

Trafficking: Design for the Viral Exchange of Digital Content on Mobile Phones

Richard Harper*, Tim Regan*, Mark Rouncefield**, Simon Rubens[^], Kharsim Al Mosawi^{^^}

*Microsoft Research, Cambridge, CB3 0FB, r.harper/tregan@microsoft.com

** Dept of Computer Science, Lancaster University, UK, m.rouncefield.com

[^]New Experience Ltd, London, simon.rubens@new-experience.com

^{^^}Dept of Computer Science, University of Bath, Kam26@bath.ac.uk

ABSTRACT

In this paper, we report the user research background to, the design of and eventual fate of an integrated solution to the downloading and sharing, via Bluetooth, of broadcast TV content on mobile phones. In particular, we report, first of all, the discovery of emerging social practices involving the exchange of multimedia content on mobiles that we label 'trafficking'. Second, the iteration of a design solution to extend these practices to include the trafficking of broadcast TV content 'segments'. Third, the implications this had for basic assumptions in the interaction design afforded by the two primary OS's in the mobile handset domain. And then, fourth, the legal and business inhibitors-enablers that affected not only this research but which are likely to affect all attempts to stretch the capacity of mobile devices and mobile interaction design to afford new ways of 'trafficking' multimedia content, especially content subject to digital rights management

Author Keywords

Mobile devices, mobile TV, trafficking, content genre, social experiences, sociology, EPGs.

ACM Classification Keywords

H5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

INTRODUCTION

There has been a great deal of research exploring ways of enabling, sustaining and invigorating social connections between mobile users. This has been a concern for the major businesses (such as Nokia, Vodafone, Intel) as well as for academic researchers, such as ourselves. This research has led to the devising of new ways to 'sniff', 'touch' and 'sense' others, to use the companies' own

anachronistic terms [e.g. 7]. It has also shown the depth and power of the bonds that even the most ephemeral mobile messages can make: hence other curious linguistic formulations, perhaps most egregiously to the English language, 'text gifting' [14]. Curious words aside, the bulk of this research has been based on the production and exchange of materials that have been designed for person-to-person communication. More recently, though, it has begun to be discovered, by ourselves and others, that a different kind of material designed for individual consumption, namely broadcast television content, is beginning to get used as the material for person-to-person exchange.

In this paper we report on how we came to this discovery, consider the implications the behaviours in question have for mobile handset interaction design, and report our own (ongoing) efforts to satisfy those implications with novel user experiences. As we shall see, the implications that broadcast content file exchange have for some fairly basic assumptions underscoring the design of mobile devices are significant. Some assumptions lead to user experiences that are not only practical but also reflect the sought-for experiences; another set of assumptions produce experiences which are almost impossible to render into anything like the sought-for ones. This difference is manifest in the distinct user experiences afforded by CE and Symbian devices, respectively.

We shall present our research in the following form. First, we report, or rather summarise, our reading of the literature on mobile TV and note two things. One, this literature seems preoccupied, somewhat dully, with trials and laboratory studies of different screen resolutions and compression algorithms. It notes that users would prefer better screens with better images. Second, much more interestingly, this literature also reports that the trials (if not the lab studies) indicate that the primary value of TV content to the phone would *not* appear to be to watch TV, as if mobile TV was a substitute for more traditional TV watching practices (ones in the home, for example). Rather, users seem to delight in using broadcast content on mobiles to augment their real experiences, whether those experiences relate to the watching of (typically in the trials!) ice hockey games in Helsinki or showing a TV clip

to a friend at the event or soon thereafter. In short, the literature seems to suggest that TV-in-the-hand (for want of a phrase) supports the other things that the body is doing, (apart from holding a TV in the hand), whether it be watching something for real or talking to a friend nearby. TV-in-the-hand supports not consumption of multimedia content by the individual, then, but the social use of that material by the same individual as part of a larger 'social event'. The substitution of the traditional TV is not an issue we shall explain; it is the altering and augmenting of social connectivity.

We will then report a series of in-depth interviews with users of mobile multimedia and TV content services currently available to the public (i.e., not as subject to a trial). Here we sought to explore any evidence linking their behaviours with those suggested in the mobile TV studies. In examining what these users downloaded and watched, in determining how they managed their file hierarchies and device memories, we discovered that users in the wild are currently adapting their practices so as to make the use of multimedia downloads a common feature. Moreover, we found that the kind of practices that are emerging entail not just the augmenting of experiences, as was suggested by the mobile TV literature, but the routine exchange of multimedia files via Bluetooth. These exchange practices have various social codes associated with them, such as the need for the receiving of a file to be reciprocated by the giving of one, meaning that there is what one might think of as an economy involved, albeit without money. We will call this system of exchange *trafficking*.

We will then report the design of a new system that extended this economy by providing opportunities for downloading and sharing - or trafficking in our preferred nomenclature - multimedia files. We report a collaboration with a broadcast TV content provider that sought to produce an integrated 'seamless solution' whereby individuals watching TV in real time (say in the home setting), could download to their mobile phones, short (2 minute) segments of the TV show in question almost immediately after watching that segment (i.e. within seconds of it being broadcast). This entailed devising a network procedure whereby such downloads could be done effectively, the design of an interaction experience (akin to using an EPG on a mobile) that enabled the user to select the content, and a means of providing the content over GPRS connections.

