CRITICAL ANALYSIS AND EVALUATION OF INTERACTIVE AND CUSTOMISED APPLICATIONS ON MOBILE TELEVISION

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Critical Analysis and Evaluation of Interactive and Customised Applications on Mobile Television

Interactive and Customised Mobile Television Applications are Evaluated Using the Views of Consumers, Advertisers, and Telecommunications Operators with Regard to Services and Also Assessing the Usability of Mobile Devices

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Abstract

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Keywords: Mobile Television, User-Generated Content, HCI, Infotainment, Product Placement, Personalised Advertising, Regulations, Non-Commercial Advertising, Human-Mobile Interaction

The shift of media from traditional forms to new digital ones has raised the possibility of new kinds of media services, including mobile television. In today's communications market, mobile phones are of increasing importance to users and, since mobile devices are connected most of the time, they have a high degree of location independence. The availability of 3G technology and the mobile devices needed to implement mobile television are now established and available. Mobile television is expected to be an important

new service that could penetrate the market place and provide new applications, as well as create a market for new players and new investments, if the appropriate price, content and philosophy for content design are found. This research explores the many potential application areas for mobile TV, with a particular focus on advertising. Various organisations that seek success in this market can utilise the potential for advertising on mobile TV. Ultimately, mobile device users are able to use mobile TV for entertainment and information sourcing. However, a number of challenging issues remain to be addressed.

The features that appealed to the consumers were studied in this research. Surveys were conducted to obtain an understanding of consumers' opinions and needs regarding the mobile TV experience. Many users clearly do like to interact with video content on mobile devices. Interactive mobile TV advertising can benefit users who will be able to use an essentially 'free' mobile TV service, funded by an advertising model. This research proposes an environment for interactive advertising on mobile TV and discussion of an implementation of the proposed designs.

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List of Abbreviations

2D	Two-Dimensional
2G	Second Generation
3D	Three-Dimensional
3G	Third Generation
3GP	Third Generation Platform
4G	Fourth Generation
AAC	Advanced Audio Coding
ARM	Advanced RISC Machine
ATM	Asynchronous Transfer Mode
ATSC	Advanced Television Systems Committee
ATSC-M/H	Advanced Television Systems Committee-Mobile/Handheld
AVI	Audio Video Interleave
B2C	Business-to-consumer
BBC	British Broadcasting Corporation
BMCO	Broadcast Mobile Convergence
BT	British Telecom
C2B	Consumer-to-business
CARU	Children's Advertising Review Unit
CCTV	Closed Circuit Television
CMMB	China Multimedia Mobile Broadcasting
CMYK	Cyan, Mgenta, Yellow, and Black
DMB	Digital Media Broadcast
DMB	Digital Multimedia Broadcasting
DMH	Dual Mode Handsets
DTV	Digital TV

DVB	Digital Video Broadcasting
DVB-H	Digital Video Broadcasting - Handheld
DVB-S	Digital Video Broadcasting over Satellite
DVB-S2	Digital Video Broadcasting - Satellite - Second Generation
DVB-SH	Digital Video Broadcasting - Satellite services to Handhelds
DVD	Digital Video Disc
DVR	Digital Video Recorder
DWT	Discrete Wavelet Transformation
EDGE	Enhanced Data rates for GSM Evolution
ELG	European Launching Group
EU	European Union
FET	Far EasTone Telecommunication
GPRS	General Packet Radio Service
GPS	Global Positioning System
GSM	Global System for Mobile Communication
HCI	Human Computer Interaction
HD-DIVINE	High Definition Digital Video Narrow Band Emission
HDTV	High Definition TV
HSDPA	High Speed Downlink Packet Access
HSPA+	High Speed Packet Access
HSUPA	High Speed Uplink Packet Access
HTML	Hypertext Markup Language
IP	Internet Protocol
ISDB	Integrated Services Digital Broadcasting
ISDB-T	Integrated Services Digital Broadcasting - Terrestrial
LCD	Liquid Crystal Display
M-Advertising	Mobile Advertising
MBMS	Multimedia Broadcast Multicast Service
Mbps	Mega Bits Per Second
M-Commerce	Mobile Commerce
MDTV	Mobile Digital Television

MediaFLO	Media Forward Link Only
MEF	Mobile Entertainment Forum
MHz	Megahertz
MIPS	Millions of Instructions per Second
M-Learning	Mobile Learning
MMA	Mobile Marketing Association
MMI	Man–Machine Interaction
MMS	Multimedia Messaging Services
MOV	QuickTime Movie
MP4	Moving Picture Experts Group - 4
MRC APU	Medical Research Council Applied Psychology Unit
MPEG	Motion Picture Experts Group
NTSC	National Television System Committee
PAL	Phase Alternation Line
PC	Personal Computer
PDA	Personal Digital Assistant
PMR	Private Mobile Radio
PMSE	Programme Managing and Special Events
PSP	PlayStation Portable
RGB	Red Green Blue
RISC	Reduced Instruction Set Computer
RSPG	Radio Spectrum Policy Group
RSVP	Rapid Serial Visual Presentation
RUI	Remote User Interaction
S-DMB	Satellite Digital Multimedia Broadcasting
SECAM	Sequential Colour with Memory
SMS	Short Message Service
SPSS	Statistical Package for the Social Sciences
SWF	Shock Wave Flash
T-DMB	Terrestrial Digital Multimedia Broadcasting
TV	Television

UI	User Interface
UK	United Kingdom
US	United States
VCR	Video Cassette Recorder
VMTV	Virgin Mobile TV
VOD	Video-on-Demand
WAP	Wireless Application Protocol
WiBro	Wireless Broadband
WiMAX	Worldwide interoperability for Microwave Access
WMV	Windows Media Video
WWW	World Wide Web

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Chapter 1

Background and Literature Review

1.1 Mobile TV Definition

The phrase ‘mobile TV’ is not new; its existence goes back to the 1950s when Motorola brought out mobile TV, or in other words, portable televisions (TV devices which are portable), to market (Tadayoni and Henten 2006).

1) “*Mobile TV is an audio-visual service which provides two way multimedia communications to mobile handheld devices with broadcast downlinks and return links in frequency bands dedicated to telecommunications services. Mobile TV should therefore not be limited by the traditional, linear concept of TV in our homes. A successful mobile TV service offers that, together with on-demand video, still images, sound and text*” (Englund 2007, p.35).

2) Mobile TV can be defined as “*TV in the mobile or TV for the mobile. TV in the mobile simply implies that traditional TV content is re-broadcast in the mobile phone. The content is not produced with the mobile platform in mind,* *but rather just compressed and perhaps shortened versions of traditional TV content such as news, sports, music videos etc.*" (Bria et al. 2007, p.2). On the other hand, there is TV for the mobile, "*namely that content is produced and optimized for the mobile platform and the mobile user situation. This means content that can be clearly reproduced on the small screen (e.g. mobile phone size), it is enhanced with interactivity features, and its length is adapted to the consumption pattern of the mobile users*" (Bria et al. 2007, p.2).

The current research adopts the following broad definition for the mobile TV concept: "*any video played in a mobile device*" (Wang 2007, p.4). In addition, the current research is interested in the surrounding areas of interactive interfaces. Mobile TV combines the services of a mobile device with television content and represents a logical step for mobile TV stakeholders (See Chapter 2, Section 2.8). Mobile TV is a term used to describe a service for subscribers to mobile telecommunication networks, usually from mobile phone operators (Magaia and Victor 2009). One feature of mobile TV is to enable consumers to view their favourite live streamed, traditional/linear or video-on-demand (VOD) shows almost 'anytime, anywhere' (See definition quote 1) (Robertson 2008). Another exciting opportunity for users is mobile TV podcasts, where content is delivered to a user's mobile on demand, or by subscription. Stored locally on the handset, this content can then be viewed even when there is no network connection. A service provider can schedule the delivery during 'off-peak' hours, for example, during the night. Many services offered by mobile TV providers are struggling to receive a high level of usage (Bhebhe 2008). Since DVB-H was launched in 2004, mobile TV commercial adoption has been over-optimistic; in fact mobile TV services have had a slow take-off (Bhebhe 2008).

Live broadcasted mobile TV is still developing. Although it is now possible to download clips using a mobile device (offline mobile TV), there are still some difficulties facing this process such as the content is often fragmented and unclear, the download time is too long, and the mobile phone lacks the long battery life to make it practical. Mobile providers need to find ways of transmitting content without monopolising the 3G network resources or degrading the quality of telephony. One method that has been proposed is to send video through satellite, avoiding the 3G network and simultaneously giving the ability to users to receive direct broadcasts; however, terrestrial solutions have become more prominent since 2008 (Owen 2008).

Mobile TV over cellular networks allows viewers to enjoy personalised and interactive TV with content specifically adapted to the mobile medium. It is currently assumed that users prefer to watch short video clips from TV programmes, via a mobile (See definition quote 2) to be updated with news, weather, sports, stock markets, and events like the Olympics. This particular activity was picked to show that the mobile TV experience is different to TV because of the exclusivity of the mobile devices. This exclusivity is based on the characteristics of mobile devices such as the screen size and the contexts in which such a service is used.

1.2 Background of Electronic Media

This section is concerned with video broadcasting. For that reason, the focus will be on the development of a specific technology, television, i.e. the development of traditional TV, and the effect of digital TV on analogue TV. In addition, the development of new TV experiences, such as mobile TV will be explored. How mobile TV will affect traditional TV remains a separate matter that needs further exploration and investigation by other studies. Initially, this section will discuss the development of TV, from traditional forms of TV to new formats such as mobile TV.

To discuss the establishment of mobile TV service, there is a need to study the TV broadcasting history that began with terrestrial TV, which uses radio waves to send and receive signals without the involvement of satellite transmissions. Satellite television was the next major development in TV technology. This format uses TV signals transmitted by means of communications satellites. Later, cable TV was launched, supplying users with television transmitted via radio frequency signals through coaxial cables or fibre optics.

During the 1940s and the 1950s, worldwide, almost all analogue formats were standardised and black and white images were provided with monophonic audio. These formats were later tailored to broadcast colour images, stereo audio and other characteristics, whilst still being backwards compatible with televisions unable to use these features. The most common analogue television encoding systems are: the Traditional Phase Alternation

Line (PAL), Sequential Colour with Memory (SECAM), and National Television System Committee (NTSC) systems (Robin and Poulin 2000).

Traditional TV has a number of limitations, such as high bandwidth use resulting in a low definition service. Also, only one channel can be broadcast at a time, which means that the customer has fewer channels and no interactivity, beyond the usual volume and channel selections. Finally, there are limitations of a set bandwidth. All of these limitations have given Digital Video Broadcasting (DVB) an advantage over analogue TV. The transmission of digital television is more efficient. Digital TV is easily integrated with other digital processes and systems. For the user, digital television offers resolution and sound quality similar to Blu-ray and digital multiplexing; it introduces possibilities for new forms of user interactivity, offers sub-channels, and allows the broadcasting of private programming. For governments, digital television provides a free radio spectrum to be auctioned and allocated for telecommunication services. For industry it provides an infrastructure for products such as mobile TV, Wi-Fi internet, and other services.

Digital TV (DTV) was launched in the 1990s. The High Definition Digital Video Narrow Band Emission (HD-DIVINE) project started in late 1991 (Whitaker 2006) in Scandinavia. It attempted to prove that a digital High Definition TV (HDTV) system can be used within a short time frame without an intermediation phase, via analogue technology. In 1992, HD-DIVINE demonstrated a digital terrestrial HDTV (Whitaker 2006). At the end of 1991, many European stakeholders, such as broadcasters, regulatory associations, and equipment manufacturers, met to establish a group overseeing digital TV development in Europe (DVB Project Office 2007). The group, known as the European Launching Group (ELG), signed a Memorandum of Understanding in 1993 for the establishment of the DVB project (DVB Project Office 2007).

The Netherlands was the first country to switch, completely, to digital TV in 2006, followed by Finland in 2007 (Socorro 2009). The United States moved to full digital TV in 2009, and the United Kingdom is expected to switch to digital by 2012 (Great Britain National Audit Office 2008). There is a clear worldwide commitment to moving to digital, and it is thought this will provide users with various advantages over analogue TV. These advantages include enabling users to 'actively interact' with TV, providing them with greater flexibility in requesting the services they require. Traditional TV is seen as a 'sit-back' and view offering consumer's little interaction. On the other hand, digital TV offers opportunities for an increased level of interactivity for the audience, for example the ability to change/choose alternative content, and this is one of the aspects motivating the change from analogue TV to digital TV.

In 2000, BBCi were the first to add an interactive service, during the Wimbledon tennis championships (Curran 2003). Discussing the development of interactivity over traditional TV leads to the understanding of new TV experiences with interactivity, e.g. mobile TV. Digital video broadcasting is applied in many countries and delivered to fixed mediums, but broadcasting to mobile mediums is still an emerging domain.

Initially, mobile TV began with satellite and terrestrial Digital Multimedia Broadcasting (DMB); in the first country which is South Korea, satellite DMB provided wider range of video content, while terrestrial DMB was free of charge for usage. Mobile TV is one of the services provided by many 3G mobile devices. In Europe, specifically in the United Kingdom and Italy, 3G services were commercially launched in March 2003. The European Union Council required coverage of about 80% of the European population from the 3G operators by the end of 2005. 3G subscribers reached 614 million by December 2007, and this number is expected to increase annually by 34% (“RNCOS Releases” 2008 cited in Kimmel 2010). With their higher network capacity, 3G technologies enable network operators to provide users with a wide range of advanced services. Since the technology needed for the activation of mobile TV services is available, this should be more vigorously promoted, as it is currently not widely known to all people. Promoting the technology introduces an understanding to some consumers that the technology needed is available, for instance to inform consumers that the technology that allows them to view TV on mobile devices is available; therefore, these consumers can start using such a service. There is a need to state that the existing mobile networks, 2.5G or 3G, and the upcoming 4G network, support interactivity with mobile TV content.

1.3 Digital Convergence

In recent years, digital convergence has become an extensively researched topic, and is highly relevant to this research.

1.3.1 Definitions of Convergence

1) Convergence can be simply defined as "*the act of converging and especially moving toward union or uniformity*" (Merriam-Webster 2010). In addition, Merriam-Webster's collegiate dictionary defines convergence as "*a movement toward a point or the coming together to unite in a common interest or focus*" (Yoffie 1997, p.2). This movement is not literally about objects, it can be through different types, as with Tanjuakio's (2008) definition of convergence, which is "*approaching a definite value, as time goes on; or approaching a definite point, or a common view or opinion, or a fixed state of affairs*".

2) The previous definitions are concerned with the movement towards unity in markets and technology. Greenstein and Khanna point out that convergence describes a process of change in industry structures that combines markets with technological and economic dimensions to meet merging consumer needs. It occurs either through competitive substitution or through the complementary merging of products or services, or both at once (Pagani 2003). The mobile TV service is a result of the convergence of several markets, as Straubhaar and

LaRose (2005, p.4) define convergence as "*the integration of mass media, computers and telecommunications*". Regarding the relationship between content and consumer in converged media, Shaver (2008) defines convergence as "*the shifting in the relationship between consumers and content producers*". Technological convergence can be described as "*the modern presence of a vast array of different types of technology to perform very similar tasks*" (Tanjuakio 2008). In addition, it is defined as the process by which distribution channels are reduced and content broadens. Technological convergence is exemplified by the development of digital delivery methods (Albarran and Arrese 2003).

3) Digital convergence: "*Is the progressive blurring of the boundaries between the consumer electronics, computer, and entertainment (especially television and film) industries made possible by the digitalization of signal delivery systems of all sorts (e.g. telephone, broadcast television, cable, and satellite infrastructures)*" (Hart 2004, p.60). The telecommunication networks are seen as the nexus for the convergence of TV with the Internet and the next upcoming digital video services (Maheshwarri et al. 2008). The most important features of digital media are better image and audio resolution (as digital information is zeroes and ones, whereas analogue information is a continuous varying electrical or magnetic value) and cheaper (producing a considerable number of copies is cheap) compared to traditional media. Digital convergence in the mobile telecommunication sector refers to joining different types of data all together on one channel and then following the standards that facilitate further convergences in mobile telecommunication technology (Tanjuakio 2008). Web TV, TiVo, Slingbox, AppleTV, Windows Media Center and mobile TV are examples of digitally converged devices and services (Lockhorn 2008).

1.3.2 Advantages of Digital Convergence

Thinking about convergence leads to an assumption that users will be able to access ‘everything’ on mobile devices, i.e. all content distributed through all types of standards (Lindner 2008). Digital convergence has many advantages (See Chapter 4, Section 4.14). When discussing convergence in mobile phones it is worth mentioning that the rapidly growing mobile phone sector has heavily affected traditional types of media; the use of mobile devices, the Internet and video broadcasting has led to the invention of new types of video broadcasting or electronic media (Maheshwarri et al. 2008) such as ‘YouView’, for more information see Chapter 8 section 8.3. Apparently, some users from young age groups, and probably from some other groups too, are not aware of the convergent facilities of mobile phones and interactive TV devices (De Freitas and Bagur 2009); this might explain the slightly low percentage of users of these new converged facilities (for more information see Chapter 4).

1.3.3 Digital Convergence Issues

As digital convergence is developing into new forms, it impacts and interacts with changes within the social and technological contexts users find themselves. This can throw up issues and problems that need critical examination. For convenience, these are classified into two categories:

1) Societal Challenges: These challenges arise from consumers' heavy and inappropriate usage of digital media devices, as in the case of young users downloading content of a violent nature or when users are using devices while driving, increasing the chances of car accidents (Mohan et al. 2008).

2) Technological Challenges: The technological challenges resulting from trying to learn the ways to use technology, such as in using mobile phones for watching TV or browsing the Internet (Mohan et al. 2008).

The convergence of two different types of devices, namely mobile phones and TV, resulted in the creation of mobile TV (See Chapter 4).

1.4 Convergence and Mobile Devices

In recent years, there has been extensive research activity in the field of mobile videophony proposing proprietary or standard-based schemes. The convergence of more than one device made it clear that mobile devices would no longer be only a medium for calling or messaging. Wireless gadgets are in an evolutionary period (Nasco and Bruner II 2007). Mobile devices are significantly used (Nasco and Bruner II 2007), especially among young age groups. Shari Walsh's findings from Queensland University of Technology, Australia, which are based on two studies carried out amongst young people aged 15–24, show that being connected all the time is the most important factor in mobile phone ownership. Users feel upset when they are unable to use their mobile phones (Walsh 2007). In this respect, Kindberg et al. (2005) note that mobiles are "*carried to keep some treasured person or object close*". This also applies to mobile TV, which users can watch in certain places when traditional TV is not around, or if the user wishes to view a certain show in private. Currently, users are increasingly demanding mobile access to multimedia services, and the ability to surf the Internet, conduct financial transactions and use other services.

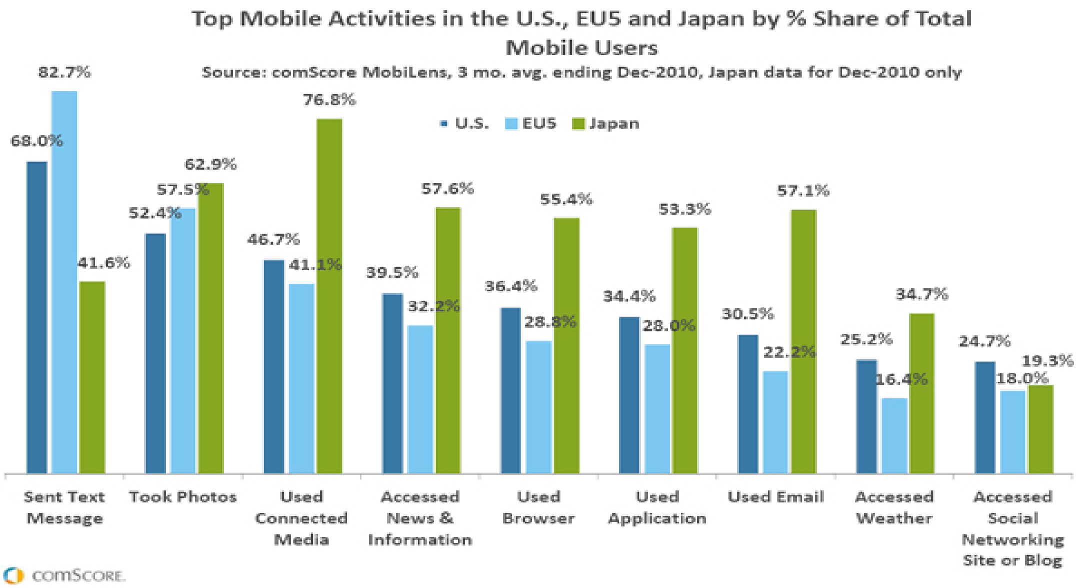


Figure 1.1: Mobile Features Commonly Used (comScore Inc. 2011)

Individuals vary in the way they use their mobile phones. Apart from voice calls, sending text messages, using a browser, using connected media, accessing news and information and using a mobile device's camera are the most common features used on mobile phones. Figure 1.1 shows the statistical usage of different technologies to access services in different countries, and one of these services is using connected media via mobile devices; in other words, mobile TV. Clearly, Japan registers the highest ratio. With this ratio it seems that mobile TV applications have the potential for success with the adoption of mobile devices and then using them to view videos.

Mobile TV is related to the Internet. The Internet is used by users for sharing videos between devices and it is a way to view and download videos to the devices. The statistics indicate the application areas for mobile phones; the main concern will be with particular areas related to mobile TV services, such as accessing connected media on mobile devices, accessing weather, or news and information and browsing. The data of this report has to be interpreted with caution, as it is published as part of a commercial enterprise; however, there are some interesting points for discussion. The figures of what comScore Inc. has projected were that 55.4% of Japan citizens have accessed the Internet via their mobile phones; this is of course according to the methodology they have followed as service providers. In addition that 76.8% of Japanese accessed connected media. Another survey among European and US mobile users, commissioned by Tellabs and carried out by Nielsen, Global Information and Media Company with over 50,000 consumers, presented a prediction that 71% of the consumers utilise mobile services such as mobile internet daily (Tellabs 2009). Nielsen Online carried out a mobile media study, which shows that mobile internet usage rose eight times more than PC internet usage for the year 2008, especially among the youngest age groups (15–24); the mobile internet usage ratio was about one to four while the PC internet usage ratio was about one to eight (Leahul 2008). The number of mobile internet users has risen from 5.8 million to 7.3 million, which represents an increase of 25% (Leahul 2008).

Technological convergence affected the telecommunications industry by shifting the background of telecommunications from analogue. In respect of mobile devices, convergence has changed the devices' appearances; therefore some of the current mobile devices are much smaller with touch screens and/or cameras (Tanjuakio 2008). Although it was feared that the mobile internet would not be successful because of the size of display on the mobile, this service is attracting more and more users. Similarly, mobile TV may gain similar success among users regardless of the size of the screen. The screen 'size' is not always controlled by the mobile device dimensions, for example with the use of wearable devices such as eyeglass frames and lenses. In other words, small mobile devices can provide users with a similar effect to big screen displays. These wearable devices do not occupy the user's entire field of view, allowing the user to maintain their attention on their surroundings (Costanza et al. 2005).

Interactive mobile TV, as one of the 'upcoming' media services, is thought to be different as it is not so much a replacement as much as it is supplementary to the available media services.

1.5 Mobile TV Technology

Mobile TV depends on the infrastructure technology available. Third generation (3G) mobile communication networks offer transmission speeds that make it possible to stream high-quality video and audio to mobile devices along with other new devices. With the rapid and vast development of wireless communications, there are more plans to transmit multimedia content over wireless channels. 3G technologies with higher network capacity enable network operators to provide users with a wide range of advanced services. Even if the bandwidth increases for 3G wireless, it is still not comparable to the bandwidth of broadband optical communication systems like Asynchronous Transfer Mode (ATM), which could allocate many Mbps to end users. Thus, for wireless multimedia applications (e.g. mobile TV), higher compression is required for both image and video signal.

The technology needed for the activation of mobile TV services is available. In Europe, specifically the United Kingdom and Italy, 3G services were commercially launched in March 2003. The European Union Council required coverage of about 80% of the European population from the 3G operators by the end of 2005. Today, with a reasonable percentage of 3G users, the mobile industry has the opportunity to create more advanced products and services that better meet customers' needs and to some extent drive these 'needs' and desires via clever marketing and product visibility.

The technology and mobile devices needed to activate mobile TV are available; the next thing to establish in this section is whether mobile devices are highly adopted in various countries; if this is indeed the case, then the value chain of mobile TV services would be encouraging. Currently mobile devices are heavily used, and their users employ them in different aspects of their lives (The Economist 2007). Carphone Warehouse's study indicates that the number of mobile phones in some European countries is more than the population, with an average ratio of 1.35:1(Dunstone 2007). In another study investigating the number of mobile subscribers in thirty countries, fourteen countries have more mobile subscribers than the population. This is because users have more than one SIM card in use (The Economist 2007).

It is likely then that mobile devices will remain one of the dominant digital media devices but the mobile telecommunication sector will be facing some future challenges concerning consumers and technology service providers as a result of the convergence of standards and technology. Changes in standards and the advanced technology will create a need for consumers to switch mobile devices to address the occurrences of the convergence. In general, not all mobile devices support mobile TV services. For example, using a mobile TV service requires the use of a 3G mobile device. So, those who have a 2G mobile device would need to change to a 3G mobile device (Tanjuakio 2008). The number of 3G mobile phone subscribers in South Korea and Japan is higher than second generation (2G) mobile phone subscribers (The Economist 2007). These countries are often looked to as 'early adopters' of new electronics so it is not unreasonable to speculate that this trend may continue elsewhere.

1.6 Literature Review

As part of this research, a literature review on the topic of mobile TV as well as the predictions for it, especially multimedia on mobile devices, was conducted. One challenge faced while carrying out this research has been the low volume of serious academic literature concerning interactive mobile TV advertising. This is often the case when new fields are ventured. Because mobile TV is evolving extremely rapidly, publications will often contain old information. For this reason, this research relies mainly on online papers on mobile TV, mobile multimedia and other related subjects. The literature review is classified into two categories; technical, and services, as follows;

1.6.1 Technical Literature Review

Gerstel (2005) argues that an understanding of technical issues about live video broadcasting on mobile devices provides a bridge, in the sense of content and TV channels, between traditional TV and the mobile market. Delivering live video broadcasting to mobile devices requires a permanent connection with a streaming server during the user's whole viewing experience. Comparing live streaming and video-on-demand reveals that, for live content, the average session time is longer; therefore the connection may be affected by dropdowns when the user enters an area with no network. In addition, in some situations users are not allowed to watch TV on mobile devices; therefore it is a user's choice to switch off the service, for example in a classroom or while driving. Addressing the connection dropdowns is required to provide user satisfaction, therefore a stable connection with full bandwidth that is not degraded by other users must be provided at least for streamed content. Mobile content developers need information from mobile operators regarding the real bandwidth conditions in the operator's network as noted by Gerstel (2005). Gerstel adds that frequency updates also cause a problem; especially for mobile devices' news content as users always expect that providers are broadcasting up-to-date information. Another viewing scenario is downloading content to mobile phones, which guarantees higher quality services without connection dropdowns; the video content will be displayed regardless of the poor network bandwidth and ends with the user's satisfaction with the service. From the content producer's point of view, it satisfies users and displays a better video quality. A mobile TV service includes the usage of live streamed and downloaded content; therefore, in order to call this service a success, users must enjoy both cases.

Providing higher bandwidth is considered a significant cost to network operators. In Sodergard's study (2003), users chose medium quality clips of around 200Kbps, and the effective bit rate was 29Kbps. When delivering digital TV through PDAs, users had a number of opinions on picture quality. Comparisons were made with television sets in areas such as blocked channels, sound and picture adjustment, and difficulty in changing channels while using mobile devices. The people who were familiar with the idea of mobile TV and had previously watched videos on mobile devices did not compare television quality with mobile TV experience and were more satisfied with the image quality. The study shows that field trial users are not asking for different content tailored for mobile devices, but they have asked for the ordinary content traditionally displayed on traditional TV sets. Even those who said that mobile TV content must be different have asked for a piece of the existing TV content. The reasons for this might be that tailored content is still vague as a concept to users and they are uncertain about whether the content would suit their demands. In addition, the tailored content market is still smaller than the ordinary content market, resulting in less variety of content and lower production values. On the other hand, there are some users who are satisfied with downloading video (pre-existing or tailored) regularly onto their mobile phones to be viewed regardless of any conditions. Another reason is the main issue mentioned by users in Sodergard's study (2003), i.e. the lack of tailored content in general and the lack of variety in the content to satisfy the tastes of diverse users. The opposite applies to ordinary content; therefore most of the users prefer to view ordinary content. With the variation in consumer needs, providing both types of content is required. The lack of tailored content appears to be because of the emerging state service of mobile TV. A further reason would be that ordinary content is significantly cheaper to use for service providers. Another aspect to be discussed is the interactive properties of mobile video; both types of content can apply these properties. There are attempts to produce tailored short films that suit mobile devices. For example, at the Tampere thirty-second International Short Films Festival was a competition, launched to advertise the availability of such content (Lehtola and Mokka 2002). Another example is Portable Film Festival, which is carried online and provides free content for mobile devices (ScreenWest 2006). A further example is Samsung Electronics, which launched a website called 'AnyFilms.net', providing mobile users with short films (Samsung 2005).

1.6.2 Services, Content and Contexts for Consumption Literature Review

This section is specifically concerned with discussing the following mobile TV topics: services, usage, contexts, preferred content, interaction, types and social means.

A study by Lehtola and Mokka (2002) presents the results of a trial called 'PMA-pilot' held by Sonera Mspace in 2000; even though this is an old study, some of the findings are still relevant. This trial lasted for two months and involved two hundred participants. Many different devices were used to test multimedia applications, including 3G mobile phones; pocket PCs and GSM phones (Lehtola and Mokka 2002). Various types of content were provided to participants such as news headlines, sport highlights, up-to-date information on the weather, information or trailers of movies, music video clips, and addresses and directions services. The results conducted from the pilot trial were optimistic, since 60% of the participants enjoyed the experience and over 90% will use mobile TV many times a week. There were a few disadvantages of the experience. These were low transmission speed, one terminal, and lack of content. If all these were addressed, 60–80% of the participants thought the service would be more enjoyable. Finally, the results reflected that news and music video clips were the most preferred content (Sonera 2000 cited in Lehtola and Mokka 2002). A more recent trial was held in the city of Oxford, United Kingdom, in September 2005, by O2 in collaboration with Nokia and Arqiva. This trial was carried out with about 400 O2 customers. This trial provided users with sixteen 24-hour terrestrial and satellite TV channels (ITV1, ITV2, BBC1, BBC2, BBC News 24, Channel 4, Five, CNN, Discovery Channel, Sky News, Cartoon Network, MTV, British Eurosport, Shorts TV, Sky Travel and Sky Sports News) on mobile devices. The trial revealed the following results: users are interested in the service trialled; 76% of trialled users would subscribe to the service within the following year and 83% of the users were satisfied with the service provided (O2 n.d.).

There is more evidence to strengthen the argument that mobile TV services are accepted and asked for by some groups. In 2004, a survey was carried out in Japan among mobile phone users; 43% of the participants showed interest in a mobile TV service, saying that it is the most desired service (NEAsia Online 2004 cited in Trefzger 2005). Another survey carried out by Sony Ericsson revealed that 40% of the participants are interested in mobile TV (Strupczewski and Carew 2004 cited in Trefzger 2005). In Germany, a survey carried out by bmco[1] among participants of a mobile TV trial revealed that 77.8% thinks that mobile TV as an idea is either good or excellent (Strategy Analytics 2005, pp.12–13 cited in Trefzger 2005).

On the other hand, there are people who are not enthusiasts about mobile TV services. Negative results are provided to enrich this current research

[1] bmco: (Broadcast_Mobile_Convergence) was a joint project in Berlin between Nokia, Philips, Universal Studios Networks Deutschland GmbH and Vodafone.

with opposition views, in order to show the real market or to encourage this group to use the service by providing for their needs. A survey carried out by Strategy Analytics' Advanced Wireless Laboratory reflects, surprisingly, that over 70% of US users are not interested in viewing short content on mobile devices; while Europeans showed a slightly lower percentage (Strategy Analytics 2005, pp.11–12 cited in Trefzger 2005).

The main purpose of Caj Sodergard's (2003) study was to investigate the opportunities and possibilities of mobile TV. The researchers focused on deploying mobile TV using PDAs and tablet PCs; the obtained results are similar to, but not necessarily the same as, mobile TV using mobile phones.

Sodergard (2003) states: "*Public and private transportation vehicles and public places are potential environments for mobile television services. Even in homes, mobile television handsets are interesting, both as a personal television set and as a tool for establishing a closer interaction with television programmes. In addition to these possibilities for enriching viewer experience, mobile television offers the broadcaster new audiences, the teleoperators a new distribution channel and the equipment manufacturer new receiver product possibilities*."

The previous quote points out the environments or contexts in which mobile TV might be used. Sodergard (2003) states that, in spite of the fact that traditional TV services are available, mobile TV is used even at home because mobile TV is such a personal service device; a user may watch a certain content that interests him/her while others are watching regular TV. One of the ways in which Sodergard's study (2003) investigates consumer interests in mobile TV is through interviewing two samples of mobile users. The first sample was selected randomly while the second sample was made up of experts in mobile TV. Both samples were tested on the implemented trial system, namely, a trial mobile TV service. With regard to content, users were able to watch full programmes transmitted weeks earlier from three leading 'Finnish TV' channels. All users were asked to use the service through WLAN. In general, users' opinion was that a mobile TV service is considered to be similar to traditional TV, but not as a multimedia service. The key point was that it enabled them to watch programmes transmitted some weeks previously – a service known as video-on-demand (VOD). The length of the programme is paramount for users who prefer viewing short programmes. Users may also prefer to watch a short clip from TV shows. The conclusion is that most users do prefer watching short videos on their mobile devices instead of watching a full length show. Users commented that "*Children in particular – even preschoolers – liked the service so much that it replaced the traditional television in some cases*" (Sodergard 2003). For instance, although users usually use the extra time they have while on a bus or any other transportation means reading the newspapers, news headlines were the most popular content among the older users. Sodergard's study ignored important challenges expected to face mobile TV services such as pricing. In other words, all of the interviewees who were enthusiastic about the experience paid nothing, but when mobile TV requires a subscription it is unclear whether users would keep up their enthusiasm.

Repo et al. (2004) produced a field study conducted on a small sample of 13 users, which focused on watching videos on a mobile phone. A setting's physical and social contexts refer to the situations the users were interested in – known as the viewing positions, and what Harrison and Dourish call ‘space’ and ‘place’ (Harrison and Dourish 1996); in other words, concerns were not just about the physical layout or characteristics of the setting, but also the meaning attached to it, which turns it from a space to a place. According to Spagnolli and Gamberini (cited in Rettie 2005), the distinction between space and place is that there are two categories of space, “*objective space – homogenous and measurable*” and “*mental space – pure and abstract*”, which could be distinguished from place, that is “*recognizably associated to meaning on a psychological and cultural basis*” (Spagnolli and Gamberini 2004, p.49 cited in Rettie 2005).

The key question in Repo et al.’s (2004) research was: In what kind of situations is it significant to watch mobile videos? The interest is in the contexts of consumer usage and usual reactions towards watching mobile TV. Another part of the research provided a user group with mobile phones and digital video content. It aimed to study their usage in many different environments. Users were asked to evaluate their experience of watching mobile TV by giving critical feedback and comments. Comments by users’ family and friends were also required. Participants were asked to watch mobile TV in some given situations, such as sitting by a coffee table, or while being on public transport, either as part of teaching them the use of the videophone or in connection with their hobbies. The users also kept diaries where notes and reflections on the viewing experience were registered. The study reported that users preferred to use mobile TV in two main contexts. The first context is while being on transportation or perhaps while waiting for an appointment for entertainment purposes. The second context is when users wanted to share an experience, for example showing videos of a family event or the birthday of a relative. Repo et al.'s (2004) research limitations are the size of the sample and, they argue, the pre-given situation should have been general categories instead of specific situations, in order not to ignore the many possible user situations.

Many studies were concerned with the user's preferred content to be viewed on mobile phones. Most results come out with new outcomes, which could be commercially attractive. Sports are usually seen as suitable content, but not for all age groups and genders. A study conducted by a small sample of specialists, who examined some issues with regard to providing rich multimedia content on mobile phones during an ice hockey match (Ojala et al. 2004), revealed that technical issues were supposed to be taken into consideration for some of the sample, and the results were interesting. An online survey was placed on the website of Helsinki Hockey Club to provide the study with users' comments and feedback. The study is relevant to the use of mobile TV broadcasting channels because it is about watching video on mobile phones and about live streaming. The study reflects a degree of acceptance of the use of mobile TV for sport and this is discussed in more depth in the results below. The Helsinki Hockey Club's online survey revealed that users would like to use the devices during the match to look at goals again and check the statistics during the intermissions. Another result of the survey is that users do save goals, mishaps and fights on the mobile devices, to be taken with them when they leave the arena. In addition, the users revealed that they would send comments from the match and a meeting place at the next intermission to friends' devices. On the other hand, fans of a competing team would get a summary of the goals of the other team and the mistakes of their team to be sent to their friends' devices. It was concluded that users agreed that the use of mobile TV in sport events is a social communicator and enriches the viewing experience.

1.6.3 Mobile TV Commercially Applied

The following are some practices of commercially launched mobile TV services. Mobile TV services are applied in various countries; in this current research the services were classified according to the countries as follows.

In Singapore, a broadcaster called MediaCorp TV launched a mobile TV service titled 'TVMobile' in 2001. MediaCorp claimed to be the first to use Digital Video Broadcasting (DVB). TVMobile was initially deployed into 1,500 buses to enable commuters to use a mobile TV service. There were some limitations to the service, such as users could not select channels, meaning all users had to watch the same programmes. A further limitation is that the service was limited to buses. Back then, TVMobile planned to spread the service to cover people in many contexts, such as those queuing or using other kinds of transportation (TVMobile 2001 cited in Lehtola and Mokka 2002).

In Taiwan, mobile operator Far EasTone Telecommunication (FET) launched a mobile TV service in 2010. The service consisted of twenty channels and is applicable on Smart phones and tablet PCs. The price plan is a fee-based through paying approximately $5.5 per month (Hwang 2010).

In the US in 2003, Sprint, a mobile carrier, adopted MobiTV, a content aggregator that includes a bundle of channels such as Fox and CNN. In addition, MobiTV provides cartoon and music channels. Later on, Cingular and Alltel adopted MobiTV to be available for their consumers. MobiTV spread to other countries such as the UK through operators like 3 and Orange, and to Canada through the operators Bell Canada, Rogers and TELUS Mobility. MobiTV used several technologies to deliver the service, such as Wimax (Tadayoni and Henten 2006). Another example in the US is Verizon, a mobile operator, which in February 2005 began to offer a mobile TV service called ‘Vcast’. Vcast offered video-on-demand content, which included sport, news, entertainment and weather. Content is provided through famous broadcasters such as CNN and users get access to the content through a Vcast portal. The price plans were divided into, firstly, fee-based through paying $15 per month to have access to the service in addition to other services such as unlimited access to web portals and, secondly, advertising-based through choosing to watch advertisements in order to pay a cheaper subscription (Wang 2007).

Curwen and Whalley’s paper (2008) mentioned that in 2006 the operators 3 UK, Orange, O2 and Vodafone declared the launch of a two-month trial that used the TDtv standard and took place in Bristol, in conjunction with MobiTV.

In Italy, in June 2006, mobile operator 3 launched a mobile TV service based on the DVB-H standard. This mobile TV service is called ‘WalkTV’. Within five months from the WalkTV launch date, the number of subscribers reached approximately 111,000. The high penetration numbers of the service was because of the launch date, which was timed in relation to the football World Cup. After that, the number of subscribers increased gradually, to 140,000 by the end of September 2006 (Tadayoni and Henten 2006).

In Korea, in May 2005, TU Media was the first operator to launch a worldwide mobile TV service applied to mobile phones using satellite Digital Multimedia Broadcasting (S-DMB). In December 2005, TU Media planned to develop terrestrial DMB (T-DMB) (Trefzger 2005; Lee and Kwak 2005). This was possibly because TU Media was facing competition from broadcasters such as MBC using T-DMB. TU Media established a channel called ‘Blue’ that displays content provided by several producers. The pricing plans were a monthly fee of $13 for the basic service in addition to $20 paid once, as a service fee. Furthermore, a premium channel costs $4 per month (Wang 2007). As a comparison between Vcast and TU Media, Vcast provides two ways of pricing models while TU Mobile has only one model. Vcast provides more varied types of content (including video-on-demand, internet content and live streamed) in comparison with TU Media, which only provides live streamed content. Finally, Korean Telecom announced that it will commercially release its mobile TV service in 2011 (Wood 2010).

In Japan, in October 2004, mobile TV was launched using a S-DMB standard, However, Japan was not considered the first to apply mobile TV commercially because mobile phones were not the handsets used; specific portable TV devices were required (Lee and Kwak 2005).

In Sweden, in November 2005, a live streamed mobile TV service was launched by the Vodafone operator. This service was a result of a joint venture between Kanmera and Expressen-TV, the leading Swedish tabloid (Curwen and Whalley 2008). On the other hand, in the Netherlands, the Dutch operator KPN has decided to stop providing its mobile TV service that used DVB-H technology. KPN mobile TV service failed due to the lack of new handsets that supports the DVB-H technology (Briel 2011).

In Hong Kong, PCCW, a leading telecoms player, offers mobile TV services that include video-on-demand (VOD) through NOW TV, a pay TV service provided by PCCW. The content displayed is classified into news headlines, movie trailers and sport (Wang 2007). Furthermore, the mobile operator CSL launched twenty-five live streamed channels. The channels consisted of entertainment, news, sport and music. The content was provided by famous broadcasters such as the BBC. Regarding business plans, CSL enabled users to subscribe either through paying a fixed monthly fee or to include the fee in a mobile tariff, for example, 200 minutes voice calls plus 100 minutes TV viewing (Wang 2007). Comparing this pricing plan with all previously mentioned pricing plans shows that all the other plans exclude the mobile phone tariff from the mobile TV subscription.

Another example is SmarTone, a mobile operator that launched a mobile TV service consisting of video-on-demand content provided by famous broadcasters such as CNN; SmarTone’s iN! Portal contains all content, allowing users to select their preferred clips. This service is delivered using HSDPA technology. The pricing models are based on pay-per-view; for instance live TV news costs HK$1–4 per minute, while sport costs HK$2 per clip (Wang 2007). This pricing plan is considered to be acceptable by some users, even though it is more expensive than all the previously mentioned pricing plans.

Finally, the mobile operator 3 launched a mobile TV service with four live channels. These channels were classified into two news channels (Bloomberg and Phoenix InfoNews), one movie channel and one music channel. The price plans are HK$15 per month for unlimited viewing of news (Wang 2007). The pricing business model is generally accepted but some users are concerned only with news, in which case it is thought to be expensive.

The previously mentioned practices of commercially launched mobile TV services raise some scenarios for utilising mobile TV. Mobile TV is not just about watching videos but is moving to a deeper level to become a social activity and an interactive experience.

The following studies of multimedia messaging services (MMS) provide the mobile TV industries with some opportunities, e.g. advertising. Kindberg et al. (2005), along with other experts, have conducted research into the reasons for capturing images within these two dimensions: affective vs. functional and social vs. individual. Affective reasons are related to mutual experiences and how to enrich this shared experience either immediately or later. In the study, capturing photos or videos using a mobile phone camera is described as part of a social experience. The images or videos which are captured are saved on the mobile phones and later shared with friends and families who were not present when they were captured, as a form of ‘telepresence’. Kindberg et al. (2005) noted that they “*are carried to keep a treasured person or object close*”. The collection of images and videos form a ‘live memory’ of these personal experiences. By contrast, the functional reasons for which images are used include supporting a shared or personal task.

Kurvinen’s study (2003) covers particular aspects and circumstances of capturing and sharing images that might be more widely known and relevant than private images. This aspect could be used for humour and having fun. The captured images were used for daily relationships and not for improving functional ones. The sample comprised of 25 users and was conducted over a period of 27–37 days with a sum of 4,159 overall multimedia messages. Kurvinen’s viewpoint is that an image is used as an ‘interactive image’, which is used to say things that cannot be phrased as an idea, leaving the opportunity for participants to understand the meaning behind the image. This method of presenting images provides a significant opportunity for a conversation concerning the understanding of image meaning. The study further suggests that images are used to express emotions, for example crying or smiling. In addition, these images may either keep relationships stable or improve relationships. Therefore, mobile messaging is a way of connecting with another despite the other’s physical absence. Kurvinen’s study (2003) is similar to Taylor and Harper’s study on SMS and their ways of keeping relationships or improving them. The impact of SMS messaging on the social aspects of relationships in terms of maintaining them through jokes is discussed as well as being highlighted in Graham et al.’s (2005) study. The study indicates that SMS technology is an example of how a technology becomes a daily practice (Graham et al. 2005).

The small screen, or the 'fourth screen', has also impacted in other ways. Beale's study (2005) examines some important ideas on how a Smartphone is linked to various aspects of social interaction. For example, a mobile phone's calendar can be used to alert or remind the user when one of his or her interests is available. There are various ways for exploring this idea such as in the idea of dating services and sharing jokes, which can open a way for exchanging information as an aspect of community building via file sharing. Beale points out these aspects to comment on possible future ventures of mobile TV (Beale 2005).

Repo et al.'s study (2004) argues that mobile TV is different, special and social. The specialness or uniqueness of mobile TV means it is like a TV set on the move and mobile TV is different since its viewing experience is based on some characteristics that are different from all other TV viewing experiences. Mobile TV being social means it enriches as well as strengthens social relationships among people, for example being able to send event video clips to family and friends, allowing them to share the fun. Another example is acting as amateur or professional reporters through sending video clips of an event to others or news agents. A further example is advertisers sending video clips of sale offers or new arrivals products to people.

All of the different studies referred to above provide information about the acceptance of mobile TV services. Most studies planned to investigate the following two questions: “*Is mobile TV accepted and interesting?*” and “*Can you watch video on a mobile device?*” Some of the studies, like this one, discuss the development of new mobile device tailored content. Studies and research conducted indicate that there will be a niche market for mobile tailored content. Mobile tailored content is interesting because it is about changing the system of producing and consuming content based on the users’ interests rather than imposing the content on them. This supports a new way of sharing and a new viewing experience.

Some of the studies are concerned with discussing the driving forces for mobile TV usage. Repo et al. (2004) indicate that use of mobile TV helps in changing or improving social behaviours, viewing positions, types of watching, and producing and sharing content.

Ojala’s study (2004) explores generating recorded videos to be viewed by users or even to enjoy a shared experience of viewing content as was mentioned previously. When Ojala applied a different type of content to be viewed on a mobile device that was not similar to watching programmes at home on TV, that content was an ice hockey match. One of the mobile TV drivers is to watch the events live and see the details of these events.

1.7 Conclusion

In the first section a literature review of the development of media was presented, discussing the history of digital media. We can conclude that digital media has the potential to offer more diversity and choice in content and, potentially a better service in terms of technical quality when compared to analogue TV, although challenges of device adoption and broadcast method remain. Another conclusion is that digital media provides all sectors with new services in the media market. A further conclusion is that digital media in certain cases provides social technologies. In addition, it can be concluded that digital media has more than one style depending on the way media is presented. Based on all of the previously mentioned conclusions, a result is reached that a shift from analogue to digital is going to be applied across the world. Then, a discussion of the history of video broadcasting was presented. It is concluded that video broadcasting is emerging to various platforms. After that, the chapter discussed the availability of technology and mobile devices that supports mobile TV services. In conclusion, this is the first step towards commercially launching mobile TV, but the availability and consumers' uptake of compatible devices remain separate matters that need further exploration and investigation. There are certain mobile devices that are capable of providing mobile TV services. The main features of mobile TV services were then described, their possible uses and a discussion of how accepted and interesting the service is. It is concluded that there is a need to keep a two-way channel between users and service providers to keep users interested in the service provided.

Next, there was a discussion of digital convergence in terms of its history and market changes that are based on users' needs. It is concluded that if converged devices are not be adopted by users, then convergence will not take place. Another conclusion is concerning the converged media, for example a mobile TV service being a platform that allows users to access almost everything on mobile devices. This was followed by discussing the effect convergence had on the usage of many devices and services in the same way these devices and services had affected their predecessors. For example, the invention of the telephone affected telegraphs and the invention of the radio affected newspapers. Moreover, television affected radio, mobile phones affected telephones. It is concluded that new converged technologies do not necessarily replace their predecessors but they do affect them.

A variety of specialised studies were presented and dealt with from two different perspectives: the technology and the service. Some studies are based on the deployment of mobile TV services using live streamed, video-on-demand and downloaded content. It is concluded that mobile TV is not limited to live broadcasted content. Another conclusion is that the business plans provided by the previously mentioned studies differ from one to another and are not sufficient, as the number of subscribers is still below expectations; therefore free rewards should take place in order to encourage users to adopt the service. Another conclusion is that a mobile TV service should be special; therefore tailored content should be supplied to the service in order to be charged for, but if the service is a replica of traditional TV, which is free, then the subscription is not attractive. A further conclusion is the need to expand the market of tailored content and allow users to experience suitable content for such a converged medium. The studies that were carried out from the service-related perspective examined the mobile devices utilised and the consumer demands, as well as multimedia messaging and mobile TV applications. Finally, it is concluded that mobile TV is considered to be a social activity when compared to traditional TV. Therefore allowing users to produce or consume the programmes or shows they would prefer to view will expand this social activity.

The next chapter is concerned with mobile TV and its applications.

Chapter 2

Mobile TV and its Applications

2.1 The Rationale for Mobile TV

Mobile TV is a new and emerging service, and it is expected to be a major driver of the mobile market in the coming years. Benefits differ from one user to another and from one company to another, according to the type of implementation and the technology utilised by the distributor (Wilson 2007). Sodergard (2003) states that being able to view TV on the move, using small mobile devices in different contexts, is beneficial. The benefits of mobile TV can be analysed from different perspectives, as shown in Table 2.1 below.

Chipchase et al. (2007) provide a number of motivations for using mobile TV, as follows:

1) Reducing boredom: watching TV to pass the time, for example during the user's travel by train, or waiting to depart to their desired destination.

2) Feeling of uniqueness and distinction: the desire to be the first can be sufficient in some cases to make people use a service, but unfortunately this reason might become the same reason why the same user might decline that service later on.

3) Staying up to date with news, information and shows: staying up to date with new events can be a motivation for mobile TV adoption. The most popular events were music concerts, sport shows and short movie clips – most users in the research of Chipchase et al. were young, and these users stated that news was not important to them.

Participants		**Benefits**
Consumer (Subscriber)	End-user (personal)	• Entertainment (e.g. sports, movies, shows, presentations) • Education (mobile TV learning) • Keeping up to date with information or news • Location based services (e.g. maps) • Auction participation (e.g. Reverse bid) • Interaction with TV shows (e.g. voting, posting opinions, etc.) • Watching, storing and replaying anytime and anywhere • Feeling of uniqueness
	End-user (business)	• Increased proficiency • Open new venues for improving B2C and C2B interactions • Viral marketing – generating customer awareness through sending video content to people • Strengthening customer loyalty • Keeping up to date with information (e.g. stock exchange) • Advertising products through mobile TV

		advertisements
Content Providers		• Emergence of new revenue generating models • Increase in market share • Open venue for emerging development such as 'infotainment' programmes, 'advertainment' and 'advermation' (mixture of entertainment, advertisements and information) • Open venue for a variety of applications in education such as m-learning
Service Providers		• Emergence of new revenue generating models • Increase in market share • Opportunity of being connected with rural areas
Device Manufacturers (If successful in developing suitable technology for mobile TV)		• Leading in technology • Competing in the market • Increasing sales • Increasing consumer loyalty • Opening channels for new revenue sharing model with others such as content providers and/or service providers

Table 2.1: Benefits of Mobile TV for All Participants

The benefits of using mobile TV services are summarised as follows:

1) It provides consumers with a real-time mainstream service to their mobile devices. Consumers can watch their favourite shows almost 'anytime, anywhere'.

2) It allows consumers to interact with TV shows. It could also be used to buy any product through advertisements just by clicking on the product displayed in the video content.

3) Consumers will not miss anything from their favourite shows. Clicking on the 'time-shifting' button gives the viewer total control over stopping the streamed content and then continuing the streaming from the point at which it was paused. This could happen, for instance, when the consumer receives a telephone call while viewing content.

4) Being able to remotely access video content on mobile devices allows users to be informed, updated and entertained during their leisure time.

5) Consumers are able to access different types of video content on one device while on the move.

6) It enables users to enjoy watching video content and replay the content freely without limitation.

2.2 Mobile TV Technologies

Mobile services can be traced back to the 1980s when the relevant technology was developed (Kumar 2007). Similarly, mobile TV services were able to be launched when the relevant technologies were developed.

2G technologies are GPRS and EDGE networks. Firstly, general packet radio service (GPRS) is a "*packet switched network on the circuit switch-based GSM networks*" (Kumar 2007, p.105). GPRS enables video data to be exchanged between consumers. Secondly, enhanced data rates for GSM evolution (EDGE), also known as Enhanced GPRS, provides users with higher transmitting data rates than the rates provided by GPRS (Kumar 2007).

Satellite broadcasting technology provides users with direct delivery of mobile TV to their handsets, using WiMAX or WiBro (wireless broadband). Worldwide interoperability for microwave access (WiMAX) offers fixed mobile internet access to users. WiBro is high speed internet access which uses WiMAX bands (Kumar 2007).

Furthermore, other technologies can be applied to mobile TV, such as terrestrial broadcasting technologies, i.e. T-DMB, ISDB-T, MediaFLO and DVB-H.

2.3 Mobile TV Standards

Like most new technologies, there are several different standards for mobile DTV broadcasting (See Table 2.2) that have been adopted around the world (Ironi 2009). The various standards for mobile TV grant involved parties opportunities to develop their preferred proprietary standards and vie for market share in a particular country or region (Lin 2010). Successful standards can be either proprietary or open. Open standards have an advantage over proprietary standards in allowing greater interoperability between devices if they are adopted by different vendors. On the other hand, proprietary standards may allow greater customisation for particular devices or applications, producing greater efficiency of operation. From the several different standards available, there are a few main competitors in the broadcasting domain. The selection of technological standards usually involves politics, business interests, compatibility to legacy/existing technology, sustainability and cost (Lin 2010).

The main two competitors in the broadcast domain are Digital Media Broadcast (DMB) and Digital Video Broadcasting - Handheld (DVB-H) (Ambulant 2006). Of these two standards, DVB seems to present the optimum user experience because of the available bandwidth. However, spectrum stability and availability will play a leading role in the success of both technologies. For example, in the UK, the spectrum needed for the DVB-H standard will not be available until 2012 when the analogue TV system shuts down. However, even at that time, there is no guarantee that the analogue TV spectrum will be allocated to DVB-H. There are many other technologies looking to utilise this spectrum, and governments worldwide recognise the fact that wireless spectrums are a valuable commodity for which a premium price can be asked (Ambulant 2006). Poor technical choices for standards create a high social cost (Lin 2010). However, a small country such as Singapore will find it hard to afford the high social cost of poor standard choices. So far, Singapore and many other countries have adopted a technology-neutral approach to mobile TV in order to avoid the risk of selecting inappropriate standards.

The mandatory standard, like South Korea's DMB, initiated the take-up of its mobile TV industry (Lin 2010). In the UK, British Telecom (BT) is promoting the DMB standard that they have been testing (Bowser 2007). Virgin Mobile took its DMB standard into the UK market (Bowser 2007). Whether it is successful or not will depend on the number of subscribers, but there are some concerns about the available bandwidth, which has implications for the picture and sound quality.

Table 2.2 summarises the acronyms, definitions and advocators of some of most significant distribution technologies (standards).

Standard	Description
ATSC-M/H	• ATSC (Advanced Television Systems Committee): documents a digital television format. • ATSC-M/H (Advanced Television Systems Committee - Mobile/Handheld) is a standard used in the USA for mobile TV, which allows digital television broadcast signals to be received by mobile devices. • It was developed by the Advanced Television Systems Committee, and is expected to replace the analogue NTSC television system, for example, on June 12 2009 in the United States, August 31 2011 in Canada and December 31 2021 in Mexico.
DAB-IP	• DAB Digital Audio Broadcasting (DAB), also known as Eureka 147, is a digital radio technology for broadcasting radio stations, and was launched specifically in the UK. By 2006, there was more than one thousand stations worldwide broadcasting DAB format. • Advocators: Samsung, LG
DMB (Digital Multimedia Broadcast)	• T-DMB (Terrestrial Digital Multimedia Broadcasting) – examples: South Korea, Germany

	• Advocators: Samsung, LG
	• S-DMB (Satellite Digital Multimedia Broadcast) – examples: South Korea, Japan
DVB	• DVB-H (Digital Video Broadcast - Handheld) – this standard is used in Europe and some Asian countries. • Advocators : Nokia, TI, Microsoft
	• DVB-S (Digital Video Broadcasting over Satellite) - first generation was developed in 1994 and was continuously developed until 1997.
	• DVB-SH (Digital Video Broadcasting - Satellite services to Handhelds) the specification is designed for the delivery of audio, video and data services to handheld devices. However DVB-SH is designed to support hybrid satellite/terrestrial networks that use S-band spectrum.
	• DVB-S2 (Digital Video Broadcasting - Satellite - Second Generation). Developed to replace the DVB-S standard, this was launched in 2003.
CMMB	• CMMB China Multimedia Mobile Broadcasting – China.
ISDB and ISDB-T	• ISDB (Integrated Services Digital Broadcasting) – Japan and Brazil. • ISDB-T (Integrated Services Digital Broadcasting - Terrestrial) – this standard is used in Japan.

