

PLAYING MOBILE GAMES: CONSUMER PERCEPTIONS *AN EMPIRICAL STUDY*

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Abstract: The paper presents the design and the results of a project studying the adoption of mobile gaming (playing mobile games) in the New Zealand youth market. An adoption model extending TAM (Technology Adoption Model) was used, with intention to use as the dependent variable. Data were gathered from a sample group consisting of undergraduate university students. It was found that adopters of mobile gaming were likely to be male as well as female, and also that the group surveyed exhibited a behaviour towards relatively high spending on mobile entertainment (in proportion to income). Perceived expressiveness was found to be the most significant influential factor affecting intention to use, while perceived enjoyment was found to be motivated by perceived ease of use. Recommendations regarding developing and offering mobile games are also included.

1 INTRODUCTION

It has been suggested in the literature that mobile gaming is a mobile service which will become a significant revenues stream builder for mobile business (Ankar & D’Incau 2002; Kleijnen, de Ruyter & Wetzels 2003; Shchiglik et al. 2004). Supporting this market research forecasts predict that worldwide mobile gaming revenues will “increase six-fold within the next four to five years (Armitt 2005). According to Paavilainen (2003, p. 94) the expected adopters of mobile gaming are young people who already use regularly mobile devices. Based on the potential of this market segment, the compound annual growth rate of mobile gaming revenue worldwide is predicted to fall anywhere between 31% and 50% in 2008 (Wisniewski & Morton 2005). In New Zealand, where the cellular market is expected to increase from NZ\$1.4 billion in 2003 to NZ\$2.0 billion in 2008 and the number of subscribers to grow from 2.8 to 3.5 million respectively (Buckley 2004), it may be expected that the mobile gaming market will also show growth.

Mobile gaming falls into the broader category of interactive mobile entertainment (Moore & Rutter 2004). A number of potential drivers of the adoption process of mobile entertainment services have been identified in prior research (Baldi & Thaug 2002;

Pedersen, Methlie & Thorbljornsen 2002; Barnes & Huff 2003; Pagani & Schipani 2003; Moore & Rutter 2004; Carlsson et al. 2005; Pedersen 2005). A point had been made in several studies that the socio-cultural and economic contexts have been a significant factor in the development of mobile gaming markets in countries such as Japan and Korea where customers had been predisposed to adopt and use both small and mobile electronic accessories as a result of the leading edge electronic industry cultures (Barnes & Huff 2003; Dhaliwal 2003; Wisniewski & Morton 2005).

The study presented here aims to contribute to the understanding the preferences and perceptions of the young people in New Zealand about mobile gaming, and whether there are any specific factors or motivators related to the its adoption.

The paper is organized as follows: The next section defines mobile gaming. Section three introduces the initial research model. Section four presents a summary of the survey results and discusses some of the most important findings. In the last section the study limitations are identified and directions for further research are suggested.

2 MOBILE GAMING

Mobile gaming is an example of a mobile commerce (mCommerce) application which is provided through a paid for service. Typically the mobile network operator to whose network the player subscribes collects the revenue; the revenue stream may be also shared with other business entities involved – such as mobile network infrastructure providers, mobile content developers and publishers, portal aggregators, and retailers (Petrova & Qu 2006).

There is a variety of mobile game types depending on the level of complexity and on the device platform used - from Short Message Service (SMS)-based games to real-time games involving multiple players which are played on sophisticated smart phones. Some more advanced games might require a persistent network connection and a dedicated game server, and might have location sensitive features (Moore & Rutter 2004; Maintland et al, 2005).

Three currently prevalent mobile gaming deployment scenarios are currently prevalent. Their industry positioning is shown in Figure 1, adapted from Wong and Hiew (2005).

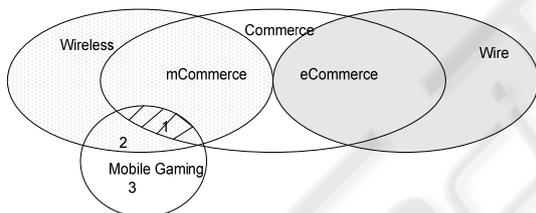


Figure 1: Mobile gaming positioning. Adapted from Wong and Hiew (2005).