All of this led to the discovery of two main problems. First, that the interaction experience afforded by CE devices resulted in the downloading and exchanging of files being almost impossible for the user to achieve in a fashion that reflected their own concepts of giving and receiving 'traffickable' files. Second, we will note that content providers are split with regard to whether to view trafficking as an opportunity or a threat. Many marketers view the trafficking practices we identified and sought to support as branding opportunities; lawyers, in content

providing organizations, view trafficking as wholly irresponsible. We conclude with remarks on the future of research in this area as a consequence of this organizational schizophrenia.

THE LITERATURE

We commenced our research with on-line inquiries seeking papers on mobile TV, mobile phone multimedia and related search terms. In general, the bulk of articles specifically on TV and-or video and mobile phones turned out to be mainly newspaper 'think pieces' focusing on particular technical and commercial aspects (such as network coverage, platform variability and so on) and were all concerned with identifying the next 'killer app'. Even more scholarly papers treated the problem similarly and tended to come to similar conclusions. Given this and, given also space, we can familiarize ourselves with this literature by mentioning the findings of a handful of papers that cover the scope of topics, concerns and methods [2,11,12,13]. [For a more thorough review see [5]].

There are a great deal of papers that report on what one might call the obvious topic when it comes to mobile TV: namely, how good does a screen need to be to succeed, and relatedly, how good does the compression algorithm need to be given the variable and limited bandwidth of the networks? One particular - and amusing - concern is that some algorithms systematically remove 'small objects' on the grounds that they are noise. This is rather irksome when mobile users are trying to watch football (or ice hockey,) on their mobile phones. The gist of this general 'speeds and feeds' research is that there is a need to be better on all fronts. What it also reports, somewhat curiously, is that users are remarkably tolerant, whatever the screen resolution, and will even watch football when they can't see the ball: all they really desire, apparently, is to claim to have 'seen the goal' [10].

Other studies report on trials in the field, rather than in the lab. Ojala et al's [11] study is perhaps worth mentioning since it is typical of reports of trials attempting to provide 'real experiences'. It reflects too, certain cultural assumptions about what trials might be of interest. In this case they sought to provide rich multimedia content to mobile phone users for sports, and given their continent, this meant before and during an ice hockey game. Ojala et al had assumed this might be an appealing place to conduct a trial, and confirmed their feelings with an online survey at a Helsinki hockey club's website. This provided them with a number of ideas concerning how a multimedia service might be used for their trial:

Question 1: What would you like to do with the device during the match – "Look at the goals again of course. During the intermissions I could check the statistics."

Question 2: What would you like to save from the match to the device and take with you when you leave the arena? - "Goals, screw ups and fights..."

The resulting challenge was in part technical and in part social: technical insofar as downloading rich multimedia content imposed high data rate requirements that could not (at that time) be satisfied by the mobile phone networks; social insofar as users needed to be able to satisfy some of the above desires: to see repeats of the goals and so forth.

The result was Ojala et al devised a system whereby static content was made available with a commercial Bluetooth based WPAN service called iJack. The static content contained hyperlinks to dynamic content produced in real-time during the use of the service, which could be downloaded over a commercial mobile phone network. The main service was provided as a set of XHTML pages through which an online match report was made available containing a hyperlink to a web page with dynamic content created during the match. For mobile phone users the service – the XHTML pages, the video files - was provided through five iJack points situated around the hockey arena and they accessed the online component of the service using GPRS connection. Video clips of the match were produced with an in-house video capture server which buffered the incoming video feed and produced two versions of each clip – for mobile phones and PDAs. For mobile phones the data rate of 20 kbps was employed so that the resulting clip would fit into two GPRS time slots when streamed into the phone. The video files (50-70 kB) were automatically uploaded to a streaming server, where they were manually inserted into the online match report with a text description.

Unfortunately, though the subjects in the trial were very positive about its goals and purposes, the actual experienced offered left much to be desired. One obvious concern was that the puck could not be seen on the mobile devices (though as with those football fans interviewed in the screen resolution studies, this did not seem to matter so much); another was that the users were not pleased with the content or its production. Ojala and his team produced the content themselves and this was not as good as was the norm for broadcast TV, trialists complained.

In another paper, this time clearly representing technical concerns, Gerstel [4] argues that the problem of providing the right fit of technology to user need can be grasped by taking the case of live video streaming to mobile phones as indicative of the distance between the patterns and assumptions of the fixed (broadcast) user and the mobile (narrowcast) user. He explains that the delivery parameters for live video require that a connection with a streaming server must exist during the entire session, but that in the case of mobile users the average session time is generally shorter than this, increasing the risk of a “dropped stream”. This is in part due to user preferences (taking snippets rather than whole sessions) and partly technical as users can and do enter areas of less coverage when 'mobile'. To provide a satisfactory user experience, there is a need, he explains rather obviously, to match or exceed the data rate of the video clip so others' consumption of the mobile

bandwidth (such as those making audio calls) does not have a direct and adverse impact on mobile video user experience. He goes on to claim that content providers need guidance from mobile operators on the real-world bandwidth conditions in the operator's network. One operator's network may support data-transfer rates up to 128 Kbps in optimal conditions, but real-world conditions may dictate encode rates at 56 Kbps or less to prevent buffering of the content while it plays back on the phone. (And mobile operators, faced with bandwidth contention at a cell site, may favour voice traffic). Gerstel also suggests that update frequency may also become a problem especially for TV news content - one likely use of mobile phone TV - since users have come to expect that whatever they are receiving is the latest and best information available to them.