HSPA+	• HSPA+ (High Speed Packet Access) contains two mobile telephony protocols: first, High Speed Downlink Packet Access (HSDPA) and, second, High Speed Uplink Packet Access (HSUPA), which improves the performance of existing protocols. A further standard later evolved (known as HSPA+).
MBMS	• MBMS Multimedia Broadcast Multicast Service. Advocators: Ericsson
MediaFLO	• MediaFLO is also known as FLO TV. FLO in MediaFLO stands for Forward Link Only, which means that the link is one way from the tower of the device. MediaFLO system transmits data on a frequency separate from the frequencies used by current cellular networks. MediaFLO was launched in the US and was developed by Qualcomm. • Advocators: Motorola
TDtv	• TDtv is based on TD-CDMA technology. It joins IPWireless UMTS TD-CDMA with 3GPP Release 6 Multimedia Broadcast Multicast Service (MBMS).
1seg	• 1seg is based on Japan's ISDB-T.

Table 2.2: Mobile TV's Most Popular Standards (Kumar 2007; Luo 2008)

2.4 Applying Mobile TV

Mobile TV services have been applied in many countries worldwide. Three countries will be investigated in this section, namely Jordan, England and South Korea, as the latter was the first country to apply mobile TV. The three countries are categorised into two groups: firstly, the countries that utilised mobile TV commercially (England and South Korea) and, secondly, the country that did not (Jordan). This section investigates the first category while the second category will be addressed later in this research.

In May 2005, TU Media, the South Korean telecommunication company, was the first operator to launch commercial mobile TV (Chipchase et al. 2007). Seoul's subway has good cellular connectivity and mobile phone usage is common. It is quite different from the London underground system where there is no connectivity, which is deemed as one of the barriers to implementing mobile TV (Chipchase et al. 2007). Virgin is looking to provide consumers with new services that allow the downloading of videos to handsets and the ability to store content to be viewed in areas that are out of coverage, such as London's underground. Thus, the problem of poor reception of video material in London's underground would hopefully be solved (Wray 2007).

South Korea started offering mobile TV services to train passengers and TU Media is working to ensure that no interruption will occur to the mobile TV service on the move (Chipchase et al. 2007). However, in some cases it is difficult to ensure that no interruption will occur at all because there is no guarantee that while users are utilising the underground the signal might not become low due to fading, resulting in a reduction of signal power (Pahlavan and Levesque 2005). In addition to this, while users are using mobile TV on the move, interference can occur with other users on the same cell. For example, TU Media installed base stations in shadow areas to improve the signal quality, but the Chipchase et al. (2006) study shows that participants still complained about the lack of coverage.

South Korea led the way in developing this sector. Then some European countries took the lead such as the UK; and "*British Telecom (BT) was the first company outside South Korea to implement mobile TV"* (Pistoia 2008, p.87). Although mobile TV services are not commercially available in Jordan, users do watch video content on mobile devices. Content is downloaded video or video captured using the mobile camera, which is then viewed later on.

2.5 Mobile TV Usage

Broadcast video is the most commonly used viewing method by the world's consumers (Chipchase et al. 2007). The Trefzger (2005) study predicts that mobile TV will attract millions of subscribers in the upcoming years – as proven by its success in countries such as South Korea, which has a high penetration of mobile TV services. South Korean consumers have access to a variety of ways of watching TV on a mobile device, among which are: downloading videos from PCs, streamed from websites, video-on-demand and broadcast video.

Researchers have pointed out that usually new technology is used by early adopter individuals and after that spreads to general use (Carr Jr 1999). Rogers' theory concerning the rate of adoption from a marketing perspective is defined as "*the relative speed with which an innovation is adopted by members of a social system*" (Rogers 2003, p.23, cited in Hinsch 2010, p.52). Initially, the adoption of new technologies is slow and the diffusion among the majority of people tends to become slow after the market is saturated. Bass (1969 cited in Maloney 2009) devised mathematical equations to calculate the expected adoption rates of innovation.

Table 2.3 represents the difference between using mobile devices and mobile TV, and how they can be classified.

Mobile Phone usage	**Mobile TV usage**
Calls	Downloaded Video
SMS and MMS messaging	On-Demand Video
Audio (Music)	Live Video
Camera	User-Generated Video Content

Table 2.3: Mobile Devices and Mobile TV Usage

Mobile TV is assumed to be a different TV viewing experience (McQueen and Reid 2005) of broadcast, mobile-generated and downloaded content – using a mobile device connected to a wireless or broadcast network. All types of mobile TV create the whole mobile TV market (Ambulant 2006).

User-generated content such as podcasts can be downloaded to any video player. Websites like youtube.com, google.com, yahoo.com and myspace.com are sites that host user-created content. In addition, these sites have moved from hosting content for viewing to allowing downloads, so viewers can download this content onto their mobile devices such as a mobile phone, PSP, PDA, laptops, iPhone, iPod or any other video player (Ambulant 2006).

Ultimately, there are some barriers to the adoption of mobile TV, which must be addressed in order to gain the maximum level of operation and activation of a mobile TV service.

There is also a need to know the contexts in which this service is used (See Chapter 8, Section 8.3). Mobile TV services are thought to be acceptable by users only if the device is to be used in different situations or different viewing contexts, where the mobility feature of the device is relevant (Sodergard 2003). The subsequent research examined the different contexts of mobile TV usage and identified what users prefer. Chipchase et al. (2007) state that there are four main user contexts for mobile TV: *1)* home; *2)* commuting; *3)* micro and macro breaks; and *4)* secret use. Knoche (2005) states that the usage of mobile phones revolves around the three general user areas of home, work and public. O'Hara et al.'s (2007) research went into much more detail. Observing that mobile TV is consumed in numerous places – including "*trains, buses, cars, airport lounges, work cafeterias, people's desks, in the* *office, cafes, the gym, the hospital, on the walk to school, and the school playground*", they found that mobile TV is also used in places where traditional TV, or other video consuming mediums, are available.

2.6 Mobile TV Types

There is two main ways of delivering live mobile TV (Liang et al. 2008):

- Via a two-way cellular network.
- Through a one-way dedicated broadcast network.

Depending on the way the content is distributed to the devices, there are three methods of delivering content to mobile devices using wireless technologies as follows:

1) Offline Mobile TV

With offline mobile TV, video content is pushed to consumers' mobile devices to be stored and viewed later on. It is well-known that at certain times of the day there will be spare capacity on the network, so the content is downloaded easily and then viewed at a later time (Laine and Mittermayr 2006).

2) Connected Mobile TV

Connected mobile TV is streaming video over mobile networks. Many mobile operators have launched a mobile TV service using the 2.5G and 3G networks and will use the upcoming 4G network to stream a variety of live TV channels to subscribers. Up to 2006, there were no major technical problems, because subscribers were still small in number (Laine and Mittermayr 2006).

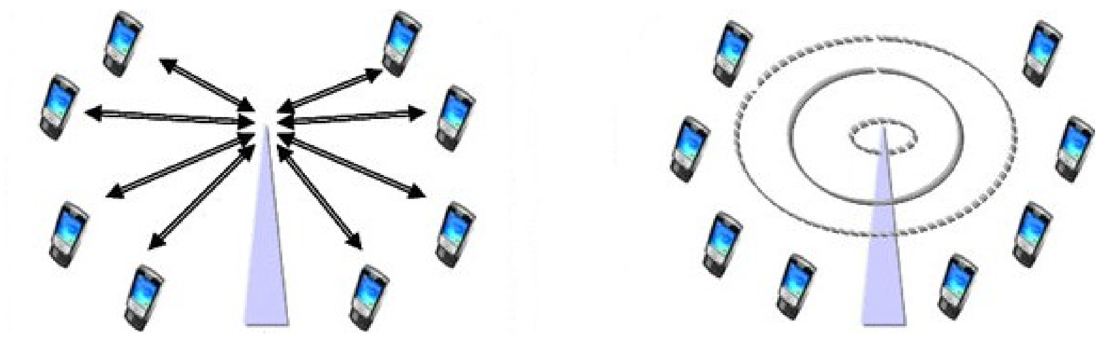
3) Pure Broadcast Mobile TV

Pure broadcast mobile TV is concerned with the delivery of video content through broadcast networks only. There are a number of standards that allow video content to be broadcast to mobile devices. A mobile device which the user carries has a built-in mini TV receiver (Laine and Mittermayr 2006).

With regard to last two methods of delivering content to mobile devices, namely connected mobile TV and pure broadcast mobile TV, both of these methods use internet protocol (IP) for broadcasting mobile TV content (Laine and Mittermayr 2006). The previous classification is not a convenient model because the last two categories are similar.

2.7 Mobile TV Transmission and Content Delivery

Content can be delivered to users either individually (unicast) or delivered to all subscribers (broadcast). Mobile TV services using 3G networks do not use multicast or broadcast; instead unicast is used (Zhang et al. 2008). Figure 2.1 represents the way content is transmitted to mobile devices.



Unicast Broadcast and Multicast

Figure 2.1: Content Delivery and Transmission to Users

A different classification of content delivery or transmission would be as follows:

- Unicast transmission refers to the "*sending of information packets to a single destination*", e.g. mobile phone (Armitage et al. 2006, p.46).
- Broadcast means transmitting or "*sending a packet to all destinations*" (Armitage et al. 2006, p.46).
- Multicasting is similar to broadcasting, but is implemented in a more efficient manner. For instance, it identifies a subset of users to broadcast TV to their handsets. When multicasting is unavailable, unicasting the exact same content to many users can be costly. Internet Radio stations may have high bandwidth costs because of this (Comer 2008). Unicast approaches may eventually run into capacity limits and cause high costs. However, this problem might be defused or even overcome with multicast solutions. Broadcast transmission does require new handsets and a dedicated broadcast infrastructure (Bauer et al. 2007).

These terms are also used for streaming content to users without delivering the content, such as the working principle of YouTube. Unicast servers provide a stream to a single user at a time, while multicast servers can support a larger audience by serving content simultaneously to multiple users.

Out of more than 120, most of the commercially launched mobile TV services worldwide are based on existing two-way cellular networks (Ericsson 2007), using unicast transmission systems. By using unicast systems, the content is transmitted separately from a single source to a single destination, such as from a server to a mobile handset. In this case, each individual user gets the desired content. Using broadcast systems, the same content is delivered to a very large number of mobile handsets in a single transmission.

Metcalfe's Law represents the network and how users are connected (Satchell 1991). Metcalfe's Law illustrates the network effects of communication services such as the World Wide Web, mobile applications such as TV, and the Internet. Metcalfe's Law states that the usefulness, or value, of a network equals approximately the square of the number of users of the system N^2 (Odlyzko and Tilly 2005). Metcalfe's Law adds that a network with n users has n (n-1)/2 connections between them (Odlyzko and Tilly 2005).

Some examples of Metcalfe's law are presented – a 5-person network (N=5) may have a utility value of 25X. And so on: N=6: 36X, N=7: 49X, N=8: 64X. A 12-person network may have a value of 144X.

The number of connections is important for mobile TV applications such as mobile learning and mobile commerce.

2.8 Mobile TV Stakeholders

The potential size of the mobile TV market is clearly an important factor. Many different stakeholders are involved in the provision of mobile TV services. The mobile TV value chain consists of many players, all of whom are looking to develop their market share. These players are classified by Trefzger (2005) as follows:

- Service providers.
- Content providers and media companies.
- Network operators.
- Content aggregators.
- Subscribers and consumers.

Advertisers should be added to the list as one of the stakeholders because mobile TV service consists of advertising. In addition to that, device manufacturers and technology developers should be included in the list because of their responsibility for providing the infrastructure required to the mobile TV service.

Content developers and media companies are always keen to seize the larger part in this equation by increasing the revenue or possibly through sharing revenue with service providers (Trefzger 2005). The service providers are the second party in this equation who are seeking to enlarge their share by generating the largest revenue from pay-per-view or subscription. The third party is advertisers. Marketers are looking for new marketing techniques by shifting to mobile solutions – mobile advertising – because of a reduction in perceived cost effectiveness of traditional terrestrial TV advertising models.

The fourth party is the broadcast network operators, who are installing new technologies and licensing these technologies to others. The fifth party comprises content aggregators such as Yahoo, YouTube, MySpace and others providing mobile TV users with downloadable content and generating revenue from advertisements. The sixth party is made up of device manufacturers and technology developers, who are hoping that users will buy the latest gadget, and who are hoping to sell new technologies to service providers, etc. Finally, the most important factor – the consumer (Trefzger 2005) is the target to be supplied with the service that all of the previous parties are waiting to benefit from.

With respect to collaboration between stakeholders, it is expected that models will be designed for individuals with tailored content and interactive mobile advertising, and they will be able to view content that is suitable according to mobile TV regulations and standards, making it easier for the user to view almost any content on any device (Ambulant 2006).

2.9 Mobile TV Interactivity

Interactivity, in theory, is "*the extent to which users can participate in modifying the form and content of a mediated environment in real time*" (Steuer 1992, p.84); however, practically, significant delays in real-time response can negatively affect the experience of the user. Interactivity is examined as a communication process in which each message is related to the previous messages exchanged, as well as to the relation of those messages to the messages preceding them. There are three levels of interactivity (Rafaeli and Sudweeks 1997):

1) None-interactive, when a message is not related to previous messages.

2) Reactive, when a message is related only to one immediately previous message.

3) Interactive, when a message is related to number of previous messages and to the relationship between them.

Interactivity is executed on mobile devices, which enable users to interact via keyboards, touch screens or any I/O devices. Mobile devices even encourage users to be more engaged or involved in interactive applications.

2.10 Mobile TV and Handsets

Mobile TV is now available to be used with a wide range of applicable mobile devices (O'Hara et al. 2007). Mobile phones have transcended their role from being a device for communication to providing a multitude of additional services. Handsets are the intermediation interface for mobile TV users.

Kumar (2007, p.xv) states that: "*Mobile handsets present the most visible facet of the cellular mobile industry*." Mobile handsets have continuously implemented additional applications, such as multimedia messaging, video conferencing, video-on-demand, cameras capturing images and video, download of documents and mobile TV. TV is expected to be the component that will drive the demand for the next generation of mobile devices.

Mobile manufacturers need to produce devices that can operate through different types of networks, roam through technologies and play content from different types of formats (Kumar 2007). Virgin Mobile is going to supply the market with new mobile TV handsets (Wray 2007). Motorola have announced significant progress in the mobile media arena by introducing a Motorola mobile TV DVB-H compatible device, with mobile TV broadcasting solutions. Lightweight mobile devices, such as the personal media player, expand consumers' mobile TV experience to almost 'anytime, anywhere' for live or recorded TV (Robertson 2008). These devices enrich the mobile TV experience. Another example is the iPhone, which has some specific mobile TV capability such as high-standard widescreen display that is easy to interact with, the low battery consumption compared to many other devices, and the considerable internal memory size.

2.11 Mobile TV Consumers' Experience

Consumers' viewing experience of mobile TV over cellular networks is different because of interactivity and portability. The mobile TV market is a market full of promise, or is already fulfilling its promise. According to Telephia there are six million mobile TV users in the US, with a 188% yearly growth. According to M:Metrics, (the Mobile Media Authority), 11% of 3G users report watching video on their mobile phones (Wilson 2007). In Korea, it is a different case – their mobile TV service is more developed. According to Gerbarg (2008) advertising-based (free) mobile TV is being used by 9.7 million mobile users, while fee-based (paid) mobile TV is used by around 1.3 million.

Wilson's (2007) survey revealed that users aged 55 years old and above, along with about 21% of the people surveyed, said that a number of offered applications and services improve accessibility and make life easier or safer for elderly people, as well as helping people who need medical assistance. This proves that there is an acute need for a mobile TV health application, especially for people with medical needs. Mobil-click is a mobile device that allows elderly and disabled people to call for help when they touch a button – it was first launched by Vodafone in Germany. The three large buttons make it a very easy device to use. It enables people who are suffering from heart problems to have their blood pressure checked through the mobile phone (Wilson 2007).

Content could be a major barrier to adoption of mobile TV services. Lack of compelling content is a challenge facing adoption of mobile TV. Addressing the content barrier is achieved through various steps such as: tailoring content to mobile devices, which is already starting to appear (Kumar 2007), and enabling users to choose what to watch on mobile TV by switching the channel until they find the content they are interested in.

Content developers are supposed to generate TV content that is targeted and segmented according to geographic territories and languages. For instance, some countries such as Jordan and England are expected to reject TV sharing and device lending because of their individualist cultures, even though they might enjoy sharing certain videos, especially tailored ones, with family and friends. Koreans, on the other hand, have a totally different view, in that they do often share TV content or lend their devices, because of their collectivist culture (Chipchase et al. 2007).

Nevertheless, consumers must find the content interesting and reasonably priced in order to purchase the mobile TV/video service. Table 2.4 presents the results of a study conducted by Nokia, which indicate that 83% of the test group are satisfied with the mobile TV/video service and 76% say they would sign up for the service within twelve months (Digital Transactions 2006).

	Finland	UK	Spain	France
Positive response to mobile TV	58% believe the service would be popular	83% are satisfied with the service	75% would recommend the service	73% are satisfied with the service
Willingness to pay for mobile TV	41%	76%	55%	68%
Acceptable monthly fee for mobile TV	$10	Unknown	$5	$7

Table 2.4: Results from Nokia's Study (Digital Transactions 2006)

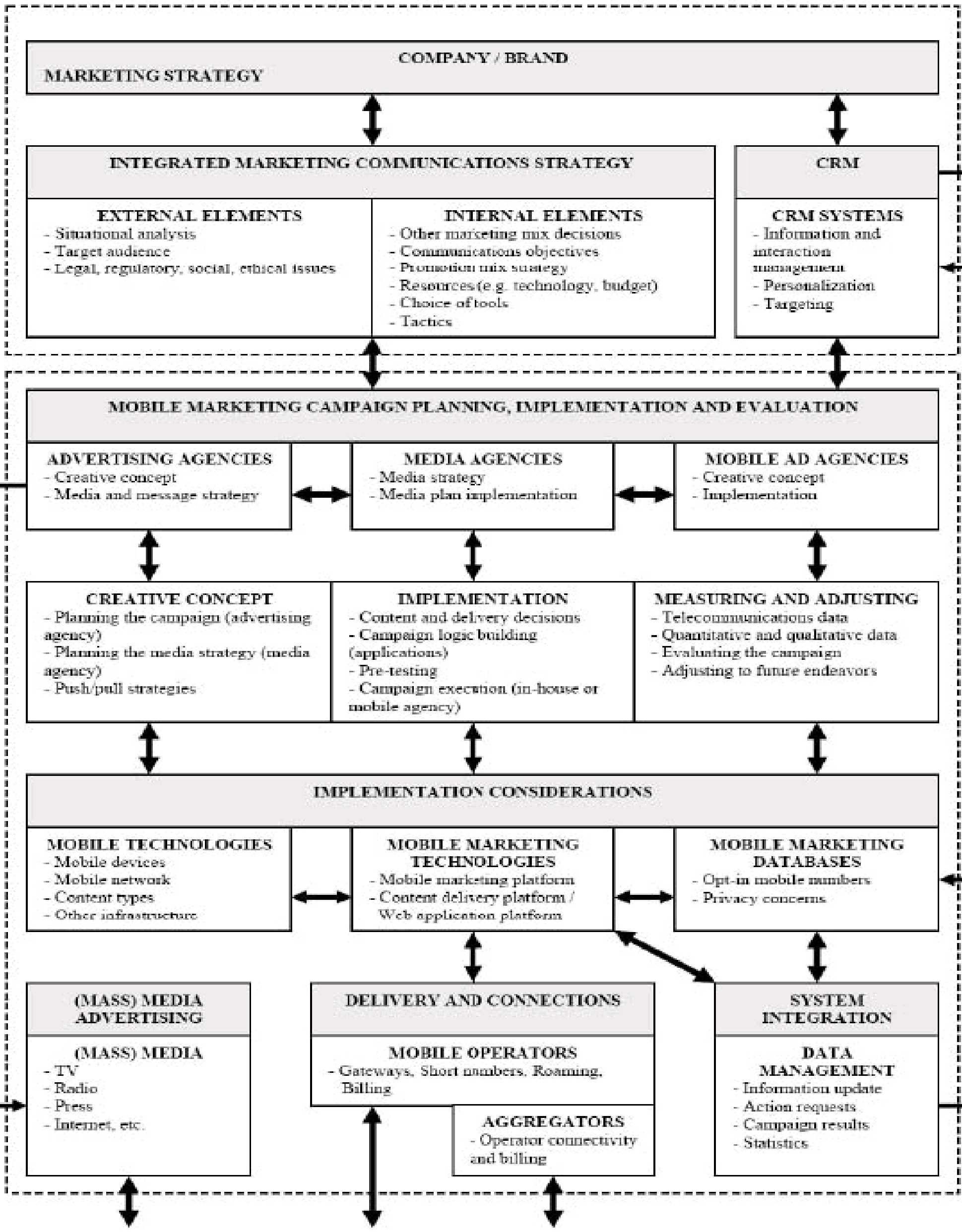
2.12 Background to Mobile Marketing

The Mobile Marketing Association defines mobile marketing as "*the use of wireless media as an integrated content delivery and direct-response vehicle within a cross-media marketing communications program*" (Marriott 2006). Mobile marketing is marketing for, or with, a mobile device, such as a mobile phone. Mobile marketing is the use of the mobile medium as a communication and entertainment channel between a brand and an end-user. Mobile marketing is a personal channel enabling spontaneous, direct, interactive and/or targeted communications, any time, any place (Mobile Marketing Association 2004).

Velti is a marketing company, one of the leaders in its field, with good prospects, although it is still in its early stages. According to Velti, the traditional marketing media are not accepted anymore, and the increasing amount of people using mobile phones creates significant opportunities for marketers to target users personally with the new methods of marketing. However, some rising obstacles, such as privacy, should be taken into consideration. Another obstacle might be the user's unfamiliarity with the new types of marketing (Kavassalis 2000).

Regarding mobile marketing, the following figure represents a framework for the mobile marketing environment.

= Framework of Mobile Marketing Environment



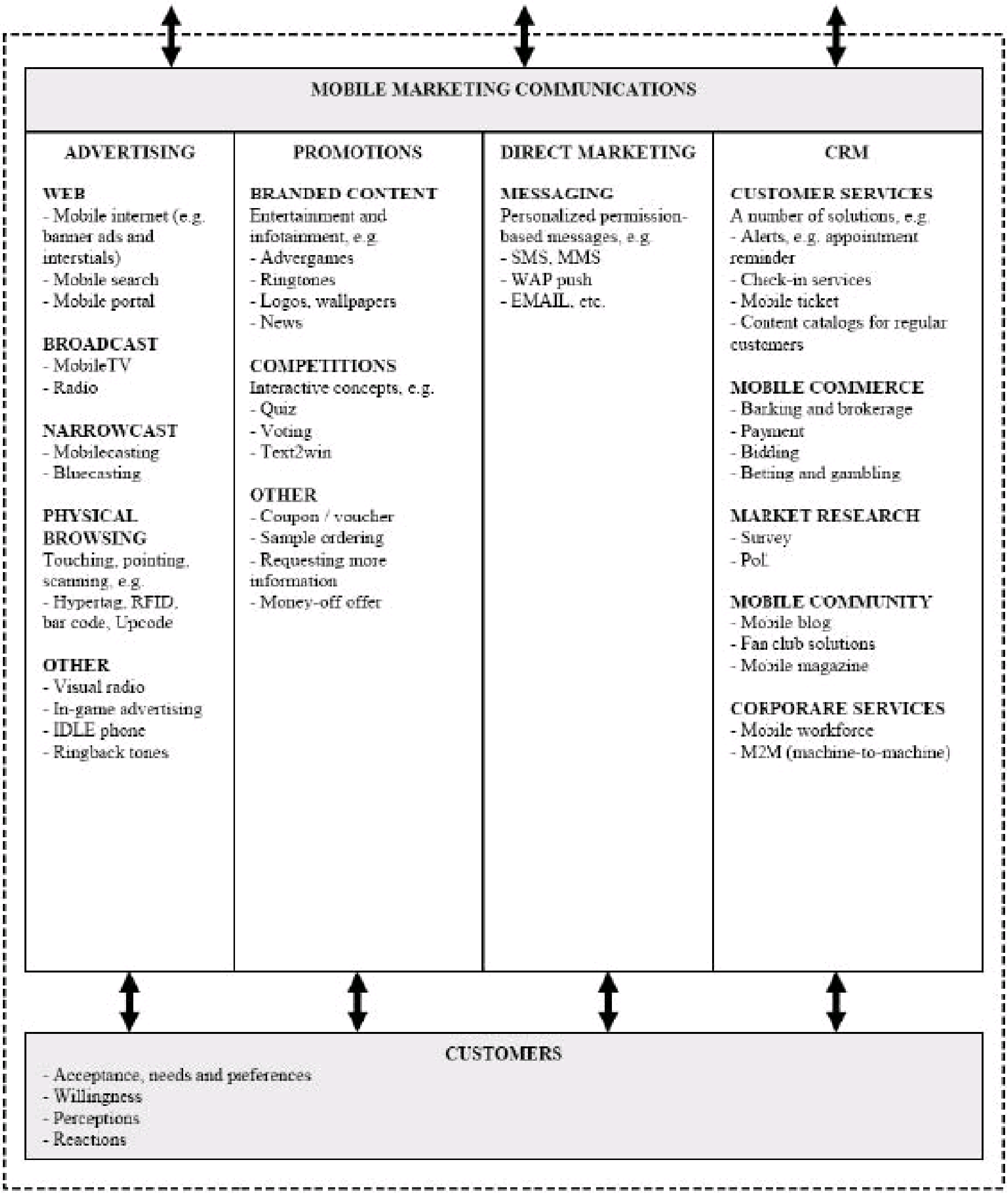


Figure 2.2: Mobile Marketing Environment (Mobee 2007)

2.12.1 Mobile Advertising

It is useful to give some explanations and definitions related to mobile TV advertising as follows:

- Mobile advertising is a form of advertising via mobile (wireless) phones or other mobile devices. It is a subset of mobile marketing (Mobile Marketing Association 2009).
- Mobile TV advertising is new revenue earning business area for the operators (Joarder 2007).

Mobile advertising is "*a form of advertising via mobile – wireless – phones*" (Kavassalis 2000, p.2) or other mobile devices. Currently, mobile phones and the Internet are the key drivers toward a new advertising era (Maheshwarri et al. 2008). Mobile advertising is conceived by other markets as using mobile web banners (top of page banners) or mobile web posters (bottom of page banners), while, in other markets, it is dominated by SMS advertising. Other kinds of mobile advertising include MMS advertising, such as in mobile games and mobile videos (Mobile Marketing Association 2008). Laura Marriott[2] said that mobile phone advertising might be "*the silver bullet we've been looking for in advertising for a long time*" (Richtel, 2006).

Mobile networks started to implement advertising in the mid 2000s, but advertisements on mobiles are still only a small fraction of the whole advertising industry (Indian Television 2005), which is estimated to be worth

[2] Laura Marriott, Executive Director of the Mobile Marketing Association.

$2 trillion by the year 2020 (Jackson and Andrews 2005). Mobile advertising worldwide totalled $2.7 billion in 2007, and by 2012 it is expected to be $19.1 billion (Pearce 2008). Yet, advertising on mobile phones is expected to spread extremely fast in the coming five years, creating a market worth more than $11.3 billion – £6 billion – annually (Wray 2006). eMarketer forecasts that mobile advertising will reach $14 billion by 2011 (MobiADNews 2007). Mobile advertising is expected to exceed revenue of $12.8 million in 2011 (Gartner 2008 cited in Vasco 2009). Mass markets have fragmented. Therefore, impersonal mass communication, especially media advertising, has become less effective, whereas targeted one-to-one marketing communications have become more important (Webster 1992; Peppers et al. 1999; Shaw et al. 2001).

Some examples of advanced mobile advertisements include those devised by Sprint Nextel, which said that it would start offering a banner advertisement service at the present time to consumers. These will be provided by mobile startup Enpocket. MVNO Amp'd Mobile said that it would broadcast advertisements on its video channels sponsored by Procter and Gamble (Fehrenbacher 2006).

Advertisers are increasingly trying to maximise the relevance of advertisement content to individual users by tailoring campaigns to users' age, gender, location and personal interests. Kurt Sillen, Vice President of Ericsson Mobility World, says: "*Customized mobile advertising adds value to existing Mobile TV services*" (3G.co.uk 2006).

Mobile TV advertising will gain high revenue, valued at approximately $4.4 billion by 2011 (Wray 2006). This estimation is based on worldwide users paying for downloaded content for a video-on-demand experience and for being charged for mobile TV services per month. In 2006, the American mobile advertising industry rose to $421 million and, according to the eMarketer research firm, it is expected to increase further until it reaches $4.7 billion by 2011 (Time Warner 2007). The differences in predictions and estimations could be a proof of the under-development of the mobile advertising market.

Mobile TV is expected to be a key driver of the mobile market. The service has started to take off and, in some cases; companies have started applying mobile TV advertising. Global mobile marketing and advertising is estimated to reach $3 billion by the end of 2007, and will increase sixfold to $19 billion by 2011 (ABI 2008 cited in Seric et al. 2010). For instance, a UK study, conducted by Informa Telecoms and Media and reported in the trade journal Marketing Week, predicts that the global mobile advertising market will be worth $11.3 billion by 2011, a significant increase on the earlier forecast of around $871 million for the year 2006 (Lester 2006a cited in Wilken and Sinclair 2009).

A significant body of opinion is against mobile TV advertising, taking the view that advertisements on mobile internet and TV services are 'irritating' for consumers, according to new research (Fitzsimmons 2007). There is a view that branded content and opt-in Bluetooth downloads are better for reaching consumers who use mobile devices such as phones, music players and game devices in large numbers worldwide (Fitzsimmons 2007). There are some complaints from users about getting interrupted by advertisements if they are not targeted and with no prior permission.

2.12.2 Comparison between Traditional and Mobile Advertisements

According to Google's chairman, "*any future development would involve internet-based TV,*" and "the company *would have to establish a much better metrics approach than the current broadcast TV advertising offers*" (MarketingVOX 2006).

Traditional television is no longer a reliable way of reaching an audience because the audience is becoming fragmented across more channels and their attention is being competed for across other media, the inability to target specific groups to the same extent means it could be less cost effective and the numbers of TV viewers are shrinking. Therefore traditional 30-second advertisements no longer meet the requirements of the advertisers (3G.co.uk 2006). Therefore, in the UK, online advertising has overtaken television advertising (informitv 2009). Traditional TV that broadcasts advertisements transmits channels to consumers free of charge. If mobile TV will be broadcasting the same type of content displayed on traditional TV, then it should be free and funded by the advertisements. These advertisements would be accepted by users on mobile TV. Receiving a free service is an option that most of the users prefer rather than being charged for the service.

On the other hand, mobile TV would be charged for, if users wish to have a service with no advertisements.

Video on mobile devices is a significant opportunity for marketers to directly reach the consumers (Burns 2006) and gain the attention of the largest number of them everywhere, even when they are on the move. This obviously requires the agreement of the carrier (Richtel 2006), and it must be done with targeted criteria. On fixed traditional TV, many advertisements are wasted because few people give them attention. Schmidt says that Google started testing mobile advertisements in Japan. It was found that response rates were similar to web advertisements and have expanded worldwide. The company is working with text advertisements and audio creations, and it has distributed them according to Google's targeting criteria (MarketingVOX 2006).

There is a need to analyse what kind of advertisements will succeed and how to get the attention of the consumers. Learning a lesson from the decrease in the number of viewers of advertisements on traditional TV, product placement is perhaps a solution to avoid the skipping of advertisements (Turow 2006) using DVRs. One issue that should be taken into account is the usability of interactive TV advertisements on mobile phones, which enable the users to view the advertisements that match their tastes and to interact directly with them rather than forgetting all about the products that were just viewed – for the reason that by the 1990s an average American was viewing 3,000 advertisements per day (Gentile 2003). This is a new scenario for advertisers and companies to deal with. They are more aware now of the need to attract consumer attention, reflecting on the fact that increasingly TV audiences prefer to change or mute the channel when commercials start. Moreover, they have also become increasingly apt at blocking advertisements from their field of vision (Webster et al. 2005, p.195).

2.12.3 Product Placement and Mobile Advertising

Product placement is a type of advertisement that could be useful in this context because it does not disturb or interrupt the recipient. Product placement is commonly used to create excitement about the launch of new products (O'Guinn et al. 2008). Product placement varies from cars to food to clothes. As mobile TV services are used in certain contexts where continuous short videos with no commercial breaks (normal advertisements that halt the programmes on traditional TV) are preferred, product placement suits mobile TV well because it enables users to enjoy the viewing experience of a short video without distraction. Product placement embeds the product in the video displayed, saving users' time as well as providing them with a 'better' viewing experience.

An example of product placement displayed on TV is the brand 'FedEx' in the films 'Matrix Reloaded', 'Transformers' and 'Cast Away'. Surprisingly, sometimes a show creates a brand by placing a nonexistent brand; for instance, in the show 'Friends', the coffee shop has become a famous brand that can be invested in later on.

Product placement has been proved to have multiple advantages that make it suitable for mobile TV. The following advantages will be fully explored in further chapters, product placement:

1) Does not interrupt users' viewing experience.

2) Can fund mobile TV services.

3) Saves time where advertising and entertainment are combined so watching a movie includes viewing advertisements.

4) Enables users to interact directly with the product by buying the product or getting more information about it.

5) Influences the user's opinion of the product, especially if a favoured celebrity is using it.

6) Reaches more consumers via the commercial message.

7) Raises awareness about the use of the product.

8) Informs consumers of the product itself.

9) Removes the boundaries between the consumer and the manufacturer.

10) Extends the opportunities for marketing. This is what is currently known as the new interactive mobile advertising service.

However, on the other hand, product placement is thought to bring some concerns regarding video production risks, such as its potential to ruin the show or movie, making it into one long advertisement, at the expense of artistic or politicised content.

2.13 Mobile TV Applications

Mobile TV is predicted to be one of the most important new services that will penetrate society through new applications, a vast market and big investments. Former applications used prior to mobile TV were simple applications, which mobile phone providers operated to help all sectors of the community. The following are some of the main pre-existing applications of mobile TV services.

2.13.1 Mobile Blogging (Moblog)

A moblog is a form of blogging in which users publish blog content from a mobile device. The key point is the idea of video blogging, which is interesting since it is all about publishing and uploading videos to the user's blog. Mobile blogs can be closer to 'real time' and can be updated when on the move. Mobile blogging has given birth to the new journalistic activity of capturing videos of breaking news when traditional reporters are not around (Chen 2006).

2.13.2 Comics and Cartoons

Comics and cartoons are two of the most compelling services to be launched as mobile TV services. In the UK, the famous ‘Alex’ cartoon of the Daily Telegraph’s business pages has been popular as a mobile TV application, as are Japanese ‘manga’ comics worldwide.

2.13.3 Mobisodes

Mobisodes are brief video shows specially tailored for viewing on mobile devices. Instead of broadcasting full shows, mobile operators display just a few minutes of popular tailored content, which is provided to subscribers upon request (Ankeny 2009). Tailored content is generated through recording and capturing videos of any event or festival, which can be blogged, published as a mobisode, or simply sent to other users using handheld devices.

2.13.4 Filmmaking

Mobile filmmaking initially used animation, and then moved to producing movies using mobile device cameras. Before movies were produced on mobile devices, people used to download video content onto their mobile devices. The future of mobile devices’ tailored content will lie with global, creative and interactive user-led filmmaking (THE AGE 2006).

2.13.5 Sports

One of mobile TV's applications is sport, such as football matches displayed through football portals, football news, match result tickers, player statistics, and much more. Another example is the Olympic Games in 2012 in London which, thanks to mobile interactivity, will enable people travelling to attend the games to stay connected to the whole event and not just the event they are going to watch.

2.13.6 Tracking (Stalking)

Stalking is described as people being tracked. Users are able to find out what websites other people have been browsing, what programs they have been running, or even what videos they have been watching. If users agree to be tracked, then users will allow their viewing history to be known. An example is 'YouTube', which basically allows users to share their uploaded videos with all viewers (Mowery 2007).

2.13.7 Video Conferencing

Mobile video conferencing is a meeting of people at different sites who 'get together' using telecommunication video and audio, a facility offered by 3G services. In addition, video conferencing can be used to share documents.

2.13.8 Viral Video and the New Age of Media Reporters

Viral video refers to video clips that are shared among, and sent by, multiple mobile devices. Some amateur users capture videos of an event when professional reporters were not present or were not able to capture it. An excellent example is the video of the woman who tried to attack Pope Benedict XVI, which was captured on a mobile phone by an American couple attending the Christmas Eve Mass in the Vatican. AP New Agency showed this video in all its news reports of the event.

2.13.9 Mobile Learning

Mobile learning, abbreviated to ‘M-Learning’, allows distance learning using portable devices. Mobile devices create new opportunities for gaining knowledge, practical experience and up-to-date information. Using mobile TV, mobile learning can entertain and teach simultaneously. In addition, it enables users to interact with information rather than only receiving it.

2.13.10 Cameras

Using a mobile camera to generate videos that are used for CCTV or spying is yet another available option. It can be applied as a mobile TV application, as streaming TV for security or spying. Vibo is the company that released the first 3G web cameras that can also operate as mobile phones (Kenson 2006). Another example is using cameras to fight crimes. Since crime records are high in South Africa, mobile TV film of crimes, captured by unprofessional users, can help fight crimes in places where the police force is not immediately available.

2.13.11 Business on the Move

Mobile TV services could be used for navigation – for users to view videos of roads and places they are searching for, so as to avoid wasting time searching for an address. Mobile TV could also display information about public transport timetables and schedules, door-to-door delays, and other transport news.

2.14 Conclusion

This chapter has presented the different views of researchers on mobile TV services regarding technology, opportunities and user experiences. Mobile TV is a service that offers TV on the move. Mobile TV is not only suitable for real-time video but also downloaded video and video-on-demand. There are three ways content can be transmitted to mobile TV users: broadcast, unicast or multicast. Mobile TV services are operated through several technologies via terrestrial and satellite distribution (such as DVBH, T-DMB, S-DMB, MediaFLO, ISDB-T), but there is no single global standard (Urban 2008). Mobile TV delivers a number of services including video-on-demand (VOD) and live content. This content is either ordinary or tailored. Another method for one-to-one broadcasting is podcasting, where content is delivered to a mobile user on demand free of charge or through subscriptions. However, the business model or value chain of mobile TV services includes many stakeholders, which can increase the complexity of the situation.

It can be assumed that mobile phones were designed to be carried continuously by users. It is concluded that there is an opportunity for using mobile TV in many contexts, but there are differing opinions regarding which are the most useful or important. Mobile TV contexts are classified into four categories. Each category has its own context and reason for viewing.

Some of the reasons behind using mobile TV services are freedom to watch video almost anytime, reducing boredom, the feeling of uniqueness and distinction, and staying up to date with news, information and shows. However, many challenges could hinder the adoption of mobile TV.

Other conclusions are that many applications can be designed, created and then applied to mobile TV. The mobile TV applications section discusses some pre-existing mobile TV applications.

Advertisements are a type of content displayed on mobile TV. It is possible for advertisements to fund mobile TV services in order to encourage more users to participate. In addition, there are a large number of users who could be targeted by advertisers. Users' participation is revealed in interactive advertising. Mobile interactive advertising was discussed in this chapter and its advantages and disadvantages were summarised. Interactive mobile advertisements must concentrate on enabling users to gain full control of their viewing experience. One of the issues raised in this research is the usability of advertisements in interactive TV displayed on mobile phones. Most television programming in the world is funded by advertising, so interactive TV advertisements on mobile devices are a new avenue for advertisers and companies to utilise in order to attract the attention of consumers, thus generating revenue. Revenue from traditional services is falling for a number of reasons, including the fact that people have devised strategies to ignore advertisements, or alternatively they are using technology that can remove advertisements from programmes that have been stored short term. Here, the idea of product placement can solve advertisers' problems. However, TV companies need programmes that attract the consumer. Mobile TV offers a special kind of content that is tailored to short attention spans. Sport is one of the most acceptable types of content. The dominant expectation is that the content has been compressed

– i.e. programmes are much shorter – which is not the case with traditional TV. This means that there will be no time for advertising interruptions.

The next chapter is concerned with the future of mobile TV.

Chapter 3

The Future of Mobile TV

3.1 Mobile TV and Traditional TV

Mobile TV is not traditional TV on mobile devices as it is viewed as a different experience to that of traditional TV (Knoche and McCarthy 2005; International Engineering Consortium 2006). Mobile TV is not a replacement for traditional TV – rather it is about adding new services and functionalities, to deliver video content to people in specific contexts. Consumers might use mobile TV even though they own a large screen medium because it is not so easy for large mediums to be used 'anywhere, anytime' like mobile TV (Ambulant 2006).

There is a difference in the viewing experience of traditional TV and TV 2.0. The latter's characteristics are based on the mobile viewing experience: 'anytime, anywhere' (Mashup 2007). Table 3.1 presents a comparison of traditional TV and mobile TV from different perspectives, provided by the Mashup event TV 2.0 speakers and this research.

Traditional TV	TV 2.0
Stationary	Mobility
Content is produced by content providers	Any selected item could be produced by users (user-generated content)
It is a motionless service and watched at particular times and in specific places	It is an almost anytime anywhere service
A very high number of productions, high cost for sales and distribution	A very low number of productions, low cost for sales and distribution
Is totally arranged with content providers or high cost professional reporters and studios	Is totally arranged with amateurs or low cost professional reporters and studios
Non-reactive	Reactive because, for instance, professional or amateur reporters are used
Editors suggest and decide what is displayed in a show	Editors become users when they suggest and decide what to be displayed in a show
Total content provider produced contents	Total self-produced content, or edited parts of existing content
24/7 limited or non-interactive feedback	24/7 interactive feedback

Table 3.1: A Comparison between Traditional TV and TV 2.0

Upon conducting the above comparison between two viewing experiences, a number of questions were raised and left unanswered. Future studies should take these questions into consideration. These questions are classified into categories related to mobile TV content, service providers, content delivery questions, social aspects and categories of mobile TV media. The questions were based on the knowledge of the experts in the mobile TV field who were also speakers in the debate.

- Mobile TV content questions: Who will generate most of the content for fragmented audiences? Professionals or amateurs? What will happen to content editorially made for audiences? What does ‘no constraints’ in terms of access to TV content really mean for data delivery across constrained networks?
- Mobile TV content delivery questions: Which platform will be the most important? Web, mobile or broadcast? Mobile TV social aspects question: Will there still be a shared social experience, e.g. ‘What did viewers think of the Eastenders storyline last night?’
- Mobile TV Service providers’ questions: Who will be the dominant players, and which interests ‘lose out’ to rapid technology change?

Considering the questions mentioned above, many of the outcomes will be in the hands of users, who will decide in what measure they will view mobile TV tailored content or re-purposed content, as displayed on traditional TV.

3.2 Mobile TV Challenges

Mobile TV challenges are classified into five groups according to the type of challenge: cost; device manufacturers and technology; content developers; mobile devices; and service providers.

3.2.1 Cost Challenges

Cost is one of the main challenges to the users' adoption of mobile TV services. Firstly, the high cost of handsets that enable users to use mobile TV service remains a main problem at present (Al-Hawamdeh 2004; Knoche 2005). Secondly, there is the cost of the mobile TV service itself. Gideon Bierer from MTV Networks argues that a mobile TV pricing model should be a combination of subscription and pay-per-view (Kelly 2006). Different pricing models, from a service provider's perspective, are either fee-based or advertising-based (Bauer et al. 2007). Pricing models could be evaluated from a broader media business perspective according to Urban's (2008) study, which classifies pricing models as pay-per-view; free model; one-time fee; and, finally, subscription. Urban (2008) adds that the free model is the most popular. Holland (2006 cited in Urban 2008, p.30) mentions that "*the experience of pilot projects supports this assumption*".

From a consumer's perspective, the problem is with the content delivered to mobile devices. Bhebhe's (2008) study states that viewers do not want to pay a fee for a service which is a replica of the content they receive on TV at home. Mobiles should create a new TV viewing experience with different content.

3.2.2 Device Manufacturers' and Technology Challenges

Device manufacturers need to react to challenges that hinder the adoption of mobile TV services. This section considers device manufacturers' technology challenges for the period before and after 2006. From 2004 until 2011 the problems were as follows:

1) High power consumption: A mobile's battery life is very important for portability. If the power consumption is high, it limits the use of mobile TV services (Al-Hawamdeh 2004). In 2009 further improvements were carried out, but battery life still remained the main barrier to mobile TV adoption (Buchinger et al. 2009). The power consumption challenge can be addressed through time-slicing, as applied by the DVB-H standard (Kumar 2007). Up to 2011, battery consumption is a limitation of mobile devices (Ceri and Brambilla 2011). Mobile devices battery performance is not going to change in the near future (Gargenta 2011).

2) Limited memory: Some of the current memory capabilities are not suitable for long hours of mobile TV viewing. By 2009 a substantial improvement in memory capacity resulted in a situation where many mobile devices in the market had large memory and storage spaces

(Hefeeda and Hsu 2010). Time-slicing for transmission was available due to some possible limitations of memory, which were related to the reduction of power consumption (Buchinger et al. 2009). In 2011, mobile devices still have a memory and storage limitations (Lobo et al. 2011).

3) Limited processing power: Device manufacturers must improve processing power significantly to support millions of instructions per second (MIPS) required for mobile TV (Al-Hawamdeh 2004). But up to 2008, processors still had limitations (Bhebhe 2008). Up to 2011, processing power is still a limitation of the current mobile devices (Yin and Carswell 2011).

4) User interface design: In 2004, most handsets were not very user friendly and lacked attractive displays. Since then new handsets, with improved LCD displays and user interfaces that support mobile TV have become commercially available (Al-Hawamdeh 2004). The availability of interactive displays does not automatically mean that those displays are user friendly. In 2009, the user-friendly experience was still a challenge; for instance, navigating through menus was still a problem and there was a debate about whether these should be replaced by special TV buttons (Buchinger et al. 2009). Up to 2011, the small interface of mobile phones is considered to be a limitation to the use of these devices (Zhou et al. 2011).

5) Bandwidth limitation: Bandwidth is usually more to do with the price to charge for it, if the technology is already in place. But in this category the discussion is about the limitation of bandwidth that prevents new users from utilising the service. As mobile users increased, there was a higher amount of shared content, which led to lower bandwidth capacity (Al-Hawamdeh 2004). In 2009, limited bandwidth was still a challenge, with poor picture quality or slow playback being key problems (Buchinger et al. 2009). Another view states that bandwidth is not something that users should worry about – people will eventually be able to view videos through mobile devices as they do with computers (Magaia and Victor 2009). This view seems unrealistic because both viewing methods are radically different. Up to 2011, mobile devices have still bandwidth constraints (Lobo et al. 2011).

6) Service quality limitation: Up to 2004, connection stability and improving signal quality were key challenges (Al-Hawamdeh 2004). There were improvements in 2007, but reception quality was still a problem (Constantiou and Mahnke 2007). By 2008, there were still problems with connection. For example, mobility restrictions and poor roaming were challenges encountered by Dual Mode Handsets (DMH), a term which emerged from iPhone, and which is a WiFi-enabled cellular device (Dialogic 2008). Up to 2011, mobile devices still have issues with quality of the wireless service (Lobo et al. 2011).

Moore's Law reveals the time limits for addressing device manufacturer challenges. According to Moore's law, the doubling of speed or service size occurs every eighteen months (Edwards 2008). When this law is related to mobile communications, the following points should be taken into consideration.

Firstly, processors used in mobile phones should be able to process the received content during a short period of time, preferably whilst consuming low amounts of power. There are some new technology processors that have high processing power, using advanced RISC machine (ARM) technology. Their processing speed is up to 1,000 MIPS (Smith 2005). It is recommended that mobile TV services need 500-1,000 MIPS, as in PXA3xx Monahans (Marvell n.d.).

Secondly, bit rate (Mbps) is related to transmission rate and is equally important for video transmission because it must be able to cover the whole movie or video duration. Transmission speeds of 3G started in 2001 with 2 Mbps and then increased up to 10 Mbps and more, which is adequate for TV transmission (Ghys et al. 2003; Kioskea 2009). Transmission speed is expected to be doubled every one and a half years, and it is believed that 4G will exceed 100 Mbps (Rosenberg and Kemp 2003). Other researchers disagree and expect that 4G data transmission rate will only reach 20 Mbps (Al-Kasasbeh et al. 2008). Although 3G is capable of running mobile TV services, 4G will create significant added value by accommodating application requirements such as mobile TV. In this research, calculations using Moore’s Law (as shown in Figure 3.1) show that, in terms of transmission speed, the development from 3G to 4G will have gone from 2 Mbps to in excess of 100 Mbps within nine years.

Thirdly, a bandwidth of 6 MHz is able to cover TV transmission and, in the case of mobile TV video, compression can be applied to enhance and reach an adapted bandwidth as well as a reasonable bit rate (Clear Channel Satellite n.d.).

Fourthly, it is important to select a fast access memory to perform the data accesses required for all processing within the permitted time for video transmission.

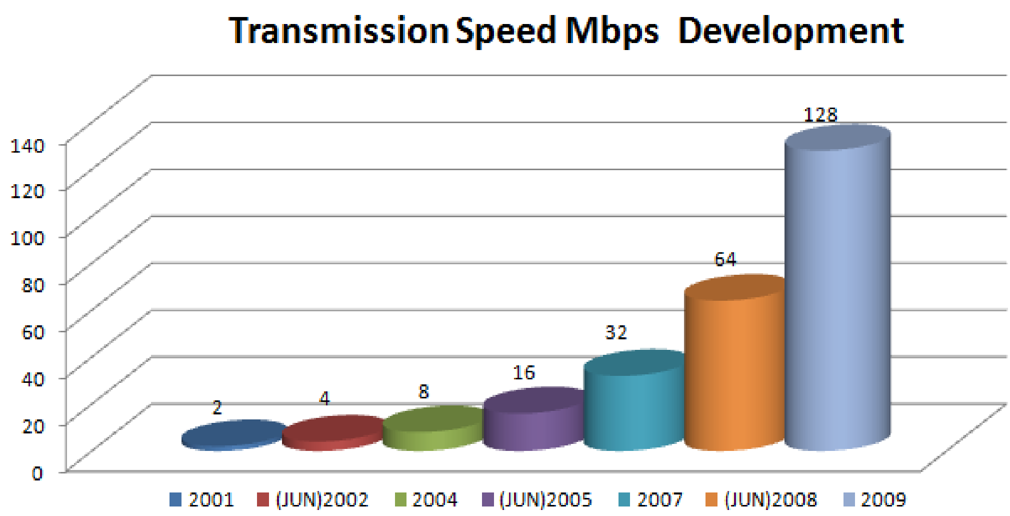


Figure 3.1: The Development of Transmission Speeds According to Moore's Law

Based on Moore's law, calculations carried out by this research demonstrate the following results: 3G technology was commercially launched in 2001 and by 2010 4G was commercially available. The 3G bandwidth is currently 6 MHz, so it needs 7.5 years to achieve 4G's bandwidth, which was expected to be over 100 MHz by 2009.

Due to the high licensing costs for the additional spectrum, the launch of 3G networks was delayed. Additional delays were also caused by the cost of upgrading equipment for operating new services. 3G technologies are currently applied in many countries. Therefore, technically speaking, mobile TV is operational now and is available in many countries. Moving to 4G technology will enrich the quality of mobile TV. Thus, 4G can be considered an improvement on 3G in relation to the mobile TV viewing experience.

3.2.3 Content Developers' Challenges

Content developers are responsible for generating attractive and compelling content for mobile devices and the user base. One of the challenges facing mobile TV adoption is that there are two different, yet connected, worlds – the first is the consumers' world, while the second is the developers' world. In other words, developers can produce content without first knowing what the consumers' needs and interests really are. In Finland mobile TV has been facing a slow takeoff because of limitation such as the lack of content (Kanervo 2011).

Once the users' preferred content has been established, the content developers need to control the video quality by optimising video frame size, frame rate, colour depth and compression. These four video properties are defined as follows:

1) Frame size is defined as "*the number of pixels in each row x column and of bits per pixels*" (Wireless Center 2006).

2) Frame rate: "*The refreshing video frame rate is number of frames per second. Decreasing video frame rate reduces the bandwidth consumption but compromises the smoothness of the video movement*" (Wireless Center 2006).

3) Colour depth: "*The number of possible colours represented by a pixel. A 256-colour video requires 8 bits of data per pixel; a 16 million-colour video requires 24 bits of data per pixel*" (Wireless Center 2006).

4) Compression: "*Reduction of the bandwidth consumption at the expense of image quality. Examples of video compression standard include MPEG1, MPEG2, MPEG3, MPEG4 ... MPEG7, and MPEG 21*" (Wireless Center 2006).

3.2.4 Mobile Device Challenges

Mobile device challenges between 2004 and 2011 are summarised as follows:

1) Small size keyboards: Most mobile devices have a numeric keypad that includes a number of cursor keys, but its small button size is deemed as a limitation (Al-Hawamdeh 2004). However, a keyboard's limited size is related to a user's need for a small and light mobile device (Buchinger et al. 2009). Touch-screen mobile devices have addressed this challenge to a certain degree. Up to 2011, limited keypad is still to be a limitation (Zhou et al. 2011).

2) Screen size: With the continuous improvement of mobile phone resolution, screen sizes are likely to remain small as long as users prefer small and portable devices (Al-Hawamdeh 2004; Buchinger et al. 2009). Improving mobile devices' screen size is not an option if users are still interested in small device sizes (Urban 2008). The main concern is that service quality is related to screen size, as the resolution reduction leads to a loss of detail (Buchinger et al. 2009). Still up to 2011 mobile devices have screen size constraints (Lobo et al. 2011).

3) Stability, dropouts and connectivity coverage are major concerns for all users on the move (Ministry of Internal Affairs and Communications 2009). There is a need to be able to use mobile phones with a good signal at any time. Up to 2011, mobile devices have connectivity problems (Lobo et al. 2011).

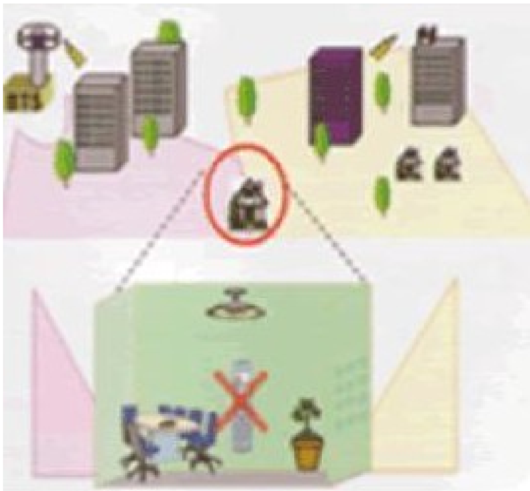


Figure 3.2: Indoor Poor Mobile Signal (Ministry of Internal Affairs and Communications 2009)

4) Fashionable devices and simple user interfaces: both of these aspects encourage users to adopt mobile devices. For instance, when on the move, there is no time to read manuals and instructions in order to be able to use mobile devices' facilities. In addition, fashionable devices are attractive to users who wish to use them to make a fashion statement to others being the early adopters.

3.2.5 Service Providers' Challenges

The following points summarise the service providers' challenges in providing mobile TV:

1) Multiple technologies and standards are used: the spread of multiple technologies (Al-Hawamdeh 2004) in markets like the UK will determine which standards are introduced to the market first. DAB standard is available to be received in parts of the UK market (Spurge 2001), but it is expected to take a few years before it moves to DVB-H standard because DVB-H is waiting for the spectrum of analogue TV to be released (Owens 2006). All broadcast standards face a similar problem, which is the need for a suitable spectrum – apart from some standards such as DAB which is using a spectrum via digital radio (Owens 2006). Until DVB-H is widely deployed, an increasing number of users of DAB will find it problematic and costly (e.g. buying new equipment that suits the new standard) while the timescale to completely shift to DVB-H is also significant (Ambulant 2006). It seems

that most operators are testing a variety of solutions but they are very slow in providing them to consumers (Owens 2006). In some countries frequencies in the range of DMB are not assigned to the service, therefore the development of DMB was stopped and other platforms such as MediaFLO were deployed (Bauer et al. 2007). Another challenge is the compatibility of different frequencies. For example, if the DVB-H standard is used in Spain while a different frequency is used in France, it is not guaranteed that user devices would be compatible with frequencies in both countries. From a device manufacturers' perspective, different hardware options will increase costs, and ultimately high costs are a problem for users.

2) Lack of quality: the quality of the mobile TV service remains the main problem at present (Al-Hawamdeh 2004; Knoche 2005). Up to 2011, still the low quality of the image is considered to be a limitation as stated by Bouteiller (2005 cited in Casero 2011).

3.3 The Future of Mobile TV

The purpose of discussing the future of mobile TV services is to explore the opportunities for attracting users to this novel service. But, before doing so, it is the responsibility of all parties involved in the mobile TV market to educate people about the service and its multiple uses. Only when all these challenges and more are addressed will mobile TV become, as expected, the 'Next Killer Application'.

