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# Early Consumer Adoption of Mobile TV from the Perspective of Flow experience<sup>1</sup>

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## **Abstract**

*Mobile TV service, television service to subscribers via mobile telecommunications networks, is posed to take the limelight as the next killer application of wireless technologies. However, in the paradigm where many wireless applications and services speedily emerge and soon collapse; mobile TV vendors and service providers hope that it will be sustain its market share and viability over the uptake curve between innovators/early adopters and the late majority prior to reaching its plateau. This study is an investigation into how early adopters of mobile TV may offer valuable information for its long term survival. This study specifically aims at examining the influence of psychological concentration, or flow experience, on early consumers' intention to use mobile TV. Though prior studies of flow experience give attention to technological antecedents, this study examines content as an antecedent of concentration in addition to two other technological factors (i.e. perceived ease of use and speed). The preliminary results of our survey and its measurements are presented and as well as its potential contributions and future research directions.*

**Keywords:** Flow experience, concentration, speed, content, perceived ease of use, mobile TV, the digital multimedia broadcasting (DMB).

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<sup>1</sup> The study is in progress.

## INTRODUCTION

Mobile communication technologies have changed the way we live and do business. Within two decades mobile phones have gone from being an expensive luxury to being an integral part of everyday life. The number of worldwide wireless subscribers in 2005 was estimated to be over 1.6 billion, which is equal to around a 20% (percent) penetration of households worldwide (Shim 2005). As the wireless market continues to mature, wireless subscribers continue to push its performance and application envelope in an effort to get comparable applications and services as found in the wireline arena. At the same time wireless providers continue to fight for market share by offering new services that have the potential of creating revenue. Mobile TV service is one such service that is expected to be the next killer application for the wireless industry (Cullen 2005, Hyers 2006, Shim et al. 2006). Mobile TV service involves bring TV services to the mobile phone via wireless networks. Mobile TV can also be described as “takeout TV” or “cellevision” in which it uses a multicast process to deliver digital multimedia contents such as dramas, news, music, sports and documentaries, to mobile devices<sup>2</sup> (Shim et al. 2006).

Mobile TV is currently in an infant stage, but it is projected to rapidly evolve as wireless subscribers have initially indicated that the ability to watch mobile TV is indeed a service that they are willing to pay a premium for. It is reported that over a million Korean people subscribed to mobile TV services since the service was deployed in the late 2005 and it is projected that the number of subscribers will reach over 10 millions by 2009 (Shin 2006). By the year 2011 it is estimated that in North America alone more than 27 million subscribers will spend an estimated \$2.3 billion to access mobile TV and another \$841 million to be spent capture from advertising agency in support of mobile TV (Hyers 2006). (Cullen 2005) reported that 56 percent of UK cellular phone subscribers are interested in mobile TV. These forecasts give a much need light at the end of the tunnel for network operators, service providers, and advertisement managers alike. Adoption and diffusion of mobile TV means a new source of revenue for wireless operators and service providers and another venue for advertising firms to gain market share (Shim et al. 2006).

Despite the optimistic predictions, some pessimists doubt the viability of mobile TV to garner and sustain long term adoption or growth. Critics are quick to cite the multitude of current technical drawbacks that may impede consumers’ adoption of mobile TV (i.e. screen size, coverage area, and lack of standards concerning content). Due to the small screen size on many wireless phones, pessimist believe this will negatively impact subscribers ability to immerse themselves into the mobile TV. The current limitation on service coverage areas and quality of service (i.e. clarity, sync between picture and sound, as well as service interruptions can also potentially impact mobile TV long