Even within just these papers on the technology of mobile TV it becomes clear, if somewhat unsurprising then, that bandwidth is an expensive, limited, and variable resource in wireless connections. This is a common finding. Most of the papers propose the following kinds of solutions to these concerns: better compression algorithms; networks with more capacity; more flexible network management; and so forth. But it is clear also that there is a certain kind of assumption or set of assumptions about the patterns or nature of mobile TV consumption as well. Mobile users want TV content only for short periods, for example; but when they do it should be as good as broadcast quality; there should not be a perceived sacrifice of communication needs (to talk, say) with the ability to watch; and so on. In terms of the assumptions of the technology providers, such as the mobile network operators, they prefer to triage traffic according to monetary value and this often makes multimedia a low priority on the same network; and so forth.

Some papers primarily focus on the user experience with a view not simply to affirm these concerns about bandwidth, quality and so on, but with an interest in ‘discovering’ what mobile TV might be for (if not for ice-hockey). In our review of these - and again there were several dozen - we began to note that some were beginning to point toward what appeared to be the special or unique or distinct social features of ‘mobile TV’ that did not quite fit these assumptions about user behaviours - though not quite contradicting them either.

An exemplar of this is Repo et al's [12] ‘field’ study looking at situations where watching a video or moving image (including clips from TV shows) on a mobile phone was ‘meaningful’. The situations they were interested in referred to a setting's physical and social contexts – i.e. not merely with the physical layout or characteristics of the setting but with the kind of ‘meaning’ attached to it that effectively turned it from a ‘space’ in to a ‘place’ [6]. In particular, Repo and his colleagues gave mobile phones with video capacity to users who watched videos (pre-selected by the researchers) in different situations which

they then evaluated for 'meaningfulness'. Users were 'asked to give genuine user experiences and critical feedback concerning the device and its services' and to add comments from family members and others. Participants were also asked to watch video in specific pre-given situations – at the coffee table, on public transport, while teaching the use of the videophone. They were asked to kept diaries of their, and others', responses to these experiences.

The study identified two different kinds of situations in which use of videos on mobiles seemed 'natural'. The first would appear obvious: for users to entertain themselves in boring situations such as a bus trip, or in queues. The second, however, certainly when we read of it, seemed more interesting and pregnant with possibilities. Repo et al reported that mobile video was very popular when users wanted to have fun with others; that is when they wanted to share an experience that could entail using TV-in-the-hand. Examples included watching, together, images of someone singing in a karaoke or similarly laughing with kids as they at a well known cartoon story. This brought to mind the Ojala et al study, of course, and the apparent delight that people would have if they were able to watch an event for real and then watch it again, whilst still at the event, on a mobile.

It seems to us that Repo's study, albeit an early one (2003), exemplifies what this user focused strand of the literature tentatively points towards as a whole: that the particular experience that mobile TV appears to afford is not quite like what traditional TV consumption affords. Certainly, TV watching on the mobile - or if you prefer TV *usage* on the mobile - is often about filling up boring times and places, but it also appears to be essentially 'social' since it entails some kind of enactment in front of the phone rather than something participated in through the phone. In short, a look at the literature would seem to attest to a theme emerging: a theme to do with how mobile TV watching might offer opportunities not so much to watch, but to watch something that causes others, nearby, to *react*.

A STUDY OF CURRENT PRACTICE

If the literature is replete with studies offering artificially created user experiences, requiring people to watch mobile phone TV, providing them with predetermined content and offering them incentives to consume, then the hubris of such inquiries is that they cannot necessarily capture some of the behaviours that only time, routine and habit produce. Nor, yet, can they map what might be the ways in which those routines shape and drive patterns of usage; this is all beyond the scope of the inquiries reported above. This is not to say that these studies were undertaken without sensitivity to these limits (nor to say that within the corpus of literature there are not studies which look at 'natural' usage) but it is to say that it becomes hard to stretch the utility of trial-based research towards claims about practices that are in their essentials routine, habitual, to do with the

everyday techniques used to slake boredom and combat idleness. Repo et al's study sought for the everyday but was essentially flawed as regards its ability to capture some things. Boredom, for instance, is not something that can be produced in trials; idleness cannot be understood through its imitation. These human frailties are beyond the scope of the scientific methods that use artifice (though obviously these same methods are good for capturing other things). The technique that does gain some insight into the practices related to these concerns entails the analysis of behaviour 'in the wild', of individuals making best use of the technologies they have to hand. Such studies are often ethnographic in nature, though not always, but certainly entail qualitative techniques of data acquisition and analysis [though mobiles generate their own methodological problems. See 4].

As it happens we were able to undertake such studies once we had completed our literature review. The rapid pace of development in mobile network provision and terminal function has meant that mobile technologies now support a degree of multimedia content consumption that was not possible at the time Repo et al were writing. All the UK networks for example offered downloadable content for viewing by the summer of 2006. Accordingly, we undertook a program of interviews to find out what these users of multimedia content were doing, why they were doing it and how they fitted these patterns of behaviour into their larger and perhaps historically more fixed patterns. We particularly wanted to see if we could map from these to what we found in the literature search. We hoped that some combination of insights might be possible: something from the lab studies and trials, something from the natural vitality of behaviour in-the-wild.