Although mobile TV services are still in the early stages in most of the developed countries, there are some high expectations that services will grow rapidly in the coming years (Englund 2007). There is now a general expectation that mobile TV will create significant added value for customers by providing several services to meet users' requirements. Therefore, new mobile TV services will add value in more than one domain, for example enabling users to check London's stock exchange while on the move or to listen to some important announcements. Moreover, a new service, mobile TV learning, is an addition to the teaching domain by educating people on a mass scale. For example, students can view some video lectures on mobile devices. Advertisers can benefit from mobile TV, which could open a new channel for their offerings, and mobile operators seeking to gain more revenue will probably work their best to make mobile TV services available for customers. The media sector will be working on generating especially tailored video for mobile TV. As a tool for entertainment, it reduces boredom, for instance while travelling, to watch a movie, sports or other event. Mobile TV enables users to miss none of their favourite programmes displayed on traditional TV, especially if the context where users are found does not allow them to use traditional TV, for example while camping.

eMarketer, a market research firm, indicated that in 2006 there were 44.5 million 3G subscribers worldwide who used mobile TV services on their mobile devices, and predicted that this figure will be doubled yearly to reach 520.9 million in 2009 (BBC 2006). Mobile phone providers must find new ways of transmitting content with the help of 3G networks, but it is expected that with the implementation of the 4th generation (4G) satellite networks users will have greater ability to receive direct broadcasts. The fact that both mobile TV services and the necessary technology are available means that, over time, the service will mature and diversify. Research conducted worldwide suggests that mobile TV will become increasingly important in the mobile market. Predictions have been made that the mobile TV market will be worth about $15bn by 2011(Ambulant 2006).

So, it is evident that mobile TV might become popular among users and could be heavily utilised. Furthermore, mobile TV is feasible and reasonable given the high rates of mobile device and TV usage, in addition to the long periods of TV consumption in the mobile world and established user behaviours. For instance, mobile TV in South Korea is highly adopted (Trefzger 2005). Evidence shows mobile TV is expected to generate worldwide revenue of up to €5.1 billion in 2009. However, appliance of MBMS-technology in the cellular networks and further enhancements in the future are very likely to increase this business potential. For Germany this means overall revenues from mobile TV of about €165 million in 2009. Next to those 'premium revenues' generated by user fees, a further revenue potential exists in the form of advertising revenues from the mobile channel (Trefzger 2005). A well-established application will find its way among the large numbers of mobile subscribers.

In addition to this, and according to the MMA (Mobile Marketing Association), 23% of US subscribers watched video in 2007 (Wilson 2007). It is estimated that by 2010 more than 50 million people will be using mobile TV on a fee-based service, which does not include those who would use it as an advertising-based service (Curwen and Whalley 2008). In the USA specifically, there will be a growth in the mobile TV users, from 24 million in 2008 to 47 million in 2012 (Ernst&Young 2009). It is still unclear whether this expectation is based on satellite or terrestrial services, but it is expected to be a combination of both (Curwen and Whalley 2008). Informa expects that, by then, the mobile TV market will be worth $40 billion (Curwen and Whalley 2008). A report by Juniper Research in 2006 expected, conservatively, that the mobile TV market will be worth $11.7 billion by 2011 (Curwen and Whalley 2008), while Informa expects that the market will be worth $38 billion by 2011 – with 210 million subscribers (Curwen and Whalley 2008). According to Informa, more than 95 million subscribers, from the 210 million worldwide, will be in Asia-Pacific countries. Possibly because China has the world's largest population and mobile TV's largest potential market (Bhebhe 2008). A new report by Juniper expects that mobile TV's DVB-H based service will have 120 million subscribers by 2012. Consumer expenditure is expected to be $6.6 billion by 2012 (Bhebhe 2008). In conclusion, all these studies predict that mobile TV services will be used by a large number of users, and will successfully generate revenues.

On the other hand, there are some people who are not enthusiastic about mobile TV (Schuurman et al. 2007). This is mostly because of the lack of compelling content for mobile devices. Creating a rich mobile TV experience requires the overcoming of barriers, such as problems with channel changing. It can take up to a minute to connect to a TV signal after selecting a channel to watch. It might be acceptable during macro breaks to wait for a minute when a channel is changed, but it is not acceptable during micro breaks, when the user only has a few minutes (Chipchase et al. 2007). Content must be compelling for a service to be a success. Mobile TV will require both popular content from other mediums and tailored content generated specifically for this service (Chipchase et al. 2007). Further, alternative forms of content can be employed, such as copying content from PCs to mobile devices (Chipchase et al. 2007). The mobile TV subscription fee is also a challenge to the success of the service. This could be overcome by interactive mobile TV advertisements, or pay-per-click schemes, to fund mobile TV services. Alternatively, a cheap annual rate, as with traditional TV, could be paid. This might work if the mobile TV content is similar to that of traditional TV.

The three issues addressed above could be considered areas that companies in the mobile TV domain would be interested in developing and enhancing. In future, content developers must be innovative in finding new types of content, and in delivering the content users have been waiting for. If this is not achieved then mobile TV will not succeed. Mobile TV is a new service that offers all sectors a significant and ideal opportunity to try to build its own applications that enrich the sector's usage. Mobile TV must apply high levels of interactivity in order to give the user the authority to deal with their personal device in any manner they wish. Finally, enriching user-generated content is a must and could be achieved by providing users with better production tools.

The future of mobile TV is based on many factors, such as which technology is able to deliver video over mobile devices. While discussing the future of mobile TV, it is worth mentioning that the technical development of handsets, and an improvement in content delivery technology, will surely increase the number of users and, with that, the revenues generated by them. The 3G mobile network is currently capable of delivering mobile TV to users, and technical problems such as speed and bandwidth are being addressed, and with the new 4G these problems will hopefully be solved. In future, device manufacturers are expected to provide users with mobile devices equipped with wide screens, better audio quality, cheaper memories and better interaction I/O devices, as in the newly developed touch screens. Furthermore, newly developed wearable devices are able to address the screen size challenge, using personal display eyewear such as 'Argo MP/3G-2', which offers a six-foot distance equivalent to a 35-inch screen size (Felong 2007a). The wearable computer is under development in order to address interaction device challenges. Wearable computers may replace traditional interfaces, such as keyboards, with speech control (Felong 2007b). The parties who are involved in upgrading the mobile TV infrastructure are responsible for upgrading the network speeds and the transmission speeds. New standards must be applied and preferably unified worldwide.

3.4 New Mobile TV Applications

The following sketches are some examples of the applications that would be applicable on mobile TV service. A brief description of the services conducted through the use of mobile TV is discussed in the remainder of this section.

3.4.1 Mobile TV Marketing

These applications are thought to be the key drivers behind the use of mobile TV services. The following figure represents mobile commerce and advertising.

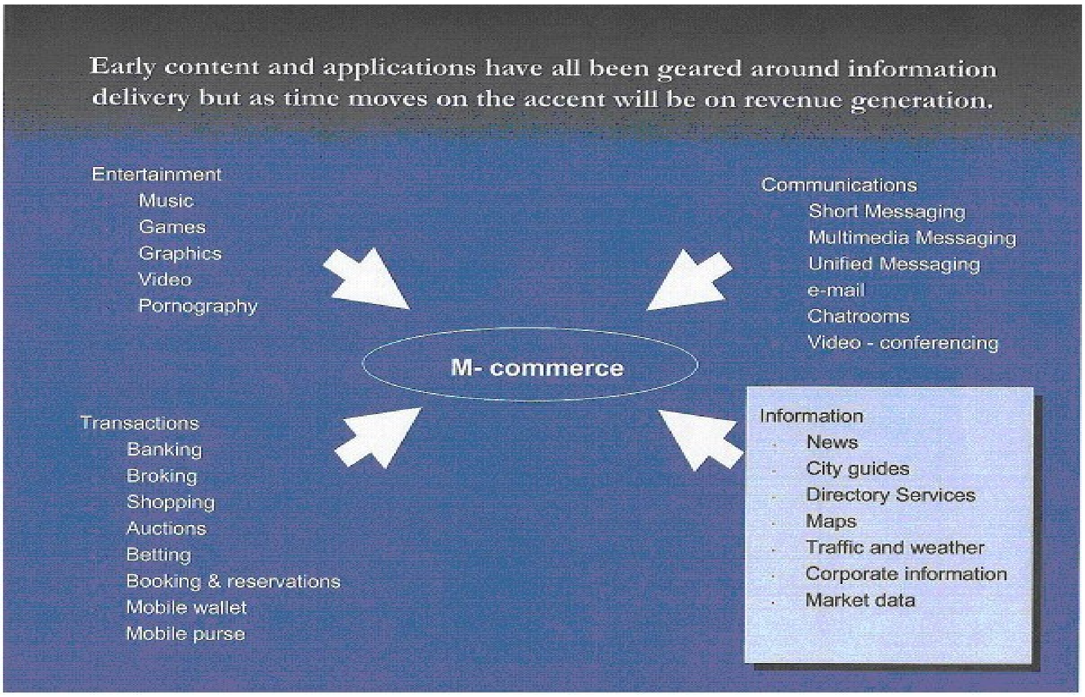


Figure 3.3: M-Commerce and M-Advertising (Awad 2006, p.1)

Digital video content streaming over mobile networks allows users to use a device to subscribe to a bundle of channels provided by mobile operators. The operators have deployed the mobile TV service looking for new areas to generate revenue that will pay back the high fee they have paid for the 3G network licence (Ambulant 2006). The generating revenue scenario could be through advertisements rather than consumers paying subscriptions. Consumers are more satisfied if they get this service free of charge.

1) Mobile TV Advertising

Mobile TV advertising is a new marketing solution. It is a direct and personalised method of advertising conducted through wireless devices by sending appealing video clips to viewers of mobile TV stations. A subset of mobile advertising is interactive mobile advertising, which allows mobile users to interact with advertisements displayed on their mobile devices. Interactive advertisements provide click-to-buy or click-to-know information options about the product embedded within the video. This is similar to the idea of 'infotainment' – that is establishing the idea of extrapolation from commercial advertising to non-commercial information provision and then using product placement as an alternative to web browsing. The main advantage attained from mobile advertising is receiving free or cheap mobile TV services as a result of the advertising revenue generated.

2) Mobile TV Commerce

M-Commerce applications are divided into two main branches: *1)* Shopping and purchasing: consumers can shop using websites linked to video content showing products displayed on their mobile devices; and *2)* Payments: Consumers can pay for their purchases using mobile devices.

3.4.2 Health Advice

Health advice is one of the mobile TV applications that can enhance human life by combining new technologies with services needed by users. The main service in this domain focuses on providing health tips, information on medical conditions, regulations and contact with responsible committees to the maximum number of citizens through interactive advertisements displayed on mobile TV. Another example is monitoring elderly people’s health. A contribution to this research is the idea of an application consisting of a CCTV camera, which works through scrolling buttons or knobs for interaction and is controlled by the users themselves. The aim of this application is to take care of the elderly who might be suffering from diseases, to remind them to take their pills, or to remind them of other medical requirements.

3.4.3 Mobile TV Tourism

Mobile TV can have a positive impact on tourists when it is used to show video content about the places to visit in a country or to give directions to hotels, restaurants, etc.

3.5 Regulatory Framework of Mobile TV Advertising

There will be some products that could be prohibited by mobile TV providers. Copyright or intellectual property is an issue to be considered. Detailed regulations are set by governments in order to control the market and protect people from infringements of the rights of others.

Since mobile TV is an evolving market there are no clear policies that regulate the service. Regulations play a key role in the adoption of new services. Unclear mobile TV regulations may negatively affect stakeholder engagement (Lin 2010). For instance, Singapore is cautious about launching mobile TV services because of unclear regulations.

Regulators can check other media formats to agree on regulations that suit mobile TV, or can modify pre-existing laws, rather than just applying them (Lin 2010). Therefore, the regulations of traditional TV could be applied to mobile TV. Whether traditional TV regulations are applicable to mobile TV is still questionable (Lin 2010). Mobile TV has exclusive characteristics such as interactivity, customisation and personalisation. Therefore, old media regulations are inadequate when applied to mobile TV (Lin 2010). Curwen and Whalley (2008 cited in Lin 2010) stated that broadcasting acts applied to traditional TV are not applicable to mobile TV for two reasons. First is the convergent nature of mobile TV. Second is that broadcasting acts are strictly – in terms of content – applied to traditional TV, which is funded by the public through a compulsory annual subscription.

Since mobile TV can be viewed by all age groups, it is important to ensure that people are not offended by video content. In addition, traditions and cultures play a broad role in regulating specific markets. For example, Singapore is a conservative country with multiple religions and ethnic groups. This may mean that some restrictions on content displayed should be considered. However, restricting content limits innovation and creativity. Hence, video content should be controlled and organised by appropriate regulations and laws. For a new converged service such as mobile TV, less strict regulations are appropriate. For example, the US has adopted a laissez-faire approach to control of mobile TV policymaking (Lin 2010).

Many countries, such as South Korea, Italy and Singapore, apply traditional TV broadcasting acts, or modified versions of them, to mobile TV (Lin 2010). This research will investigate the regulations specifically addressing mobile TV, bearing in mind that the services, not the platforms, are the things that should be regulated. Mobile TV provides video-on-demand, broadcasted TV, interactive videos, etc. and each service has different content codes and regulatory obligations (Lin 2010).

It is established now that content producers and broadcasters are responsible for what appears on screen. This statement is arguable, especially with online publishing spaces such as YouTube, as existing European law gives broadcasters and producers relative immunity from legal responsibility if they remove content when they are notified about it. An example is the recent case where Google executives in Italy were taken to court for allowing someone else's content to be displayed on YouTube. They were, however, found to be liable, which goes against existing European law. They will appeal, but this demonstrates that this area is a complex matter.

This does not mean that broadcasters and content providers are not responsible, as both self-governing broadcasters and the BBC confirm that they accept responsibility for fulfilling consumers' tastes and requirements. The fourth paragraph of the BBC Producers' Guidelines states:

"*The content of party political broadcasts, party election broadcasts and Ministerial broadcasts (together with Opposition replies) is primarily a matter for the originating party or the government and therefore is not required to achieve impartiality. The BBC remains responsible for the broadcasts as publisher, however, and requires the parties to observe proper standards of legality, taste and decency*" (Parliament 2010).

3.5.1 Mobile Advertising Regulations

Mobile advertising seems promising because it is personalised and targeted. It also represents a change from traditional media formats. Mobile advertising could be tailored especially for mobile devices. When talking about targeted and personalised advertisements, the sender must first have the permission of the user and information about the targeted recipient. Users' permission is needed in order not to cause them any disturbance or intrusion on their lives (Cleff 2007).

Recent research shows that the regulations of advertising on mobile devices are still unclear, and all agree that mobile operators are self-regulating. Consequently, most users are suspicious of advertisements displayed on their mobile devices (Advertising Standards Authority 2009). Users could self-regulate mobile advertising if they were authorised.

Advertising agencies should be aware that they might face many problems with different types of regulations in various countries, including from international trade laws (Stromdale 2007). Most countries have their own regulations (Stromdale 2007). Sometimes, a regulation in the seller's country is different from the buyer's and this can cause conflict as to which law is to be applied if there is a fault in a product, or if a product is legal in country 'A' and illegal in country 'B'. For example, in Germany it is illegal to advertise using the phrase 'two for the price of one', while in other countries it is legal (Stromdale 2007).

Governments are usually responsible for protecting their citizens, using laws and regulations, some of which control the use of advertisements. For example, the Commonwealth Trade Practices Act and the Fair Trading Acts of the various states in Australia create laws and regulations in order to compensate consumers if a company does not stick to its promises (Hudson 1999).

3.5.2 Mobile TV Advertising Regulations

Legal issues can affect joint simulcasts by, for example, ITV1 and mobile operators 3 and Virgin. Channel 4 is supposed to stop displaying advertisements on its simulcast broadband TV service, but argues that its mobile broadcasting is an extension of its TV services. The Institute of Practitioners in Advertising raised an important issue facing mobile agencies – actors and musicians can claim compensation if mobile advertising infringes copyright issues (Sweney 2006).

In the next couple of years, copyright will be a big issue and could possibly disable the video sharing process. Copyright is an important intellectual property issue, which is usually seriously enforced (Gordon and Bone 1999). Basically, copying other people’s work is allowed as long as the creator is referenced. It is difficult for users to understand copyright restrictions, particularly in cultures that do not have a strong concept of copyright ownership.

Two of the main legal aspects concerning mobile TV are permission systems and the radio frequency distributions needed to coordinate the spectrum in European countries, to stop radio frequency interference. EU countries are attempting to address both of these aspects through the Radio Spectrum Policy Group (RSPG) (Freshfields Bruckhaus Deringer 2006). The mobile industry needs to have a dialogue with the European Commission on how they can take advantage of the extra digital bandwidth when the European Commission switches off analogue TV. Hopefully, by showing the European Commission some worthy business cases that can help communities and address human needs, they will be able to win the spare spectrum for mobile TV use (Freshfields Bruckhaus Deringer 2006).

Two European countries are taken here as case studies for European regulation system: the United Kingdom and Italy. The UK regulator, Ofcom, is very attentive to how the 14 UHF channels will be used when the analogue terrestrial TV is switched off. There is a chance that these 14 UHF channels will be used for high definition TV (HDTV) or for mobile TV. As there are expectations that mobile TV services will be one of the mobile market's drivers, there is a need to assign spare channels to the service. Mobile TV will be allotted some of the spare channels using different types of technology standards, which will compete with each other to deliver the best mobile TV service. Ofcom predicts that, in the UK, terrestrial TV will not be switched off completely until 2012, although some channels could be released earlier than that. Digital Audio Broadcasting (DAB), private mobile radio (PMR) and Programme Managing and Special Events (PMSE) have reserved the UK's third band while Ofcom has reserved 20% of the whole DAB capacity for non-radio use. This band reservation helps in applying mobile TV using DAB-IP in addition to other new services (Freshfields Bruckhaus Deringer 2006).

AGCom, the Italian communications regulator, established a mobile TV regulation in May 2006 (Freshfields Bruckhaus Deringer 2006). This regulation gave mobile operators the opportunity to broadcast the football World Cup, which took place in Germany in 2006. AGCom took into account the regulations created by the UK's regulator Ofcom (Freshfields Bruckhaus

Deringer 2006). To summarise, both mobile operators and mobile content producers are required to follow the same regulations as digital terrestrial TV broadcasting when broadcasting video to mobile devices.

The Italian Ministry of Communications gave conditional permission to the content providers and mobile operators to follow the regulations while broadcasting (Freshfields Bruckhaus Deringer 2006). If the requirements are met, then the ministry is supposed to give permission within sixty days starting from the date of application submission. The requirements are usually related to the business model, capital capabilities and assets, and criminal records. The applicants must fulfil some conditions concerning what kind of shows to broadcast and mobile broadcasting standards. According to the regulations of 2006, a mobile TV provider must have a licence to broadcast content to mobile handsets (Freshfields Bruckhaus Deringer 2006). As for fixed digital terrestrial operators that already have a licence, they will be able to transmit content to mobile devices after stating this fact to the Ministry of Communications. So, an Italian operator will become an official mobile TV operator just by informing the Ministry of Communications of the technology standards used. On the other hand, mobile TV operators will face some barriers in the early stages of mobile TV services (Freshfields Bruckhaus Deringer 2006).

3.6 Conclusion

This chapter has presented the different views of researchers on the future of mobile TV services regarding adoption, revenue, challenges, new applications and regulatory frameworks. Mobile TV is a service that offers TV on the move. In addition, mobile TV allows video content to be viewed on mobile devices. It is concluded that mobile TV is not only suitable for real-time video, but also previously downloaded video and/or video-on-demand.

Many challenges could hinder the development of mobile TV. These challenges can be addressed by the different parties engaged in the mobile TV industry. It is concluded that mobile TV is facing many challenges because the service is still in its early stages, and during development new challenges will emerge until it reaches a stage where it is established. In order for this new service to be viable, the challenges must be addressed and resolved. Regarding the differences in researchers' views on the barriers facing mobile TV services, this research concludes the following. Mobile TV challenges can be classified into five categories, according to the party responsible for addressing such barriers: device manufacturers, content developers, mobile devices, service providers, and costs. In this research mobile device challenges are thought to be the easiest to address – as newly launched devices partially resolve some of the barriers. Technological challenges are thought to be the hardest as they are dependent on collaboration by different parties.

Other conclusions are as follows – many applications can be designed, created and then applied to mobile TV. The mobile TV applications section discusses some new applications. This research concentrates on interactive mobile advertising as an application. It also contributes to interactive mobile advertising by providing an alternative to break advertisements – that is, intervening in a show to display an advertisement. It is concluded that revenue is currently declining from advertisements on traditional television due to the increase in the use of other media. Therefore, new strategies could be offered for advertising, which could be utilised in both traditional TV and mobile TV. A further conclusion is that advertisements that are targeted at the users' needs are more effective for both the advertiser and the user. The experience of Google has demonstrated that such targeting is not seen as an imposition on the user but rather as added value.

Mobile TV is an emerging technology and for this reason the regulatory framework of the technology is not yet well established and needs development. Recommendations with regard to traditional TV regulations are produced and then applied temporarily, awaiting the formulation of a mobile TV broadcasting act. Currently it is still too early to forecast the future development of mobile TV regulations.

In future, providers need to overcome the slow takeoff of mobile TV adoption. This can be done by addressing the challenges, for example fashionable handsets, cheap prices, user friendly interfaces, regulatory framework, compelling content and service quality (Bhebhe 2008). In addition, future work should focus on seeking to evaluate which new applications are viable for mobile TV.

The next chapter is concerned with human–computer interaction via mobile devices and converged media.

Chapter 4

Human–Computer Interaction with Mobile Devices and Converged Media

4.1 Introduction

This chapter discusses the interaction environment of mobile TV services. In today's society, television is considered to be one of the major socialising agents (Smith and Wood 2003). Mass media, specifically TV, is a powerful socialising mediator (Berns 2006). The relationship between mass media and interaction can be divided into social or unsocial types. Literally, a non-conversational mass media, such as television, is unsocial interaction (Matheson 2005). While conversational mass media, such as a mobile phone, is a social interaction (a way for individuals to interact with each other). For example, people communicate with their families and friends and interact with other people using SMS and by voting using mobile devices. Mobile TV is a combination of both social and unsocial interaction. Viewing a video is unsocial interaction, while generating a video or uploading it to be viewed by others is considered a social interaction.

Although there are enthusiastic users at one extreme who will utilise modern technology (the so-called innovators or early adopters), there are users who are not so concerned, so it is the interface developer's responsibility to try to engage the latter with attractive and user-friendly designs. Smart designers do recognise that some users of new technologies are not concerned about these technologies because they have a need only to get a job done and having fun downloading music and movies (Shneiderman 2002).

Rogers and Scott (1997 cited in Mastrian et al. 2010) defines early adopters as the former ones to adopt new technologies. "*The first 13% of the population to adopt new technologies*" are the early adopters (Mastrian et al. 2010, p.49). Who adopts new technologies while it is developing is the technology adoption lifecycle. The technology analyst Gartner describes the hype cycle as a tool for assessing new technologies from many perspectives such as their related hype and mainstream adoption time (Volkmann et al. 2010). A graphical representation of the adoption of new technologies is called a hype cycle. This affects the way people perceive technology and also its rate of adoption.

This chapter will discuss human–computer interaction (HCI) with mobile devices and converged media. The aspects that will be covered are the definitions, levels, devices, legal issues, content and challenges. In addition, attitude change, design of interfaces and a few examples of HCI with mobile devices and converged media are presented.

4.2 Definition of Human–Computer Interaction

Interaction is “*the term used when an operator interacts with a computer by means of a set of input devices to achieve a desired effect*” (Daintith 2004, p.267).

> This interactive process is defined as “*describing a system or a mode of working in which there is a response to operator instructions as they are input. The instructions may be presented via an input device such as a keyboard or a mouse, and the effect is observable sufficiently rapidly, thus enabling the operator to work almost continuously. This mode of working is sometimes referred to as conversational mode. An interactive system for multiple users will achieve the same effect by time sharing*” (Daintith 2004, p.267).

Human–computer interaction and man–machine interaction (MMI) are two terms that represents the same concept. Even so, it is arguable that *the “terms which use ‘machine’ may be taken to have a wider remit than terms where the term ‘computer’ is used*” (Booth 1989, p.4). The term human–computer interaction is common in literature; therefore, this term will be used. A simple definition of HCI is “*the study of the interaction between humans and computers*” (Booth 1989, p.4). This may be acceptable as a general definition but, due to the complexity of the term HCI, a more detailed definition is required. Therefore, HCI is defined as “*the study of how people design, implement and use interactive computer systems, and of how these systems affect individuals, organizations, and society*” (Bogner, M. S. 1994 cited in Sandberg, K. W. and Pan, Y. 2007, p.166 ; Aspden et al. 2004 cited in Sandberg, K. W. and Pan, Y. 2007, p. 166).

Interactive computer systems are comprised of interfaces that allow human interaction. A human–computer interface is defined as follows:

> "*The means of communication between a human user and a computer system, referring in particular to the use of input/output devices with supporting software. Human computer interface is a branch of the science of ergonomics, and is concerned especially with the relationship between workstations and their operators. The aim is to develop acceptable standards for such aspects as display resolution, use of colour, and navigation around an application*" (Daintith 2004, p.248).

This chapter is mainly concerned with interactive TV, and this term is defined as

> "*Anything that enables the television viewer and the people making the television channel, programme or service to engage in a dialogue. More specifically, it can be defined as a dialogue that takes the viewers beyond the passive experience of watching and allows them to make choices and take actions – even if the action is as simple as writing one's name and address on a postcard and posting it, a telephone call or a message for voting, or drawing a picture on the television screen*" (Gawlinski 2003, p.5).

4.3 Background on Interaction

In computers, interactivity is the dialogue that occurs between a human and a computer program. Programs that run without immediate user involvement are not interactive; they are usually called batch or background programs (Musaji 2002). Interactivity with content enables engagement with users to be activated and maintained. One analogy of interactivity is when one opens a fridge and the light goes on; but this is not at the same level as interacting with a video by playing it then selecting a product in order to learn more about it or to buy the product. In addition, games are usually thought to require a considerable level of interactivity. However, order entry applications and many other business applications are also interactive, but in a more constrained way (offering fewer options for user interaction). In conclusion, there are different interaction levels depending on the available interaction methods (See Section 4.5).

4.3.1 Background to Interactive TV

Many of the world's TV operators and a considerable number of companies are spending millions to change television services to be more interactive. The reasons behind this are as follows: television is a popular device which already generates high revenue; television is one of the basic experiences encountered on a daily life basis; television is trusted; television has a considerable impact on people; and television can be viewed at home while relaxing (Gawlinski 2003).

Many sectors have been developing interactivity via TV, ever since the beginning of interaction using the telephone; however, to interact directly with the TV through the TV itself will, it is believed, generate more revenue than expected (Gawlinski 2003). Further differences are the degree of interaction and the way of interaction.

Due to the recent developments in interactive television it has become a popular technology, even though interactive technology is not new. From the early beginnings of television, producers have tried to add interactivity to television. For example, in the case of children's television, producers demonstrate indirect interactivity when some children's shows ask the children to sing with the presenter or sometimes to jump while they jump or clap with them and so on (Gawlinski 2003). Even though there is an argument that this is considered to be audience participation, it is social interaction which is produced by watching TV. Participation is also a type of interaction: "*television audience-participation programs are systems of social interaction involving both audiences and performers*" (Horton and Strauss 1957, p.579).

Viewers are able to interact with television in various ways as follows: first, by providing feedback; secondly, competitions or quizzes for prizes; thirdly, sharing opinions or questions; fourthly, fundraising; and, fifthly, voting (Gawlinski 2003). All these methods could be deployed on mobile devices relatively easily. Sixthly, there is also t-commerce, which is "*a term that describes the sale and purchasing of goods and services through interactive television*" (Curran 2003, p.157) in addition to advertising using the idea of product placement or any other type of advertising in order to buy products, as well as giving information about the product or any object that appears in a video (Curran 2003). Quizzes are also a way of interacting with live video (Curran 2003).

The United Kingdom is selected as an example for this research, in particular the BBC, because the BBC has long-standing experience as a broadcaster worldwide and was one of the first to develop interactive TV (Curran 2003). The BBC was the first company ever to broadcast programmes worldwide, in the year 1936. The public-funded general director, Sir John Reith, was not initially an enthusiast and was under-whelmed by this new technology. Thus, he wrote in his diaries that: "*…to Alexandra Palace for the television opening. I had declined to be televised or take part*" (Gawlinski 2003, p.3). Lord Reith's unenthusiastic position was because he thought that television was a threat to society and would ruin and corrupt the nation, according to BBC historian Lord Briggs (BBC n.d.). Lord Reith's opinion could be derived from his religious background in the Free Church of Scotland (BBC n.d.). Furthermore, in 1938 Lord Reith left a television device in his office when he left his work because he said that he would never use it (BBC n.d.). However, things have changed today.

Content is so important to all channels today, and the BBC has always had high production values and a good reputation for its drama and current affairs programmes. In the year 2000, BBC interactive, or BBCi, added interactive services for the first time during the Wimbledon Tennis Championship (Curran 2003). The BBC offers the viewers the service of interaction with sports events by means of the ‘red button’. However, Real-time sport, along with its potential for interaction with viewers, has increasingly migrated to commercial TV stations for financial reasons (Khan and Singh 2010).

4.4 Changes in Users’ Attitudes

Due to new converged devices, such as mobile TV users, viewing experiences will change. Changes in users’ attitudes can be divided into three main components, as follows (Halloran 1967; Triandis 1971; Strickland 2001):

1) Cognitive change relates to people’s beliefs and is measured by reporting methods.

2) Affective change involves feelings and evaluations, and is measured by physiological attributes.

3) Behavioural change is measured by the intention to do something different from the norm, and is recorded by observation. Behavioural change is an action as a result of an attitude object; this component is not always a reflection of an individual’s feelings and beliefs.

Changing these three components leads to a change in individuals’ attitudes. In changing the cognitive component, there are two types of beliefs: central and less central. The central beliefs include the name of a service (e.g. mobile TV); while less central beliefs include mobile TV as not a successful service. Changing the affective component is when the user experiences a change in their heart rate. An example of changing the behavioural component is viewing an advertisement of a movie trailer then a person investigates the film to find information then buys the film and finally spends their free time watching the movie in addition to videos related to the movie.

These components are always related to newly developed products and technologies, for instance interactive television. Television started as a one-way channel for receiving and displaying video content. With the development of new TV experiences, interactivity was added to the TV set, providing a two-way channel. New handheld technologies present challenges to users as they demand a change in their attitudes (Triandis 1971). Mobile TV is an application that provides a new TV viewing experience. However, new kinds of content and interaction are relatively unexplored. Interactive advertising on mobile TV is linked to this new environment. Television is a pervasive medium, and mobile TV moves this environment to any time and any place (Triandis 1971). Interacting with television changes the users' attitudes regarding the whole viewing experience. It is not easy to change people's attitudes unless users have the knowledge of how to use interactive TV and it involves user friendly, interesting content. Van Dijk and de Vos (2001) think that "*interactivity has to be learned by users and producers*". An example of changing users' attitudes is when the mobile phone was first invented and just a small number of people utilised it. However, now many people own a mobile phone, so there has been a transformational change in the attitude toward the baseline technology of the mobile phone (Triandis 1971). Another example is when the World Wide Web was invented; users were not initially enthusiastic about using it but over time it has become a part of every user’s life. This is an example of the hype cycle theory. For example, buying products using e-commerce has changed the way that society buys and sells products. Some of the traditional ways of thinking have changed as a result of the new technologies. Mobile TV, also, has changed people’s attitude in the way they view video content, giving them the option to watch whatever they want almost anytime anywhere.

4.5 Interactive Levels

Interaction varies in the levels at which users deal with the content displayed on mobile devices (Chittaro 2006). According to Rafaeli (1988 cited in Kalayanaraman and Sundar 2008), there are three types of communication sequence: non-interactive, reactive and fully interactive. These types of interactivity are based on users’ responses but classifying interactivity into levels is appropriate because not all interactions are at the same level. Therefore, a new classification that divides interactivity into levels is required. For instance, interactivity could be divided into the following three levels. High level interactivity refers to an electronic dialogue taking place between regular users and experts. At this level of interactivity, programs interpret the data collected from users to find their understanding and then to explore the expected actions. At this level, programs allow users to give all the instructions and no extra instructions are required, such as in ‘Second Life’; in addition, TV audience participation and voting mean the audience can create the programme decisions or generate video content then upload it to be shared with users and displayed on screens. Medium level interactivity refers to ‘especially the part in between’, for example, watching video-on-demand (VOD), which is streamed with no playing controls. Low level interactivity includes capabilities such as the ‘red button’, adjusting the volume or changing channel. In other words, high level interactivity and low level interactivity are ‘lean-forward’ and ‘lean-back’ modes respectively. YouTube is an example of interaction at various levels, starting from generating the content to uploading it; the viewers choose the video and then they watch it (Gawlinski 2003). However, high level interaction is thought to be the preferred level of interaction, especially with mobile devices. This is confirmed by what this article states, that a high level of interaction leads to more engagement of users (Chittaro 2006).

4.6 Interactive Mobile TV

Combining richly tailored content or live broadcast mobile TV with an interactive experience will enrich the whole mobile market. Qualcomm’s FLO TV revealed that its mobile TV service is being improved by adding interactive applications; in addition, competitor MobiTV announced plans to add interactivity (Swedlow 2010). FLO TV announced that the new service will include live streamed content, video-on-demand content, and will be integrated with interactivity based on the user’s habits of viewing and interacting with content. Bill Stone, president of FLO TV, said that their new service will be delivered to a variety of devices including portable media devices, e-readers and tablets such as the iPad (Swedlow 2010). In addition, FLO TV announced its joint venture with Audiovox, which is a new service called ‘FLO TV Auto Entertainment’, to be utilised while in vehicles (Swedlow 2010).

This combination is an opportunity to generate additional revenue for the market (Kumar 2007). Content developers, broadcasters and mobile operators will jointly share the responsibilities of building this whole experience until it matches the consumers’ needs (Kumar 2007). Usually, when services are commercially applied and expected to generate a substantial amount of revenue, producers must consider the needs of users, not what the producers prefer to show.

Delivering interactive programming is different from just broadcasting a simple programme on mobile devices (Kumar 2007). The user’s interaction is the core idea; users must feel that they control the whole viewing experience, with no restraints from providers. Standard television has adopted the interactive approach but not to the extent that interactive mobile TV is expected to. The difference between these situations is that mobile devices are personal, can generate videos, and that mobile platforms will take interactivity to a much higher level because users can interact by pressing any key on a mobile device (Kumar 2007).

The interactive experience on mobile devices is generated from users interacting with different data types, which are animations, text, video and audio. These four different types of content that generate the user experience present raw information in a pleasant way that attracts people, especially if it is tailored for them. There are some tools that may represent the raw data, such as charts; different tools are available in order to create various types of interactivity. Some of the most common platforms for creating interactivity include Adobe Flash and Microsoft Silverlight, in addition to Java, Camtasia and Macromedia flash lite (Kumar 2007). Although flash has been the most popular software for designing, Macromedia flash lite is special software written for mobile devices (Kumar 2007).

Even if user interface designs created for desktop computers were successful, it is not so easy to fit them on a mobile device or even other types of desktop device. This is because of the differences between the technological environments, user needs for interactivity with each technology environment given the disparity of context, and the purposes of using any mobile device or desktop device. However, the size and form of the mobile devices limits the types of input/output devices that can be applied to them; this can make the human interaction with the mobile device lower than expected, especially if the designers insist on applying the same interfaces used on desktop computers. However, the devices that are currently being manufactured are attempting to address this problem. For instance, the iPhone has a touch screen that consists of a virtual keyboard and other devices enable users to insert memory cards; in addition, some mobile devices have USB ports. Internet downloading and uploading can be considered to be input and output devices.

Mobile device interaction is unlike desktop computer interaction. In each situation, the design and evaluation of interfaces are different. Using mobile devices and interacting with the mobile applications in some situations may affect the user. Such interaction may not only be in the physical context of mobile devices, but also in multitasking, for example using the mobile device while walking.

Moving to a social context is important as it indicates how the device is being used according to the characteristics of the users. Mobile devices' advantages include certain cases where desktop computers are not around, especially while on the move or if there is a special need (for example, a disabled person). Mobile technologies are now in use worldwide; when designers develop interfaces for mobile devices they should be aware of the social impact of such devices. Mobile technologies do have an impact on users and societies (Druin 2009); this is related to users' attitude changes (See Section 4.4). The design of the user interface is not the only difficult part of the development, as the evaluation of the design is also problematic. If the results of the evaluation are to be meaningful, then the evaluation of mobile applications must take as much time and effort as the design of the user interface. Usability testing is a well-developed science now and is thought to be sufficient – according to Kaikkonen et al. (2005), the prototypes of designers can be field-tested and their success can be determined as well as what design changes need to be made. Evaluation techniques should work and focus according to standards so that mobile applications results help to enrich the interactive experience.

4.7 Interactivity challenges for mobile devices

4.7.1 Challenges facing computing and HCI

There is extensive research that covers the challenges of mobile interactivity.

1) Users' lack of understanding is deemed as a challenge to interaction using mobile devices. Users without knowledge on how to use the interface may lead to a decrease in user numbers. This lack of knowledge includes each aspect of the interface, for instance navigating the interface. As mentioned in the previous section, for better understanding, the user relies on visual animations and coloured tools such as charts and diagrams. These tools enrich the user's ability to solve problems. With the improvement of user interfaces and with the many studies of consumer needs when designing the optimum user interface, there is a background of principles and standards that designers could follow to provide a better usage by consumers. These design standards of user interfaces help people to interact properly with devices and media, which lead to the objectives of the interface. If designers were to follow their own personal tastes in designing interfaces, it might lead to a failure in usage perspective (Chittaro 2006).

2) An increasing amount of research is currently being carried out on interfaces and people's interaction with regard to user culture, community, age and other aspects. The research area of HCI is growing extremely fast and will continue to grow in the future because of ever-changing social aspects and habits. Culture, human abilities, users' backgrounds and users' personalities are other challenges that face interface designers. If designers are looking for worldwide open designs then they should take into consideration the following points: characters and numerals; the format of date and timing; the format of currency; grammar and spelling of words; the format of weight and measures; titles of names (e.g. Mr or Mrs); addresses; shapes of buttons and colours; telephone country key; writing or reading from left to right or right to left; identification numbers; and sorting order (Shneiderman and Plaisant 2004).

3) As mobile devices continue to decrease in size and weight in order to enhance portability, they are at the same time adversely affecting usability. For instance, the iPhone 4 is one of the accepted devices with a weight of 137 grams, while the size is calculated through three elements: height 4.5 inches, width 2.31 inches and depth 0.37 inches (Apple n.d.). If interaction by users with mobile technology was minimal, then mobile technology would not spread so widely. Mobile interfaces must be designed according to users' needs, otherwise the experience would be negative and the developers of the interfaces would be wasting time and money.

Another way of categorising HCI challenges is (Oppermann 2001):

1) Firstly, consistency is important, so interaction should be consistent from one device to another.

2) Secondly, interaction must be suitable for the device and the environment of the system. Different interaction techniques work on the computer desktop, but palmtop computers and Wireless Application Protocol (WAP) phones do not support them. Using the keyboard and mouse is a way of interacting on a desktop, but a pen is a way of interacting with a palmtop. The visual predominance of the desktop will be replaced by the palmtop audio display.

Addressing the challenges of designing for mobile devices is the responsibility of developers. These developers must take into consideration the limitations imposed by the small screen size and low resolution of mobile devices compared to other devices. The other issue is the height and width aspect ratio of the screen which is small compared to the 4:3 regular ones (Chittaro 2006). It is difficult to select more than one interface using both at the same time because of the limited space due to the small screen size. Technically speaking, the mobile device has a small memory compared to other graphic cards.

With the considerable improvements in mobile device processor speeds, bandwidth and storage facilities according Moore's Law (See Chapter 3, Section 3.2.2), a development in input and output devices took place as well.

A touch screen mobile is a device that supports interactivity. A 3.5-inch (diagonal) widescreen multitouch screen, such as the iPhone screen, is included in these kinds of touch screen mobile devices (Apple n.d.).

Various mobile devices, such as mobile phones, palmtop computers and personal digital assistants (PDA), have implications for the design of user interfaces. These designs lead to different ways of interaction. A further challenge is the slow connection, which affects the interactivity when data is stored on a distant database (Chittaro 2006). However, currently available devices have the capability to solve most of these problems. The iPhone, for example, has sixteen gigabytes of memory storage, which is a reasonable size for a mobile device designed to be portable and small in size. Another challenge is mobile device interfaces that could be interrupted by the calls that are received to the mobile device while interacting through user interfaces (Chittaro 2006). Another challenge facing users in interacting with mobile devices is the small variety of input and output devices that are included in mobile devices. All the services delivered to them, no matter how powerful they are, will be displayed on tiny visual displays, resulting in poor audio interaction and limited input techniques (Dunlop and Brewster 2002). However, they do have the best capabilities for audio interaction through speakers, because some of these devices are made for audio (communicating calling). Old devices do have limited input facilities but not the iPhone, which has a multitouch screen meaning the user; can control everything (Dunlop and Brewster 2002).

Writing texts and displaying them is restricted because of the small screen size; for example, doing a presentation on PowerPoint would be easier than reading e-books or writing an essay. Some websites and interfaces include large menus and lists, which could be a problem when displayed on a mobile device screen. In dealing with this problem, researchers are testing dome text presentation techniques, which involve displaying the text horizontally so that it has to be scrolled to be viewed. This is one solution; another might be by way of the Rapid Serial Visual Presentation (RSVP), which displays the text in small bits sequentially in the same place (Chittaro 2006). Displaying large images and photos could pose the same problem with the small screen size. Without a zooming function in order to see the image and to reduce the number of zooming in and scrolls needed to view the whole chart or picture, new techniques should be developed (Chittaro 2006). These problems are being solved to an extent with the new devices such as the iPhone.

4.7.2 Challenges Facing Designers

There are challenges facing designers when designing an interactive interface for mobile devices.

1) For instance, mobile devices are different from desktop computers in screen size, and the technique of designing is also different; this makes it difficult to adapt the same interfaces designed for desktop computers to mobile devices (Chittaro 2006).

2) The need to understand the whole environment of mobile usage, taking into consideration the screen size and the privacy of these devices, is another challenge. New techniques for designing interfaces for mobile devices should be deployed and a contrast of colours on these small devices should be studied and tested to achieve the optimum design according to user requirements (Chittaro 2006).

3) Another challenge a designer faces is when designing to differently size mobile technologies (Tidwell 2010). The reason behind designing to differently sized technologies is because currently it is common for a person to interact with many types of mobile devices; for example, a person might have a laptop at the office and use an iPad when away from the office or when on the move. In addition, mobile devices can be used in both situations – at home and on the move.

A more in-depth classification of the design challenges of mobile devices, according to Dunlop and Brewster (2002), are as follows:

1) Designing for mobility: for work on small devices, as the user is mobile so there is no static environment; it changes while the user is moving.

2) Designing for a widespread population: although mobile devices are different from computers, mobile users should not need guidance to use the devices.

3) Designing for limited input/output facilities: as memory and processors are improving, so input and output devices are matching them. The idea of portability means keeping the screen as small as it is, while the keyboard keys are limited in size; sound quality is improving, since it was inadequate before.

4) Designing for incomplete and varying context information: provide information about the situation of mobile devices because of the availability of networks and sensors; for example, knowing the position of the mobile device by using the Global Positioning System (GPS).

5) Designing for users multitasking at levels unfamiliar to most desktop users: multitasking is one of the keys for desktop designs but for mobile devices it must be the same as desktop designs, for opening more than one interface or using the mobile device for using interfaces; but it might not work on mobile devices.

Designers must find new ways of designing, rather than following the traditional way of designing for a personal computer, because mobile users are a larger group incorporating a variety of ages. For the mobile devices case, a critical point is to try to use the maximum space of the screen to display an interface or video with no interruption, because the mobile device is a more personal device compared to a personal computer. In the early stages a PC was used by more than one user, while these days a PC is used by one user. Mobile devices were used by more than one user but now some users own more than one mobile device, which they interact with in various ways. Personal computers and mobile devices require some prior training in order to know how to use them, but now that younger people are growing up with mobile devices and PCs, they are experts in using the functions of mobile devices and there is no need for prior training for this age group. With the high number of users today, however, there are many consumer worries and needs that should be taken into consideration (Dunlop and Brewster 2002).

4.8 Human–Computer Interaction Examples

This section provides examples of a number of scenarios in the field of mobile devices interaction which are perceived to have relevance to Mobile Television. The development of the telecommunication domain does increase the interactive capabilities of media platforms. This development gives the option of more opportunities for access to remote computing resources and data for example. Many commentators have stated that interfaces must be user friendly and match the consumers' needs in order for more users to be engaged with the mobile TV environment.

The following scenarios are based on case studies which show what can happen if the interfaces are properly designed. The scenarios are as follows: web surfing and interactive TV advertising.

4.8.1 The Web Surfing Scenario

The newly developed mobile devices enable web surfing. With this service, many interactive applications have come about, for example the Global Positioning System (GPS), which helps to find a user’s destination, to help a person who is lost to find their way, or to search for the nearest services such as restaurants, clubs or hotels. This application is a very useful tool for tourism; everything can be sorted out on the move with no wasted time being spent in searching. People either do these services regularly or use them only for emergencies (Chittaro 2006). These days, as within most high-tech countries, the telecommunication operators such as 3G England enable users to use maps and GPS. France Telecom has experimented in mobile yellow-pages with two-dimensional (2D) and three-dimensional (3D) interactive maps (Chittaro 2006).

Mobile devices, such as a PDA or a moving tracked camera which captures physical maps, allow users to see a digital content of the whole space of the map by just using their mobile devices. This is the purpose of tracking mobile cameras over a physical map (Schőning et al. 2006). To track the mobile camera over the physical map, ARToolkitPlus markers are used. This application has a very strong marker, but the main disadvantage is that some parts of the map space are unclear. This problem has been addressed in different ways, for example using markers such as the North arrow. Markers could be covered by a digital plot of the map, especially when it is displayed (Schőning et al. 2006).

4.8.2 Interactive TV Advertising

There are several types of interactive TV advertising and they appear in different situations. The main types are as follows:

1) Enhanced television advertising: These advertisements appear to viewers between or during programmes, and are known as ‘break advertisements’ (Gawlinski 2003).

2) Interstitial advertisements: This type of advertisement appears to viewers while the main service loads. Users perform actions here like pressing on the red button (Gawlinski 2003).

3) Banner advertising: This works just as banner advertisements do on websites. Usually banner advertisements are located on a part of the screen displaying content that users have chosen to view. As with interstitial advertisements, banner advertisements do perform actions (Gawlinski 2003).

4) Interactive mobile TV advertising.

Direct-response interactive television advertising gives the user the opportunity to interact during or after the programme; usually users buy the products or get more details and information about the product. Advertisers do not usually care about the brand value they are working for; rather they concentrate on the number of purchases or any other achievement of the product (Gawlinski 2003).

Advertisements that appear during or after a programme interrupt the viewing enjoyment of users. Advertisers and service providers cannot stop this type of enforced advertising and can instead give the user the choice to watch the advertisement by selecting it or by way of product placement; there is no alternative way of advertising that reaches wide range of people, that has so far replaced break advertisements therefore this chapter suggests designing new ways of advertising.

Interactive TV advertising has the advantage of combining targeted advertisements and the response of the interaction of the user. Interactive advertising on mobile devices must be produced to a high standard if advertisers and content producers wish to gain revenues by users paying money to fund mobile TV through personalised advertising and promotions. The advertisement for the 'Chicken Tonight' sauce was the first United Kingdom interactive television advertisement back in 2000. A small icon was placed on screen while the advertisement was displayed on Sky Digital; this icon enabled users to press the icon to reach interactive screen offering information and vouchers (Gawlinski 2003).

The first interactive advertising campaign was launched in August 2005 by Channel 4 for Suzuki Swift. This new and innovative idea was designed to provide interactive content to all mobile phone users (Channel 4 n.d.). Another success story is that of Virgin Mobile back in 2001, which linked to an interactive television application called the Brit Awards on ITV; it had a 91% brand recall rate with viewers and an unusually high 0.4% response rate to competitions within the service (Gawlinski 2003).

Interactive mobile TV advertising might be the key opportunity advertisers have been searching for. The beauty of interactive mobile TV is that it combines the strengths of both TV and the mobile device. Interactive television advertising is dropping in revenues, as it was affected by internet advertising revenues in 2000 (Gawlinski 2003).

Most of the advertising methods will not work properly on mobile devices because the screen is so small but applying product placement advertising will be suitable for users who want to enjoy the whole size of the mobile device screen. It enables the user to interact with the video (Curran 2003). In this chapter a new technique of advertising is recommended. This new technique employs the capabilities of product placement to present the phrase ‘infotainment’, i.e. providing information about a product through linking the user with the website to buy or to gain more information about the product. Product placement attempts to move to the idea of non-commercial advertising, thus giving people more information about any object (e.g. product, place and car) rather than just displaying products. With the idea of product placement, screens will be clear of any disruption and the viewing experience will be more enjoyable.

The following advertisement is displayed on interactive TV; it can also be used on mobile devices. After pressing the red button during an Audi television advertisement, for example, viewers are taken to screens with information and promotions about the product (Gawlinski 2003). This idea is already being applied, but in this study the work will be on mobile TV interactive advertising and will be in a different type of interaction, which means product placement and personalised advertisements.

This chapter suggests that an iPhone, for example, would have an application to select advertisements related to the user's interests, which could be stored in the application's inbox. The application icon shows that there are new and un-viewed personalised advertisements that the user may watch if he or she wishes. This is trying to make users want to view the advertisement and to be engaged rather than deleting it or switching channels in some cases, resulting in an annoying viewing experience. Recently, Apple launched a new advertising platform called iAd. This platform is an emotional and interactive way of advertising using tailored content; Steve Jobs demonstrated some examples such as the Toy Story 3 banner advertisement (Beaumont 2010). Apple has information concerning its users, which helps the advertisers to send users targeted advertisements (Beaumont 2010).

4.9 Designing Interactive Interfaces

In the coming decades, HCI research, especially designing interfaces, will continue to develop rapidly. Interfaces and computers have now become powerful tools for socio-technical systems, economists, etc. (Shneiderman and Plaisant 2004). Techniques such as user interface prototyping are critical to developer success (Ambler 2004). According to Larry Constantine and Lucy Lockwood (2008 cited in Swamy 2010), there are some general principles of user interface design; these principles are followed in order to develop an optimum user interface design. The principles are as follows (Constantine and Lockwood 2008 cited in Swamy 2010):

1) The structure: refers to the way interfaces design are organised, so the concern is about the overall framework of these designs. Organising these designs should provide useful interfaces, which are consistent, apparent and group the related components together. Regarding mobile devices, the structure principle must take into consideration the small screen size of these devices and the way interfaces are supposed to be structured and designed. For example, designing interfaces for mobile devices with popup or dropdown menus.

2) The simplicity: refers to the way interfaces are designed in a simple way and are easy to use. In addition, designed using the user's language and providing users with an interface that requires fewer procedures for the user to reach the targeted action. Regarding mobile devices this is a principal that matches the needs of these devices as they are personal and small sized.

3) The visibility: refers to the way components in the designed interface are clearly visible without any interruption by redundant or irrelevant information. Regarding mobile devices, because of their size every component must be visible and no irrelevant information is supposed to be provided.

4) The feedback: refers to designed interfaces being able to inform users of any change occurring, actions required or errors occurring through clear and understandable messages.

5) The tolerance: refers to the ability to design interfaces that are flexible. Tolerance is required to provide users with the ability to redo or cancel an action; that is supposed to lead to fewer costs occurring due to mistakes and should prevent errors. In the case of mobile devices, the likelihood of misuse or mistakes is higher compared to computers; therefore flexibility and tolerance are required.

6) The reuse: refers to the way designed interfaces reuse components in a consistent way to prevent users from remembering or rethinking. In the case of mobile devices, reuse of components offers the users a simple way of navigating and interacting with interfaces.

As referred to previously, mobile devices typically have much smaller screens than computers and even smaller than traditional TV screens; this is likely to be a significant issue. In addition, TV screens are typically increasing in size to give a more immersive and ‘surround-sound’ experience, simply because digital technology is decreasing in cost. Thus the gap between the standard TV experience and the TV experience on a small mobile device seems to be widening. In addition, when it comes to audio-visual broadcasted content to mobile devices, some media experts have argued that the quality of the audio is more critical to the user’s experience of content than the visuals (Bria et al. 2007). Videos are usually associated with audio as a commentary; the commentary adds meaning to the video. If the visuals were corrupted the customers could still listen to the commentary; on the other hand, if the customers lose the audio the video becomes meaningless. The quality of the audio on small mobile devices is generally very poor because the speakers are so small (See Section 4.7.1).

There is also the issue of display design and the thirteen principles for display design defined by Christopher Wickens et al. (Blue and Hill 2009). These principles are used to develop an efficient display design, to generate a user satisfaction of utilising such interfaces, for ease of use of such interfaces, and for many more advantages.

These thirteen principles could be applied to most platforms, even though some may not suit specific devices; therefore there is an opportunity to utilise the most relevant principles that fit a certain display. However, all principles carry a similar degree of importance. The principles are categorised as follows (Wickens et al. 2004 cited in Blue and Hill 2009, ch. 25, pp.11-12):

A) Perceptual principles:

1) Make displays legible: all components displayed must be noticeable in order to be utilised.

2) Avoid absolute judgment limits: sensory variables (e.g. volume, colour) should have many levels and are not to be left to the users to decide.

3) Top-down processing: users' past experiences should reflect on the way signals are explained and professed.

4) Redundancy gain: signals should be displayed using different methods (e.g. text, verbal and colour) in order to be recognised properly by users.

5) Discriminabilty: similarity causes confusion; similar features should be avoided as they cause confusion while the concentration should be on the disparate features of signals.

B) Mental model principles:

6) Principle of pictorial realism: the display should have the image of the component it symbolises (e.g. low volume should be represented as a lower horizontal level).

7) Principle of the moving part: components with motion should flow in the direction that the user's mind expects. For instance, a high volume level should move vertically to the top end of the scale.

C) Principles based on attention:

8) Minimising information access cost: reducing the time and effort spent when moving from one action to another by allowing users to access the component that is situated in the nearest place.

9) Proximity compatibility principle: in certain situations a job requires the user's diversion between components. These components must be logically related. And reducing the effort and time costs are achieved by uniting each category of components by a specific unique colour or shape.

10) Principle of multiple resources: more than one resource used simultaneously can be interpreted by users. For instance, a movie with subtitles can be processed by a user.

D) Memory principles:

11) Replace memory with visual information: a user should not need to keep important information in his short-term memory or to remember from his long-term memory. Using checklists and menus reduces the user's need to remember, even though in some cases using memory helps to reduce the effort and time costs of browsing.

12) Principle of predictive aiding: a user being proactive is more effective than if they are reactive. Users being able to reduce the use of their minds to find a simple way to complete jobs. This allows users to think of the upcoming situations rather than thinking of the current ones.

13) Principle of consistency: if designs were developed in a similar manner then a user can transfer his knowledge from the long-term memory to utilise other designs. Consistency is a must for the designs.

The designer can focus on the designing phase, after the competition of all schedules and plans according to the user's requirements. The interface developer must ensure that the interface is reliable and works consistently. If developers want to innovate, they must set standards and stick to them in order to have the optimum interface; they can also use widgets for the right task to increase consistency. Sticking to standards is important, and if there are developing partners their ideas must be taken into consideration and executed if they are within the standards that were set. Copying of the designer's standards by others should be taken into consideration because it is dangerous.

The interface must be designed in a way that takes into consideration that there are users from different cultures who write in different types, e.g. left-to-right or right-to-left. In the interface, the notes and messages should be worded strongly and able to be clearly understood (Ambler 2004). There are different cultures worldwide, even in the same community. A design for one community will not satisfy another community, so for the best designs developers must design an interface for a specific community according to their needs and then test it on a sample of this community (Shneiderman and Plaisant 2004).

To find out if the design is working properly and whether it matches consumer needs, the following points should be taken into account: the time it takes for user to learn how to use the interface; the speed of performance; the number of errors the user has made; the maintenance needed for the interface regarding time duration; the satisfaction of the user regarding the interface content and usage (Shneiderman and Plaisant 2004). In order to obtain strong messages and improve the interface it is a good idea to look at how others work, for example using the appropriate colours in user interface designing, and checking the contrast of colours to ensure that the information on screen is still readable. If the screen has more than one field alignment it should not affect visualisation (Ambler 2004).

Better designs, according to some findings by Robert Miller through a classic piece of user research from the late 1960s, which is still applicable today, should take less than a 0.1 second's response time for users to feel that the system is reacting immediately and that they are controlling the content directly. There needs to be less than one second's response time for users' thinking processes to have no interruption and less than a tenth of a second's response time for users to maintain their attention on what is going on (Gawlinski 2003).

It is expected that users make mistakes, so designers should design a user interface that recovers from mistakes made. Data should be justified appropriately; for example in columns of data, common practice is to right-justify integers, decimal align floating-point numbers, and to left-justify strings. Items should be grouped in an effective way, for example items that are logically connected will be grouped on screen (Ambler 2004).

Virtual reality and telepresence techniques might change the user's interaction with technology. Screen-to-screen interaction with companies is a new development of face-to-face interaction. It is difficult to design an interface for various devices, for example small size devices such as mobile phones and larger devices such as plasma screen TVs (Shneiderman and Plaisant 2004). A clever designer who designs an interface that is simple and creative gains positive feedback from users (Shneiderman and Plaisant 2004). "*Artificial intelligence techniques of knowledge representation may be* *used to model the user of a computer system, and so offer the opportunity to give personalized advice on its use. The design of the machine interface may incorporate expert-system techniques to offer powerful knowledge-based computing to the user*" (Daintith 2004, p. 248). When the interactive interface is designed properly users will not have time to notice minor problems in the design of the interface; instead they will concentrate on their work. Also, guaranteeing privacy and security to users is a must for a clever designer (Shneiderman and Plaisant 2004).