In Segment 1, gamers play real-time 2D or 3D games on a 3G mobile phone and interact with groups of gamers via network carriers. Revenue is collected by the mobile services provider (for downloading a game) and by network carriers (for transferring data). The segment covers multiplayer games, including also WAP (Wireless Application Protocol)- and SMS- based games.

In Segment 2 gamers play without connecting to a carrier network – rather they create a private ad hoc Bluetooth network or play individually. They pay once only – for downloading the game.

In Segment 3 (which lies entirely outside both the wireless environment and mCommerce), games still are played on mobile devices, but these need not be connected to a network as the games are embedded in the devices at the time of manufacturing (Ollila et

al. 2003). Subsequently there is no usage cost and no direct financial benefit to other business entities except to manufacturers and device vendors.

3 RESEARCH MODEL

Mobile gaming may involve both monetary and non-monetary transactions across the mCommerce value chain model (Barnes 2003). A number of value chain actors (network operators, game designers and distributors, mobile service providers) are involved in providing a mobile gaming service; studying consumer (user) readiness to accept such a service may help identify potential market segments and provide useful insights into factors motivating consumers' acceptance. Information systems and technology acceptance models (e.g. Davies 1989; Venkatesh 2003) have been adapted and used in a number of studies of mobile business services adoption (Aarmio et al., 2002; Hung, Ku & Chang 2003; Pagani & Schipani 2003; Nysveen, Pedersen & Thornbjornsen 2005; Yang 2005; Wu & Wang 2005), in empirical studies on mobile gaming adoption (Kleijnen, de Ruyter & Wetzels 2003; Yoon, Ha, & Choi 2005) and in studies on online gaming (Hsu & Lu 2004).

The constructs of the Technology Acceptance Model (TAM) and of its extensions found in the reviewed literature on mobile services and specifically on mobile gaming were identified and used to build a research model and to formulate the hypotheses of the study. The research model of the study is shown in Figure 2. "Intention to use" (IU) is a dependent variable; 'actual use' (a dependent variable in TAM), was dropped from the model based on results which confirm the positive relationship between intention to use and actual use (Bhattacharjee 2000; Wu & Wang 2005). A similar approach was followed in other related research (Pagani & Schipani 2003; Nysveen, Pedersen & Thornbjornsen 2005).

3.1 Perceived Usefulness and Perceived Ease of Use

Mobile gaming is an activity well suited to 'filling gaps' in time when travelling or waiting (Anchar & D'Incau 2002); therefore it may be perceived as a useful value added service. Mobile device or context limitations (small screen, playing a game in a public place) may also be of significance.

H1: Perceived usefulness (PU) has a positive effect on IU.

H2: Perceived ease of use (PEOU) has a positive effect on IU.

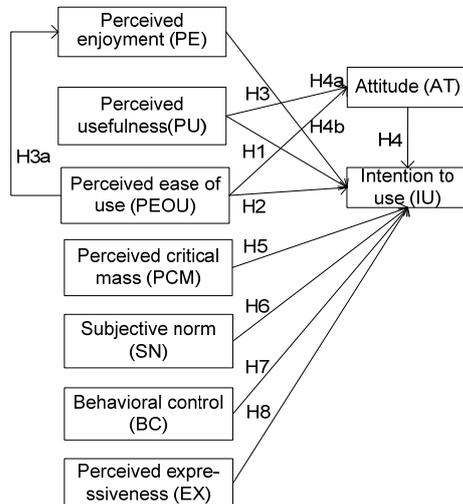


Figure 2: Proposed research model.

3.2 Perceived Enjoyment

As mobile gaming is a leisure-oriented service it may be expected that the enjoyment and fun-seeking aspects will be important. A positive relationship between ‘computer playfulness’ and ‘perceived ease of use’ was found in Venkatesh (2000). While a challenging game evoke positive feelings, a game which is technically difficult to play may be perceived as not enjoyable (Moore & Rutter 2004).