Subjects were selected by approaching staff in mobile phone shops for individuals that the staff knew were heavy users; sometimes they volunteered themselves and sometimes identified others. By heavy users we simply meant individuals who regularly downloaded, viewed or shared multimedia content on their phones. We then used a networking technique, whereby one heavy user identified another for us, until we had 12 hours of video tape analysis of 6 individuals, some of whom were interviewed as couples; and 5 half-hour interviews of individuals. These individuals used a mix of devices, with Motorola's Razor being used by three, though the most common were Nokia devices. None used CE devices (the significance of which we did not realise until later). This was not a large 'sample' of course, and can hardly be said to provide the richness of longer term ethnographic research but it did provide us with enough distinct evidence to move forward.

We found that, in broad outline, there was a distinction between what users did by themselves, and what motivated them to use content when they were with others. When alone, again in broad terms, interviewees explained that they use content to 'kill time' and especially in anodyne places (trains, cars, waiting rooms). In this they were like

Repo's subjects. The interviews also explained that occasionally they sought content on a need-to-know basis, such as sports results and national news events. When together, with friends and partners, meanwhile, our subjects reported that they used multimedia content to impress those they were with. They would show files (even though screen size was small); they would exchange 'good ones'. Above all, they used mobile content to enjoy themselves socially, to play with friends, if you like, in an apparently new way. It seemed to us that much of the behaviour in question had gift-giving like characteristics [9, 15]. Many of the subjects reported how they would download files so as to give them to friends and partners. 'Stuff they would like' included such things as downloaded Herbie trailers which were later given to a sister's boyfriend since 'he's a real Herbie fan'. Several others also reported that they would download a pop video so as to share it the next time they saw their friends.

What was especially noticeable about this sharing was that it was done when people were together, via Bluetoothing. A second striking feature was the volume of it. Some individuals explained that they would exchange over a dozen files a day. Those who did it less offered accounts for their parsimony, saying that they were alone most of the time they were at work, for example, or that their friends had been on holiday recently and so their chance to trade had been reduced. Thus, and unlike the text-giving patterns reported in the literature, this kind of giving seemed more like an economy – a very big one. Several individuals reported how they would invest to participate: buying downloadable content so as to give that in return for other content: pop videos and purchased wallpapers and ring tones were particular important here.

As subjects discussed this giving and receiving, the features of this behaviour became clearer. Sometimes it was a kind of philanthropic exercise, giving to honour someone else. Sometimes, indeed, more often, it was economic, but it was not a cash economy. This was more like something in which the absence of monetary exchange appeared to hide the fact that 'value' (that could be measured, monetised if you like) was indeed being given and received. As we pried deeper, we found that the content suitable for this did not necessarily need to have a financial cost, it simply needed to have a value in the trade. For example, unusual ring tones freely downloaded could be traded as well as those which cost money. The key was that the files, whatever they were, had some worth. Value here meant not money but local interest: what 'my friends would like', as one put it.

Eventually, this led us to think of the trade as *trafficking*. In our view, it was trafficking in the sense that something illicit was going on, illicit because it deliberately avoided the invoking of monetary measures yet consisted of a system whereby the offering files with some value was done in return for other files of value. Value was implicit, though fundamental. Access to this system was provided by

having enough files of value to make trafficking worthwhile.

Several people interviewed queried whether such behaviours were allowed or would continue into the future since they recognised themselves that the behaviour had an illicit quality to them. They recognised that pop videos cost something, for example, and recognised that the exchange of these files for free (via Bluetooth) seemed to run counter to the idea of financial value in the first place. Several individuals even asked us whether this behaviour would be made illegal and technologically impossible in the future.

Whatever its legality or the metaphor used to describe it, our interviews indicated that this behaviour was one of the main drivers of mobile multimedia usage. In particular, this led us to think that the future would indeed entail multimedia - mobile TV being one source of that content - but that content would not be only for individual's slaking boredom; it would, more significantly, be for social consumption. Thus a network would be entailed, of course, but the most important network in this vision of the future was not technological, it was social.

DESIGN OF A SYSTEM

This excited us. It made us think that these practices, combined with the increasing capacity of mobile networks and devices, might be pointing towards a future that was beginning to be grasped by those undertaking mobile TV technology trials and tests. The trials research reported in the literature had, it seemed to us, pointed towards how the watching of TV-in-the-hand was not to be understood in terms of screen quality and compression rates but in terms of how that content made others react. Thus, our interviews, combined with this reading, encouraged us to think that the discernable future was one where TV-in-the-hand wouldn't be about substituting what one might call traditional TV watching by merely taking TV content in to new places; it was one where some elements of TV content played itself out, so to speak, in new practices. As we say, these we imagined would be essentially social.

So, it was with this mind that we presented our findings to a content provider and, with them, outlined a concept for a service or experience that would build upon and hopefully deepen the social practices in question.