Ageing groups are an important issue for designers, and engaging them in the interaction services is a plus for designers, while understanding their physical abilities is important. Children are another important part of the community, and designers are supposed to understand their abilities. In this case, there are the parents' requirements for their children's safety. Children also desire to have the ability to do anything without penalties; children can deal with many issues, for example horror stories, but with some user frustration (Shneiderman and Plaisant 2004). Designers must take children's limitations into consideration, for example the audio which comes out might frighten them; young children sometimes want to replay a game, reread a story, and redo something, such as music, even when adults play it for them (Shneiderman and Plaisant 2004).

User frustration usually stems from bad design, or it could be difficult to understand because the design is not matching with the group or community. Solving these problems should start with increasing network speed or server capacity; increasing the research on the reasons behind user frustration will enrich the designers with solutions of the usage problems of the interfaces; online help and messages are needed sometimes if the interface is complicated; interfaces on small sized mobile devices may be misleading if the design was not that good; interfaces that are not safe, either because of storage of personal information and data of the user or viruses, are unacceptable; some kind of untargeted advertisements such as pop-up advertisements disturb the recipient, so disabling them from appearing on the interface is a plus; training people to use interfaces for desktop computers is acceptable, but for mobile devices it is hard and online demos might help; error messages that keep appearing disturb users, so designing tiny ones, which appear only on serious errors, would be better; developing a user enquiry line (e.g. contact phone number, email address, etc.) is also important (Shneiderman and Plaisant 2004).

4.10 Interactivity and Legal issues

For normal mobile applications, there is no face to face interaction to gain comfort from, so reliability and security are important; all of this applies on mobile devices. Furthermore, mobile devices provide a degree of privacy, especially when viewing content or saving records and data on the devices. Interactivity between mobile devices and users is all achieved through an interface. These interfaces may consist of some content that is regulated, for instance, copyright or patent protection for online information, images or music.

Freedom of speech on electronic environments, for example Mblogs, is important. The author should have the freedom to write anything on his or her blog. The Internet is an open source to anybody who desires to get opinions and information of others, so giving freedom of speech to bloggers is important; in fact, this applies not only to bloggers but anybody who wants to talk or write. There are more legal issues, such as equal rights for special needs or disabled users, and different laws are applied in each country so it is important to take the user's country's laws into consideration. For example, for UK users interacting (buying, selling, etc.) with a website of a company that is located in the USA, then 'electronic commerce and internet' law in the UK should be taken into consideration by the American company and vice versa (Shneiderman and Plaisant 2004). In the electronic environment, websites such as Yahoo and eBay are supposed to apply the laws of the country that the consumers are in. Therefore, developers of online services must take into consideration all legal concerns of their designs (Shneiderman and Plaisant 2004).

With the issue of copyright, it is believed that 'free' content downloaded to mobile devices will present persistent difficulties. The iPhone device, by default, aims to prevent users from illegal sharing, whilst 'legitimate' content can be bought from Apple's store iTunes, and this does seem to be a successful revenue generation model. For user-generated content, this is less of an issue, but this area brings additional challenges of privacy and so on.

4.11 Interaction Devices

> "*Devices of increasing sophistication are becoming available to mediate the human–computer interaction. These include graphics devices, touch-sensitive devices, and voice-input devices. They have to be configured in a way that will facilitate an efficient and desirable interaction between a person and the computer*." (Daintith 2004, p.248)

Amparo Lasen, from the Digital World Research Centre at the University of Surrey, carried out a comparison study between Madrid, London and Paris, investigating the usage of mobile devices in public places. The findings are as follows (Lasen 2004).

Parisians are always in fear of disturbing others, because it is common for people there to openly complain when mobile users use their devices (Lasen n.d.). People in Madrid keep their mobile phones on, even when they are in places where they should be switched off (Wakefield 2004). Users from Madrid and Paris freely uses their mobile phones while on the pedestrian pathway rather than in other places, but Londoners tend to use their phones in temporary zones with other users (Wakefield 2004; Lasen n.d.). In Madrid, users share their face-to-face interaction with a third party, but that does not occur in London or Paris (Lasen n.d.).

Designers of interfaces seek to cater for as many users as possible. If not, then interfaces need redesigning. Discussing the response of the interaction of users' interfaces, users prefer shorter response times which lead to shorter user think time; longer response times i.e. >15 seconds are disturbing (Shneiderman and Plaisant 2004). Interaction at the beginning is low level interactivity depending on what users can do with the interface; for example, entering some data is interaction, but it's at a low level. Using mobile devices to interact with varies according to the user; for example, using the mouse to select something is a way of interacting, and using the keyboard for selecting is another option of interactivity.

The development of areas in mobile devices was matched by the improvement of the input/output devices for human interaction with these devices (Shneiderman and Plaisant 2004). Touch screen interfaces are an easier way for interaction between the user and the device, as it is a better way of presenting this information and interacting with it. A multitouch screen has recently been invented and commercially distributed through the new iPhone; this is a high level method of interaction, enabling users to use more than one interaction (e.g. finger) at the same time (Shneiderman and Plaisant 2004). While there was a limitation in the number of input/output devices, now users are looking at new developed input/output devices such as the wide multitouch screen and voice recognition (Shneiderman and Plaisant 2004). Voice or speech recognition might open the way for speech conversation interaction to replace the other input devices, and this is one of the easiest ways for users to use input data to devices. Conversing with the device might be another way of interacting with highly technological devices; giving an order to the computer to turn on or to shut down might be applicable in this technological revolution.

All types of manual input depend on the user's performance, which is about the speed at which the user moves his/her hands in relation to the object. Fitts' Law predicts the user performance and is a standard in input design. Smith and Salvendy (2007) state that this law predicts the required time to move to an object and it is based on the distance required to reach the object (amplitude) and the size of the object (width). The prediction is established by dividing the logarithm of the amplitude by the width. This equation leads to an understanding that a distance far from the object will take a longer time to move to the object. For example, if the distance to the object is 1cm, it will take 2 seconds; therefore a distance of 3cm will take 6 seconds. The other way of distinguishing ways of input devices is by their control display ratio; the ratio is between the distance movement of the input device and the reaction of the object. For example, if a mouse, which is an input device, moves 1cm on the display surface in order to reach an object distance of 2cm on the screen, the device has a 1:2 control display ratio (Jacob 1996).

While the mobile phone continues decreasing in size, a challenge of designing an innovative keyboard is still an issue. There are two types of keyboards; the first type is the regular keyboard, and the second type is the virtual keyboard, where a projector reflects the image of a keyboard on a flat surface and the user can interact with it as if it was a normal keyboard by way of a sensor, which follows the movement of the user's fingers. The types of controlling device used are as follows: the first is an easy-to-use direct control device, such as a touch screen. The second type is an indirect control device, which takes time to learn how to use, such as mouse. The third type is the novel device, which is used for special purposes such as eye tracking (Shneiderman and Plaisant 2004).

The keyboards, keypads and buttons that are wired to any device are discrete input devices. The most popular type of keyboard in English-speaking countries is the QWERTY keyboard layout; it has buttons that can control the cursor, as well as entering characters, numbers and special characters (Stone and Stone 2005). There are other types of layouts for keyboards, for example pressing the button three times to type a character, as is the case on mobile device keyboards.

Continuous input involves a variety of devices. Most of the devices that are used for manual pointing can be under this category of input device. The continuous input devices are categorised as follows (Jones 1999):

1) Type of motion: linear vs. rotary. A mouse measures 2D linear motion; a knob, rotary.

2) Absolute or relative measurement: A mouse measures relative motion; a Polhemus magnetic tracker, absolute.

3) Physical property sensed: A mouse measures position; an isometric joystick, force.

4) Number of dimensions: linear 1D, 2D and 3D and/or 1, 2 and 3 angular. A mouse measures two linear dimensions; a knob measures one angular dimension; and a Polhemus measures three linear dimensions and three angular.

5) Direct vs. indirect control: A mouse is indirect because it moves on another surface; a touch screen is direct because it moves on the same screen.

6) Position vs. rate control: When a mouse moves the cursor changes its position; a joystick can change the speed of the cursor.

7) Integral vs. separable dimensions: A mouse enables easy and matched moves across 2D simultaneously; a pair of knobs does not.

3G mobile devices, such as PDAs and mobile phones, give the user the ability to adopt an interactive application on the devices (IBM n.d.). 3G mobile devices such as PDAs are becoming very important and so designers are devising more applications for these devices, due to the difficulty in executing all applications of the devices because of the shortage of memory. Two new technologies were developed by the Remote User Interaction (RUI) project; the first is User Interface Mapping, which was developed because the user could not interact with legacy applications, and this new technology enables that. The second technology is User Input Mapping, developed to improve user experience by the mapping pen, which inputs the content using a keyboard or mouse (IBM n.d.).

The IBM research laboratory developed embedded handwriting recognition, which is used for a variety of operating systems, with high recognition accuracy. The laboratory has been the leader in continuous handwriting recognition research, which is used to transform handwriting on paper into text files (IBM n.d.). As mentioned, there are trackers that are used to sensor the foot position and head position with 3D images or videos and can be used as mobile device inputs.

The voice of the user is considered an input. The user communicates with a computer, or any other device, as if speaking with another person instead of using input devices such as a mouse or keyboard (Access and Hawking 2004). Most of the speech recognition programs require discrete speech, pausing between words. Discrete speech is easier to recognise and be computed. But continuous speech is more natural and fluent speech (Access and Hawking 2004). The problem would be that the speech would have no meaning because the computer could not understand the language if the processors and recognition models were not powerful.

There is more than one aspect to consider when predicting what the new innovative input devices might be in the future. Initially, new device characteristics are an indication of the new technology that can be applied to these devices; the size of new devices might change and the capability of handling input devices might, or might not, be easy. These devices may have built-in input devices or may need to be bought separately.

These different types of input device will enrich the HCI field, and large workstations might totally disappear or at least decrease in size as a result. If the input devices are separate, the portable devices will reduce in size, but if the aim is for a built-in device, the devices will be increasing in size. Input devices might replace the available devices, such as the mouse or keyboard. While display technology is improving, so the type of input devices might change, for example the iPhone multi-touch screen, which allows the user to interact directly on the screen. If devices reduce in size, so interacting through the display technology will be a solution and users can utilise other input devices as the industry develops new ones. The virtual environment is developing, for instance writing on a surface by hand and handwriting recognition might replace other devices.

One of the solutions for interacting with mobile devices is a small remote control or device to interact with a mobile device or laptop entering the input needed to complete a job. Virtual reality devices are a combination of 3D devices (Fröhlich et al. 2001). They are tracking systems (e.g. magnetic) that are used to locate the position of objects, commonly participants' heads and virtual devices such as a virtual glove for hand inputting, thus allowing the user to reach the displayed environment and then interact with it. Usually sensors are attached to these objects while other devices are used to track the sensors (Bainbridge 2004). Virtual reality is like interacting with devices as if in the real world; users can grab, point and move objects by hand in this virtual reality 3D world, and these devices could enable the user to feel as if they are living inside the devices, to pick and move items to different places. Body language in this virtual reality world might enable the users, by moving hands, legs or heads, to interact with these devices similarly to do the same jobs the users enters characters and numbers for (Jacob and Tangible Media Group 2001).

The future types of input method would lead to natural communication between users and computing devices, which can be translated to an input in order to perform a user's orders; this means devices will be able to do anything users require. The other way of predicting the future input might be by measuring some physical attributes of a person. Parts of the body could be measured to interact with computer devices, to be interpreted to input (Sá 2001). For some situations, especially medical ones, an eye tracker could be used for interpreting the needs of a sick person, for example.

4.11.1 Examples of Interactive Devices

The interactivity between the user and the mobile device has moved to the next level with the new iPhone, with this new technological development of the user interacting with data. Users design their own desktop; they select the applications and icons they would like to view on the desktop and save everything in the ‘cloud’. The cloud is a virtual memory storage that is given to the consumers on which to save data as a backup; it can be accessed from a different device from the one that has saved the data. Steve Jobs co-founder and CEO of Apple has described the new 3G iPhone as a phone and iPod that is always connected to the Internet (David 2008). There are thousands of applications, covering all areas including games, economics, finance, health, social networking, artists and much more. The number and variety of applications was not available for other mobile devices.

There are many mobile devices that can dial and receive calls, but the iPhone introduces a new era of interacting by the download of favourite applications. The iPhone, or any mobile device that has the capabilities of a computer, is not designed to be able to write whole documents on Word or to prepare a PowerPoint presentation; instead, using its cloud, a user could work on a laptop and then access it through an iPhone while on the move. In other words, the idea is to have backup documents in the cloud to be accessed while on the move or while being seated (David 2008). Finally, the iPhone is always connected to the Internet and it has the functionality of updating automatically. Updates appear on the icon of the application so that up-to-date information is supplied to users, and the choice of how to interact is up to the user (David 2008).

4.12 Interactive Content

When designing personalised interactive content, designers must be aware of certain colours that might mislead the user and not allow those kinds of interfaces which disturb users' concentration when they appear. These problems were known to developers, who tested the interfaces on users. The testing phase is a major issue for the design of any product, for example, testing in car companies by crashing cars to check the safety of the people in the car. "*All sciences are vain and full of errors which are not born of experience … and not tested by experience*." (Richter 1969 cited in Shneiderman 2002, p. 71) In order to guide designers, many HCI journals are attempting to compile practical and theoretical frameworks and demand for higher quality is not a thing a designer can predict (Shneiderman 2002).

Users' responsibilities help designers to improve the interfaces by providing them with feedback. The users are responsible for giving feedback on designs; in fact it is a difficult process to use an interface (e.g. a website), especially when it has a catalogue with a vast number of products with images and prices which vary according to timing; for example, if there was sale, there might be a comparison of prices with competitors and updated information concerning the product, such as the quantity available and so on. The idea behind catalogues with images of the products is to enable consumers to choose from catalogues, and to pay before receiving the product. This means that companies do not need to accumulate cash from each customer after buying (Shneiderman 2002).

One of the most important characteristics of the World Wide Web is the ability to generate a wide range of data about every single user click. This is called a clickstream or web log data, and it keeps a record of the sites visited by the user. As an example, Google does that by keeping records on the most visited type of content and so on (Shneiderman 2002). Personal information, such as a consumer's name and address, is collected during the purchase process. This helps many stakeholders, such as advertisers, to have a database of consumers to be targeted with advertisements that match their interests. Advertising is an important aspect for companies selling online; however, it is not easy to create a creative advertisement online, taking into consideration the limitations of mobile devices. The internet can enrich the marketers with data from the applications completed by consumers in a simple and cheap way. The merchant links users to advertisements of the accessories for the product or the same product in different places. For example, if somebody bought a mobile phone online and he was sixteen years old and living in the USA, online advertisements about mobile phones will then appear to everybody with the same characteristics (sixteen years old and living in the USA). When a person searches for a product or buys a product, a list of suggestions of products and accessories appears. For example, in PC World when one buys a laptop, offers of half-priced printers and scanners show up because a laptop was bought (Shneiderman 2002).

An interactive method of commerce is through online selling, which represents an important method for companies. That is for the reason that online stores are open 24/7 so consumers have the choice in context with the idea of almost anytime anywhere; for example, e-Bay and Amazon products can be bought and sold at any time of the day and customer services are available all the time. The further advantage of online shopping is that consumers can gain information regarding the product by comparing prices with different companies, product guarantees and shipping charges; for example, the CNET website compares product prices immediately for the consumer. Consumers can complain to the company if the product is faulty or contact them if there is an enquiry. Furthermore, consumers are able to contact companies to create their own personalised deal; the new computing era allows the consumer to create the product itself, for example, Dell is a computer manufacturer that allows users to customise their own PC or laptop according to the specification they need and within their budget (Shneiderman 2002).

Product placement is a type of advertising that can be applied to mobile TV. If, for example, a consumer saw Michael Jackson in a video clip wearing a Tshirt, then pressing on the product would give some information about that product and link the user with the brand website in order to buy the product. This is one way of advertising on mobile TV and more ways could be deployed such as rollover, dropdown, popup, etc. It will also be more acceptable if the buttons hide. The user would feel as if they were interacting with the device (Curran 2003).

Finally, there must be testing of user interfaces for interactive mobile TV scenarios. In this way, users can directly give interface designers the answers to questions that need to be solved. Here Leonardo da Vinci is an inspiration and the reader is invited to wonder how Leonardo would use such applications. Surveys are a good start, but for accurate results the idea of observation does that. It is thought that Leonardo da Vinci would be a supporter of building a model for designing interfaces and after that testing them. Innovative ideas and devices, especially in input/output devices or screens for interaction, are being developed and are growing rapidly (Shneiderman 2002).

4.13 Interactive Mobile TV Content

Types of content for mobile TV are: *1)* real-time content and *2)* non-real-time content. Real-time content includes broadcasted or multicasted video to mobile devices, live TV of tailored content or ordinary content, live music, live sports, live news, web cams, networking games, interactive advertisements, etc. The second type of content is non-real-time content (tailored and ordinary), which is controlled by users to be displayed at the required time and it includes VOD, music-on-demand, video games, personalised content, webcasting, interactive advertising, web browsing, etc. (Kumar 2007). It is becoming a fact that users are asking for more interactivity than just viewing the content; they want to interact with the content displayed on mobile devices by rewinding, forwarding, pausing and much more (Kumar 2007).

4.13.1 Customer-Generated Content

A mobile device is a personal, almost anytime anywhere, and mobile TV is a personal and targeted service. Some telecommunication operators encourage people to download and upload video content. People who upload content will earn 10% of the revenues when their video is downloaded or viewed; for example 3, United Kingdom's mobile media company, encourages users to upload video and then pays them when the content is downloaded (Kumar 2007).

4.13.2 Video-on-Demand

VOD is a way of interacting with the content. Users are supposed to choose the preferred type of content from video libraries to download or stream the video. There is the ability to interact with the video, not only for choosing the preferred content but by offering video cassette recorder (VCR)-like control of digital video such as rewind, forward and pause. Pause stops the video and it can be restarted at a later stage (Kumar 2007).

4.13.3 Video Push Technology

This type of mobile TV viewing is different as it is about downloading the content on the device to be viewed later on. Usually money is paid for downloading and viewing the video; it can be viewed almost anytime anywhere and an unlimited amount of times (Kumar 2007).

4.13.4 Adult Services

Personal and portable are the two characteristics of mobile TV that make adult content one of the most profitable contents on a mobile device. Mobile TV is used by one person only, unlike a TV set at home (Kumar 2007).

4.14 Converged Media for Mobile TV

Converged media has been around for a while. Itheil de Sola Pool, an MIT political scientist, is the founder of media convergence (Jenkins 2006). Pool was the first to indicate that convergence is a force for change in the media sector. A procedure called ‘convergence of modes’ is thought to be a point that removes boundaries between media including unicast (e.g. telephone) and broadcast (e.g. TV) communication (Jenkins 2006).

In this section, a general description and definition of the term convergence is presented. Initially, Straubhaar and LaRose (2005) define convergence (See Chapter 1, Section 1.3.1). In the case of technologies such as computers and telecommunications, convergence is defined as the evolving of different technologies in order to perform similar tasks. As technologies are divided into either analogue or digital, mobile devices are considered digital devices; therefore there is a need to define digital convergence. "*Digital convergence is generally described as a unification of the functions, and a coming together of the previously distinct digital technologies. Particularly, the last couple of decades have witnessed widespread digitization of information and content, increasing incorporation of digital technologies into the products of diverse industries, and often, an accompanying shift to using von-Neumann-like (a design model for a stored-program digital computer) platform-based product architectures*" (Mentana and Sundrarajan 2003 cited in Xu et al. 2006).

Some examples of digital convergence are WebTV, TiVo, Slingbox, AppleTV, Windows Media Center, mobile TV and so on. Digital convergence has been applied to achieve consumer needs in developing video-on-demand, interactive services and new digital content. In education, digital convergence develops new ways to enhance students' learning. While for business, it develops new ways of communication and new channels for distribution (Yoffie 1997). From a technical perspective there are several advantages to the concept of digital convergence (Covell 2000): *the ability to easily broadcast and edit the content of digital media; the addition of interactive capabilities to the content of the media; and finally, that digital convergence refers to data, audio, video and media in digital form.*

Digital convergence is about shifting all media from the traditional media to a new digital media and then delivering it through global networks. Henry Jenkins in his book Convergence Culture states: "*If the digital revolution paradigm presumed that new media would displace old media, the emerging convergence paradigm assumes that old and new media will interact in even more complex ways*" (Jenkins 2006, p.6). It was expected by some that new converged media (interactive new media) would replace traditional media (passive old media). Convergence history shows that old media has never been displaced but it could be affected. For example, television did not replace radio. But their functions shift with the invention of new technologies. Convergence has affected many devices and services. For instance, FM radio affected AM radio; telephone affected telegraphs; radio affected newspapers; CD affected tape recordings; DVD affected CD; television affected radio; HDTV affected NTSC; mobile devices affected telephones; 3G affected 2G mobile devices; and smart phones (iPhone and Blackberry) affected other 3G mobile devices. The advantages of digital media are that they are better quality and cheaper compared to traditional media.

In conclusion, traditional media were affected by the growth of the mobile devices sector. TV and printed media are shifting to be digitised using these devices. Video over the Internet and mobile TV were expected to displace broadcasting. This new converged media was thought to provide users with their choice of content in an easy way (Jenkins 2006).

Converged media is concerned with services and new invented ways for society to interact and do business. Due to the high adoption of converged media, users want to consume media in various contexts including on the move. Mobile TV is an example of a convergence between the telecommunication and broadcasting sectors (Goggin and Hjorth 2008). Mobile TV is a multimedia and personal service in the user's pocket; it is not just a TV on the move. The value of mobile TV is in its converged environment. With the increasing popularity of mobile TV services, there is an opportunity for convergence between the telecommunication and broadcasting services. Converged media must be adopted by users otherwise convergence will not be applied.

Media convergence is classified into two layers, platforms and applications. There are three action points in order to achieve optimal converged media: *1)* Careful selection of existing media for convergence; *2)* Transformation of existing media for preferred user experience; and *3)* Design for the new platform. Converged media is not just about the technological shift. Convergence changes the relationship between industries, viewers, technologies and markets (Jenkins 2006). Media convergence includes a shift in the cultural, industrial and social paradigms. Convergence at a social level presents users' interaction with others and using media platforms to develop a new experience, new forms of media and content that connect users socially (e.g. Videoconferencing). Currently people are surrounded with a converged media world that keeps reforming according to the consumers' and technological needs. This changes consumers' way of learning, consuming and interacting. Converged media includes the introduction of a variety of new media technologies that enable users to attain, give feedback on, produce, consume and edit media content (Suárez-Orozco and Qin-Hilliard 2004).

Convergence of media is when multiple products join to form one product including the accumulated advantages of all of the products. Media convergence presents alternative ways for the media to be consumed and produced (Jenkins 2006). Convergent Media is a "*cross platform media that was conventionally associated with a particular platform or device but through convergence can now be distributed and accessed through another device or platform e.g. IDTV, mobile TV, and VOIP etc*." (DeFreitas and Bagur 2009). Further examples of converged media is the Sony PlayStation – primarily a game console that is also used for playing DVDs, web surfing, listening to music and chatting with friends. Another example is the iPhone, which is used as a phone, camera, games console, mp3 player, radio, video camcorder, for web surfing and portable computer.

Mobile devices such as mobile phones, iPods, and PS3s are capable of providing various types of media beyond the primary function of the device. Concerning mobile devices, the convergence enables users to access many services via mobile devices. Media convergence and mobile devices allow users to access almost every media on every device, every media company selling every type of media product, every kind of media content delivered though every type of channel. Converged media for mobile devices leads to a result that with the growing mobile devices sector has considerably affected traditional media by developing new ways of digital media using internet and mobile devices. With the replacement of analogue TV by digital TV, media services have expanded for example video-on-demand, IPTV, mobile TV, digital video recorders, high definition TV and much more.

Currently, all types of media, in one way or another can be delivered and consumed on mobile phones. Technological convergence is demonstrated by amateurs and professionals using mobile phones to produce videos for competing in festivals, users listening to radios, users being able to play games, and games producers considering these devices as one of the platforms. Some of these converged media will be a success and others will not (Jenkins 2006). The mobile phone is the device that has converged the greatest variety of services and technologies. Traditional media has an impact on mobile phones; beside that the advantage of mobile phones is that they are strongly linked to user-generated content (Goggin and Hjorth 2008). Mobile phones are improved with new media channels, delivery methods and functions by digital converged media (Goggin and Hjorth 2008).

Convergence concerns the interaction between audio, video and data, in addition to sharing the resources with each other. Currently interactivity linked to mobile TV services is considered to be a revolutionary idea that provides a new opportunity for mobile and media stakeholders. Mobile TV personalisation enables broadcasters and users to be ‘in-touch’ and, in the case of marketing, it provides communication between service providers and users. In both cases, this communication leads to an increased user interest in interactivity and in selection and control of content they wish to receive. For example, the BBC allows viewers to choose the camera angle that they wish to watch from in sports programmes. Some media productions allow storylines whose end points are determined by the user. An example is producing interactive storylines, like the film ‘Sliding Doors’ which has two storylines with two different endings. This communication leads to advantages for all stakeholders such as new content formats, targeted content and personalised advertising.

Broadcasters face a major change in their environment and are seeking to generate additional revenue from the content they offer. The cooperation between mobile operators and broadcasters is to provide the best opportunity to provide two-way channel interactivity for some TV programmes. Media content digital manipulation is a reason for the introduction of converged media technology (Wells and Hakanen 1997). Currently, content is being consumed not only on traditional channels but also using various channels and media. There has been a move towards providing TV shows on various screen sizes.

In the case of mobile devices, mobile TV users are supplied with personalised programmes. These programmes could be supplied for different contexts, such as providing TV programmes on transportation micro breaks using mobile devices. Therefore, content needs to be short to accommodate users’ limited attention spans when using a small screen on mobile devices. In addition programme, producers and directors needs to apply cinematic techniques (close-ups, large font for text and titles) that suits mobile TV consumption. Additionally, they should apply automatic cropping for the content traditionally displayed on TV. Finally, the dialogue of short programmes needs to be cropped to contain only the main lines of each character of a programme (Tsekleves et al. 2009).

Finally, despite the advantages of digital convergence, there are also pitfalls, such as new policies and regulations to deal with the changes; these policies and regulations include intellectual property, copyright and consumer rights. In addition, there is the effect on the passive old media sector including the reduction of traditional media sales leading to loss of jobs. Another pitfall concerned with the regulatory sector of digital convergence is the transition to cross-product, cross-platform and cross-sectional licensing. Derived from the previous point, pricing is another pitfall of technological convergence; new innovated technological converged devices are expected to be expensive compared to traditional media devices; in addition, the licensing fee is paid by service providers, therefore revenue is expected to be generated from consumers through subscriptions. A further pitfall is that network operators are required to change their infrastructures to new ones that enable them to apply the technological convergence. Another challenge to technological convergence is the service provider's responsibility to deliver mobile TV applications and content that suits the users' demands and viewing contexts. Another pitfall is the low quality of manufactured devices; in addition, these devices should have the ability to be upgraded rather than changed when a new technological convergence occurs. As a final point, the other pitfalls that work against technological convergence are the traditional TV, which now comes with a larger screen like a home cinema, PCs, with multiple screens and even wall-sized displays, and mobile phones with increasing functionality, such as the iPhone.

4.15 Conclusion

Interaction is a way of dealing with a device according to the user's needs, and then the system should perform the required task. Interactivity is not new, it has already been applied in different contexts, such as mobile commerce. Interactive television has more than one classification, and ranges from high interactivity to low interactivity. There are further classifications such as physical or social interaction. Some examples of interaction with TV are participating in quizzes, feedback, communicating by answering or asking questions and fund-raising. There are various elements in the process of interaction, which are: content, devices, users and technology. Interactive devices/capabilities include: touch screens, voice and speech recognition, continuous input involving a variety of devices used for manual pointing, regular and virtual keyboards. Two new technologies have been developed: User Interface Mapping and User Input Mapping.

Designers and researchers who work in human–computer interaction have concentrated on the development of graphical user interfaces and mobile devices during the past few years (Shneiderman and Plaisant 2004). User interfaces are now the most important tool by which humans and machines can communicate. It is concluded that designing interfaces for PCs is different from designing for mobile devices. For mobile devices, there is no prior training for users, while for desktops there is some form of training to explain the rules of interface usage. In the case of mobile devices, the absence of previous training leads to an obstacle to the adoption of interactive services for mobile devices because of the user's lack of understanding in the way the interface is used on mobile devices. This challenge is addressed by providing users with help menus. Furthermore, challenges are presented in the chapter, such as designing interfaces for different sized devices. For instance, as mobile devices continue to reduce in size and weight (which increases their portability) the usability – in cases such as mobile TV interactivity – will begin to suffer. One of the main challenges facing interface designers is addressing the user's needs, which is because of the complexity of requirements; these needs includes the users' cultures, communities, backgrounds, abilities, personalities, ages and so on. Many other challenges hinder the adoption of interactive services, such as designing for limited input/output devices, designing for mobility, consistency, designing interfaces suitable for the device and its environment, designing interfaces that could be interrupted for instance voice calls or messages, designing for a widespread population, designing for incomplete and varying context information, and designing for users multitasking at levels unfamiliar to most desktop users. All of these previously mentioned challenges need extensive research by designers to find solutions to address them.

It is concluded that there are many challenges that hinder the adoption of interactive services. There are many factors that encourage the adoption of interactive TV services, such as that interactive TV is a trusted service and can be viewed in the lean-backward position (Gawlinski 2003). Many companies are spending millions to shift to interactive services; this indicates that there are potential benefits for both companies and users of the services.

Designing interfaces for mobile devices is regulated by some legal issues of HCI that all stakeholders and especially designers must take into consideration; these are: equal rights for special needs (users with disabilities); freedom of speech; copyright for online information, images and videos; privacy and the use of records and information (Google databases); and different countries' laws for selling and buying.

Users are also responsible for deciding whether the interface is a high-quality design or not. The users' responsibility begins with the interface testing phase, by providing feedback on new interface designs. Surveys are a good start for getting the information that is needed by designers; moreover, observations provide more accurate feedback for many stakeholders. Evaluating whether the design is satisfactory and matches consumer needs is required for the success of the designs.

There is increasing interest in converged media, although it has been around for some time. Interactive mobile TV is a unique TV viewing experience, therefore new personalised content must be provided to users. There are two main types of content: real-time and non-real-time content. Shifting technologies from non-interactive TV services to interactive ones is followed by applying the interactive TV to mobile devices. With the shift, in order to increase the number of users, the users' attitudes should change. Cognitive, affective and behavioural changes are elements that lead to changes in people's attitudes. In addition, with improvement in interaction techniques, users' attitudes might change, leading to a successful new interactive service. This chapter has presented some examples of HCI via mobile TV such as: the memory aid scenario; the roadside accident scenario; the patient in the home scenario; the web surfing scenario; and interactive TV advertising. In this chapter interactive TV advertising is classified into four main types including interactive mobile TV advertising, which is considered to be a principal concern of this chapter.

Finally, future work is to develop new techniques of interaction in addition to overcoming the challenges facing the adoption of interactive services. This chapter presented this research's new invented technique of interaction using the idea of product placement. Advertising is a sector that Apple has developed, with a way of interaction with advertisements using the application iAd. This chapter suggests an interactive advertising technique, which is a video-on-demand advertisement through messages that appear in the user's inbox, which are received in an application icon on the desktop of the mobile device; that gets the user's attention and they can click on the icon of the advertisement in order to establish the process of interaction. In the next chapter, there is a demonstration of the surveys carried out by this research. In addition to the results of these surveys, these results were analysed and conclusions were drawn.

Chapter 5

Research Methodology, User Surveys and Analysis

5.1 Purpose of Research

5.1.1 Objectives of the research

The objectives of this research fall into the following categories:

1) To gain familiarity with mobile TV and to achieve new insights into it from many sectors.

2) To understand the characteristics of a particular individual situation or a group (such as Jordanians and Britons). This was achieved by analysing the questionnaires and the designed and implemented prototypes.

3) To determine the frequency with which a particular behaviour occurs or its associations. This was achieved after analysing the questionnaires of this research, for example by determining the number of respondents who view video on mobile devices.

4) To test the causal relationships between the demographic variables and the questions posed in the conducted survey.

5.1.2 Hypotheses to be Tested

The hypotheses to be tested in this research were as follows:

1) Motorola Engineers are expected to be highly pro-technology with regard to the use of mobile devices as they are in the market of mobile devices.

2) Aspects such as Education, Occupation, Length of time using, Gender and Age Groups are likely to influence the results.

3) UK respondent, as members of a 'technologically advanced' nation may more readily welcome advanced technologies.

4) Individuals in Jordan, a developing country, may find it more difficult to obtain mobile devices capable of delivering mobile TV. For example, at that time of study, 3G was not available in Jordan.

5) Social, cultural and sociological dependencies with regard to mobile TV.

6) Connectedness is a property of the modern world brought about by the Internet, networks, and interactive devices. One would therefore expect connectedness and interactivity to be a key aspect in mobile TV take-up.

7) As new media communications grow, advertising revenues for traditional media is subject to greater competition from other fields. One would therefore expect advertisers to be looking for opportunities in new media.

5.1.3 Questions within the Research

In this research various factors that could affect the introduction of new methods of interactive mobile TV advertising were analysed. The views of consumers were also sought about the acceptability of the optimum interfaces for mobile TV services.

These objectives were achieved by seeking answers to the following questions which were composed in order to: *1)* Discover the respondents understanding of selected concepts; *2)* Explore the respondent's preferences; and 3) Analyse the respondent's mobile TV services viewing experience.

1) Is there a relationship between the consumer age and the use of mobile TV service?

2) What are the factors that lead to a 'free' mobile TV service?

3) What are consumer content preferences for different age groups, and how can we adapt this knowledge to the production of mobile TV?

4) What are the consumer demands for adequate mobile devices?

5) Is there a relationship between the age group of consumers and the acceptable types of advertisements being displayed on traditional TV and mobile TV?

6) Is there a relationship between the consumer's age and the preferred degree of interactivity?

7) Is there a relationship between the consumer's age group and: *A)* all of the factors related to the idea of product placement; *B)* The length of video content displayed on mobile devices; *C)* The type (e.g. touch screen) and size of mobile devices screens; *D)* The type of mobile device owned; *E)* The type of content displayed either on mobile devices or traditional TV; or *F)* The place where mobile TV can be used?

8) Is the idea of the shift from commercial advertising to non-commercial information provision and then to the use of product placement as an alternative to web browsing convenient to consumers?

9) How do the consumers adopt and adapt to new handheld technologies to increase consumption of new services like mobile TV?

10) What is the level of consumer attention paid to mobile TV programmes and advertisements?

11) Are the new approaches to the generation of media for mobile television convenient to people (for example tailored mobile TV content)?

12) Is mobile TV different from traditional television and from mobile phone usage because it is a new medium?

13) What level of interactivity between the two extremes (high interactivity and low interactivity, i.e. 'lean-forward' and 'lean-back' modes) is most acceptable to mobile users, especially in relation to advertising via product-placement-like modalities?

14) What is the best type of advertisement to be displayed on mobile TV?

5.2 Research Dimensions

Currently, mobile TV is a developing concept and may have significant potential for all sectors of society. This research sought to investigate the rate of take-off of mobile TV services and the decline of TV advertising revenue. The potential for interactive mobile TV advertising was also analysed. Direct questions were used to elicit people's views of the services as suggested by Boyd et al. (1977).

5.3 Data Collection Methods

There were two kinds of data collected and used in this research. The first kind was the primary data, which is generally collected by means of experiments, questionnaires, observations and interviews. In this research the primary data was collected through experiments and questionnaires. The second kind is secondary data, which was collected as literature reviews from books, journals, articles and websites.

In this research the data collection procedure involved the following:

1) The defined sampling process (See Section 5.5) was followed.

2) The data collected was kept in time order.

3) Comments and other contextual events were noted.

4) Non-responses were recorded.

This research aims to provide a range of useful information for the mobile TV field, specifically to measure the value of using interactivity to generate advertising revenue and finding new ways to bring products to the consumer's attention. This information is supplied to users in new ways, analogous to users web browsing in specific situations of viewing advertisements in order to save time, and provides users with an easier way to reach information. A questionnaire was distributed to a sample of people. In addition, an experimental survey concerning the designed prototypes was carried out in this research.

5.4 Designing a Questionnaire

Following Burgess' (2001) methodology, this research's procedure for designing a questionnaire was split into three elements:

1) Determine the questions to be asked.

2) Select the question type for each question and specify the wording.

3) Design the question sequence and overall questionnaire layout.

The questions concentrated on the consumer acceptance of the idea of interactive mobile TV advertising and consumer needs.

Following Clough and Nutbrown's (2002) methodology, these research questions require the researcher to in order to follow current best practice:

1) Define the limits of the study.
2) Clarify the research study.
3) Identify empirical issues and work on empirical questions.

Following Boyd et al.'s (1977) and FAO Corporate's (1997) methodology, the questionnaire was constructed in nine steps and these are the guidelines that were followed in this research in order to follow current best practice:

1) Decide on the information required.
2) Decide what type of questionnaire to use.
3) Decide on the content of individual questions.
4) Decide on the type of question.
5) Decide on the wording of questions.
6) Decide on the question sequence.
7) Determine form, layout and method of questionnaire reproduction.
8) Make a preliminary draft and present it.
9) Revise and prepare the final questionnaire.

The questionnaire was based on the literature review. This research adopted a self-administered questionnaire and the research questionnaire consisted of two parts. The first part deals with the demographic variables while the second part deals with the questionnaire statements that measure the research variables as follows:

1) Mobile devices questions 1–8.

2) Mobile TV questions 9–11.

3) Advertisements questions 12–16.

4) Interactivity questions 17–21.

5) Product placement questions 22–26.

The questionnaire was formed after monitoring a sample's usage and reporting how they reacted physically and verbally. When the questionnaire was structured and well defined, wording was chosen to make the analysis of data easy and for it to be more understandable for respondents. Questions may be considered good if they match the research objective. According to Youngman (1986), there are seven different types of questions under two main categories: open and closed. Firstly, open questions allow the respondents to write their own opinions in their own words. Open questions were not used in this research because they require the respondents to read these questions individually. In addition, this type of questions does not enable an automatic statistical analysis to run on them. A further reason is that this type of question might lead to a non-response from the respondents and that was the case in the pilot surveys carried out under this research. Secondly, closed questions allow the respondents to choose from the listed answers or to write ‘Yes’ or ‘No’ to the questions. In addition, open questions are expressed in a multiple-choice form. Therefore the closed type of question was used to avoid the disadvantages of open questions. Closed questions can be divided into six types as follows: category, list, scale, quantity, ranking and grid questions. In this research category, list, scale and ranking questions were used for scoring. Quantity was not used because the responses would then be numbers and these research questions do not require numbers as answers. In addition, a grid was not used because it records answers to two or more questions while in this research questions were individually statistically analysed.

5.5 Population and Sampling

In any sample plan there are three major elements as follows (Reed and Proctor 1995):

1) Who will be served?

2) How many should be served?

3) How should representatives be chosen?

In this research the suitable sample size was achieved by following the findings of two qualitative studies, Abbie Griffin and John Hauser (Griffin and

Hauser 1993 cited in DePaulo 2000). Abbie Griffin and John Hauser finds that 30 people or less is adequate for a small market segment while 200 to 400 is required for studies which were conducted within the context of quality function deployment and with a large population groups (DePaulo 2000). This research examined the acceptance of new ways of advertising through mobile TV and to have interactive advertisements, so a 497 sample was used because it was over the upper limit of the range 200 and 400. This research uses both qualitative and quantitative approaches.

The convenience sample was divided between two different countries: Jordan and England. The sample included any person whether he/she was an effective user of mobile phone services, especially mobile TV, or not. The objective was to cover all the society groups and especially the young users, because they are the majority of users in Jordan and England. In addition, this age group is more concerned with new advances in mobile services; taking into account that in both countries the number of mobile phone users exceeds the number of the population.

5.6 Validity

Validity tests the reliability of the developed instruments that measure the concept they were designed to measure (Sekaran 1992). There are several types of validity test. In this research the following were used.

5.6.1 Content Validity

Content validity is a "*function of how properly the factors and elements of a concept are outlined*" (Sekaran 1992, p.171).

Reviewing the literature related to this research topic was used to validate the items contained in its questionnaires.

5.6.2 Face Validity

This "*indicates that the items that are intended to measure a concept do so on the face of it; i.e. they look like they are measuring the concepts*" (Sekaran 1992, p.171).

This test was accomplished by judging the questionnaires through expert judges who were well experienced in the fields of mobile communication, marketing, statistics and management. Among these experts were: Prof. Muzhir Al Ani in mobile communication, Dr Emad Masoud in marketing and Prof. Mohammed Subhi Abu Saleh in statistics. Their suggestions and recommendations were used to guide additions and deletions of items and to improve the wording of the statements. Therefore more than one pilot survey was produced.

5.7 Reliability

The measure of internal consistency was assessed in this research. "*The internal consistency of measures is indicative of the homogeneity of the items in the measure that taps the construct*." (Sekaran 1992, p.174) Inter-item consistency reliability and split half reliability are methods for testing consistency (Sekaran 1992).

5.8 Statistical Analysis Techniques

In this research, the Statistical Package for the Social Sciences (SPSS) was used to analyse the data from questionnaires. In addition, some manual analysis was carried out for tables and figures. This software is used to analyse relationships between variables or to examine the difference between different groups. The analysis techniques used are the Chi-square, Descriptive, Cross-tabs and ANOVA.

5.9 Introduction to User Surveys and Analysis

This section investigates whether the mobile infrastructure is adequate to support mobile TV in the context that the 3G standard technology enables consumers to utilise the mobile TV service. This study also examines mobile devices owned by consumers. In this research mobile devices are classified into two types: devices that support mobile TV and devices that do not. A 3G device and above does support mobile TV while a 2G mobile device and below does not support mobile TV.

The survey of this study is divided into five sections; these sections are designed as follows: *1)* Mobile phones; *2)* Mobile TV; *3)* Advertisements; *4)* Interactivity; and *5)* Product placement.

The first section explores the use and types of mobile device. The second section explores mobile TV services. The third section explores users' preferred types of advertisement. The fourth section explores the level of interactivity needed on mobile devices. The fifth section explores the idea of product placement.

A detailed description for the inclusion of the survey questions and answers are as follows:

Question 1 explores the respondent's use of their mobile devices. The answers to the question were: *1)* Calls (the most popular feature). *2)* Calls and SMS (the two most popular features). *3)* Calls and radio (the most popular feature in addition to a non-popular feature).*4)* All of the mobile device features.

Question 2 concerns the respondent's use of video on their mobile devices. The answers were either yes or no.

Question 3 addresses the type of content preferred to be viewed on mobile devices. Answers were divided to present the main types of video content according to this research's literature review.

Question 4 is to identify if the respondents mobile devices include a camera and a coloured screen. The answers were as follows: *1)* Camera(s) and colour screen (mobile devices that are capable of displaying video). *2)* Camera(s) and monochrome screen (which are not available but in order to find the users understanding of what monochrome screen means). *3)* No camera(s) and colour screen (mobile devices that are not capable of displaying video). *4)* No camera(s) and monochrome screen (mobile devices that are not capable of displaying video).

Question 5 addresses the type of mobile device owned by the respondents and is correlated to the previous question. The answers were as follows: *1)* Second Generation mobile devices (which in general are not capable of delivering mobile TV service). *2)* Third Generation mobile devices (which in general are capable of delivering mobile TV service). *3)* Touch screen mobile devices (which mostly are capable of delivering mobile TV service and enable users to interact with the content in various ways). *4)* Fourth Generation and above (the new mobile devices which are capable of delivering many new services such as mobile TV).

Question 6 addresses the respondents most preferred content to be viewed on traditional TV. This question is to differentiate and compare between the experiences of mobile TV and traditional TV. The answers contained the most common content viewed on traditional TV according to this research's literature review.

Question 7 addresses the preferred type of content to be viewed on mobile devices. The answers were all of the types that are to be displayed on mobile devices and were as follows: *1)* Ordinary content (content displayed on traditional TV). *2)* Tailored content (content to be produced to suit mobile TV). *3)* Combination of ordinary and tailored content. *4)* Animation content (type of content that could be suitable for mobile devices and interactive).

Question 8 addresses how convenient viewing mobile TV is for users. The answers were divided based on the degree of convenience.

Question 9 is concerned with the mobile TV service viewing contexts. The answers were based on categories that were mostly significant by the literature. The answers were as follows: *1)* At work or at school (this group is based on the different educations of users and to check on the respondents ability to do more than one task at a time). *2)* At home (to check on the user's ability to use mobile TV when traditional TV is around). *3)* Walking (this is based on the idea of on the move TV). *4)* Travelling (including on any transportation this is an option that was based on the literature as one of the most common contexts).

Question 10 addresses the willingness of the respondents to adopt mobile TV in the future. The answers were: *1)* Adopt the service (for those who are convinced of the service). *2)* Not adopt the service (for those who were not convinced of the service). *3)* Have not decided yet. *4)* Test the service (for those who are still in the process of deciding).

Question 11 concerns the preferable length of the content to be displayed on mobile devices. The answers were divided as follows: *1)* Short (is the length of content that would be preferred based on the literature and could be suitable for on the move TV experience). *2)* Long (is the length of content that is displayed on traditional TV). *3)* Both short and long (is a combination of both that could be an open option that could combine the requirements of a large sample of people). *4)* Do not mind (is an option for the users who would not care about the length of the content).

Question 12 concerns the users' feelings when viewing advertisements on traditional TV. The answers were broadly based on the users feeling that they were either interested or not interested and whether they change the channel when advertisements appear. Finally, feeling annoyed when advertisements are displayed.

Question 13 is about the usefulness of advertisements displayed on traditional TV.

Question 14 addresses the respondent's views about the idea of extrapolation from commercial advertising to non-commercial information provision and then using product placement to web browsing. The answers were divided into being enthusiastic about it, finding it a splendid idea and saying it will be used when available and conversely, those who would not be interested.

Question 15 concerns the ability to adopt online advertisements to mobile devices. The answers were divided based on the respondent's expected thoughts about these advertisements. For example: attractive, not attractive, annoying, and in need of more development.

Question 16 concerns the idea of delivering targeted advertisements to the users. The answers were based on the user's thoughts such as not useful, useful, disturbing, and not disturbing.

Question 17 concerns the users thought of interactive video to be displayed on mobile devices. The answers were based on the degree of interaction. For example, no interaction, low interaction (such as in the case of red button), high interaction (such as a user driven) and finally the degree of interaction is dependent on the type of video displayed.

Question 18 concerns whether mobile TV is a replacement to traditional TV. The answers were either not a replacement, is a partially replacement, is a totally replacement and depends on the content displayed.

Question 19 concerns the preferred screen size of the respondent's mobile device. The answers were as follows: small screen (such as in the case of most of the mobile phones); do not mind (the screen size is not an issue), medium screen (as in the case of iPhone) and finally wide screen (as in the case of most of the tablets).

Question 20 concerns the degree of interactivity of the mobile devices. The answers were as follows: not interactive, low interactive, high interactive and medium interactive. Even though, the boundaries between the levels of interaction are still unclear.

Question 21 concerns the user's thoughts of touch screen mobile devices. The answers were that these devices are not useful (ex. not easy to be used), depends on the aspect measured, in need for more development and finally useful in the case of mobile TV.

Question 22 concerns the user's knowledge of the concept product placement. The answers were divided based on the level of understanding of the concept: unknown, barely known, partially known and finally known.

Question 23 concerns the users thought of the idea of product placement being an alternative way of advertising to be used on mobile devices to fund mobile TV service. The answers were that it does not help funding, does not help funding but still is a good way of advertising, does partially funds and finally totally funds the service.

Question 24 concerns the permission required for delivering advertisements to mobile devices. The answers were receiver's permission, no permission, service provider's permission (as a responsible to regulate the service), and finally network operator's permission.

Question 25 concerns mobile phones being a replacement to other devices in the aspect of video streaming. The answers were no replacement will occur, depends on the type of content displayed, partially replace and finally will totally replace other devices.

Question 26 concerns the user's preferred features for their future mobile devices. The answers were as follows: a touch screen, Camera(s), supports all types of multimedia files (in order to enable various content to be displayed on various platforms), and finally, large memory size.

This survey divided users into four age groups in order to achieve better results analysis. Age group is one of the most important demographic variables and the literature studies shows that the people in between ages 20 to 40 would be the most to adopt mobile TV service. Therefore, the age groups were divided into four categories and a symbol was assigned for each category as follows:

1) Age group younger than 21 (Age Group 1).
2) Age group 21–30 (Age Group 2).
3) Age group 31–40 (Age Group 3).
4) Age group older than 40 (Age Group 4).

The survey was conducted in two countries, Jordan and England. There were 317 participants from Jordan including 8 engineers from Motorola and 180 participants from England. Concerning the gender of the respondents, the following tables represent Gender 1 which is males and Gender 2 which is females.

Gender

	Number of Respondents	Percentage	Cumulative Percent
Males	90	50.0	50.0
Females	90	50.0	100.0
Total	180	100.0	

Table 5.1: Gender England Survey

Gender

	Number of Respondents	Percentage	Cumulative Percent
Males	225	72.8	72.8
Females	84	27.2	100.0
Total	309	100.0	

Table 5.2: Gender Jordan Survey

Gender

	Number of Respondents	Percentage	Cumulative Percent
Males	8	100.0	100.0

Table 5.3: Gender Motorola Survey

Occupation is a further demographic variable in the survey to demonstrate the differences of people who will view mobile TV. The user's occupation could lead to the mobile TV environment required for the specific group; in addition shows the person's ability to pay a subscription to any service. Anybody would fall in one of the following categories:

1) Private sector employee.

2) Governmental sector employee.

3) Student.

4) Unemployed.

Education is another demographic variable that helps in conducting the requirements of people based on their education degree. The following groups that this study thought to cover the education sector that matches with people.

1) Primary school (is till year 6).

2) Secondary school (year 6 till 12).

3) University undergraduate.

4) University postgraduate.

Finally, mobile phone usage is a demographic variable. The grouping of the usage was based on the start of mobile phone service, for instance it goes back to the 1995 in Jordan. The following were the groupings:

1) Less than 6 years.

2) 6–10 years.

3) 11–15 years.

4) More than 15 years.

For each question, the answers were divided into two, four or six options numbered as a, b, c, d, e and f, depending on the number of options; for instance, two options were a and b while four options were a, b, c and d, and so on. The survey consisted of five main variables: age group, gender, occupation, usage and education. However age group was the only category which produced enough variability to make meaningful statements about.

This chapter includes some key examples of the survey questions. The most important questions that are related to the hypothesis were included while the remainder is in the appendix. The main text includes tables with commentary on the questions chosen and the remainder is in Appendix 2. This chapter presents four age groups for each of England and Jordan. While Motorola only presents age groups (2 and 3) as they are the only ones available.

In general, after looking at the statistical significance in the following areas: education and length of usage; the results of most of the questions show no relationship between these areas and most of the questions. Therefore these variables are excluded from the chapter.

The hypotheses included in the analysis of this chapter were the first, third, fourth, sixth and seventh. These were thought to be the most important ones as they are more related to the core of this research in addition that they were sufficient to compare the samples. The remainder is in Chapter Eight.

In the case of Motorola engineers the tables were excluded as the results of Chi-square tests were not sufficiently significant given the relatively small sample size.

5.10 Summary of the Analysis – England

Mobile TV services require specific types of mobile device. This survey asked the users about the types of device they own. A 3G mobile phone contains a camera and a coloured screen. On the other hand, a 2G mobile phone does not include a camera and it makes no difference if the screen is coloured or not. Users may own more than one device.

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	52.392[a]	9	.000
Likelihood Ratio	53.177	9	.000
N of Valid Cases	180		

a. 8 cells (50.0%) have expected count less than 5. The minimum expected count is 1.60.

Table 5.4: England's Survey Question Four (Age Group)

It was found that X^2 value = 52.392[a]is significant at .000 which means that there is relationship between Age Group and Question 4. The difference in age group affects the features of mobile devices. The majority from age groups 1, 2, and 3 own a mobile device with a camera and coloured screen. The majority from age group4 were divided between owning a mobile device with a camera and coloured screen or no camera(s) and monochrome screen.

This question was asked to explore the respondent's mobile devices. Most respondents claimed that they own a mobile phone with a camera and a coloured screen – which does support mobile TV services. In addition, fewer respondents stated that they own a mobile phone that does not have a camera or a coloured screen – which does not support mobile TV services. This result matches the hypothesis of UK people being a western world should readily welcome advanced technologies.

This question included an option of whether the user owns a mobile device which contains a camera and a monochrome screen (not coloured). A mobile phone with a camera and a monochrome screen is a characteristic of mobile phones owned by some respondents. This is an interesting answer as this type of mobile device is not available in the real world, but this choice might be because of misunderstanding the concept of 'monochrome screen'. The respondents may have thought that monochrome screens are the non-touch screens while they are actually the non-coloured ones.

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	26.132[a]	9	.002
Likelihood Ratio	29.941	9	.000
N of Valid Cases	180		

a. 5 cells (31.3%) have expected count less than 5. The minimum expected count is 1.07.

Table 5.5: England's Survey Question Five (Age Group)

It was found that X^2 value = 26.132^a is significant at .002 which means that there is relationship between Age Group and Question 5. The difference in age group affects the respondent's type of mobile device. The majority from age groups 1, 2 and 3 do own a 3G mobile device. The highest percentage of respondents from age group 4 do own 2G mobile devices.

The results of this question reflect a connectedness in the results of the previous question as the majority own mobile devices with camera and colours screens which matches with the results of this question as the majority own a 3G mobile devices. This result meets the hypothesis of UK users being a western culture welcoming of advanced technologies.

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	13.784[a]	3	.003
Likelihood Ratio	12.970	3	.005
N of Valid Cases	180		

a. 1 cells (12.5%) have expected count less than 5. The minimum expected count is 4.27.

Table 5.6: England's Survey Question One (Age Group)

It was found that X^2 value = 13.784^a is significant at .003 which means that there is relationship between Age Group and Question 1. The difference in age group affects the respondent's use of mobile devices. The majority from age groups 1, 2, and 3 do use their mobile devices for calls and all other services. The highest percentage of age group4 does use their mobile devices for calls and all other services.

In general the majority of respondents do use their mobile devices for more than just calls and they do use all of its features. This result meets the hypothesis of UK people being a western world and welcoming of advanced technologies.

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	11.317[a]	3	.010
Likelihood Ratio	9.919	3	.019
N of Valid Cases	180		

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 5.60.

Table 5.7: England's Survey Question Two (Age Group)

It was found that X^2 value = 11.317[a] is significant at .010 which means that there is relationship between Age Group and Question 2. The difference in age group affects the respondent's video being viewed on mobile devices. The majority from age groups 1, 2 and 3 do use their mobile devices for viewing videos. The respondents from age group4 were divided equally between viewing video and not viewing video on mobile devices.

In general, the majority of respondents do view video on their mobile devices which matches with the respondent's answers to the previous questions of being using all their mobile devices features. This result meets the hypothesis of UK people being a western world readily welcoming of advanced technologies.

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	17.417[a]	9	.043
Likelihood Ratio	17.469	9	.042
N of Valid Cases	180		

a. 6 cells (37.5%) have expected count less than 5. The minimum expected count is .93.

Table 5.8: England's Survey Question Eight (Age Group)

It was found that X^2 value = 17.417[a] is significant at .043 which means that there is relationship between Age Group and Question 8. The difference in age group affects the respondent's point of view of watching video on mobile devices. The majority from age groups 1, 2 and 3 do think that watching video on mobile devices is convenient. The majority of age group 4 were divided equally between not convenient and convenient.

It is a promising service that will be at the forefront of the mobile market in the coming years. Surprisingly most of the respondents declared that mobile TV is convenient. As UK is considered to be a western country that should readily welcome advanced technologies, this is an obvious result.

Some users do think that a mobile TV service is not convenient because of the many reasons such as the price, incompatible content and so on.

Fortunately, with this high degree of acceptance of the service among users, consumers can be asked about the specific contexts in which they prefer to use mobile TV. In order to know more, this survey asks the users to choose where they prefer to use their mobile TV service.

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	78.166[a]	9	.000
Likelihood Ratio	77.986	9	.000
N of Valid Cases	180		

a. 3 cells (18.8%) have expected count less than 5. The minimum expected count is 2.13.

Table 5.9: England's Survey Question Ten (Age Group)

It was found that X^2 value = 78.166[a] is significant at .000 which means that there is relationship between Age Group and Question 10. The difference in age group affects the respondent's future intension to adopt mobile TV service. The majority of users from age groups 1 and 3 will adopt mobile TV service when it is applied. The highest percentage of respondents from age group 2 will adopt mobile TV service when it is applied. The highest percentage of users from age group 4 will test mobile TV service when it is applied.

In general the highest percentage of respondents will adopt mobile TV broadcasted service when it is applied. This result is connected to the result of respondents agreeing that mobile TV service is convenient. This is met with the hypothesis that UK people being a western world should readily welcome advanced technologies.

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	21.259[a]	9	.012
Likelihood Ratio	20.158	9	.017
N of Valid Cases	180		

a. 5 cells (31.3%) have expected count less than 5. The minimum expected count is 1.07.

Table 5.10: England's Survey Question Twelve (Age Group)

It was found that X^2 value = 21.259[a] is significant at .012 which means that there is relationship between Age Group and Question 12. The difference in age group affects the respondents feeling of viewing advertisements on traditional TV. The highest percentage of respondents from age group 1 are not interested in advertisements on TV. Around 50% of the respondents from age group 2 are not interested in advertisements on TV. The highest percentage of respondents from age group 3 are annoyed of advertisements on TV. The highest percentage of respondents from age group 4 are interested in advertisements on TV.

