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New mobile digital video technologies are creating dramatic shifts in the ways that video-based content can be produced, consumed, and delivered. One such shift has been the emergence of mobile video devices like video-enabled iPods and mobile phones. In the same way that the Walkman revolutionized music consumption behaviors, these mobile video devices are changing how, when, and where people are interacting with video. Another revolutionary shift comes from video content web sites like YouTube and Google Video which publish vast quantities of video content viewable on mobile devices. Such technology revolutions change the way users behave and change their expectations in regards to their mobile video experiences. To help understand these changing behaviors, we conducted a three week study of mobile video users in the US and in the UK. In this paper, we highlight some noteworthy observations from this study.

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Abstract

New mobile digital video technologies are creating dramatic shifts in the ways that video-based content can be produced, consumed, and delivered. One such shift has been the emergence of mobile video devices like video-enabled iPods and mobile phones. In the same way that the Walkman revolutionized music consumption behaviors, these mobile video devices are changing how, when, and where people are interacting with video. Another revolutionary shift comes from video content web sites like YouTube and Google Video which publish vast quantities of video content viewable on mobile devices. Such technology revolutions change the way users behave and change their expectations in regards to their mobile video experiences. To help understand these changing behaviors, we conducted a three week study of mobile video users in the US and in the UK. In this paper, we highlight some noteworthy observations from this study.

1 Introduction

Video-based content and the many ways it can be integrated into our daily routines are strongly influenced by the technologies through which we experience it. This relationship between technology and the ways in which people consume video can be illustrated by looking at how some key technical advances over the years have created new and interesting social phenomena. Consider, for example, the effects of introducing personal video recorders or PVRs into the home environment [Brown 06]. These PVRs created a shift away from the organizing structure of the TV schedule, giving people the opportunity to access and view content at more convenient times which led to new solitary and social behaviors, such as how renting a video could be the basis for a social occasion, etc. With the advent of new digital video technologies, we are seeing even more dramatic shifts in how video-based content is produced, delivered, organized, manipulated and exchanged by both individuals and groups.

2 Motivation

One such shift in recent times has been the emergence of mobile video devices such as Video iPods and mobile phones. In the same way that the Walkman revolutionized music consumption behaviors, these mobile video devices provide opportunities for video content to be consumed in a whole range of new places and circumstances. Understanding the new solitary and social behaviors that have developed around video consumption is integral to continued innovation in the area of mobile video. In an effort to divulge some of the mystery behind mobile video usage, we conducted a study of current mobile video consumers. We gathered information about the circumstances of how and when users watched mobile video as well as their overall preferences regarding mobile video and any unmet needs. We also looked at more focused details such as how users accessed, stored, organized, shared and created video-based content that they consumed on a mobile video device. In the following sections we provide a description of our

investigation, an analysis of our data, as well a discussion on technology recommendations and potential areas of opportunity in the mobile video space.

3 Evaluation

The only requirements for our volunteers were that they own a video-enabled portable device and that they use the device for watching video at least once a week. Participants were pre-screened for the study by either a phone conversation or by answering a series of questions via email. We excluded the use of laptop-only mobile users since we chose to focus on purely hand-held mobile viewing experiences. We broadcast a request for volunteers via email. Some factors which may affect mobile video usage such as the use of public transportation and the availability of media services differ widely from country to country [Stockbridge 06]. Therefore, we chose participants from both the US and UK to see if any geographic trends emerged. Our final participant group consisted of 28 volunteers (13 from the UK and 15 from the US), both male and female, ranging in age from 14 to 47. Each participant was compensated with a gift certificate at the completion of their interview valued at 50 British pounds or 50 US dollars.

At the start of the study, each participant was given a small diary notebook and asked to record their mobile video experiences for a three week period. We asked them to record the date, circumstance (e.g., “on the train home from work” or “waiting for my mom to pick me up from practice”), and activity (e.g., “watching Family Guy” or “looking for free videos on iTunes”) for every mobile video episode they had during the given time period. See Figure A for the instructions included in the diary notebook, and see Figure B for an example page from a single diary entry of one of our participants. We encouraged them to record not only when they watched mobile video, but also when they performed other related activities as well, such as searching for or purchasing content. At the end of the three week diary period, we met with each participant individually for a one-hour interview. Some of the younger participants were interviewed in pairs if they had a friend who was also in the study in order to help them be more comfortable and communicative in an interview setting. During the interview, we had participants talk through their diary entries with us and discuss in more detail the circumstances and motivations of each experience. Each interview was either video-recorded or audio-recorded to ensure accuracy in quoting the participants, and we kept their diary notebooks for further review.

4 Analysis

Our participants owned and used a variety of devices. The Apple Video iPod was the most common device used in the study, which reflects its relative popularity in the consumer market. Participants also used Sony Playstation Portable (PSP) devices, video-enabled Archos devices, HP iPAQ handhelds, and video-enabled mobile phones. The goal of our research was to unearth qualitative results from an investigation on how people use mobile video in their everyday lives, not to quantitatively evaluate the experiences of these 28 persons. In the course of interviewing each of the participants about their mobile video experiences, we began to see patterns emerging in terms of their behavior, preferences, and frustrations. Similar behavior patterns were observed in each country; therefore, we will not compare or contrast results by geography. Here we will discuss these results which we have divided into the categories of media content and mobile device usage.

