment:* While entertainment will not be the primary use of mobile devices, it may have a role. Traditional content providers can explore the development of "meta-narrative" applications, much like websites that provide extra character information and story details for an ongoing dramatic series. The paradigm is the extraordinary meta-narrative activity around *Star Trek.* Gaming also shows strong promise, including Hypernet concepts and persistent gaming.

It is likely to be a slow build toward a future of wireless content in which technological capabilities and consumer needs find a good marriage. A number of hurdles must be overcome, but perhaps above all else the telecommunications industry (carriers and equipment vendors alike) needs to figure out how to promote innovation. Arguably, like the music industry in the case of online distribution, it is stifling it, due to rival standards. The creation of effective standards would allow seamless delivery of third-party services across carriers and would likely spur innovation and consumer adoption. Until then, things will move more slowly in the U.S. than in key European and Asian markets.

Endnotes

1 Analysts Digital 4Sight have an excellent series of reports entitled the "Hypernet Revolution," which cover a range of key issues in advanced mobile services.
2 See: http://www.garmin.com/products/rino/.
3 For an excellent discussion of mobile games, including *BotFighters,* see: Lauf, R. & Cosgrave, D. (2001). Mobile Games: Play on the Go. *Digital 4Sight.*
4 *For a good description of Majestic, see:* http://www.wired.com/news/business/0,1367,43944,00.html.
5 See Lyman, P. & Varian, V., How much information, http://www.sims.berkeley.edu/research/projects/how-much-info/index.html.
6 See: http://www.technologyreview.com/articles/prototype41201.asp.
7 See: http://news.com.com/2100-1033-802775.html.
8 See: http://www.newscientist.com/news/news.jsp?id=ns99991847.

References

Anonymous. (2002). More Power to the Thumb. *The Economist Technology Quarterly,* June 22, p. 11.

Funk, J. (2004). *Mobile disruption. The technologies and applications driving the mobile Internet.* New York: John Wiley & Sons.

Jupiter MMXI. (2002). European Mobile Internet: European Market to Take Off in 2003.

Katz, J. E., & Aspden, P. (1997). A Nation of strangers? *Communications of the ACM, 40*(12), 81-86.

Klym, N. (2001). The Hypernet-Enabled Customer: Designing Wireless Transactions. *Digital 4Sight.*

Odlyzko, A. M. (2001). Content is Not King. *First Monday, 6*(2).

Rappoport, P. N., Kridel, D. J., & Taylor, L. D. (2002). The Demand for Broadband: Access, Content and the Value of Time. http://www.sess.smu.edu.sg/newsletter/pdf/Rappoport_1.pdf.