In general the majority of respondents do think that advertisements displayed on traditional TV are not interesting and even annoying. This responds positively with the hypothesis that as new media communications grow, advertising in traditional media is declining. One would therefore expect advertisers to be looking for opportunities in new media.

According to the hypothesis mentioned in the previous paragraph that it is expected that advertisers need to be looking for opportunities in new media; therefore new ways of advertising should occur. This research, therefore, changes the whole concept and context of advertising, moving it from core advertising to the emerging idea of infotainment advertising. In other words, it is a shift from commercial advertising to non-commercial information provision, and the use of product placement to web browsing which could be suitable for mobile TV.

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	28.132[a]	9	.001
Likelihood Ratio	30.260	9	.000
N of Valid Cases	180		

a. 8 cells (50.0%) have expected count less than 5. The minimum expected count is .80.

Table 5.11: England's Survey Question Fourteen (Age Group)

It was found that X^2 value = 28.132[a] is significant at .001 which means that there is relationship between Age Group and Question 14. The difference in age group affects the idea of extrapolation from commercial advertising to non-commercial information provision and then using product placement to web browsing. The majority from all age groups thought of the idea as splendid and will be used when applied.

It was felt that this idea, from the users' point of view, is a surprise; most respondents think that this idea is splendid and that they would use it if it was implemented. This proves that the hypothesis which is that as new media communications grow, advertising in traditional media is declining is correct. One would therefore expect advertisers to be looking for opportunities in new media.

Only a few respondents responded positively to the idea as being not useful and splendid. This indicates that users are in need of some new forms of advertising to be viewed on mobile devices or on traditional TV.

The idea of product placement enables active interaction between mobile devices and users. The interaction with a video is either to obtain more information about the product or to buy it. There is a need for consumer interaction with product placement advertising, or with any type of video content. Interactivity is considered to be one of the principal drivers in the mobile market. Four levels of interactivity are available: non-interactive; low level interactivity, as in choosing the content the user wishes to watch; the enormous medium level interactivity, which still has undiscovered areas such as rewinding or forwarding live content; and finally high level interactivity, which is when users produce the content, for example on their mobile phones, and then share it with family and friends or upload it to some websites such as 'YouTube'.

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	21.527[a]	9	.011
Likelihood Ratio	22.243	9	.008
N of Valid Cases	180		

a. 1 cells (6.3%) have expected count less than 5. The minimum expected count is 4.27.

Table 5.12: England's Survey Question Twenty (Age Group)

It was found that X^2 value = 21.527[a] is significant at .011 which means that there is relationship between Age Group and Question 20. The difference in age group affects the mobile devices degree of interactivity. The highest percentage of respondents from age group 1 prefer a medium level interaction of mobile devices. The highest percentage of respondents from age groups 2 and 3 prefer a non-interactive mobile devices. 50% of respondents from age group 4 prefer a non-interactive mobile devices.

A general question related to the level of interaction needed on mobile devices and the current significant developments in interactive devices is addressed. In order for mobile devices to match with the respondents requirements of having an interactive video; there was a general agreement among the majority of respondents to have interactive mobile devices with various level of interaction. This is connected to the hypothesis that connectedness is a property of the modern world brought about by the Internet, networks, and interactive devices being all pervasive. One would therefore expect interactivity to be a key aspect in mobile TV take-up. Individually talking the highest percentage of users were asking for a non-interactive mobile devices. This result was a surprise as the mobile devices enable users to interact with the content at a various levels. This might be because of the thought that interacting disrupts the viewing experience.

5.11 Summary of the Analysis – Jordan

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	108.566[a]	9	.000
Likelihood Ratio	96.794	9	.000
N of Valid Cases	309		

a. 4 cells (25.0%) have expected count less than 5. The minimum expected count is 1.46.

Table 5.13: Jordan's Survey Question Four (Age Group)

It was found that X^2 value = 108.566[a] is significant at .000 which means that there is relationship between Age Group and Question 4. The difference in age group affects the available features of mobile devices. The highest percentage of respondents from age group 1 own mobile devices with a camera and colour screen. The majority of respondents from age groups 2 and 3 do own mobile devices with camera and coloured screen. The majority of respondents from age group 4 own mobile devices with no camera(s) and monochrome screens.

This question is designed to reach a clear view of the users' devices, i.e. 3G mobile phones tend to contain cameras and support mobile TV, while 2G mobile phones are not equipped with a camera and therefore do not support mobile TV. The respondents are in general agreement that they own mobile phones that contain coloured screens and cameras, features that match those of 3G and above or touch screen mobile devices. Therefore most respondents' mobile devices are able to display mobile TV services.

This result does not match with the hypothesis of Jordan being a developing country where it would be expected to be more difficult for users to obtain mobile devices capable of mobile TV. For example, at that time 3G was not applied in Jordan. The reason for this surprising result is a cultural reason for example that the mobile device in Jordan would represent the person's level in the society.

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	47.721[a]	9	.000
Likelihood Ratio	58.034	9	.000
N of Valid Cases	309		

a. 1 cells (6.3%) have expected count less than 5. The minimum expected count is 2.72.

Table 5.14: Jordan's Survey Question Five (Age Group)

It was found that X^2 value = 47.721[a] is significant at .000 which means that there is relationship between Age Group and Question 5. The difference in age group affects the respondent's type of mobile devices. The highest percentage of respondents from age groups 1, 2 and 3 do own 3G mobile devices. The majority of the respondents from age group 4 do own 2G mobile devices.

In general the majority of the respondents do own mobile devices that are capable of displaying mobile TV. The highest percentage owned 3G devices. In addition, some owned touch screen devices and finally some owned 4G mobile devices. This result matches with the previous one as the respondents own mobile devices with camera and coloured screen. But the result does not match with the hypothesis of Jordan being a developing country where it would be expected more difficult for users to obtain mobile devices capable of mobile TV. For example, at that time 3G was not applied in Jordan.

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	78.152[a]	6	.000
Likelihood Ratio	82.168	6	.000
N of Valid Cases	309		

a. 1 cells (8.3%) have expected count less than 5. The minimum expected count is 4.08.

Table 5.15: Jordan's Survey Question One (Age Group)

It was found that X^2 value = 78.152[a] is significant at .000 which means that there is relationship between Age Group and Question1. The difference in age group affects the respondent's use of mobile devices. The highest percentage of age group 1 do use their mobile devices for calls and all other services. The majority of respondents from age groups 2 and 3 do use their mobile devices for calls and all other services. The highest percentage of age group 4 use their mobile devices for calls only.

In general the devices owned by the respondents have many features, but were they used by the respondents? The majority of respondents used their mobile devices many features in addition to calls. This result does not match the hypothesis of Jordan being a developing country where it would be expected to be more difficult for users to obtain mobile devices capable of mobile TV.

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	18.188[a]	3	.000
Likelihood Ratio	18.772	3	.000
N of Valid Cases	309		

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 9.13.

Table 5.16: Jordan's Survey Question Two (Age Group)

It was found that X^2 value = 18.188[a] is significant at .000 which means that there is relationship between Age Group and Question 2. The difference in age group affects the respondent's video being viewed on mobile devices. The majority from age groups 1, 2 and 3 do watch video on mobile devices.

The respondents from age group 4 were divided equally between either watching video on mobile devices or not.

There is a connection between this result and the previous ones. The results show that the majority of respondents do watch videos on their mobile devices.

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	155.556[a]	9	.000
Likelihood Ratio	149.850	9	.000
N of Valid Cases	309		

a. 4 cells (25.0%) have expected count less than 5. The minimum expected count is 1.84.

Table 5.17: Jordan's Survey Question Eight (Age Group)

It was found that X^2 value = 155.556[a] is significant at .000 which means that there is relationship between Age Group and Question 8. The difference in age group affects the respondent's point of view of watching video on mobile devices. The majority of respondents from age group 1 do think of watching video on mobile devices as not convenient. The majority of age groups 2, 3 and 4 do think of watching video on mobile devices as convenient.

As the majority of respondents do view video on their mobile devices therefore it is not surprising that the majority do think of watching video on mobile devices as convenient. But however the results does not match with the hypothesis of Jordan being a developing country would be expected more difficult for users to obtain mobile devices capable of mobile TV. For example, at that time 3G was not applied in Jordan. This result shows that the respondents accept the service in general while the rest of the questions reflect the detailed needs and requirements to form a genuine mobile TV service.

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	75.091[a]	9	.000
Likelihood Ratio	65.290	9	.000
N of Valid Cases	309		

a. 4 cells (25.0%) have expected count less than 5. The minimum expected count is 1.17.

Table 5.18: Jordan's Survey Question Ten (Age Group)

It was found that X^2 value = 75.091^a is significant at .000 which means that there is relationship between Age Group and Question 10. The difference in age group affects the respondent's future intension to adopt mobile TV service. The highest percentage of respondents from age groups 1 and 4 in the future when mobile device service is applied will adopt the service. The majority of respondents from age groups 2 and 3 in the future when mobile device service is applied will adopt the service.

The result shows that the majority of respondents will adopt a broadcast mobile TV service when it is applied in the future. This matches negatively with the hypothesis that Jordan being a developing country where it would be expected to be more difficult for users to obtain mobile devices capable of mobile TV. For example, at that time 3G was not applied in Jordan.

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	65.412[a]	9	.000
Likelihood Ratio	88.987	9	.000
N of Valid Cases	309		

a. 4 cells (25.0%) have expected count less than 5. The minimum expected count is .87.

Table 5.19: Jordan’s Survey Question Twelve (Age Group)

It was found that X^2 value = 65.412[a] is significant at .000 which means that there is relationship between Age Group and Question12. The difference in age group affects the respondents feeling of viewing advertisements on traditional TV. The highest percentage of respondents from age group 1 are interested in advertisements displayed on TV. The majority of respondents from age groups 2, 3 and 4 are interested in advertisements displayed on TV.

According to the hypothesis which predicts that as new media communications grow, advertising in traditional media is declining. One would therefore expect advertisers to be looking for opportunities in new media. The results shows that almost 50% of the respondents are interested in advertisements displayed on traditional TV. The percentage shows that there is a decline as the other respondents were not enthusiast about advertisements being displayed on traditional TV. Therefore the result matches the hypothesis.

According to the hypothesis a new advertising technique is introduced in this study. Product placement means displaying products in a video content, which enables the users to interact with the content so as to learn more about the product or to buy it. This study is contributing to introducing original concepts in advertising. Users as well as advertisers are becoming more familiar with terms such as extrapolation and non-commercial informative advertisements. Advertising is no longer traditional. It is becoming a vehicle for information provision. Thus, product placement is considered to be a method using web browsing.

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	60.894[a]	9	.000
Likelihood Ratio	69.801	9	.000
N of Valid Cases	309		

a. 2 cells (12.5%) have expected count less than 5. The minimum expected count is 2.33.

Table 5.20: Jordan’s Survey Question Fourteen (Age Group)

It was found that X^2 value = 60.894[a] is significant at .000 which means that there is relationship between Age Group and Question 14. The difference in age group affects the idea of extrapolation from commercial advertising to non-commercial information provision and then using product placement to web browsing. The majority of respondents from age groups 1, 2 and 3 think that the idea of extrapolation from commercial advertising to non-commercial information provision and then using product placement to web browsing is splendid and will be used when applied. 50% of the respondents from age group 4 think that the idea of extrapolation from commercial advertising to non-commercial information provision and then using product placement to web browsing is splendid.

Apparently, respondents find this novel method of advertising useful and are willing to have it on their mobile devices once it is applied. This result matches with the hypothesis.

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	97.665[a]	9	.000
Likelihood Ratio	92.298	9	.000
N of Valid Cases	309		

a. 4 cells (25.0%) have expected count less than 5. The minimum expected count is 1.75.

Table 5.21: Jordan's Survey Question Twenty (Age Group)

It was found that X^2 value = 97.665[a] is significant at .000 which means that there is relationship between Age Group and Question 20. The difference in age group affects the mobile devices degree of interactivity. The highest percentage of age group 1 prefer mobile devices with a high degree of interactivity. The majority from age groups 2 and 3 would prefer mobile devices with a medium degree of interactivity. 50% of respondents from age group 4 would prefer mobile devices with a medium degree of interactivity.

The results show that the majority of respondents ask for interactivity on mobile devices. Specifically the highest percentage of respondents prefer a medium level of interactive devices. This result matches with the hypothesis that connectedness is a property of the modern world brought about by the Internet, networks, and interactive devices being all pervasive. One would therefore expect interactivity to be a key aspect in mobile TV take-up. The difference in the respondents views on the degree of interactivity is due to the lack of understanding of the boundaries between the levels of interactivity or because users are not familiar with the interactive mobile TV experience. It has been pointed out earlier that interactivity can be classified into four levels: none, high, medium and low.

5.12 Summary of the Analysis – Motorola

The second survey sample held in Jordan consisted of engineers worked with Motorola. The sample contains eight engineers who revealed the following conclusions. Motorola's engineers are divided into two age groups (2 and 3).

The occupation was excluded as the Motorola engineers are all from a private sector therefore there is no need for the occupation as a demographic variable in this case. In addition, all of the engineers were male therefore the Gender as a demographic variable was excluded.

In general 50% of Motorola engineers use their mobile devices for calls and text messages. They are not highly pro-technology with regard to the use of mobile devices as it was expected as they are in the market of mobile devices. The other 50% do use all the features of their mobile devices. Surprisingly five of the respondents do not watch video on their mobile devices. In this case the reasons could be either the limited time that they have got, or because they have some information on the upcoming technologies. The analysis of the survey includes the types of device owned by respondents in order to check if mobile TV service could be applicable. The first step for deploying a mobile TV service is to ensure that the infrastructure needed is available. In addition, the question aimed to explore the respondents' understanding of the mobile devices they own.

2G mobile devices do not contain a camera. Strangely enough, this fact does not correlate with what all users have said concerning owning mobile devices with a camera and coloured screen what matches with Motorola engineers of being highly pro-technology – which are two main features of a 3G mobile device. The misunderstanding comes from the fact that officially 2G and 3G mobile devices are well-defined, but 2.5G and 2.75G ones are not.

Mobile TV is predicted to be one of the most successful services in the mobile market. The previous results match with the following as 50% of the respondents think that watching video on mobile devices is inconvenient. However, the others think it is convenient. This division among users reflects the division in the real world between technology enthusiasts and the resistant users of technology. In addition, some respondents might find mobile TV service unacceptable because of the current challenges facing mobile TV.

In the future when a broadcast mobile TV service is available all of the respondents will adopt the service. This shows that the service in general is not rejected by them. But the previous answers could be a representative of a rejection of the current mobile TV experience but as they are in the market of mobile devices and have some inside information about the upcoming developments in the mobile TV service domain therefore in the future they would adopt it.

Concerning the advertisements and the idea that as new media communications grow, advertising in traditional media is declining. In this case here two thirds of the respondents were interested in the advertisements displayed on traditional TV. One would therefore expect advertisers to be looking for opportunities in new media. New types of advertisements must be designed to meet users' requirements and needs. A new contribution this study adds is the idea of the shift from commercial advertising to non-commercial information provision, and then using product placement to web browsing for the mobile TV viewing environment. This contribution is thought by two thirds of the respondents to be a splendid and will be used when applied. This result might be because traditional ways of advertising do not take into consideration the capabilities of the mobile TV service. This way of advertising engages respondents with almost all the facilities provided by their mobile devices.

Connectedness is a property of the modern world brought about by the Internet, networks, and interactive devices being all pervasive. One would therefore expect interactivity to be a key aspect in mobile TV take-up. The majority of engineers do prefer highly level interactivity on mobile devices for example such as multi-touch screen mobile devices. Interactivity is a must on mobile devices; that is what users are asking for, but the level varies among them.

5.13 Conclusions

The following are the results from the main hypotheses included at the start of the chapter:

1) Motorola Engineers are expected to be highly pro-technology with regard to the use of mobile devices as they are in the market of mobile devices. This hypothesis proved to be false. As the results showed that they were not interested in the current mobile TV service.

2) UK respondent, as members of a 'technologically advanced' nation may more readily welcome advanced technologies. This hypothesis proved to be true. The results showed that they were interested in the current mobile TV service.

3) Individuals in Jordan, a developing country, may find it more difficult to obtain mobile devices capable of delivering mobile TV. For example, at that time of study, 3G was not available in Jordan. This hypothesis proved to be true. The results showed that the Jordanian respondents were up-to-date with mobile technology and the use of it. It is concluded that there is no major difference in the results between the Jordanian and English samples.

4) Connectedness is a property of the modern world brought about by the Internet, networks, and interactive devices. One would therefore expect connectedness and interactivity to be a key aspect in mobile TV take-up. This hypothesis proved to be true. As the results showed the interactivity is an aspect that the majority of respondents from all samples were asking for.

5) As new media communications grow, advertising revenues for traditional media is subject to greater competition from other fields. One would therefore expect advertisers to be looking for opportunities in new media. This hypothesis proved to be true. Due to the results conducted there are many respondents who were not interested in advertisements displayed on traditional TV. In addition, the majority of respondents were welcoming to the new idea of non-commercial advertisements.

The first section of this chapter presented the research methodology used and the purpose and objectives of this work, the data collection methods, the design of the questionnaires and the sampling, validity, reliability and statistical techniques. A concept survey was designed, distributed and analysed. This survey included respondents from two countries, Jordan and England, with a sample size of about 497. As the main subject of this research is mobile TV, there was a need to collect data to seek to understand what users think of mobile TV as a service. It is concluded that most of the respondents from Jordan do use their mobile devices for more than simple phone calls or messaging, and they do utilise their mobile devices to watch video. It is also concluded that there is likely to be a willingness to adopt mobile TV services in the future when they are available. Therefore the hypothesis of Jordan being a developing country would be expected more difficult for users to obtain mobile devices capable of mobile TV, does not match that conclusion.

In England, users agree with Jordanian respondents with regard to the use of their mobile devices for watching videos. Therefore they desire such a service. This conclusion is related to the hypothesis of UK people being a Western world should readily welcome advanced technologies. A user's adoption of a mobile TV service is dependent on many aspects such as the price, the type of content displayed, the device capabilities and many more aspects. Motorola engineers are expected to be highly pro-technology with regard to the use of mobile devices as they are in the market of mobile devices, but surprisingly they are not enthusiastic with regard to mobile TV service. That could be because of the immaturity of the service from their point of view or that they have an inside information that the upcoming technology will provide a better services. Another reason could be that the engineers are busy and have got no extra time to spend on such services. Surprisingly, Motorola engineers mentioned that their devices had a camera and coloured screen, which did not correlate with their answers about owning 2G mobile devices. That could be because of the high end of 2G such as 2.75G to be considered as a 2G mobile devices. Future research is recommended to study users' understanding of the type of devices they own.

It is concluded that most of Jordan's and England's respondents show a degree of acceptance of mobile TV services. On the other hand, Motorola engineers indicated an opposite point of view. As most respondents describe mobile TV service as useful, the number of adopters to the service is still fewer than expected. This could be because mobile TV as a general service is perceived to be useful but there are some roadblocks which prevent users from fully adopting the service. From the literature survey carried out in this research it is clear that factors such as the content displayed, infrastructure, interactivity, context, screen size, ergonomics and price are all aspects that could have contributed to this unexpected result. One of the vendors who had problems because of a low number of users was Virgin Mobile TV (VMTV), which was launched in 2006 but failed to attract users and was abandoned in 2007. Therefore, to turn this into a viable, commercial service, the barriers need to be addressed.

The main problem presented by this research is mobile TV's failure to take off with consumers. Therefore, a solution must be achieved. It is well known that advertising is a way to fund TV services. It is believed that price is one of the barriers, which could be overcome through advertising. A concept survey was held in two different countries. The results indicate that Jordan has not yet commercially applied a mobile TV service while the opposite applied to England. A further difference between both countries is culture.

This concept survey was carried out with the following objectives:

1) To question whether users were familiar with the concept of 'mobile TV'.

2) To collect information on several subjects related to mobile TV and the interactive advertisements applied to it.

3) To explore the user requirements of a mobile TV service.

Therefore this research assumed that identifying the users' requirements and their understanding of mobile TV services would help to find appropriate ways of advertising that suit mobile TV services. In this way, a reasonably priced, or free, mobile TV service could be achieved. Online advertising is one of the major ways for generating revenue to almost all online services. It seems that many advertisers who have switched their advertisements from traditional TV to the Internet (probably because of their feeling that the viewing audiences for traditional TV are going down and Internet users are going up – particularly for younger viewers, who the advertisers want to influence to buy their products). Some argue that advertisers who might have helped to fund mobile TV services have already found success on the Internet. This research disagrees as mobile TV has not yet fully applied advertisements to the service. In addition, mobile TV is not yet considered to be an alternative to the Internet as there are many differences between both services. It is concluded that the advertisements displayed on traditional TV are thought to be interesting to almost 50% of the Jordanian sample and Motorola engineers. On the other hand, respondents from England find advertisements on traditional TV not as interesting. Therefore, in Jordan there are another 50% who are not interested in advertisements on TV as well as the majority of England sample. The overall result is that there is a rejection to advertisements on traditional TV from many respondents. This result matches with the hypothesis that as new media communications grow, advertising in traditional media is declining. One would therefore expect advertisers to be looking for opportunities in new media.

The new ways of advertising that are thought to suit the mobile TV experience is the use of non-commercial information advertising. This way of advertising was thought by the respondents to be excellent, and once it is available most of the users consulted intend to use it. It is concluded that new interactive and customised advertisements could be the most acceptable type of advertisement on mobile devices.

In this research, further barriers were also explored, such as interactivity as mobile devices by nature are interactive. The results of the survey show that the majority from all samples are requiring interactivity to mobile devices. Even though the samples differs in the degree of interactivity. This result matches with the hypothesis that is the connectedness is a property of the modern world brought about by the Internet, networks, and interactive devices being all pervasive. One would therefore expect interactivity to be a key aspect in mobile TV take-up.

The next chapter will discuss the procedure for designing interactive interfaces which are suitable and acceptable to consumers. It also discusses the new emerging revenue generation models.

Chapter 6

Design of Prototypes

6.1 Introduction

This chapter provides details of the design principles used in order to construct the applications of this research. This takes into account the perceived barriers to mobile TV, the consumer needs and the limitations of traditional advertising. It also illustrates the emergence of new revenue generation models.

The design of mobile TV applications is able to exploit the convergence of two types of devices – mobile phones and TVs. These new interactive mobile TV applications are an end-to-end solution based on existing technology that enable mobile phone users to watch streamed TV programmes live or video-on-demand shows, and at the same time interact with the show displayed on their mobile phone screen. This allows the utilisation of new TV formats. In addition it widens target groups and builds customer loyalty while potentially giving end users a more advanced and enhanced TV experience. Audience involvement can be stimulated by appropriately targeted content. Video on mobile phones can be used by marketers to directly reach the consumer when they are on the move with no intermediation (Burns 2006).

Users are migrating to interactive digital devices. This is one of the reasons why the advertising sector is shifting to digital channels in order to reach users. Previously, mobile advertising was limited to the popular methods of a mobile web banner at the top of the page or a mobile web poster at the bottom of the page. Further kinds are SMS advertising, MMS advertising, and advertising within mobile games and mobile videos. Audiences in the UK may not welcome advertisements on traditional TV because of the interruption caused to the watching of a programme viewers are interested in, especially in the case of an advertisement in which viewers may have little or no interest. At the same time the ubiquity of mobile devices and networks means that, for many people, these are displacing traditional television. There is, therefore, an opportunity to explore the personalisation of advertising.

The decline in advertising revenues on traditional TV acts as an incentive to raise awareness among content producers for mobile devices, especially marketers, to investigate new revenue generation methods of mobile advertising and the opportunities available for targeting consumer groups.

With the extensive availability of multimedia content for display on mobile devices, opportunities for tailored mobile advertising have arisen. Different forms of advertisements, which are tailored to suit the user’s age, gender, location, and personal interests, lead to new trends emerging in product placement to ensure relevance to individual users. In addition, combining product placement with interactivity in the advertising leads to new ways of generating revenue, finding new ways to bring products to consumers' attention, and providing other information, similar to that produced by web browsing. This is what is called 'infotainment'.

This chapter utilises the findings of the research detailed in Chapter 5 on the content that various groups of respondents expect, the preferred types of advertising, the opportunities for interactive advertising (both as a revenue stream and as a paradigm for more general forms of interaction), and the relationship between the content on the device and the real world in which the user is placed. The additional details in this chapter concentrate on the reason for applying interactive mobile TV to the idea of product placement, in addition to applying many other types of advertisement, including customised and interactive forms. This is linked to the perception that mobile TV will be qualitatively different from traditional TV.

In this chapter, the process of designing the interactive mobile TV advertising applications will be discussed step by step under the following subheadings.

6.2 Content and Prototypes

6.2.1 Mobile Video Content and consumer needs

A concept survey was carried out as part of this research. The surveys were analysed in detail in the previous chapter. There are a number of key points that have emerged from exploring and surveying consumers' needs, which are critical to designing optimum and adaptable interactive mobile TV advertisements. The key elements to emerge from the concept survey data are as follows:

1) Type of Video content.

2) Personalisation.

3) Interactivity.

4) Mobile devices.

5) Infotainment.

In this research, survey samples from two different countries were involved. Although different age groups had different views about the relative importance of the various application areas, there was general agreement that greater user control over what kind of content should be mediated to the user was welcome. In addition, user control is not specific to the kind of content to be mediated but there are many other methods of user control, such as interacting with the content. Different age groups from both countries reflected different views on the level of interaction they prefer. Content that is directly relevant to the user's interests is unsurprisingly more welcome than content that is not. Content that is directly relevant to the user's interests to be viewed on mobile devices is relatively different from that on traditional TV. Content that is related to the user's familiarity (ordinary content) is more welcome than content users have no idea about (tailored content). From this, the types of content directly relevant to users' interests has also been noted in the area of mobile purchasing and learning, this is presented in the idea of 'Infotainment' and 'Advertainment'. For example, the Ministry of Health distributing videos on cutting smoking is not linked to saleable products, but is rather used as a source of general knowledge to show the viewer how to protect themselves. In another example, Amazon sends its users information on new books relating to themes that were evident from previous purchases the user has made. Thus Amazon is building up a profile of each of its users and their interests, and targeting relevant advertising of new products to meet these interests. There is general agreement by the survey respondents that they do prefer the idea of customised advertisements. Thus the emphasis is upon seeking to meet the individual user's needs and requirements rather than imposing blanket commercial advertising upon them. Thus the more the user perceives them as being in control; the more likely they are to take notice of the content. Selectivity in online advertising is known to be much more effective, as has been demonstrated from the advertisements on web pages produced by Google searches. Selectivity is represented in the case of mobile TV advertising specifically in interacting with the content through the idea of product placement or buttons, which is thought to be effective, as demonstrated by the prototypes of this research. Advertisements that are directly relevant to the interests of the user, as indicated by their search terms, are also clearly more cost-effective for the advertiser.

6.2.2 Searching for Appropriate Content

For this section, the most popular content was derived from the surveys of this study. The results show that there are fewer consumers who wish to get tailored content than those who are asking for pre-existing content. In this research, based on survey respondents' demands, some tailored content was a result of continuous work of capturing videos using a camcorder, while ordinary content was a result of the selection of some pre-existing videos displayed on traditional TV. The following kinds of content apply to both tailored and ordinary content: *1)* news headlines; *2)* advertisements; *3)* movies; *4)* song clips (songs); *5)* sport matches; *6)* tailored content using a video camera; *7)* personal events; and *8)* others.

With regard to the type of content to be utilised, it is important to decide how interactivity is going to take place within such content. There are some methods of interaction that use buttons placed on the video interface or use clickable regions in the video of the products.

Interacting with video is possible through selecting the content the user is interested in viewing and then checking if the user needs to rewind or forward it, download the content to watch it later, or possibly share it with family or friends. Mobile device camera(s) are used to capture some events, concerts, and family or friends so that the mobile device owner can share them with other people (via social networks for example). Professionals, on the other hand, use camcorders to produce tailored content in which clicking on the interactive regions in a video or clicking buttons on the video are utilised to react to the user's choice. In addition, the idea of 'infotainment' is utilised in order to fulfil the consumer’s desire of clicking on an object in order to purchase it, or to get more information about it.

Additional work undertaken in this research relates to the following fields:

1) Background review of all mobile generations was collected and studied.

2) Using images and videos of radiology, such as ultrasounds, FMRIs, MRAs and hysterosonographies, as an application of mobile. Doctors would receive these videos through mobile devices in rural areas or anywhere else.

3) An experimental standardised test video was captured using a camcorder to explore ideas about creating a test video, analogous to ‘Lenna’, the well-known standard test image. The camera was also used to capture videos to utilise them as tailored content video.

4) Video content was displayed and investigated on mobile devices such as PSPs, iPods and mobile phones.

6.2.3 Compression of Appropriate Content

The chosen content must be within a small file size in order to be displayed on mobile devices that might have limitations in memory size and processor power. When large file size content is downloaded they might not work on mobile devices that might show a message that there is no enough memory to open the file. Therefore, some of the content was compressed in order to apply interactivity on it and then displaying it on mobile devices. The wavelet transform concept, as used for compression and algorithms, was programmed by this research using Matlab, a fourth-generation programming language. Compression algorithms were viewed in this research as the best tool to decrease the video content size for transmission to, and display on, mobile devices. This compression was applied to some video content before adding any interactive capabilities because of the following reasons: easier to transmit video content to mobile devices; limitation of the memory size of mobile devices; considerable large size of the ordinary and tailored content; and it could be effective to reduce the usage of the bandwidth rather than being pressured. The following program is an example of these algorithms.

Using the 'clear' command after each execution and clearing all variables are required to be executed before applying the following algorithm. This algorithm is used for image generation of x (m, n) of 6*6 size. X represents an indexed image. M represents number of columns. N represents number of rows.

```
%Number of m columns = 6.
for m = 1:6
%Number of n rows = 6.
   for n = 1:6
      x(m,n) = 100*(1/(m+n -1));
   end
end
x

% Applying Discrete Wavelet Transformation (DWT) on columns.
for j = 1:2:5,
   for k = 1:1:6,
         y(j, k)=0.5*(x(j, k)+x(j+1,k));
   end
end
y

% Applying Discrete Wavelet Transformation (DWT) on rows.
for j = 1:1:5,
   for k = 1:2:5,
         z(j, k)=0.5*(y(j, k)+y(j,k+1));
   end
end z
```

```
% Converting to integer values

z1=int8(z)

%Deleting zero rows

z2 = [z1(1,1:end);z1(3,1:end);z1(5,1:end)]

% Transposing matrix

z3=z2'

%Deleting zero rows

z4 = [z3(1,1:end);z3(3,1:end);z3(5,1:end)]
```

As mentioned earlier, the above algorithm was designed to show how video content is compressed due to mobile device and broadcasting limitations. In addition, for the ease of designing prototypes and simulation of an interactive mobile TV services. It is a simple example of wavelet transformation that converts the image into multi-resolution sub-images that contain spatial information as well as frequency information. This algorithm starts with generating a 6x6 matrix image. The second step is defining rows and columns. The next step is the formation of a nested loop for inserting numbers in each block. After producing the matrix, the application of the DWT process starts on columns with the loop, which the formula works on by moving from the first two blocks of the first column to the third, fourth, fifth, sixth columns and so on for the rest of the columns. The same DWT process is applied to the rows. The results were converted to signed 8-bit integers, in the output range -128 to 127. Finally, zero rows and zero columns are deleted, to result in the final matrix, which is z4.

This algorithm works on a generated 6x6 image size and could be implemented to work on high-resolution images. Further work is expected to employ compression algorithms that work for video displayed to mobile devices. This can be applied using a two-dimensional Discrete Wavelet Transformation (DWT) algorithm, which converts the image into multi-resolution sub-images containing spatial information and frequency information. In this algorithm these images should be stored on a device in order to be read then converted into decimal values. After applying the previously mentioned algorithm to some of the videos it was shown to be adequate to dramatically reduce the size of this content (See Chapter 7, Section 7.3.1, Figure 7.1).

As in this case, the compression was applied manually in this research because it was applied to a specific video content, as the content was downloaded into the mobile devices. In the real time video broadcasting the content will not be compressed manually. This algorithm can be extended to include other capabilities such as being automatically applied to compress the live streamed content.

6.3 Definition of Terms

The following terms are relevant to research designs because they represent the software tools used in designing the interfaces.

1) Campbell (2006, p.214) defines an image map as "*a graphic with one or more clickable regions or hotspots*". "*The array of invisible link buttons (called hotspots) responsible for this magic is called an image map. An image map contains one or more hotspots, each leading somewhere else*" (McFarland 2005, p.142).

2) In HTML, "*image files consist of rows of pixels and each pixel has a unique location on the user's screen. The browser can determine the mouse click location and actions that can be performed based on this location. An image map element allows image regions to be specified by circles, rectangles and polygonal forms. Common uses include actual maps or individual item groupings. Image maps work by providing information that associates regions of an image with the action to be taken*" (Mercer 2003, p.57).

3) Camtasia Studio is the software that enables non-technical users to create a recorded video that retains high definition quality by selecting a widescreen format (1280 X 720). This software provides the users with recording options by offering the choice of full screen, window or region. Users can add audio to the video in addition to a video-in-video. This software enables users to save the video in various formats. In addition, in Camtasia it is possible to: "*import recordings, videos, images and audio files into a Camtasia Studio project (.camproj); arrange the sequence of clips on the timeline; edit the* *audio and video tracks; add special effects such as transitions, callouts, Zoom-n-Pan Keyframes and Flash quizzes; and produce the video in a shareable file format*" (TechSmith n.d.).

4) Flash lite is the software intended for mobile devices and enables users of mobile devices to view multimedia content that had been previously developed by Flash. "*Adobe® Flash® Lite™ software is a powerful runtime engine for mobile and consumer electronics devices that benefits both device manufacturers and content developers. It enables manufacturers to provide customers with improved web browsing, video content, and compelling interactive experiences*" (Adobe n.d.).

5) Flash is a multimedia platform that enables users to add animation and interactivity. "*(Adobe Flash) software is an advanced authoring environment for creating rich, interactive content for digital, web, and mobile platforms*" (Ghoda 2009, p.10).

6) Usability is "*the capability in human functional terms to be used easily and effectively by the specified range of users, given specified training and user support; to fulfil the specified range of tasks, within the specified range of environmental scenarios*" (Shackel and Richardson 1991, p.24).

7) Interface testing is "*a dynamic analysis technique*", which is "*similar to interface analysis, except test cases are built with data that tests all interfaces*" (Wallace et al. 1996, p.29).

6.4 Designing Prototypes

6.4.1 Background to Design Aims and Objectives

The traditional way of advertising on TV is a 30-second advertisement broadcast between programmes or within programmes. Some viewers find these traditional advertisements both boring and disruptive and will stop viewing at this point. One feature of digital video recording that has sought to address this is to effectively record and play back without the advertisements, for example TiVo (Gutnik et al. 2007). About 90% of TiVo subscribers skip commercials; therefore advertisers have to find other ways of communicating information about their products.

The new models of advertisements are all about attracting users and there are many competing platforms such as radio, TV, newspapers, the Internet and mobile TV. TV advertisements combine video and audio to tell a story of a certain product. Even though many commercials do not provide consumers with detailed information about the products, as advertisers are seeking to sell lifestyles with the product as an adjunct to this, presenting product information would make people take notice of the information and ensure that they are better informed and thus able to make better comparisons with other competing products.

Product placement can be entertaining, acceptable, credible and informative, and gives brand confidence. The ideas of product placement, ‘advertainment’ and information browsing by similar methods are central to this research. ‘Advertainment’ is a combination of advertising and entertainment. Therefore, ‘advertainment’ is not about placing goods or services in a programme but rather about producing entertaining content including a product message. Users are able to view promotions in programmes, movies and in virtual worlds such as ‘Second Life’. As mobile TV content is either tailored content (such as ‘YouTube’ content) or ordinary content, this may contain tagged or linked products.

In the case of product placement advertising, this is invisible so there is no disruption to the viewing experience and skipping advertisements is not a problem. However, product placement does not enable viewers to skip commercials as they are embedded within the media. The extensive use of product placement leads viewers to fail to notice the product or become too familiar with it. Therefore, it decreases the effectiveness of this method of advertising.

In spite of the developments associated with portable mobile TV, it still has its limitations. Mobile TV provides users with short content displayed on the full mobile screen with no interruptions, as in the example of a banner advertisement. Product placement provides users with full screen size, non-disturbing advertisements with tagged or linked products. The Internet can be used to support the linking of products to their websites. As users of mobile TV services are still low in numbers, and the providers ask for subscriptions to this service, it is thought that a basic mobile service can be funded by revenue generated by interactive mobile TV advertising.

6.4.2 Design Principles

Design standards for user interfaces help people interact appropriately and optimally with devices and content. Design and implementation are based on the user's needs. The interface needs to be reliable and work consistently. If developers want to innovate, they must set standards and comply with them in order to have the optimum interface. For example, keeping colours and fonts in harmony will lead to consistent working prototypes. Reliability is about ensuring that the prototypes have no errors and are safe to use, for example buying products with no errors or frauds. User needs obtained via a concept survey were used as the basis for the design and implementation of the prototypes. A review of the final prototype was also carried out through a survey.

Designers must distinguish the features that are to attract the user's attention to interact with them to choose the appropriate colours. Designers need to be aware that certain colours that might mislead the users as well as disrupt the users' concentration when they appear. New techniques for designing interfaces for mobile devices should be deployed, and a contrast of colours on these small devices should be studied and tested to achieve the optimum design based on user requirements. Some examples are as follows: avoid combining the colours blue and yellow as many people suffer from colour deficiency in these colours (Spiezle 2001). Avoid the use of bright and bold colours, for instance the use of yellow in text is hard to read (Spiezle 2001). Some examples of colours that might mislead users are orange, green and red (Stone and Stone 2005). On the other hand, the use of dark colours on a light or white colour background is advised. Alternatively, instead of using colours, texture or shading could be applied to attract the user’s attention (Spiezle 2001).

To find out if the design of prototype is working correctly and whether it meets consumer needs, the following points should be taken into account: the time needed by the user to learn how to use the interface, the speed of performance, the number of errors the user has made, the maintenance needed for the interface with regard to time duration and the satisfaction of the user with the interface content and usage (Shneiderman and Plaisant 2004).

Screen-to-screen interaction with companies is already operating alongside traditional face-to-face interaction. Designers face the challenge of designing to different sized technologies, whether small devices such as mobile phones or large devices such as plasma screen TVs. A good designer who produces a simple and creative interface gains positive feedback from users. When the interactive interface is designed successfully, the users will not notice the design of the interface; instead they will concentrate on their work. Also, guaranteeing privacy and security to users is mandatory for a good designer to take into account (Shneiderman and Plaisant 2004).

User frustration usually stems from bad design, or designs that are difficult to understand or use. Solving these problems should start with redesigning the prototype. Conducting more research on the reasons behind user frustration will enrich the designers’ experience with the issues of interface usage problems. Online help and messages are needed sometimes if the interface is complex. Small mobile devices may be misleading if the design was not produced specifically for this size of device. Interfaces that are not safe, either because the storage of personal information and data of the user is risky or it is open to viruses, are unacceptable. Untargeted advertisements such as pop-up advertisements disturb the recipient's viewing experience, so blocking them can be an advantage. Training people to use interfaces for desktop computers is acceptable, but for mobile devices it is not normally feasible. Online demonstrations might help. Error messages that keep appearing disturb users, so designing small ones, which only appear upon committing serious errors, would be better. Developing a user enquiry line is also important (Shneiderman and Plaisant 2004).

Mobile TV is expected to become a multimedia experience with an emphasis on spontaneity and brevity due to the constraints associated with the normal use of a mobile device. As mentioned above, the fact that the video should not be more than three minutes long emphasises the importance of brevity. Moreover, user-generated content and interactivity corresponds to the keyword 'spontaneity'. However, future devices will be cheaper, have more power and capability and may also incorporate a larger screen and functions currently in Netbooks. The Cloud may also play a greater part in servicing the requirements of users via mobile devices.

Mobile devices are different from desktop computers in terms of screen size and interface layout. This makes it difficult to adopt the same interfaces designed for desktop computers on mobile devices. Mobile devices need to be portable and therefore need to be relatively small with a correspondingly small screen size. This small screen space needs to be utilised effectively.

Usability is a major concern for both designers and users when respectively producing and utilising new interfaces. The various factors raised by users to be considered when making a decision about interface usability are as follows: *1)* Usefulness of the application; *2)* Suitability of the application usage; and *3)* Cost of using the application (Shackel and Richardson 1991).

UTILITY	**- will it do what is needed functionally?**
+	
USABILITY	**- will the users actually work it successfully?**
+	
LIKEABILITY	**- will the users *feel* it is suitable?**
must be balanced in a trade-off against	
COST	**- what are the capital and running costs?**
	- what are the social and organizational consequences?
to arrive at a decision about	
ACCEPTABILITY	**- on balance the best possible alternative for purchase.**

Figure 6.1: The Paradigm of Usability and Related Concepts (Shackel and Richardson 1991, p.22)

In addition there are the following five principles. The first is 'safe exploration' – users being able to explore the interface without facing troubles. The second is 'instant gratification' – users being able to see immediate results of their actions. The third is a term that presents a combination of satisfying and sufficing and is called 'satisficing' – users being able to use the interface without spending time learning how to utilise it. The fourth is 'deferred choices' – users being able to skip some steps and still complete the job. The fifth is 'multiple windows', which should be avoided as they can be irritating and confusing.

6.4.3 Design Aims and Objectives

1) Design of advertising revenue accrual during interactive mobile TV according to the obtained analysis. This aim is important to fund and generate revenue to all the stakeholders establishing mobile TV services.

2) Establishment of new approaches to media generation for mobile television. This aim is dependent on the uniqueness of mobile TV in terms of the type of content and its specialities such as the length of the content. In addition, the uniqueness and personal devices and the speciality lead to new interactive mobile TV services. In general, a totally new viewing experience is to be studied and researched.

3) Design of interfaces with a range of interactivity between the two levels of high interactivity and low interactivity, i.e. 'lean-forward' and 'lean-back' modes, especially in relation to advertising via product-placement-like modalities. This aim is stated as the mobile TV experience is in between the level of interaction in traditional TV, which is represented in the lean-back modality (low interactivity) and online TV, which is represented in the lean-forward modality (high interactivity).

Figure 6.2: Mobile Devices with Various Ways of Interaction

4) Design of prototypes that enable users to interact directly with the video through clickable regions (pressing on the object displayed on mobile devices). These buttons are a common method of interaction that suits the mobile devices due to the interaction input and output devices available, therefore they are applied in this research.

5) Design of prototypes that enable users to interact with objects displayed on video, with pressing keys providing users with menus of various objects displayed on mobile devices. This is another way of interaction that could be applied to mobile devices, which is particularly suitable for the limitations of mobile devices such as the screen size.

6) Design of different shapes of pressing keys (square, rectangular, circle, transparent, etc.). This aim is specifically implemented to the interfaces that apply buttons as a way of interaction.

7) Design of prototypes that provide users with the maximum amount of screen size to enable them to enjoy viewing the video. This aim is to design effective interfaces as a simulation to the mobile TV service that will be suitable for the limitations of mobile devices, such as small buttons with top up menu lists or through product placement. In addition, the type of content and the length of it must be considered. Finally, no framing for the interfaces is used.

8) Design of prototypes with non-primary colour pressing keys because they are more calming than primary colours. The aim is to use the colours that suit the mobile TV experience and that do not affect the users utilising it.

9) Extrapolation from commercial advertising to non-commercial information provision and the use of product placement to web browsing. The aim is to provide the users with infotainment instead of displaying useless entertaining advertisements.

The overall objective of these designs is to provide an entire mobile TV experience that is based on the people surveyed demands. People surveyed demands take into consideration content from different perspectives such as the type, interactivity and length of content. In addition, this experience should take into consideration barriers to the adoption of mobile TV experience, such as mobile device limitations. A further barrier is the price of the service; therefore these designs are based on either a subscription or a free service. Free services are always preferred by users, as is the case for the traditional TV experience. Therefore the designs applied advertisements coaxed with video content through different ways according to the people surveyed acceptance.

This research's prototypes or interfaces are based on two types: *1)* an interface with interaction capabilities then linked to webpages; *2)* interfaces that are not linked to webpages. The 'Eight Golden Rules of Interface Design' of Ben Shneiderman are linked to current best practice and they are also key references in the literature on usability metrics. This research's design approach conforms to Shneiderman's golden rules as follows:

Rule 1. These interfaces include a consistent sequence of action, through clicking on an object or pressing a key; then actions are in sequence, especially in each group of interfaces.

Rule 2. These interfaces can be used by any user (non-experts) and the interfaces try to reduce the number of interactions by enabling the user to single click using product placement to reach a website or make two clicks using buttons to reach a website.

Rule 3. These interfaces have a direct proportion between the response and the actions. For instance, a minor action by clicking on an object in the prototypes leads to a website, which is a minor response. While a major action, such as buying an object, leads to a purchasing procedure, which is a major response.

Rule 4. These interfaces have grouped sequences of actions. Each interaction leads to the next step without any drop in the flow of actions until the user's job is accomplished.

Rule 5. These interfaces deliver simple error handling for users. No serious error faces the users when utilising these interfaces.

Rule 6. These interfaces allow the users to easily and freely reverse the actions by a single action, for example, clicking the ‘close’ or ‘skip’ buttons.

Rule 7. These interfaces allow users to take actions and no actions are being taken by the interfaces; therefore the users are not respondents to anything.

Rule 8. These interfaces reduce the short-term memory load by designing simple interfaces.

6.4.4 Designing User Interfaces

In this research, various aspects user interface design were, such as screen size, screen layout, colours, interaction and software tools. Designing user interfaces in general uses a mixture of three main colours: red, green, and blue (Olsen 1998). For example, from these three colours the orange colour is generated from high intensity of red and moderate intensity of green, and no blue colour (Carey 2009). The human eye can distinguish thousands of colours (Eiffe 1993). When designing an interface there are some combinations of colours that are best avoided. For example, white text on a yellow back ground is hard for users to read (Stone and Stone 2005). On the other hand, white text on a black background is easy to read (Stone and Stone 2005) and this was the case for most of the interfaces. Using the minimum number of colours is preferred as designing an interface using too many colours can cause confusion (Stone and Stone 2005). Guidelines on the use of colour while designing an interface indicate that no more than six colours should be used in addition to black and white (Stone and Stone 2005). The interfaces designed in this research had a general agreement that all of them, whether video or still image, have used less than six colours including white and black. In this research, most of the interfaces mainly consist of videos therefore there are no background standard colours. Therefore, interfaces which apply interaction using the idea of product placement do not embed a background colour, while other interfaces that use pressing keys (buttons) do embed background colours to these buttons.

On mobile devices the screen sizes are small compared to a TV or PC. Therefore the screen size is an aspect that should be taken into consideration while designing. In this research more than one device was used, such as PSPs, mobile phones, iPhones and laptops.

The design of the detail in the screen layout includes two steps. "*The first step is to elaborate the detail design*" (Cho et al. 2007, p.42). "*The second step is to evaluate the usability of design candidates and to select the most usable method*" (Cho et al. 2007, p.42). A screen layout is designed taking into consideration the screen constraints.

The screen layout has three steps as follows:

1) Sequence of elements (vertical, horizontal).

2) Nesting of elements.

3) Spacing between elements.

It is important to know the pros and cons of the designed interfaces. This is applied to the currently available suboptimal solutions in order to achieve the optimal solutions that could be designed in the future. The type of application designed in this research may have some constraints due to the use of some elements such as the screen size and interaction with videos.

General aspects of screen layout are as follows (Waloszek 2002):

1) Flow of control: the way users progress on the screen while completing a job.

2) Dependencies: the way elements on the screen depend on each other and how one may affect the other.

3) Togetherness: the elements that are related to each other on screen.

4) Aesthetics and general Gestalt principles: the ways information is being communicated visually.

In this research, the flow of control reflects the sequence of the elements that appear on the screen. Flow of control has two main objectives: efficiency and understandability of the interfaces. The natural progression when using an interface is represented in the following example: completing an application usually requires a user to start by filling in their name, this is efficiency and usability. Understandability is required because if the user does not understand how to use the interface the user's task will not be performed. On the other hand, a badly designed interface requires the users, for any reason such as errors, to revisit the application to be completed. Therefore in this research all these aspects were taken into consideration. Another aspect of the layout of elements is the reading direction. In this research, the two countries studied, Jordan and England, represent different cultural backgrounds, which are drivers to the flow of control. For example, the English language reading direction is from left to right while in the Arabic language it is from right to left. In this research the English language reading direction was applied as it is understandable by both samples. In addition, text is presented from top to bottom. Finally, elements were allocated from right to left (opposite to the reading direction) and from bottom to top. Zigzagging to and from and up and down, is prohibited.

Dependencies, for instance when pressing on an element on the screen it is expected that the details or options will appear below the element not above it, are related to the flow of control, for instance English is written from left to right and top to bottom. These rules are followed by default on the designer's part. Furthermore, from left to right (in reading direction) and from top to bottom is recommended. But from right to left (opposite to the reading direction), from bottom to top, and changing columns from upper right to lower left, from lower right to upper left, across several columns (for more than two columns) is not recommended. Arranging interface elements is the first step in designing. This arrangement can be performed and tested by designers on paper.

In this research, nesting, for instance entering a value in a search fields at the left and after that clicking on the start button on the right of it, is used to show the complex hierarchical relations and dependencies between objects. Nesting is also used to hide the details while the users select the option and after that the details appear. Nesting uses visual separators that may otherwise clutter the interface visually.

Spacing is also taken into consideration in this research; this is concerned with readability and recognising the elements of the interface. Spacing is about how many pixels there are between an element and the border of a group.

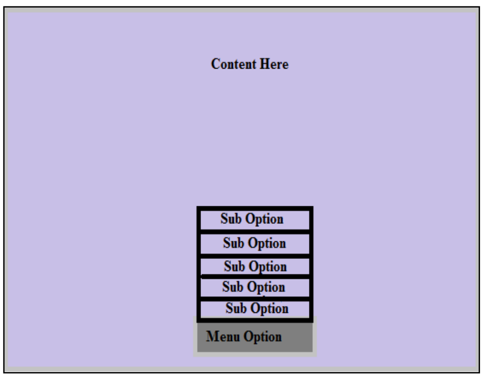
With respect to interactivity as the fourth aspect, in this research there are various methods of interaction, such as clickable regions on the objects that appear in the video and pressing keys that appear at the bottom end of the prototype; both of them enable users to interact with the video. The first option allows interaction with menus that correspond to the users' choices while the second allows it via the invisible clickable area. These methods are detailed in the sections below.

6.4.5 Wire-framing the Designs

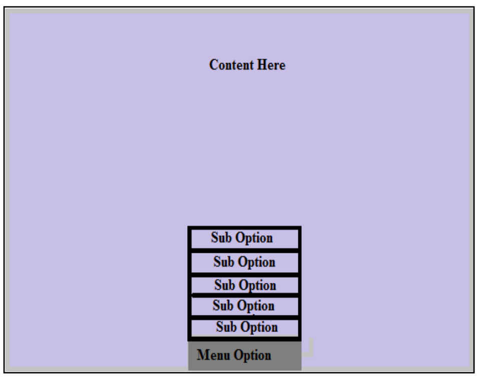
Wire-framing creates a framework structure of the prototypes. In this research the planning step of prototypes started with the simple and traditional way of hand drawing the sketches. In addition, a professional phase of planning was completed using a Microsoft Paint or Adobe Fireworks tool to design the sketches of the layout of the prototypes. Also the Adobe Fireworks tool was used in order to draw the skeletons of prototype structures. This was an integral part of the planning process for the prototypes to achieve an optimum and effective design for their appearance and function.

1) Microsoft Paint Sketches

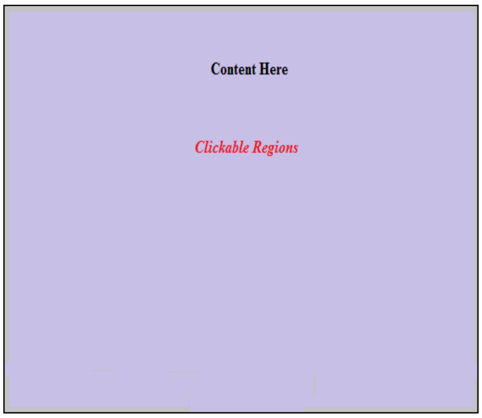
This section presents the use of the Microsoft Paint tool for designing the structure of the prototypes that were applied to the mobile devices as applications.



A



B

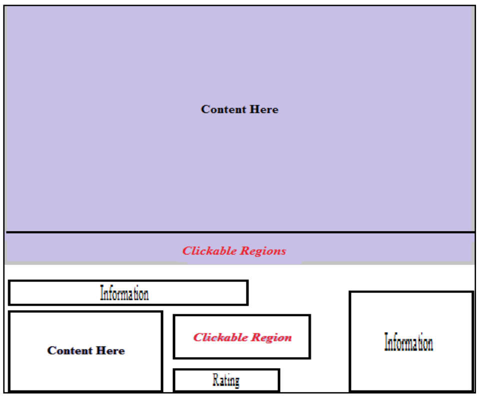


C

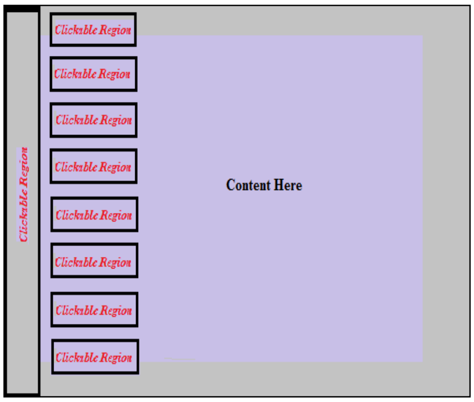
Figure 6.3: Paint Brush Design Sketches 1

In sketches A, B, and C the initial steps of the design were made by first inserting a ready-made shape, such as a rectangle, then selecting the lavender colour from the palette and clicking on the canvas to fill it with the foreground colour. In addition, each element on screen was identified with text that describes it.

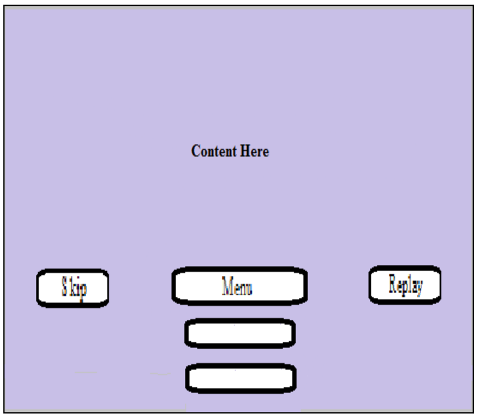
In sketches A and B pressing keys were generated with menu lists and all the elements were labelled with text. The only difference between sketch A and B is that A has a pressing key in the bottom part of the prototype while B has a pressing key (button) at the bottom end of the sketch. In sketches A and B the pressing keys of sub options appear only when the menu option pressing key is pressed. Sketch C adds a text 'Clickable Regions' into the prototype, showing that the prototype allows interaction through clicking on the video itself.



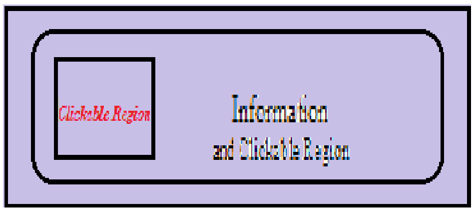
D



E



F



G

Figure 6.4: Paint Brush Design Sketches 2

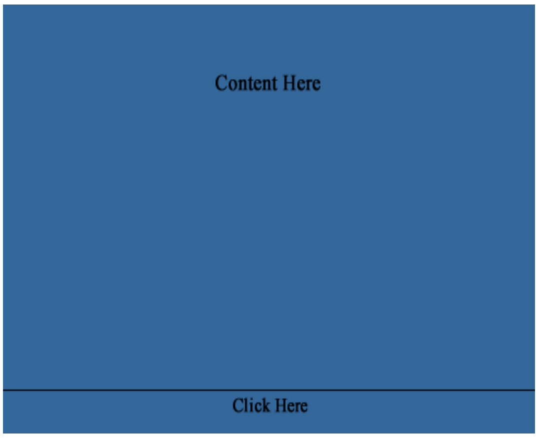
With respect to sketches D, E, F and G, the steps for the design were to first insert a ready-made shape, such as a rectangle, then select the lavender colour from the palette and click on the canvas to fill it with the foreground colour. In addition, each element on screen was identified with text that describes it.

Sketch D presents an interface that contains video content in the main body of the sketch and at the end part of the interface, which includes a clickable region at the top part; after that, from left to right, there is the area with information about the video, other video content that is related to the displayed video, another clickable region, interactive area for ranking the video, and finally information of the video displayed appears when clicking the second clickable region.

Regarding sketch E, this design displays content in the main body of the screen. The left side of the content consists of two parts, from left to right. The first part contains a clickable region with a scroll bar; the second part shows pressing keys (buttons), which appear after pressing the first part of clickable regions. Sketch F is an interface that presents video content that is placed in the main body of the sketch. At the bottom of the sketch a pressing key is shown that, when clicked on, produces a drop down menu. At the bottom part of the sketch, at the left side a pressing key appears only when the video begins to play and at the right side a pressing key appears when the video stops playing.

Sketch G presents a design of an audio player that consists of two parts; from left to right, the first part is a clickable region that controls the player, while the other part includes information on the audio being played.

