Strategic Industrial Applications of Games and Gamification

Proceedings of the International Gamification for Business Conference 2015 (IGBC15)

Innovation Birmingham

21-22 September 2015

Edited by Tim Baines, Aston University, UK; Panagiotis Petridis, Aston University, UK and Keith Ridgway, AMRC, University of Sheffield, UK

Aston Business School

Aston Centre for Servitization
Research and Practice

ASTON CENTRE FOR SERVITIZATION RESEARCH AND PRACTICE

The Aston Centre for Servitization Research and Practice has been established to guide suitable businesses through the transition from selling products alone to competing through Product-Service Systems. Focusing on mainstream manufacturing, the Centre engages and impacts on local, national and international businesses through innovative research and education programmes and bringing academics and business leaders together organising conferences and a number of other events and workshops to promote servitization. Current projects include:

GAMIFICATION FOR SERVITIZATION

Working in partnership with the Advanced Manufacturing Research Centre at the University of Sheffield this EPSRC funded programme is developing applied game technologies to transform the servitization of mainstream manufacturing companies.

EXPLOITING SERVITIZATION IN WEST MIDLANDS SMES

Part-funded by the West Midlands European Regional Development Fund, this project aims to help small and medium sized companies in the region to grow in value. We run a programme of workshops and ongoing targeted support to help companies to understand servitization and implement services-led strategies.

We also deliver two modules on servitization as part of Aston Business School's MBA programme, namely; Developing a Technology-Led Service Strategy and Transforming to Technology-Led Services.

Aston Centre for Servitization Research and Practice acknowledges the support and research funding from:

EPSRC
Pioneering research and skills

EUROPEAN UNION
Investing in Your Future
European Regional Development Fund 2007-13

The University Of Sheffield.
Advanced Manufacturing Research Centre

BOEING

ACKNOWLEDGEMENTS

We would like to thank all contributing authors for the high quality of papers submitted and the range of topics addressed. We trust that this inaugural International Gamification for Business Conference (IGBC15) will be remembered for being ground-breaking, informative, enjoyable and providing thought leadership in this dynamic area. We also wish to thank our industrial collaborators for their ongoing encouragement and support for the work of the Aston Centre for Servitization Research and Practice.

Panagiotis Petridis, Tim Baines 2015.

INTRODUCTION

Welcome! These are the proceedings from the inaugural International Gamification for Business Conference.

Gamification has the potential to transform the education, skills and motivation of workers across all sectors, and significantly impact the competitiveness of firms worldwide. However, much of the business community has yet to embrace this innovation, and major gulfs exist between games designers, business leaders, researchers and practitioners.

The International Gamification for Business Conference focuses on building bridges. It sets out to accelerate the adoption of gamification in business by bringing together the research, development and business communities, and engage these around innovations in serious games and gaming techniques for real-life industrial applications.

This year's International Gamification for Business will focus on strategic applications in industry, bringing together the world's leading researchers and practitioners to debate the theory and practice of Gamification

We still have much to learn both about gamification and the processes by which we bring our communities together in this very dynamic area. We believe that the papers in these proceedings testify that we are making progress, but we believe that we have still only just started to realise our goals.

Day one of the conference is an industry day comprising serious games companies demonstrating state of the art technologies. There will also be a short report on the results of the Business Games Jam organised by ACSRP on 19/20 September.

Keynote presentations and academic conference papers will be presented on day two.

Panagiotis Petridis, Tim Baines, Keith Ridgway 2015.

CO-CHAIRS

Dr Panagiotis Petridis- Aston University, UK
Prof Tim Baines – Aston University, UK
Prof Keith Ridgway – AMRC, University of Sheffield, UK

LOCAL ORGANISING COMMITTEE

Dr Ali Bigdeli - Aston Business School, Aston University, UK
Dr Guang-Shi (Victor) – AMRC, University of Sheffield, UK
Dr Jim Baldwin – AMRC, University of Sheffield, UK
Dr Sylvester Arnab, Coventry University, UK
Dr Kurt Debattista, WMG, University of Warwick, UK
Dr Anastasios Bakaoukas, University of Northampton, UK
Dr Christos Gatzidis, Bournemouth University, UK
Dr Maurice Hendrix, University of Northampton, UK
Dr Petros Lameras, SGI, UK
Dr Eike Anderson, Bournemouth University, UK
Dr Ian Dunwell
Gill Holmes, Chair, Local Organising Committee, Aston Business School, Aston University, UK
Dr Daniel Andrews, Aston Business School, Aston University, UK.
Dr Daphne Economou, University of Westminster, UK
Dr Christopher Brewster, Aston Business School, Aston University, UK.

KEYNOTE SPEAKERS

Prof Hélène MICHEL, Grenoble Ecole de Management, France
Prof Maja Pivec, University of Applied Sciences, Graz, Austria
Dr Jannicke Baalsrud Hauge, Bremer Institut für Produktion und Logistik (BIBA), Germany & GaPSLabs at KTH, Sweden

INTERNATIONAL ADVISORY COMMITTEE

Prof Sara de Freitas, Murdoch University, AUS
Dr Fotis Liarokapis, Masaryk Univeristy, Czech
Prof Roumiana Peytcheva-Forsyth, Sofia University, Bulgaria
Prof Maja Pivec, FH JOANNEUM, Austria
Dr Christopher Peters, KTH, Sweden
Dr Katerina Mania, Technical University of Crete, Greece
Dr Per Backlund, University of Skövde, Sweden
Dr Genaro Rebolledo Méndez (Universidad Veracruzana, Mexico)
Dr Jannicke Baalsrud Hauge, Biba, Germany

CONFERENCE SECRETARIAT

Jill Forrest, Aston Business School, Aston University, UK
Maria Podsiadly, Aston Business School, Aston University, UK

CONTENTS

Session 1: Training and Development using Gamification

Session 2: Serious Games Applications

Session 3: Gamification Applications

GAMIFICATION AND ENTREPRENEURIAL INTENTIONS: A THEORETICAL AND METHODOLOGICAL APPROACH

Jose Ruizalba, Anabela Soares, Arnaud Banoun & Miguel Rodriguez-Molina

ABSTRACT

Purpose: This study is part of an ongoing research project that aims at investigating the moderating role of gamification on entrepreneurial intentions.

Design/methodology/approach: A quantitative research strategy has been designed suggesting the use of online surveys. The data collection has already started. These surveys included a validated Entrepreneurial Intentions scale (based on Liñán and Chen, 2009; Liñán et al., 2011; Guerrero and Urbano, 2014; Ruizalba et al., 2015) used in this study to evaluate and compare the level of entrepreneurial intentions of students in a gamified and in a non-gamified environment.

Findings: No findings can be described at the moment as this is part of an ongoing data collection. It is however expected that a difference is found between the 2 samples collected (that is, technologically gamified vs non-gamified environments).

Originality/value: The contribution of this paper is, so far, theoretical and methodological focusing on the moderating role of gamified environments on entrepreneurial intentions.

Key words: Entrepreneurial intentions, Gamification, Technology, Education.

1. INTRODUCTION

The present paper focuses on the impact of gamification on entrepreneurial intentions. Although a relatively recent trend, the concept of Entrepreneurial Intentions builds upon a solid and tested framework from social psychology: the Theory of Planned Behaviour (Ajzen, 1991). Accordingly, research has supported the concept of entrepreneurial intentions and their impact on entrepreneurial behaviours (Liñán et al., 2011; Krueger and Brazeal, 1994; Diaz-Garcia & Jimenez-Moreno, 2010; Ruizalba, et al. 2015).

In line with these findings, this research focuses in one online provider (Studyka - http://en.studyka.com/) that allows the challenges to be concluded by any team of participants anywhere around the world. Participants (students for the purpose of this paper) can find and recruit their own team members online. Studyka is a free international online platform that offers professional challenges for students. As a true teaching resource, Studyka helps teachers from all over the world train their students to face the issues companies are currently confronted with. Using the challenges in class is really simple. They can be used as case studies or exercises. Studyka can adapt to academic program through three different integration options: Simple integration (One class, one challenge), multiple integration (One class, various challenges that students can choose from throughout the year) or a customized integration. Launched in 2012, the platform has provided support to many major client accounts in France and internationally by involving students in challenges. Studyka's clients include actors from different activity sectors as Allianz, Bouygues Construction, Google, Michelin, Mircrosoft and Youtube.

Challenges provide students with the opportunity to face real-life business cases during their studies, many internships, jobs and prizes (vouchers, world tour, gift). Competition is a light motive for studyka's platform and for students who participate in their challenges. Students are very much involved in this competition and do their best to win. Regarding their performance in challenges, students get individual ranking which helps the platform to rank schools as well. With up to 2 or 3 different challenges each month, students can create a substantial link with studyka's partner firms

as well as free coaching sessions by experienced business managers. Furthermore, students have the opportunity to get in touch with the company's top management during the awards ceremony.

Following this, a survey was conducted in order to compare entrepreneurial intentions in students in this technologically gamified context (provided by Studyka) against students in a traditional teaching context.

As part of an ongoing data collection process, this paper briefly describes the state of the art on entrepreneurial intentions and gamification, providing a research model and focusing on expected outcomes of the comparison of technologically gamified vs non-gamified environments.

As a result, the reminder of this paper includes a literature review clarifying the theoretical background, entrepreneurial intentions and gamification. This is followed by the explanation of main methodological decisions, main findings and conclusions and implications.

2. LITERATURE REVIEW

2.1. Theoretical Background: Theory of Planned Behaviour (TPB)

The Theory of Planned Behaviour (TPB hereinafter) (Ajzen, 1991) states that attitudes toward behaviours (beliefs about consequences of the behaviour), subjective norms (beliefs about normative expectations of others), and perceived behavioural control (beliefs regarding the existence of factors that facilitate or prevent the behaviour) shape an individual's behavioural intentions and subsequently his behaviours (see figure 1).

Alongside with Krueger et al., (2000) and Ruizalba et al. (2015), we believe that any 'entrepreneurial' activity can be seen as intentionally planned behaviour. As a result, the present research uses TPB as a theoretical underpinning.

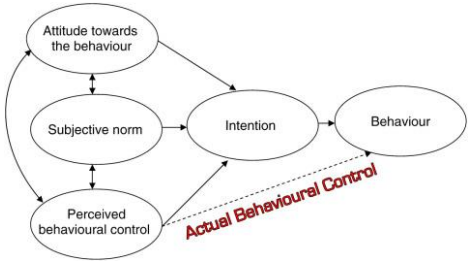

Figure 1: Theory of Planned Behaviour (Ajzen, 1991, p.182).

2.2. Entrepreneurial Intentions

Entrepreneurial intentions (EI henceforth) refer to the level of interest in starting a business (De Clercq et al., 2011; Fitzsimmons & Douglas, 2011; Krueger et al., 2000; Lent, Brown & Hackett, 1994) and have long been studied (e.g. Krueger & Carsrud, 1993; Liñán & Chen, 2009) particularly when it comes to the development and teaching of entrepreneurship in educational/university settings (Veciana, Aponte & Urbano, 2005; Souitaris et al. 2007; Kirby, Guerrero & Urbano, 2011; Liñán, Urbano & Guerrero, 2011).

In an era where the "entrepreneurial potential" (Krueger and Brazeal, 1994) is considered essential by employers, students and educators, there is still limited research in how institutions foster the development of such a multidimensional topic. Some authors argue that entrepreneurship consists

of a series of personality traits (e.g., Leutner et al., 2014; Dubrin, 2015) where others argue that it is something that can be fomented and stimulated (e.g., MacBride, 2014).

Instead of focusing on entrepreneurship, entrepreneurial potential or entrepreneurial behaviour, we focus here on EI given that these are antecedents of any entrepreneurial behaviour. According to Bagozzi et al. (1989) and Ajzen (1991) intentions are the predictor per excellence of planned behaviour. Given that, Krueger et al. (2000, p.413) argue that it is fundamental to understand intentions particularly in entrepreneurship which is a "rare, obscure, and involves unpredictable time lags".

Entrepreneurship attitudes reveal fundamental for entrepreneurial intentions and behaviours (Diaz-Garcia & Jimenez-Moreno, 2010). Furthermore, EI were found to be related and linked to entrepreneurial growth aspirations (Autio & Acs, 2010; Autio, 2011; Estrin, Korosteleva & Mickiewicz, 2013; Gartner & Liao, 2012; Hessels, Van Gelderen & Thurik, 2008a, 2008b; Tominc & Rebernik, 2007).

In view of this, EI can be said to be related to behaviour, attitudes, subjective norms and perceived behavioural controls (Ajzen, 1991; Krueger et al., 2000; Liñán and Chen, 2009; Liñán et al., 2011; Diaz-Garcia & Jimenez-Moreno, 2010; Guerrero and Urbano, 2014).

Several frameworks have been suggested to explain EI (the seminal work of Shapero, 1975; 1982), many of them focusing on the TPB (e.g., Krueger & Brazeal, 1994; Veciana et al., 2005; Ruizalba et al., 2015). The present study follows Ruizalba et al (2015) suggested a framework based on TPB in which the authors analysed the role of gender on EI.

2.2. The moderating effect of Gamification

According to Deterding et al. (2011) gamification refers to the use of game design elements in nongame contexts. In turn, Kapp (2012) argued that using game mechanics, aesthetics and strategies engaged people, motivated action, promoted learning and problem solving, all with the goal of modifying or promoting desired behaviours (Lee and Hammer, 2011; Huotari and Hamari, 2012). More recently, Hamari and Koivisto (2015:419) state that gamification refers to technologies that attempt to promote intrinsic motivations toward various activities, commonly, by employing design characteristic to games.

Following these definitions, gamification has most commonly been used to change behaviours, skills development and innovation challenges (Gartner, 2012) through the use of leaderboards, achievements, feedback, clear goals and narrative (Hamari, Koivisto, & Pakkanen 2014; Hamari, Koivisto, & Sarsa, 2014)

Gaining increased attention in non-gaming settings in 2010 (Zichermann and Cunningham, 2011), technology has propelled the use of gamification in various contexts. Whether considered in motivating consumer behaviour, employees or students in their learning journeys, gamification has proved to be useful and increasingly popular (Robson et al., 2015).

In an increasingly "gamified" world, companies have found in technologically gamified environments new ways and tools to manage their relationships with their employees and customers. Several companies have been known to facilitate this process (e.g., Saffron Interactive, Knewton, Foursquare, Mindbloom, Recyclebank, etc.) by providing an environment where companies/universities from any field can set challenges online that can be completed from anywhere around the world. Focusing on multidisciplinary problem-solving situation, the challenges give companies a chance to promote their brands and simultaneously foster innovation and entrepreneurship.

In their review of the gamification literature, Hamari, Koivisto and Sarsa (2014) found that research reported positive results of gamification implementations. Recent research has also suggested some frameworks, for example, Robson et al., (2015) that suggested a framework for gamification based on mechanics (set up, rules and progression), dynamics (players' behaviour) and emotions (players' state of mind).

Nonetheless, there is still a lack of research and theory in this field (Hamari and Koivisto, 2015). Thus, concerns have been raised regarding the failure of many of these initiatives (rushed due to the "buzz" in the field) due to poorly designed environments/rewards (Gartner, 2012). Rather than looking at the benefits of gamification, the present research focuses on the effects of gamification on behaviour antecedents particularly EI.

2.3. Research Model: Gamification and Entrepreneurial intentions

In order to investigate the moderating role of gamification on EI the following research model is suggested (see figure 2):

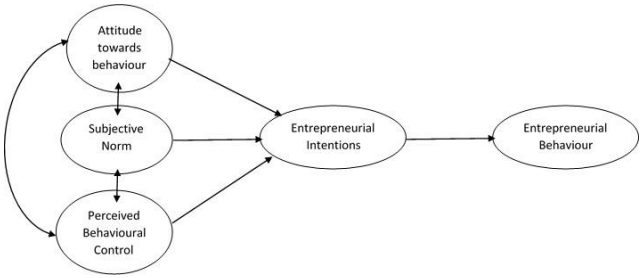

Figure 2: Entrepreneurial Intentions based on TPB.

Figure 2 suggests a research model in which gamification is not represented although it will be the moderating variable which will be operationalized by dividing the sample into 2 groups: gamified vs non-gamified.

3. METHODOLOGY

For the purpose of this research, we have adopted a quantitative research strategy using the EI questionnaire (based on the surveys used by Liñán and Chen, 2009; Liñán et al., 2011; Guerrero and Urbano, 2014) previously used by Ruizalba et al. (2015). This was adapted here to evaluate the level of intention of students that participate in games against students that do not.

The items used in the questionnaire used in this research can be seen in Appendix A. The final questionnaire included a total of twenty two questions focusing on all elements of the suggested framework: subjective norms, perceived behavioural control, attitude towards behaviour, entrepreneurial intentions, university of origin and challenge participation (in the technologically gamified Studyka platform).

The data will be collected from June to mid-September from a gamified environment and a non-gamified environment in order to compare both samples and the moderating effect of gamification (multi-groups; SEM analysis). Two subsamples have been identified: a) business students that are already enrolled in the studyka platform (gamified environment) and b) business students in a non-gamified environment. We targeted a sample of 600 students in total.

To collect data from the gamified environment we were supported by Studyka managers and their IT team and for the non-gamified environment the questionnaires were sent to students from different countries to ensure a heterogeneous sample.

So far a sample was collected only from students within a non-gamified context. Further data collection will increase the sample of students within a gamified context which will then allow us to conduct SEM and a multi-group comparative analysis of the effects of gamification on EI (Kline, 2010).

4. FINDINGS

This is part of an ongoing investigation therefore no results are available at this stage. We expect to collect more than 250 responses in order to be able to conduct SEM and the main hypothesis is that gamification impacts positively on EI.

5. CONCLUSION

This research stemmed mainly from our curiosity to understand psychological dimensions behind EI.

If you have intention of doing something you will most probably do it (as argued by Ajzen, 1991 TPB). The focus of this research is therefore on EI in students. It is not our aim to promote entrepreneurship education. However, what we argue is that gamification might have an effect on is. As a popular topic, this might be of interest for scholars in the entrepreneurship field as well as universities, at a time were so much is discussed about the gap between employers and universities.

So here we focus on the levels of entrepreneurial intention before and after the challenges in a technologically gamified environment. Expected outcomes from this research are that levels of entrepreneurial intentions are higher in students that have performed the Studyka challenges.

Studyka is an online platform were students participate in challenges set by companies such as Philips, Microsoft, etc – this companies come to studyka to have access to a pool of international students and enable innovative solutions to their current problems. In this platform students experience competition, rewards, teamwork, pressure from deadlines, to name just a few. This has many similarities to the 'communities of practice' (Wenger, 1998), giving students the opportunity to experience first-hand real problem-solving activities.

We believe that students that are in a technologically gamified environment will have higher levels of EI than the ones on traditional education environment. Just the fact that they decide to participate is in itself a pointer of the EI and characteristics.

Unlike many of the "student engagement" buzz activities, gamification increases the time players (students) spend on the tasks organised by teachers, contributing to the psychological predisposition to complete the task (Zichermann y Cunningham, 2011; Kapp, 2012). Furthermore, gamification is a tool that facilitates the simulation of real life situations fitting in with the concept and principles of 'communities of practice' (Wenger, 1998).

REFERENCES

Ajzen, I. (1991), The Theory of Planned Behaviour, *Organizational behaviour and human decision processes*, Vol.50, pp.179-211.

Autio, E. (2011), High-aspiration entrepreneurship, In M. Minniti (Ed.), *The dynamics of entrepreneurship* (pp. 181-208), Oxford: Oxford University Press.

Autio, E.; ACS, Z. (2010), Intellectual property protection and the formation of entrepreneurial growth aspirations, *Strategic Entrepreneurship Journal*, Vol.4, pp.234-251.

De Clercq, D., Honig, D. and Martin, B. (2011), The roles of learning orientation and passion for work in the formation of entrepreneurial intention, *International Small Business Journal*, Vol.31 No.6, pp.652-676.

Deterding, S., Dixon, D., Khaled R., and Nacke L. (2011), From Game Design Elements to Gamefulness: Defining "Gamification", In Proceedings of the 15th International Academic MindTrek Conference: Envisioning Future Media Environments, Tampere: ACM.

Diaz-Garcia, M.C.; Jimenez-Moreno, J. (2010), Entrepreneurial intention: The role of gender, *International Entrepreneurship and Management Journal*, Vol.6 No.3, pp.261-283.

Dubrin, A. (2015), *Leadership: Research Findings, Practice, and Skills*, 8th Edition, Boston: Cengage Learning.

Estrin, S.; Korosteleva, J.; Mickiewicz, T. (2013), Which institutions encourage entrepreneurial growth aspirations?, *Journal of Business Venturing*, Vol.28, pp.564-580.

Fitzsimmons, J.R.; Douglas, E.J. (2011), Interaction between feasibility and desirability in the formation of entrepreneurial intentions, *Journal of Business Venturing*, Vol.26, pp.431-440.

Gartner (2012), "Gartner Says by 2014, 80 Percent of Current Gamified Applications Will Fail to Meet Business Objectives Primarily Due to Poor Design", [online], Available: http://www.gartner.com/newsroom/id/2251015, Accessed: 30/06/2015

Gartner, W.; Liao, J. (2012), The effects of perceptions of risk, environmental uncertainty, and growth aspirations on new venture creation success, *Small Business Economics*, Vol.39, pp.703-712.

Guerrero, M.; Urbano, D. (2014), Academics' start-up intentions and knowledge filters: an individual perspective of the knowledge spill over theory of entrepreneurship, *Small Business Economics*, Vol.43 No.1, pp.57-74.

Hamari, J. and Koivisto, J. (2015), Why do people use gamification services?, *International Journal of Information Management*, Vol.35, pp.419–431.

Hamari, J., & Koivisto, J. (2015), "Working out for likes": An empirical study on social influence in exercise gamification, *Computers in Human Behavior*, Vol.50, pp.333-347.

Hamari, J., Koivisto, J., & Pakkanen, T. (2014), Do persuasive technologies persuade? – A review of empirical studies. In A. Spagnolli, L. Chittaro, & L. Gamberini (Eds.), *Persuasive technology*, LNCS 8462 (pp. 118–136), Switzerland: Springer International Publishing.

Hamari, J., Koivisto, J., & Sarsa, H. (2014), Does gamification work? – A literature review of empirical studies on gamification, In Proceedings of the 47th Hawaii international conference on system sciences Hawaii, USA, January 6–9, 2014.

Hessels, J.; Van Gelderen, M.; Thurik, R. (2008a), Drivers of entrepreneurial aspirations at the country level: the role of start-up motivations and social security, *International Entrepreneurship and Management Journal*, Vol.4 No.4, pp.401-417.

Hessels, J., Van Gelderen, M., Thurik, R. (2008b), Entrepreneurial aspirations, motivations, and their drivers, *Small Business Economics*, Vol.31 No.3, pp.323-339.

Huotari, K., y Hamari, J. (2012), Defining gamification-a service marketing perspective, In Proceedings of the 16th International Academic MindTrek, Tampere: ACM.

Kapp, K.M. (2012), *The Gamification of learning and Instruction*, San Francisco, CA: John Wiley.

Kirby, D.A., Guerrero, M., Urbano, D. (2011), The theoretical and empirical side of entrepreneurial universities: An institutional approach, *Canadian Journal of Administrative Science*, Vol.28 No.3, pp.302-316.