H3: Perceived enjoyment (PE) has a positive effect on IU.

H3a: PEOU has a positive effect on PE.

3.3 Attitude

Attitude was dropped in the extended TAM proposed by Venkatesh and Davies (2000). As prior research of mobile services adoption indicates that consumers’ attitude may influence intention to use (Hung, Ku & Chang 2003; Nysveen, Pedersen & Thorbjornsen 2005; Yoon, Ha & Choi, 2005), the construct was included.

H4: Attitude (AT) has a positive effect on IU.

H4a: AT has a positive mediating effect between PU and IU.

H4b: AT has a positive mediating effect between PEOU and IU.

3.4 Perceived Critical Mass

This construct refers to the notion that consumers may use a service because other people around them are using it (i.e. people would follow others’ behaviour). A positive relationship between critical mass and intention to use was reported in a wireless services context (Kleijnen, de Ruyter & Wetzels 2003) and in online gaming (Hsu & Lu 2004).

H5: Perceived critical mass (PCM) has a positive effect on IU.

3.5 Subjective Norm

This construct refers to the notion that an individual’s perceptions depend on a reference group’s opinion as playing a mobile game may give a sense of commonness, leading to being ‘approved’ by the members of the reference group (Kleijnen, de Ruyter & Wetzels 2003). Similar constructs have been used in (Hsu & Lu 2003; Nysveen, Pedersen & Thorbjornsen 2005).

H6: Subjective norm (SN) has a positive effect on IU.

3.6 Behavioural Control

Behavioural control includes external factors related to the quality of the service and the revenue model of the supplier. Adoption of mCommerce may be constrained by perceived security and privacy risks, and by service cost (Kleijnen, de Ruyter & Wetzels 2004; Wu & Wang 2005).

H7: Behavioural control (BC) factors (security and cost) have a negative effect on IU.

3.7 Perceived Expressiveness

A mobile phone and the related services contribute to the owner’s identity, status and public image (Baldi & Thaung 2003; Barnes & Huff 2003; Funk, 2004, p.27). The effect of ‘perceived expressiveness’ is stronger in the mobile gaming context compared to other mobile services (Nysveen, Pedersen & Thorbjornsen 2005).

H8: Perceived expressiveness (EX) has a positive effect on IU.

4 SURVEY AND RESULTS

A form of purposive sampling known as ‘judgment sampling’ (Sekaran, 2003, p. 277) was used and a

sample of university students was selected. It included both New Zealand and international students. The survey instrument was based on items used in the reviewed literature. The anonymous questionnaire contained between 3 and 6 questions per construct, with answers to be provided on a Likert scale from 1 (strongly disagree) to 5 (strongly agree). The questionnaire was structured into three parts, with all respondents answering the general questions in the first part. Part 2 (29 questions) and part 3 (15 questions) were aimed at respondents who were actual users ('mobile gamers') or were 'non-mobile gamers', respectively.

The sample consisted of 96 respondents, with 44.8% males, 54.2% females, and one not specified. The majority (96.9%) were young adults between 15 and 35 years of age. They fitted well with the mobile generation group (Aarnio et al. 2002; Paavilainen, 2003, p. 93; Shchiglik et al. 2004; Pedersen 2005; Wong & Hiew 2005).

The sample data showed that mobile phone penetration had reached a saturation point: Only one respondent did not have a mobile phone. Most respondents (80.1%) owned a less than two years old device. A very small number of respondents (less than 10%) had a 3G cell phone. A significant number of the respondents (72.9%) owned a model with a colour display but only 75.2% of them were mobile gamers. However owing a relatively high-end mobile device as a pre-condition to engaging in mobile gaming was met by the sample: 57.3% of the respondents had WAP-enabled devices and 45.7% had Java-enabled devices. Significantly, respondents ranked mobile entertainment as one of the top mobile services available—second after SMS.

A relatively low 'mobile phone expenditure' group dominates the sample (with average monthly expenditure less than NZ\$60). This is consistent with the high proportion of prepaid customers in New Zealand reported by Buckley (2004) and may indicate that in New Zealand, those who spend more are likely to be using the technology for business rather than for personal use.