Please include the following for each entry:

- Date
- Time
- Location
- Device
- Action Performed

Example Diary Page

9pm Wed

Waiting for friends in downtown

Palo Alto

video iPod

watching 'Law & Order'

or

Monday morning

on the train from Guilford to

Bristol

Audiovox smartphone

browsing for new content and then

downloading Rocketboom and

watching two episodes

Figure A: Diary Instruction page

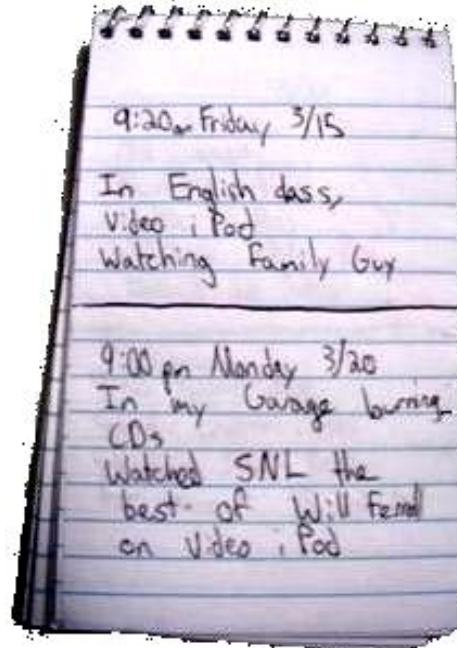


Figure B: Actual diary entry page

4.1 Media Content

A common point of frustration for the majority of our participants involved the numerous video formats that exist and the difficulty of transferring video to and from their mobile devices. The technical terms of industry standards such as bit-rate, frame-rate, and special resolution were a foreign language to many of our participants. Most of them just wanted to know how to convert their DVDs to a format playable on their mobile device. Since most DVDs are encoded in MPEG-2 and are encrypted, there is both a technical barrier to converting them to the supported formats of the many mobile devices and a legal barrier that prevents consumers from doing so.

“I know there’s this software you can use, like if you have season one of Friends, you can convert it onto your iPod. But I still haven’t found out how to do that.” – Katie, age 16

Comedy was the most popular genre of media content on our participants’ mobile video devices. The great majority of the study’s participants, across age and gender, downloaded short comedy-oriented, often animated, video clips. The positive experience of watching comedy on a mobile device is also supported by [Repo 03], where animated films, karaoke recordings, and music videos were considered the most interesting content. Cartoons like “Family Guy,” “Southpark,” and the “Simpsons” were popular with a range of ages, whereas several younger interviewees mentioned downloading “Saturday Night Live” comedy shorts. Another participant liked watching classic cartoons like “Felix the Cat”, and downloaded contemporary cartoons such as “Sponge Bob” for her five-year old nephew. One interviewee, James H. (age 17) highlighted a few sensible reasons as to why comedy was an appealing source of content. He explained that since mobile video viewing is often done in short segments, usually 20 minutes or less, he prefers content that isn’t very long in duration and doesn’t have a complicated plot to follow. He shared that it was easier to start watching comedy from the point where he last paused as it

doesn't require as much immersion in the video. We were also told by another participant that comedy is good content for the mobile device because it continues to be funny when watched multiple times, whereas dramas and reality-based shows are only interesting the first time.

"I like comedy...Futurama, Family Guy, the Simpsons. You can pick up on things when you watch it the 2nd time." - James S., age 14

Many of our mobile video participants, especially the younger ones, consider the search for video content to be entertainment in itself. One college student participant mentioned that she browses iTunes for hours at a time looking for interesting and preferably free video clips that she can download to her Video iPod for later viewing. Two high-school students scour file-sharing networks like LimeWire, searching for "*.m4v", the file extension for iPod-compatible videos. They also search Google Video because the site has the option of downloading videos in iPod and PSP formats. The search for content for these participants was not just a necessary and tedious task, but instead it was a game and even a social activity that could be enjoyed with friends. In this case, the video content was considered both social and physical currency that could be burned onto CDs and DVDs and traded with friends like baseball cards. In addition to the physical media serving as currency, the skills acquired in order to find and convert the content served as "kudos" or bragging rights.

"I do a lot of browsing. I could do it for 3 hours at a time... 'cause I like checking out new videos." - Jackie, age 24

Most of our participants did not pay for the majority of the video content that they watched. Some participants downloaded just the free video clips from iTunes while others browsed online and through file-sharing networks. A few of our participants created personal video media such as recording snowboarding trips or family events to share at social gatherings. Those who did pay for their content fell into two categories: either they purchased TV shows from iTunes, or they purchased DVDs and then converted the content for their mobile devices. One participant always purchased her favorite TV drama to watch on her Video iPod because she does not have enough time at home to watch television. Another participant owned all the DVDs to his favorite TV sitcom "Will and Grace". Although he felt ethically justified in doing so because he owns the content, he still expressed sincere concern about the fact that he was technically crossing a legal boundary by converting his DVDs to watch on his Video iPod. Several other participants expressed similar opinions about content ownership. They believed that if they purchased the content, then they should be able to watch the content on a variety of playback devices including their home television and mobile devices. Participants expressed interest in transferring their recorded television shows to their mobile devices, but some participants said it depended on the show and if they were willing to sacrifice the viewing experience of watching it on their HD TV.