Kline, R.B. (2010), *Principles and Practice of Structural Equation Modelling*, Guilford press.

Krueger N.F.J., Reillly, M.D. & Carsrud A.L. (2000), Competing models of entrepreneurial intentions, *Journal of Business Venturing*, Vol.15 No.5, pp.411-432

Krueger, N.F., and Brazeal, D.V. (1994), Entrepreneurial Potential and Potential Entrepreneurs, *Entrepreneurship Theory and Practice*, Vol.18 No.3, pp.91-104.

Krueger, N.F. and Carsrud, A.L. (1993), Entrepreneurial intentions: Applying the theory of planned behaviour, *Entrepreneurship and Regional Development*, Vol.5, pp.315-330.

Lee, J.J. and Hammer, J. (2011), Gamification in Education: What, How, Why Bother, *Academic Exchange Quarterly*, Vol.15 No.2, pp. 1-5.

Lent, R.W.; Brown, S.D.; Hackett, G. (1994), Toward a unifying social cognitive theory of career and academic interest, choice, and performance, *Journal of Vocational Behavior*, pp.45, pp.79-122.

Leutner, F, Ahmetoglu, G, Akhtar, R, & Chamorro-Premuzic, T (2014), The relationship between the entrepreneurial personality and the Big Five personality traits, *Personality & Individual Differences*, Vol.63, pp. 58-63.

Linan, F., and Chen, Y.W. (2009), Development and cross-cultural application of a specific instrument to measure entrepreneurial intentions, *Entrepreneurship Theory and Practice*, Vol.33 No.3, pp.593-617.

Linan, F., Urbano, D. and Guerrero, M. (2011), Regional variations in entrepreneurial cognitions: Start-up intentions of university students in Spain, *Entrepreneurship & Regional Development*, Vol.23 No.3–4, pp.187-215.

MacBride, E. (2014) *Kathryn Shaw: Entrepreneurship Requires Practice, Practice, Practice* [Online]. Available at: http://www.gsb.stanford.edu/insights/kathryn-shaw-entrepreneurship-requires-practice-practice-practice [Accessed: 18 March 2015].

Robson, K., Plangger, K., Kietzmann, J., McCarthy, I. and Pitt, L. (2015), Is it all a game? Understanding the principles of gamification, *Business Horizons*, Vol.58 No.4, pp.411-420.

Ruizalba, J., Vallespin, M., Martin-Sanchez, V., Rodriguez-Molina, M. (2015), The moderating role of gender on entrepreneurial intentions: A TPB perspective, *Intangible Capital*, Vol.11 No.1, pp. 92-117.

Shapero, A. & Sokol, L. (1982), The social dimensions of entrepreneurship, In The Encyclopedia of entrepreneurship (pp. 72-90), Englewood Cliffs, NJ: Prentice Hall.

Shapero, A. (1975), The displaced, uncomfortable entrepreneur, *Psychology Today,* Vol. 133 No.9 (November), pp.83-88.

Souitaris, V., Zerbinati, S., Al-Laham, A., (2007), Do Entrepreneurship Programmes Raise Entrepreneurial Intention of Science and Engineering Students? The Effect of Learning, Inspiration and Resources, *Journal of Business Venturing*, Vol. 22 No. 4, pp. 567-587.

Tominc, P.; Rebernik, M. (2007), Growth Aspirations and Cultural Support for Entrepreneurship: A Comparison of Post-Socialist Countries, *Small Business Economics*, Vol.28, pp.239-255.

Veciana, J.M., Aponte, M.S. and Urbano, D. (2005), University Students' Attitudes Towards. Entrepreneurship: A Two Countries Comparison, *International Entrepreneurship and Management Journal*, Vol. 1, pp.165-182.

Wenger, E. (1998), *Communities of Practice: Learning, Meaning, and Identity*, New York: Cambridge University Press.

Zichermann, G. y Cunningham, C. (2011), *Gamification by Design: Implementing Game Mechanics in Web and Mobile Apps*, Cambridge, MA: O'Reilly Media.

ACKNOWLEDGMENTS

We would like to thank Studyka for agreeing to participate in this research and to all the participants who have made this data collection possible.

APPENDIX A: **Entrepreneurial Intentions Questionnaire**

(Linan and Chen, 2009; Linan et al., 2011)

Entrepreneurial intentions (EIN):

Q4. I am ready to do anything to be an entrepreneur.
Q6. I will make every effort to start and run my own business.
Q9. I have serious doubts about ever starting my own business.
Q13. I am determined to create a business venture in the future.
Q17. My professional goal is to be an entrepreneur.
Q19. I have a very low intention of ever starting a business.

Attitude towards behaviour (ATT):
Q2. A career as an entrepreneur is totally unattractive to me.
Q15. Being an entrepreneur would give me great satisfaction.
Q10. If I had the opportunity and resources, I would love to start a business.
Q12. Amongst various options, I would rather be anything but an entrepreneur.
Q18. Being an entrepreneur implies more advantages than disadvantages to me.

Perceived behavioural control (PBC):
Q7. I am able to control the creation process of a new business.
Q1. Starting a firm and keeping it viable would be easy for me.
Q5. I believe I would be completely unable to start a business.
Q14. If I tried to start a business, I would have a high chance of being successful.
Q16. It would be very difficult for me to develop a business idea.
Q20. I know all about the practical details needed to start a business.

Subjective norm (SN):
Q3. My friends would approve of my decision to start a business.
Q8. My immediate family would approve of my decision to start a business.
Q11. My colleagues would approve of my decision to start a business.

AUTHOR CONTACT DETAILS

Jose Luis Ruizalba Robledo
The Claude Littner Business School, University of West London, Jose.Ruizalba@uwl.ac.uk

Anabela Soares
The Claude Littner Business School, University of West London, Anabela.Soares@uwl.ac.uk

Arnaud Banoun
EDC Paris Business School, arnaud.banoun@edcparis.edu

Miguel Rodriguez-Molina
Departamento de Comercialización e Investigación de Mercados, University of Granada, rmolina@ugr.es

HOW TO MOTIVATE & ENGAGE GENERATION 'CLASH OF CLANS' AT WORK?
EMERGENT PROPERTIES OF BUSINESS GAMIFICATION ELEMENTS IN THE DIGITAL ECONOMY

Nicholas Dacre, Panos Constantinides & Joe Nandhakumar
[*please do not cite without permission from the author*]

ABSTRACT
Organisations are currently lacking in developing and implementing business systems in meaningful ways to motivate and engage their staff. This is particularly salient as the average employee spends eleven cumulative years of their life at work, however less than one third of the workforce are actually engaged in their duties throughout their career. Such low levels of engagement are particularly prominent with younger employees, referred to as Generation Y (GenY), who are the least engaged of all groups at work. However they will dedicate around five cumulative years of their life immersed playing video games such as 'Clash of Clans', whether for social, competitive, extrinsic, or intrinsic motivational factors. Using behavioural concepts derived from video games, and applying game design elements in business systems to motivate employees in the digital economy, is a concept which has come to be recognised as Business Gamification. Thus, the purpose of this research paper is to further our understanding of game design elements for business, and investigate their properties from design to implementation in gamified systems. Following a two year ethnographic style study with both a system development, and a communication agency largely staffed with GenY employees, findings suggest properties in game design elements are emergent and temporal in their instantiations.

Key words: Business Gamification, Motivation, Digital Economy, Leaderboard, Self-Continuity.

1. INTRODUCTION

1.1 Digital Economy

Companies striving to embrace the digital economy (Skilton, 2015) have historically committed considerable resources into developing their business systems towards greater efficiency (Ciborra & Hanseth, 1998; Strader, Lin, & Shaw, 1998). This is particularly salient as organisations transition from relying on incumbent platforms, such as legacy ERP or CRM infrastructures as a source of competitive advantage towards implementing new and innovative internal business applications (Herzig, Ameling, & Schill, 2012). In this context, built on an architecture of dispersed, highly interconnected, always-on systems such as cloud-based corporate platforms, the digital economy affords businesses innovative opportunities to disrupt organisational processes and enhance their competitive advantage (Briscoe & Marinos, 2009; Skilton, 2015). However, whilst focusing on elements of operational functionality (Ciborra, 2000), organisations have largely neglected human-elements of motivation and engagement in the development and implementation of their business systems. Considering that two thirds of employees are either disengaged or actively disengaged in their work activities (O'Boyle & Harter, 2014), companies must also consider the challenges of staff motivation and engagement across their business systems. One novel approach to applying these dimensions in the digital economy, is by leveraging certain highly engaging game design elements and game mechanics typically derived from video games (Thom, Millen, & DiMicco, 2012). In order to further understand the motivational properties of these game design elements, and what this may signify for business systems, in the following section we focus on one of the most successful games currently in circulation called 'Clash of Clans' and the significance with its users.

1.2 Generation 'Clash of Clans'

Clash of Clans originally developed by Finnish company Supercell (Carayannis & Rakhmatullin, 2014), is both outperforming and outranking in terms of downloads and active users, most other titles in the gaming industry, including well renowned Candy Crush Saga (Erturkoglu, Zhang, & Mao, 2015).

The game's success is such that it has displaced traditional Massively Multiplayer Online Game (MMOG) behemoth World of Warcraft which held a record breaking 12 million users at its peak (Lee et al., 2011). In contrast, Supercell have an estimated 29 million active daily users across their gaming platforms, which in turn generate around $5 million in revenue each day (Cheng, 2014). This accessible and yet highly addictive strategy game represents a confounding success of mobile and gaming innovation in the digital economy. The largest segment of players in Clash of Clans comprise of Generation Y (GenY) participants (as shown in Figure 1). These individuals are highly adept with nascent technology, have grown to expect instant feedback, and espouse greater levels of self-determination (Connor et al., 2008; MacLeod & Clarke, 2009). Players immersed in Clash of Clans will also elect to dedicate anywhere between 30 minutes and 6 hours of gaming per day, whilst trying to earn virtual trophies, climb the leaderboard, and engage in battle quests (Supercell, 2014). However, these figures are in stark contrast to the levels of engagement and motivation of analogous employees in the workplace (O'Boyle & Harter, 2014). Thus, the game design elements employed to captivate and engage users in Clash of Clans, should be of significance for organisations wishing to engage their employees across their business systems in the digital economy.

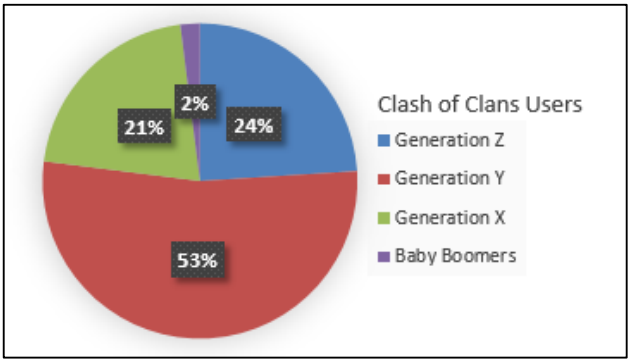

Figure 1: Clash of Clans by Gen. Identifier (adapted from newzoo data explorer)

1.3 The Disengaged Workforce

An overwhelming two thirds of staff are either not engaged or actively disengaged whilst at work costing the UK economy between £52 and £70 billion in lost productivity each year (O'Boyle & Harter, 2014). Such is the problem that the UK Secretary of State for Business, initiated an investigation which lead to the 2009 MacLeod 'Engagement for Success' report (MacLeod & Clarke, 2009). One particular aspect of the document outlined that younger employees "*want more out of work than simply a wage packet at the end of the week*" (ibid, p.29). Furthermore, GenY workers represent the least engaged of all the groups in the workplace (Adkins, 2015). This is particularly problematic for organisations that rely on a growing number of younger graduate employees who are less "*willing to abandon that desire for self-determination when they enter work*" (MacLeod & Clarke, 2009, p. 29).

As illustrated in Clash of Clans, GenY will elect to dedicate a considerable amount of time actively participating across a number of interactive, social, collaborative and competitive activities whilst immersed in video games (McGonigal, 2011; Supercell, 2014). This poses a distinct challenge for companies on how to design and implement business systems that may motivate and engage GenY staff. In response to these challenges there is increasing evidence that organisations such as Delloitte, Capgemini, IBM, and SAP for example, are introducing game design elements into their business systems (El-Masri et al., 2015; Hamari, Koivisto, & Sarsa, 2014; Herzig et al., 2012). Ultimately, towards motivating and engaging their employees, particularly GenY, across a multitude

of behavioural dimensions. This nascent process has come to be recognised as the 'Gamification' of internal employee business systems towards greater motivation and engagement across the enterprise.

In this section we have identified game design elements as particularly salient for business systems in order to motivate and engage, an otherwise disengaged generation of employees. Now a discussion on the conceptual background and understanding of gamification is presented. Particular relevance is focused on the concepts of business gamification and self-determination theory, followed by literary evidence of application in practice. The research and approach section outline the applied methodology followed by the analysis and findings. Finally the contributions are presented.

2. CONCEPTUAL BACKGROUND

2.1 Understanding Gamification

Gamification refers to the idea of incorporating a variety of game design elements, mechanics, dynamics, and behavioural approaches typically derived from video games to non-game contexts (Burke, 2014; Deterding et al., 2011; Hamari, Huotari, & Tolvanen, 2015; Kapp, 2012). Implementing games outside of traditionally recognised leisure activities, such as in a work environment, in itself is not a new phenomenon. One of the most notable applications of this approach to date has been through 'Serious Games'. However the concept of gamification should not be confused with serious games. Although some similarities can be drawn between serious games and gamification, and the terms in some scholarly articles have been used interchangeably (Richter, Raban, & Rafaeli, 2015), serious games and gamification however are not one and the same (Landers et al., 2015). Serious games present an embodiment of a game, as in the virtual representation often delivered as a 3D construct built on the same architecture as video games (such as the Unity game engine) which encompass levels of interactivity through a graphic user interface (Petridis et al., 2010). Where a video game might be centred on leisurely pursuits (Wood, Griffiths, & Parke, 2007), serious games however are generally developed for educational and training purposes (Michael & Chen, 2005). Gamification, in contrast to serious games, is not generally supported by a fully stimulatory environment developed through a game engine. Instead it proposes the adoption of game design elements typically derived from video games and applied to non-game contexts (Deterding et al., 2011), towards eliciting customer or employee engagement (Herger, 2014; Zichermann & Cunningham, 2011).

2.2 Business Gamification

Whilst gamification has been applied in a variety of organisational settings (Deterding, 2012; Khatib et al., 2011; King et al., 2013; Monu & Ralph, 2013; Singh, 2012), the concept itself can be delineated as either customer-focused or business-focused. Where a customer-focused approach to gamification is adopted, game design elements are normally used to engage consumers across a number of marketing approaches (Huotari & Hamari, 2012; Paharia, 2013; Zichermann & Cunningham, 2011). However where gamification is used in a business environment, this is referred to as 'Business Gamification' or 'Enterprise Gamification' and is typically focused on engaging and motivating employees (Herger, 2014; Mollick & Rothbard, 2013; Penenberg, 2013; Reeves & Read, 2013). In this context, gamification enables organisations focused on business issues, on providing meaningful methods in which to apply a range of motivational and engaging game design elements through their enterprise systems (Herzig et al., 2012; Rauch, 2013; Thom et al., 2012). The result and success of this type of gamification can vary depending on how these elements are applied across business systems, and the context in which they are adopted (Thom et al., 2012). One such factor of success is by establishing greater levels of self-determination through the application of intrinsic and extrinsic motivational factors (Hamari et al., 2014; Muntean, 2011; Ryan & Deci, 2000).

2.3 Self-Determination Theory & Gamification

As outlined in the MacLeod report (2009), self-determination is a particularly important dimension for GenY in the workplace. The concept of self-determination has a long research history, predominantly through the work of Ryan & Deci (2000) attributing dimensions of Competence, Relatedness and Autonomy as basic universal human requirements towards greater self-continuity (Sani, 2010). Essentially, these dimensions seek to provide levels of mastery, connection and independence in supporting basic human psychological needs, whilst not necessarily disconnecting individuals from collaborative activities (Deci & Vansteenkiste, 2004). Self-determination theory has more recently been the focus of human engagement and motivation research through the exploration of intrinsic and extrinsic values in gamified systems (Hamari et al., 2014; Nicholson, 2012). Engagement and motivation in self-determination theory state that, greater the levels of intrinsic motivation, as in an internalised or emotional stimuli, the greater the pull towards completing an activity (Ryan & Deci, 2000). In contrast, where activities are inherently driven by extrinsic motivation, these may motivate in the short-term but can also have a detrimental effect on the long term intrinsic motivational factors of an activity. Having reviewed the conceptual background to business gamification, we now outline our methodological approach and the context of our empirical research.

3. APPROACH & CONTEXT

3.1 Data Collection

This paper draws on ethnographic data collected over two years from both a system development, and a communication agency with a largely GenY workforce. From the onset of the research process, the agency was operating in a market with progressively diminishing margins, and required new and innovative ways to motivate and engage its employees towards increasing its competitive advantage. The lead researcher was able to observe and capture both the development and implementation of this gamified business system throughout the two years of fieldwork, during which the following key research question was examined; *If gamification is the use of game design elements in a non-game context, what are the properties of game design elements in gamified business systems*? The process of the project endeavoured both the system developer and the communication agency to work together in developing various strategies, game mechanics and game design elements. These would be implemented into a gamified business system that would not only facilitate the effective support of key business processes for the agency, but also provide a highly innovative and engaging platform for their employees.

4. ANALYSIS & FINDINGS

4.1 Self-Continuity

In this analysis we focus on the emergent properties of one of the most prominent game design element in the agency's gamified business systems. We use the concept of self-continuity (Sani, 2010) to specifically focus on a distinct game design element which embodies the reflection of the 'self' over time. This is particularly important as self-continuity elements can be recognised by individual achievements, badges, trophies, or evolutionary aspects of an online profile in a gamified business system or video game. For example one of the most prominent game design elements of self-continuity in the Clash of Clan video game, is through the leaderboard system (as show in Figure 2).

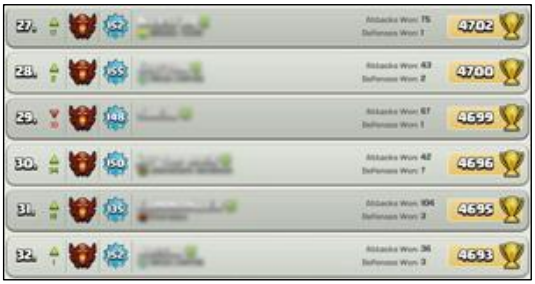

Figure 2: Clash of Clans Leaderboard System

Self-continuity in this context, represents the projection of the person's various achievements, goals and online profile over time. Social psychologist, Professor Sani states that "*we have a sense of self-continuity because inside us there truly is something that corresponds to a continuous self, something that is the subject of all our experiences*" (2010, p. 1). In the context of our empirical study we use this interpretation of self-continuity to identify the agency's Leaderboard system as a particularly salient game design element, and its significance for individual employees perpetuated with the self over time.

4.2 Leaderboard

The agency's Leaderboard system offers a visual representation of the top tier of system users identified as highflyers. Every time an employee logs into the gamified enterprise system, on the right side of the screen, prominently positioned is the leaderboard listing top achievers in a number of categories. Some of the metrics used in calculating the position of employees on the leaderboard are through various mechanics, dynamics and collaborative or participatory endeavours. The mechanics and rules which mediate the leaderboard system are such that all accumulated points are levelled at the end of the calendar year for every single employee in the company. This innovative game mechanic emerged from the design process, when the system developer and agency debated how to keep employees engaged throughout the leaderboard system. For example, when a number of highflyers were found to be consistently at the top of the leaderboard, this in turn proved challenging for other staff to gain recognition for their activities. Hitherto there was very little incentive for other staff to engage with the leaderboard system.

4.3 Motivational Properties

What transpires from our analysis, is that the motivational properties of the leaderboard is much higher for employees who engage with the gamified business system nearer the start of the calendar year. This is especially significant as this is when all active employees essentially commence their journey together through the digital infrastructure, as everyone's points begin variably at the same level. This provides an element of commonality and community, and reinforces the cultural ethos of '*we are in this together*', which the agency tries to foster towards synergised collaboration through the business system. Everyone starts the game with the same abilities and opportunities at that stage, and the empirical evidence suggest that during this period, the motivational properties through the leaderboard system are very high. Individual employees are hoping to get recognised and gain *kudos* from their colleagues. However when running the same analysis with employees who join the company at a later stage the findings reveal different engagement properties.

4.4 Emerging Affordance

The agency employ new staff at different times of the year, as it is sensible to recognise that businesses generally do not only recruit new staff at year start. Staffing is a constant

organisational process due to factors such as expansion, new projects or natural attrition. When analysing specific interviews with employees who joined the agency mid-term, a common theme of disengagement with the leaderboard system emerges. For example in one case an employee joined the company in September, at that stage the leaderboard highflyers were well established having earned points and rewards for their activities across the gamified business system during the previous eight months. In this case the employee's engagement with the leaderboard system was very low.

> *"…there's no incentive for me to try and climb the leaderboard, have you seen where [name anonymised] is, look at how many [points] he has, how am I going to beat that?"*

The challenge in earning enough points to get listed in any meaningful way on the system by employees joining mid-term, and therefore have their work activities and engagement with the gamified business system recognised, is perceived as being unsurmountable through the leaderboard. In this case a low level of engagement is afforded by properties of that game design element over time, which not only has the counterintuitive effect of disengaging certain members, but also impacts overall self-continuity of individual employees. Here, the leaderboard offers varying degrees of motivation and engagement depending on its temporal context rather than its situational setting. This analysis into the leaderboard provides us with an insight into the emergent properties of game design elements from the design process, to the affordance between the employee and the gamified business system. These emergent properties are also found to originate from the design process, but also from the rules and engagement pull factor instantiated from the activities by colleagues within this business system.

4.5 Temporal Dimensions

Through our analysis the empirical data suggests temporal dimensions for game design elements in a gamified business system. Where a game element which provides the same function over time may be perceived differently and therefore affects the levels of motivation and ultimately the levels of employee engagement through the business system. This analysis offers implications in our understanding of the role and impact of game design elements for levels of employee engagement through a gamified business system.

5. CONTRIBUTIONS

5.1 Limitations

Although this research provides an insight into understanding game design element properties in a gamified business system, it is not without limitations. Using self-continuity we analysed a specific game design element over time, however further research might engage in a wider analysis of congruent elements.

5.2 Emergent Properties

In this particular study, our findings suggests that game design elements exhibit emergent properties which can be situated in both the design and development process, but also by the instantiation from the activities of the users. These implication for practice provide a particularly salient insight into the emergent properties of game design element, where stakeholders tasked with developing specific elements of engagement as part of a wider business system, may not foresee the actual levels of engagement or motivational affordance. For research, this alludes to a continual and evolving process of examining properties of game design elements, and also how these can exhibit alternative emergent properties beyond their original design.