In-phone games dominated the actual users segment (51.09%), followed by downloadable games (27.17%). This result aligns with reported results (Schiglick et al. 2004; Wisniewski & Morton 2005).

The mobile gamer sub-sample consisted of both female and male consumers (55.7% and 44.3% respectively). The possibility of an association between 'gender' and 'playing' in the sample was tested and rejected (Pearson's Chi-Square .103 with a significance level of .749), meaning that both males

and females were likely to be mobile gaming adopters.

A small number of respondents (5.7%, males only) preferred strategy games and the same number (females only) preferred card games. Action and sports games were preferred by females and males (12.9% and 21.4%) with more females than males expressing the preference (the respective ratios were 2:1 and 3:2).

Consistent with the proposed research model further analysis was performed on the mobile game sub-sample only (70 respondents). The construct validity of the instrument was evaluated by computing convergent and discriminate validity performing a principal component analysis with a Varimax rotation. Seven factors (PE, PU, PEOU, SN, BC, EX, IU) met the criteria used in the study (Hair et al., 1998, p. 90, p.111). As a result un the revised model two constructs (PCM and AT) were dropped.

Using SPSS12.0 a correlation bivariate procedure was run including the factors retained in the revised model. Using Pearson's correlation ('*r*') as a measure of strength it was found that IU had a significantly strong relationship with SN ($r=.264$, sig. =.030), PEOU ($r=.339$, sig.=.005), PE ($r = .366$, sig.=.002), PU ($r = .398$, sig.=.001), and EX ($r=.428$, sig.=.000).

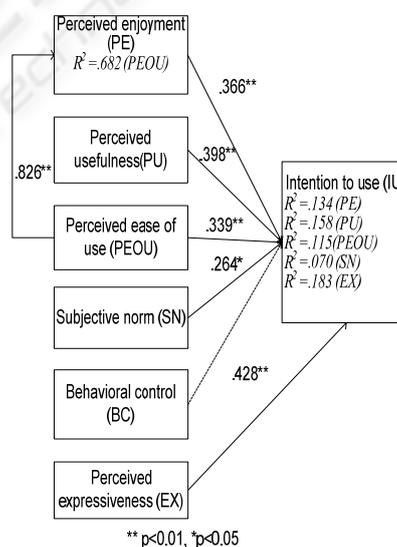


Figure 3: Survey results.

The correlation between PE and PEOU was strong with $r=.826$ and sig.=.000.

The hypotheses were tested using regression analysis in SPSS 12.0 and considered supported when path coefficients (Beta) were significant at the .05 and .01 levels of the p-value (Figure 3).

Hypotheses H1, H2, H3, H3a, H6 and H8 were supported while H7 was not. Hypotheses H4, H4a H4b and H5 could not be tested.

5 DISCUSSION & CONCLUSION

The results indicated that the target groups for mobile gaming adoption among the 'mobile generation' include a high percentage of owners of relatively advanced mobile phone devices, both female and male, with different mobile game type preferences. Current usage was found to be predominantly of embedded games - not a significant revenue generator.

As also suggested in Repo et al. (2006) mobile service providers may take advantage of the high level of ownership of devices with advanced functions by offering and actively promoting services to meet the preferences of 'Segment 2' consumers - such as new and updated downloadable games which are relatively cheap but are still revenue builders (though not as profitable as interactive games). The rate of adoption of mobile gaming services may increase if consumers were made more knowledgeable and aware about them, to capture low 'mobile budget' consumers willing to spend on mobile entertainment. Mobile game developers and distributors may explore the gender differences in the youth market and develop games and game distribution strategies differentiating between the preferences of two gender segments.

'Perceived expressiveness' was found to be most significant factor influencing adopter's behaviour and should be included as a construct in further studies. 'Perceived ease of use' is a significant motivator directly and indirectly through 'perceived enjoyment'. The relationship between these two constructs needs to be studied in more depth. Cost and security were not found to be significant factors influencing adoption which may be context dependent.