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<sup>2</sup> In this paper, mobile TV service refers to the digital video broadcasting-Handheld (DVB-H), and the digital multimedia broadcasting (DMB). DVB-H has been tested mainly in European countries and Nokia supports this standard. On the other side, DMB has been mainly adopted by Asian countries, Japan and South Korea. DMB is an advanced version of digital audio broadcasting (DAB), which was initiated in the United States and European countries in 1990s (Shim 2005). DMB service for in-automobile terminals was started in Japan in 2004, and DMB service on mobile phones as well as in-automobile terminals was inaugurated in South Korea in 2006 (Shim 2005). In Europe, major mobile service providers such as O2, Orange France, and The Italian arm of 3, have prepared for DVB-H (Cullen 2005). Also, US mobile service providers will make or already made an alliance with network operators to launch mobile TV in 2007 (Hyers 2006).

term cumulative adoption throughout its life cycle. Critics question if consumers will continue to pay for services that that can only utilize in certain area and even within those areas receiving low QoS.. Another potential adoption inhibitor is the currently competing content standards with one standard considering it to be an extension of traditional TV while their opposition would rather it to be a new licensable medium (Cullen 2005). The former argues that traditional TV operators are eligible to provide mobile TV contents which will lead to even more new service while the latter espouse that new content producers are needed to provide content that is viewable on wireless device. The standards tug of war for content rights continues to be a heated debate that shows no indications of being quenched in the never future. While the debate ensues, consumers may not be unable to enjoy high-quality content..

These pessimistic opinions arouse ones' attention concerning the viability of consumers' adoption of mobile TV. According to chasm theory, a critical success factor as to how a new IT service or product will be accepted is dependent of its adoption by early adopters (Moore 1991). Early adopters have a critical role as opinion leaders or champions in ensuring that general users accept a new IT service or product. This fact suggests that early adopters' perception of mobile TV service may significantly impact the diffusion and sustainability of mobile TV. This research will investigate early subscribers' adoption of mobile TV, more specifically *which psychological factors influence their intention to use mobile TV service*. In order to examine their adoption of mobile TV service, this paper utilizes *flow* theory (e.g. the concentration concept).

The pessimists' points can be summarized as the disturbance of technological drawbacks in consumers' psychological *flow experience* with mobile TV service. Flow is defined as "the holistic sensation that people feel when they act with total involvement" (Csikszentmihalyi 1977, p. 36). *Flow* has been adopted as defining the optimal IT user experiences. In the context of mobile TV, flow represents the impact of the tiny screen, service dead-spots, and difficulty of using the mobile device seamlessly. Subsequently, mobile TV users are also service consumers as well as IT users therefore, in addition to the technological aspect, mobile TV content may also influence consumers' flow. Though technological limitations may be tolerated in order to watch mobile TV ubiquitously, consumers will not continue to pay for shows that provide no entertainment value. The uniqueness of this study is its ability to consider both the technological and content sides of flow whereas prior research were only able to investigate the artifacts technological aspect or its tasks (i.e. contents) separately (Finneran and Zhang 2005). One benefit of this paper is the investigation of how consumers' flow experience with mobile TV is influenced by both technological aspect and content aspects, and how flow experience influences consumers' intention to use mobile TV. The outcomes will be compared against prior studies determine if flow experience affects users' attitude or behavioral intention in the various contexts (Ghani 1995, Hoffman and Novak 1996, Hsu and Lu 2004).

The rest of the paper proceeds as follows. In the next section, we describe the research model consisting of technological factors (speed and perceived ease of use), content, flow experience (concentration), and intention and the hypotheses development. The third section describes the research methodology, including the instrument construction, site selection, sampling, and the preliminary analysis of the pilot study.