5.3 Implications

In summary, our contributions for knowledge in this research suggest that game design elements not only exhibit alternative emergent properties as a result of the interactions through the activities they support, but also how these mediate levels of motivation and engagement with a business system. This is prominent for practice, where organisations facing challenges in better engaging and motivating their workforce (Burke, 2014; Deterding, 2012; O'Boyle & Harter, 2014; Rauch, 2013), need to respond to system design challenges (Zhang, 2008). We therefore conclude by suggesting a dimension of *emergence* of game design elements, in the gamification of business systems to engage the workforce in the digital age.

REFERENCES

Adkins, A. (2015). Majority of U.S. Employees Not Engaged Despite Gains in 2014. Retrieved 28 January, 2015, from http://bit.ly/1uUCjpX

Briscoe, G., & Marinos, A. (2009). *Digital ecosystems in the clouds: towards community cloud computing.* Paper presented at the Digital Ecosystems and Technologies, 2009. DEST'09. 3rd IEEE International Conference on.

Burke, B. (2014). *Gamify: How gamification motivates people to do extraordinary things*: Bibliomotion, Inc.

Carayannis, E. G., & Rakhmatullin, R. (2014). The Quadruple/Quintuple Innovation Helixes and Smart Specialisation Strategies for Sustainable and Inclusive Growth in Europe and Beyond. *Journal of the Knowledge Economy, 5*(2), 212-239.

Cheng, R. (2014). How Clash of Clans' clan wars got me addicted all over again. Retrieved 26 April, 2014, from http://cnet.co/1HMpXZl

Ciborra, C. (2000). *From control to drift: the dynamics of corporate information infastructures*: Oxford University Press.

Ciborra, C., & Hanseth, O. (1998). From tool to Gestell: Agendas for managing the information infrastructure. *Information Technology & People, 11*(4), 305-327.

Connor, H., Shaw, S., Shaw, S., & Fairhurst, D. (2008). Engaging a new generation of graduates. *Education+ Training, 50*(5), 366-378.

Deci, E. L., & Vansteenkiste, M. (2004). Self-determination theory and basic need satisfaction: Understanding human development in positive psychology. *Ricerche di Psicologia*.

Deterding, S. (2012). Gamification: designing for motivation. *interactions, 19*(4), 14-17.

Deterding, S., Dixon, D., Khaled, R., & Nacke, L. (2011). *From game design elements to gamefulness: defining gamification.* Paper presented at the Proceedings of the 15th International Academic MindTrek Conference: Envisioning Future Media Environments.

El-Masri, M., Tarhini, A., Hassouna, M., & Elyas, T. (2015). *A design science approach to Gamify education: From games to platforms.* Paper presented at the Twenty-Third European Conference on Information Systems (ECIS).

Erturkoglu, Z., Zhang, J., & Mao, E. (2015). Pressing the Play Button: What Drives the Intention to Play Social Mobile Games? *International Journal of E-Business Research (IJEBR), 11*(3), 54-71.

Hamari, J., Huotari, K., & Tolvanen, J. (2015). Gamification and Economics. *The gameful world: Approaches, issues, applications*, 139.

Hamari, J., Koivisto, J., & Sarsa, H. (2014). *Does Gamification Work?—A Literature Review of Empirical Studies on Gamification.* Paper presented at the Proceedings of the 47th Hawaii International Conference on System Sciences. HICSS.

Herger, M. (2014). *Enterprise Gamification: Engaging People by Letting Them Have Fun*: CreateSpace Independent Publishing Platform.

Herzig, P., Ameling, M., & Schill, A. (2012). *A generic platform for enterprise gamification.* Paper presented at the Software Architecture (WICSA) and European Conference on Software Architecture (ECSA), 2012 Joint Working IEEE/IFIP Conference on.

Huotari, K., & Hamari, J. (2012). *Defining gamification: a service marketing perspective.* Paper presented at the Proceeding of the 16th International Academic MindTrek Conference.

Kapp, K. M. (2012). *The Gamification of Learning and Instruction: Game-based Methods and Strategies for Training and Education*: Wiley.

Khatib, F., DiMaio, F., Cooper, S., Kazmierczyk, M., Gilski, M., Krzywda, S., . . . Popović, Z. (2011). Crystal structure of a monomeric retroviral protease solved by protein folding game players. *Nature structural & molecular biology, 18*(10), 1175-1177.

King, D., Greaves, F., Exeter, C., & Darzi, A. (2013). 'Gamification': Influencing health behaviours with games. *Journal of the Royal Society of Medicine, 106*(3), 76-78.

Landers, R. N., Bauer, K. N., Callan, R. C., & Armstrong, M. B. (2015). Psychological theory and the gamification of learning *Gamification in education and business* (pp. 165-186): Springer.

Lee, Y.-T., Chen, K.-T., Cheng, Y.-M., & Lei, C.-L. (2011). *World of Warcraft avatar history dataset.* Paper presented at the Proceedings of the second annual ACM conference on Multimedia systems.

MacLeod, D., & Clarke, N. (2009). Engaging for success: enhancing performance through employee engagement: a report to government.

McGonigal, J. (2011). *Reality is broken: Why games make us better and how they can change the world*: Penguin.

Michael, D. R., & Chen, S. L. (2005). *Serious games: Games that educate, train, and inform*: Muska & Lipman/Premier-Trade.

Mollick, E. R., & Rothbard, N. (2013). Mandatory Fun: Gamification and the Impact of Games at Work. *The Wharton School Research Paper Series*.

Monu, K., & Ralph, P. (2013). Beyond Gamification: Implications of Purposeful Games for the Information Systems Discipline. *arXiv preprint arXiv:1308.1042*.

Muntean, C. I. (2011). *Raising engagement in e-learning through gamification.* Paper presented at the Proc. 6th International Conference on Virtual Learning ICVL.

Nicholson, S. (2012). A user-centered theoretical framework for meaningful gamification. *Games+ Learning+ Society, 8*(1).

O'Boyle, E., & Harter, J. (2014). State of the global workplace: Employee engagement insights for business leaders worldwide: Gallup.

Paharia, R. (2013). *Loyalty 3.0: How to revolutionize customer and employee engagement with big data and gamification*: McGraw Hill Professional.

Penenberg, A. L. (2013). *Play at Work: How games inspire breakthrough thinking*: Hachette UK.

Petridis, P., Dunwell, I., De Freitas, S., & Panzoli, D. (2010). *An engine selection methodology for high fidelity serious games.* Paper presented at the Games and Virtual Worlds for Serious Applications (VS-GAMES), 2010 Second International Conference on.

Rauch, M. (2013). Best practices for using enterprise gamification to engage employees and customers *Human-Computer Interaction. Applications and Services* (pp. 276-283): Springer.

Reeves, B., & Read, J. L. (2013). *Total engagement: How games and virtual worlds are changing the way people work and businesses compete*: Harvard Business Press.

Richter, G., Raban, D. R., & Rafaeli, S. (2015). Studying Gamification: The Effect of Rewards and Incentives on Motivation *Gamification in education and business* (pp. 21-46): Springer.

Ryan, R. M., & Deci, E. L. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *American Psychologist, 55*(1), 68.

Sani, F. (2010). *Self continuity: Individual and collective perspectives*: Psychology Press.

Singh, S. (2012). Gamification: A Strategic Tool for Organizational Effectiveness. *International Journal of Management, 1*(1), 108-113.

Skilton, M. (2015). *Building the Digital Enterprise*: Palgrave Macmillan.

Strader, T. J., Lin, F.-R., & Shaw, M. J. (1998). Information infrastructure for electronic virtual organization management. *Decision Support Systems, 23*(1), 75-94.

Supercell. (2014). How Often Do You Play Clash Of Clans? (On Average A Day). Retrieved 7 December, 2014, from http://bit.ly/1ML7s97

Thom, J., Millen, D., & DiMicco, J. (2012). *Removing gamification from an enterprise SNS.* Paper presented at the Proceedings of the ACM 2012 conference on Computer Supported Cooperative Work.

Wood, R. T., Griffiths, M. D., & Parke, A. (2007). Experiences of time loss among videogame players: An empirical study. *CyberPsychology & Behavior, 10*(1), 38-44.

Zhang, P. (2008). Technical opinion Motivational affordances: reasons for ICT design and use. *Communications of the ACM, 51*(11), 145-147.

Zichermann, G., & Cunningham, C. (2011). *Gamification by Design: Implementing Game Mechanics in Web and Mobile Apps*: O'Reilly Media.

AUTHOR CONTACT DETAILS

Nicholas Dacre, Panos Constantinides & Joe Nandhakumar.
Warwick Business School, University of Warwick, United Kingdom.
nicholas.dacre@mail.wbs.ac.uk

TOWARDS A SOCIO-TECHNICAL THEORETICAL FRAMEWORK FOR ENTERPRISE GAMIFICATION

Umar Ruhi

ABSTRACT

Purpose: This paper discusses an ongoing research investigation pertaining to enterprise gamification. The author proposes a theoretical framework for investigating key individual, organizational and technological factors that are posited to be important determinants of effective gamification initiatives in organizations.

Design/methodology/approach: The planned empirical investigation in this study comprises a quantitative methodology with an online survey questionnaire that will be administered to employees and management teams in organizations with current gamification initiatives. The analysis of survey responses will be performed using exploratory factor analysis and structural equation modelling (SEM) techniques.

Findings: The expected contributions of this research include an improved understanding of cognitive, affective and conative aspects of using gamification technologies in a work context. The research findings from this planned study are expected to provide valuable insights on key success factors for the effective adoption and institutionalization of enterprise gamification initiatives in organizations.

Originality/value: The planned research investigation seeks to explicate technology key success factors and management best practices for gamification based interventions in the enterprise which are currently lacking in both academic and industry literature.

Keywords: Enterprise Gamification; Socio-Technical Research; Organizational Commitment; Employee Engagement; Psychological Climate

1. INTRODUCTION

As a relatively new technology based intervention, gamification refers to the process of incorporating game-like elements in non-game contexts with the aim of driving positive behavioral outcomes among target audience (Deterding et al., 2011; Hamari et al., 2014; Huotari and Hamari, 2012). In an enterprise setting, gamification techniques may be applied to engage employees in helping an organization realize business process improvements, service efficiencies, talent development, innovative research ideas, and constructive collaboration practices (Buggie et al., 2014; Hense et al., 2014; Meister, 2013; Werbach, 2014; Ruhi, 2015). For the purpose of this paper, the author draws upon his previous research on meaningful enterprise gamification to refer to *"corporate scenarios where game thinking and game-based tools are being used in a strategic manner to integrate with existing business processes or information systems, and these techniques are being used to help drive positive employee and organizational outcomes"* (Ruhi, 2015).

While many potential benefits of enterprise gamification have been discussed in the academic and practitioner literature, some early adopters have reported failures with their gamification initiatives. Consequently, researchers and experts have advised that businesses not deploy gamification initiatives it in a knee-jerk fashion to coerce behaviour and outcomes. Rather, organizations and leaders are urged to understand the business case for gamification, appreciate the opportunities and limitations associated with it, and approach the implementation of technologies within the firm's specific organizational and individual context. Attention has been drawn to factors such as user experience, employee motivations, and organizational culture – all key to the successful adoption of enterprise gamification programs. However, owing to the novel nature of gamification and its emergent corporate use-cases, there is a general dearth of academic and industry literature explaining these issues (Deterding et al., 2013; Hamari et al., 2014).

The proposed study aims to address this research gap by explicating technology key success factors and management best practices for gamification based interventions in the enterprise. Toward this, the research investigation would explore cognitive, affective and conative aspects of using gamification technologies in a work context, and study the effects of these technologies on user experience, organizational culture, employee engagement, and commitment.

Our planned methodology is geared towards explaining how gamification leverages human psychology using technology platforms and motivates individual behaviours that drive organizational outcomes. In doing so, this study will be among the first to undertake an empirical investigation based on currently operating gamification programs across various organizations and industry sectors. Data will be collected from employees and management teams in organizations with current gamification initiatives. Through exploratory factor analysis and structural equation modelling techniques, we aim to develop and validate psychometric measurements and path models that can be applied to assess gamification interventions in terms of the factors that affect the success of these initiatives and their subsequent performance outcomes for individuals and organizations.

In addition to being among the first in answering the call for empirical research on gamification, this study aims to provide important practical implications. It hopes to assist in a rethink of gamification platforms as holistic sociotechnical systems rather than narrowly defined software systems. The research findings can potentially aid in the development of game mechanics that translate into positive user experiences and foster higher levels of employee engagement. Furthermore, our research findings will provide insights on key success factors for the effective adoption and institutionalization of enterprise gamification initiatives in organizations, and subsequently help them enhance the performance of their employees and drive positive business outcomes.

2. RESEARCH OBJECTIVES

Despite its touted benefits, little is known about the individual and organizational factors that determine the success or failure of enterprise gamification initiatives (Hamari and Koivisto, 2013; Hamari et al., 2014). According to a recent systematic review of the academic literature on gamification, Hamari et al. (2014) noted that only a few studies have attempted to evaluate the effectiveness of gamification through rigorous empirical research, and of these, many have yielded contradicting findings.

In addition to the above, human computer interaction (HCI) researchers have stressed the need for academics and practitioners to consider features and functions of gamification technologies vis-à-vis user experience processes that drive engagement at cognitive and affective levels (Nicholson, 2012; Deterding et al., 2013). Current industry literature on this subject usually only offers advice for adding gamification as a bolt-on application or service for existing business processes (Ferrera, 2012; Zichermann and Cunningham, 2011). This proposed research is concerned with addressing the current gap in the academic and industry literature through three objectives as outlined below.

1) *Measure fit between game design elements and pertinent user experience dimensions:*

To our knowledge, currently, there are no academic studies that have formally validated linkages between game design elements such as points, badges and leaderboards, and user experience (UX) dimensions such as usability, affect, and value (Park et al., 2013) through an empirical investigation. Furthermore, to study the full range of interactions that users have with gamification features, HCI researchers have emphasized the need for quantification of user experience in a gamification context (Park et al., 2013; Deterding et al., 2013). Our proposed research aims to answer this call.

2) *Examine the mediating role of employee engagement as a multidimensional construct that drives intended positive behavioral outcomes through enterprise gamification:*

The industry has many encouraging accounts from organizations that have successfully deployed enterprise gamification platforms to inspire higher levels of employee engagement (Buggie et al.,

2014; Palmer et al., 2012; Wang, 2011). However, research that provides an empirically grounded explanation of the motivation process driven by gamification tools is currently sparse (Deterding et al., 2013; Hamari et al., 2014). In this study, we aim to model and validate the mediating role of engagement as a cognitive and emotional manifestation of an employee's motivation, and to study its relationship with behavioral outcomes such as workplace commitment and individual intention to use gamification technologies.

3) *Clarify the role of psychological climate as an enabling factor for driving employee engagement and positive behavioral outcomes through gamification:*

As such, the introduction of gamification technologies in the workplace constitutes a significant change in the organization's operating model. Research in organizational psychology has shown that organizational contexts have an important role to play in any transformation or change initiatives (Martin et al., 2005; Hamzeh and Bergstrom, 2010), of which enterprise gamification is an example. To our knowledge, to date, no research studies have investigated the role of organizational environment in shaping behavior through gamification initiatives. In this study, we aim to empirically validate the role of psychological climate as an organizational environment construct to analyze whether employee perceptions of workplace characteristics can be shaped through gamification initiatives, and to determine the correlation between employee-ascribed workplace attributes and outcomes of gamification programs.

3. THEORETICAL FRAMEWORK

The theoretical framework shown in *Figure 1* below depicts the overall orientation of this study and the core ideas that underpin the research investigation. The components of the conceptual framework are outlined in this section.

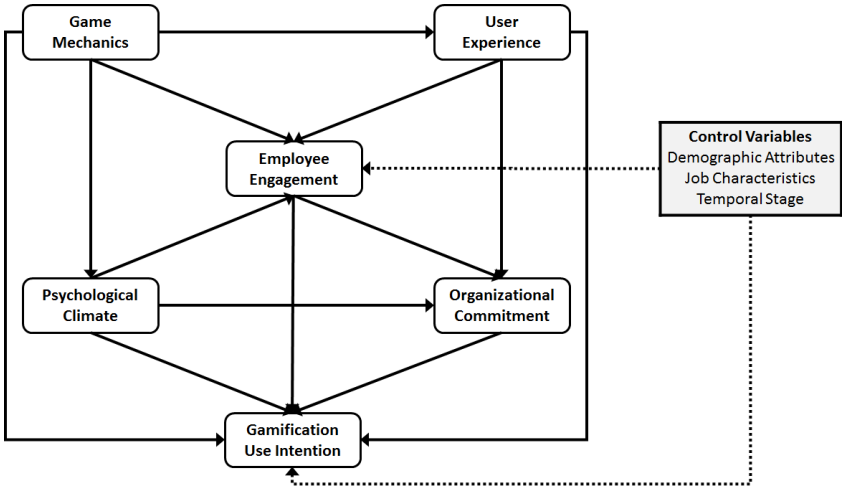

Figure 1: Theoretical Framework for This Study

Game Mechanics and *User Experience* constitute the *technographic constructs* in the theoretical framework. Game mechanics refers to the various actions, behaviors, and control mechanisms that are integrated with non-game activities and processes (Sicart, 2008). Processes imbued with these game-like elements have the potential to create a positive and compelling user experience. User experience constitutes a multi-dimensional construct that captures the users' overall perceptions and feelings about their interaction with the technology. Sub-dimensions of user experience include usability, affect, and user value (Park et al., 2013). In the context of gamification, part of the user experience relates to the cognitive and emotional effects of game mechanics that help drive user

behavior. These effects are referred to as game dynamics (Hunicke et al., 2004), and they contribute towards the overall subjective user experience of individual participants.

Employee Engagement is at the core of any enterprise gamification initiative (Deterding et al., 2013; Palmer et al., 2012), and the link between employee engagement and business performance is well documented (Buggie et al., 2014). In the proposed theoretical framework, employee engagement is posited to play an important role as a mediating construct between gamification initiatives and the behavioral outcomes for their participants. Through links between engagement and game mechanics and user experience, engagement is conceptualized to be a manifestation of motivational elements (such as game dynamics). This is in line with prior research showing that engagement cannot be separated from the environment in which the user interactions occur (Fredricks and McColskey, 2012).

Organizational Commitment relates to an employee's attachment, identification and involvement with the organization (Meyer and Allen, 1991). It also represents an individuals' belief in the organization's goals and their desire to exert considerable effort on behalf of the organization (Morrow, 1983). In the theoretical framework, organizational commitment is posited to be a consequent of user experience and employee engagement. This will allow it to be validated as an indicator of the efficacy of gamification initiatives in driving positive employee behaviour, and as a mediating variable that affects employee intentions to continue using gamification technologies on a voluntary basis.

Psychological Climate is used in this theoretical model as a construct that characterises the organizational culture (Brown and Leigh, 1996). Extant research has demonstrated it to be a critically important factor that impacts workplace attitudes and behaviors (O'Neill and Arendt, 2008). In the proposed theoretical framework, psychological climate is posited to be linked to employee engagement and employee intentions to continue using gamification technologies. Findings from previous research show that organizational contexts play an important role in business transformation and change initiatives (Hamzeh and Bergstrom, 2010; Martin et al., 2005), and enterprise gamification can be classified as such an undertaking (Buggie et al., 2014; Palmer et al., 2012).

Gamification Use Intention is positioned as the ultimate consequent variable in the theoretical framework. This is aligned with other theoretical models in the information systems literature including the technology acceptance model (TAM) (Davis, 1989; Davis et al., 1989) and the IS success model (DeLone and McLean, 2003; 1992).

Lastly, the theoretical framework includes various control variables that will be investigated in terms of their interaction effects on employee engagement and gamification use intention variables. Inclusion of demographic attributes as control variables will help answer questions such as whether gamification is only suitable for certain age groups (e.g. Gen Y). To investigate the effect of novelty, the model includes temporal stage as a moderating variable. Many critics of gamification contend that these technologies are only successful in the initial stages after their launch, and as novelty wears out, so does the participation in such initiatives. It is also posited that job characteristics (job autonomy, variety etc.) would be important moderating variables in determining the success of gamification on employee engagement.

4. PLANNED RESEARCH METHODOLOGY

4.1 Data Collection & Sampling Frame

Quantitative data will be collected from participating organizations through web-based survey questionnaires administered to employees and management teams in organizations with current gamification initiatives.

The study will draw samples of respondents from a diverse cross section of organizations that have implemented gamification initiatives. The principal investigator has already sought cooperation from multiple potential organizations experimenting with gamification initiatives in Canada. Additional organizations across various industry sectors will be approached for potential participation in the research study.

A purposive sampling procedure will be used to select diverse gamification programs that vary in their business process context, time maturity, and the nature of game design features deployed as part of the initiative. Additionally, we will solicit participation from employees with varying levels of exposure to gamification programs.

4.2 Survey Resource Instrument & Construct Measurement

The survey instrument for quantitative data collection will comprise demographic information questions, technographic behavioral items, questions about work atmosphere, and psychographic perceptions based questions. While the demographic and technographic sections of the survey will be operationalized through direct questions consisting of an inventory of possible responses, the questions pertaining to other constructs in the theoretical framework will be operationalized using psychometric scales with responses on a Likert-scale and through categorical response type questions. Most measurement items pertaining to the theoretical constructs will be adapted from scales that have been previously used and validated in other research studies. The key variables in this study will be measured using the following scales:

- *Game Mechanics* data will be collected by creating an inventory of popular gamification tools and features used across gamification platforms. These include features such as points, badges, leaderboards, feedback mechanisms, and goal setting features. Survey items pertaining to the availability, efficacy, and level of use of these tools and features will use a 7-point scale ranging from “Use Very Rarely” to “Use Very Frequently”. The quality of the features and functions in the game mechanics inventory will be assessed using pertinent indicators from the Information Systems (IS) Success model (DeLone and McLean, 2003; 1992) and the Task-Technology Fit (TTF) scale (Goodhue, 1998).
- *User Experience* will be operationalized as a multi-dimensional construct. Generic indicators pertaining to elements such as usability, affect and user value will be used from the User Experience (UX) hierarchical dimensions suggested by Park et al. (2013). Additionally, we will develop our own measures by including self- and social-elements of gamification platforms (Huang and Soman, 2013) and elements from the Mechanics, Dynamics and Aesthetics (MDA) framework (Hunicke et al., 2004; LeBlanc, 2005).
- *Employee Engagement* will be measured using the short form of the Utrecht Work Engagement Scale (UWES-9) (Schaufeli et al., 2006) and the ISA (Intellectual, Social, Affective) engagement scale (Soane et al., 2012).
- *Psychological Climate* will be operationalized using indicators from the Psychological Climate Measure (PCM) (Brown and Leigh, 1996).
- *Organizational Commitment* will be measured using items from the organizational commitment scale (OCS) (Mowday et al., 1979).
- *Gamification Use Intention* will be operationalized using the IS continuance intention scale developed by Bhattacharjee (2001).
- *Control Variables* in the research framework will be operationalized as follows. Demographic Attributes data will be collected through questions about the respondents’ age, gender, education, and occupation. Information about the time since launch of the gamification program (*temporal stage*) will be obtained through self-reported responses as well as data from the participating organization’s project teams. Finally, *Job Characteristics* will be measured using the attributes

suggested in the widely used Job Diagnostic Survey (Hackman and Oldham, 1975) and the Job Characteristics Inventory (Sims et al., 1976).