The study has a number of limitations: it was not longitudinal and socio-economic factors were not explored. Considering separately mobile gamers and non-mobile gamers reduced the size of the sample and imposed constraints on the subsequent factor analysis; the initial research model had to be revised. d testing of four of the initial eleven hypotheses could not be tested.

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REFERENCES

- Aarnio, A., Enkenberg, A., Heikkila, J. and Hirvola, S., 2002. Adoption and use of mobile services. Empirical evidence from a Finnish study. In *Proceedings of the 35th Hawaii International Conference on System Sciences*, Hawaii.
- Anckar, B. and D'Incau, D., 2002. Value-added services in mobile commerce: An analytical framework and empirical findings from a national consumer survey. In *Proceedings of the 35th Hawaii International Conference on System Sciences*, pp. 1087-1096.
- Baldi, S. and Thaug, H. P.-P., 2002. The entertaining way to m-commerce: Japan's approach to the mobile internet - a model for Europe? *Electronic Markets*, 12(1), 6-13.
- Barnes, S. J. and Huff, S. L., 2003. Rising sun: iMode and the wireless Internet. *Communications of the ACM*, 46(11), 79-84.
- Bhattacharjee, B., 2000. Acceptance of e-commerce services: The case of electronic brokerages. *IEEE Transactions on Systems, Man, and Cybernetics-Part A: Systems and Humans*, 30(4), 411-420.
- Buckley, A., 2004. Prepaid subscribers curb New Zealand cellular services market growth. Retrieved March 20, 2006 from http://www.idcresearch.co.nz.PressRelease_Mobile0404.pdf.
- Carlsson, C., Hyvonen, K., Repo, P. and Walden, P., 2005. Asynchronous adoption patterns of mobile services. In *Proceedings of the 38th Annual Hawaii International Conference on Systems Sciences*, p.189a.
- Davis, F. D., 1989. Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*, 13(3), 319-340.
- Dhaliwal, J., 2003. Analyst speak: Why is East Asia so into mobile gaming? *New Media Age*, 15 (Nov 13, 2003).
- Funk, J. L., 2003. *Mobile disruption: The technologies and applications driving the mobile Internet*. New Jersey: John Wiley & Sons
- Hair, J. F. Junior, Anderson, R. E., Tatham, L. and Black, W. C., 1998. *Multivariate Data Analysis*, 5th edition, New Jersey. Prentice Hall, Inc.
- Hsu, C. and Lu, H., 2004. Why do people play on-line games? An extended TAM with social influences and flow experience. *Information and Management* 41, 853-868.
- Hung, S, Ku, C. and Chang, C., 2003. Critical factors of WAP services adoption: An empirical study. *Electronic Commerce Research and Applications*, 2, 42-60.