2) Adobe Fireworks Sketches



H
Figure 6.5: Adobe Fireworks Design Sketches

Sketch H was designed using the Adobe Fireworks tool, to present a prototype of interactive content. The steps in designing this prototype started with selecting a marquee tool from the bitmap set to insert a rectangle and then choosing the blue colour and filling the rectangle using a paint bucket tool. The vector set text tool was selected to enter ‘Content Here’ where the content is displayed. The clickable interactive area is shown by selecting a line tool from the vector set to draw a line demonstrating an invisible pressing area for the last part of the prototype. Finally the selecting text tool from the vector sector was used to insert ‘Click Here’ to show where users can interact with the content.

6.5 Designs Testing

Initially designs were done by hand using a paper and pencil. Then, pilot sketches were designed using two software tools – Adobe Fireworks and Microsoft Paint. Testing is a process that ensures the usability of the pilot sketches. These sketches were retested until a refined version was adopted. Refining the sketches was based on this testing procedure in order to generate the optimum sketch.

The sketches were based on general user interface design guidelines. In addition, the user requirements resulting from the survey carried out in this research and presented in Chapter 5 were utilised. Interactivity links users directly with the objects that appear on the screen during the video session. Thus a new way of accomplishing product placement was achieved. This work aimed at creating the optimum interactive user interface and achieving consumer acceptability.

6.6 Conclusion

The aim of this chapter has been to produce designs that match with the research aims and objectives as well as the user requirements. The results obtained on consumers' needs in the design process have also been incorporated. Interactive interfaces are suitable and appropriate to consumers because it puts them in control of the content they wish to view. The interactive mobile TV interface enables an exploration to be made of the territory of interactivity between low level interactivity and high level interactivity. The emphasis in mobile TV is on interactivity, personalisation and the inclusion of user-generated content.

Designs were initially drawn by hand and then developed using the two tools Paint Brush and Adobe Fireworks. The designs followed established guidelines. For example, in the selection of colours pairs were chosen according to the guidelines. In this chapter designs were produced using different ways of interacting and also different shapes. The same basic design can be changed using different colours or shapes of pressing keys (buttons). These different designs were generated in order to match the tastes of as many users as possible. Designs for special mobile interactive video content and special commercial or non-commercial advertisements have been accomplished. Testing was an important process that was applied to the designs in order to produce the most feasible and optimum interfaces.

The next chapter is concerned with the implementation of prototypes.

Chapter 7

Implementation of Prototypes

7.1 Introduction

This chapter details the implementation of the prototypes discussed in the previous chapter. These prototypes are interactive video content, which could be used to generate revenue. Delivering interactive content is an advance on broadcasting simple programmes on mobile devices. Providing interactivity is therefore a core function. Users must be able to feel that they control the viewing experience with no constraints from any participant, such as the service provider. Standard television has adopted the interactive approach, but not to the extent that interactive mobile TV offers. Mobile devices are personal and can generate videos and can take interactivity to a more advanced level through key functions. Such keys may be physical buttons on mobile devices or icons on the screen which respond to touch. One of the interface objectives is that it is easy to read and use. Tools used for implementation depend on the type of content and interaction.

The implemented prototypes were mainly designed to be used as either streamed video or video-on-demand. For this reason, simple interaction was required. Interaction with video displayed on mobile devices can be in different modes, for example rewinding and forwarding. However, in the case of this research, interactive capability is achieved with objects in the displayed video, or menus that appear in the video, or with customised videos (e.g. advertisements) appearing on a mobile device desktop, as with icons that appear on the iPhone desktop.

The implemented prototypes were iteratively refined through further consultation with some respondents and usability testing. Tests were carried out on various kinds of mobile devices that display video content in order to check the applicability of playing videos on these devices. Initially the prototypes were implemented on laptops, as a type of mobile device, using various tools. The prototypes were then implemented on mobile devices using various types of video formats but unfortunately not all of them worked. All the prototypes that were implemented on mobile devices can also play on computer devices. Finally, a survey was conducted to enable users to give feedback on the type of interactive videos, including advertisements, which were implemented in order to consider the preferred type of content to be displayed on mobile devices.

7.2 Tools and Tools Selection

Tools for creating designs and structure of prototypes are, for instance, Microsoft Paint and Adobe Fireworks. In the case of content, tools for producing tailored content are either camcorders or cameras. Authoring tools generally cater for interactivity by producing Shock Wave Flash (SWF) files. Some of the most common platforms for creating interactivity include Adobe Flash, HTML, Camtasia and Adobe Flash Lite.

After analysing consumer needs, a search for appropriate software that meets these requirements was conducted. The content was divided into images and videos. The prototypes were implemented in a way which allows consumers to enjoy viewing mobile TV without disruption as well as being able to interact with the content. These requirements were met through the following:

1) Static links in still images, analogous to product placement advertising, were demonstrated. At the beginning, the need to apply interaction to images led to the software package HTML. To explore the idea of interacting with images, these links were implemented using the option of an image map, which provides the image with clickable regions. These images, through the use of HTML, were applied on a laptop computer. In the case of mobile devices, the static links in still images were implemented using the software package Adobe Flash. These images were applied on mobile phones (e.g. Nokia N95).

2) Experiments were piloted with dynamic links that track objects in videos analogously to product placement advertising. In the case of mobile TV, video content is required to apply interaction to them. Many mobile devices require SWF files to display interactive videos on them. Therefore a search for software that produces SWF files was done. The software Camtasia versions 3 and 5 were employed, and were used to provide interactive videos in many shapes, such as videos linked to the Web and videos with quizzes or surveys. Even though mobile devices play SWF files, these prototypes using Camtasia were not able to be displayed on the devices. Therefore, after Camtasia, the Flash software package was used to apply interactive video on most mobile devices. In addition, Flash Lite was experimented with to apply interactive video on mobile devices, but unfortunately was not utilised because it is concerned with specific mobile devices and depends on the mobile phone series number (e.g. Nokia N80). Finally, another option was Microsoft Silverlight for mobiles; this was undergoing development and the final version had not been released at the time of this research implemented its prototypes. Therefore Microsoft Silverlight was not used.

In the case of tailored content, video equipment was selected to download video captured from a mini video cassette to computers in order to save it on DVD. The next step was to download various video converter programs for the purpose of converting the captured content and then saving it on DVD in the format needed for applying interaction – mostly converting from .avi to other kinds of format that suit some particular mobile devices like 3GP (AAC) mobile phones, MP4 for IPod and PSP, and finally WMV for Windows phones.

7.3 Testing Prototypes

After implementing the designs of prototypes, some problems and issues were identified. Testing prototypes and getting feedback from users is the best way to know whether prototypes are giving users what they desire. The problems were classified into two main categories. The first category related to technical problems and the second related to usability satisfaction issues. An example of a technical problem is the inability to run a video on a device because of format incompatibility. The usability issues are identified by usability testing. Examples of usability satisfaction issues are appropriate use of colours, design layout, such as pressing keys (buttons), and complex interfaces. Users are also responsible for deciding whether an interface layout is good or not. Sometimes interfaces may be very artistic and stylish but may be difficult to use for the novice user. Thus, the aim is to make interfaces clear and ultimately avoid confusion among users when using the mobile device. The interfaces for both expert and novice users should be effective in utilisation. It is sometimes difficult to cater equally well for both categories with the same interface (Padilla 2003). Clarity is the most important aspect for novice users; for example, a fully explained interface provides these users with clarity. In the case of this research's interfaces, they provide users with simple and clear ways of interaction that are linked in some cases to websites which provide full explanations to the novice users. On the other hand, efficiency is the most important aspect to the expert users, for example elements that provide users with a shortcut to reach the required action. In this research the interfaces provided users with the minimum number of clicks in order to reach the action required; therefore it could be accepted by the expert users. Usually combining both aspects for the different types of users is hard to achieve as they are the extreme opposites of each other; for instance, a fully detailed explanation that suits novice users causes interruption to expert users while, on the other hand, efficiency elements that suit expert users cause confusion to novice users (Padilla 2003). In the case of the interfaces implemented by this research, both aspects were taken into consideration. The interfaces allow users to click on the clickable regions or buttons that enable the users to be linked to the websites of the places, products and objects embedded in the video; therefore there is no need for a full explanation as it is only representing simple interactive options. On the other hand, the online websites that users are linked to provide the users with detailed explanations, as required by novice users.

Although it is problematic to combine both extreme aspects for novice and expert users when designing online interfaces, mobile TV interfaces face fewer problematic issues in combining efficiency and clarity for users. Mobile TV interfaces are concerned with engaging the users with an infotainment and advertainment experience. Therefore, in order to provide users with entertaining content, a simple interaction element is required to provide to novice and expert users. In the case of novice users, a clear and simple way of interaction was achieved with less detail and fewer explanations, as the idea of interaction is based on the aspect of minimal distraction, just enabling users to interact with clickable regions to be linked to online informative websites that provide novice users with fully detailed explanations of the user interface. On the other hand, expert users will be provided with an efficient way of interaction that does not disturb their viewing experience and in the end leads them to the information they require.

Prototypes implemented must be compatible with most mobile devices and for this reason Shock Wave Flash (SWF) files were used. Usability satisfaction problems arose after testing the initial prototypes. Some of these problems were that prototypes with many pressing keys (buttons) were less acceptable for displaying videos because of screen size. The pressing keys occupied space on the handset screen, which reduced the available space for the video to play. Moreover, the colours used should not affect the content and should remain readable.

The following section summarises the tests done on prototypes as they were implemented on mobile devices. This meant there were many factors that required testing prior to applying the prototypes to ensure users' approval, namely checking that the prototypes' video format was supported by the mobile devices, and checking if any prototype needed technical improvement; for example, PSPs support MP4 video format, so if the video content is not in that video format, the prototype will not work on a PSP device.

7.3.1 Testing Mobile Devices

The first component of the test was to select the consumer's preferred video content, especially one displayed on a mobile device. After choosing the content, there was a need to convert the video format to make it compatible with most mobile devices. Each mobile device requires a specific video format, and converters were used to convert each video to the appropriate and suitable video format that matches the mobile device requirements. For example: .3GP for mobile phones, .AVI for Windows, .MP4 for iPod and PSP, and .MOV for Mac.

Video Format	Video File Extension	Mobile Devices	Developed By
AVI	.avi	Computers using Windows and most of the web browsers	Microsoft
Windows Media	.wmv	Computers using Windows	Microsoft
MPEG	.mpeg or .mpg	Popular on the Internet and supported by most web browsers	MPEG Software Simulation Group
QuickTime	.mov	Does not work on Windows computers without an extra component being downloaded	Apple
RealVideo	.rm or .ram	For streaming video with low bandwidth (online video)	Real Media
Shockwave (Flash)	.swf	Requires an extra component to play	Adobe Systems
Moving Picture Expert Group-4	.mp4	iPod/PSP	Moving Picture Experts Group

Third Generation Platform	.3gp	Mobile phones	3rd Generation Partnership Project
Flash Video	.flv	Popular on the Internet especially on sites such as YouTube, Google Video, MySpace, etc.	Adobe Systems

Table 7.1: Most Common Video Formats

These were the most common video formats that suit most PDAs, iPods, iPhones, PSPs and mobile phones in general. It is thought that the most compatible format is .mp4 because .3gp does not work on PSP, for example. On mobile phones, some of the phones support both .3gp and .mp4 video formats.

The displayed video on mobile devices was either pre-existing or tailored content. First the content was played on laptops. Then it was tested on the following mobile devices: iPod, PSP and mobile phones. Some of these devices, such as the iPod and the PSP, have no cameras, so they were used only to display content. On the other hand, other devices, such as mobile phones, are equipped with cameras so they were used to display and generate content.

As mentioned in section 7.4, there were limitations encountered in the implementation process. Each software package had barriers to implementing an interactive video. Furthermore, there were obstacles relating to the mobile devices themselves, such as the screen size and battery consumption.

A test was done with an informal feedback group to measure the battery consumption of some of the devices used, as well as to check the degree of acceptability of video on small screen mobile devices. The first test was conducted while using a PSP, iPod and a mobile phone whilst travelling on a train. It was thought that it was difficult and uncomfortable to carry a device with the hand(s) while watching a long video. The quality of the video was high. The informal group's experiences, in addition to the designers', indicated that it is acceptable to watch a movie on it. The remaining problem that hindered the viewing experience was battery consumption, which was acceptable in the case of the PSP, but was unacceptable in the case of a mobile phone.

Mobile device battery life can be increased by turning the volume down and setting screen brightness at the lowest level. On the other hand, doing so will affect the mobile TV viewing experience. It is expected that a PSP would provide users with two and half hours of video viewing at the lowest level of settings. As mobile devices do not provide users with low battery consumption, developments and advances are currently being witnessed.

In terms of screen size and battery consumption, each mobile device has specific characteristics, as presented in Table 7.2.

Nokia N80	Motorola V3x	PlayStation Portable (PSP)	iPod Classic
Screen size 95*50*23 mm	Screen is TFT with 240*320 pixels, 33*45 mm	Screen size 4.3", 16:9 widescreen TFT LDC 170*74*23mm, in addition to a 480*272 pixels high-resolution screen	LCD screen size reaches 2.5 inch
Camera is a 3 mega pixel camera (2048*1536) with a 20x digital zoom	Second external camera 96*80 pixels	No camera	No camera
Battery standby is up to 192h	Battery that lasts up to 250 hours	Battery that lasts up to 7 hours	Battery playback time for music is up to 36 hours while for video is 6 hours
Talk time is up to 3h	Talk time up to 5 hours	No talk time	No talk time

Table 7.2: Characteristics of Various Mobile Devices

All the above mobile devices are capable of displaying video content. For users who require a widescreen, PSP is the device that best suits this requirement and allows users to enjoy a video viewing experience. However, the device is not for communication as it is a games console; therefore it is only suitable for specific contexts. A fully interactive experience of a mobile TV service that consists of generating video content is not supported by some of the above-mentioned devices, such as the PSP and iPod Classic. All the devices mentioned above provide a reasonable battery life that suits the characteristics of the videos of a mobile TV service.

At the beginning all video content chosen was converted to a video format accepted by each of the mobile devices mentioned above. For example, there were three versions of a new TV series called ‘Prison Break’: the first one suits the iPod, the second suits the PSP, while the third suits mobile phones. This applies to all videos. Another issue related to the mobile device is the memory size. Mobile devices have limited memory, so there is a need for compression of the pre-existing (ordinary) content.

A B

Figure 7.1: Quality Comparison between a Video Before and After Compression

Figure 7.1 presents the difference in the quality between the same video content after compression. Video A is not compressed and reflects a good quality while video B is compressed and shows lower quality. It should be noted that high compression of videos should be avoided as this leads to the production of low quality video content. Each time a video is compressed with variations in types of compression it leads to a loss in quality, an action that is irreversible.

In order to ensure the quality and colours of the pictures presented on the paper copy of the thesis correlate with those on a mobile phone screen, a comparison was done. The results showed that there were some differences between both situations. The resolution of the pictures displayed on the paper copy of the thesis is lower than on the mobile devices. Concerning the colours of the pictures displayed on the mobile devices, it was obvious that they were darker and some colours were different (e.g. grey).

Mobile device screens display colours as red, green and blue. In addition, a limited range of the visible screen could be displayed through combining RGB colours. In the case of brightness of the pictures displayed on mobile devices compared to on paper, the reason is that mobile devices produce light while on paper the specific wavelengths of light are absorbed or reflected (Tan et al. 2010). There is a difference in the colour displayed in both cases, as the colour gamut produced for paper is different to the one for monitors. When printing the thesis the pictures displayed in some cases did not match with those displayed on monitors. The pictures displayed in this thesis were taken using a camera and, as most of these devices save the pictures in RGB files, there was a need to convert it to CMYK due to printers preferring either RGB or CMYK files. The RGB file preferable printers are able to use colour management elements while converting it to CMYK. On the other hand, CYMK file preferable printers require this type of file as it is the mode required for the printing process.

The following section highlights another type of testing employed: namely asking an informal feedback group about the advantages and disadvantages of the pilot prototypes in order to iteratively refine them.

7.3.2 Informal Feedback Group

The prototypes implemented on mobile devices went through a testing phase. This phase began with the designer's testing and then moved to gathering feedback from the designer's informal feedback group. It was more of a first-hand testing phase meant to collect feedback to help in refining the pilot prototypes. This was, of course, followed with presenting the refined prototypes to the informal feedback group. This stage compels the designers to implement final designs and have them tested by public users, who will check the degree of acceptance of each prototype as well as name the best prototype.

7.4 Efficiency Considerations

7.4.1 Battery Considerations

Power efficiency is a key feature of mobile devices, and is important for the service of mobile TV in that the limitations of mobile devices affect the usability of the service. Mobile devices' high battery consumption is affected by features such as cameras, which consume a large portion of the available battery power. Another reason behind the power consumption is the backlighting, which should be reduced. This problem can be addressed by changing the energy supply available from rechargeable batteries or secondary batteries (lithium-Ion based) to primary batteries (Zinc-Oxygen) or through solar mobile device charging.

7.4.2 Size Considerations

Size is the most difficult challenge to address. The basic concept of mobile devices is that they are undersized and can be used on the move. Mobile devices have remained lightweight and small in size even though screen sizes are becoming bigger. But, with the development of wearable devices, this challenge might be taken into consideration. Among these wearable devices are the Teleglass T3-F video eyeglasses, which enable users to view a larger screen (28 inch screen size) from about 6 feet away. These developments of wearable devices enable users to view videos on a larger screen compared to the mobile device's actual screen.

7.4.3 Usability Considerations

The manufactured mobile devices must be fashionable and easy to utilise – for example menus with fewer options and text with a clear meaning – in order to enable users to enjoy the use of these devices, which could provide a vast amount of applications; for example the iPhone has thousands of applications and there is still much to be applied in the future. These applications will not be used if they are hard to use. Therefore prototypes or applications must provide users with an easy way to facilitate interaction with on-screen content. This will surely result in the generation of the maximum revenue the providers are looking for.

7.4.4 Cost Considerations

A mobile device’s cost is still problematic to some people, even though mobile device prices are dropping down to within the reach of most people. The most important aspect of the cost is the mobile TV subscription. It might be unaffordable for consumers to pay a monthly subscription for the service in addition to what is required to be paid as the tariff for the voice calls, text messages and internet access. Therefore, this research proposes the idea of a funded mobile TV service in order to engage more users in the service as the subscribers currently constitute small numbers.

7.5 Problems Encountered and Solutions

The initial prototype designs were simply drawn using pencil and paper but this was thought to be inefficient. In order to design professional prototypes and user interfaces, Adobe Fireworks was selected because it is easy to understand and use, it is flexible, and it exploits a designer’s creativity. In addition, it uses pixel based sizing and is suitable for mobile applications. Finally, it is easy to use Fireworks to turn a design into an interactive prototype, even though only creating a single master page is possible. While designing the prototypes, it was difficult to find the method of interaction and the prototypes' layouts, such as in the case of designing buttons or colours for these buttons, which suits the mobile TV service and meets the users' demands. The designed prototypes were not always applicable.

The other problem encountered was selecting the content to be used for the prototypes. In this case, it was difficult to find suitable content from both types, pre-existing and tailored content. For tailored content, there was a need to generate videos and images using either cameras or professional camcorders, whereas for pre-existing content, there was a need to find videos and images to download and implement the ideas on. The problem of the large size of content also arises. Mobile devices are limited in terms of memory, so compression algorithms were used on large sized content.

A HTML image map was used in order to generate interactive images with clickable regions, but these were to be used on mobile devices. Unfortunately these images only worked on laptops. This research is mainly concerned with video in the case of mobile TV. Therefore, the Camtasia program was used in order to apply clickable regions on video content. After applying clickable regions as designs, there was a need to implement another design with pressing keys (buttons); Flash was used for this purpose. Flash Lite uses the implementation for specific mobile phones.

7.6 Final Prototypes

In order to reach the final optimum prototypes, various procedures were followed, starting with the pilot designs and then redesigning prototypes more than once until they met consumers' needs. An initial survey was conducted to identify the consumers' demands required for the design of the first draft of the prototypes. These designs were then implemented using various tools on the computer. The next step was to implement those prototypes on mobile devices. The interfaces implementation phase was different from the evaluation phase. Later, those prototypes were tested in order to check their usability. If the designs were compelling, they were considered to be a final version. On the other hand, the designs with faults were redesigned until the final version was reached. Final designs were tested by a sample of users and an experimental survey was carried out to find the preferable prototype.

Interactive video content was classified into two types: ordinary (pre-existing) content and tailored content. Each of these was divided into still image maps, image maps in videos and movie trailers. Figure 7.2 shows the types of interactive video content.

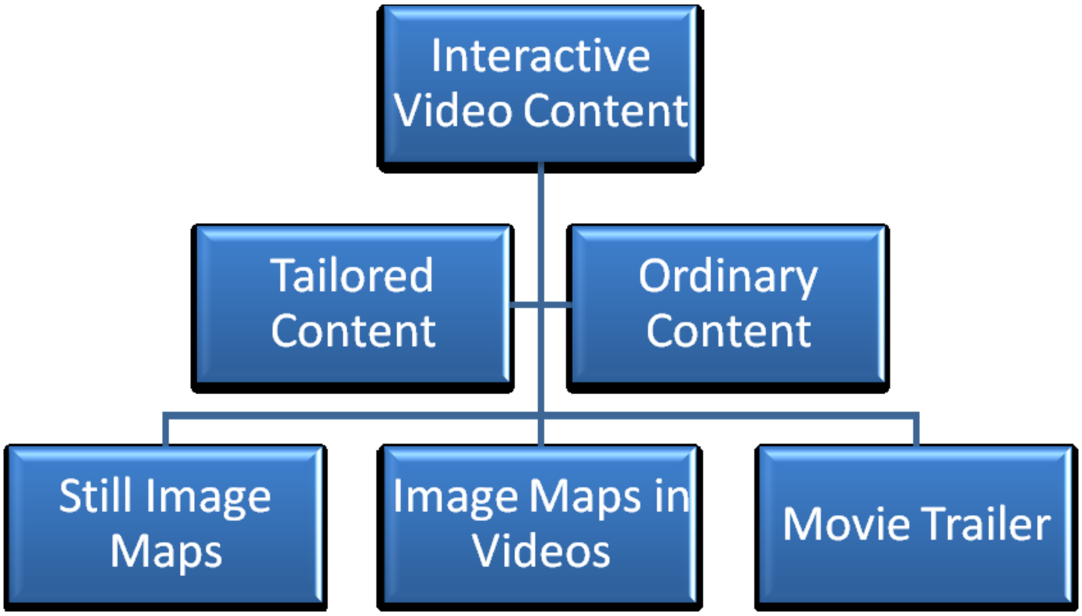


Figure 7.2: Types of Interactive Video Content

In this section, most of the implemented prototypes were displayed on mobile devices and, by default, they work on personal computers. Some of the prototypes import the same video content but using different methods of user interaction.

7.6.1 Still Image Maps

A still image map is a simple method of product placement advertising that works by using a small part of a still image to insert a logo. The first part of this section shows some of the image maps on HTML which represent product placement using a still image. The images were programmed using ‘image map’ in HTML. The following still image is linked from the logo region in them. In HTML, there are three types of tag: open, close, and open and close. In addition, there are three types of region: rectangular, square and poly. The following algorithms were implemented to generate image maps in all types as shown below.

Tag is the following instruction <MAP NAME="map1"> this tag is called map; the image can be used either if it was online or elsewhere, only by copying the image location. <img Scr = "http:// html help; Scr here is the source which is the attribute , X is the name of the picture.

.

 img here is the tag and Scr is the attribute .

If an image is needed to be taken from an internet website then; <img Scr= http://www.xxxxxxx.com/picture name>; img here is the name of the folder.

 <MAP NAME ="Omar">.

1) Applying rectangular shape:

<AREA HREF=http://sanyo.com/ SHAPE =RECT COORDS="0, 0,100,100">.

2) Applying circle shape:

<AREA HREF = http://www.tdk.com SHAPE =CIRCLE COORDS="251, 143, 47">.

3) Applying poly shape:

<AREA HREF= http://www.gap.com/ SHAPE = poly COORDS ="150,217,140,257,150,217,110,257">.

</MAP>

The following Figure 7.3 is an interactive captured image using HTML linked to http://www.tdk.com/; linked to http://sanyo.com/; linked to http://www.gap.com/; linked to http://www.coca-cola.com/index.jsp.

Figure 7.3: Interactive Captured Image Using HTML

From images a movie can be generated using Matlab and it is shown below. This example creates a movie from a multiframe indexed image using the immovie function.

X here is a four dimensional array of images that are going to be used to create the movie.

mov = immovie(X,map);

To play the movie uses the following function.

movie(mov);

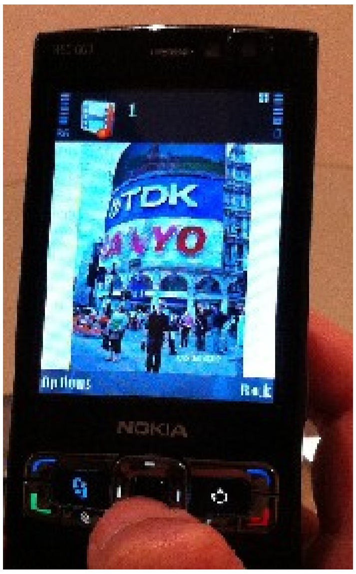
In this example a multiframe image Z.tif is used to generate a movie.

```
Z = uint8(zeros(128,128,1,27));

for frame=1:27

    [Z(:,:,:,frame),map] = imread('Z.tif',frame);

end
```

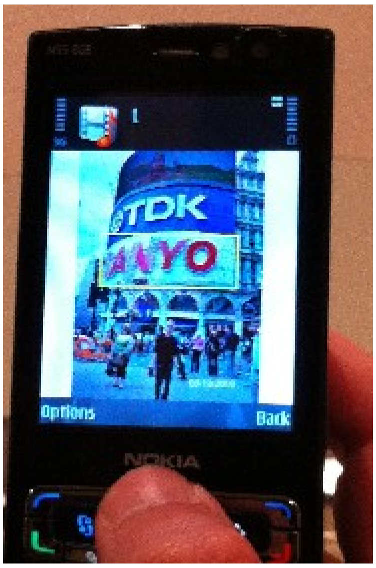
Display the movie twice for the two below instructions.

```
mov = immovie(mri,map);

movie(mov);
```

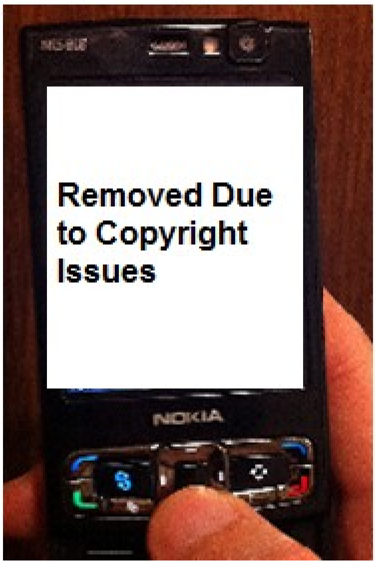
The second part of this section shows some image maps on Flash which represent product placement using a still image. The images were programmed using Flash. Figure 7.4 illustrates an image that was captured under this research. This image consists of many brands; therefore the idea of product placement can be implemented. The images were programmed using Flash. Interactivity was added to the idea of product placement in the following still image, linked from the logo region in them to each product's website.


TDK
Options
NOKIA

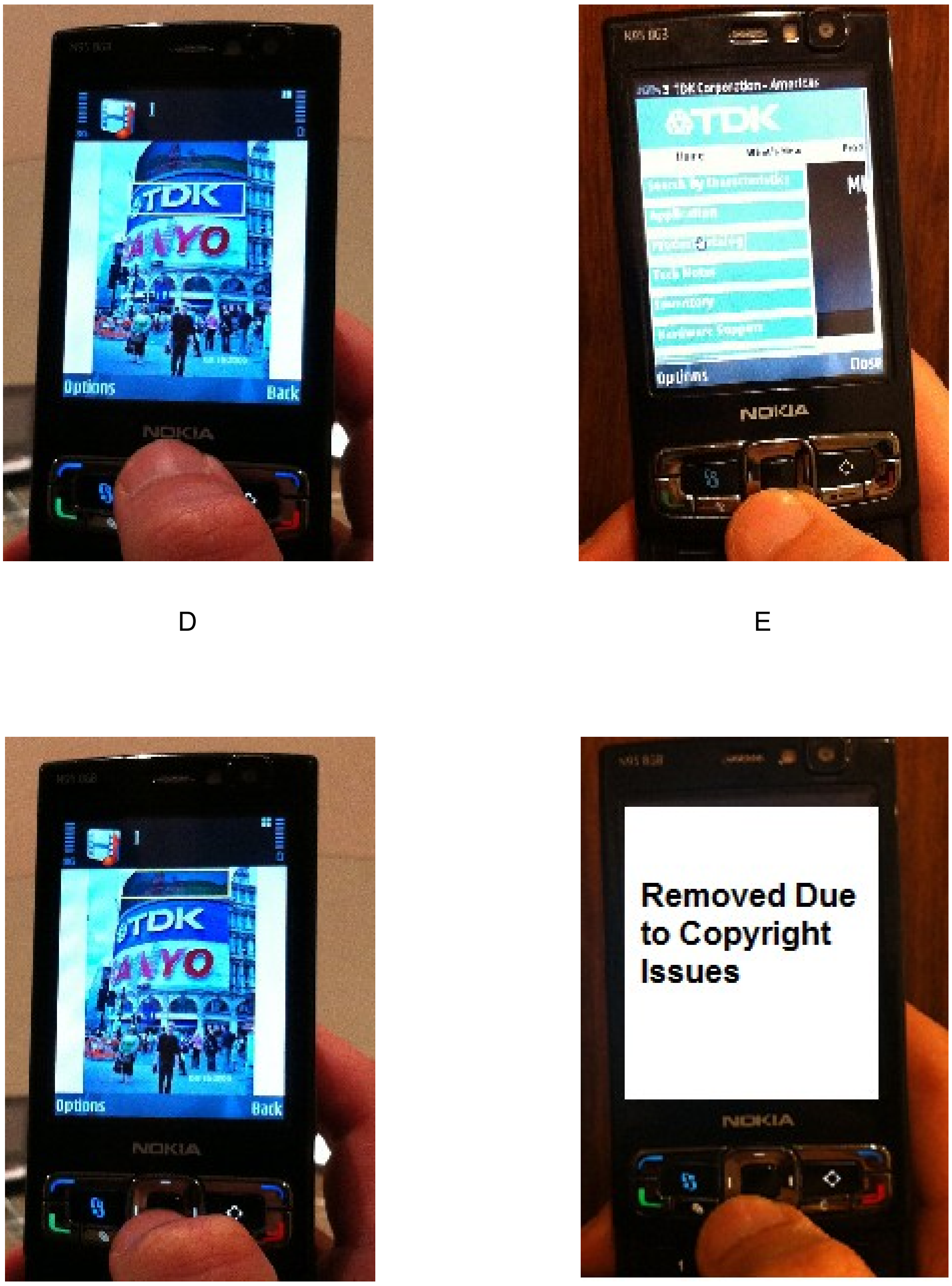
A


TDK
Options
Back
NOKIA

B


Removed Due to Copyright Issues
NOKIA

C



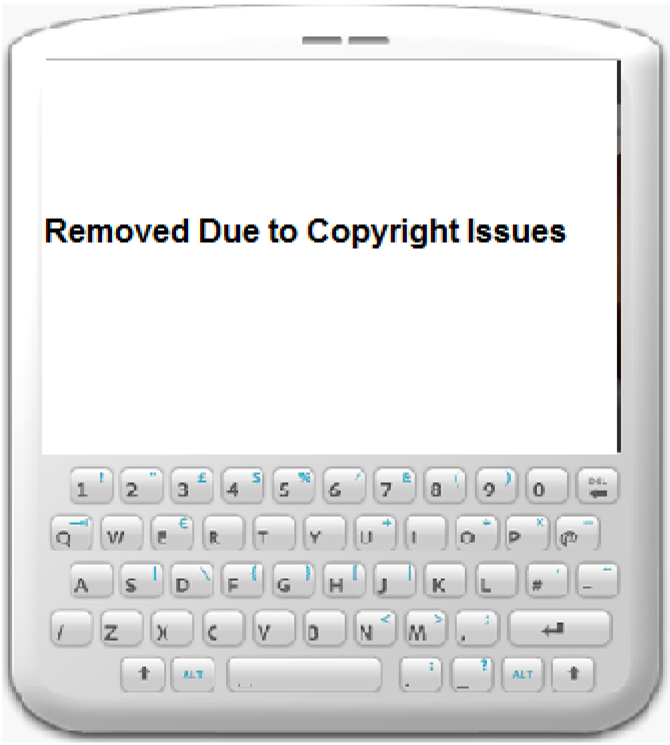
D E

F G

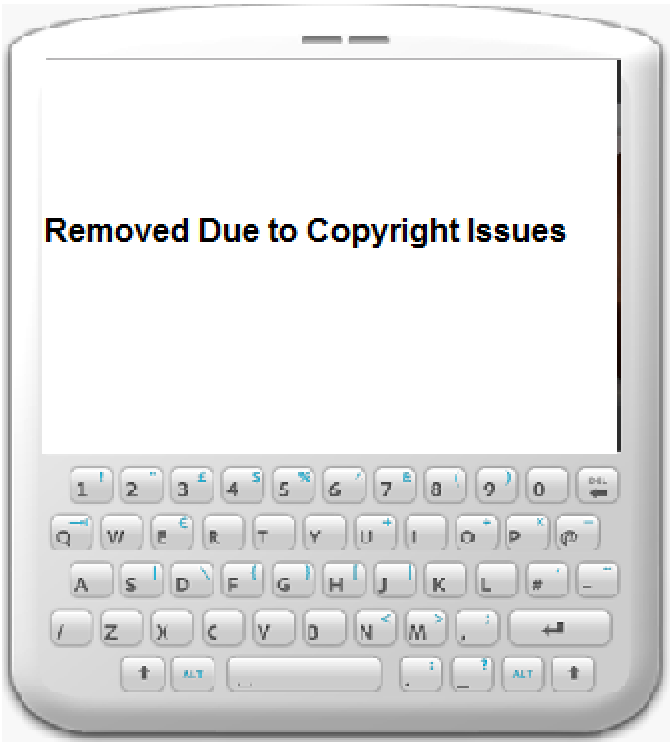
Figure 7.4: Interactive Captured Image Using Flash

As is obvious in the image in Figure 7.4 (A), there is four brands: Sanyo, TDK, Coca Cola and Gap. Therefore each region that represents the brand allow users to click on it to be directly linked to linked to http://www.tdk.com/; linked to http://sanyo.com/; linked to http://www.gap.com/; linked to http://www.coca-cola.com/index.jsp, the official brand website to either get more information about the product or to buy it. As shown in Figure 7.4 (B), pressing on the navigation keys once leads to the selection of the first brand, which is Sanyo, and then pressing on the confirmation key links the user directly to Sanyo's official website, as presented in Figure 7.4 (C). As shown in Figure 7.4 (D), pressing on the navigation keys twice leads to the selection of the second brand, which is TDK, and then pressing on the confirmation key links the user directly to TDK's official website, as presented in Figure 7.4 (E). As shown in Figure 4 (H), pressing on the navigation keys three times leads to the selection of the third brand, which is Coca Cola, and then pressing on the confirmation key links the user directly to Coca Cola's official website, as presented in Figure 7.4 (I). As shown in Figure 7.4 (F), pressing on the navigation keys four times leads to the selection of the fourth brand, which is Gap, and then pressing on the confirmation key links the user directly to Gap's official website, as presented in Figure 7.4 (G).

The third part of this section shows some still images which represent interactivity. The images were programmed using Flash. These images present interactivity using pressing keys instead of image maps, therefore the following interface indicates that through pressing keys (buttons) and clickable regions many types of interaction can be performed instead of only using the idea of product placement. This interface represents a different style of interaction with images. But, unfortunately, when this design was emulated using Adobe Device Central it worked properly but when trying to apply it on mobile devices it did not work.



A



B

Figure 7.5: Interactive Image Using Flash

7.6.2 Image Maps in Videos

Extending the concept of product placement advertising to video is more complex. For initial video experimentation, the software Camtasia (versions 3 and 5) was used. This is commonly used, for example, by educators for recording narrated PowerPoint presentations. More advanced developers can use the Flash software environment to integrate video content into Flash projects. In addition to creating videos to place directly inside a Flash project, developers may use Camtasia Studio to create quick prototypes of projects and professional-quality Flash presentations.

Using Camtasia, there was a need to consider how to follow the product inserted within the video with a link that is invisible to viewer. When the viewer clicks on an object, it guides him/her to the company that produced this product for the purpose of making a purchase or getting more information. In addition, there is a need to design some interfaces after recognising consumers' needs by following the questionnaire process. The link could appear in the same page or on a new page according to preference; alternatively, a small icon could fly to the side of the page as a reminder of something that could be opened later if the user is watching a movie or other video presentation and does not want to be disturbed immediately.

The following steps are applied to implement interactive video with clickable regions:

1) Open a new file on Camtasia program.

2) Import a video and drag it to the time line.

3) Add callouts, placing the callout on the object required.

4) Make Flash hot spot by entering the required URL to open it either in the same window or in a new browser window (repeat the previous step until the object is tagged during the whole video; this applies to the next section as well).

5) Produce video in any chosen format, preferably an SWF file.

6) Save file to any directory.

A

B

Removed Due to Copyright Issues

C

Figure 7.6: Dairy Queen Advertisement with Product Placement Target Indicated

Figure 7.6 shows a ‘Dairy Queen’ video product advertisement. This is a test video that is an advertisement and is linked to http://www.dairyqueen.com/us-en/. The quality of this video is not perfect due to it being compressed to the lowest quality for the purpose of producing the smallest video size. Two ways of interaction using two different tools for the purpose of comparison are reflected in Figure 7.6 (A), using Camtasia; users are able to interact directly with the object in the video to get more information about the product or buy it. This is one example of pre-existing content advertisements that use the idea of product placement without buttons embedded within the video as if they are part of the video. Figure 7.6 (B), using Flash; a button was used to enable users to interact by pressing on the button and choosing from the menu what exactly he/she requires to be linked to on the Internet. Figure 7.6

(C) represents the link (website) that is the result of clicking on the clickable region.

Figure 7.7: Levi's Advertisement with Clickable Regions

The video shown in Figure 7.7 was displayed on traditional TV but without interaction. This pre-existing content advertisement was used to implement a type of interaction using clickable regions, enabling users to interact with the video to get more information about the product or buy it through using the idea of product placement by linking the advertisement with the product's website.

Another example represents pre-existing video clip content that uses the idea of product placement to link users to the channel's website if they wish to find more information about the video clip, or the channel displaying it, or to get information about and timings of the programmes broadcasted on the channel.

There are many ways to interact with a video; in addition to clickable regions providing users with the ability to interact with videos. Different types of interaction include engaging users by enabling them to solve quizzes or fill in a survey. The following steps are applied to implement an interactive video which displays a quiz:

1) Open a new file on Camtasia program.

2) Import a video and drag it to the time line.

3) Add quiz after choosing where it will appear on the time line.

4) Fill the quiz name and choose answer numbering.

5) Choose quiz feedback when questions are answered. Choose [if correct display ‘correct’] and [if incorrect display ‘incorrect'].

6) Choose how answers are displayed: multiple choice, fill in blank or short answer (not correct).

7) Fill in questions then fill in answers and select the correct answers.

8) Produce the video in any chosen format, preferably an SWF file.

9) Save to any directory.

The following prototype provides users with multiple ways of interaction.

Removed Due to Copyright Issues

A

Removed Due to Copyright Issues

B

Figure 7.8: Dime Advertisement with a Quiz

Figure 7.8 is an example of a pre-existing content advertisement displayed on traditional TV and in this research it was linked to the original website of the product to enable users to get more information or to buy the product. It is a good example of using the idea of product placement. Furthermore, a questionnaire was inserted within the advertisement to enable users to directly give their feedback regarding the quality of the product and the purchasing procedure to the company. Some questions were about the product itself whilst others were related to the type of advertisement and the usage of this type of online commerce.

In this case interactivity is created via a survey, which is demonstrated in the displayed video. The following steps are applied to design an interactive video which displays a survey:

1) Open a new file on Camtasia program.

2) Import a video and drag it to the time line.

3) Add survey after choosing where it will appear on the time line.

4) Fill the survey name and choose answer numbering.

5) Choose survey feedback when questions are answered.

6) Fill feedback.

7) Choose the method how answers are displayed: multiple choice, fill in blank or short answer.

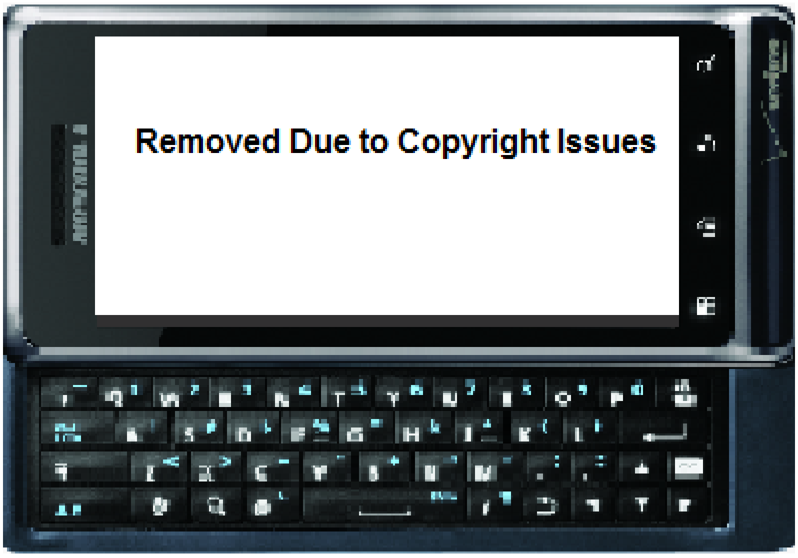
8) Fill questions and then answers and select the correct answer.

9) Produce the video in any chosen format, preferably an SWF file.

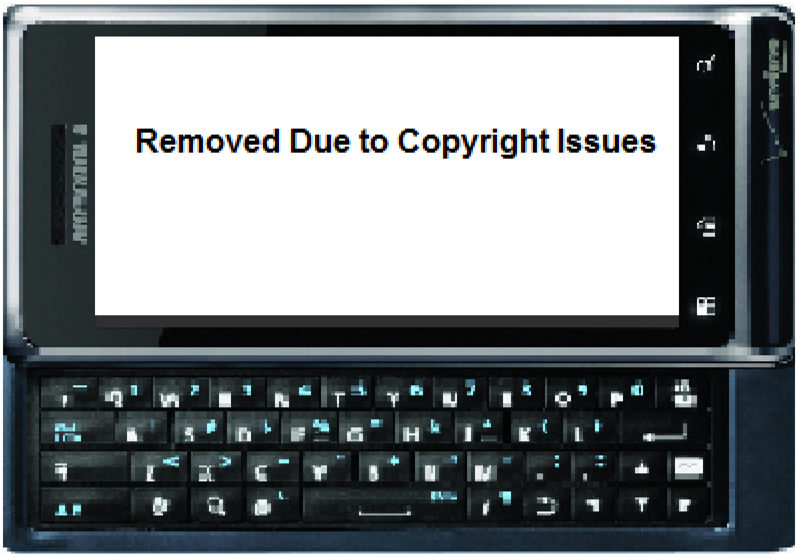
10) Save to any directory.

7.6.3 Movie Trailer

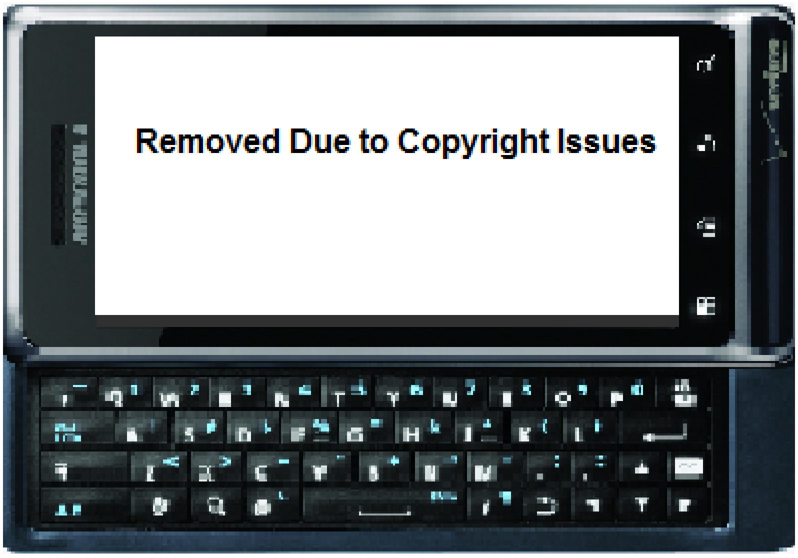
The method of producing movie trailers is more complex than those explained in section 7.6.1 since it involves movies. Accordingly, this section shows some examples of movie trailers that link the users to somewhere else while the movie is playing. Such a field is challenging yet interesting within the proposed work. This section works with the two kinds of video content, pre-existing and tailored.



A


Removed Due to Copyright Issues

B


Removed Due to Copyright Issues

C

Removed Due to Copyright Issues

D

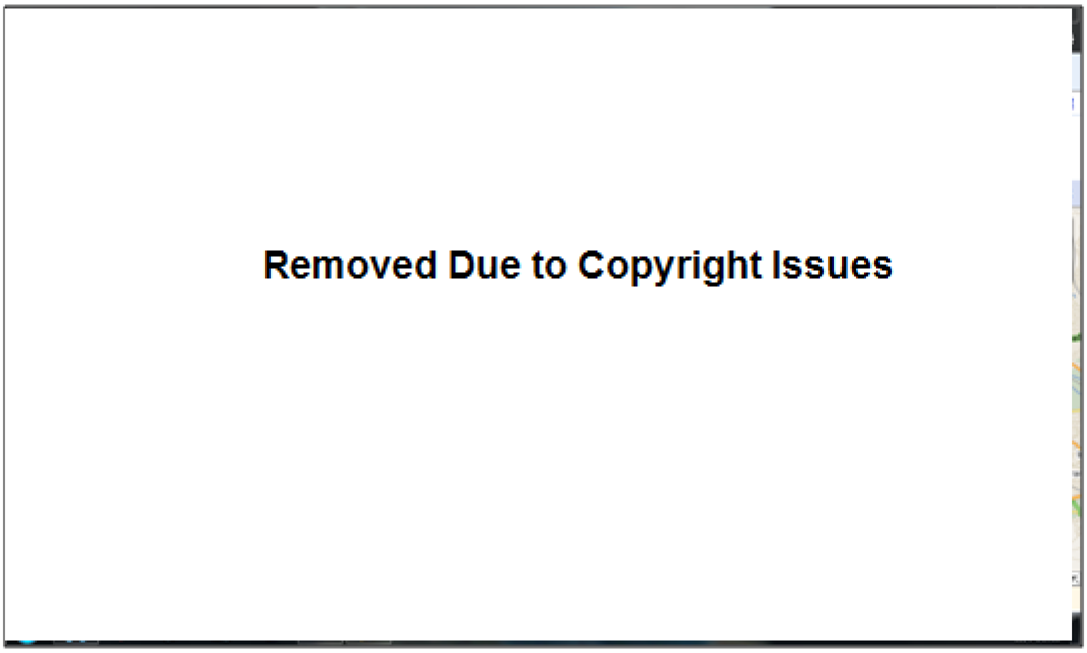
Figure 7.9: Harry Potter Trailer Video with Product Placement

Figure 7.9 shows the movie trailer for the film Harry Potter. The logo of the production company Warner Bros was linked to http://www2.warnerbros.com/main/homepage/homepage.html and the link was moving while the movie was playing. In addition, users were able to interact with the video by gaining more information about the film, the producing company, the nearest cinemas and much more. This is a product placement idea which could be applied on mobile devices. The video was created using Camtasia 5 and 3 and then produced as a Shock Wave Flash file.

In this case, advertisements are implemented using a raw video displayed on TV. To link a product to its website in the whole video, the link is moved to wherever the product moves. This is accomplished by adding new callouts while the video is running and entering callouts in all the scenes the product appears in. After importing the media and then putting the video on the time track, the callouts are added, and a flash hotspot is made. After that, a link is added to jump to the website or to the URL from the area marked. To give options, the website either appears on the same page or in a new browser window. The video is produced in the format needed, SWF format being chosen as the best. By linking the still and moving images to the website of the product's company, the Flash hotspot and a jump to the company's product URL in a new window, the consumer is offered the option to buy online (etc.) interactively. Unfortunately this prototype worked only on some mobile devices such as laptops.

A

B

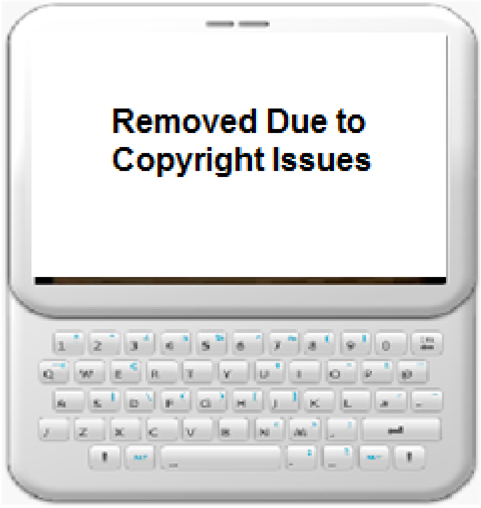


C
Figure 7.10: University Of Bradford Landscape View

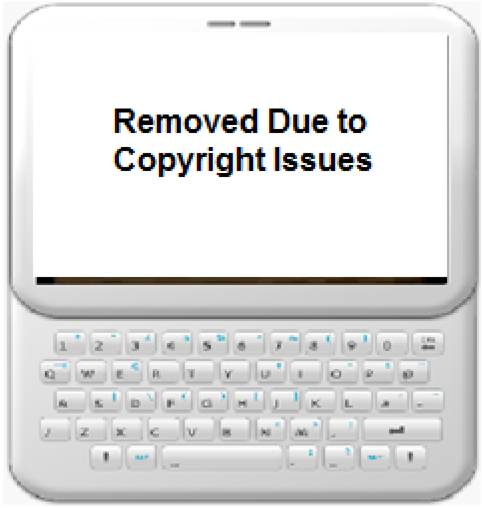
This video is one of the personally captured videos linked to http://maps.google.co.uk/maps?q=university+of+bradford&rls=com.microsoft:en-GB:{referrer:source%3F}&oe=UTF-8&redir_esc=&um=1&ie=UTF-8&sa=N&hl=en&tab=wl.

The link contains the map of the University of Bradford. This video experiment expands to include a video aimed at testing the concept of information placement, which is not linked to saleable products but is used as a navigator to show the viewer how to go to the location of the video, which is the University of Bradford.

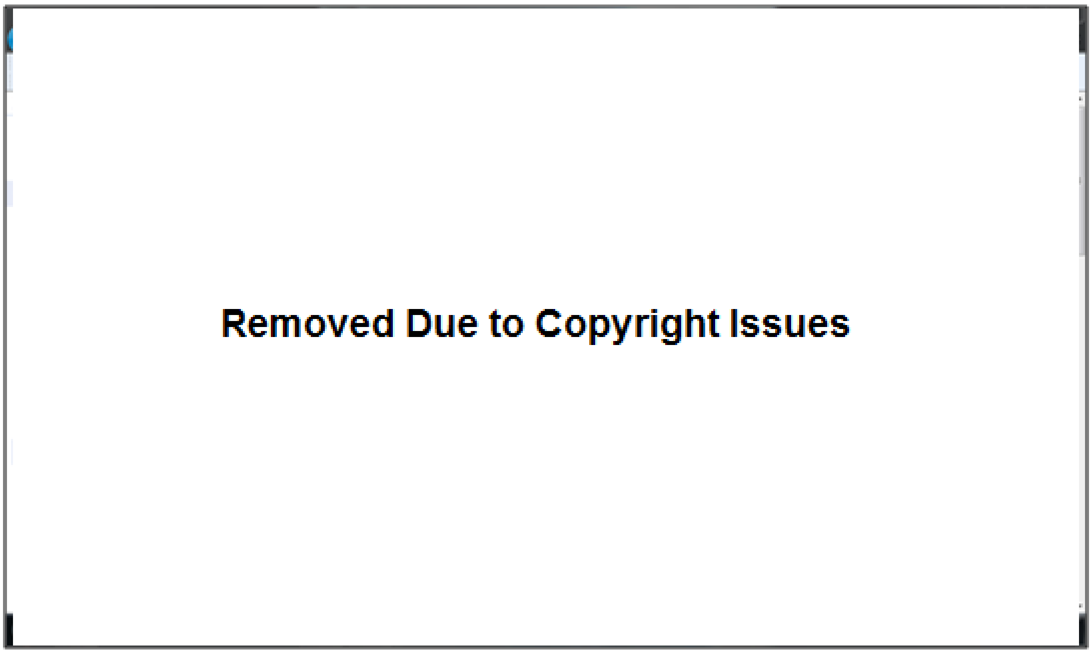
The following is an additional examples of non-commercial video linked to a website that enable users to get more information and a map about Wadi Rum, a place in the Jordanian desert that appears in the video displayed.



A



B



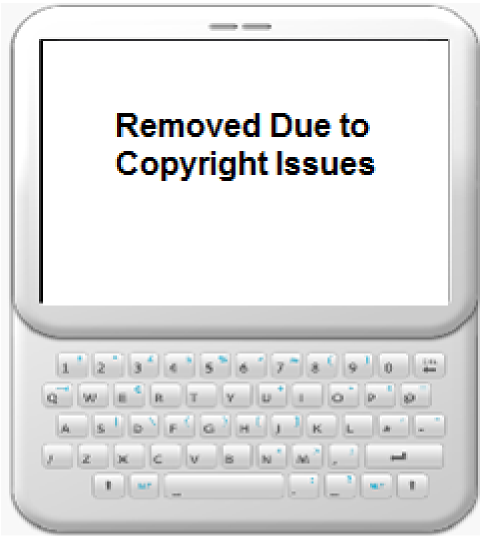
C

Figure 7.11: Wadi Rum Tailored Non-commercial Video

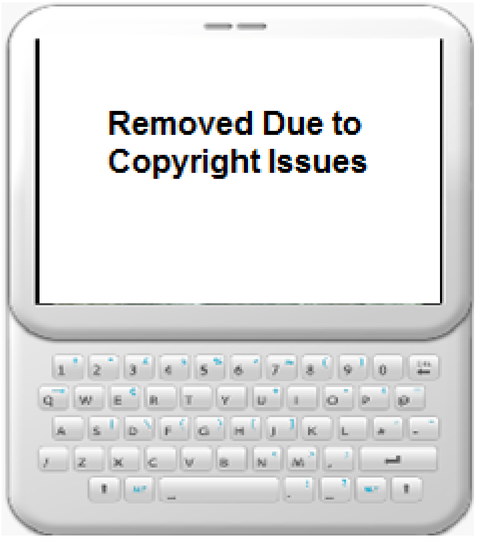
This video, captured by others using camcorders, was utilised in exploring the idea of extrapolation from commercial advertising to non-commercial information provision. This video is linked to http://maps.google.co.uk/maps?q=wadi+rum&rls=com.microsoft:en-

GB:{referrer:source%3F}&oe=UTF-8&redir_esc=&um=1&ie=UTF-8&sa=N&hl=en&tab=wl.

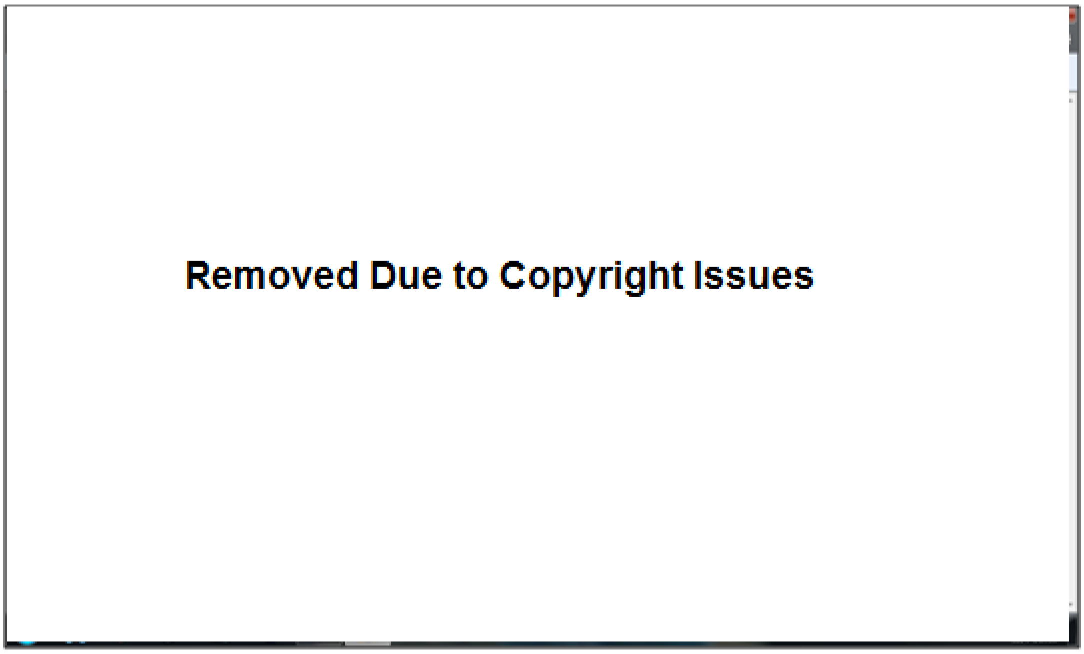
This video experiment expands to include a video aimed at testing the concept of information placement, which is not linked to saleable products but is used to provide users with information and images of Wadi Rum in addition to a navigator to show the viewer how to go to Wadi Rum.