4.3 Data Analysis Procedures

Demographic and technographic variables will be analyzed using a selection of statistical analysis techniques including descriptive statistics, non-parametric statistical tests, cluster analysis, and contingency table analysis procedures.

Exploratory factor analysis will be used to assess the validity of various measures incorporated in the survey resource instrument and to subsequently recalibrate the instrument with the valid indicators. These procedures will also be used to ascertain the dimensionality of various newly conceptualized constructs in the theoretical framework, including the user experience construct.

The theoretical model will be analyzed in its full form using component-based structural equation modeling (SEM) to test statistical conclusion validity, estimate the measurement model, and analyse the structural model. Component-based SEM approach is suited to this study since it allows for predictive analysis in an exploratory setting (Chin, 1998; Anderson and Gerbing, 1988).

5. EXPECTED CONTRIBUTIONS & CONCLUSION

While gamification technologies and related management interventions hold great promise, as a subject area, enterprise gamification remains largely unexplored, especially from an empirical research standpoint. The proposed research seeks to remedy this current state by investigating enterprise gamification initiatives in terms of their socio-technical determinants as outlined in the posited theoretical framework.

The planned research is original in several ways. First, it investigates the promising innovation of gamification that is top of mind for many fortune 500 companies (Buggie et al., 2014; Post, 2014). The study seeks to explicate technology key success factors and management best practices for gamification based interventions in the enterprise which are currently lacking in both academic and industry literature (Rauch, 2013; Kumar, 2013; Burke, 2014). Second, the study aims to investigate and assess the multi-dimensional nature of the user experience (UX) construct which is an under-researched area in human computer interaction (Cowan and Jack, 2011; Law and van Schaik, 2010; Park et al., 2013). Third, this study aims to clarify the role of psychological climate, an organizational culture factor that has been discussed in the organizational psychology literature, and has been shown to shape individual behavior in a variety of business transformation initiatives.

In addition to its potential theoretical contributions, the proposed research also expects to offer important implications for practice. The outputs of this research program have the potential to advance an understanding of organizational objectives that can be satisfied through the implementation of gamification platforms. Furthermore, the research findings can aid in the development of game mechanics that can translate into positive user experience and foster higher levels of employee engagement. Finally, our research findings will provide insights on key success factors for the effective adoption and institutionalization of enterprise gamification initiatives in organizations, and subsequently help them enhance the performance of their employees and drive positive business outcomes.

REFERENCES

Anderson, J.C. and Gerbing, D.W. (1988) Structural equation modeling in practice: A review and recommended two-step approach. Psychological Bulletin. 103 (3) pp. 411–423

Bhattacherjee, A. (2001) Understanding Information Continuance: An Expectation-Confirmation Model. MIS Quarterly, 25 (3): 351–370

Brown, S.P. and Leigh, T.W. (1996) A new look at psychological climate and its relationship to job involvement, effort, and performance. The Journal of applied psychology, 81 (4): 358–368

Buggie, M., Pluck, E. and James, E. (2014) Enterprise Gamification: Playing to win. New York, NY, USA

Burke, B. (2014) Redefine Gamification to Understand Its Opportunities and Limitations. Stamford, CT, USA

Chin, W.W. (1998) Issues and Opinion on Structural Equation Modeling. MIS Quarterly, 22 (1): pp. 7–16

Cowan, B.R. and Jack, M.A. (2011) Exploring the wiki user experience: The effects of training spaces on novice user usability and anxiety towards wiki editing. Interacting with Computers, 23 (2): 117–128

Davis, F.D. (1989) Perceived usefulness, perceived ease of use, and user acceptance of information technology. MIS Quarterly, 13 (3): 319–340

Davis, F.D., Bagozzi, R.P. and Warshaw, P.R. (1989) User Acceptance of Computer Technology: A Comparison of Two Theoretical Models. Management Science, 35 (8): 982–1003

DeLone, W.H. and McLean, E.R. (1992) Information Systems Success: The Quest for the Dependent Variable. Information Systems Research. 3 (1) pp. 60–95

DeLone, W.H. and McLean, E.R. (2003) The DeLone and McLean Model of Information Systems Success : A Ten-Year Update. Journal of Management Information Systems, 19 (4): 9–30

Deterding, S., Björk, S.L., Nacke, L.E., et al. (2013) “Designing gamification: creating gameful and playful experiences.” In CHI ’13 Extended Abstracts on Human Factors in Computing Systems on - CHI EA '13. New York, NY, USA. 2013. ACM Press. pp. 3263–3266

Deterding, S., Dixon, D., Khaled, R., et al. (2011) “From game design elements to gamefulness: defining gamification.” In Proceedings of the 15th International Academic MindTrek Conference on Envisioning Future Media Environments - MindTrek ’11. New York, NY, USA. 2011. ACM Press. pp. 9–15

Ferrera, J. (2012) Playful Design: Creating Game Experiences in Everyday Interfaces. New York, NY, USA: Rosenfeld Media

Fredricks, J.A. and McColskey, W. (2012) “The measurement of student engagement: A comparative analysis of various methods and student self-report instruments.” In Handbook of research on student engagement. Springer. pp. 763–782

Goodhue, D.L. (1998) Development and measurement validity of a task-technology fit instrument for user evaluations of.. Decision Sciences, 29 (1): 105–138

Hackman, J.R. and Oldham, G.R. (1975) Development of the Job Diagnostic Survey. Journal of Applied Psychology. 60 (2) pp. 159–170

Hamari, J. and Koivisto, J. (2013) “Social motivations to use gamification: an empirical study of gamifying exercise.” In Proceedings of the 21st European Conference on Information Systems SOCIAL. 2013. pp. 1–12

Hamari, J., Koivisto, J. and Sarsa, H. (2014) “Does Gamification Work? -- A Literature Review of Empirical Studies on Gamification.” In 2014 47th Hawaii International Conference on System Sciences. January 2014. IEEE. pp. 3025–3034

Hamzeh, F. and Bergstrom, E. (2010) “The Lean Transformation: A Framework for Successful Implementation of the Last Planner System in Construction.” In International Proceedings of the 46th Annual Conference of Associated Schools of Construction. Boston, MA, USA. 2010. pp. 1–8

Hense, J., Klevers, M., Sailer, M., et al. (2014) “Using Gamification to Enhance Staff Motivation in Logistics.” In Meijer, S.A. and Smeds, R. (eds.) Frontiers in Gaming Simulation. Lecture Notes in Computer Science. Springer International Publishing. pp. 206–213

Huang, W.H.Y. and Soman, D. (2013) Gamification Of Education, Research Report Series: Behavioural Economics in Action. Toronto, ON, Canada

Hunicke, R., LeBlanc, M. and Zubek, R. (2004) “MDA: A Formal Approach to Game Design and Game Research.” In AAAI Workshop on Challenges in Game AI, Nineteenth National Conference on Artificial Intelligence. 2004. pp. 1–5

Huotari, K. and Hamari, J. (2012) “Defining Gamification: A Service Marketing Perspective.” In Proceeding of the 16th International Academic MindTrek Conference. MindTrek ’12 New York, NY, USA. 2012. ACM. pp. 17–22

Kumar, J. (2013) “Gamification at Work: Designing Engaging Business Software.” In Marcus, A. (ed.) Design, User Experience, and Usability. Health, Learning, Playing, Cultural, and Cross-Cultural User Experience SE - 58. Lecture Notes in Computer Science. Springer Berlin Heidelberg. pp. 528–537

Law, E.L.-C. and van Schaik, P. (2010) Modelling user experience – An agenda for research and practice. Interacting with Computers. 22 (5) pp. 313–322

LeBlanc, M. (2005) “Game Design and Tuning Workshop.” In FuturePlay 2005 International Academic Conference on the Future of Game Design and Technology. East Lansing, MI. 2005

Martin, A.J., Jones, E.S. and Callan, V.J. (2005) The role of psychological climate in facilitating employee adjustment during organizational change. European Journal of Work and Organizational Psychology. 14 (3) pp. 263–289

Meister, J.C. (2013) How Deloitte Made Learning a Game. Harvard Business Review [online], 2. Available from: https://hbr.org/2013/01/how-deloitte-made-learning-a-g

Meyer, J.P. and Allen, N.J. (1991) A three-component conceptualization of organizational commitment. Human Resource Management Review. 1 (1) pp. 61–89

Morrow, P.C. (1983) Concept Redundancy in Organizational Research: The Case of Work Commitment. Academy of Management Review. 8 (3) pp. 486–500

Mowday, R.T., Steers, R.M. and Porter, L.W. (1979) The measurement of organizational commitment. Journal of Vocational Behavior. 14 (2) pp. 224–247

Nicholson, S. (2012) “A user-centered theoretical framework for meaningful gamification.” In Games+ Learning+ Society 8.0. Madison, WI, USA. 2012

O’Neill, B.S. and Arendt, L.A. (2008) Psychological Climate and Work Attitudes: The Importance of Telling the Right Story. Journal of Leadership & Organizational Studies. 14 (4) pp. 353–370

Palmer, D., Lunceford, S. and Patton, A.J. (2012) The Engagement Economy: How Gamification is Reshaping Business. Deloitte Review, 11: 51–69.

Park, J., Han, S.H., Kim, H.K., et al. (2013) Modeling user experience: A case study on a mobile device. International Journal of Industrial Ergonomics, 43 (2): 187–196

Post, R. (2014) Game on: could gamification help business change behaviour? The Guardian [online], 11 June. Available from: http://www.theguardian.com/sustainable-business/game-on-gamification-business-change-behavior

Rauch, M. (2013) “Best Practices for Using Enterprise Gamification to Engage Employees and Customers.” In Kurosu, M. (ed.) Human-Computer Interaction. Applications and Services SE - 31. Lecture Notes in Computer Science. Springer Berlin Heidelberg. pp. 276–283

Ruhi, U. (2015) Level Up Your Strategy: Towards a Descriptive Framework for Meaningful Enterprise Gamification. Technology Innovation Management Review, 5 (9): 1–16

Schaufeli, W.B., Bakker, A.B. and Salanova, M. (2006) The Measurement of Short Questionnaire A Cross-National Study. Educational and Psychological Measurement, 66 (4): 701–716

Sicart, M. (2008) Game Studies - Defining Game Mechanics Game Studies - Defining Game Mechanics. Game Studies, 8 (2): 1–15

Sims, H.P., Szilagyi, A.D. and Keller, R.T. (1976) The Measurement of Job Characteristics. Academy of Management Journal. 19 (2) pp. 195–212

Soane, E., Truss, C., Alfes, K., et al. (2012) Development and application of a new measure of employee engagement: the ISA Engagement Scale. Human Resource Development International, 15 (5): 529–547

Wang, R. (2011) Demystifying Enterprise Gamification for Business. San Francisco, CA, USA

Werbach, K. (2014) “(Re)Defining Gamification: A Process Approach.” In Spagnolli, A., Chittaro, L. and Gamberini, L. (eds.) Persuasive Technology. Lecture Notes in Computer Science [online]. Springer International Publishing. pp. 266–272

Zichermann, G. and Cunningham, C. (2011) Gamification by Design: Implementing Game Mechanics in Web and Mobile Apps. Sebastopol, CA, USA: O’Reilly Media Inc.

AUTHOR CONTACT DETAILS

Dr. Umar Ruhi
Telfer School of Management, University of Ottawa,
Ottawa, ON, Canada
umar.ruhi@uottawa.ca

GAMIFICATION OF BUSINESS TEACHING IN A HIGHER EDUCATION CONTEXT: AN EXPLORATORY CASE

Alexander K. Kofinas

ABSTRACT

Purpose: To investigate benefits of gamification in a Higher Education Context

Design/methodology/approach: An exploratory approach utilising an experiment as the research design. Two different cohorts studying the same subject; underwent the same assessment and completed the unit in the same time period: 15 weeks. Both cohorts had the same unit coordinator and were marked by the same unit team. The first cohort studied the subject without any attempts in gamifying delivery, the second cohort engaged with a gamified curriculum.

Findings: The cohort that engaged with a moderately gamified curriculum exhibited stronger final results and a higher level of engagement. The findings suggested that a gamified approach to curriculum delivery would increase the student engagement and the results. The pilot results informed the design of a bespoke software sponsored by the university to facilitate the gamification of educational activity for business education.

Originality/value: The gamification in the context of higher education does enhance student engagement and performance. The first pilot has led to the development of a bespoke software that is combining the successful elements of the pilot study with the lessons from the literature to support effectively a structured, gamified approach to education.

Key words: Higher Education, Gamification, Student Engagement, Business Education

1. INTRODUCTION: THE UK ACADEMIC CONTEXT

The British Higher Education context is rapidly morphing. The rise of fees in the UK Higher Education (hereinafter HE), the removal of student caps and the liberalisation of the sector (allowing new entrants such as BPP and Regent's University both for-profit institutions) are all factors that have increased the competition among HE institutions for students (Anonymous, 2014). Research on student experience demonstrates some apathy and disengagement among the student population as students seem to adopt a stance of entitlement for their education (Soilemetzidis et al., 2014).

The rapidly changing socio-economic context affecting the British HE institutions is one side of the dilemma, the other side is the pedagogical approach of HE institutions to education. The three-year long degree with its emphasis on textual information and its over-reliance to lectures and seminars may appear outdated to a younger generation, able to acquire information at a much faster pace and in a diversity of formats beyond text via social media and the Internet (Culkin et al., 2011, Kubler et al., 2010). HE institutions find their own existence challenged with questions about their impact (AACSB, 2008) and their approach to education, feedback, and learning (Nicol et al., 2006).

HE institutions have reacted to this challenge with a plethora of teaching approaches to rejuvenate the student learning experience. Blended learning, work-based learning, flipping the classroom, the MOOCs are just some of the fragmented facets of the HE response (Gibbs et al., 2009, Kubler et al., 2010). However, a promising pedagogical approach to this brave new world of HE is the game-based approach to teaching and learning; also known as gamification (often technology-enabled) of academic activities. The next section will provide a review of gamification in the academic context.

2. GAMIFICATION IN HIGHER EDUCATION

Games have moved into the mainstream (Alpert, 2007, Deterding et al., 2011) and their ability to engage and engross the players pose an interesting paradox. People are willing to commit enormous amounts of time and effort to play games and yet they may be disengaged from their studies in the case of students and work in the case of employees. A review of the literature reveals that the main components of game engagement could probably be distilled along the following four themes (Dickey, 2007, Landers et al., 2011, McClarty et al., 2012, Mead, 2010):

1. Rankings and Progression pathways that allow for continuous comparisons among players
2. Narratives and socialisation/collaboration that allows for immersion in the game environment
3. Scaffolded Learning with increasing Challenges (mastery) that allows for slow and yet gripping immersion to the game (the "just one more turn" symptom)
4. Immediate (Multi-Layered) Feedback which allows for continuous feedback on progress

A cursory examination of current higher education practice highlights that all four themes suggested above are inadequately addressed and gamification has the potential to deliver great benefits (McClarty et al., 2012). The rankings and progression pathways can be likened to formative and summative assessment, however they are typically delivered only twice or three times per semester and comparisons are not easily achieved as information is not publicly available. When it comes to the narrative: educational narratives are weak; assessments are not linked to a story or a meta-narrative; they are stand-alone items. The scaffolded learning with increasing challenges that tends to get the gamer addicted to the game Is not well developed in educational context, especially with the focus on education as independent study which often seems to excuse poorly designed material and poorly developed educational content (Nicol et al., 2006) . Finally, the feedback is not immediate with the average HE institution providing detailed feedback 3 weeks after submission of a summative assessment.

Pioneer academics within Higher Education have been experimenting with the gamification of the curriculum for many years. Examples abound from the incorporation of MMORPG mechanics in role-playing in the classroom (Susaeta et al., 2010) to simulations that use game mechanics (in particular rankings and scaffolded learning within a simulated world) (Dubbels, 2013). However, gamification attempts in Higher Education have proven to be challenging: often the educators adopt gamification principles rather mechanistically and in a piecemeal fashion (adopting only the point system and league tables; or a badges system) (McClarty et al., 2012). In other cases, the process is managed by technologists and there is too much focus on the mechanics of the gamified process that often ignores the underlying philosophy and pedagogy that should guide the gamified activity (Dickey, 2007, Wu et al., 2012). Not all games are appropriate for all academic activities and they have to be fit for purpose. That requires imagination, continuous feedback from the users and a continuous trial and error to fine-tune the activities (Landers et al., 2011, Hamari et al., 2014).

3. RESEARCH DESIGN

This exploratory research emerged as the course team faced a problem with the delivery of Business Research Skills (hereinafter BRS), a Level 5 HE module. Traditionally, students on this particular module performed very poorly with low attendance (especially for the seminars) ranging from 20%-40%. The October cohort 2013-14 was no exception and the poor results prompted action. The course team conducted an experiment (De Vaus, 2001) with the subsequent cohort, the February cohort of 2014 and added a gamification element. The following table compares the characteristics

of each cohort and it highlights the fact that the only dimension that differs substantially between the two cohorts is the addition of the gamification component:

Dimension	October Cohort 2013-14	February Cohort 2014
Period of Delivery	15 Weeks	15 Weeks
Number of students:	77 students	50 Students
Contact hours per student	36 hours	36 hours
Team Delivering the module	2 tutors	One additional tutor delivering the gamification element
Team Marking the module	2 tutors	Same team
Gamification Delivery per student	0 Hours	10 hours

Table 1: Comparison of the dimensions of each of the cohorts

Thus the two cohorts had similar profile before they were taught the module. The main outcome used to measure the effectiveness of the gamification component was the grade distribution. The assumption is that the gamified component was the main reason for any substantial differences noted between the two cohorts. The experimental research design is shown in Figure 1 below:

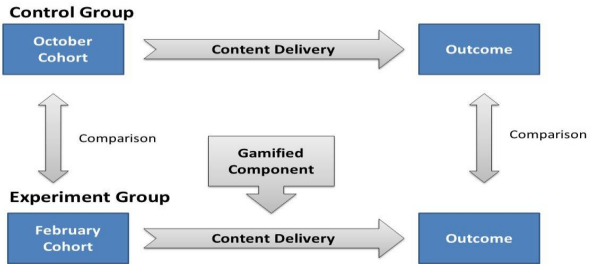

Figure 1: Experimental Research Design

The gamification component for the February cohort covered five seminar sessions; they were converted to a series of activities that together formed rounds on a competitive league engaging teams of students. Parallel to that there were individual scores.

The activities undertaken by the students of the experiment group as part of the gamification process were varied in order to a. taste a variety of skills and abilities. Quizzes were designed to test retention of knowledge, debates were used to test understanding of high-level concepts in research methodology and to practice rhetoric, while mini-presentations/vivas were utilised in order to test students' main ideas for research and their abilities to articulate them. In contrast to normal games the activities were diverse and were designed to purposefully test different skills and abilities thus ensuring that different teams would win each round. All these skills were relevant to the BRS module and were designed to prepare students to deliver the summative assessment successfully. Furthermore, the design of activities was such to ensure that different teams would have the chance to win each round and thus ensure that no team would dominate this competitive process.

4. DATA ANALYSIS

Below [Figure 2] an outline of four of the activities undertaken and team performance for each of the first four rounds:

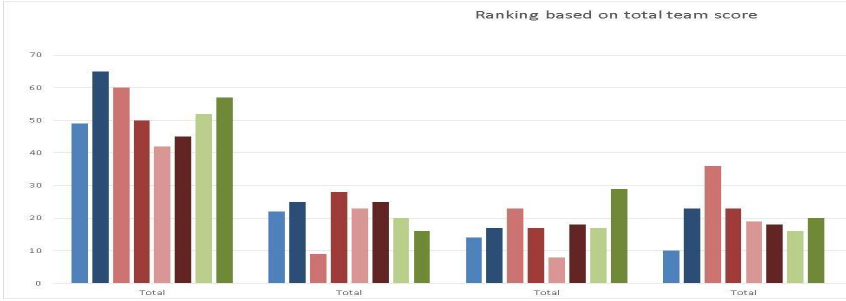

Figure 2: Score for each Team Activity

Each colour represents a different team and their results according to a point system. As we can see that there is a fluctuation with regards to the identity of the winning team scoring as different teams do better with different activities.

The relative grade distribution indicates a higher involvement from the February cohort and overall better results with a much higher proportion of 2:1/1st class module results in relation to the October cohort and far fewer failures proportionately [see Table 2 below].

February Cohort		
Classification	No. of Students	% of students
1st Class	2	4.00%
2:1 Class	11	22.00%
2:2 Class	10	20.00%
3rd Class	24	48.00%
FAIL	3	6.00%
Grand Total	50	100.00%

October Cohort 2013-2014		
Classification	No. of Students	% of Students
1st Class	3	3.90%
2:1 Class	7	9.09%
2:2 Class	30	38.96%
3rd Class	26	33.77%
FAIL	11	14.29%
Grand Total	77	100.00%

Table 2: Comparing grade distribution of the two cohorts

The average grade in the February cohort was 54% while in the October cohort the average grade was 47%; a substantial difference in assessment performance. With demographics being effectively the same, academic abilities similar, the marking team identical and the size of cohorts comparable the experimental intervention (gamification component) is most likely the reason for the substantial difference in performance

4. DISCUSSION

The comparison of the grade distribution between the two cohorts strongly indicates that gamification had a positive effect on student engagement. This outcome supports the literature on game-based learning which overall indicates that gamification does improve the engagement and performance of students (de Sousa Borges et al., 2014, Hamari et al., 2014, Wu et al., 2012).

The design of diverse gamified activities bore fruits. Different individuals and different teams won each round thus indicating that the challenges were not based on same kind of knowledge base and/or ability. Attendance increased, engagement increased and the actual performance was substantially higher in the experiment group (Feb cohort) than in the control group (Oct cohort) in what is deemed to be one of the most problematic units of the curriculum.

The positive results of this and other pilots have led to the creation of an internal project funded by the University of Bedfordshire Student Experience grant that aimed to gamify aspects of the curriculum with a focus on skills and employability. It was deemed important to develop a focused approach in gamification that would be supported by a web-based platform and would emulate the successful elements distilled from our pilot studies, and the extant literature on gamification.

5. WEB-ENABLED GAMIFICATION: CURRENT AND FUTURE DEVELOPMENTS

The pilot outlined above clearly demonstrated that the software should support a range of different activities and should facilitate their delivery in a flexible, user-friendly manner. However, the bespoke software has the added advantage that it would allow real-time access and continuous engagement inside and outside the classroom in a user-friendly manner utilising a number of devices including tablets and mobile phones. The designed web-based platform would work on similar principles to popular persistent browser-based, massively multiplayer online real-time strategy games (MMORTS) and would assume that social interactions are vital for student engagement and are mostly happening offline alongside the platform (though the platform allows for internal communications). MMORTS also maintain an environment of competition among players by providing a variety of matrices and statistics for players to peruse and thus benchmark their progress against other players.