## THEORETICAL BACKGROUND AND HYPOTHESES DEVELOPMENT

### *Consumers' flow experience into mobile TV: concentration*

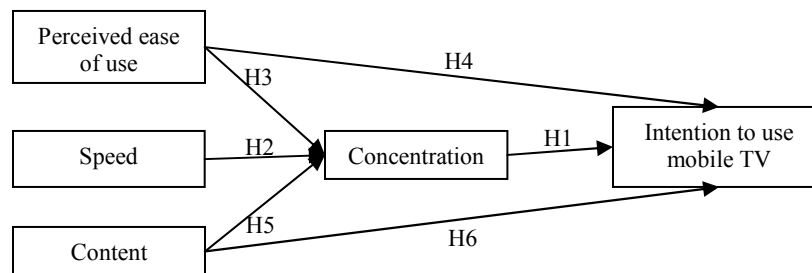
*Flow*, developed by Csikszentmihalyi (1990), represents “the state in which people are so involved in an activity the nothing else seems to matter” (p. 4). Flow was initially used to describe dancers' or rock climbers' sensation in the middle of an optimal experience. The state of *flow* is characterized by “a narrowing of the focus of awareness, so that irrelevant perceptions and thoughts are filtered out, by loss of self-consciousness, by responsiveness to clear goals and unambiguous feedback, and by a sense of control over the environment” (Csikszentmihalyi, 1977, p. 72). Novak et al. (2000) classifies flow components, proposed by Csikszentmihalyi (1997), into three stages: *flow antecedents* (a clear goal, feedback, and challenges match skills), *flow characteristics* or *experience* (concentration and focus, and control), and *flow consequences* (loss of self-consciousness, transformation of time, and autotelic). Unfortunately however, there is no dogmatic application of flow classification in existence (Finneran and Zhang 2005). Prior studies have applied Csikszentmihalyi's work in many diversified ways. In (Ghani 1995) control was used as a flow antecedent; in (Chen 2000) loss of self-consciousness was used as flow experience; and (hoffman and Novak 1996) added the new relevant construct of telepresence.

Flow has been popularly adopted in the information technologies and online environments fields. Some previous studies include: investigations concerning personal computers (Ghani and Deshpande 1994) and online environments (Chung and Tan 2004, Koufaris 2002, Novak et al. 2000, Skadberg and Kimmel 2004). Ghani and Deshpande (1994) examine flow with computer in the workplace. In their model, perceived control (skills) and challenge are used as flow antecedents. *Flow* is measured by enjoyment and concentration which encourages users to use computers. Chung and Tan (2004) examine various antecedents of perceived playfulness which is considered one dimension of flow experience in the Web context. Among the antecedents, content and speed are demonstrated to have a large influence on perceived playfulness. In order to examine unplanned online shoppers' purchases and intention to return, Koufaris (2002) adopts product involvement, web skills, value-added search mechanism, and challenges as antecedents of flow. Koufaris uses perceived control, shopping enjoyment, and concentration as flow experience. His flow model is valid in forecasting online shoppers' intention to return, although it fails to explain unplanned purchases. Novak et al. (2000) build the flow model in the online environments. The model includes challenges/arousal, skill/control, and focused attention, interactivity/telepresence as the main antecedents of flow. Without using dimensions of flow experience, they measure Web users' flow directly based on narrative description of flow. Skadberg and Kimmel (2004) built a tourism website in order to evaluate the flow model. This study is different from prior studies in that they use domain knowledge as skill and information in the website as the challenge. They adopt enjoyment and time distortion as flow experience, and their model shows that flow experience significantly affects users' learning.

Among diverse flow experience concepts, this paper adopts *concentration*, which is defined as the extent to which an individual attention is absorbed by activity (Hoffman and Novak 1996). Concentration is not only conceptually

identical to flow concept, but it has also been commonly used as flow experience (Csikszentimihalyi, 1997; Novak et al. 2000; Skadberg and Kimmel 2004). Ghani (1995) stated that humans ought to concentrate when experiencing flow. Concentration is also considerably relevant to mobile TV service. Mobile TV users generally use the service in an ‘unstable’ situation. Users typically use mobile TV during their commute or in short spare time on the road. Imagine an individual using mobile TV in a crowded space like subways or buses. In this situation the surrounding people may “peep” at the individual’s mobile TV or the individual may have to constantly check for his/her arrival at the destination while on the subway or bus. Consequently, when low-level concentration is caused by technological drawback (e.g. flawed scenes, difficulty to use a device) and content is combined within an unstable usage situation, it may have an incredibly significant influence on users’ intention to use. Based on prior studies, flow experience positively affects users’ attitude or behavior. Koufaris (2002) demonstrates that flow experience influences online shoppers’ intention to return; Hsu and Lu (2004) reveal that flow affects users’ intention to play an online game; and Skadberg and Kimmel (2004) show that flow ultimately changes users’ attitude and behavior through increasing learning. Following prior studies, this study also assumes that concentration affects users’ intention to use mobile TV as shown in Figure 1.