A



B



C
Figure 7.12: Le Royale Hotel Tailored Non-commercial Video

This video, captured by others using camcorders, was utilised in exploring the idea of extrapolation from commercial advertising to non-commercial information provision. This video is linked to http://www.leroyalamman.com/. The link contains information on the building that appears in the video. This video experiment expands to include a video aimed at testing the concept of information placement, which is not linked to saleable products but is used to provide users with the website of Le Royale Hotel in Amman.

The videos demonstrated above were employed in an experimental survey to differentiate between the various types of advertisements preferred by consumers. This experimental survey was achieved by using emulator Adobe Device Central CS5. Unfortunately not all of the interactive videos were able to play on real mobile phones. Another use of these captured videos was exploring the idea of tailored content that could be specially used for mobile devices.

Most of the above interfaces were demonstrated with no pressing keys (buttons), except Figures 7.6 and 7.8. Therefore, this study used Adobe Flash CS3 and CS5 to implement an interface that contained buttons to enable users to interact directly with the video and apply almost all of the previously mentioned types of interface. Flash Lite was used, but unfortunately it provides the capability needed for implementing prototypes that suit a specific handset or series of mobile phones in particular.

The following steps are required to design a simple pressing key using Flash [creating the button]:

1) Open new flash file, then choose flash file (action script 2.0).

2) Insert a frame to draw the chosen shape of the button on stage.

3) After renaming the button and layer, insert a key frame to all frames.

4) Export the flash movie.

Afterwards, apply interaction to the button by creating a link button in Flash:

5) Import video.

6) Select the button inside the Flash document.

7) Set the complete URL and whether to open in the same window or in a new one.

8) Now click on the button to take consumers to the website.

In other words, the steps to produce a URL button on flash are as follows:

1) Open new flash file, then choose flash file (action script 2.0).

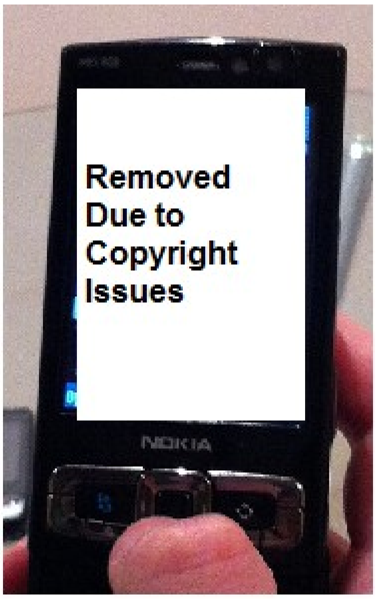
2) From tools, choose for example Rectangle tools, and then draw it on stage.

3) Click right-click on the button shape and choose the option convert to symbol, and then choose the type of the button.

4) Set focus on the shape drawn, from windows ‘menu’ select ‘behaviors’, then click on ‘Plus Icon’, and then choose web -> go to web page.

5) Fill the textbox with the URL required.*6)* Press Ctrl + Enter on the keyboard to run the file and test it.

The following example demonstrates further how a whole movie, not just a trailer, is employed to enable interactivity in videos since movies are one of the popular content viewed.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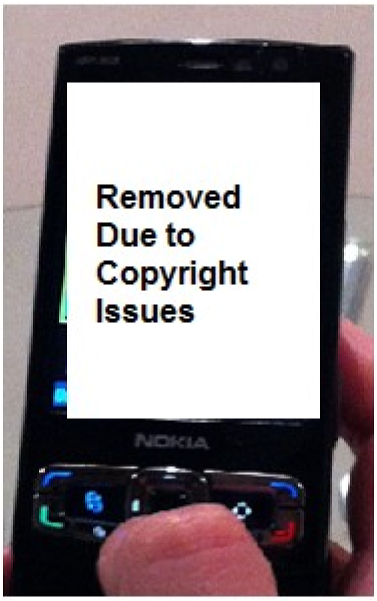
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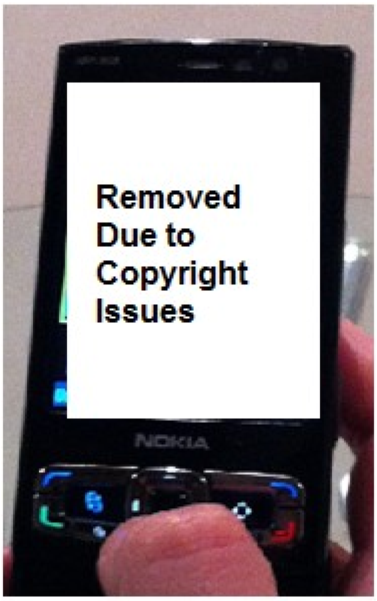
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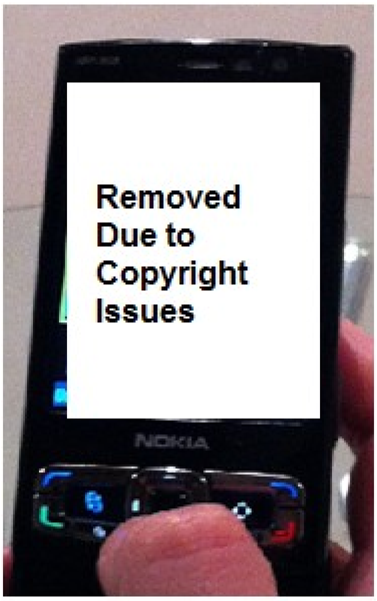
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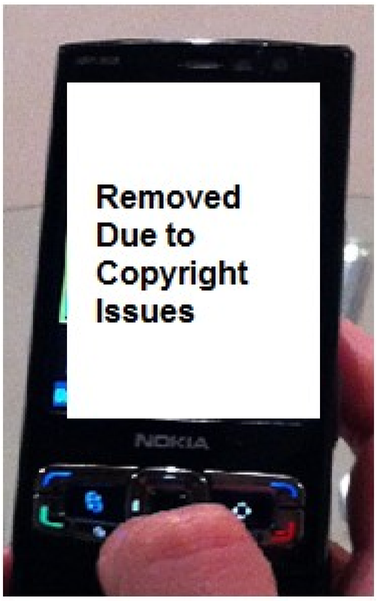
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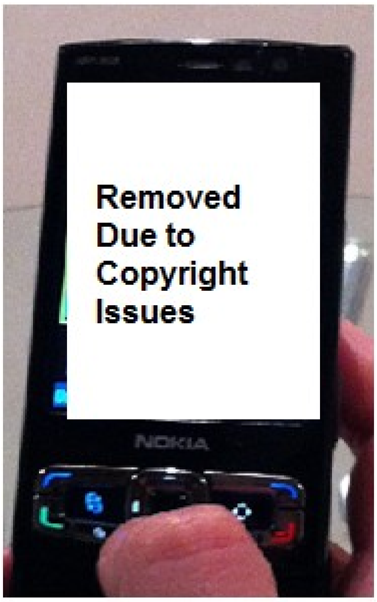
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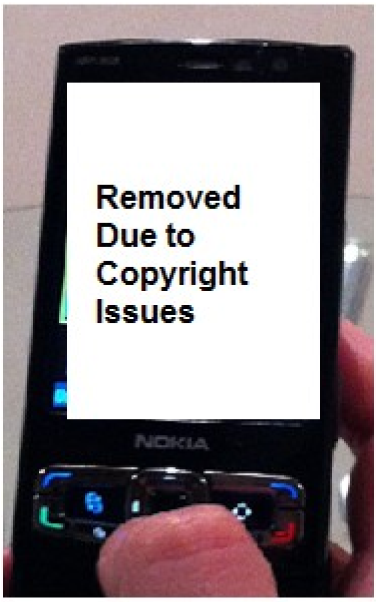
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H

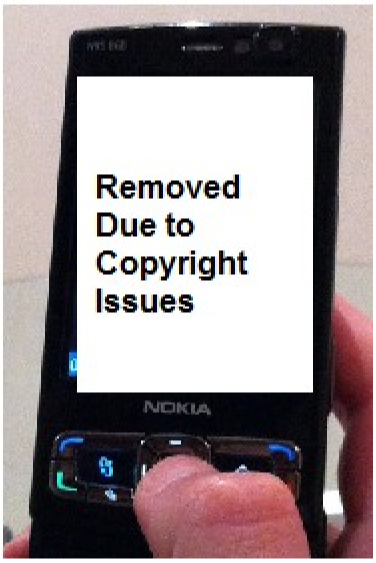
I

Figure 7.13: Pre-existing Simpsons Movie

Figure 7.13 is a pre-existing video content, a cartoon movie displayed on traditional TV. This figure presents the video and every interactive element and the action that appears whenever an element is clicked on. This figure enables users to immediately interact with it using the product placement as well as links for the users to the Simpsons on ‘Hulu’, a free online video service, or it could be linked to the Simpsons website itself. The online shop website is linked to videos that enable users to get more information about a certain object or simply to buy it, which presents the idea of ‘infotainment’. In addition, more options are provided, such as downloading a movie. It enables users to access more information about the movie actors, dates of production, new series, and other information required by users. Furthermore, other interaction elements are through ranking the video and the name of the video. In addition to the above, Figure 7.13 (I) includes different methods of interaction using clickable regions that enables users to be linked to the Simpsons on ‘Hulu’, a free online video service.

This prototype shows pressing keys displayed near the bottom part of the screen. The pressing keys (buttons) had a positive response to consumers' needs because users expected to view a button at the bottom of the screen to save as much space as possible in the middle of the screen.

The following examples are of pre-existing advertisements displayed on traditional TV with the element of interactivity added to them by this research. There are two ways of interaction. However, there is a slight difference in technique.



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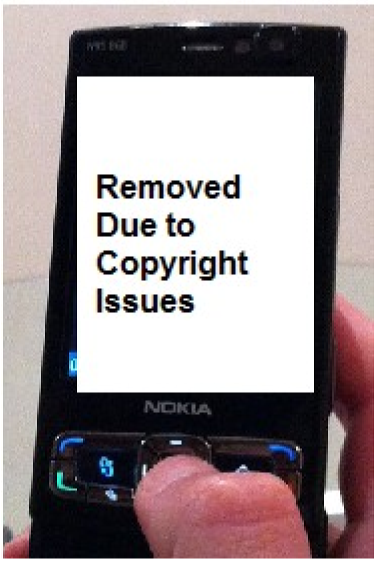
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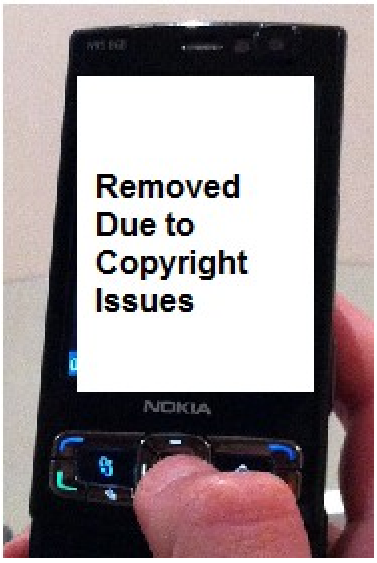
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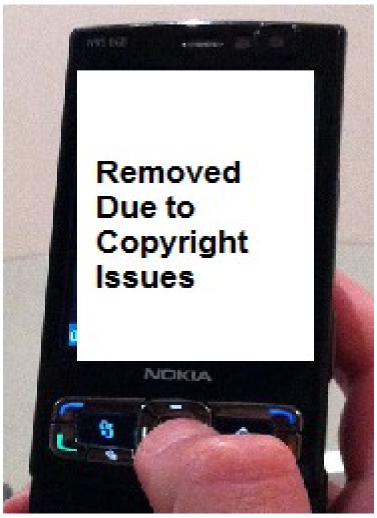
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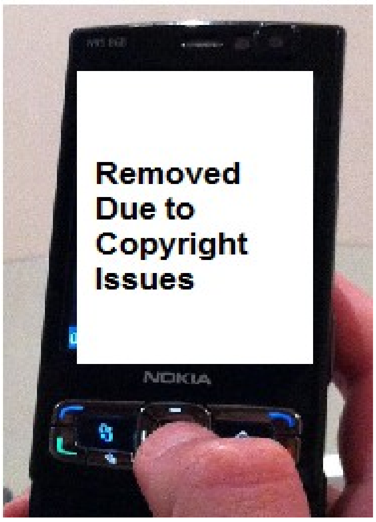
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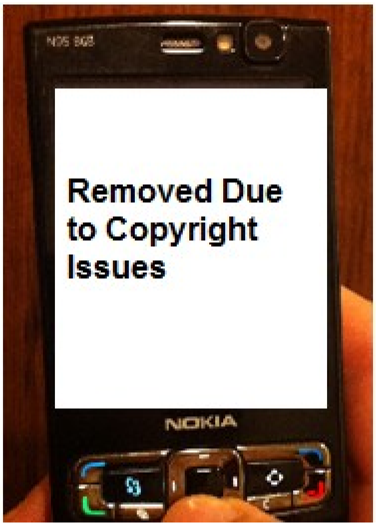
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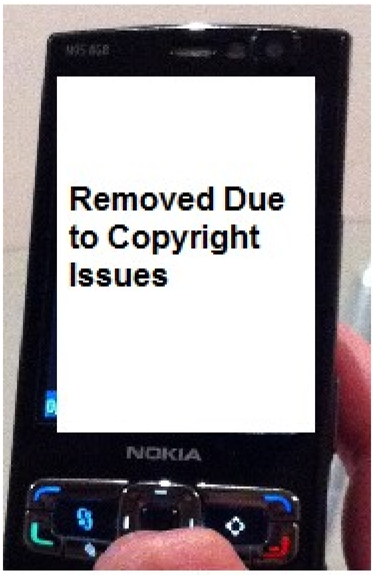
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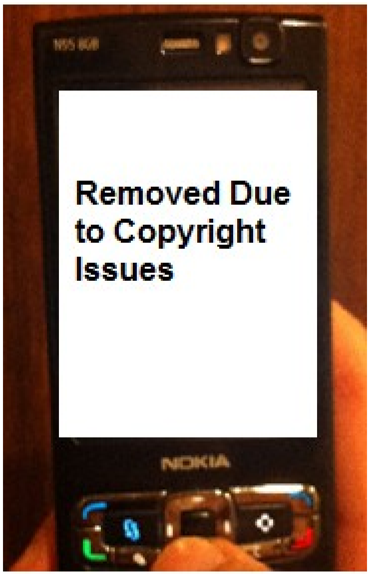
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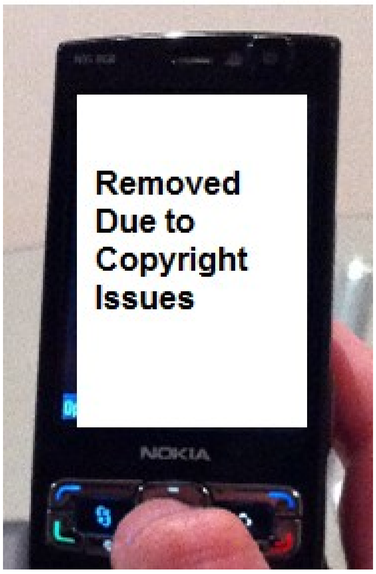
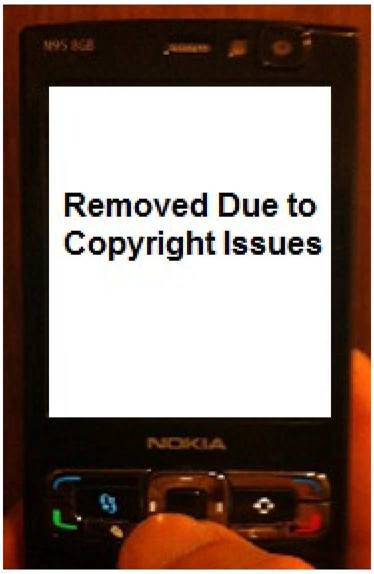
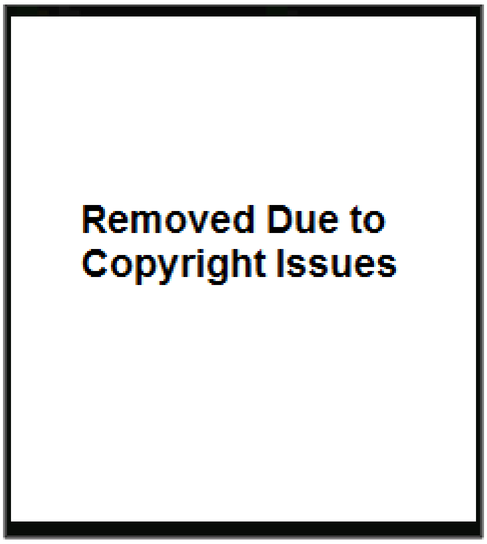
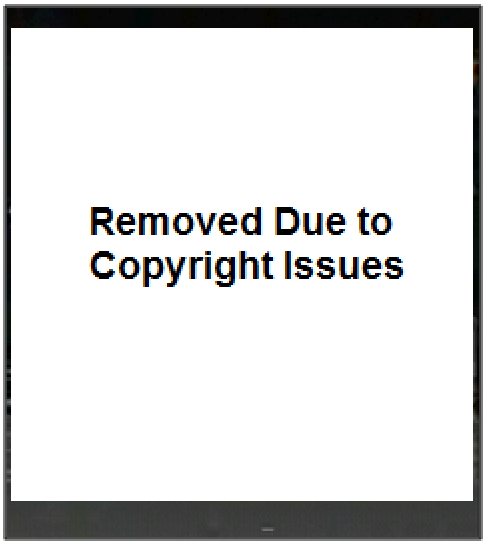




I J





K L

Figure 7.14: Pre-existing Adidas Advertisement

Figure 7.14 shows an advertisement for adidas with a Flash-implemented pressing key which is then linked to a URL www.adidas.com.

Figure 7.14 (A to J) shows the use of interactivity by clicking a drop down menu of pressing keys or the buttons at the left and right hand side of the drop down menu. Clicking on each of the pressing keys links the users to the website of the object or product to get more information about it or to buy it. In video E, when the user clicks on the option of menswear they are linked to the adidas menswear website, as appears in image F. While in video G, when the user clicks on the button for women's wear they are lead to the adidas women's wear website, as shown in image H. Furthermore, video I present an option to the users to click on the logo of adidas to be directed to the adidas original website, as shown in image J. Video K presents the interactive video on the computer before it is applied to mobile devices. Video L, on the other hand, uses an almost invisible button with no menus – to provide users with more space on the screen. This fulfils the user requirement for a larger space on the screen. These examples were implemented here to support the use of pre-existing content as an advertisement on mobile TV. Moreover, videos B and C present interactive prototypes using pressing keys to allow interaction with the video. These keys allow further options to users by pressing on the key 'skip' to end the session of the advertisement and pressing on the 'replay' key to start the advertisement again.

7.6.4 Online Advertisements

Online animation advertisements differ from all the examples above. The pre-existing and tailored online advertisements enable users to interact directly with them without any intermediation. The ability to interact with a video is attained either by clicking on an object displayed in the content or clicking on the pressing keys (buttons) provided. The main purpose of interaction is to engage users who either interact to get more information on the object embedded within the content or to buy it.

In this section, still images or online animated advertisements that appear on the Web were tested by a sample of users in order to find out if they were accepted or not and find out if they preferred using them on mobile devices. The objective was to identify their problems and to compare the tailored content which this research implemented. The online advertisements tested represent banner, popup and rollover advertisements. Although these pre-existing advertisements can be displayed on some mobile devices while surfing the Web, they were tested to demonstrate that the space provided for such advertising on a mobile device screen, especially in the case of mobile TV, is not enough. There is also a difference between online advertisements and the expected mobile TV advertisements in the way revenue is generated.

Interaction was achieved by using either pressing keys (buttons) or embedding clickable regions, as shown in some of the previous examples of still and dynamic prototypes and some of the online interactive advertisements.

The following section presents an analysis of the survey results. These surveys were completed after users had tested all types of advertisements presented in this study.

7.7 Results of Informal Group Survey

Implementation of the user interface is not the only difficult part of development. Evaluation of the prototypes is also problematic. This section includes a few examples of questions from the survey. The main text includes the users' commentary on the questions chosen, with the remainder of the information in Appendix 2. The survey was carried out in England and Jordan on a sample of sixty respondents. This sample was limited as this is a testing tool to check which the acceptable prototypes were. As these prototypes will be of concern to a considerably large number of respondents, a survey that covers all of them is almost impossible. This is an experimental feedback survey that checks the usability of the prototypes. The problem was that it took a long time to find respondents who accepted being part of the experimental survey. Initially, respondents tested various interfaces. Then a questionnaire was filled in regarding their experience of the use of the interfaces. The sample age groups were as follows: age group 1 (younger than 26 years) and age group 2 (older than 25 years). This experimental survey aimed at investigating the respondents' preferred type of mobile interface. The results of evaluation are shown below. The age group scales were divided into two age groups due to the limited sample size in order not to reduce the size of the sample more by dividing it in to more age groups. The 25/26 year old boundary was set after the experimental survey was gathered; these boundaries were chosen as the ages varied and the maximum age was 50 years old therefore it was divided into those two groups.

Two main types of advertisement, falling within the main categories of tailored or ordinary (pre-existing) content, were used for the survey:

1) Interactive mobile advertisements were classified as follows: a) still image maps; b) image maps in videos; and c) movie trailers. Age group 1 thought that interactive mobile advertisements were the best type of advertisements, of course according to their usage experience.

2) Online advertisements, including rollover advertisements, were shown to age group 1 of the surveyed respondents, as well as banner advertisements and popup advertisements.

Users from age group 2 agreed with age group 1 that interactive mobile advertisements were generally the best type, specifically image maps in videos and movie trailers. On the other hand, online advertisements and specifically popup advertisements were the worst. Surprisingly, both age groups came to the same ranking results. Some respondents indicated that the second and third types of online advertisement, namely the rollover advertisements and banner advertisements, were the best types. Finally, respondents thought that popup advertisements were the least interesting type of online advertising. This is because popup advertisements interrupt the respondents' viewing or web surfing experience.

This study aims to ensure that the designed interfaces in general and interactive mobile TV advertisements in particular are acceptable to respondents. The types of online advertisements mainly used were: popup, rollover and banner advertisements. These types of advertisements were the most popular therefore they were selected by this experimental survey. In addition, the following types of interactive mobile advertisements were used: still image maps, image maps in videos and movie trailers. These types of advertisements were utilised because they matched consumers' needs.

7.7.1 Analysis of the Survey Questions

Most respondents from both age groups agreed that the best type of advertising is the interactive and informative mobile advertising, which provides information on a place or a product. There is a general agreement among respondents that interactive mobile advertisements are preferable to watch because they combine information with entertainment. On the other hand, online advertisements, specifically popup advertisements, are not preferred by age groups 1 and 2.

Is the experience of watching advertisements different to using advertisements? The answer seems to be yes. Advertisements that are easy to use enable respondents to interact easily with the interface by getting more information or buying the product. However, watching a good quality interface might attract respondents to watch but not necessarily to interact with the interface. Approximately 50% of the respondents agreed that interactive mobile advertisements are preferable, whereas online advertisements specifically popup advertisements, are thought to be the least preferred type of advertising to interact with. Surprisingly the results were all similar for both age groups. This might be because the respondents agree that traditional methods of advertising used on TV or online are not suitable for the service of mobile TV.

Advertisements for mobile devices are thought to be tailored, especially for mobile TV, and thus different to those designed for traditional TV or the Web. The ordinary (pre-existing) type of content would work on mobile devices. Instead, tailored content is preferred by age groups 1 and 2, and having a combination of pre-existing and tailored content is the second preferred option by respondents. Respondents do not mind using pre-existing content for advertising on mobile devices; in fact, some respondents preferred to watch pre-existing content. This indeed comes as a surprising finding of the experimental survey.

There is a general agreement among surveyed respondents in both groups that online advertisements, specifically popup advertisements, were not welcome, and that they need further development and improvement. Perhaps if they are developed, they would become more attractive. Both age groups think that online advertisements, specifically banner advertisements, are not appropriate, contrary to rollover advertisements which are considered convenient. Interactive mobile advertisements are not only considered convenient but are also viewed as a splendid idea. Respondents agreed that interactive mobile advertisements are mature enough and acceptable.

7.8 Conclusion

In this work, new ways of interacting with media content have been utilised in order to optimise the appropriateness of future technology. Users are seeking more and more efficient ways of interacting with information. This chapter has discussed the implementation of the prototypes. It was concluded that, in order to address interactivity, HTML software package was used to provide users with clickable regions in an image. To work with videos and for that purpose, various software packages were chosen. It was concluded that the mobile TV experience can present the idea, providing users with an alternative idea to commercial advertising as represented in non-commercial information provision as well as the use of product placement as a link to web browsing. It is concluded that interaction through videos was implemented through two approaches, either clickable regions (objects, products) or buttons. It is concluded that the prototypes implemented by this research will have implications for the future of mobile TV as it changes the way of TV being consumed. Users will be able to enjoy an informative and entertaining viewing experience in many contexts. It is concluded that the mobile TV domain is still developing; therefore new developments will enrich the whole experience.

The prototypes went through many steps before their implementation as there was a need to take into consideration many aspects, such as mobile devices, users and video content including advertising. It is concluded that the mobile TV experience has many scenarios, in this research it is thought that an advertising based mobile TV service is more efficient than a subscription based one. This is concluded in the case of mobile TV subscription as since it was implemented it has not been proven a considerable success. It is concluded that advertising will have implications on the growth of the number of users as it will be free for users. This research implemented a simulated mobile TV advertising based experience. It is concluded that a mobile TV experience needs to include advertisements that suit the whole context. It is concluded that mobile TV will have implications for the future of revenue generation through online advertising as the interaction methods, either through buttons or clickable regions, were linked to URLs. In addition these implications are to increase the online commerce and 24/7 advertising that generates loyalty. It is concluded that the revenue generation is different regarding mobile TV experience due to its uniqueness.

The testing stage included an informal feedback group and use of the primary prototypes. After testing the prototypes several times and refining them, final prototypes were implemented. Further testing in the form of a survey was conducted to check the respondents' degree of acceptance of and approval of the different types of prototypes.

It is concluded that the respondents had a general agreement that the tailored interactive mobile advertisements are the best type to be used, while online advertisements, specifically popup advertisements, were a rejected type of advertising as they disturb the user's viewing experience.

It is concluded that the developments in the UI mostly help the introduction of new mobile TV applications, for instance the development of new tools that enable users to invent new applications for mobile TV. However, on the other hand, the developments of UI hinder the development of new mobile TV applications as it is so separated. For instance, implementing mobile TV applications does not mean that all these devices would be able to display the same applications (e.g. iPhone).

The next chapter contains the discussion and conclusion. It will discuss in detail the results drawn from each chapter as well as draw conclusions from that into the main findings of this study.

Chapter 8

Discussion and Conclusion

8.1 The Results of this Research

The purpose of this research was as follows: firstly, to gain an understanding of ‘mobile TV’ and evaluate it from a number of perspectives; secondly, to survey the users in order to understand their needs and requirements; thirdly, to analyse the user surveys and to test the causal relationships between the demographic variables and the research questions.

The research objective was achieved by finding answers to the research questions. These questions were formulated in order to:

1) Discover the respondents understanding of some concepts.

2) Explore the respondent’s preferences.

3) Analyse the respondent’s viewing experience of mobile TV - either online or offline.

The hypotheses to be tested in this research were as follows:

1) Motorola Engineers are expected to be highly pro-technology with regard to the use of mobile devices as they are in the market of mobile devices.

2) Aspects such as Education, Occupation, Length of time using, Gender and Age Groups are likely to influence the results.

3) UK respondent, as members of a 'technologically advanced' nation may more readily welcome advanced technologies.

4) Individuals in Jordan, a developing country, may find it more difficult to obtain mobile devices capable of delivering mobile TV. For example, at that time of study, 3G was not available in Jordan.

5) Social, cultural and sociological dependencies with regard to mobile TV.

6) Connectedness is a property of the modern world brought about by the Internet, networks, and interactive devices. One would therefore expect connectedness and interactivity to be a key aspect in mobile TV take-up.

7) As new media communications grow, advertising revenues for traditional media is subject to greater competition from other fields. One would therefore expect advertisers to be looking for opportunities in new media.

The research provided results based on empirical findings which complement results in the existing literature. There is a lack of relevant academic study and research in the area of mobile TV applications. This lack of academic research material motivated the current investigation to carry out a concept survey to evaluate the current situation. One potential issue is that mobile TV service targets large portions of the general population so the survey sample conducted as part of this research might be considered small. However, according to the literature, this research adopted a similar sample size to that required for studies which were conducted with a large population group as defined by Abbie Griffin and John Hauser (See Chapter Five, Section 5.5). In addition, the choice of random subjects should be fairly representative of more detailed surveys.

The main results to the hypothesis were as follows:

1) Motorola Engineers are expected to be highly pro-technology with regard to the use of mobile devices as they are in the market of mobile devices. This hypothesis proved to be false. As the results showed that they were not interested in the current mobile TV service.

2) UK respondent, as members of a ‘technologically advanced’ nation may more readily welcome advanced technologies. This hypothesis proved to be true. As the results showed that they were interested in the current mobile TV service.

3) Individuals in Jordan, a developing country, may find it more difficult to obtain mobile devices capable of delivering mobile TV. For example, at that time of study, 3G was not available in Jordan. This hypothesis proved to be true. As the results showed that the Jordanian respondents were up-to-date with mobile technology and the use of it. It is concluded that there is no major difference in the results between Jordanian and English sample.

4) Aspects such as Education, Occupation, Length of time using, Gender and Age Groups are likely to influence the results. As the results showed, gender and age groups do have an effect on the most of the cases. Education has a lower effect in the English sample while in the Jordanian sample a lower effect applies. Occupation does have a lower effect compared to gender and age groups. Length of time using has no effect in most of the cases in the Jordanian and English samples.

5) Social, cultural and sociological dependencies related to mobile TV. As the results showed that there are some social, cultural and sociological dependencies to do with mobile TV.

6) Connectedness is a property of the modern world brought about by the Internet, networks, and interactive devices. One would therefore expect connectedness and interactivity to be a key aspect in mobile TV take-up. This hypothesis proved to be true. As the results showed the interactivity is an aspect that the majority of respondents from all samples were asking for.

7) As new media communications grow, advertising revenues for traditional media is subject to greater competition from other fields. One would therefore expect advertisers to be looking for opportunities in new media. This hypothesis proved to be true. Due to the results conducted there are many respondents who were not interested in advertisements displayed on traditional TV. In addition, the majority of respondents were welcoming to the new idea of none commercial advertisements.

Regarding the acceptance of mobile TV, it was expected that a mobile TV service would be accepted by respondents. The results showed that there are some who do not accept the service. Therefore, it raises the question of whether mobile TV will become a viable service. For this reason the challenges were studied and some solutions were proposed such as funding mechanisms for a mobile TV service. However, the majority of users find the service convenient. If the service is useful, is applied, and then used by consumers, it is clear to that mobile TV is a new service in its own right and could be adapted to contexts where other types of technology are not available.

8.2 The Importance of Ease of Use

It is concluded from this research that mobile devices must be fashionable and easy to use; and able to connect users to a wide range of services and applications on mobile devices. These services and applications will not be used if they are difficult to access. Therefore services and applications must provide a user-friendly interface to facilitate interaction with on-screen content. This in turn has the potential to increase revenue generation and meet the requirements of the service and application providers.

As indicated earlier, mobile devices have a small screen that might inhibit the ease of use in a mobile TV service. An example of a portable device that is easy to use is the iPhone, which has a high-resolution display that is easy to interact with, low power consumption compared to many other devices, and substantial internal memory.

Improved input/output capabilities now allow users to interact with mobile devices. For example, a touch screen is an easier way to interact, as it allows the user to point at the relevant menu item or object directly. Also, voice recognition enables users to easily perform activities on mobile devices. The virtual keyboard could be another input device that makes the mobile devices easier to use. Handwriting recognition is another possible way to interact with devices in a user-friendly environment. In future, adaptive methods may be used to allow the device to be tailored automatically to the user's particular requirements and behavioural attributes.

A user-friendly environment in the context of digital convergence may be characterised by one that allows users to access multiple media types across multiple devices. An example of a converged device is the Sony PlayStation – a game console that is also used for playing DVDs, web surfing, listening to music and conversing with friends. User-friendliness may be exemplified by amateurs and professionals utilising their mobile devices to generate videos, listening to audio, being able to play games, and games producers' utilising these devices as delivery platforms.

Current platforms make it easier for users to develop video-on-demand, interactive services and new digital content. In addition, user-friendly converged media includes the introduction of a variety of new media technologies that enable users to attain, give feedback on, produce, consume and edit media content (Suárez-Orozco and Qin-Hilliard 2004).

Mobile TV is a multimedia and personal service in the user's pocket; it is not just a TV on the move. In this research, the ease of use in the case of the viewing experience to gain the control of the viewing without constraints. In this research, one of the objectives that have been identified is that the interface is easy to read and use.

According to Larry Constantine and Lucy Lockwood (2008 cited in Swamy 2010), a set of general principles were proposed to design an optimum user interface that is easy to use. Firstly, the structure is defined, which is how the interface design is organised. Secondly, simplicity is defined, for example an interface with a minimum number of procedures required by users. Thirdly is visibility is concerned with defining the visible elements so that the disruption to the user is minimised. Fourthly, feedback informs users of any action that has been initiated, or any reaction required. Fifthly, tolerance ensures flexibility, enabling the users to redo or cancel any action. Sixthly, reuse is concerned with reusing the components of the interface rather than forcing the user rethink or remember.

Christopher Wickens et al. (Blue and Hill 2009) stated thirteen principles for display design that consist of the ease of use of the interface. It is concluded that these are a general principles that might not suit all platforms therefore the most suitable principles could be chosen to be applied to a particular display.

The categories were as follows:

A) Perceptual principles.

14) Make displays legible: the components of the interface to be noticeable to be used by users.

15) Avoid absolute judgment limits: having many levels of variables such as volume.

16) Top-down processing: the past experiences of the users should reflect on the way signals are explained and professed.

17) Redundancy gain: different ways should be used for displaying signals to be recognised properly by users.

18) Discriminabilty: avoiding similar features as they can cause confusion.

B) Mental model principles:

19) Principle of pictorial realism: including the slogan images of the interface components.

20) Principle of the moving part: if the components in the interface are with motion therefore it should flow in the direction that the user's mind expects.

C) Principles based on attention:

21) Minimising information access cost: decreasing the effort and time needed to move from one action to another.

22) Proximity compatibility principle: interface should be related as the users could divert between components.

23) Principle of multiple resources: users can interpret multiple resources used simultaneously.

D) Memory principles:

24) Replace memory with visual information: the use of some options as a user should not need to keep important information in his short-term memory or to remember from his long-term memory.

25) Principle of predictive aiding: users being proactive rather than reactive being able to think of the next step rather than thinking of the current job.

26) Principle of consistency: design being similar therefore the users can transfer knowledge from their long-term memory to use the designs.

To make an interface easy to use a screen layout took into consideration the screen constraints. The following steps were to make an interface easier to use;

1) Sequence of elements (vertical, horizontal).

2) Nesting of elements.

3) Spacing between elements.

In this research, the general aspects of screen layout that makes an interface easy to be used are those according to Waloszek 2002. These are

1) Flow of control;

2) Dependencies: the components of the interface depending on each other;

3) Togetherness: the components of the interface are related to each other;

4) Aesthetics and general Gestalt principles: the way information is being communicated visually.

The interface developer must ensure that the interface is reliable and works consistently. To make a design easy to use the interfaces should take into consideration that users could be from different cultures. As the design for a community might not satisfy other communities, the designs should be tested on the target community.

In addition, the interface should be able to recover from errors made by users. Understanding the user’s physical abilities is also important in making interfaces user-friendly. In addition, children’s abilities should be taken into consideration. Colour choice and colour mix are also important factors. For example, white text on a black background is easy to read. In addition, using the minimum number of colours is preferred as an interface that contains too many colours can cause confusion to the user. Furthermore, an interface should not include more than six colours. In this research the interfaces followed all of the above principles.

To make the interface easy to use it should have less than one second’s response time for users’ thinking processes, and less than a tenth of a second’s response time for users to maintain their interest (Gawlinski 2003). In order to ensure that the interfaces of this research were easy to use they were iteratively refined through further consultation with respondents and usability testing. Regarding the tools used for prototypes designing, Adobe Fireworks was selected because it is easy to understand and use, and Fireworks can easily convert a design into an interactive prototype.

It is concluded that advertisements in this research are easy to use because they enabled respondents to interact easily with the interface to obtain more information or to buy products and services. Product placement can be usefully applied to advertising on mobile TV.

8.3 The Importance of Personalised Content

Users did not think that mobile TV will replace other devices in the area of video streaming. Initially it was thought that they could - as mobile TV provides the users with interactive and technological converged services that are not available in other devices. The user survey contradicted this view. Therefore the prototypes were designed for on any device that supports swf files.

As mobile TV advertising was previously an unexplored field, this research studied advertising on traditional TV and on the Web. It is possible to adopt these ways of advertising, or determine if there is a need to innovate a new way of advertising on mobile TV. On traditional TV, programmes can be constantly interrupted by advertisements and respondents seem to be interested in advertisements on TV. Surprisingly, advertisements on traditional TV are perceived to be of a useful value to some respondents.

On mobile TV, advertisements could work in a different way without disturbing the user by utilising product placement. Customised advertisements can be a way of solving some of the problems associated with traditional ways of advertising. Customised advertisements are better, according to most of the respondents who were asked. Customised advertisements can work side by side with the concept of product placement, as well as providing a revenue stream to support the mobile TV service. Therefore, these principles of interaction were applied in the prototypes that were developed.

Product placement enables the users to interact with the product directly, either by buying it or by finding information about it. This is termed 'Infotainment'. Respondents do prefer interaction in various degrees on video or devices.

The new contribution of this research is in shifting the users' and advertisers' way of thinking about advertising to the idea of extrapolation, from commercial advertising to non-commercial information provision, and then to the use of product placement. This transforms the whole concept and context of advertising, moving it from the core of traditional 'push' advertising to the emerging idea of 'infotainment' advertising. Respondents generally agree that this could be very useful, and that they will use it if it is implemented, except the elder age group from the Jordanian sample who think it is a useful idea but they will not use it. On the other hand, the Motorola respondents from age group 3 think that it is a poor idea. Surprisingly, none of the respondents thought it was a weak idea.

It is clear that mobile devices are very important to users because of the continued growth of the mobile market. There are over two billion mobile users worldwide, but the number of mobile phones is significantly greater because many users own more than one mobile device (Kumar 2007). It is concluded that mobile devices are not only devices that allow users to be in constant contact, they also create a virtual social environment for the users. It is concluded that mobile handsets have established new social activities and behaviours, for example in the way young users socialise and communicate.

By definition, these have a high degree of personalisation implicit within them.

Mobile devices allow users to get immediate access to a wide variety of information and to get connected with advertisers in more ways than previously. It is concluded that utilising mobile devices solely for communication is no longer sufficient to satisfy the customers' business and personal requirements. Therefore consumers are increasingly demanding mobile access to multimedia services, surfing the internet, conducting financial transactions and other services. Accessing multimedia services is considered to be part of mobile TV. Mobile devices are also personal, so it could also be termed 'Personal TV'. It is concluded that Mobile Digital Television (MDTV) has the potential for success because it combines the two most commonly used electronic devices among consumers - TVs and mobile phones. It is concluded that digital media offers better services compared to analogue media and it offers many new services in various sectors. Digital convergence opens up new application domains for mobile devices. It is concluded from the results of this research that mobile TV will affect traditional TV but will not replace it. This is because of the different domains of the experience.

It is concluded that the services and viewing experience of mobile TV over cellular networks is expected to be qualitatively different from traditional fixed-device TV viewing. Two kinds of viewing are available 'lean-forward' as in the case of mobile TV, and 'lean-backward' as in the case of traditional TV. The idea behind lean-forward media is that viewers are engaged and actively searching for content, with a short attention span; videos must be separated into short clips. While on the other hand, lean-back media or ‘passive media’ are when viewers relax while watching TV, with a long attention span.

Combining both together in some cases leads to a disappointing experience, as in the case of 3D TV which is displayed on a traditional TV screen that is considered to be ‘lean-back’ experience that involves a long content for the long attention span. 3D TV is not yet the commercial success that was initially expected. It was thought to work fine for short documentary films where 3D adds some novelty value to the viewer experience. However, it is unclear what the 3D adds to feature films where the emphasis is on telling a story. The latest trend in the marketplace is ‘Smart TV’. The collaboration between Sony, Logitech, Google and Intel has resulted in the ‘Smart TV’ environment. The ‘Smart TV’ is simply the integration of live TV with the web. For example, connecting a TV set with a Google box that allows users to search for content of the web. Another example is ‘YouView’ a new product of BBC and other major networks and will be launched in 2012. The idea is to put broadband and web content into the TV. The service is a revisiting of the concept of the TV viewing experience by integrating the content of lean forward media and lean back media. The differences, in addition to mobility, are that mobile TV will deliver the content to consumers in a variety of ways including video-on-demand, traditional/linear and live TV programmes. A mobile TV service can be offered either online or offline. It is concluded in this research that mobile TV content can be offered in many ways as shown in Figure 8.1.

Finally, a novel idea that combines the traditional media with the mobile media is represented in the following example which is the iPad being used as an adjunct second screen to normal television broadcasts. This second screen can be used to interrogate items in the broadcast, or zoom in to particular areas of interest in the broadcast to get more detail. It can also do programming, and access news, Twitter and Facebook. An iPad in this mode is almost mobile television with multimedia internet, and it is clear that the traditional concept of a broadcast channel is disappearing. Homes are increasingly being provided with broadband access at 100 Mbits/sec downstream and 10-20 Mbits/sec upstream. Traditional broadcasters are facing the challenge of the packaging of content by network distributors and operators. Traditional TV appears to be concentrating more on larger, high definition screens in order to generate a cinema experience in the home, and in order to retain market share for traditional TV. The trend towards mobile and seamless media is likely to continue.

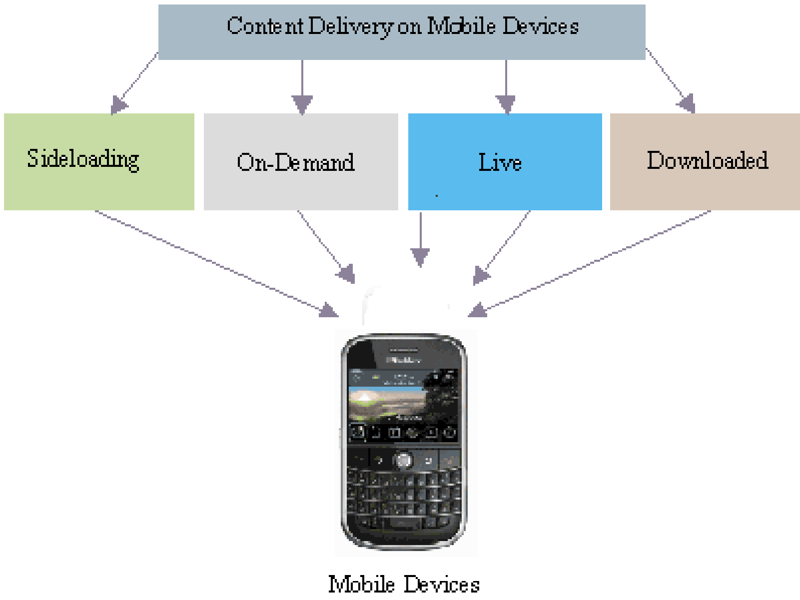


Figure 8.1: Interactive Video Content Delivery on Mobile Devices

1) Live - live TV continues broadcasting in real time.

2) On-Demand - streamed video content from video archives according to the consumer's request.

3) Downloaded - video content downloaded to mobile devices to be viewed either on (or at) the spot, or could be saved to be viewed later on.

4) Sideloading – is similar to downloading but it is video content transferred between two local devices. Particularly between a computer and a mobile device.

One reason why respondents surveyed in the UK and Jordan do not see mobile TV as a replacement to traditional TV is because the latter is largely unaffected by the mobile TV viewing public or their context. This research studies the different contexts of mobile TV, and the respondent's preferences. Knowing the viewing contexts enables mobile TV content providers to provide users with the type and duration of content that suits the viewing context. In addition, content providers can target particular groups of users known to have particular sets of interests, and advertisers can also target their advertisements to communities with potential interest in their products (as Google do by matching advertisers to search terms).

The following categories of contexts were classified by this research which are a hybrid combination of Knoche (2005), O'Hara et al. (2007) and Chipchase, et al's. (2007) contexts, with some additional extra contexts:

- At home;
- While walking;
- At work;
- While travelling;
- and other contexts, such as private use.

1) At home: watching mobile TV at home. In cases, while lying in bed or when the family is at home, it will be hard for a user whose favourite sport is football to watch a game on traditional TV if the family is not interested in sports. This is a reason for watching sports on mobile TV.

2) While walking: watching mobile TV on the move wherever the user might be, walking in the street instead of listening to music, while going to work or in a shopping centre.

3) At work: breaks between planned activities and tasks, such as lunchtime break.

4) While transporting: watching mobile TV on journeys, for instance using the underground on the way to work or on the bus or train while travelling.

5) Other contexts: during the school lunchtime, sharing videos with friends, device lending: sometimes a user's siblings borrow mobile devices from them simply because they would like to see the content users are viewing and cannot do that because the screen is too small for a group to view. In addition, other contexts could be when taking children to school. Parents can give them mobile TV to watch in order to keep them quiet (O'Hara et al. 2007). Another context is while waiting for the bus to arrive or when waiting for friends. Finally, private use (Chipchase et al. 2007): this could be carried out in the classroom during classes or in the library when a user is doing homework.

Regarding mobile TV use, the focus of this research was on video content on mobile devices, irrespective of the method of connection. Mobile TV content or programs does not always mean that it must be a feature-length film or program; instead, as declared by Chipchase et al's. study - mobile TV content might be short videos. In addition, this research concludes that the majority of people surveyed preferred short length videos, typically a few minutes. Both short and long videos are either pre-existing content or content especially made for mobile devices, otherwise known as mobile tailored content.

The mobile TV industry opens up a new market for content developers. Content producers need to generate new episodes for mobile devices (mobisodes) either tailored or taken from popular shows and programs with shorter length, adjusting the content to suit mobile TV.

Sometimes TV programme content is untargeted to particular viewers. For example, a show about Colombia at midday, a time which is supposed to target children, could be broadcast rather than a cartoon for both mobile screen and traditional TV. Another example would be if a TV service has no archives of content available to the user, or the so-called video-on-demand service is not searchable, or is not community driven, in other words tailored by the users themselves. In addition, TV shows can distort reality because channels are not neutral and independent, and indeed, can act as propaganda.

Finding suitable content to be displayed on the mobile TV could be considered as one of the challenges that is facing the adoption of mobile TV services. This research suggests that content providers could collaborate with Google to use its new service which tracks every text entered by users into its set of services (Mowery 2007). Tracking user searches can be used to help mobile TV content developers and service providers in identifying user's most viewed, most popular and favourite content (tailored or pre-existing); therefore mobile TV users will be provided with the same types of content to be displayed on mobile device TV. However, sharing of Google's search history could be considered an infringement of people's personal lives. Google argues that it is for users' benefit, as no personally identifying information is supplied (Google n.d.). Google's search history gives highly accurate information because of its wide sample of users.

If the pre-existing content is preferred for viewing then tools could be used to apply some cropping or close-ups that could be more suitable for mobile devices. On the other hand, if the users prefer to view tailored content on mobile TV then some platforms such as 'YouTube' could be used to provide this type of content. However, there is still a need to establish an understanding of tailored content as it is thought to be vague to some users. There is a further option which is the combination of tailored and pre-existing content which was identified by some of the survey respondents. This option could be the most convenient as it offers both types that are available and matches the interests of various groups of users.

Content is delivered to users either individually (unicast) or collectively (broadcast or multicast). This research suggests that mobile TV systems should combine transmission systems, to meet consumers' needs for various types of content. Technically this combination offers more network capacity and less spending and investing in infrastructure, to reach the optimal solution. A combination of unicast and multicast systems will not affect users; they will not even notice any difference in the quality of service, and the user will receive the selected content. This combination scenario might be the key to achieving customisation, and reaching the maximum number of users. This research suggests that regardless of the technologies used for mobile TV, there is a need to regulate it in terms of delivery method, unicast and multicast (Lin 2010).

The development of mobile TV offers many new opportunities, but also challenges, which will need to be addressed over time. Mobile TV services have faced these challenges since their inception. There is no doubt there will be many more challenges ahead, and stakeholders need to consider their options carefully in order to make the most of the opportunities presented by mobile TV. This research classified the challenges faced by mobile TV into five groups according to the type of challenge: cost; device manufacturers; content developers; mobile device; and service provider challenges.

Concerning the availability of a large variety of mobile devices that are capable of displaying, receiving and broadcasting video content, it is concluded that the availability of various mobile standards for video broadcasting are challenging for mobile devices.

In conclusion, it is preferred that mobile devices are small. Extending the size of keyboards or screens is possible, without increasing the size of the device, using touch screens such as applied by iPhone. A further solution, as proposed by Knoche and McCarthy's (2005) research, is that people could use a separate device with a wider screen and low power consumption. Knoche and McCarthy's suggestion is based on a sample of users and needs further study.

It is concluded that phone calls, SMSs and MMSs could interrupt the mobile TV user's viewing experience (Lejealle 2008). This challenge is considered to be hard to address but minimizing its affect could be by pausing the video content when a call appears and, after answering, the video could be resumed.

A further challenge is the cost of the mobile TV service. The studies included in the literature review of this research detail the need to set a pricing model for a mobile TV service. Service providers have invested substantial capital in the infrastructure of mobile TV services; therefore they expect to make a financial return from user subscriptions or sponsors for this service. This issue could be addressed through an ad-based plan. A review of all of the available types of advertisements can then determine the most appropriate ones that suit the mobile TV experience. A replication of the traditional TV content will need to adapt the same untargeted type of advertisements displayed on traditional TV but the problem is that most people will not pay for a service that they can receive at home free of charge.

Many other challenges which were highlighted in earlier chapters also hinder the user's adoption of a mobile TV service. Some of these challenges are the responsibility of more than one stakeholder. However, the collaboration between different remote stakeholders is also considered as a challenge (Engstrom et al. 2008). The mobile TV value chain defines the relationship between the players that collaborate with each other to deliver to the needs of the. Value chains will be disassembled, and new models will be established in this extremely fast developing market. As mobile TV helps to establish a closer relationship between the telecommunications and media sectors, then content providers need to establish new partnerships with service providers. As this happens, the value chain will become more complex (Wang 2007).

The slow take-off of mobile TV services is partly due to the cost; therefore a pricing model needs to be set which will increase the diffusion of the service. Mobile TV has not yet established a specific business model because of the broad definition of mobile TV (Urban 2009), in other words the different ways for receiving content and then displaying it in a mobile device. One of the vendors who had problems because of a low number of users was Virgin Mobile TV (VMTV), which was launched in 2006 but failed to attract users, and was abandoned in 2007. Therefore this research aimed to study the mobile TV experience and sought to discuss the ways to increase the number of users.

It is concluded in this research that the types of channels would be: first, free-view because of the advertisements, second normal rate payment having channels with no advertisements, and, third, a premium account with extra channels and content with no advertisements.

Paid and free mobile TV service, such as S-DMB and T-DMB, clearly have different pricing models. T-DMB will invest about 50 to 80 million dollars and offer a low number of channels, while S-DMB will invest 500 to 800 million dollars with a high number of channels. In addition there is the cost of the content displayed. T-DMB is a free service, whilst S-DMB is through subscription, so there will be a periodic charge (Bauer et al. 2007).

This research adopts the advertising-based model since mobile TV is not established as service; therefore the cost will not be a challenge to mobile TV adoption. Some communication services, such as mobile phone services, internet, and TV, have applied the subscription model, whilst the pay-per-use model has had a very slow take-off (Urban 2009).

The advertising model for traditional TV is based on 30 second advertisements. Traditional advertising may not always be effective because this type of advertising usually interrupts the user's viewing session. Therefore, there is a decrease in the number of viewers of traditional TV as well as the reduction in viewing times which will reduce the number of advertisements viewed. In addition DVR's may be used to record and then omit advertisements (Templeton n.d.). Furthermore, viewers might change the channel to skip advertisements. Thus, finding new ways to advertise to consumers is becoming a major objective for marketers. On the other hand, using DVR's is not always considered to be a way to skip advertisements as some users do pay attention to advertisement when fast forwarding. In addition they might go back to view a commercial that interests them.

A report by the Mobile Entertainment Forum (MEF), a mobile entertainment global trade association, stated that the revenue of the ad-funded games and videos will be £145m in the UK by 2012. Although it is in their interests to show that it will be a large market, data from all sources should be considered even if these sources were the service providers themselves (Direct Marketing Association 2008). However, the growth of mobile advertising is slower than expected due to the global economic crisis but analysts predicted that 2009 would be the year for mobile advertising.

One mobile advertising portal surveyed its user base of 16-25 year-olds and reported that nearly 50% would accept advertisements in return for content (Direct Marketing Association 2008). Examples of companies which have used the idea of ad-funded shows are Orange with brands such as Coca Cola and Saab. In the USA, MySpace have been testing a similar funded advertisement concept in addition to ‘Big Brother 2007’ which, for mobile viewers, was free to be viewed with funded advertisements, and 3, the mobile operator, which in 2007 launched this service as well (Direct Marketing Association 2008).

The best way of getting an audience excited through mobile video advertising is by engaging them immediately in an exciting and stimulating video. The increasing availability of multimedia content creates a substantial opportunity for sophisticated forms of mobile advertising.

It is advised to widen the mobile TV experience by asking people about the preferred types of advertisements to be used on mobile TV. For example, after the surveys conducted under this research were analysed, the conclusion shows that customised advertisements are preferred by respondents in addition to non-commercial advertisements. Therefore, a combination of both might satisfy both advertisers and users.

8.4 The Importance of Interactivity

This research studied the interactive mobile TV experience. The literature shows that interactivity is thought to be one of the key drivers in the mobile market because it is a consumer’s preference. Interacting with TV allows the users greater flexibility in requesting the services they require. According to questions asked by the survey, it appears that it is too early to tell whether there is a different interactive level in the use of mobile devices (e.g. low level interactivity such as ‘the big red button’ and high level interactivity such as advanced video interfaces). With a mobile TV service users can interact with the device using both hands while in the ‘lean-forward’ mode. On the other hand, with traditional TV a remote control can be used with one hand in a ‘lean-back' mode. A further aspect is the way content is provided. In the case of mobile TV content, it is broadcast, downloaded, or viewed online on platforms such as ‘YouTube’. Even though this research classified interaction into three levels, according to the respondents of the survey the results seem to be unclear, and it is hard to classify interaction into levels. Another problem is the difficulty of inventing new ways of interaction on a mobile TV service, due to the limited screen size and the limited availability of interaction modes.

It is concluded that mobile TV is expected to be an important new service that could supply users with new applications, as well as creating a considerable market for investments, if the appropriate content and content design philosophy are found. This research identifies the many potential application areas for mobile TV, such as in the education sector where mobile TV can be used for training and learning. However, a number of issues remain unclear, such as mobile TV technologies, industry strategies, market development, and consumer behaviour. It is concluded that among the surveyed respondents, especially the elderly, that mobile TV applications make life easier. Mobile TV becomes a social network through viral video; sharing video with other users.

After analysing the questionnaires, the data gathered was used to design and implement the prototypes in this research. These prototypes were heavily dependent on user interaction.

Clearly, interactivity changes a passive user viewing experience into a more engaged involvement in the content. It also links into the current ways of working in the more dynamic and real-time environments of mobile phones and social networks.

Products play a major role in society, and media is used to introduce such products to consumers. It is useful, therefore, to distinguish between different types of product representations in media. Different forms of advertisements lead to new trends emerging in product placement. This can be traced back to the 1950s when Gordon's Gin funded Katharine Hepburn's character in 'The African Queen' (Sutherland 2005). Some of the major broadcast networks adopt product placement such as ABC, NBC, WB, UPN, NBC, and FOX. Product placement is credible, entertaining, informative, acceptable, and gives brand confidence (Lai-man and Wai-yee 2008).

Product placement is about placing a real product in a fictional environment while reverse product placement is about placing a fictional product in a fictional environment, which is then released into the real world. In some cases of reverse product placement, the fictional product became popular among users and for that reason companies decided to produce the product. In another cases reverse product placement is utilised to generate a buzz of interest regarding a product before its launch.

According to literature research concerning product placement, there are three types as follows: "*implicit product placement, integrated explicit product placement and non-integrated explicit product placement*" (Tiwsakul et al. 2005 cited in Lai-man and Wai-yee 2008). Implicit product placement is a branded product that has no active role in the video content, for example a Coca Cola can on a table. Integrated explicit product placement is a branded product that has an active role in the video content, for example an actor drinking a Coca Cola can. Non-integrated explicit product placement is a branded product that has an active role in the video content but is not integrated in the video content, for example the Coca Cola logo and name is presented as a sponsor (Lai-man and Wai-yee 2008).

However, embedding products in video is not the only way. Verbal placement can occur by pronouncing the name of the product in the movie. In addition, a logo can be placed in the video, so there is more than one form of product placement. The view of respondents on product placement in a free mobile TV service is unclear. If it can be used, then product placement could be the main type of advertising that funds the service.