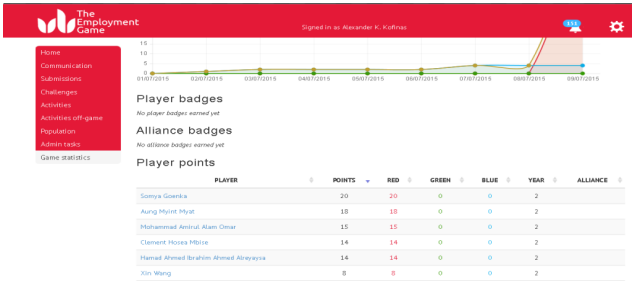

Figure 3: Rankings of Players

Another important aspect highlighted by the pilot was the importance of rankings, an aspect that is seamlessly incorporated in the software as students can see their progress as they complete each activity, on a group level and an individual level as demonstrated in figure 3:

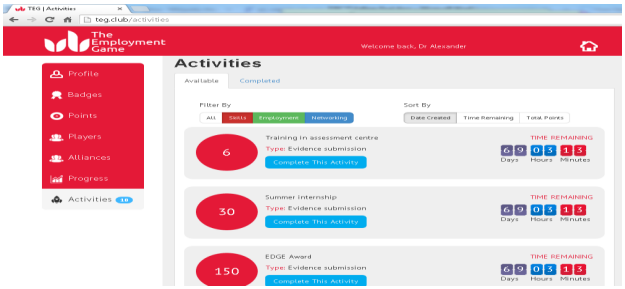

Figure 4: Range of activities a student can undertake

At the same time MMORTS allow cooperation by providing mechanisms for forming guilds and alliances where players come together to interact and socialise while they compete against each other. Any player could form a guild as demonstrated in Figure 5:

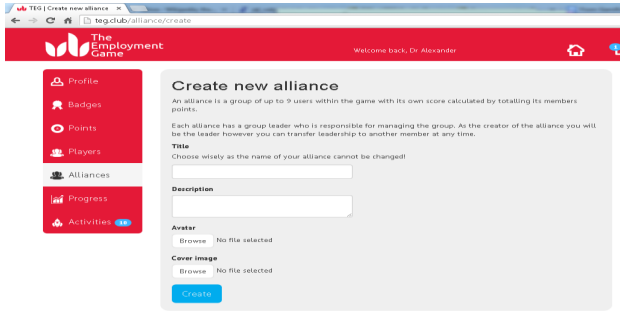

Figure 5: Web-Page for Creating new Alliances

This desire to cooperate and compete is a characteristic of the millennial generation (Popescu et al., 2013) where often they will cooperate/compete around a focal activity and thus propel the whole community forward (Dery et al., 2014, Massanari, 2013). This is a dynamic that if harvested can be very productive and is implicitly one of the aims of the web platform. The narrative typical of MMORTS has to be adjusted in the context of Higher Education; the pilot lacked on narrative and it was short (four activities over five weeks). There is a need for a longer narrative, this year we are aiming this year to develop a year-long competition that will resemble the quest narrative and will be individual and team-based.

As the pilot showed even the BRS module which is considered a very academic module can be gamified. As this is the module that leads to an academic dissertation the team is considering to convert the dissertation into the backbone for the competition with its process emulating the structure of a quest with the ultimate goal of creating the dissertation report:

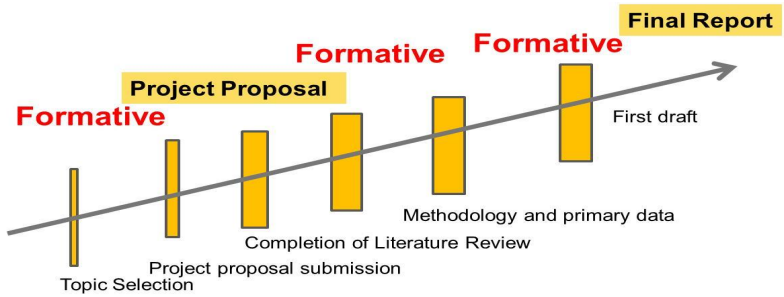

Figure 6: The final year dissertation as a Quest Game

Note that most of the obstacles that would be gamified are formative assessments instead of summative. The aim is for the student within the context of her personal quest to engage with activities that enable and enhance learning; thus the game should be designed so that students may fail when practicing with formative assessments so that they can succeed when submitting a summative assessment. The pedagogy behind this new (for our university) approach to learning is based on the idea that students learn experientially by trying new things in a competitive/cooperative context and that the double-loop learning process of failure is as important as the single-loop learning process of success.

If we were to plot the whole module along time it could be seen as a continuous process of gamified activities that enable the student to undergo a series of single and double loops of learning experience (Argyres, 2004) as demonstrated in figure 7:

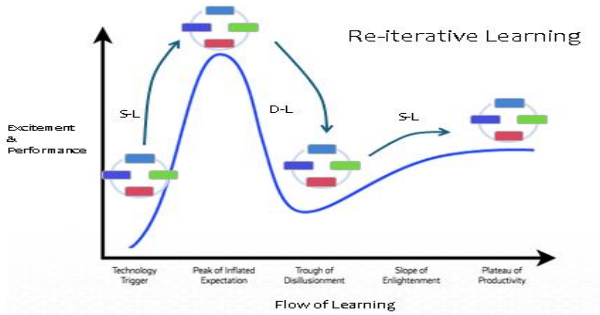

Figure 7: The continuous and re-iterative nature of Learning (author work adapted from the hype cycle popularised by Gartner Research (for example: Redman et al., 2004))

This year 2015-16 the first version of this web-enabled "gamified approach" to teaching will be rolled out. The course team is aiming to address some of the weaknesses of the earlier design. Data will be collected at a more detailed level with regards to attendance and student performance in real time rather than at aggregate level. Feedback will be sought via interviews and surveys rather than relying on results alone as the current exploratory experiment scores low in validity.

6. CONCLUSION

The first gamification pilot (and others not described in this paper) encouraged the course team to the benefits of gamification. The learning achieved by the team in these pilots has led to the creation of a bespoke software that combined the team's experiences with gamification, knowledge gained from extant literature and basic principles from MMORTS games to develop a novel approach to educational content delivery as a gamified system of progression that is not shackled by the formal summative elements of educational activity.

REFERENCES

Aacsb 2008. Final Report of the AACSB International "Impact of Research" Task Force. Florida, USA: AACSB.

Alpert, F. 2007. Entertainment software: suddenly huge, little understood. *Asia Pacific Journal of Marketing and Logistics,* 19**,** 87.

Anonymous 2014. Patterns and Trends in UK Higher Education. London: Universities UK.

Argyres, C. 2004. Double-Loop Learning and Implementable Validity. *In:* TSOUKAS, H. & MYLONOPOULOS, N. (eds.) *Organizations as Knowledge Systems: Knowledge, Learning and Dynamic Capabilities.* Palgrave Macmillan.

Culkin, N. & Mallick, S. 2011. Producing work-ready graduates. *International Journal of Market Research,* 53**,** 347-368.

De Sousa Borges, S., Durelli, V. H., Reis, H. M. & Isotani, S. A systematic mapping on gamification applied to education. Proceedings of the 29th Annual ACM Symposium on Applied Computing, 2014. ACM, 216-222.

De Vaus, D. A. 2001. *Research design in social research,* London, SAGE.

Dery, K., Tansley, C. & Hafermalz, E. Games people play: social media and recruitment. 2014. ACIS.

Deterding, S., Dixon, D., Khaled, R. & Nacke, L. From game design elements to gamefulness: defining gamification. Proceedings of the 15th International Academic MindTrek Conference: Envisioning Future Media Environments, 2011. ACM, 9-15.

Dickey, M. D. 2007. Game design and learning: A conjectural analysis of how massively multiple online role-playing games (MMORPGs) foster intrinsic motivation. *Educational Technology Research and Development,* 55**,** 253-273.

Dubbels, B. 2013. Gamification, serious games, ludic simulation, and other contentious categories. *International Journal of Gaming and Computer-Mediated Simulations (IJGCMS),* 5**,** 1-19.

Gibbs, G., Knapper, C. & Piccinin, S. 2009. Departmental Leadership of Teaching in Research-Intensive Environments. London: Leadership Foundation for Higher Education.

Hamari, J., Koivisto, J. & Sarsa, H. Does gamification work?--a literature review of empirical studies on gamification. System Sciences (HICSS), 2014 47th Hawaii International Conference on, 2014. IEEE, 3025-3034.

Kubler, J. & Sayer, N. 2010. Higher Education Futures: Key Themes and Implications for Leadership and Management. London: Leadership Foundation for Higher Education.

Landers, R. N. & Callan, R. C. 2011. Casual social games as serious games: The psychology of gamification in undergraduate education and employee training. *Serious games and edutainment applications.* Springer.

Massanari, A. 2013. Playful Participatory Culture: Learning from Reddit. *Selected Papers of Internet Research,* 3.

Mcclarty, K. L., Orr, A., Frey, P. M., Dolan, R. P., Vassileva, V. & Mcvay, A. 2012. A literature review of gaming in education. Pearson.

Mead, K. 2010. Game-based Learning and Intrinsic Motivation. *Unpublished manuscript, available [November 25, 2010] from: http://www. alice. org/publications/TeachingObjec ts-firstInIntroductoryComputerScience. pdf.*

Nicol, D. J. & Macfarlane-Dick, D. 2006. Formative assessment and self-regulated learning: A model and seven principles of good feedback practice. *Studies in higher education,* 31**,** 199-218.

Popescu, M. M., Romero, M. & Usart, M. 2013. Serious games for serious learning using SG for business, management and defence education. *Int. J. Comput. Sci. Res. Appl,* 3**,** 5-15.

Redman, P., Dulaney, K., King, M. J. & Pittet, S. 2004. Hype Cycle for Mobile and Wireless Hardware and Software, 2004. Gartner, Inc.

Soilemetzidis, I., Bennett, P., Buckley, A., Hillman, N. & Stoakes, G. 2014. The HEPI–HEA Student Academic Experience Survey 2014. York: HEPI - Higher Education Academy.

Susaeta, H., Jimenez, F., Nussbaum, M., Gajardo, I., Andreu, J. J. & Villalta, M. 2010. From MMORPG to a classroom multiplayer presential role playing game. *Journal of Educational Technology & Society,* 13**,** 257-269.

Wu, W.-H., Chiou, W.-B., Kao, H.-Y., Hu, C.-H. A. & Huang, S.-H. 2012. Re-exploring game-assisted learning research: The perspective of learning theoretical bases. *Computers & Education,* 59**,** 1153-1161.

ACKNOWLEDGMENTS

I wish to acknowledge Dr. Rhidian Lewis for his support with my vision of gamification and Patricia Wilson for her support in our first gamification pilots. I am grateful to University of Bedfordshire's support of my vision: the internal grant was vital in creating the supporting bespoke software.

AUTHOR CONTACT DETAILS

Dr. Alexander K. Kofinas
Management and Business Systems
University of Bedfordshire
alexander.kofinas@beds.ac.uk

An Inquiry into Gamification Services: Practices, Experiences and Insights

Sylvester Arnab, Madhav Nalla, Casper Harteveld & Petros Lameras

ABSTRACT
Adding game mechanics and game design thinking into non-game scenarios, known as gamification has demonstrated impact in improving engagement, nurturing attitude and behaviour, and facilitating learning. Gamification techniques applied in business commonly aims to engage customers as well as employees, often respectively implemented as customer-facing websites and employee-facing internal applications. However, as gamification rises in popularity within the business community, companies may feel pressured to start applying it to their websites and business processes and may do this without a thorough understanding of what it entails or how to proceed. In order to get insight into the best practices of business gamification, this paper discusses findings based on semi-structured interviews conducted with four senior management of companies with extensive knowledge of and experience with gamification, covering five main themes: methodology, design, administrative, issues and insights. The aim is to provide understanding of the design and implementation of gamification projects in business and to demonstrate the potential of extracting considerations for gamification design and development based on the experience of gamification vendors.

Key words: Gamification, business, interviews, design principles

1. INTRODUCTION

As business gamification rises in popularity, more companies will be exposed to its potential benefits. Despite this rise in popularity, a large majority of gamification projects have been predicted to fail (Harbert 2014). This prediction is primarily based on the poor initial design as opposed to the technology used. This is an indication that the various CEO's, entrepreneurs, CIO's, marketing managers, as well as the newer roles of CXO's and Chief Engagement Officers will require appropriate advice and best practice guidance for applying gamification to their business.

With this in mind, this paper aims to explore the views of companies that have provided extensive gamification services to business clients on designing and implementing gamification projects in order to identify best practices in business gamification. Section 2 provides a brief background on gamification for business, followed by Section 3 that describes the study methodology. Section 4 summarises the findings and the paper is concluded in Section 5.

2. BACKROUND

Deterding et al. (2011) describe gamification as the process of using the design characteristics and processes of games, particularly electronic games, in non-game contexts. It is the application of game mechanics and game design thinking to non-game environments to increase user engagement and solve problems. Game mechanics are a set of rules that facilitate how a game is played (e.g., achievements, juicy feedback); game design thinking is about using the approach to design games, which includes providing an engaging experience to users.

Gamification has been gaining popularity since, although its practices have been used throughout history in relation to games. In 2007, Bunchball was the first company to provide gamification as a service (Paharia 2013). The reason for its recent rise in traction is probably linked to social factors as well as a convergence of various technologies – the growth of the electronic games industry, increased computer processing power, the internet, mobile devices, "web 2.0" and social media.

The popularity of electronic games across demographics may have provided a favourable environment for gamification to develop. Today, the average U.S or U.K gamers are in their thirties and 47% of gamers are female (Galarneau 2014). A need to find ways of increasing engagement of online audiences and consumers as well as engagement of employees in the workplace are the main business drivers for gamification. A commonly cited statistic is that the average new website visitor will spend ten to twenty seconds before leaving. Decreasing bounce rates and increasing site stickiness are essential to e-commerce profitability (Lin 2007). Within organisations, Reeves and Read (2009) argue that younger generations of employees expect work to be as engaging as the electronic games they grew up with; that many employees are bored or frustrated with their jobs and therefore not as productive, focused or fulfilled as they could be.

According to Gartner (2013), gamification had reached the "peak of inflated expectations" by 2013 and the cycle in 2014 suggests that it is currently in the trough of disillusionment; which signals a period where an emerging technology has lost momentum in the expectation. Success stories are touted, as well as failures cited by critics. Gartner (2014) expects gamification to reach the "plateau of productivity" within 5 to 10 years; that is, mainstream adoption begins to take off and more rigid assessment criteria are evident. At this stage, the technology's general market applications and relevance are accepted (Gartner, 2014). However, it is unclear what best practices exist and disseminating best practices are key for the successful adoption of emerging technologies. In this study we aimed to identify these best practices in business gamification through interviewing companies that have provided extensive gamification services to business clients.

3. METHOD

Four semi-structured interviews were conducted with senior management of companies involved in gamification. The sample was selected from a comprehensive list of 116 companies compiled from the gamification vendors provided on the Gamification.Co website, a website that provides guidance to companies interested in gamification. The majority of companies on the list were contacted by email (i.e., a few companies did not seem to qualify as a company that has provided extensive gamification services to business clients) and out of those six initially agreed to be interviewed, four interviews took place in October 2013. The resulting sample represents a good mix of companies applying business gamification for consumer facing and employee facing applications so as to compare and contrast their approaches:

- **Company A** is a small consultancy owned and run by a leading gamification expert; who was the interviewee. The consultancy specialises in *gamification design for consumer facing websites* and is based in California, USA. It does not have its own gamification platform or developers but offers expert advice to companies wishing to apply gamification.
- **Company B** specialises in enterprise gamification, that is, *gamification for internal employee facing applications*. It is based in Israel and the USA. The interviewee is the founder. The company has its own gamification platform, which can be integrated into various business processes including sales, customer service, knowledge collaboration and training.
- **Company C** is highly focused on *the gamification of corporate learning*. It is based in the UK and the interviewee is the founder and managing director. The company has its own gamification platform that can be combined with various learning content to improve corporate training, employee qualification rates and leadership skills.
- **Company D** is a UK based digital user experience agency that specialises in digital marketing and branding. The interviewee is the CEO and former head of innovation. The company has a lot of experience with *the consumer facing side of gamification*.

Taken as a whole the interviews attempted to cover all the main areas relevant to the practice of design and implementation of a business gamification project. Based on our literature review we

identified and structured our interview questions around five main themes: methodology, design, administrative, issues and insights (Appendix A).

The *methodology* theme seeks to answer the overall process that the company uses when approaching gamification. It was clear from the literature that there is an overall methodology that can and should be used with gamification. Werbach (2013), defines five core stages – define business objectives, identify target behaviours, describe the players, devise activity loops and finally add the appropriate game mechanics. Paharia (2013) describes a four stage basic methodology of plan, design, build and optimise whereas Kumar & Herger (2013) place more emphasis on understanding the players first, followed by business objectives. Other authors, Duggan and Shoup (2013) and Zichermann and Cunngingham (2011) include similar stages to Werbach, but place a stronger emphasis on choosing appropriate reward mechanisms for players.

The other parameters emerged from a more detailed examination of the overall methodology described in the literature. It was clear that without proper design, a gamification project would fail and that this should be a key consideration once a company has examined it's business objectives and identified key player types. Design factors include aesthetics, reward mechanisms, the player journey (Paharia, 2013) and anti-gaming mechanics (Duggan & Shoup, 2013). Hence, the *design* theme investigates the basic design considerations for gamification.

The *administrative* theme looks at various measurements such as metrics of engagement and return on investments (RoIs). Questions related to *issues* theme were asked to gauge what problems a typical gamification project will have and what the potential barriers to success are. Administrative and issues parameters were naturally included, as these need to be anticipated and investigated for any IT project. Applying gamification to a website or an application is fundamentally an IT project with the added dimension of design factors. Some of the methodologies reviewed provided a brief overview of administrative variables such as building the site, analytics and metrics to use once the site is built and measures for return on investment. Issues commonly found in IT projects include security problems, scalability and user adoption. Duggan and Shoup (2013) for example, note the importance of compliance with data protection laws as a gamified system will generate a lot of user data, some of which maybe deemed personal.

The final parameter, *insights*, was added to gain further knowledge that could be added to the gamification literature. The interviewees had their own unique experiences and industry specific knowledge that could be used to draw further conclusions as to how best to implement business gamification, pitfalls to avoid and possible future trends.

The interviews were conducted through one-hour phone conversations. The findings in the following section are a snapshot of the main findings of the views of the companies.

4. FINDINGS

The Findings are presented below and are categorised under relevant themes emerged from the analysis. These are: methodology, design, administrative, issues and insights, comprising the overarching themes of research analysis.

4.1 Methodology

Company A: *Company A* adopts its own approach. Stage 1 is to understand the problem and define quantifiable business metrics. There needs to be a benchmark to measure success or failure. Stage 2 identifies the players, without going deep into player types – just the basic demographics (which will be later refined). Stage 3 is the desired actions, which should be broken into small and discrete steps. Each desired action has a motivator to move onto the next action. The win state in the users

mind should be accomplished by carrying out the desired action. Stage 4 is user metrics, which are different from business metrics. User metrics are what the user sees – the achievement symbols, badges etc. Stage 5 is assigning the incentives or rewards. It is important to understand and clarify what is given to the user. The incentives should be based on the eight core drivers to motivate users towards desired actions: meaning, empowerment, social influence, unpredictability, avoidance, scarcity, ownership and accomplishment. The 6th stage is focused the four stages of the player journey: discovery, onboarding, scaffolding and the end game.

Company B: *Company B* also has its own gamification methodology. First goals are defined according to the business process, followed by player profiling, designing the required behaviours, design of gamification features, production and installation and finally analytics. At this point, the design may be altered according to the results of analytics. Goals and objectives come from the client company. For Company B, gamification is seen as a parallel process to performance management, as "what gets measured gets achieved". Getting the right metrics are crucial otherwise the result will be wrong. Generally, the main objectives will be around four areas of the business client – customer service, learning, sales and operations and innovation. This is because the company specialises in enterprise gamification.

Company C: *Company C* noted that they have an existing platform that was used as a template for each case. This is because the company specialises in gamification for corporate learning; not much work is needed for each new case. They may add new tools that have gamified features. For instance, content authoring tool called 'Genie' was added to the existing gamification platform. Large corporations looking to add gamified learning can simply buy the platform ready to go.

Company D: *Company D* has developed its own trade marked methodology known as 'Emotional Ignition'. Various methods are fused with game mechanics for a more powerful result. The software developmental methodology varies depending on the client's processes but is mainly lean and agile with fast prototyping. Core objectives are defined by the client business and brand. First it is important to understand the main purpose – customer or employee engagement, so as to decide if it is about improved internal environment engagement or external relationship engagement. The next stage is a deep dive into user profiles – ethnographical and anthropological research techniques are used to understand real user needs, barriers and what emotional triggers are needed to guide the user through the experience. User behaviours are distilled into "primary states" which are mapped onto player journeys e.g. drop out point, dwell point, sales conversion. Then the required game mechanics or psychological influences are chosen to cause the necessary effect. Testing involves using the feedback loops built into standard designs. Analytics are used to inform key activity metrics and reveal areas for improvement to the player experience and journey flow.

Table 1 summarises the perspectives of the companies.

Table 1: Views on methodology

Company	Methodology
A	Own approach focused on player motivations and metrics 6 stages – understand problem and define business metrics; understand basic player demographics; define desired actions; align incentives/rewards with 8 core drives; design player journey
B	Own approach focused on analytics and metrics Goals defined according to business process; player profiling; required behaviours; design; production; installation.
C	Ready to go gamification platform with configuration options
D	Own trade-marked methodology ('Emotion Ignition') with focus on emotions Client defines objectives; deep dive into user profiles; user behaviours summarised and mapped onto player journey; game mechanics chosen according to psychological influence; testing done via feedback loops built into the system; analytics used to improve player experience and journey flow

4.2 Design

Company A: *Company A* emphasized player types for design, which starts with demographics information, and can involve more later if needed. The approach does not offer a specific formula but it is more agile, where the core game mechanics are further developed to match the player types as an incremental process. It focuses on user experience (e.g., "how users feel") and then applies from the large tool kit a set of principles. Aesthetics is considered to be less important, but could be useful during onboarding and discovery phases as they are highly context dependent, which means the core shell of design is more important than how it looks. *Company A* makes use of Bartle's (1996) four player types of explorers, socialisers, achievers, and killers.

Company B: When designing for player types, *Company B* has its own system of classification. The company also stated that they would not consider the generic four Bartle types. They focus on the culture of the players – organisational, departmental and even nationalities (as many of their clients are global organisations). There are eight to ten main prototypes used, for example, competitive prototype, service prototype, learning, team building, etc. The core game mechanics used are points, levels, progression, leaderboards and team challenges.

Company C: For *Company C*, the gamification platform is pre-designed for core users – populations in the "middle of every company". The platform is designed to help increase sales or up-skill managers with leadership skills. The content is developed for them and in-line with an awarding body for a particular type of learning e.g. sales, management skills. Aesthetics is fundamental to the company's gamification approach compared to *Company A* – the interviewee noted that without "eye-candy" features, there are no sales. The aesthetics should be in line with the company brand though and there is a constant iteration around this.