*H1: Consumer’s concentration on mobile TV service will positively influence the intention to use it.*



**Figure 1. The research model**

### ***Concentration antecedents: technological factors and content***

#### **Technological antecedents of concentration: speed and perceived ease of use**

The first technological antecedent of concentration is *speed* referring to “the rate at which input can be assimilated into the mediated environment” (Steuer 1992, p. 85). Speed is relevant in *feedback* which is one of antecedents of flow experience proposed by Csikszentimihalyi (1997). Discontinuous or slow interaction with a technology indicates sluggish feedback. When interacting with a technology, unexpected discontinuity caused by speed may interrupt users’ concentration. In the context of mobile TV, if a consumer encounters discontinuity of the service caused by

slow transmission speed, the consumer will be unable to easily enjoy watching mobile TV. Novak et al. (2000) and Chung and Tan (2004) empirically inspect that speed is a significant antecedent of flow experience. Skadberg and Kimmel (2004) state that speed has considerable influence on flow experience mediated by attractiveness. Thus, we hypothesize that:

*H2: Speed will positively influence consumer's concentration on mobile TV service.*

The other technological construct is *perceived ease of use* (PEOU) which indicates an individual assessment that using a technology will be relatively free of effort. PEOU is one of the main constructs that explains an individual willingness to accept technology in the Technology Acceptance Model (TAM). PEOU estimates the robustness and influential in explaining user technology acceptance (Hu et al. 1999). The significant relationship between PEOU and flow experience is rooted in the original concept of flow. In the situation where an individual feels it is difficult to deal with a mobile device, the individual is unlikely focus on mobile TV service to its fullest. Csikszentimihalyi (1977) also argued that an individual experiences more flow when the individual can more skillfully cope with challenges. The positive influence of PEOU on flow experience was also empirically examined by Moon and Kim (2001) and Hsu and Lu (2004). Additionally, prior literature demonstrates that PEOU influences an individual's intention to use a technology (Agarwal and Karahanna 2000, Hu et al. 1999). Therefore the easier it is for an individual to interact with a technology, the more likely the individual will find it useful and intend to use it. Thus, we hypothesize that:

*H3: Perceived ease of use will positively influence consumer's concentration on mobile TV service.*

*H4: Perceived ease of use will positively influence consumers' intention to use mobile TV service.*

### **Content as an antecedent of concentration**

Doll and Torkzadeh (1988) describes *contents* as a construct which has dimensions of exactness, relevance, and sufficiency. Palmer (2002) defines content of websites as a construct which includes “the amount and variety of content as well as the use of text, graphics, and multimedia” (p. 156). De Wulf et al. (2006) synthesize previous concepts of content and defines *content* as an individual's concern about credibility, timeliness, relevance and efficiency of information provided by a content provider. In this study we accept the previous definition with the exception of credibility. The credibility dimension is rooted in informative content. In the case of entertainment-oriented contents like mobile TV, credibility is not easily applied in an individual's cognition understanding of contents. This manuscript defines content as a consumer's assessment that programs are applicable (relevance), up-to-date (timeliness, and sufficient (sufficiency). It has been reported that *content* is a significant predictor of positive responses such as end-user computing satisfaction (Doll and Torkzadeh 1988); website satisfaction (De Wulf et al. 2006); and perceived success of websites (Palmer 2002).