It is concluded that advertisements that break the continuity of programmes are not satisfactory on both traditional TV and mobile TV. The difference between traditional advertising and product placement is that in traditional advertising there are target groups while product placement is seen by all those watching the programme (BMW Education Programme n.d). On the other hand, it is concluded that the increase use of product placement might contribute to ad-blindness of viewers resulting in the products not being noticed. In addition, the over use of product placement could affect the video content. For example, some movies are thought to be a long commercial because of the extensive use of branded products.

Consequently, advertisers and vendors need to think of new ways of putting the products in front of the consumers' eyes. This research also deals with the application of interactive mobile TV concurrently with the idea of product placement, as well as applying other methods of advertising involving customised and interactive content.

8.5 Mobile TV Regulations

General regulations are in place to control mobile TV services. As the service develops, the regulations will expand to cover all aspects of mobile TV services. When comparing the regulations of traditional TV with mobile TV, it is found that laws and regulations of the former cover more aspects than those of the latter. Broadcasting video content over mobile devices has become a grey area. Traditional TV, on the other hand, has clear regulations that state what to do and what not to do (Sweney 2006).

The following example clarifies the concept of intellectual property with regard to mobile TV. Watching a video clip is acceptable, but using a mobile device to download and then watch a popular TV show, like ‘Friends’, is prohibited. If the content the user is watching is modified by others, it is their content, and they are the ones who decide who will view it and on what channels and services it can be displayed.

In the case of mobile advertising, many types of advertising might be considered illegal or unethical. This is because the viewers are not regulated, and some minors might watch these advertisements and be influenced by them. The Federal Trade Commission in the United States will act for consumers if advertisements mislead consumers or affect consumer behaviour (Federal Trade Commission n.d.). This research, however, supports and stresses the fact that content providers are responsible for generating content, and that service providers are responsible for what appears on the screens, and parents are responsible for monitoring their children’s actions.

8.6 Unanswered Questions

It was noted in Chapter 3 (Section 3.1) that a number of questions were left unanswered by a brainstorming session by a key people in the media and telecommunications. There questions were as follows –

- Mobile TV content questions: Who will generate most of the content for fragmented audiences? Professionals or amateurs? What will happen to content editorially made for audiences? What does 'no constraints' in terms of access to TV content really mean for data delivery across constrained networks?

- Mobile TV content delivery questions: Which platform will be the most important? Web, mobile or broadcast? Mobile TV social aspects question: Will there still be a shared social experience, e.g. 'What did viewers think of the Eastenders storyline last night?'
- Mobile TV Service providers' questions: Who will be the dominant players, and which interests 'lose out' to rapid technology change?

Considering the questions mentioned above, many of the outcomes will be in the hands of users, who will decide in what measure they will view mobile TV tailored content or re-purposed content, as displayed on traditional TV.

8.7 Future Work and Recommendations

The future of interactive and customised mobile TV applications will become a major topic as it has the potential to be adopted by almost any business, education, or social sector. However, as these sectors are still developing themselves the future of interactive and customised mobile TV services are difficult to predict.

Future work will be based on various aspects such as: mobile devices, people's behaviour and attitude change, mobile TV infrastructure, video content, the modes of interaction, the user's acceptance of mobile TV service, user's familiarity with mobile TV services, the cost of the service, and new funding models for mobile TV services.

Recommendations for future work are as follows:

1) To conduct surveys with larger samples in order to establish an understanding of the consumer needs regarding mobile TV services.

2) To find new innovative ways of interaction that enhances the mobile TV viewing experience.

3) To develop more advanced prototypes.

4) To develop new interactive mobile TV applications.

5) To generate customised content that suits the mobile TV experience.

6) To find ways of applying interactive video files on all mobile devices.

7) To establish an understanding of the levels of interaction.

8) To develop new innovative ways of advertising to generate revenue through mobile TV services.

9) To consider redefining the concept 'mobile TV' as it is more than live broadcasting.

10) To further explore and investigate consumers' uptake of compatible devices.

11) To design and implement prototypes that work correctly on a wide variety of different platforms.

12) To explore the more the effect of demographic variables on the adoption of mobile TV service.

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Appendix 1

Surveys

A1.1 Mobile TV Concept Survey

INTERACTIVE APPLICATIONS ON MOBILE TV

A) Age Group

a)	Younger than 21 years	b)	21–30 years
c)	31–40 years	d)	Older than 40 years

B) Occupation

a)	Student	b)	Governmental sector employee
c)	Private sector employee	d)	Unemployed

C) Education

a)	Primary school	b)	Secondary school
c)	University undergraduate	d)	University postgraduate

D) Mobile Phone Length of Usage

a)	Less than 6 years	b)	6 –10 years
c)	11–15 years	d)	More than 15 years

E) Gender

Male	Female

Mobile Phones

1) I use my mobile phone for

a)	Calls only	b)	Calls and text messages
c)	Calls and radio	d)	Calls and all services (SMS, MMS, calendar, etc.)

2) Do you watch videos on your mobile device?

a)	Yes	b)	No

3) I mostly prefer to watch _______on my mobile device.

a)	Song clips	b)	News headlines
c)	Movies	d)	Advertisements
e)	Sport	f)	Personal events

4) My mobile device includes

a)	Camera(s) and colour screen	b)	Camera(s) and monochrome screen
c)	No camera(s) and colour screen	d)	No camera(s) and monochrome screen

5) What is my mobile device type?

a)	Second generation	b)	Third generation
c)	Touch screen	d)	Fourth generation and above

6) I watch _______on traditional TV

a)	News	b)	Sport
c)	Movies	d)	Advertisements

7) The preferred type of content to be viewed on a mobile device is?

a)	Ordinary content	b)	Tailored content
c)	Combination of ordinary and tailored content	d)	Animation content

Mobile TV

8) Watching video through mobile devices is

a)	Strongly not convenient	b)	Not convenient
c)	Convenient	d)	Very convenient

9) I would like to watch mobile TV while I am

a)	At school or at work	b)	At home
c)	Walking	d)	Travelling

10) In the future when a broadcasted mobile TV service is applied, I will

a)	Adopt the service	b)	Not adopt the service
c)	Have not decided yet	d)	Test the service

11) I prefer videos to be

a)	Short	b)	Long
c)	Both short and long	d)	Do not mind

Advertisements

12) When you watch advertisements on TV you feel

a)	No interest	b)	Annoyed
c)	Interested	d)	Change the channel

13) In addition, watching advertisements on traditional TV is thought to be

a)	Not useful	b)	Annoying
c)	Depends on the advert	d)	Useful

14) The idea of extrapolation from commercial advertising to non-commercial information provision and then using product placement to web browsing is thought to be

a)	A splendid idea	b)	A splendid idea and will be used
c)	Not a splendid idea	d)	No interest

15) Advertisements such as popup, rollover and banner advertisements on mobile devices are thought to be

a)	Attractive	b)	Not attractive
c)	In need of more development	d)	Annoying

16) Customised advertisements are?

a)	Not useful	b)	Disturbing to the recipient
c)	Not disturbing to the recipient	d)	Useful

Interactivity

17) I prefer to have an interactive video which is

a)	Not interactive	b)	Depends on the type of the video
c)	Low interactive	d)	Highly interactive

18) Would the idea of mobile TV be a replacement for traditional TV?

a)	No	b)	Depends on the type of content displayed
c)	Partially	d)	Totally

19) To enjoy the experience of viewing mobile TV I prefer to have a mobile device with a _________ screen

a)	Small screen (e.g. Nokia N80)	b)	Do not mind
c)	Medium screen (e.g. iPhone)	d)	Wide screen (e.g. iPad)

20) Mobile devices should have a _______degree of interactivity

a)	Non-existent	b)	Low
c)	Medium	d)	High

21) I think that touch screen mobile devices are

a)	Not useful	b)	Can be useful and can be not useful together depending on the aspect measured
c)	Partially useful and in need for more development	d)	Useful

Product placement

22) The idea of product placement is

a)	Unknown to me	b)	Barely known to me
c)	Partially known (it is a way of advertising)	d)	Known to me

23) The idea of product placement as an alternative to all other ways of advertising

a)	Does not help fund a mobile TV service	b)	Does not help fund a mobile TV service but is a better way of advertising and we can pay a subscription to fund the service
c)	Does help partially fund a mobile TV service	d)	Does help totally fund a mobile TV service

24) Advertising using mobile devices must be controlled by

a)	Receiver's permission	b)	No permission
c)	Service provider's permission	d)	Network operator's permission

25) Mobile phones will replace other devices in the aspect of video streaming

a)	No	b)	Depends on the type of content displayed
c)	Partially	d)	Yes

26) The most preferred characteristic to be included in my future mobile device is

a)	Touch screen	b)	Camera(s)
c)	Support for all types of multimedia file	d)	Large memory size

A1.2 Informal Group Survey

Different Types of Advertisement

1) Which type of advertisement would you prefer to view?

a)	Popup advertisements (online advertisements)	b)	Banner advertisements (online advertisements)
c)	Rollover advertisements (online advertisements)	d)	Non-commercial advertisements (interactive mobile advertisements)

2) Which type of advertisement would you prefer to use?

a)	Popup advertisements (online advertisements)	b)	Banner advertisements (online advertisements)
c)	Rollover advertisements (online advertisements)	d)	Non-commercial advertisements (interactive mobile advertisements)

3) Which type of content applied in the prototypes was preferred to be utilised in the mobile TV service?

a)	Tailored content	b)	Ordinary (pre-existing) content
c)	Both of them	d)	None of them

4) What do you think of popup advertisements?

a)	Very convenient	b)	Convenient
c)	Need development and improving	d)	Not convenient

5) What do you think of banner advertisements?

a)	Very convenient	b)	Convenient
c)	Need development and improving	d)	Not convenient

6) What do you think of rollover advertisements?

a)	Very convenient	b)	Convenient
c)	Need development and improving	d)	Not convenient

7) What do think about non-commercial advertisements?

a)	Very convenient (splendid idea)	b)	Convenient
c)	Need development	d)	Not convenient

8) Rank the advertisements by scale from the most to the less preferred (1 most preferred and 4 least preferred).

- Rollover advertisements	1	2	3	4
- Banner advertisements	1	2	3	4
- Popup advertisements	1	2	3	4
- Non-commercial advertisements	1	2	3	4

9) If there are any comments, please write below:

Appendix 2

Analysis of Surveys

Due to restrictions on the length of the thesis some parts of the survey results were excluded from Chapter Five; therefore they are included in this appendix. In Chapter Five, only two age groups were chosen, which were 2 and 3, in order to be compatible with the age groups of the Motorola sample (the Motorola sample contained only age groups 2 and 3). In addition, only nine questions – the most important ones - were included in Chapter Five. The survey consisted of five main variables: age group, gender, occupation, usage and education. Only the age group was taken into consideration.

Motorola engineers were all from the same occupation therefore the occupation was excluded. In addition, Motorola engineers were all from the same gender (Males) therefore the gender was excluded.

This Appendix includes the remainder of the survey questions. The main text includes tables with commentary on the questions. This Appendix presents four age groups for each of England and Jordan. While Motorola only presents age groups (2 and 3) as they were the only ones available.

In general, after looking at the statistical significance in the areas of education and length of usage, the results indicated no relationship between these areas and most of the questions. Therefore these variables are not included in this Appendix.

In the case of Motorola engineers, the tables were excluded as the results of Chi-square tests were not sufficiently significant given the relatively small sample size.

A2.1 England's Sample – England

A2.1.1 Age Groups 1, 2, 3 and 4

3G mobile devices can be used for sending files, SMS, MMS and other multimedia. Services such as watching videos or listening to audio files can be accessed by users of the 3G mobile devices. Audio and video files could be downloaded from websites, shared among users or broadcast via radio or TV.

Since respondents are actually using services available on their mobile devices, including watching videos, then their preferred content needs to be explored in detail.

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	48.123[a]	15	.000
Likelihood Ratio	46.719	15	.000
N of Valid Cases	180		

a. 10 cells (41.7%) have expected count less than 5. The minimum expected count is .13.

Table A2.1: England's Survey Question Three

It was found that X^2 value = 48.123[a] is significant at .000 which means that there is a relationship between Age Group and Question 3. The difference in age group affects the respondent's thoughts on the preferred content genre to be viewed on mobile devices.

The survey's results show that respondents prefer varied video content to surf and view via their mobile phones. Respondents from age groups 1 and 2 prefer to watch song clips, on their mobile devices. In addition, respondents from age group 3 prefer mostly news headlines. The most interesting result is the general agreement that respondents from age groups 1, 2 and 3 prefer not to watch sports on their mobile devices. Few respondents from age groups 1, 2 and 3 prefer to watch movies on their mobile devices.

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	27.308[a]	9	.001
Likelihood Ratio	29.759	9	.000
N of Valid Cases	180		

a. 9 cells (56.3%) have expected count less than 5. The minimum expected count is .27.

Table A2.2: England's Survey Question Eleven

It was found that X^2 value = 27.308[a] is significant at .001 which means that there is a relationship between Age Group and Question 11. The difference in age group affects the respondent's thoughts on the length of the video.

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	18.617[a]	6	.005
Likelihood Ratio	21.807	6	.001
N of Valid Cases	180		

a. 3 cells (25.0%) have expected count less than 5. The minimum expected count is 2.67.

Table A2.3: England's Survey Question Six

It was found that X^2 value = 18.617[a] is significant at .005 which means that there is a relationship between Age Group and Question 6. The difference in age group affects the respondent's thoughts on the content genre displayed on traditional TV.

The survey's results show that respondents prefer more in-depth surfing in the video content via their mobile phones. Respondents from group 1 prefer to watch short video among which are songs, on their mobile devices. Furthermore, respondents from age group 1 would watch anything except sports. Age group 4 findings were different. Respondents from this group do not use mobile devices to watch movies either because they understand movies as only being long-feature movies or perhaps because they are not interested in mobile TV services. However, they do watch news. More interesting content attracts more users, but the consumer requirements need to be studied and understood in order to meet them. In this respect, checking what is preferred to be viewed on traditional TV would help; for example, a small number of respondents from age groups 2 and 3 prefer to watch sports on traditional TV. There is a general agreement preference among age groups 1, 2, 3 and 4 for watching news on TV.

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	27.722[a]	6	.000
Likelihood Ratio	25.275	6	.000
N of Valid Cases	180		

a. 6 cells (50.0%) have expected count less than 5. The minimum expected count is .27.

Table A2.4: England's Survey Question Seven

It was found that X^2 value = 27.722[a] is significant at .000 which means that there is a relationship between Age Group and Question 7. The difference in age group affects the respondent's thoughts on the preferred type of content to be displayed on mobile devices.

If respondents were viewing all types of content either on traditional TV or mobile TV, the type of content could be tailored specifically for mobile devices or ordinary content that is already in use on TV. In the case of age group 4, some respondents do prefer a combination of both ordinary and tailored content to be viewed on their mobile devices. The results reflect the preference of all age groups of viewing ordinary content that has been produced for traditional TV. In addition, this content must suit the special characteristics of the mobile devices, taking into consideration the challenges and the attitude towards using these devices, such as the screen size.

Mobile TV is a new experience of watching video content on mobile devices in situations when traditional TV is not accessible. It is called an “anytime, anywhere” service. Although many respondents agreed that mobile TV is convenient, or that they will adopt the service when it is commercially applied, the content will be an issue when convincing people who are not enthusiastic about mobile TV services. The types of content that would suit a mobile TV service must be short videos, according to respondents from all age groups. For example, it is agreed that a full-length movie, which is more than one hour long, will be too time-consuming for transportation means, i.e. on the way to work. Instead, some short video clips might be better content for such a context.

If mobile TV is the opportunity that service providers, advertisers, content producers and many more sectors have been waiting for, then is it a service that can be used everywhere? Yes is the answer, but not all respondents will utilise it everywhere. Content producers then can utilise the information to generate content tailored to these contexts.

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	24.293[a]	9	.004
Likelihood Ratio	24.453	9	.004
N of Valid Cases	180		

a. 5 cells (31.3%) have expected count less than 5. The minimum expected count is .53.

Table A2.5: England’s Survey Question Nine

It was found that X^2 value = 24.293^a is significant at .004 which means that there is a relationship between Age Group and Question 9. The difference in age group affects the respondent's views regarding the context of mobile TV.

Fortunately, with this high degree of acceptance of the service among respondents, they can be asked about the specific contexts in which they prefer to use mobile TV. In order to know more, this survey asked the respondents to choose where they prefer to use their mobile TV service. Four options were set out in a question about the preferred context to be in while watching mobile TV. The first was while walking, and this indeed was the most preferable context among respondents from age groups 2 and 3. Second was while working, none of the respondents from age groups 1, 3 and 4 agreed to this. Third was while travelling, which was the second preferable option among respondents from age groups 1, 2, and 3. In addition, a few respondents from age group 4 prefer to use mobile TV while travelling. Fourth was when at home; this was a general option that might include some of the above. Few from age groups 1 and 3 agreed to this option because they already have TV screens at home which provide them with a better viewing experience. The issue is that respondents from age group 4 do prefer to use mobile TV at home in order to watch some content in private without being interrupted by family or friends. Surprisingly, it appears that respondents from age group 4 were divided equally between while walking and at home.

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	41.662[a]	9	.000
Likelihood Ratio	37.881	9	.000
N of Valid Cases	180		

a. 8 cells (50.0%) have expected count less than 5. The minimum expected count is .27.

Table A2.6: England's Survey Question Eighteen

It was found that X^2 value = 41.662[a] is significant at .000 which means that there is a relationship between Age Group and Question 18. The difference in age group affects the respondent's thoughts of mobile TV being a replacement to traditional TV.

Mobile TV is not considered a replacement for traditional TV because it is created for any contexts including where traditional TV is not accessible. Mobile TV is also used for personal viewing when users desire to watch a video unaccompanied. It was evident from the results that most of the respondents from all age groups believe that mobile TV will not replace traditional TV, whereas a small number of respondents from age groups 3 and 4 think that mobile TV will either completely or partially replace traditional TV.

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	8.556[a]	9	.479
Likelihood Ratio	9.261	9	.414
N of Valid Cases	180		

a. 4 cells (25.0%) have expected count less than 5. The minimum expected count is .27.

Table A2.7: England's Survey Question Twenty-Five

It was found that X^2 value = 8.556[a] is significant at .479 which means that there is no relationship between Age Group and Question 25. The difference in age group does not affect the respondent's view of mobile devices being a replacement to other devices in the aspect of video streaming.

Previously, this study compared mobile TV with traditional TV. Similarly, it compared mobile TV with other video streaming devices. As shown by the results, most respondents from age group 4 were divided in thinking that mobile phones will either replace or not replace other devices in the aspect of video streaming. Most of the respondents from age group 1 agree that mobile phones will replace other devices in the aspect of video streaming. Most of the respondents from age group 3 share the same opinion. In addition, most respondents from age group 2 agree that mobile phones will partially replace other devices in the aspect of video streaming. Mobile devices are designed to perform different functions. A PSP device, for instance, can display video even though it is a gaming console, and a mobile device is a telephone which has multiple uses for totally different contexts.

There are many differences between mobile TV and traditional TV; one of these differences is that short videos are preferred on mobile TV. As mentioned above, the survey reveals that most people from age groups 1 and 4 are interested in the duration of the videos. Apparently, a short video is preferred on mobile devices. However, some people asked for longer videos to be viewed on mobile devices.

One other aspect of comparing a mobile TV service with traditional TV is the type of content used for mobile TV or traditional TV. Mobile TV content and traditional TV content were introduced above. By carrying out the comparison between traditional TV and mobile TV, it is obvious that the mobile TV experience is different from traditional TV; that is, both services will be used, but in different contexts. Once this fact is established, the question of mobile TV replacing traditional TV is raised. A reduction in the number of users of traditional TV is expected to take place, although the usage of mobile devices for watching TV is limited to certain situations. Mobile TV has a different type of content and respondents show interest in watching news headlines or song clips.

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	18.163[a]	9	.033
Likelihood Ratio	20.121	9	.017
N of Valid Cases	180		

a. 5 cells (31.3%) have expected count less than 5. The minimum expected count is .80.

Table A2.8: England's Survey Question Thirteen

It was found that X^2 value = 18.163^a is significant at .033 which means that there is a relationship between Age Group and Question 13. The difference in age group affects the respondent's thoughts of viewing advertisements on traditional TV.

Advertisements on traditional TV give an indication of respondents' acceptance, taking into consideration a general agreement among respondents from age group 1 who are not interested in advertisements on traditional TV because they think they are not useful. Respondents from age groups 3 and 4 add that such advertisements are annoying. While most of the respondents from age group 2 were equally divided between finding it not useful or annoying.

The type of content to be viewed on mobile devices varies; one type is advertising which is the main focus of this study. The decline in revenue from advertising on traditional TV has led to content producers for mobile devices, and especially marketers, to investigate mobile advertising and the opportunities available for targeting particular consumer groups and link in directly to their interests. From the results it is clear that most people are not interested in the advertisements displayed on traditional TV. Therefore, new and more creative methods of advertising must be developed. Are there any opportunities for advertising on mobile TV? People surveyed felt that if advertisements are to be displayed on a mobile TV service, then users should view targeted and customised advertisements. This is not a surprising finding because mobile devices are indeed 'personal devices'.

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	10.444[a]	9	.316
Likelihood Ratio	13.674	9	.134
N of Valid Cases	180		

a. 12 cells (75.0%) have expected count less than 5. The minimum expected count is .53.

Table A2.9: England's Survey Question Sixteen

It was found that X^2 value = 10.444[a] is significant at .316 which means that there is no relationship between Age Group and Question 16. The difference in age group does not affect the respondent's thoughts of customised advertisements.

Most of the respondents from age groups 1, 2 and 3 are interested in customised advertisements and think it is a useful idea; moreover, there was also general agreement among all respondents from age group 4 that customised advertisements are a useful idea. It is believed that customised advertisements would not be an interruption to the user, as age group 4 stated. Only a small number of respondents from age groups 1, 2 and 3 think that customised advertisements disturb the recipient's viewing experience.

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	39.669[a]	9	.000
Likelihood Ratio	44.475	9	.000
N of Valid Cases	180		

a. 6 cells (37.5%) have expected count less than 5. The minimum expected count is 1.87.

Table A2.10: England's Survey Question Fifteen

It was found that X^2 value = 39.669[a] is significant at .000 which means that there is a relationship between Age Group and Question 15. The difference in age group affects the respondent's thoughts on the advertisements such as popup, rollover and banner advertisements on mobile devices.

A mobile TV service is a new way of viewing TV or video in general and, if users are seeking a free service, then there is the option of funding the service through advertisements. Advertisements such as popup, rollover and banner advertisements to be displayed on mobile devices do not attract respondents from age groups 1, 2 and 3, contrary to the views of respondents from age group 4 who are attracted to these advertisements. A division of respondents from age group 4 agree that popup, rollover and banner advertisements could be improved then used on mobile TV while only some respondents from age groups 1, 2 and 3 share the same opinion.

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	23.322[a]	9	.006
Likelihood Ratio	21.991	9	.009
N of Valid Cases	180		

a. 7 cells (43.8%) have expected count less than 5. The minimum expected count is .27.

Table A2.11: England's Survey Question Twenty-Two

It was found that X^2 value = 23.322[a] is significant at .006 which means that there is a relationship between Age Group and Question 22. The difference in age group affects the respondent's thoughts of the idea of product placement.

The idea of product placement might be new to some people but it has been common since the 1980s. Product placement is a well-established way of advertising that could be a solution to funding mobile TV services without causing disturbance to the recipient. Product placement introduces the users to a product within the video in order for them to obtain information about the product or to buy it. The idea of product placement is unknown to most respondents from all age groups. Few respondents from age group 4 know the idea of product placement. A few respondents from age groups 1, 2 and 3 barely know the concept of product placement.

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	40.047[a]	9	.000
Likelihood Ratio	31.285	9	.000
N of Valid Cases	180		

a. 4 cells (25.0%) have expected count less than 5. The minimum expected count is .53.

Table A2.12: England's Survey Question Twenty-Three

It was found that X^2 value = 40.047[a] is significant at .000 which means that there is a relationship between Age Group and Question 23. The difference in age group affects the respondent's views of the idea of product placement as an alternative to all other ways of advertising.

Among respondents from age group 1 there was a general agreement that product placement as an alternative to all other ways of advertising could fund mobile TV totally, providing them with a free mobile TV service. While most respondents from age groups 2, 3 and 4 think that product placement does not help funding the service, they are not sure if it is enough to fund the service completely; additionally this is reflected in the belief among some respondents from age group 1 that product placement does not help funding. It should be stressed here that this is the respondents' point of view on product placement; popup, rollover and banner advertisements are not the solution the respondents are looking for but customised advertisements are better accepted by respondents. Hence, a combination of customised advertisements with product placement can fund a mobile TV service. The variation in the extent of product placement funding of mobile TV service is due to the legal issues and barriers of product placement.

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	18.499[a]	6	.005
Likelihood Ratio	20.022	6	.003
N of Valid Cases	180		

a. 4 cells (33.3%) have expected count less than 5. The minimum expected count is .80.

Table A2.13: England's Survey Question Twenty-Four

It was found that X^2 value = 18.499[a] is significant at .005 which means that there is a relationship between Age Group and Question 24. The difference in age group affects the respondent's views on the permission required to control the use of advertisements on mobile devices.

As was mentioned earlier, respondents from age groups 1, 2 and 3 are in general against popup, rollover and banner advertisements, so the solution of having advertisements that display upon the user's request could be viable. The survey asked whether there was a need to seek any kind of permission before using product placement. Getting the network operator's permission to use product placement was what most of the respondents from all age groups agreed to. The second option for respondents from all age groups was that the service provider must have the ability to give permission, even though users should have the full control over selecting videos with product placement advertising. Respondents from all age groups answered negatively to the idea of product placement being without permission; every action must be done with permission, irrespective of whether it comes from the user or from any other responsible stakeholder.

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	23.991[a]	9	.004
Likelihood Ratio	27.371	9	.001
N of Valid Cases	180		

a. 2 cells (12.5%) have expected count less than 5. The minimum expected count is 2.40.

Table A2.14: England's Survey Question Seventeen

It was found that X^2 value = 23.991[a] is significant at .004 which means that there is a relationship between Age Group and Question 17. The difference in age group affects the respondent's thoughts regarding the idea of interactive video.

The answers varied among the people surveyed. The highest percentage of the respondents from age groups 2, 3 and 4 asked for low interactive video content on mobile devices, while respondents from age group 1 preferred to have highly interactive video, a preference shared with a small number of respondents from the other age groups.

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	30.043[a]	6	.000
Likelihood Ratio	20.272	6	.002
N of Valid Cases	180		

a. 4 cells (33.3%) have expected count less than 5. The minimum expected count is .53.

Table A2.15: England's Survey Question Nineteen

It was found that X^2 value = 30.043[a] is significant at .000 which means that there is a relationship between Age Group and Question 19. The difference in age group affects the respondent's views on the mobile device screen size.

For interactivity purposes, respondents requested a large screen size on their mobile devices. Touch screens could be the solution. In addition, a multi-touch screen, as used in the new 3G iPhone, is an advanced input/output device. Almost all of those surveyed were concerned about the screen size; none of the respondents from any age group asked for a small screen size. In the end, there was general agreement among most respondents from all groups that they wish to have wide (large) screen mobile devices.

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	9.406[a]	6	.152
Likelihood Ratio	9.484	6	.148
N of Valid Cases	180		

a. 1 cells (8.3%) have expected count less than 5. The minimum expected count is 3.47.

Table A2.16: England's Survey Question Twenty-One

It was found that X^2 value = 9.406[a] is significant at .152 which means that there is no relationship between Age Group and Question 21. The difference in age group does not affect the respondent's views on touch screen devices.

If all mobile phone services are used by some users, then is the screen size sufficient for watching video content? For example, watching movies or interacting between users and devices might be difficult when the user claims that the screen size is not large enough for interactivity. For interactivity purposes, there are input/output devices that enable and enrich the interaction experience. One of the ways of interacting with mobile devices is through screens. There is general agreement among most respondents of all groups that touch screen mobile devices are useful.

As touch screen mobile devices are already in use, respondents are asking manufacturers to support them with mobile devices that enable them to interact using a touch screen or a keyboard. Nevertheless, none of the respondents from age groups 1, 3 and 4 required a touch screen with future devices, even though a few respondents from age group 2 required a touch screen with future devices because they are already applied and being used.

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	10.737[a]	9	.294
Likelihood Ratio	10.948	9	.279
N of Valid Cases	180		

a. 7 cells (43.8%) have expected count less than 5. The minimum expected count is .27.

Table A2.17: England's Survey Question Twenty-Six

It was found that X^2 value = 10.737[a] is significant at .294 which means that there is no relationship between Age Group and Question 26. The difference in age group does not affect the respondent's thoughts of the most preferred characteristic to be included in the respondent's future mobile device.

Finally, what are respondents expecting from mobile devices that will enable them to create their optimum experience? Looking into the future, respondents are asking manufacturers to support them with mobile devices with some extra features. Cameras in mobile devices are available; therefore a camera was not the preferred option for respondents. Some respondents in each group required large memory size facilities. As multimedia is becoming one of the driving domains within the mobile market, and mobile devices are still being developed, as reflected in the results, there is a general agreement among respondents from all age groups that they favour a device that supports all types of multimedia files. It is known that most of the devices do support some multimedia formats, but respondents are looking forward to having advanced mobile devices that support all formats.

A2.2 Jordanian Sample – Jordan

A2.2.1 Age Group Younger than 21 (Group 1)

Starting with the youngest age group,

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	48.042[a]	9	.000
Likelihood Ratio	52.787	9	.000
N of Valid Cases	309		

a. 4 cells (25.0%) have expected count less than 5. The minimum expected count is 1.46.

Table A2.18: Jordan's Survey Question Twenty-Six

It was found that X^2 value = 48.042[a] is significant at .000 which means that there is a relationship between Age Group and Question 26. The difference in age group affects the respondent's views on the most preferred characteristic to be included in respondent's future mobile device.

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	63.774[a]	9	.000
Likelihood Ratio	75.434	9	.000
N of Valid Cases	309		

a. 5 cells (31.3%) have expected count less than 5. The minimum expected count is .87.

Table A2.19: Jordan's Survey Question Twenty-One

It was found that X^2 value = 63.774[a] is significant at .000 which means that there is a relationship between Age Group and Question 21. The difference in age group affects the respondent's views on touch screen devices.

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	112.201[a]	6	.000
Likelihood Ratio	100.543	6	.000
N of Valid Cases	309		

a. 1 cells (8.3%) have expected count less than 5. The minimum expected count is 3.50.

Table A2.20: Jordan's Survey Question Nineteen

It was found that X^2 value = 112.201[a] is significant at .000 which means that there is a relationship between Age Group and Question 19. The difference in age group affects the respondent's views on the mobile devices screen size.

The newly developed mobile phones do still need more functions in order to support all types and formats of multimedia files, and most of the respondents agree on this. A touch screen mobile phone is popular now as it facilitates the interactivity with video when using a mobile TV service; this too is a general agreement among respondents in this age group, who believe that touch screen mobile devices are useful. Typically, a mobile device must be small and light with a small screen. However, respondents prefer a wide screen mobile device. Many manufacturers in this domain have solved part of this problem by providing touch screen mobile devices.

Mobile devices are a part of the infrastructure of mobile TV services. The 3G standard is deployed in most high-tech countries and in some developing countries. The most fundamental part of the infrastructure is the recipient. Therefore, having a suitable mobile device that supports mobile TV and enriches the interactive experience is vital. A mobile device that can provide users with most of their requirements will definitely leave a positive impact on mobile TV service usage.

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	91.291[a]	9	.000
Likelihood Ratio	109.823	9	.000
N of Valid Cases	309		

a. 2 cells (12.5%) have expected count less than 5. The minimum expected count is 2.91.

Table A2.21: Jordan’s Survey Question Nine

It was found that X^2 value = 91.291^a is significant at .000 which means that there is a relationship between Age Group and Question 9. The difference in age group affects the respondent's views regarding the context of mobile TV.

If the service is convenient, is applied, and is then used by consumers, it is clear that mobile TV is a service in its own right and is made to suit the contexts where no other type of technology is available. From the respondent's perspective, mobile TV is best utilised while at home and never while working.

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	89.599[a]	9	.000
Likelihood Ratio	77.810	9	.000
N of Valid Cases	309		

a. 5 cells (31.3%) have expected count less than 5. The minimum expected count is .87.

Table A2.22: Jordan's Survey Question Eighteen

It was found that X^2 value = 89.599^a is significant at .000 which means that there is a relationship between Age Group and Question 18. The difference in age group affects the respondent's views on mobile TV being a replacement to traditional TV.

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	65.537[a]	9	.000
Likelihood Ratio	72.414	9	.000
N of Valid Cases	309		

a. 4 cells (25.0%) have expected count less than 5. The minimum expected count is .29.

Table A2.23: Jordan's Survey Question Twenty-Five

It was found that X^2 value = 65.537[a] is significant at .000 which means that there is a relationship between Age Group and Question 25. The difference in age group affects the respondent's views on mobile devices being a replacement to other devices in the aspect of video streaming.

Moreover, most respondents agreed that traditional TV will not be replaced by mobile TV services but it might be affected by it, according to some respondents. Similarly, other devices will not disappear or be replaced by mobile TV; a comparable number of respondents think that a few devices will no longer be in use as mobile TVs will take their place.

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	38.223[a]	9	.000
Likelihood Ratio	42.386	9	.000
N of Valid Cases	309		

a. 1 cells (6.3%) have expected count less than 5. The minimum expected count is 2.33.

Table A2.24: Jordan's Survey Question Eleven

It was found that X^2 value = 38.223^a is significant at .000 which means that there is a relationship between Age Group and Question 11. The difference in age group affects the respondent's views on the length of the video.

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	77.926^a	9	.000
Likelihood Ratio	59.405	9	.000
N of Valid Cases	309		

a. 9 cells (56.3%) have expected count less than 5. The minimum expected count is .29.

Table A2.25: Jordan's Survey Question Seven

It was found that X^2 value = 77.926^a is significant at .000 which means that there is a relationship between Age Group and Question 7. The difference in age group affects the respondent's views on the preferred type of content to be displayed on mobile devices.

Content is another important user requirement. Therefore, content producers must take the users' most preferred content into consideration when presenting content production ideas that will generate the highest revenue if users were charged. Respondents in this age group stated that the acceptable type of content is ordinary content displayed on traditional TV and they will view short videos on mobile devices, such as movie trailers.

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	83.725[a]	15	.000
Likelihood Ratio	98.953	15	.000
N of Valid Cases	309		

a. 9 cells (37.5%) have expected count less than 5. The minimum expected count is .49.

Table A2.26: Jordan's Survey Question Three

It was found that X^2 value = 83.725[a] is significant at .000 which means that there is a relationship between Age Group and Question 3. The difference in age group affects the respondent's views on the preferred content genre to watch on mobile devices.

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	53.320[a]	9	.000
Likelihood Ratio	61.709	9	.000
N of Valid Cases	309		

a. 5 cells (31.3%) have expected count less than 5. The minimum expected count is .29.

Table A2.27: Jordan's Survey Question Six

It was found that X^2 value = 53.320[a] is significant at .000 which means that there is a relationship between Age Group and Question 6. The difference in age group affects the respondent's views on the content genre to be displayed on traditional TV.

On mobile devices, song clips viewed by many respondents. While on traditional TV, the highest percentage of respondents answered that sports are the most popular content. A few respondents do watch movies and advertisements.

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	133.973[a]	9	.000
Likelihood Ratio	148.551	9	.000
N of Valid Cases	309		

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 5.53.

Table A2.28: Jordan's Survey Question Thirteen

It was found that X^2 value = 133.973[a] is significant at .000 which means that there is a relationship between Age Group and Question 13. The difference in age group affects the respondent's opinion on viewing advertisements on traditional TV.

Surprisingly, advertisements on traditional TV are not of useful value, and respondents agreed on this fact. On mobile TV, advertisements could work in a different way without disturbing the user by resorting to product placement. Advertisements may be used to fund any service, and if consumers demand their mobile TV service to be free, then they must accept advertisements displayed on mobile devices. It may be beneficial to consider what people prefer to view, even in advertisements, in order to gain the maximum benefit from the advertisements.

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	37.320[a]	9	.000
Likelihood Ratio	46.103	9	.000
N of Valid Cases	309		

a. 9 cells (56.3%) have expected count less than 5. The minimum expected count is .29.

Table A2.29: Jordan's Survey Question Sixteen

It was found that X^2 value = 37.320[a] is significant at .000 which means that there is a relationship between Age Group and Question 16. The difference in age group affects the respondent's views on customised advertisements.

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	22.513[a]	6	.001
Likelihood Ratio	26.776	6	.000
N of Valid Cases	309		

a. 1 cells (8.3%) have expected count less than 5. The minimum expected count is 2.04.

Table A2.30: Jordan's Survey Question Fifteen

It was found that X^2 value = 22.513^a is significant at .001 which means that there is a relationship between Age Group and Question 15. The difference in age group affects the respondent's views on the advertisements such as popup, rollover and banner advertisements on mobile devices.

Consequently, advertisers must focus on what users prefer to watch and reflect it in their advertisements. Advertisements such as popup, rollover and banner advertisements to be displayed on mobile devices are not attractive and even improving them will not change respondents' opinions. Blocking them from being displayed is the best solution. Customised advertisements might be a way to solve the problems associated with traditional ways of advertising; customised advertisements are better, according to most of the respondents who agreed that they are a useful value.

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	67.257[a]	9	.000
Likelihood Ratio	77.658	9	.000
N of Valid Cases	309		

a. 6 cells (37.5%) have expected count less than 5. The minimum expected count is .58.

Table A2.31: Jordan's Survey Question Twenty-Two

It was found that X^2 value = 67.257^a is significant at .000 which means that there is a relationship between Age Group and Question 22. The difference in age group affects the respondent's views on the idea of product placement.

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	37.148[a]	6	.000
Likelihood Ratio	37.493	6	.000
N of Valid Cases	309		

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 6.70.

Table A2.32: Jordan's Survey Question Twenty-Three

It was found that X^2 value = 37.148[a] is significant at .000 which means that there is a relationship between Age Group and Question 23. The difference in age group affects the respondent's views on the idea of product placement as an alternative to all other ways of advertising.

Customised advertisements can work side by side with the idea of product placement, which can be a significant advertisement opportunity to fund mobile TV services. Most of the respondents in this age group are not familiar with the idea of product placement. Product placement is a method of advertising whereby the product is placed in the video without disturbing the user who interacts with the product directly, thus saving the time and screen space that would have been occupied by other types of advertisements like banner advertisements. This type of advertising is thought to fund mobile TV services and the respondents agree, confirming that it does help funding the service completely.

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	91.948[a]	9	.000
Likelihood Ratio	106.214	9	.000
N of Valid Cases	309		

a. 4 cells (25.0%) have expected count less than 5. The minimum expected count is 1.46.

Table A2.33: Jordan's Survey Question Twenty-Four

It was found that X^2 value = 91.948[a] is significant at .000 which means that there is a relationship between Age Group and Question 24. The difference in age group affects the respondent's views on the permission required to control the use of advertisements on mobile devices.

Permission might be needed to use product placement. The service provider's permission is not the respondents' first option because service providers only deliver the service, while on the other hand network operators must have the right to give permission to allow the usage of advertisements, in this case product placement, as stated by most of the respondents in this age group. Nobody from this age group chose to have no permission to use advertisements on mobile devices.

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	149.187[a]	9	.000
Likelihood Ratio	127.757	9	.000
N of Valid Cases	309		

a. 5 cells (31.3%) have expected count less than 5. The minimum expected count is .87.

Table A2.34: Jordan's Survey Question Seventeen

It was found that X^2 value = 149.187[a] is significant at .000 which means that there is a relationship between Age Group and Question 17. The difference in age group affects the respondent's views on the idea of interactive video.

All respondents wish to have an interactive video service, which supports the idea of product placement, although they are asking for high level interactive videos.

A2.2.2 Age Group 21–30 (Group 2)

With the development of mobile phones and features that enable multimedia usage, the need for all formats and types of multimedia emerges. Respondents generally agree on preferring a mobile device that enables the playing all types of multimedia files. Mobile devices are portable devices and because of that their screens are small. Despite this fact, respondents state that they need wider and bigger screens on their mobile devices. This need can be addressed via a touch screen mobile device like the one provided on the new devices such as the iPhone. A touch screen device is partly useful and in need of further development according to most of the respondents. Moreover, this proves what most of the respondents stated about wishing to own a wide screen mobile device but never a small screen device.

Mobile TV is a different service that allows users to watch video content anytime and anywhere – something that is irrelevant to traditional TV. According to respondents, there are differences between both experiences, such as the difference in the length of the content displayed. Short videos are the most preferred to be viewed on mobile TV. In addition, most of the respondents agreed to view ordinary content of mobile devices. Other devices such as the PSP will lose some of their potential with regard to video streaming, as respondents stated. In addition, most of the respondents do not think that mobile TV will replace traditional TV.

The respondents’ preferred content to be viewed on mobile devices was advertisements; while the respondents generally agreed that the preferred content to be viewed on traditional TV was news. Most of the respondents from this age group prefer to watch mobile TV while walking.

Advertising is clearly important if people wish to have a free mobile TV service. The results indicate respondents’ views of advertisements on traditional TV as being useful or not depending on the advertisement. In the case of mobile TV, respondents were asked for the most preferred type of advertising to be used on mobile devices; advertisements, especially advertisements that are the same as those on the Web, proved to be unattractive to the respondents. The decline in traditional TV advertising raises the awareness among content producers, and especially marketers, to consider options for mobile advertising that will get the users' attention via targeted advertisements. Most of the respondents think of customised advertisements as a useful way of advertising on mobile devices.

Product placement is a type of advertising that is considered ideal for mobile devices, even if respondents are not currently familiar with it. Most of the respondents from this age group have no idea about what product placement is and so do think that the idea of product placement would help the funding of mobile TV service. Most of the respondents added that the use of advertisements on mobile devices must be controlled by the service provider's permission.

The highest percentage of respondents from this age group prefers to have a simple (low) interactive video displayed on mobile devices. On the other hand, no one has asked for non-interactive videos.

A2.2.3 Age Group 31– 40 (Group 3)

Most users have views about the screen size of their mobile devices. One of the characteristics of mobile devices is portability, which means the small size of the device results in a small sized screen. All respondents are interested in the screen size of their mobile devices; in addition, they prefer to have a medium screen size (e.g. iPhone) on their mobile device. iPhones, the newly developed touch screen mobile devices, are preferred and thought to be useful by many respondents for various reasons, among which is the screen size. Clearly, mobile phones manufacturers have achieved innovations in the mobile phone industry related to producing wider screen phones such as the new multi-touch iPhone, but there is still room for more innovative developments, especially as no respondent wishes to have a touch screen mobile that is already commercially in use.

Respondents wish to have a mobile device that supports the different formats of multimedia files. As reflected in the results, other devices such as the PSP will be partially replaced by mobile TV and will face a reduction in usage related to video streaming.

If the infrastructure that enables the service of mobile TV is applied, deciding on the content to be displayed on mobile devices is thought to be appropriate at this stage. Therefore, starting with the content that is usually viewed on traditional TV channels as reflected by the results; respondents seem to prefer watching news more than any other type of multimedia content. On the other hand, no one prefers to watch movies or advertisements.

Advertising on mobile devices was initially thought to be unacceptable or not useful to be viewed on traditional TV. Respondents disagreed with this view. Establishing new ways of advertising on mobile devices is the best way to undertake this opportunity of gaining consumer attention. As a matter of fact, advertising funds the service of mobile TV, and these popup, rollover and banner advertisements attract respondents and do not require development, according to the respondents.

Product placement is another way of advertising that is meant to reach the consumers without disturbing them. Respondents stated that the idea of product placement was still vague to them. Respondents could not see product placement as a way of advertising because it was embedded within the video.

Interactivity is one of the core drivers of the mobile TV advertising experience and product placement, and it directs the user to interact with the video by clicking on the product to receive more information about it or to buy it.

Mobile TV is a different viewing experience. Therefore mobile TV contexts are different when compared to traditional TV. Respondents generally agree that they do prefer to use mobile TV while walking. While mobile TV and traditional TV are different, the entire group agrees that mobile TV will not replace traditional TV totally; in addition, most of the respondents agree that mobile TV will not replace traditional TV.

Respondents are concerned with the length of the content; in other words, they desire short video content to be displayed on mobile devices because the service is provided on small screens, and they are often on the move. Respondents also prefer to watch ordinary content, similar to that displayed on traditional TV. They do wish to view song clips on mobile devices, but not advertisements or movies. This result seems interesting, as a mobile TV service should not be based on only one type of content. Rejecting movies was surprising as it is a main type of content for live-streamed TV. Refusing advertisements is a surprising result as the majority of the respondents think that viewing advertisements on traditional TV is useful.

Establishing new ways of advertising on mobile devices is the best way to undertake this opportunity of getting consumer attention. New methods of advertising would definitely enrich the domain of advertising; for example, all respondents generally agree that customised advertisements are a useful type of content to be used on mobile devices as they do not disturb the recipients. Customised advertisements are interesting and match the users' requirements.

Product placement is another way of advertising that is meant to reach the consumers without disturbing them. Surprisingly, users do not see product placement as a way of advertising because it is embedded within the video. The results show that advertising in general, and specifically product placement, requires prior permission from service providers – as they are able to prohibit any illegal content from being displayed. In addition, product placement helps to fund the mobile TV service if users wish to gain mobile TV for free, but if they wish to delete advertisements then they have the option of being charged for the service. As expected most respondents from this age group think that product placement, as an alternative to all other ways of advertising, does help to partially fund mobile TV. This result seems logical as product placement could not replace all types of advertisements but it is a new way that can improve the mobile advertising market.

There is general agreement that respondents wish for videos with a high degree of interactivity to be displayed on mobile devices. This result is interesting as it matches the respondents' willingness to be engaged in a high level of interaction being able to control almost every aspect of the mobile TV viewing experience.

A2.2.4 Age Group Older than 40 (Group 4)

Respondents within this group are less interested in technological services. Some respondents do wish to have a wide screen mobile device, even though most of them do not have a problem with the screen size aspect. Most respondents were divided equally in their request to have a new mobile device that supports all types of multimedia file, camera(s), and touch screen. Most of the respondents do agree that touch screen mobile devices are useful.

The majority of the respondents show a general agreement that they will use it while walking. Surprisingly, nobody from this age group will use mobile TV on transportation while travelling.

Mobile TV is a new and different service, unlike all of the previous services such as portable small TVs or traditional TV. Each one of the services can be viewed in different contexts. That is why respondents think that a replacement of traditional TV by mobile TV will not occur. The results reflect that other devices that provide users with mobile video viewing will not be replaced by mobile TV as respondents think.

If mobile TV is only convenient for most of the respondents of this age group, and in order to expand the interest of this age group respondents, then content is a paramount factor. The content to be displayed on mobile TV must be different from the content on traditional TV. The surveyed people disagree and think that ordinary content is to be viewed on mobile devices but they prefer it to be a short video. Respondents do not wish to view sport or watch advertisements on traditional TV, but most of them agreed that they watch news. On mobile devices, movies are not the content preferred to be viewed by respondents. Instead, most of the respondents agree that news headlines form a suitable content for mobile TV viewing; this might be because respondents are asking for short video content, not long videos, to be displayed on their mobile devices.

Respondents in this group find advertisements on traditional TV useful. On mobile devices, customised advertisements are useful, according to what participants said, because they do not disturb the recipient. Advertisements such as popup, rollover and banner advertisements are a way of generating profit and funding mobile TV services. As respondents stated, these advertisements do not need development and are not attractive.

Product placement is a way of advertising that neither disturbs nor interrupts the recipient's viewing. Respondents agree that the service provider's permission is required for this particular service and for advertising in general on mobile devices. Most respondents agreed that the idea of product placement is new to them. Respondents generally agreed that a mobile TV service could be funded solely by product placement as an alternative to all other ways of advertising. As product placement is about embedding products within the content displayed on mobile devices, it centres on the idea of interactivity with the users who can either learn more about the product advertised or buy it. Even then, respondents do not agree that product placement is a regular way of advertising.

There is a need for interactivity in mobile TV services and in using the devices in general. Simple (low) interactive videos are preferred and respondents do not ask for a high level of interactivity.

A2.3 Jordanian Sample – Motorola

The second survey sample from Jordan consists of Motorola's engineers. The sample contains eight engineers who revealed the following conclusions. Motorola's engineers are divided into two age groups (2 and 3).

The occupation was excluded as the Motorola engineers are all from a private sector so there is no need for the occupation as a demographic variable in this case. In addition, all of the engineers were male therefore the Gender as a demographic variable was excluded.

A2.3.1 Age Group 21–30 (Group 2)

One of the barriers to using mobile TV service is the screen size. Because of portability, the mobile screen size must be small. Respondents usually are expected to be interested in this specific feature of a mobile device, which is screen size, and do not wish to have a small screen mobile device. Thus, respondents from this age group are not concerned with the screen size and, as expected, only one asked for a small screen mobile device for mobile TV services. Surprisingly no one asked for wide screen mobile devices.

All respondents from age group 2 think that touch screen mobile devices can be either convenient or not convenient depending on the aspect measured; none of the respondents claim that such mobile devices are partially convenient, meaning that they need further development or that they can be used just for some kinds of service, for example watching video.

A newly developed mobile device that contains a touch screen is the iPhone. Respondents asked for a heavy duty touch screen mobile device. Consequently, mobile device manufacturers are supposed to address this problem and work on improving the devices currently available. For example, the multi-touch screen deployed on the new 3G iPhone is an improvement on the previous touch screens provided on old devices. Respondents agreed on having a touch screen mobile device; and therefore a camera is not an option because it is already included. Respondents think that the mobile devices' current functionality is more than enough for the time being, even though some functions are not fully activated.

This study then moved to the preferred content on mobile TV by comparing it to that displayed on traditional TV. According to the respondents, traditional TV is not used by the Motorola engineers to watch sports matches and movies. The survey moved on to the content used or preferred to be viewed on mobile TV. The preferred content is advertisements; surprisingly respondents do not view or prefer to view news headlines or movies on their mobile devices. This might be because these respondents are not interested in mobile TV as a service, while advertisements on mobile devices are presented using various methods such as SMS and MMS.

Ordinary content as displayed on traditional TV is not the same as the tailored content respondents prefer to have displayed on their mobile devices. The reason might be the respondents' understanding of the term 'tailored content'. Most of the respondents from this age group were divided equally between those preferring to either short or combination (short and long) video. This result is surprising as, due to some of the contexts mobile TV is used in and the devices' size, it was expected that they would prefer viewing short content.

What are the contexts deemed the most suitable for use of mobile TV services? Respondents generally agree that they would use mobile TV while walking, but would not use it while working. Combining the previous results, it appears that respondents would use mobile TV services while on the move but the service at this stage it is not accepted, maybe because of the quality of content, type of content or price of the service.

The respondents were asked if traditional TV would be replaced by mobile TV. There was general agreement among respondents from age group 2 that mobile TV will replace traditional TV totally. In the course of discussions about mobile TV replacing other devices providing video streaming, there was general agreement that other devices would not be replaced. Replacing other devices totally is an option for few respondents because other devices will be used in different contexts, for example the PSP will not disappear because it is a mobile gaming device and supports displaying video. So, in the context of playing games and watching or listening to music, it will be easier to use the PSP than another device for displaying video at the same time.

Advertisements are one type of content displayed on traditional TV, and respondents are always intrigued by them. The usefulness of watching advertisements on TV depends on the advertisement itself, according to a general agreement among the people surveyed; respondents answered negatively to the option of advertising being useful.

Usually free services are preferable for users and a free service will reach more consumers; this, of course, applies to a mobile TV service also. To understand the type of advertisements respondents prefer to view, advertisements such as popup, rollover and banner advertisements are considered to be one way to fund the service; many respondents, think these types of advertisement are annoying while the same percentage thinks they are attractive. Thus, advertisements do not need development because they are distracting to a considerable proportion of respondents. Therefore, advertisers should take customised advertisements into consideration as they are accepted by respondents. A mobile device is often owned by only one user who is interested in certain topics.

Product placement includes the product in the video displayed, saving the total screen size for the video to be displayed so users can preserve the viewing experience. Product placement is not a new idea but it might be unknown to some people; the respondents in this age group did partially know what product placement is. The majority of the respondents were of the view that it did not help even though it is a good way of advertising and it does partially fund the service of mobile TV. According to respondents, the barrier to product placement is the permission required; if permission is required, then who has the authority to give it? According to what respondents have said, the recipient's permission is needed. Other stakeholders are also concerned with advertisements that appear on screens, because they are intended to generate revenue from this method of advertising. Product placement does not disturb the recipient or interrupt the viewing experience, so why is there a need for the user's permission?

Interactive video is a must on mobile devices for most of the respondents; that is what respondents are asking for, but the level varies among them. The majority of the respondents are asking for a low level interactivity so as not to lose concentration while watching the content. New types of advertisements must be coined to meet users' requirements and needs.

A2.3.2 Age Group 31–40 (Group 3)

This is the second age group of Motorola engineers. Mobile TV is a new and emerging service, but is thought to be a main driver of the mobile market in the future. Mobile devices are different to other devices because they are portable and small in size. As a result, small devices must have small screens. Mobile manufacturers are working on developing a screen that could be capable of handling the users' interfaces properly without ignoring their needs of owning wide screen mobile devices such as the newly developed multi-touch screen iPhone. This proves what was mentioned, that none of the people surveyed asked for a small or medium screen sizes.

The mobile TV service is different from traditional TV; the differences are in the experience itself and in the context in which the viewing takes place. Mobile TV service is an "anywhere, anytime" service that fills the extra time where and when traditional TV is not available. Mobile TV also provides users with some space to watch private shows. Most of the respondents agree that the service of mobile TV will not replace traditional TV. It might have an impact on the traditional TV in terms of the viewing numbers, but the traditional TV service remains number one when it comes to watching a show at home with family or friends.

During a dialogue about other devices providing video streaming, like the PSP, it was mentioned that, although the PSP does enable users to watch video on it, it is designed mainly as a gaming mobile device; it might, therefore, be replaced by mobile phones with regard to video streaming depending on the type of content displayed. But the device itself will not be replaced because of the difference in the primary function of the PSP, which is playing games. In contexts when users are playing games using the PSP but desire to watch a video at the same time, most of them will not carry more than one device with them, and so a replacement might occur in our opinion.

As there are differences between traditional TV and mobile TV in various aspects, this study briefly investigated the content aspect and checks what is preferred to be viewed on traditional TV and mobile TV respectively. Starting with traditional TV, sports matches, movies and news are not the preferred content to be viewed on traditional TV. The respondents preferred content viewed or to be viewed on mobile TV not to be news headlines, movies and advertisements. Respondents state that they use their mobile devices to watch song clips. There was a general agreement among respondents that they do not prefer to use special tailored content on mobile devices nor the ordinary content; therefore, they prefer to have a combination of both tailored and ordinary content.

Respondents do not wish to use a mobile TV service while they are working or while walking, but they prefer to use it at home. This is a surprising result as respondents would use mobile TV when traditional TV is available; however, mobile TV is used in a lean-forward situation while traditional TV is used in a lean-back situation.

Respondents' answers on the question about video content displayed on mobile phones show that all respondents are concerned about the length of the video displayed on mobile devices, shown in the general agreement among respondents that they want a short video.

In traditional TV, advertisements are causing a decrease in viewing numbers. In order to win them back, new methods of advertising must be created. Surprisingly, there was a general agreement among the respondents that in watching advertisements on traditional TV the degree of usefulness depends on the advertisement displayed.

Customised advertisements are another type of advertising that does not disturb users. Therefore it can encourage users to adopt mobile TV services. Users viewing only the advertisements they are interested in could be an option. There is a general agreement among respondents that customised advertisements are useful, with no single respondent saying they are not useful. This result is interesting as it reflects a need to personalise advertisements. Users feel that customised advertising does not disturb their watching experience because users have the freedom to choose the type of content and products displayed on the screens of their mobile devices. There was a general agreement among respondents that advertising on mobile devices should be controlled by the network operator.

New ways of advertising seem to be used successfully on mobile TV. Users usually prefer to get free services rather than being charged for them; but, in order to get free mobile TV, advertisements are needed to fund the service; otherwise the users must pay for the service. Advertisements such as popup, rollover and banner advertisements can be used to fund services. There was general agreement that these advertisements are thought to be attractive, but not a single respondent thinks of them as not attractive or in need of development.

A further way of advertising is product placement, which was used previously but not extensively. Many people do not know about product placement even though they have seen it applied before. Respondents of this age group are barely familiar with the idea of product placement. Some people think that product placement is not a way of advertising. There is a general agreement that product placement would not help to fund mobile TV services. None of the respondents think the opposite.

In general, interacting on mobile devices is needed according to user requirements. Respondents think that the interactivity level is dependent on the type of video on mobile devices. Simple (low) interactive video, such as video-on-demand (VOD) content and videos with no interactivity are thought of as being out of date and failing to meet users' requirements. This is an interesting result as respondents reflect a more in-depth understanding of the idea of interactivity. For example, the level of interactivity with a movie is different to the level of interactivity required by an advertisement.

Regarding interactivity, there are some devices that support the experience of interactive mobile TV, for example the touch screen mobile devices. When the mobile TV service is deployed, the respondents might buy one because they do think that it is useful, and not a single respondent thinks it is not useful.

Respondents are not asking for touch screen mobile devices because they are already invented and commercially available and are becoming more developed, like the new 3G iPhone with its multi-touch screen. Respondents are not asking for a mobile device that includes camera(s) since most of the mobile devices now include camera(s). There was general agreement among respondents from this age group asking for a device that supports all types of multimedia file, while some are asking for a device with a large memory size.