Company D: *Company D* also pointed out that designing for player types is critical – as you need to know "who" for, before defining "how" you will create impact. Starting with the fundamentals – age, gender – to initiate the distinction of the experience and therefore the mechanics needed. Simple considerations at this stage such as do you want to create brand advocacy, team spirit, sharing of content or competition? Once the primary audience is known, more detailed user profiles are built. To get additional detail about players, active workshops and webnography techniques are used such as "hanging out" in social communities to gain insights. Adding a virtual economy depends on the experience you want to create. It can be used to guide a range of motivators if done correctly and enables a direct extrinsic reward system. In terms of core game mechanics – they are split into main

categories with over 150 specific ones. The categories are onboarding features, loss avoidance, victory conditions, gameplay, progression, feedback, goal and achievement vehicles. *Company D* also suggested that gamification does not typically work well with one or two game mechanics, but it depends on the intensity of the experience you want to create.

Table 2 summarises the perspectives of the companies.

Table 2: Views on design

Company	Design
A	Focuses on user experience design and context, aesthetics less important
B	Own classification system with 8-10 different prototypes to choose from
C	Pre-design platform with content developed with clients. Aesthetics is key
D	Focuses on player types and intensity of experience to create

4.3 Administrative

Company A: Typical metrics and KPI's analysed by *Company A* include desired actions vs. dropout rate. Also, during the onboarding stage – what behaviours will first time players have that results in behaviour a second time. For example, what did people who spend more than 10 minutes on the site do during their first time on the site? Then drive new users to those activities and compare with the time spent on their return visit. Generally, metrics are a case-by-case basis; for example with some sites, users need to spend a few seconds on each page, whereas others would require more time. Costs and timeframes vary according to the company and their goals.

Company B: *Company B* suggested that metrics are derived from user behaviour in the specific gamified experience and are used to understand the traction of the gamification solution. They employ clickstream analysis within the system – so who clicks, when and where is known. A trend analysis is performed before and after the system is gamified.

Company C: For user metrics, *Company C* requires the learner population to upload case studies on usage, including things they have learned through the platform. That is where clarity on Return On Investment (ROI) can be obtained.

Company D: From *Company D*'s point of view, benchmarking for KPIs can be based on perception and sentiment around an experience – a subjective gauge of player engagement. Metrics are normally personalised to the specific application, where the player journey through the system can be adapted based on the analytics.

Table 3 summarises the perspectives of the companies.

Table 3: Views on administrative

Company	Administrative
A	KPI includes desired actions vs. dropout rate. Look for popular behaviours that increase retention and return rates
B	User behaviours inform traction of solution. Using clickstream analysis. Trend Analysis – pre and post-gamification
C	Metrics – users upload case studies on usage; what they've learned from the gamified learning platform and improvements noted
D	Benchmarking for KPIs can be based on perception and sentiment around an experience as well as detailed metrics. Metrics vary according to application e.g. virtual training – learning points, duration of use; consumer sales – time on site, conversion funnel metrics. Variable Dashboards designed according to user needs. Player journey can be adapted to individual using analytics.

4.4 Issues

Company A: *Company A* suggested that gamification needs to be designed differently for different devices. With mobiles for example, half the screen maybe covered by a keyboard. Ideally, a customised solution should be designed for each platform, but with limited resources, it means it is better to deliver well on one platform first than doing many that are not as good. Privacy is an issue when it comes to data tracking, where users many not interact with a solution if it is perceived as intruding on their sensitive data.

Company B: *Company B* stated that the more frequently a player works with a gamified system the more effective it would be. So in terms of devices, mobiles and tablets may end up with the killer gamified applications. Organisational adoption of mobile gamification is currently low. Main issues include data integration with other business systems and blending the experience with current business processes.

Company C: *Company C*'s gamification platform works well on all devices and is mobile ready. However, it can be difficult to do large pieces of e-learning on mobile. Data protection is taken very seriously and compliance with European and US law is maintained. *Company C* reflected on their experience that there were no real change management issues as even older adults, aged 55 and above, initially sceptical, find that they enjoy the gamification features – they like the badges for example.

Company D: *Company D* suggested that mobile devices offer extra options such as geospatial data and accelerometers; which add to the volume of engagement techniques. Scalability issues have yet to surface in the company's experience, but the company was confident that such issues of managing and maintaining the volume of data and development path of players will arise. 'User fatigue' is reduced by having a clear understanding of the progression cycle. Techniques are used including breakouts, micro events, progression unlocking, spontaneous rewards and exclusive content based on duration. Change management issues are present as companies want proof of success and ROI figures before committing resources. Gamification represents a "step change" in thinking – only businesses that have fully grasped the need to innovate in their approach to internal and external engagement and collaborate with stakeholders are willing to adopt these new ideas. Also, businesses are typically not set up to review feedback and track data with the depth and frequency that a gamified process offers.

Table 4 summarises the perspectives of the companies.

Table 4: Views on issues

Company	Issues
A	Solution needs to be customisable. Privacy – users won't interact with system if they perceive it as intruding on their sensitive personal data
B	Organisational adoption of mobile gamification is low. Data integration with other business systems and experience design to blend with the business process
C	Works well on all devices, but harder to do e-learning on mobile phones. Data protection important - compliance with national laws.
D	Increasing volume of data. Scepticism among business decision-makers, change management – gamification represents a new way of thinking about, tracking and monitoring user data

4.5 Insights

Company A: *Company A* argued that whenever there is human motivation involved and you want people to perform specific behaviours, gamification can work. However, some systems or processes are harder to gamify than others and there is a need to balance between the efficiency of functional design and human focused design. *Company A* also emphasises on the rise of big data in gamification that will correlate various resources to inform on user behaviours.

Company B: *Company B* stated that there are a few ancillary benefits to gamification. They are looking into analysing emotion in gamification using big data tools. With regards to the future, the company discussed the possibility of 'Gamification 2.0', which along with big data integration will include voice, gesture and emotion recognition.

Company C: *Company C* did not identify any ancillary benefits to gamification. It was noted that one or two game mechanics, such as points with badges, are insufficient to produce an effect. Players need "somewhere to go". The platform works by promoting users to the next level, they are being developed for a role. The on-boarding process is very important and there is a virtual and real world process called 'Cool Tips' and the 'Super Learning Hero' Certification Programme. *Company C* also emphasises on emotional intelligence in online applications in the future.

Company D: *Company D* pointed out that there are different degrees of gamification and any experience could benefit from improved levels of engagement and a better understanding of guiding a player through a progressive experience. However, designers should be aware of functional needs – gamification should not be used at the expense of the practical. It was also stressed that gamification can be used to amplify existing behaviours and promote new ones equally well. It is about knowing what behaviours need encouraging and the more an individual discovers about himself or herself through the experience, the deeper the acceptance. A lot of autonomy can be engineered into gamified journeys and that is where a person may trigger new emotions that were not explicitly designed to occur. Ancillary benefits include the ability to encourage people to present data without being invasive. Such new data points can be mapped around a person's demographics to gain new insights. Big data will benefit from gamification.

Table 5 summarises the perspectives of the companies.

Table 5: Summary on insights

Company	Insights
A	Most processes involving motivation can be gamified. Trade off between functionality and design. Rise in the importance of big data and analytics.
B	Emotion in gamification using big data tools. 'Gamification 2.0'-big data integration including voice, gesture and emotion recognition.
C	Gamification is one solution to increasing engagement. To add another layer of engagement – need emotional intelligence in applications
D	User autonomy designed into gamified system can promote existing behaviours and new ones. Big Data – gamification can acquire lot of data on people in without being intrusive; new insights can be gained from mapping data points around user profiles

5. DISCUSSIONS

Although the four companies differ in their views on how to design and implement business gamification, various commonalities are to be observed from which we can identify best practices. The first main finding is that all four companies indicate *a great emphasis on avoiding de-humanising the target users by using trivial mechanics in hope of engaging them as a common entity by performing player profiling instead and emphasizing motivations and emotions in order to establish an engaging user experience*. This is a practice that the game design community has embraced (Isbister & Schaffer 2008) but which has not always found its way in gamification projects (Deterding, 2011). The companies with customer facing focus (Companies A and D) for instance emphasise on player profiling using their own framework with Company D indicating the importance of emotions in the profiling. Company B with focus on employee facing application has also indicated the importance of emotions in gamification design. Company C is also employee facing but they adopt a more bespoke approach in the form of customisable templates for clients to choose from.

This explains the emphasis on aesthetics by Company C. Hunicke et al. (2004) highlighted on the relationships between mechanics, dynamics and aesthetics in order to understand games design towards fostering the desired player experience. The mechanics refers to the features that will cause some actions to be carried out. Duggan & Shoup (2013) suggest the first stage in selecting game mechanics is to choose the right rewards. Rewards can be broadly divided into recognition, privileges and monetary. Zichermann and Cunningham (2011) identify 7 core game mechanics for gamification – points, badges, leaderboards, levels, challenges and quests, onboarding and engagement loops. As these elements will form the crux of any gamified system, it is important to examine them in more detail. A typical gamified business system will not necessarily contain all these elements. The companies also stress that the choice of game mechanics should map against the business objectives, the profile of the target audience and the desired behaviours, which will lead to a more structured journey for clients or customers. This will determine the overall dynamics or experience, which include guiding users along specific paths in a more fun and engaging way, while at the same time, increasing the rate of desired behaviours. Aesthetics play an important part in gamification, but only if aligned with the purpose of the application and the company brand; as Company A, C and D pointed out. There is no point designing wonderful, detailed sound and graphics for a senior management leadership application, for example, if senior management will regard it as trivialising their roles.

This focus on the user links to the company suggestions on *big data integration and analytics*, which is the second main finding. Analytics and optimisation are part of a gamification activity and feedback life cycle that involve taking measurements of the required behaviours and KPI's of a gamified system. Werbach (2013) defines these dynamics as engagement and progression loops. Different reward systems can be used and placed on variable schedules to induce surprise and maintain player interest. The issue of 'user fatigue' can be reduced by having a clear understanding of the user and gamification progression cycle, and the inclusion of new and fresh content and functionalities to meet the progression. Information such as increase in users, user retention, most valuable users and where people are dropping out of the system can be identified. A more in-depth analysis of user behaviours might move into the realms of emotional intelligence and emotional seduction in online applications but for now it has been useful in identifying player types and measuring performance metrics such as on-boarding. The use of 'game analytics' is on the rise (Seif El-Nasr, Drachen, & Canossa 2013); however, it is not as commonplace in game industry yet. So in this case gamification may take a leading role on big data integration and analytics as opposed to adopting techniques from the game industry.

The third main finding integrates the first and second main finding into *a procedure for designing and implementing gamification*. The companies are using their own design framework to help map player types and behaviours, which influence the development of gamified solutions specific to their clients' needs. Distilling from the methodologies the companies deploy, we can conclude that companies looking into employing gamification should: (1.) Understand the business objectives and define more specific goals; (2.) Define the behaviours that will lead to business objectives; (3.) Understand the target audience or players; (4.) Apply game mechanics according to the player types and desired behaviours; and (5.) Analyse behaviours, measure results and optimise accordingly, in order to achieve success in applying gamification in business.

6. CONCLUSION

The paper provides an overview of the perspectives of gamification service providers on the considerations and approaches employed based on the gamification methodology, the design considerations, the administrative attributes, the perceived issues and insights on the current and future gamification for business. Though differing in some perspectives, all companies agree than considering the characteristics of the users is key to ensure that the right gamification mechanics,

dynamics and aesthetics are considered. This paper demonstrates the relevance and importance of engaging gamification vendors towards understanding how gamification is being applied and what considerations inform the design and development of the solutions. Findings have also demonstrated that the application of gamification for business may have truly adopted game design thinking in their approaches. The current study represents a good mix of companies and though the sample size is small, the perspectives provide insights into the considerations and the techniques utilised which could inform the decisions on choosing gamification as a solution and the considerations for design and application of a gamified system. Further work will be built upon these findings, which will include extracting views and perceptions from a larger set of companies as well as from the user community in terms of gamification applied in a customer facing and employee facing scenarios.

REFERENCES

Bartle, R. A. (1996). *Heart, clubs, diamonds, spades: Players who suit MUDs*. [Online] Available at: http://www.mud.co.uk/richard/hcds.htm [Accessed: 08/09/2013]

Charette, R. (2005) Why Software Fails. IEEE Spectrum. 42 (9), pp. 42-49.

Deterding, S., Dixon, D., Khaled, R., & Nacke, L.E. (2011). Gamification: Towards a Definition. The ACM CHI Conference on Human Factors in Computing Systems, Vancouver, B.C.

Deterding, S. (2011). Situated motivational affordances of game elements: A conceptual model. Presented at Gamification: Using Game Design Elements in Non-Gaming Contexts , a workshop at CHI 2011 .

Duggan, K and Shoup, K. (2013) Business Gamification for Dummies. Hoboken: Wiley and Sons.

Galarneau, L. (2014) Global Gaming Stats: Who's Playing What and Why? [Online]. Available at: http://www.bigfishgames.com/blog/2014-global-gaming-stats-whos-playing-what-and-why/ [Accessed: 20/02/2014]

Gartner (2013) Gartner Hype Cycle. [Online] Available at : http://www.gartner.com/newsroom/id/2575515 [Accessed 28/06/2014]

Gartner (2014). Gartner Hype Cycle. [Online] Available at : http://www.gartner.com/newsroom/id/2819918 [Accessed 01/07/2014]

Harbert, T. (2014) Giving Gamification a Go. Computerworld. 48 (1), pp.12 – 16.

Hunicke, R., LeBlanc, M., Zubek, R. (2004) MDA: A Formal Approach to Game Design and Game Research. Proceedings of the Challenges in Game AI Workshop, Nineteenth National Conference on Artificial Intelligence.

Isbister, K., & Schaffer, N. (Eds.). (2008). *Game usability: Advice from the experts for advancing the player experience*. Burlington, MA: Morgan Kaufmann Publishers.

Kumar J. & Herger, M. (2013) Gamification at Work: Designing Engaging Business Software. Aarhus: Interaction Design Foundation.

Lin, J,C. (2007) Online Stickiness : Its Antecedents and Effect on Purchasing Intention. Behaviour and Information Technology. 26 (6), pp. 507 – 516.

Paharia, R. (2013) Loyalty 3.0 : How to Revolutionize Customer and Employee Engagement with Big Data and Gamification. USA : McGraw-Hill.

Reeves, B. & Reed, J.L. (2009) Total Engagement: How Games and Virtual Worlds Business School Press.

Seif El-Nasr, M., Drachen, A., & Canossa, A. (Eds.). (2013). *Game analytics: Maximizing the Value of Player Data*. London, UK: Springer.

Werbach, K. (2012) For the Win: How Game Thinking Can Revolutinize Your Business. [Kindle e-book]. Wharton Digital Press.

Werbach, K., (2013). Coursera Course: Gamification. [Online]. Available at: https://www.coursera.org/

Zichermann, G. & Cunningham, C. (2011) Gamification By Design: Implementing Gamification in Web and Mobile Apps. Sebastopol: O'Reilly.

ACKNOWLEDGMENTS
The work reported on this paper was supported by The University of Warwick and co-funded by the EU FP7 Games and Learning Alliance (GALA) Network of Excellence, Grant Agreement nr. 258169. Publication is co-funded by Coventry University's Research Collaboration Fellowship (RCF) and the Erasmus+ Gamification for the hard to reach project, Grant Agreement nr. 2014-1-FR01-KA204-008544

AUTHOR CONTACT DETAILS
Dr. Sylvester Arnab
Disruptive Media Learning Lab, Coventry University, UK, s.arnab@coventry.ac.uk

Madhav Nalla
Warwick Manufacturing Group, University of Warwick, UK, madhavnalla@hotmail.com

Dr. Casper Harteveld
Game Design Program, Northeastern University, USA. c.harteveld@neu.edu

Dr. Petros Lameras
Serious Games Institute, Coventry University, UK. plameras@cad.coventry.ac.uk

APPENDIX A: INTERVIEW PROTOCOL

Theme – Methodology

- Is there a specific methodology or "technology roadmap" you use when applying gamification?
- How do you identify the core business objectives?
- How do you identify core user behaviours?
- Do you link your the required user behaviours to motivations which can then be linked to specific game mechanics?
- What testing procedures do you use once the app / site is gamified?
- What would you define as the hardest, most problematic stage when implementing?

Theme – Design

- How important is it to know your user / player types before designing a gamification program?
- How do you ascertain the core player types / users of a website or application?
- Is a virtual economy an essential component of a gamified system?
- Do you have a prescribed or ideal ratio of virtual to real rewards?
- Does gamification work equally well across platforms and devices?
- What are the core game mechanics you use?
- Can gamification work well with just one or two game mechanics?
- Can you describe the importance of aesthetics for the user experience?

Theme – Insights

- If you had to pick the most important game mechanics what would they be?
- Is just applying a feedback mechanic, without rewards, levels or badges sufficient to improve user metrics?
- Do you have any predictions for future trends in gamification?

- Are there any websites or applications you would not recommend to be gamified?
- Is gamification best used to amplify existing user behaviours or can it be used effectively to promote new behaviours?
- Are there any websites or applications you would not recommend to be gamified?
- Have you notice any ancilliary benefits to gamification?

Theme – Administrative

- Are there any standard metrics you use when measuring pre- and post-gamified sites / apps?
- What dashboard facilities do you offer?
- Do you have an onboarding process or techniques for increasing user adoption?
- What are the estimated costs and timeframes for gamifying a typical site or app.?

Theme – Issues

- Are there ever issues with scalability and if so how can these be overcome?
- Are legal, data protection and privacy issues a major hurdle when applying gamification?
- Have you noticed any negative aspects of gamification?
- What systems do you recommend for protecting against “gaming the system”?
- Have you noticed any declines in user engagement post-gamification?
- Do you apply techniques / mechanisms to reduce “user fatigue “?
- Can you identify any potential causes of failure for gamification projects?
- What change management issues / barriers to adoption do companies tend to face and how can they be overcome?

DOUBLE THE SHARING- THE EFFECTS OF GAMIFICATION AT ONE OF THE WORLD'S LARGEST EMPLOYERS

Rix, Zeihlund, Long & Nielsen

ABSTRACT
In 2014, ISS, a facility management company and one of the world's largest employers, launched a gamified mobile application for employees called Share@ISS. The application engages ISS employees to be proactive by incentivizing the sharing of ideas for potential facility improvements that they encounter in their daily work. After a three month pilot project ISS saw a doubling of proactive employees at the sites where the application was tested.

Share@ISS provides a case study that demonstrates the advantages of gamification and digitalization, and provides valuable insights into how users perceive gamification efforts that are designed to support their existing workflows.

An anthropological investigation identified ISS employees' workflows, internal processes and associated behaviours and was the foundation of ISS' gamified platform. In this paper we examine how it is possible to create a sharing culture through a platform that derives its value from game elements and social features, but also simply makes work easy and more effective.

With a clear business benefit found in incentivizing ISS workers to become more proactive in their sharing of opportunities, we present the application of gamification as a means by which to make the work of employees more engaging while also incentivizing behaviours that are in line with the commercial side of ISS' business.

After a positive pilot project the application has turned into a popular work tool within the organization and continues to grow. It is already in use by ISS in Denmark, UK, Israel, Sweden and the United States. While share@ISS is in continuous development, the data collected demonstrates the positive effect of the application on user behaviour as well as diversity in how users perceive of workflow supporting gamification initiatives.

Key words: Gamification, Behaviour Change, Workflows, Results, Orchard, ISS

1. INTRODUCTION

1.1 Pro-activity

Let's gamify this paper and start out with a little role-play.

You're a cleaning lady. You've just gotten off the bus and you're walking up to the headquarter of a global IT manufacturer. They're your client. You're working for the global facility services company ISS and together with your colleagues you make sure that the IT manufacturer can focus on what they're best at – manufacturing IT products – by taking care of facility services such as cleaning, catering and maintenance. Though cleaning the floors

and restrooms can be a bit tedious you actually like your job. Your colleagues are good friends, the pay is decent and the career options are good within the company.

Today's cleaning isn't the easiest. You probably stayed an hour too late at your friend's birthday party last night and on top of that, your boss, the site manager, asked if you could finish up 15 minutes early, as the catering supervisor needs to brief everyone on something.

As you're about to enter one of the conference rooms on your cleaning route you notice that the door knob has gone loose. What do you do? Should you tell someone? You do a quick calculation: Pros: You know it would be good service to notify your site manager so he can ask the client if ISS should fix it. Cons: You're a bit tired, you're a little busy, and you're not too sure where the site manager is right now. You could write a note; however, you're not sure what happened last time you put a note on his desk about something that needed fixing... Too many cons.

Most of us probably recognize these moments where we stop for a second and ponder if we should do *that little extra* or just continue doing what's expected. It was a wish to influence these types of moments that started the gamification project at ISS.

1.2 A key ingredient to premium service

ISS is, with more than 500.000 employees, one of the world's largest employers. With 114 years of experience they're a renowned and solid name in facility services around the globe. More than anyone they know that a key ingredient to providing premium service is to be proactive. It's simply a fundamental part of what keeps their clients happy – that the client can focus on what they're best at – while ISS takes care of facility issues before the clients notice themselves.

However, ISS also knows that being proactive is a behaviour amongst employees that you can't take for granted nor easily recruit or incentivize. In their efforts to develop and drive a culture where proactivity is recognized ISS already has a global incentive program where you nominate fellow colleagues who've shown an outstanding example in generating value for the client. As this resembles more traditional programs, like getting a medal in the military for a significant and outstanding performance, it became apparent that there was still room for incentivizing on a more 'micro behavioural' level; to focus on those everyday moments where someone considers reporting that loose doorknob.

1.3 A clear business case

Focusing on a micro behaviour that realistically tends to happen more often, rather than extraordinary achievements, makes the business case quite obvious - especially when you're dealing with more than 500.000 employees. Also, not only is proactivity a service essential that keeps the client happy, it's also a natural part of the commercial side of the business; if the client gives ISS a go on fixing that doorknob it naturally adds to the revenue. This perhaps makes it less of a surprise that it was Thomas Zeihlund, a CFO at ISS, who sensed a potential when he first learned about gamification. It was clear that there could be a significant business potential and an opportunity for providing better service for the clients in motivating proactivity on a micro behavioural level amongst employees by making it motivating and maybe even fun for them to find potential facility improvements.

ISS invited Orchard MBC, an agency specialized in micro behavioural change, gamification and digital design, to do a pilot project that would answer the question: *can we motivate our staff through gamification to be more proactive by making it fun and easy to report potential facility improvements?*

2. THE PROCESS

2.1 Ethnographic research

In an effort to include different cultures and facility types the Orchard team invited five ISS locations to participate in the pilot project; two in the US, one in the UK, one in Israel and one in Denmark. Parallel to refining the conceptual approach to the solution, a series of ethnographic field visits were carried out. The ethnographic approach made it possible to get into the mindset of ISS ground level employees and understand practices around reporting potential facility improvements (Eriksen & Murphy 2008; Hammersley & Atkinson 1983). During the visits the team conducted interviews with the site management as well as participant observation with a range of personnel, including custodial and maintenance workers.

The field visits provided the team with an in-depth understanding of several central questions such as: under which circumstances is pro-activity happening and what are the reasons when it's not? How does an idea for an improvement travel from person to person and into work order systems until it's fixed? Is it even realistic in a practical sense to motivate a busy cleaning lady to pull out a smartphone and share an idea for an improvement when she sees one?