- Kleijnen, M., D., de Ruyter, K. and Wetzels, M., 2003. Factors influencing the adoption of mobile gaming services. In B. E. Mennecke & T. J. Strader (Eds.), *Mobile commerce technology, theory, and applications*, pp. 202-217. Hershey, PA. Idea Group Publishing.
- Kleijnen, M., D., de Ruyter, K. and Wetzels, M., 2004. Consumer adoption of wireless services: Discovering the rules, while playing the game. *Journal of Interactive Marketing*, 18(2), 51-61.
- Lin, J., Chan, H. C. and Jin, Y., 2004. Instant messaging acceptance and use among college students. In *Proceedings of the Eighth Pacific Asia Conference on Information Systems*, Shanghai, China.
- Maintland, C. F., van de Kar, E. A. M., de Montalvo, U. W. and Bouwman, H., 2005. Mobile information and entertainment services; business models and service networks. *International Journal of Management and Decision Making* 6(1), 47-64.
- Armitt, C., 2005. Mobile games revenues set to grow five-fold. *New Media Age*, 11 (May 26, 2005),
- Moore, K. and Rutter, J., 2004. Understanding consumers' understanding of mobile entertainment. In K. Moore & J. Rutter (Eds.) *Mobile Entertainment: User-Centred Perspectives*, pp. 49-65. Manchester, UK. ESRC CRIC (University of Manchester).
- Nysveen, H., Pedersen, P. E. and Thorbjornsen, H., 2005. Intention to use mobile services: Antecedents and Cross-service comparisons. *Journal of the Academy of Marketing Science*, 33(3), 330-346.
- Ollila, M., Kronzell, M., Bakos, N. and Weisner, F. (2003). Mobile entertainment business. European Commission, User-Friendly Information Society. Retrieved December 23, 2005, from <http://www.mgain.org/mgain-wp5-D542-delivered3.pdf>.
- Paavilainen, J., 2003. *Mobile games: Creating business with Nokia N-gage*. Indianapolis. New Riders.
- Pagani, M. and Schipani, D., 2003. Motivations and barriers to the adoption of 3G mobile multimedia services: An end user perspective in the Italian market. In M. Khosrow-Pour (Ed.), *Proceedings of the 2003 Information Resources Management Association International Conference (IRMA'03)*, pp. 957-960.
- Pedersen, P. E., Methlie, L. B. and Thorbjornsen, H., 2002. Understanding mobile commerce end-user adoption: a triangulation perspective and suggestions for an exploratory service evaluation framework. In *Proceedings of the 35th Annual Hawaii International Conference on System Sciences*, pp. 1079-1086.
- Pedersen, P. E., 2005. Adoption of mobile Internet services: An exploratory study of mobile commerce early adopters. *Journal of Organizational Computing and Electronic Commerce*, 15(3), 203-221.
- Petrova, K. and Qu, H., 2006. Mobile gaming: A reference model and critical success factors. In M. Khosrow-Pour (Ed.), *Emerging Trends and Challenges in Information Technology Management*, pp. 228-231. Hershey, PA. Idea Group Publishing.
- Qu, H., 2006. *Exploring Consumer Attitudes to Mobile Gaming in New Zealand*. Auckland University of Technology.
- Repo, P., Hyvonen, K., Pantzar, M. and Timonen, P., 2006. Inventing use for a novel mobile service. *International Journal of Technology and Human Interaction*, 2(2), 49-62.
- Sekaran, U., 2003. *Research Methods for Business: A Skill Building Approach*. Danvers. Wiley & Sons, Inc.
- Shchiglik, C., Barnes, S., Scornavacca, E. and Tate, M., 2004. Mobile entertainment service in New Zealand; An examination of consumer perceptions towards games delivered via the wireless application protocol. *International Journal of Services and Standards*, 1(2), 155-171.
- Venkatesh, V., 2000. Determinants of perceived ease of use: Integrating perceived behavioural control, computer anxiety and enjoyment into the Technology Acceptance model. *Information Systems Research*, 11(4), 342-365.
- Venkatesh, V. and Davis, F. D., 2000. A theoretical extension of the Technology Acceptance Model: Four longitudinal field studies. *Management Science*, 46(2), 186-204.
- Venkatesh, V., Morris, M. G., Davis, G. B. and Davis, F. D., 2003. User acceptance of information technology: Towards a unified view. *MIS Quarterly*, 27(3), 425-478.
- Wisniewski, D. and Morton, D., 2005. 2005 Mobile games white paper. Retrieved February 20, 2006 from http://igda.org/online/IGDA_Mobile_White_Paper_2005.pdf.
- Wong, C. and Hiew, P. L., 2005. Mobile entertainment: Model development and cross services study. In *Proceedings of ICSSSM '05*, pp. 1355-1359.
- Wu, J.-H. and Wang, S.-C., 2005. What drives mobile commerce? An empirical evaluation of the revised technology Acceptance model. *Information & Management*, 42, 719-729.
- Yang, K. C. C., 2005. Exploring factors affecting the adoption of mobile commerce in Singapore. *Telematics and Informatics* 22, 257-277.
- Yoon, Y. S., Ha, I. S. and Choi, M.-K., 2005. Nature of potential mobile gamers' behaviour under future wireless mobile environment. In *Proceedings of the 7th International Conference on Advanced Communication Technology (ICALT'05)*, pp. 551-558.