"I want the same experience across my devices." - Michael, age 35

"I would never watch 24 on my iPod." (due to preference for watching in HD) - Chris, age 31

4.2 Mobile Device Usage

We asked each participant, "If you had to choose one length of content, what would it be?" Many participants expressed that they preferred content in the range of 15 to 20 minutes. They

told us that after about 20 minutes it becomes difficult to hold the mobile device comfortably. However, they were willing to watch for longer periods of time when they were limited in their entertainment options such as on long flights or driving trips. Most of the responses seemed to reflect the notion that mobile video consumption is done in short segments during the in-between or transition moments throughout the day, such as eating lunch at their desk or waiting on someone. Several of our student participants watched while waiting to be picked up from school, walking to school, riding on the bus, or taking a long car trip with family. One student even wrote in his journal that he watched an animated sitcom while in his English class. He had finished his assignment and had a few free minutes to spare. Many mobile video experiences served as brief entertainment in a dull moment, a notion further supported by [Repo 04].

“My wife was shopping...so, I prefer to sit in the car and watch a movie.” – Rajiv, age 28

Another trend that emerged related to how our participants chose what to content to consume on their mobile device in different situations. Many participants mentioned that they would decide what type of media to watch or listen to based on how much time they had available. One participant said that if she had less time she was more likely to listen to music. With larger amounts of time, participants were more likely to choose a full 20 minute video blog or sitcom episode. The desire to finish, if possible, the video clip before they need to move on to another task was a recurrent desire with many of our participants.

“If I have 10 minutes, I listen to music – 20, I watch Video.” – Maridan, age 35

“I don’t do it unless I can finish.” – Gina, age 47

When asked about watching mobile video at home, we learned that a large number of participants were using their mobile video devices in bed. Some wanted to be near their spouses while some used it to unwind before falling asleep. In most cases the participants also had televisions in the room but preferred to use the mobile device instead. A couple of participants found creative solutions to improve on their in-bed usage. One person lamented the lack of an external speaker on the Video iPod, so she turned the volume all the way up and laid the headphones on her pillow to use as speakers. Another person got tired of holding her iPAQ, so she unhinged the flip cover and reinstalled it backwards to act as a stand for the device.

“I enjoy sitting next to my wife (on the couch), but often I may not enjoy the same show...so I’ll be watching my Video iPod.” - Phillip, age 35

“Uh, I was in my bed and I didn’t want to get up and move to the couch to watch TV. And I watched South Park and then my batteries ran out. That kind of sucked.” - Dylan, age 18

5 Recommendations and Conclusions

Working from the observations presented here, there are a number of recommendations and potential solutions than can improve the next generation of mobile video devices and services.

On the topic of mobile video content, we heard from our participants that comedy, specifically cartoons, is their first choice. They prefer to finish viewing the video in the time they have available. In general, mobile video viewing is different from TV viewing in terms of engagement, context, content decision process, and time available. Therefore the type of content

that works well for mobile viewing will also be different. Content producers should consider these differences in creating content best suited for mobile viewing. They should structure the content in segments shorter than 20 minutes. For longer videos with developed plots, we recommend that they include an intermission followed by a plot refresher to allow users to complete a single segment within twenty minutes and be reminded of the plot when they return.

Users expressed frustration about not being able to view their purchased video content on various devices and not having the technical knowledge to convert formats. We encourage the pursuit of a strategy that encompasses mobile consumption and includes the proper licensing and tools to simplify the process of downloading or streaming content to a variety of devices. For example, we were surprised to learn that people commonly use mobile video devices while in bed even when they also have a TV in the bedroom. Users want the ability to seamlessly switch to viewing a high-resolution version of their content on the TV in their bedroom and other areas in the house.

Users browse through content as entertainment, and they are willing to sift through large amounts of content if they believe they will find the occasional jewel that serves as social currency in their communities. Device manufacturers and content publishers should consider creating mobile applications for collocated and remote social browsing of content. Publishers should look at creating social web systems that give these “diggers” credit among their friends for unearthing the good finds. Also, since users are currently burning discs to exchange content, device manufacturers should enable the sharing of content between devices and consider this activity in their DRM strategies.

“My iPod is my pacifier...it helps me to withdraw and relax.” – Tan, age 35

While humorous at the time, this statement by one participant was a fairly accurate characterization of how people are using mobile video today -- as entertainment during the in-between moments of their day. The larger lesson to consider, however, is that the mobile video experience is very different from the home TV viewing experience. The ergonomics, content, duration, and engagement level of a mobile video experience must be considered anew as we create the next generation of mobile content and devices.

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