2.2 The importance of feedback

One of the most important initial findings, that also had a notable impact on the subsequent application's concept and design, was that an absolute essential circumstance in order for the proactive behaviour to happen was that *feedback* also happened. Those who experienced a strong sense of purpose, for example through colleagues or clients recognizing their extra effort, were indeed proactive and took pride in performing that behaviour - positive feedback was important to them. Several works support this view (eg. Burke 2014; Pink 2009) and show how finding purpose in certain activities will increase motivation in performing that activity. Those who weren't as pro-active had less sense of purpose, as they had usually tried being proactive but hadn't experienced feedback as a result.

From a gamification standpoint one could likely consider various graphic responses, progress bars, levelling up etc. for providing feedback to employees (Werbach & Hunter 2012). However, a key finding was that many of the employees were specifically driven by the feedback from their peers. There was nothing more satisfying for a maintenance worker than to gather a few colleagues to discuss an issue and how to fix it. This wasn't just happening offline; the facility managers from sites across Israel had simply set up a group chat on WhatsApp, as they needed a place for discussing ideas and giving each other feedback – but most of all to socialize.

For most of the staff, attempts to simply replace the social feedback and interaction with something like a virtual badge would be a straight up insult. "*So you're gonna give me a bloody gold star for doing my work?*" a maintenance worker in the UK asked with a twinkle in his eye. This remark stayed with the team as a constant reminder of how delicate a task it is to apply play to other people's work lives. Your best intentions can fail so miserably if you don't make sure you get into the mindset of your future players – are they motivated by the intrinsic factors such as doing their job well, or by the extrinsic "*bloody* gold star". Having too much focus on adding points or extrinsic rewards is a risk as this may shift the focus from the real purpose of the activity and in extreme cases make users "addicted" to the reward rather than enjoying the activity itself (Deci & Vansteenkiste 2004; Kohn 1999). This was a crystal clear reminder to avoid managerially-imposed mandatory 'fun' (Mollick & Rothbard 2014) and instead design a solution where gamification was subtle and optional.

The team learned that a social component should be central in facilitating peer-to-peer feedback, as getting recognition through comments and likes on the ideas for improvements would be a motivational driver for many. Initial ideas about gamifying that an employee simply reports the ideas to the manager would therefore hardly do the trick. The ideas needed to be *shared* with the trusted colleagues on site, with the site manager invited to this "employees' forum" rather than employees reporting to the boss. This is why it was decided to design a shared feed, in some ways similar to Instagram's, with pictures of ideas for facility improvements that all ISS employees on the site could see and interact with.

The UX was therefore reworked in an effort to master the balance of being a useful work tool in itself, where you could share an idea in no time but also have a gamification side to it that wouldn't disturb those who just wanted to use it for quick and easy reporting. This also influenced the way the Orchard team eventually introduced it to the pilot users; as a work tool that they were welcome – but not obliged – to use. A work tool that, by the way, had missions, leaderboards, badges etc., for those who were into that. This way the tool could balance the intrinsic and extrinsic motivators, providing the user with a choice when using the application (Deci & Vansteenkiste 2004).

2.3 Gamifying a fun core

During the field visits the team saw that many of those employees who were proactive actually found joy in finding these potential facility improvements as they went about their daily work. It was as if some of them practiced the famous movie quote from Mary Poppins (1964) "*In every job that must be done, there is an element of fun. You find the fun and 'snap', the job's a game*." It was almost like a scavenger hunt, but just very single-player based. This finding was extremely important to the concept development as it underlined that the team was onto something if the core of what they wanted to gamify had a fun element to it already.

This also meant that it was possible to gamify not only a desired behaviour but also a specific work process and that finding these improvements and sharing them could be the game itself. Whatever ideas there were about creating a fun game that perhaps taught employees how or why to find facility improvements suddenly seemed silly when it was possible to gamify the actual work process.

From here on the conceptual focus was on gamifying and incentivizing the various steps in this work process. So naturally, in the app you gain points by sharing an idea, points when the manager registers the idea and even more points if the idea is carried out. As we know from the game design literature (eg. Salen & Zimmermann 2004), how points are gained usually indicates what the game is all about, indicating the rules of the game, but here specifically they also had a function in communicating and rewarding that the "work order" had progressed in status and thereby fuelling a sense of purpose; "Oh, someone went along with getting that door knob fixed!" Early in the pilot phase the team saw what they expected to see, some picked up on the game side of the app and others didn't. Some were very vocal about it "*I'm second on the leaderboard, so come and get me!*" as a service navigator in Sweden expressed proudly, and some were less vocal like the maintenance workers in California who indicated that their colleagues in Texas must be cheating since they had that many points.

2.4 Share!

These findings moved the Orchard team from an initial understanding of a need to gamify reporting to a concept of gamifying a social *sharing* of ideas. And the desired behaviour therefore also crystallized itself to *sharing ideas*, which offered a straightforward name for the application by simply using the imperative clause: Share!

2.5 Global gamification

ISS were quick to let the team know that they are indeed a global organization and therefore cultural differences are significant. Not just across regions, but also on the specific location since you'll often find immigrants from all corners of the world getting their first job opportunity in a new country with ISS. This multicultural reality had a direct influence on the design and gamification. First of all it became a goal in itself to avoid as much text as possible as the users would naturally speak different languages, but also because the team was advised that there would be several illiterate employees. Completely avoiding text wasn't possible but the designers put an effort into creating an icon-based navigation, guiding users with an app-tour, introducing the interface when the user opened the app for the first time and using design references from other popular apps, so that if they knew those apps they would pick up on this one more easily.

The field visits revealed the site manager as an essential player in the game. The site manager and assisting supervisors on larger facilities are the ones who know if an idea for an improvement should just be fixed straight away as it might be covered by the contract with the client, or if the client should be presented with an offer. The site manager appeared to have a rather challenging role in guiding the staff in what potential facility improvements to look for. Say, if a couple of employees had suggested paint jobs to cover those black marks on the walls from the chairs in the meeting rooms and the client didn't want to prioritize that expense right now, he should then put quite an effort into both appreciating the proactive effort but also inform *all staff on site* not to suggest more paint jobs right now, but to please keep looking for other ideas. This can be a challenge on a busy day.

The insight of the facility manager as a kind of a playmaker in the 'improvements hunt' together with the multicultural challenge gave birth to the idea of having missions as one of the central game elements. Not only can the manager initiate missions to add fun challenges to the game and through that guide everyone to, for example, look for potential energy

saving improvements, but they can also incentivize employees by setting up rewards in line with the local culture. This ensured that there was flexibility in the perceived value of the reward and the motivation for achieving the reward (Pihl 2013). This gave the Israeli cleaning supervisor the option to include a more tangible reward like the paid breakfast at a local restaurant for the whole family, that earlier had shown itself to be very appreciated by the winning Ethiopian cleaning ladies with their large immigrant families. By contrast, another manager in Denmark might choose an intangible reward if he felt that would trigger fun competition.

2.6 A Lean Startup approach

Unsurprisingly, it proved difficult, if not impossible, to ask the employees – the future players – if the game would be fun. How would they know? On the basis of that - and for financial reasons - it made sense, as it often does, to apply a Lean Startup approach (Ries 2011) to the process. It was therefore decided to build a more basic version of the tool with just the concept critical features in order to be able to release it sooner and thus quickly learn what worked and what didn't and then adjust. What if the employees found it fundamentally inappropriate or silly to gamify their work? What if it turned out that they disliked competition and the team spent several weeks programming an advanced leaderboard? It made sense to create a *Minimum Viable Product (MVP)* - or could we call it *Minimum Viable Gamification?* – in order to learn quickly what resonated with the users and what didn't. What they found useful or motivating could then quickly be developed further, and those features that didn't provide value could be skipped without looking back on months of wasted design and programming.

2.7 Development and testing

In the spirit of the MVP a mobile application was developed for Android only - after a series of iterations on the concept, UX and design. Following a 3 month development period the mobile application together with a web application for the facility managers was soft launched at one of the sites for a 2 week period followed by a 3 month pilot testing period on all five locations. The users were onboarded with assistance from the team and weekly status meeting were conducted with the facility managers as they played a central role in managing the suggested improvements, providing feedback to the employees and generally supporting a culture where sharing ideas is appreciated. If site managers didn't play along, the game would end.

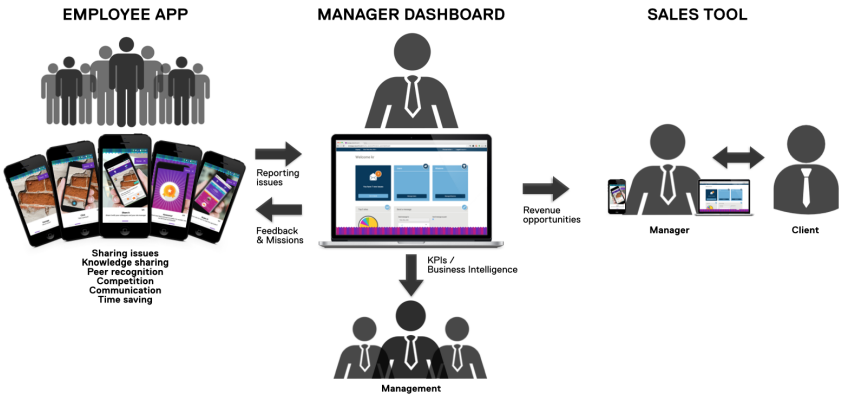

Figure 1: An overview of the Share@ISS concept.

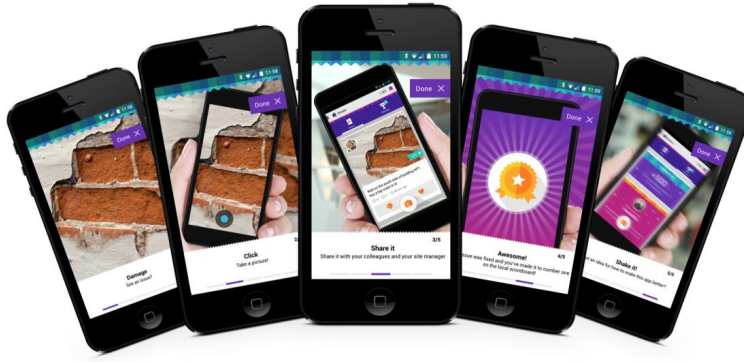

Figure 2: The apptour the user sees when opening the app for the first time.

3. RESULTS

One of the highly valuable outcomes of the Share@ISS pilot project was the *proof of concept*, which has moved the organization from imagining to knowing that a gamified mobile application like this one generates positive results on the facilities where it's being used.

Perhaps the most important result was that there was a significant pre-post increase in the number of employees submitting ideas for improvements. On average a location experienced an increase of more than 200% of employees being proactive in sharing their ideas for facility improvements.

Of 116 relevant users across the pilot sites, 94% (111 users) were onboarded (taught to use it) by the end of the 3-month period, and 71% of those were using it actively (+5 logins).

A total of 916 ideas for improvements were shared (average across sites = 9 per employee) and of the 916 ideas shared, 667 (73%) were the desired proactive behaviour. 249 (27%) were proactive ideas for improvements that were not automatically covered in ISS' contract with the client, meaning additional revenue opportunities.

These numbers are based on the fact that not all 111 users were active users for 3 months; they were gradually *joining* during those 3 months.

4. THE FUTURE

Share@ISS can be viewed as a typical example of consumerization of IT (consumer IT standards spreading to the business world). Outside work people get off the sofa to battle their friends on fitness apps, and Facebook is approaching 1.5 billion monthly active users – so why shouldn't a traditional company like ISS seize the opportunity in integrating these proven motivational formats if they can go hand-in-hand with the core of the business? Indeed not all work processes or digital business solutions can be turned into a super easy and 'fun to use' app, but Share@ISS has proven that in some cases, a work process can indeed be gamified and made easy and fun to do.

The ethnographic approach ensured that the app was built on already existing intrinsic motivational factors such as the positive social feedback of doing a 'good job' and earning recognition from peers and managers. For this reason, the application was not just some add-on to make things fun but at heart a useful tool, which eases the workflow, gamification or not.

During the pilot testing the Orchard team saw that several employees used the social feed to discuss and ask questions around the shared ideas and issues. As a consumer this is obviously not turning heads, since this is how it works on social media. However, as a global company it puts things in a very different perspective as these kinds of companies have traditionally been searching for ways to make knowledge sharing happen. How do you make sure that a great idea in one corner of the world is seen in the other? Internal newsletters, intranets and even newer corporate social media platforms haven't entirely solved the problem. Perhaps Share@ISS, which combines a useful work tool that you need frequently with a social component and gamification to help drive motivation, could put an end to ISS' 114 years of struggling with getting knowledge sharing to really work.

Share@ISS is currently being requested by new accounts within ISS without any PR, and continuous development of the app and program is ongoing. The next step is to extend Share@ISS to facilitate knowledge sharing in general and not just ideas for improvements. The first behaviour to investigate and to gamify is: when employees face a new problem or a problem they know but there might be a smarter way to fix: Ask!

REFERENCES

Burke, B. (2014). Gamify: How Gamification Motivates People to Do Extraordinary Things

Deci, E.L. & Vansteenkiste, M. (2004). Self-Determination Theory and Basic Need Satisfaction: Understanding Human Development in Positive Psychology. *Ricerche di Psicologia, 1*(27), 23-39.

Erikson, P. A., & Murphy, L. D. (2010). Readings for a History of Anthropological Theory. Toronto, University of Toronto Press.

Hammersley, M., & Atkinson, P. (1983). Ethnography: principles in practice. London, Tavistock.

Kohn, A. (1999). *Punished by Rewards – The Trouble with Gold Stars, Incentive Plans, A's, Praise and Other Bribes*. Houghton Mifflin Company, New York.

Pihl, N. (2013, 27. oktober). What are rewards? Decoding the Game Ep.2. Via http://www.gamasutra.com/blogs/NilsPihl/20131027/203329/What_are_rewards_Dec oding_the_Game_Ep2.php

Pink, D. H. (2009). Drive: The surprising truth about what motivates us. New York, NY, Riverhead Books.

Ries, E. (2011). The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses

Salen, K. & Zimmermann, E. (2004). *Rules of Play – Game Design Fundamentals.* The MIT Press.

Werbach, K., & Hunter, D. (2012). For the Win: How Game Thinking Can Revolutionize Your Business. Philadelphia, Wharton.

AUTHOR CONTACT DETAILS

Kristian Rix
Founder and CEO, Orchard MBC, kr@orchard.dk
Thomas Zeihlund
Commercial CFO, Global Corporate Clients at ISS World Services,
Thomas.Zeihlund@group.issworld.com
Timothy Long
Cand.scient.anth., Business Anthropologist, Orchard MBC, tl@orchard.dk
Tine Wulff Nielsen
Cand.comm., Gamification Specialist, Orchard MBC, twn@orchard.dk

DEVELOPING A SERIOUS GAME FOR PSS

Panagiotis Petridis, Victoria Uren and Andrew Harrison

ABSTRACT
Purpose: This paper presents the system architecture of a serious game, which is going to be run in parallel to Rolls Royce training on product-service systems (PSS).
Design/methodology/approach: The original game is outlined, requirements for an online version are defined, and the architecture is proposed.
Findings: The games approach has proven its value in design for service training but an online version is needed to improve the opportunities to deliver the game.
Originality/value: Such a system presents opportunities for the acquisition and development of specific professional knowledge, skills, and competencies

Key words: high fidelity, game engines, serious games, game-based learning, education, pedagogy

1. INTRODUCTION
Modern manufacturing is now extending well beyond mere production, and Product-Service Systems (PSS) are key to industrial success. Within a PSS, the manufacturer still produces the equipment and also takes responsibility for its through-life performance. In return they receive payment as the customer uses this 'capability'. This is a 'value in use' business model; the responsibility for equipment performance lies with the manufacturer, who receives revenue as the equipment is used by the customer.

PSSs can have an enormous impact on turnover and environmental sustainability of a manufacturer. Rather than a single transaction for the sale of a product (and then hoping for revenue for spare part sales) long-term value capture increases significantly. As a consequence, turnover can increase dramatically, in some cases by up 30% per year throughout the lifetime of the contract.

The uptake of PSSs across manufacturers in the UK is however slow. Researchers continue to praise the successes of companies such as Rolls-Royce Aerospace, yet wider adoption across supply-chain is limited. In 2009, a national survey of 500 manufacturers revealed:

- Lack of understanding about servitization and PSS with a significant number having difficulty in thinking of new and creative ways to provide a service for their customers.
- Enormous cultural challenges and uncertainty about the impact of servitization and PSS.
- Fear about the risks (short-term & long-term) and unforeseen business scenarios.

A manufacturing transformation will only be achieved if these issues are addressed. Senior managers need to be engaged extensively, their understanding and awareness improved, and their people trained. Embedding the new service culture in a business requires the development of new skills, attitudes and even a "ubiquitous language"(Evans 2003): a service vocabulary shared the entire workforce of an organization. Greater knowledge is required about successful and accelerated pathways for servitization within mainstream manufacturers. Establishing this knowledge is the manufacturing challenge.

Design for service has a critical role in ensuring the economic viability of PSS (Harrison 2006). For PSS business models to be successful, Original Equipment Manufacturers (OEMs) need to develop products which are more efficient and reliable, as well as easier to service. With the shift of responsibility for after care back to the OEM, designing for low production cost is no longer the best

long-term strategy. Long-term profitability of PSS is grounded instead on whole life cost of the product, including servicing and spares. This is a prime example of an attitude that needs to be changed in a company for PSS to provide a successful business model.

It has been shown that serious games benefit business decision making by engaging and motivating the workforce, improving training outcomes, and influencing the behavior of their existing and potential customers (Donovan 2012). However the effectiveness of the serious games could be influenced by a number of risk factors such as the rate of change of ICT Technologies and the ongoing efforts in order to support the infrastructure, losing the balance between pedagogy and gaming, the change in nature of gamers (Petridis et al. 2015).

Rolls-Royce has a pre-existing game which is used to teach key concepts of design for service in face to face sessions. The current game has been used extensively in Rolls-Royce to provide training across all areas of the company, including managers, engineers, sales staff, and many other personnel, in support of its Rolls-Royce TotalCareTM programme. The game is credited within the company with bringing the learning in the Design for Service course to life. Over the course of a couple of hours the language used by the participants visibly shifts and directly supports the cultural shift demanded by a PSS rather than manufacturing focus. However, the face-to-face nature of the existing game limits the opportunities for delivery to scheduled training sessions led by specialist facilitators. It cannot, for example be offered on an as-required basis to new members of staff, nor indeed online to university students, nor in the context of a Multiuser Open Online Course (MOOC). The Design for Service game thus offers an opportunity to take a game, for which the game mechanics are tried and tested, and explore how porting it to digital, in the form of a serious game which can be delivered as a self-contained virtual learning environment, affects how it can be delivered, and learning outcomes for players. To do this the first step is to design the architecture, which is the main contribution of this paper.

The rest of this paper is organised as follows: Section 2 describes related work, providing a review of the current state of serious games for training. Section 3 presents the first version of the Design for Service game as originally developed by Rolls Royce. Section V represents the architecture of the second version of the game which is a digital version of the first version of the game. The final section represents the conclusions and future work.

2. BACKGROUND

Modern businesses are faced with new challenges due to the rapidly evolving marketplace, to the shifting labour markets. Addressing these challenges requires a wide range of skills from both senior and front-line staff, in-turn requiring innovative and effective training tools such as serious games, gamification applications to aid staff at all levels of an organisation as they adapt in response to emerging challenges, game based learning provide opportunities for various organizational need such accelerating learning (Laine 2012), driving workforce productivity (Cook 2013), communicating with customers ((Werbach 2013)(Werbach & Hunter 2012)) and collaborating with business partners (Hugos 2012).

Because of their ability to motivate, engage and influence behaviors, serious games are being used in the corporate sector for training, recruitment and marketing and sales, via targeting planning, problem solving and hypothesis verification ((Donovan 2012)(Petridis et al. 2015)). However in order to improve the uptake and the evaluation of serious game, it is necessary for the designers to support higher order thinking (i.e. strategic thinking, analysis and interpretation of events,) and creativity simulation. This can be achieved through advances in Artificial Intelligence (AI), in particular concerning the simulation of (single) human behavior, in order to allow creation of living worlds, populated with realistic, or at least credible, non-player characters (NPCs) (GALA).

Large organisations are investing resources in using games to train their workforces in areas ranging from compliance training to leadership development. Serious games provide employees with a compelling context-relevant storyline, achievable goals, constant feedback on their progress and rewards such as achievement badges and public recognition. They also provide employees with opportunities to fail, learn from their mistakes and try again in safe environments. Typical examples games used for corporate training are IBM's CityOne, Siemens Plantville, CoCo Sim ((Donovan 2012)(Petridis et al. 2015)).

However, several factors inhibit the uptake of serious games within business. One such is the traditional high cost of game development compared to learning approaches (Petridis et al 2015). Another inhibiting factor lies in organizational cultures in which buy-in can be difficult. This difficulty underscores the often-cited need for development effort to be genuinely collaborative in nature, in order to balance the needs of engagement with the needs of instructional design. The research in this paper presents a snapshot of such a collaborative design process in action (Petridis et al. 2015).

3. FIRST VERSION OF THE GAME

The first version of the game was created by Rolls-Royce in 2001 and was played around 15 times in the first year by around 15-20 people each time. It provides training in design for service to engineers, managers and other employees. It has since been run 2-3 times per year within the company as a 3 hour training session, as well as on an MSc programme at Cranfield University. Within the context of Rolls-Royce the game is credited with bringing the training to life, and with the shared experience of the game giving employees from across the global corporation a shared vocabulary and conceptualization around service design.

The game concerns the design and servicing of washing machines for a customer who runs a chain of laundrettes. Teams each represent competitors in the washing machine market and the aim is to maximise profits. At the end of each round an Excel spreadsheet with an embedded Monte Carlo simulation is used to calculate the performance of the companies, and players are presented with a visual report, which summarises their performance and highlights key areas for improvement using red, amber, green colour coding.

The design for service is played in four rounds:

- Round 1 Players are given a brief introduction to the concepts of design for service and then have to quickly make three design choices using information on cost and reliability provided in a catalogue of parts (Fig.1). Typically, at this point, habit and time pressure will drive players to choose low cost options, a traditional design choice but not one likely to improve the in-service reliability. At the end of this and subsequent rounds players are given feedback on the performance of their company in comparison to other teams in the form of an auto-generated analysts report (Fig. 2).
    - The key learning point of Round 1 is: if you don't understand the requirement, or how you can achieve the requirement you tend to do what is easiest – clear understanding of the requirements is key.
- Round 2 Players are given the opportunity to interview a service engineer (role-played by the game facilitator in the original version). This allows them to gather information about
- which parts of the washing machine breakdown and require the engineer to be called out. They can now remake their design choices taking into account how long components last in service, their cost per year etc.

- The key learning point of round 2 is: a little service information goes a long way to optimising the result.

- Round 3 Only two design choices can be changed in this round. This drives players to be more selective about where they apply time and effort and to focus on the most important KPIs in the end of year report generated in the previous round.

  - The key learning point of round 3 is: service costs are not linear – focusing on the few key drivers gives disproportionate benefit.

- Round 4 Only one design change is permitted in this round, but it is a 'real' design choice, i.e. players are no longer constrained by the component choices presented in the catalogue but can decide to alter their designs in any reasonable way. The facilitator decides if the choices are reasonable and applies a cost and lifetime based on engineering judgement before running the Monte Carlo simulation for a final time.