In particular we devised a system called "Grab and Share". Here the idea was that a user would be watching TV in their living room say, (or public TV watching domains such as a sports pub) and being delighted in some scene or 'segment' of a show (such as a goal or a good joke) would then pick up their mobile (which we thought would be at hand), open up a kind of EPG in the device, select that segment, and download it. This would then be the multimedia file, the stuff if you like that they could replay to themselves, or to show others later on down the pub, at work, or wherever. Ultimately, too, and this was the main hope, we imagined that this stuff would be traded with their friends in the

trafficking trade. A Flash video was made to convey this concept. (It is attached with this paper, with the content provider altered for anonymity).

These ideas seemed sufficiently compelling that we and the content provider decided to build the 'system' that could enable it. The resulting architecture had two aspects, one obviously related to content - the what, how much and so forth - and the other to technological matters.

With regard to the technology, the eventual system functioned as follows (see Figure 1). Clips were generated using Windows Media Encoder running on a PC with an Osprey Capture card. The card was fed by a consumer level Set-Top Box. Though better quality feeds would have resulted from using a production quality Integrated Receiver Decoder, we deemed this unnecessary due to the format of the required resulting files (i.e. the necessarily limited capabilities of mobile devices do not require high quality video feeds.) The content was encoded at a constant bit-rate for a QVGA screen (i.e. 320 x 240 pixels) to suit SmartPhones. The resulting bit rate was about 260kb/s with 64kb/s of that made up of audio, though it is worth noting that the files were intended for download and not for streaming. A two minute clip takes less than 4MB of storage space. The thumbnail images used to represent the clips in the UI were derived from the clips using a Video Thumbnail algorithm. Finally, the encoded clip and any thumbnail was uploaded to a web server and to a broadcast carousel. The carousel played out simultaneously across the broadcast networks DAB-IP and DVB-H. Storage was managed so that the clips did not exhaust their allotted space by removing older content as directory size constraints were approached. We did allow clips to be marked for retention if required.

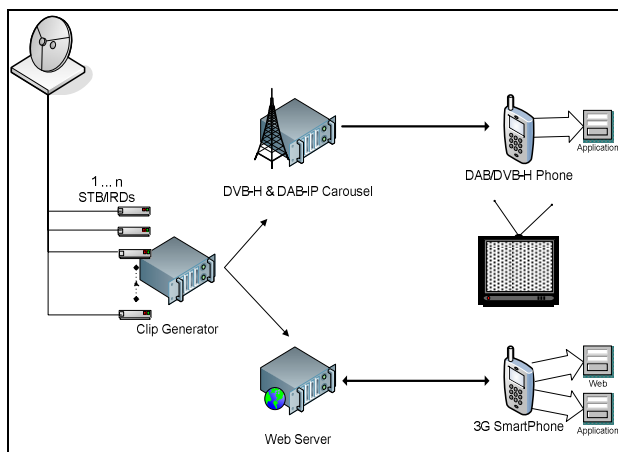


Figure 1. The architecture for "Grab and Share".

On the mobile device, the application comprised an Online Media Guide (OMG) from which clips could be downloaded and a Mobile Clip Manager (MCM) that enabled the organization and sharing of clips on Smartphone's. The OMG was designed to be device

agnostic supporting a scalable rendering interface that could accommodate access by older mobile devices with low resolution displays of 100 x 100 pixels, current QVGA 320 x 240 pixel displays and the expected 1080i HDTV displays with resolutions of 1920 x 1080. Interface scaling was achieved using a combination of smart downsizing and up-scaling of all user interface elements to increase accessibility across many devices.

The MCM had in built technique for sharing clips among friends in close proximity (~10 meters) using Bluetooth's OBEX communication protocols to enable clip transfers to nearby Bluetooth enabled devices such as mobile phones or laptop's regardless of operating system or device manufacturer.

THE USER EXPERIENCE

A number of practical and user experience problems could be predicted from the outset, of course. Some of these were factored into the design from the start. The most obvious of these was the difficulty a user would have locating the 'right' segment. Given constraints on resources, and given also our primary goal, we decided that a simple design for the OMG would allow the user to navigate to five channels only. The user would only be able to download one file from each channel with the MCM, the file in question being a short segment, constantly being replaced sequentially in a carousel-like procedure. One consequence of this design was that the users would not be able to go back or navigate to a prior segment, being only able to download the most recently broadcast.

With these and one or two other minor considerations dealt with, the eventual "Grab and Share" system worked fairly well, it seemed to us, the only apparent problem we could see once it was built being the variation in download speeds. This appeared to be primarily a function of traffic loads on GPRS connections. Indeed, these connections would sometimes fail. Nevertheless, the overall experience was the one we sought.

Before we trialed the application in the wild, though, we brought one of the subjects we had interviewed to get some initial feedback. This was not meant to be a laboratory test or to provide for a cognitive walkthrough or anything similarly grandiose. It was simply a step in an iterative process of polishing the design. Or so we thought. We were instead startled at this individual's aversion to what we had devised.

More specifically, he readily understood the concept of downloading segments from the TV, though he remained doubtful that it would be 'easy to find the right bit'. Nevertheless, the arrangement of on-the inline media guide, the OMG, he thought clear. He found the Mobile Clip Manager a little more confusing. In particular, he found the fact that when he deleted a clip, not only would that clip disappear, but the icon for that channel (rendered by the OMG) would be deleted too. We had designed it this way

since it seemed to us an economical way of navigating. We quickly amended this so that the channel icons remained when a clip itself was deleted. A more startling problem, however, emerged when he tried to exchange files, or traffic. Oddly, this was not because the system failed, but because he could not find out it had succeeded.