Finneran and Zhang (2005) argue that the actual activity (e.g. buying a digital camera on the web) is the combination of using artifacts (e.g. Internet store websites) and the specific tasks (e.g. searching for information of a specific

digital camera) related to the activity. For example, despite a well-design internet store with high-speed connection, if the online shopper cannot find the wanted information, the shopper is not likely to concentrate on or enjoy using the website. Therefore, researchers need to consider both artifacts and tasks in examining flow antecedents within the activity. This argument holds in the context of mobile TV service. In spite of minimizing technological weaknesses, consumers cannot concentrate on boring re-broadcastings or shows. Thus, when using mobile TV service, users' concentration is assumed to be affected by content (task) as well as the technological side (artifact). In their empirical study examining antecedents of flow experience, Chung and Tan (2004) found that the most influential antecedent of flow experience is content. In considering mobile TV as a sort of entertainment service, content is expected to have a direct influence of consumers' intention to use the service. If a specific content is provided by only one of mobile TV channels, one may have a high intention to use the service. On the other hand, terrible content may prevent consumers from connecting mobile TV service. Thus, we hypothesize:

*H5: Content will positively influence consumer's concentration on mobile TV service.*

*H6: Content will positively influence consumer's intention to use mobile TV service.*

## **METHODOLOGY AND PRELIMINARY TEST**

### ***Measurement and sample***

A 20-item online survey (15 items relate to the research model and 5 are demographic/general questions) was developed. The survey was initially developed in English and then subsequently translated into Korean by one of the manuscript's authors. A back translation was conducted by two other bilingual graduate students to make sure of the accuracy of the translation. A seven-point Likert-scale was used to measure each item. Based on the Technology Acceptance Model (TAM) instrument which has been widely used in prior IS research, items for *intention to use* and *perceived ease of use* were included. Items for *concentration* came from flow literature, especially those based on Ghani and Deshpande (1994) and Koufaris (2000). To measure *speed* in the context of mobile TV service, items were slightly modified from those originally developed by Novak et al. (2000) for the online context. Finally, items were used for *content* focusing on critical dimensions of content (timeliness, sufficiency, and relevance of content) which were proposed by Doll and Torkzadeh (1988) and De Wulf et al. (2006) were included.

This study chose mobile TV users in South Korea as subjects based on the pervasiveness of mobile TV in South Korea. Satellite and terrestrial digital multimedia broadcasting (DMB) service, a sort of mobile TV service, were inaugurated in South Korea in 2005 (Shim 2005), and Korean research institutes reported that the number of subscribers will be over 10 millions by 2010. Considering the rapid growth of DMB market, selecting South Korea as the study site is considered to be good fit in examining early users' adoption of mobile TV service. In order to solicit DMB users, the author will post a short notice which introduced this study with a Web address for online survey on the boards of online communities where users exchange information related to DMB service. The authors adopted an



online survey method due to the geographical distance between the researchers and the site selected. The online survey allows only one response for each IP address to prohibit a subject's multiple responses that should counter an duplicate responses.

**Table 1. Measurement items**

| Construct  | Item  | Source   |
|--|---|--|
| Intention to use<br>IN1<br>IN2<br>IN3            | Given that I have access to mobile TV, I intended to continue using it in the future.<br>I expect my use of mobile TV to continue in the future.<br>I intend to adopt it if possible.                       | David (1989)                                     |
| Perceived ease of use<br>PEOU1<br>PEOU2<br>PEOU3 | Learning to use mobile TV would be easy for me.<br>It would be easy for me to become skillful at using mobile TV.<br>I find mobile TV easy to use.  | David (1989)                                     |
| Concentration<br>CON1<br>CON2<br>CON3            | During using mobile TV, I was usually absorbed intensely in the activity.<br>During using mobile TV, I concentrate fully on the activity.<br>During using mobile TV, I am deeply engrossed in the activity. | Ghani and Deshpande (1994), Koufaris (2002)      |
| Speed<br>S1<br>S2<br>S3                          | Interacting with mobile TV is slow and tedious.*<br>During using mobile TV, I can seamlessly watch content<br>When I change channels, I can watch a new channel without any delay.                          | Novak et al. (2000)                              |
| Content<br>CONT1<br>CONT2<br>CONT3               | Mobile TV provides up-to-date contents<br>Mobile TV provides sufficient contents<br>I find that mobile TV provides contents or information, which I want to watch.  | Doll and Torkzadeh (1988), De Wulf et al. (2006) |

\* indicates the item is reverse-scaled.