More particularly, the individual found downloading straight forward and could select a file to exchange. He had no problem discovering a nearby Bluetooth device either and could send to that device. However, he then went on to say, even before he had attempted to exchange a file, ‘Oh no, you can’t do that on a Microsoft phone’, which were using in the demo. ‘It doesn’t work’. He then showed us that this was true, in his view. He demonstrated (again) how he could find a discoverable Bluetooth device, choose a file and send it. He then drew our attention to how the receiving device would show an ‘accept file’ dialogue box as if a file transfer was happening. He then pointed out that once that dialogue box disappeared, the device went back to its idle state. ‘Nothing happens’ he exclaimed, ‘It doesn’t work!’ We were perplexed by this since we knew that the files had been transferred. So we asked him to explain what he thought was happening at each step. It was then that we discovered a distinction between what this user expected and was familiar with and a design principal in CE. SO basic was this distinction that we recognized that most users would take a similar view to this one individual.

In CE, when Bluetooth files are exchanged, the file manager assumes that all files will be placed, by default, in the ‘My Documents’ folder, under the Explorer file directory manager. Further, such files are listed, alphabetically, under their own name. However, when an exchange occurs, CE does not present the exchanged file to the user, instead defaulting to what one might call the desktop. Once the transaction has been completed, the user has to open up Explorer and click through to My Documents and hence to the file in question. Our user did not know this. It turned out that his ‘mental model’ was one derived from use of non-CE devices, especially Symbian ones. These afforded an exchange experience that was fundamentally different. In particular, when files were Bluetoothed with Symbian devices, the operating system treats the file like a message. It is indifferent to the message content type. Thus an SMS and a Bluetoothed multimedia file are both presented to the user in same way once the transfer has occurred: namely in the ‘in-box’. The result of this assumption is that when a Bluetooth file transfer has completed, as ideally they would be with our Grab and Share application, the user would be presented with a dialogue box that prompts them to click through to the new message.

Recognising this difference proved something of an epiphany for us. It was only at this point that we realised the significance of the fact that none of those we had interviewed had used CE devices to Bluetooth. Their practices were such that the design of CE devices, though

perhaps ideal for other practices, did not fit what they wanted to do. We came to recognise that the difference between Symbian devices and the CE was not in terms of number of clicks or click-through menus. The difference was that, in one, the recipient of a file felt as if they had it in the hand; that something had been, as it were, given to them. With the other, it was as if something had been exchanged, but that the computer (in the device) had consumed it and made it invisible. One ‘made sense’; the other did not. When we say made sense, it made sense not just to our subjects, but to us too, when we tried the experience afforded by CE and Symbian devices respectively.

Figures 2 and 3 show the main elements of the two experiences in question (although, due to space restrictions we cannot present all the steps here). The images in Figure 2 show the states that the CE device went through, firstly showing the file in the process of being received and secondly once the file has been received. The image in Figure 3 shows the same states on a Symbian device. It is the end point of both experiences that is at issue: one indicates nothing about the presence of a new file (it being tidily placed in the My Documents folder); the other draws attention to it, presenting it in the In-box.

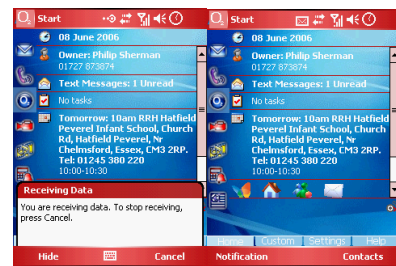


Figure 2. Screenshots of the CE device receiving and having received a file



Figure 3. Screenshots of the Symbian device receiving and having received a file

As we say, this discovery had jolted our thinking considerably. We had not expected this to be an issue. Being familiar with CE and more generally with the Windows file management system, we took for granted the sense of treating incoming files in the manner it did. It seemed quite alien to treat a multimedia file like a message, as if a Flash file was equivalent to an SMS. What we realized, however, was the sense of the user’s view as to

what they were doing when they exchanged 'stuff' on their mobiles. Their expectation that a Flash file would be treated like an SMS one was indeed a more accurate representation of *their* understanding of *their* doings.

The extent of this discontinuity between the users experience as-sought-for and the one-as-provided was so great that we presented our findings to the design team responsible for Windows CE. This team had considerably more resources for users studies than us, and besides had processes that ensured that user experiences were being constantly fed back to them. We wanted to see if they had uncovered something similar and, if so, what plans they might have for redesign in light of them.

We found, however, that the design team had not come across the problem in the user experience we had identified, though like us were sufficiently persuaded, with the screen shots we presented and the scenarios of trafficking that put them in context, that the experience was at best infelicitous, at worse, downright confusing. They concurred that a redesign was required. As it happens, they went onto explain, a complete redesign was underway and the trafficking scenario example would be further evidence used to justify that change as well as an indicator as to how the design should proceed.

Given this, we decided that it was not an optimal, given our resources, to redesign a user experience simply for the purposes of a trial. If a trial was to go ahead we would have to figure out a work-around. At the same time, the design team urged us to explore in more depth the scope or scale of trafficking, particularly in Europe, where the evidence that the design team had at hand suggested Bluetoothing was much more common than in North America. It could be that trafficking was primarily a European phenomena and not an American one.

DESIGNING THE CONTENT

If these were the findings and implications of our endeavours for the design of CE, our experience with the content side of the Grab and Share trial was altogether of another kind, though equally blunt in its consequences. Here indeed we came to an impasse that resulted in any proposed efforts to redesign CE to afford trafficking being of no avail, even had we wanted to undertake that task.

As should be clear, content was a major factor in the Grab and Share experience. The issues here were to do with quality of experience and hence can be thought of as creative. Our research had suggested that the traffickable content had to have some special value to fly. Not any old TV content would do. Something dull or in poor taste would indicate the dullness or perversity of the sender. Getting the right content was, then, important.

For the purposes of a trial, we proposed that one way of selecting content would be for producers of TV shows to mark up those segments (or scenes) that they thought viewers would like to Grab and Share. We recognised that

this would require work and a stretching of the creative imagination, since traffickable content may not be the same as trailers or simply scenes cut directly from programmes. It was possible that this content would have new features making it a new genre within broadcast TV.

This proposal was rejected. It was thought that asking producers to do this would overstretch them since their commitment was to delivering audiences for the broadcast experience, not to enable a research project (even if that did lead to new genre they would need to produce in the future). The alternative path we choose, and as we have already noted, was one whereby the user downloaded only the prior few minutes of content, broken arbitrarily into time units. It seemed to us that this might be enough for us to test the concept of Grab and Share as well as indicate something about the content that users wanted to access. This was hardly an ideal solution, of course, but seemed at least a practical way forward.

However, another issue, related to content, turned out to be more complex and this had to do with digital rights. Though in the UK at least some broadcast content is free to view, much of it isn't and nearly all of it is subject to replay rights. The trafficking we were seeking to support was then illicit just as the subjects we interviewed had feared. Nevertheless, marketing people working for the content provider, though at first doubtful, began to be enticed by the prospect of trafficking becoming a new form of viral marketing. As long as the brand was visible in each segment every time it was exchanged and played, the brand would gain value, in their view. Given, also, that the lengths of content were short, they thought there might be a way through the rights issue anyway.

The legal representatives of the content provider thought differently, however. Their view was that trafficking was indeed illicit, irrespective of its brevity or the values it provided. At the outset of the project, we had been gratified to hear that, for the purposes of a trial, and given that subjects in the trial would be subject to contracted confidentiality, the lawyers agreed the idea could be tested. Unfortunately, and before we were able to actually progress from building Grab and Share and test it in a trial with 'real users', the legal representatives changed their minds. The trial was not to go ahead.

CONCLUSION

All of this might seem to suggest that our project was a failure. Though Grab and Share was built, we only tested it in-house, and only then with one user. Even that was not meant to be a test, so much as an opportunity to elicit some guidance for polishing the system. And, further, even as we worked on this, and notwithstanding any difficulties we might have had in building Grab and Share, the content provider found itself unable to support the trial as originally planned. In short, the Grab and Share trial was not a trial at all, being more a trial of the human spirit of researchers: how much difficulty outside the scope of their creative

ideas could they thwart? How much bureaucracy, however legitimate, would be enough to terminate their hopes?

We do not view the experience as negative, however, For one thing, we went from the literature to a user inquiry and built an application; more than most papers report in CHI and elsewhere. More importantly, our collaboration with the content provider, the development of Grab and Share, the experience of all this has been very intellectually enlightening and, in our view, substantive. It has, as well, brought the fore new research findings and issues.

There are, we think, a number of main findings we want to share, the first of which is more of a general one, helping frame the latter ones. More particularly, much of the literature on mobile TV has concerned itself with technical thresholds that need to be transcended before a broadcast TV-at-home-like experience can be afforded with TV-in-the-hand devices. What we learn from this literature, broadly, is that these thresholds are being dealt with and often surpassed by technical research. We learn also, it seems to us, that the user aspects of this do not attest to the value of user-research for determining such thresholds. Indeed, quite the reverse: this literature attests to the curious fact that users can abide by experiences that would seem self-evidently below the thresholds in question. Users want to watch ice hockey goal replays on their mobile even though they know they will not see the puck; people will watch football games on mobile devices even though they know the experience is immeasurably worse than that afforded by broadcast networks and associated devices. The reason is not in what they can see with a mobile device, it seems to us; rather, it is the experience thus afforded that matters.

This is the first and overarching lesson one should take away from research to date on mobile TV. It's what the user is doing that matters, not simply what they are watching (which is often simply judged in terms of technical matters by researchers: clarity, speed, up-to-dateness, etc). Given this it seems to us that future research should focus less on 'speeds and feeds' and more on what experiences users are after and why. This will turn out to be, in our view, a rich vein of inquiry. It can take many forms, four of which we outline below

First of all, and though this seems straight forward, closer examination opens up the range of implications from it. Users do like to watch TV-in-the-hand so as to slake boredom. But it is not so much their boredom as the places they are in that are boring. TV-in-the-hand has value in places that are *anodyne*. It is the absence of what one might call 'meaning' in some places that gives value to mobile TV use in those places.