### **Pilot test**

A card sorting method was adopted to examine the convergent and discriminant validity of the measurement items (Moore and Benbasat, 1991). Five DMB users were asked individually to sort each index card, which include a single measurement item, into five constructs (intention to use, perceived ease of use, concentration, speed, and content). In Table 2, an examination of the diagonal shows that a total of 58 hits were correctly placed among 60 target placements (five constructs at 15 placements per construct), indicating an overall hit ratio of 96.6%. Further examining each row shows that the items for the particular constructs are actually being classified. All constructs were properly matched with their own items, except for the speed construct which had only one improper placement. The results from a card sorting test illustrates that users could properly classify the items into the constructs with an accuracy rate of over 93 percents and the measurement items did not violate convergent and discriminant validity. Additionally, Cronbach's alpha values for examining construct reliability were calculated. Thirty-one DMB users, who are excluded from the formal survey, voluntarily participated in the pilot test. Cronbach's alpha values of all construct were over 0.8 which is acceptable (Nunnally and Bernstein, 1994). The results of the card sorting test and the reliability test suggested that the measurement items had acceptable convergent and discriminant validity and construct reliability.

**Table 2. The results of the card sorting test**

|       | IN | PEOU | CON | SPEED | CONT | N/A | Total | % Hits |
|-------|----|------|-----|-------|------|-----|-------|--------|
| IN    | 15 | 0    | 0   | 0     | 0    | 0   | 15    | 100.0  |
| PEOU  | 0  | 15   | 0   | 0     | 0    | 0   | 15    | 100.0  |
| CON   | 0  | 0    | 15  | 0     | 0    | 0   | 15    | 100.0  |
| SPEED | 0  | 1    | 0   | 14    | 0    | 0   | 15    | 93.3   |
| CONT  | 0  | 0    | 0   | 0     | 15   | 0   | 15    | 100.0  |

## **DISCUSSION**

This study investigates early consumers' adoption of mobile TV service utilizing *flow* theory. The research model used in this study can be applied in various contexts of mobile services or technologies, and further used to compare them in terms of consumers' perception. In addition to such a practical contribution, this study has theoretical implications. First of all, though psychological *flow* has been applied in users' attitudes toward various information technologies, there has been little literature which adopts it in the context of mobile services. The study can contribute on the generalizability of psychological *flow*. Different from prior studies which focus on an impact of artifacts on psychological *flow*, this study treats content as a potential antecedent of *flow* experience in addition to technological influences which are caused by artifacts. Therefore, this study extends and makes elaborate psychological *flow* as considering the content part.

This study does not include the entire concept of *flow* which may encompass enjoyment, time reduction, telepresence, and so on. Taking into account other *flow* constructs, the future research may be improved by the adoption model of mobile TV service. Future studies will be required to clarify the influence of a tiny screen on consumers' *flow* experiences, because of the size of the screen size of mobile devices, this is expected to considerably interrupt consumers' *flow* experiences. Vividness, defined as the degree of "the representational richness of a mediated environment as defined by its formal features" (Steuer 1992) also seems to be a significant construct needed in examining the influence of a small screen. Although vividness has been not examined as a direct *flow* antecedent, it has been found to have an indirect influence on *flow* experience via telepresence (Hoffman and Novak 1996). Low-level vividness caused by small screens of mobile devices is expected to immensely affect *flow* experience.

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