This seems an oddly modest claim: of course people will watch TV if they are somewhere where there is nothing to do. But we think that this assertion, the link in question, is more interesting than it appears. It seems to us that once a relationship between place and content is recognized, then

what one researches in the future, what might be the problematic link between place, device, experience and content, becomes much more dimensional than before.

For example, the French sociologist Auge [1] points out how, in supermodernity, there is a proliferation of what he calls transit places. The most obvious are airport lounges but he suggests that cars too are transit places, just as are car parks and waiting rooms in offices. All these places are similar not only because one goes through them, but because they have what he calls an 'absence'. This absence encourages people to create content that 'fills those places up'. This content is not likely to be merely ported from other places, he holds, but will, in the process of its creation, have new forms and patterns bestowed on it. Just what these new forms and patterns are Auge is unwilling to venture, but we would like to suggest that a creative exploration of what this might be could be a major agenda for TV-in-the hand research. The issue here will not be how 'good' is the technical provision of multimedia, but the relationship between that multimedia content and the locales in which it finds value. The issue is not to merely slake boredom, as if the physical world were all of a piece it being only human mood that varies, it is to use multimedia to enrapture people in particular places in which people have not felt engagement before, places that are not like home, the cinema, the sports bar.

Second, a further and obviously related suggestion has to do with the finding that people like to use TV-in-the-hand to deepen the already rich experiences they are having in particular places. If it is the case, as Auge holds, that some places in modern society are transit locales, then other places are ones that people go to because they are already endowed with special meaning. This is recognized by default in the literature: trials are done at sports events, for example. We believe that here, too, there appears to be a role for TV-in-the-hand. Mobile TV content can be used to enhance the watching of the events for those who are watching these events for real. In this way, TV-in-the-hand does not offer "snacking", to coin a phrase, it involves making sauce for an experience already engaged in. For research, the question is what this sauce might be, how it might be created, navigated through, monetized.

Third, if we have suggested that there might be an opportunity in suffusing the anodyne domain with mobile TV content, and, further, if we have just now suggested that some domains that already have rich meaning can have that richness made even greater, then we have also discovered that the space between people may be augmented by TV-in-the-hand. Our reading of the literature, our interviews and the goal of our Grab and Share concept was to enhance the essentially social nature of some TV-in-the-hand experiences. Thus, giving and sharing clips, watching over each other's shoulders particular short sequences, settling down, as a group, to informally 'watch' a longer sequence and distributing that sequence to those who want 'it' for themselves immediately thereafter; are all ways of being

social. Trafficking, it seems to us, is a new way of binding people together. What are the consequences of this bonding, how it might be addressed in new device design and more are all substantive research topics, we believe. Indeed, so promising is this, in our view, that we give it prominence in the title of the paper.

Fourth, trafficking is not necessarily an entirely benign affair: indeed the selection of the word to coin the behaviours in question reflects the fact that something less than entirely proper is going on. Yet what we have found, despite the impasse that we had had in our efforts to test Grab and Share, is that the value of trafficking may well offset an apparent diminution of digital rights revenues. Because a short clip is exchanged for free does not mean that the use of the clip ceases to affect behaviours in ways that might lead to future revenue. Advertisers recognise something similar. They know that broadcast adverts, for example, are watched for free; they know too that some of those advertisements provide some content that ought to be paid for: highlights of the plot, samples of the sound track and so forth. But these advertisers know also that these same advertisements entice those who watch to seek more. The viewer might see the advert for free now but pays in kind later on. It could be similar with trafficked content. The problem, though, is that it is not at all clear whether the content that flies in the trafficking trade is what the content providers want to provide. It could be a subset of advertisements produced for normal broadcast consumption, for instance, or new advertisement types designed for the mobile. We had hoped to identify whether trafficked content was a new genre, one suited for the showing practices we have described, the laughing, giggling, and knowing looks at previously seen images (goals, ice-hockey fights, etc). Our research failed to uncover these because we were not given the chance to find out. But it seems to us that the vigour with which those we interviewed trafficked, the probable increase in trafficking even as we write, will provide a resource for discovering what will come to be the balance between the illicitly downloaded, the self-created and the bought for. And it will indicate too what the mix of multimedia content ends up being. Trafficking can be thought as a way of creating an electronic programme guide, one that the users themselves construct and fill up the content for (making 'channels') as they so desire. Research needs undertaking into what this amalgam of content would consist in, how it might be navigated through, stored, exchanged. The inadequacies of CE as it is currently designed attest to an opportunity here; the simplicity with which Symbian devices apparently provide support is a distraction from the fact that, in the future, something more complex, richer will almost certainly be wanted by users. Much needs to be done whatever the operating system.

In sum, we think our Grab and Share efforts have not been to no avail: we have learnt, in our endeavours, that mobile TV is here, but what it does for people, how they use it to

suffuse meaning into the dull places of contemporary existence, how they use mobile TV to enrichen their lived experiences, and how they traffic content that multimedia mobile devices can handle so as to make social bonds, are all new topics for inquiry. TV-is-in-the-hand, but how we work with users to make that hand come to touch something new, is up for grabs. It is this insight, beyond anything else, which we wish to share. This is our grab and share.

ACKNOWLEDGMENTS

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Contribution and Benefits statement

Contributes to understanding the design and eventual fate of an integrated solution to downloading and sharing broadcast TV content on mobile phones; identifying some legal/business inhibitors-enablers impacting on their development.