  - The key learning point of round 4 is: innovation and challenging the historical 'norm' is a major opportunity.

Figure 1: Pages from the catalogue of parts

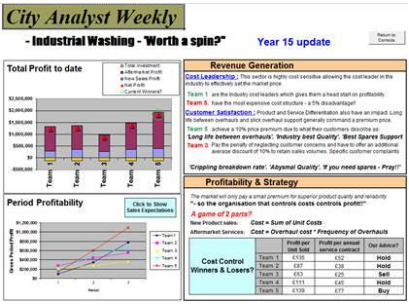

Figure 2: Analyst report provided as end of round feedback on performance

4. SECOND VERSION OF THE GAME

The serious game version of the Design for Service Game is envisaged as an on-demand, online version of the game, which might, for example, be embedded in Massive Open Online Courses (MOOC) or blended learning environments. A further challenge in implementation would be the desire to support both 'group' participation (e.g. teams competing against each other for an MSc online module where the dialog between team members enables peer assisted learning), or individual participation (e.g. players compete vs virtual competitors in machine mode).

To achieve this outcome the following requirements were specified:

1. Taught elements to be embedded within the game environment.
2. Interview with the service engineer to be delivered virtually, e.g. using an avatar.
3. Illusion of competition to be maintained even in a single player game.

The Monte Carlo simulation is to be retained as the game scoring mechanics.

5. PROPOSED SYSTEM ARCHITECTURE

The following section focuses on the proposed system architecture for our Design for Service Game. The system is divided into three parts (Fig. 3): the Logic Layer, the Data Layer, and the Presentation Layer.

5.1 The Logic Layer

The Logic Layer drives the simulation. The simulation consists of a pool of services such as:

- Step manager: provides the next step based on the decision of the player.
- Status manager: is responsible for the interpretation of the next step based on the input provide by the GUI-core.
- Response generator: is responsible for providing the next step based on the input from the step interpreter.
- Simulation: the Monte Carlo simulation takes as input the players'design choices as well as historical choices to create the illusion of competition and calculates company performance measures.

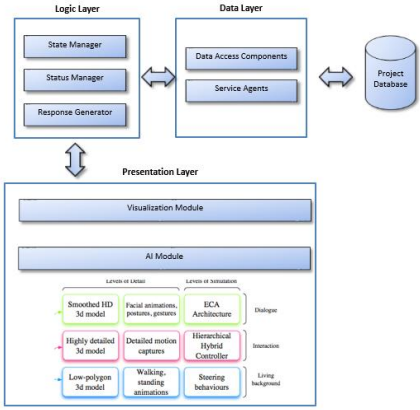

Figure 3: Proposed System Architecture

5.2 The Data Layer

The Data Layer is responsible for accessing the scenarios and data that are stored in the Project Database. The Data layer includes:

- Data Access component: these components are focussing on abstracting the logic, which is required in order to access the data.
- Service Agents: this component is focussing on implementing code to communicate with a particular service such as offline support, caching etc.

5.3 The Presentation Layer

The Presentation Layer is divided into two distinct components:

- The Visualization engine: is based on the Unity3d and is responsible for rendering the game environment. In order to accommodate the different types of data several graphical user interface template are going to be created. Once a step is received from the Logic Layer, the appropriate template will be selected and the rest of the step information will be received and will be injected into the template at which point the template can be displayed to the user.
- The Report engine: generates the colour coded company reports at the end of each round to direct the players' attention towards key areas for improvement.
- The AI component**:** The LoI framework simplifies the interaction between the player and the non player characters (NPCs). Graphically, the LoI can be represented as auras of increasing complexity centered on the players avatar. LoI is based on a simple social space metric [31] and is divided to three levels. The first level aims to populate the characters with authentic crowd in order to increase the immersion of the player. Characters located in closer

surrounding of the player belong to the interaction level. Finally, a character inside the dialogue level interacts with the player in a natural way, ultimately using speech recognition and synthesis. All the NPCs by default belong to the background level, but as the player moves in the environment and they happen to get closer or away from the player and thus enter or exit the interaction or dialogue levels.

6. CONCLUSIONS

This paper presented the system architecture for the digital version of the Rolls-Royce Design for Service. The authors presented their plans for implementation of such a system. The authors believe that such a system presents opportunities for the acquisition and development of specific professional knowledge, skills, and competencies. We expect the application of a game based learning environment will stimulate and engage the trainees.

Future plans for this game will include the comparison of the face-to-face game with the digital counterpart in terms of knowledge acquisition, and engagement.

REFERENCES

W. Cook (2013) "Five Reasons You can't Ignore Gamification," *Chief Learning Officer* vol. 12, pp. 46-55

Lynda Donovan. (2012). *The Use of Serious Games in the Corporate Sector.* Available: http://www.learnovatecentre.org/wp-content/uploads/2013/06/Use_of_Serious_Games_in_the_Corporate_Sector_PRINT_FINAL.pdf.

Evans, E., (2003) Domain-Driven Design: tackling complexity in the heart of Software.

GALA NoE. *GALA Roadmap, .* Available: http://www.seriousgamessociety.org/

Harrison, A. (2006) Design for Service: harmionising product design with a services strategy, ASME Turbo Expo 2006: Power for Land, Sea, and Air, Barcelona, Spain, May 8–11.

M. Hugos (2012) *Enterprise Games: Using Game Mechanics to Build a Better Business, :* O'Reilly.

T. Laine (2012) " Using a business game concept to enhance servitization: a longitudinal case study,," *Managing Service Quality,,* vol. 22, pp. 428-446.

P. Petridis, Hadjicosta, K., Victor Shi Guang, Dunwell, I., Baines, T., Bigdeli, A., Bustinza, Oscar F., Uren, V. (2015) "STATE-OF-THE-ART IN BUSINESS GAMES," *International Journal of Serious Games,,* vol. 2.

P. Petridis, Nadim, W., Bowden, S., Goulding, J., Alshawi, M. (2009) "Manubuild Construction Site Training Simulator for Offsite Manufacturing," in *roceedings of the 2009 Conference in Games and Virtual Worlds for Serious Applications (VS-GAMES 2009)*, Coventry, UK.

K. Werbach (2013) " Teaching Gamification: Astonishing Successes and Lessons from MOOCs," presented at the Gamification Summit.

K. Werbach, and Hunter, D. (2012) *For the Win: How Game Thinking Can Revolutionize Your Business*: Wharton Digital Press.

ACKNOWLEDGMENTS

This work was supported by EPSRC Grants Ref EP/K014064/1, EP/K014072/1, EP/K014080/1 'Transforming the adoption of Product -Service Systems through innovations in applied gaming technology'; a joint project with Aston Centre for Servitization Research and Practice, Aston Business School and the Advanced Manufacturing Research Centre, University of Sheffield.

AUTHOR CONTACT DETAILS

Panagiotis Petridis
Aston Centre for Servitization Research and Practice, Aston University, Birmingham, UK.
Victoria Uren
Aston Centre for Servitization Research and Practice, Aston University, Birmingham, UK.
Andrew Harrison
Rolls-Royce Ltd, Derby, UK.

OPTIMISING THE DESIGN AND DEVELOPMENT OF LOCATION-BASED GAMES: THE LBE FRAMEWORK

Samantha Clarke, Petros Lameras, Olivier Balet, Thibaut Brados, Elena Avantagelou, Ian Dunwell

ABSTRACT
The European project MAGELLAN designs and develops, among other systems and services, the Magellan Authoring Tool (MAT), which is a games authoring platform that has been specifically created to enable non-programmers to rapidly create and publish multiple forms of location-based experiences, involving several participants who compete or collaborate to achieve the activities and goals decided by the author. In the context of the project's training activities, a series of training processes, content and events have been realised commensurate to training creative people to create their own location-based games. To inform future iterations of the Location Based Experience (LBE) Training Framework and to assess the efficacy of the training methodology adopted for training users in the Magellan platform, this paper presents a case study following the Training and Evaluation of an associated project workshop that featured the Alpha release of the platform. An analysis of the findings is presented from data collected at the workshop featuring both end-user feedback and user evaluation observations. An investigation into the delivery methods and training content, specifically created for the Magellan Alpha Workshop, are considered and explored further as the LBE Training Framework is refined to incorporate feedback concerning future user training requirements for creating Location-Based Experiences.

Key words: Location-based games, gamification, training framework, games authoring environments, informal learning

1. INTRODUCTION
One purpose of LBE's is to extend the use of digital media to the outside world, situating users in a real rather than virtual environment, where physical structures and social protocols are pre-defined (Whyte, 2012). Outside influences such as weather, the player cannot control people, structures, noise and other events and/or the developer and can add to, or detract from, the overall experience and/or service (Reid et al., 2005). LBE's are typically reliant on using mobile technologies and location-based data, gathered through the use of location-based services and/or sensors such as a GPS module, Base ID or through local Wi-Fi connection scanning (Easton et al., 1978).

In principle, the MAT can be adjusted and used for business purposes, education and training. For example, it can be used for businesses for creating location-based games that train new staff to understand various business processes and how certain business subsidiaries function. Imagine a large company consisted of a complex internal structure with diverse units and systems. A geo-localised game would offer a practical gamified way for the staff to familiarise with the different business processes and increase their skills in relation to the core functions of the business. For example a training activity could be designed taking place at the operations management sector which when completed unlocks another activity at the supply chain sector. It could be perceived as a treasure-hunt game within a business environment where recruiting managers or trainers could exploit for recruitment / training purposes. In conjunction to this the MAT may be used as an educational tool for business education as means to enhance creativity in business studies, entrepreneurship and innovation.

In order to address this need, this paper presents an early-stage framework for the use of training and guiding users on how to develop and use LBE's as part of a European project, called MAGELLAN, which is about creating location-based games using a location-based authoring environment and tangible interfaces. Within this paper, the authors present the MAGELLAN Training Framework developed specifically to train and support users to develop location-based experiences through the

use of the MAGELLAN Authoring Tool (MAT) software. The MAGELLAN Training Framework described in Section 3 is used to inform and facilitate a training session for end-users, aiming to develop their proficiency using the MAT platform presented in Section 2, then used as a case study, documented in Section 4, to inform the preliminary development of the Location-Based Experience (LBE) Training framework as described in Section 6.

2. THE MAGELLAN AUTHORING TOOL

The MAGELLAN Authoring Tool (MAT), shown in Figure 1, is a games authoring platform (Balet et al., 2015) that has been specifically created to enable non-programmers to rapidly create and publish multiple forms of location-based experiences, involving several participants who compete or collaborate to achieve the activities and goals decided by the author. Visual authoring metaphors have been derived from this model to enable the creation of the narrative structure using building blocks (i.e. preconditions, activities) that can be linked together and visually parameterised. All edits are performed either in the scenario editor that represent the narrative structure or on the 3D map view of the geospatial playground that can include both indoor and outdoor areas. Visual authoring metaphors have been derived from this model to enable the creation of the narrative structure using building blocks (i.e. preconditions, activities) that can be linked together and visually parameterised. All edits are performed either in the scenario editor that represent the narrative structure or on the 3D map view of the geospatial playground that can include both indoor and outdoor areas.

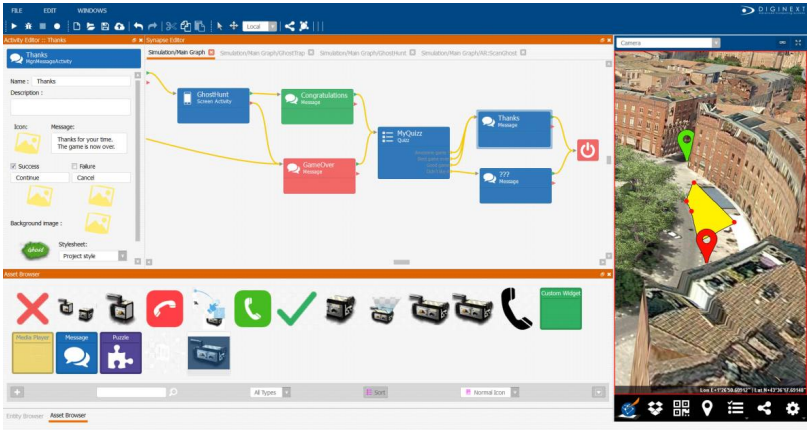

Figure 1: The Magellan authoring tool

3. THE MAGELLAN TRAINING FRAMEWORK

The MAGELLAN Training Framework (MTF) has been developed specifically to train end-users, i.e. location-based experience authors, to exploit and use the MAGELLAN Authoring Tool as a means to create, organise and publish location-based experiences. The MTF is the initial conceptualisation of what we perceive as a sustainable approach to train end-users to use the MAT. The MTF progressively is transformed to the LBE training framework (section 5) that provides a holistic interpretation of a series of training services for location-based games. A business parameter is added both to the MTF and LBE from an industrial and business applications afforded by the plurality and flexibility of the MAT to be used by people with no technical (i.e. coding) expertise and thereby making it as simple as possible for non-technical users working in the industry or in business faculties

to design and implement their own games. The MTF therefore allows transferability, localisation and application to different contexts concomitant to its visualised interface and simplistic functionality.

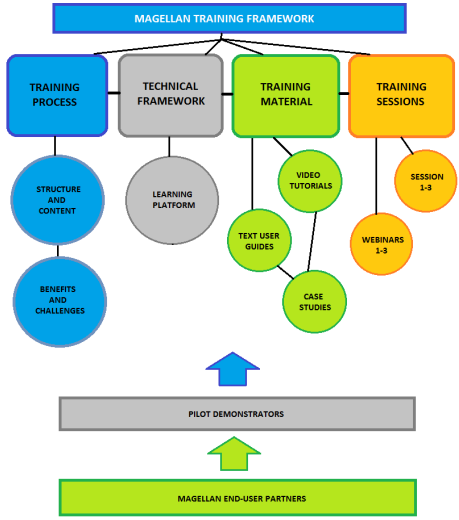

Figure 2: The Magellan training framework

The MTF shown in Figure 2 presents a general training process that encompasses a suggested list of technological tools, resources and the training content necessary to achieve a comprehensive methodology for training authors to navigate through the MAGELLAN authoring platform and gain the necessary competences to create location-based games. The objective of the MTF methodology is to create and sustain user interest in the creation of location-based games and encourage the communication of creative ideas between peers. This method looks to promote the users overall learning experience and fosters improvement of user design and development methods through an iterative process.

4. CASE STUDY

An end-user training workshop was held on February 4, 2015 in Athens, Greece to initiate and facilitate the training process of the alpha release of the MAGELLAN Authoring Tool (MAT). The workshop was organised to deliver hands-on experience of operating and developing location-based experiences using the MAT platform to a cohort of end-user developers involved in the MAGELLEN project. The training session, facilitator delivery, the MAGELLAN Training Framework directly informed training material and the overall training methodology that was delivered at the workshop.

The training session ran over one morning and one afternoon and comprised of a range of training activities that included both formal and informal training styles that had been informed by the MTF. 18 participants in total of which 13 participants were end-user trainees and 5 participants were training facilitators and/or moderators attended the training session.

4.1 Method and Findings

In order to evaluate the efficacy of the training session that had been developed using the MTF methodology, a Software Training Evaluation Questionnaire (STEQ) was given to the participants to

provide feedback at the end of the training. The STEQ consisted of 15 continuous scale questions and 14 open questions/comment sections in which the end-user participants could record their comments and thoughts. The questionnaire focused on providing feedback through five main measures of the training:

- Training Material – Quality
- Training Material – Content
- Training Material – Relevance
- Training – Organisation
- Training – Instructor & Teaching Method

Additionally, the STEQ provided open sections that enabled the participants to write down their feedback and comments concerning areas such as:

- Strong Points of Session
- Things to be Improved
- Recommendation of Course

	Question	Measure
Q1	How thorough and complete was the content of the video?	Content
Q2	How thorough and complete was the content of the Handbook?	Content
Q3	How clear and understandable was the content of the Video?	Content
Q4	How clear and understandable was the content of the Handbook?	Content
Q5	What was the overall quality of the Video (sound, video, images)?	Quality
Q6	What was the overall quality of the Handout (e.g., organisation, presentation, readability)?	Quality
Q7	How well was the overall training organised in terms of time (e.g., was the amount of time adequate for training?	Organisation
Q8	How relevant was the overall training in terms of helping you to understand how to use the program?	Relevance
Q9	How relevant were the prepared materials (e.g., did the materials match up to the training session?, did materials aid your learning?)	Relevance
Q10	How much did the group session aid your learning (Peer-to-Peer session)?	Relevance
Q11	How well prepared are you now to use the software on your own?	Relevance
Q12	How effective was the instructors teaching method in promoting learning (e.g., the way the instructor delivered material, content and instructions.)?	Instructor & Training Method
Q13	How effective was the instructor in terms of their effectiveness in addressing questions and concerns raised during class?	Instructor & Training Method
Q14	How important was it for you to learn how to use the software?	Relevance

Q15	To what degree do you think you have been trained to use the software to meet your needs?	Relevance

Table 1: Continuous Scale Questions from Software Training Evaluation

The overall mean score of 8.15 (SD=0.7, n=14) showed a positive response from participants overall, though this should be taken in the context of the limited sample and single site. There was little variance between the five topic areas (quality, content, relevance, organisation and instructor method), which could suggest participants felt the approach was effective in all these areas, but also suggests future work should focus on refining this metric to ensure data elicited from a larger sample can more strongly identify the strengths and weaknesses of the system. That the highest score was given to the question "How important was it for you to learn how to use the software" suggests an existing prior degree of perceived usefulness, which may not be reflected in a wider sample of potential end-users, given the existing limiting factors in the uptake of LBEs outlined in Section 3. Given these limitations in conclusively identifying strengths and weaknesses of the system from the quantitative data alone, the next section outlines in greater detail the qualitative findings for participants, before the refinements to the LBE training framework suggested by this data is presented in Section 6.

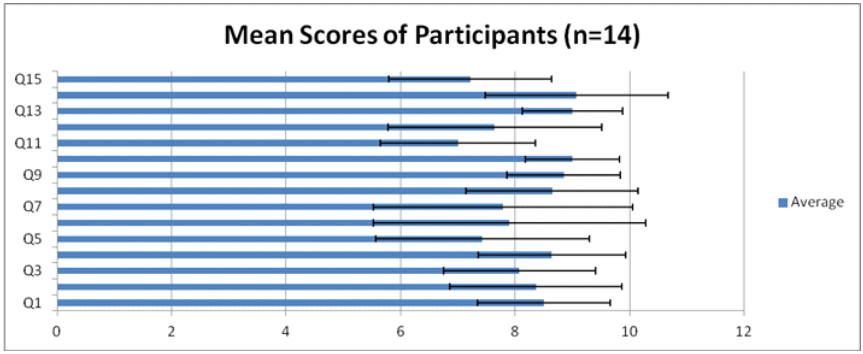

Figure 3: Mean values for scale questions

5. THE LBE TRAINING FRAMEWORK AND SCENARIO FOR BUSINESS GAME

Following the feedback on the training session that was informed by the MTF methodology, a new preliminary framework; the LBE Training Framework is proposed below in Figure 4. The LBE training framework is an iterative on-going process, which evolves and changes as refined elements are designed, modelled and applied to the MAT. It is envisaged that the LBE will be fully scalable, flexible and interoperable which may be transferred to other contexts either these serve the training of creative staff working at the business sector, or serving the educational sector as means to train practitioners and teachers working in business disciplines who are interested in using games for learning with the aspiration of improving content, link in-class teaching with out-of-classroom learning activities that add a twist in how teaching and learning is delivered. For example, in entrepreneurship modules or business strategy courses, a teacher could design a location-based game that would allow the students to solve puzzles and collect items from different business locations as a 'first-order experience' to allow students to see what strategies mean for businesses or what it means to create a business by grasping the fundamental aspects of the overarching steps for starting your own business. These potential practices would inform the LBE to provide training material; tutorials and documentation to provide examples of how the MAT may be used based on different use cases ranging from designing and implementing location-based games from a business

or science perspective.

A best practice scenario from one of MAGELLAN's end user's is about developing a location-based game for creating music communities during music events (e.g. music festivals) where small teams are collaborating and competing with other teams to explore music, albums and artists from a particular genre and then move on to the next location for finding the ultimate reward which is a hidden meeting with the rock stars. This business-focused game provides a best practice example of how location-based games may be instantiated for business contexts. The main mechanics of the game are: GPS geo-location, social game, memory game, augmented reality, connection to social media, interaction with other players, and user mobile experience.

Figure 4: The LBE training framework

Informed by the MTF Training Process used at the training workshop, the Training Process is split into 5 stages; End-User Requirements, Set Training Objectives, Create Training Action Plan, Develop Training Activities and Evaluate and Revise. End-User requirement planning helped to identify the content that was to be delivered to the participants in the training workshop. The feedback received found that adopting this approach was somewhat successful with content and relevance of training commented on as 'sufficient' and 'good for beginners'.

Adopting this approach, this stage is used to define user-training requirements from the offset. End-User Requirement planning is used to create a comprehensive review; understand current gaps surrounding the training problems and to ascertain ideas and feedback for user content. Accurate information can be ascertained and used to form the overall Training Process. During the training workshop, it was essential to have learning objectives in which the participants could work towards and feel that they were progressing in their development. Following the learning objectives that were set for the workshop; participants should have a basic knowledge in the main components of the MAT platform, the feedback indicates that all of the participants felt they had a basic knowledge

of the MAT by the end of the training workshop. To follow this, this stage is used to identify achievable training objectives that are to be accomplished by the training participants over the course of the training program. The training objectives are created to correlate to any data taken from the End-User Requirements stage. The Action plan was used to develop the educational methods in which the training was going to be developed for the workshop.
The feedback from the participants indicates that the mixed application of delivery styles focusing on a constructivist approach was received well with comments such as 'work in groups was useful' and that the training method was 'good'.

A Training Action Plan is proposed to be developed in accordance with the feedback from the End-User Requirements and the Training Objectives that are set. The Training Plan is used to outline any pedagogical theories and methods that are to be adopted for the training programme. Theories and methods chosen are used to structure the delivery style, material and structure of any training sessions to ensure that learning objectives and goals are likely to be met by the participants. Training activity planning was used to help inform the development of the training agenda and training material to be used at the workshop. Participant feedback suggests that most of the training material was found to be relevant to the training but the quality needed to be improved on. The Develop training Activities stage is proposed in which the training agenda and the training material are developed in unison with the set Objectives and the Action Plan.

Within this stage, quality control of materials and resources should be addressed. The development of the STEQ was used to help evaluate the efficacy of the training given at the workshop. Adopting this approach has provided the feedback necessary to address participant and training related issues or concerns for future training purposes. The Evaluate & Revise stage is used to develop evaluation material and gather data relating directly to the training experience on issues such as, but not limited to; Quality, Delivery, Trainers/Moderators and Usefulness which is used to inform future iterations of the training program.

Following the qualitative feedback gathered from the participants, a Design & Technology section is used to address the training need that was raised for this area. The Design & Technology phase is split into 3 stages; Game Design Fundamentals, LBE Specific Design and Technical Requirement Planning. Within the workshop, there were several participants that were not from design or technical backgrounds. Feedback in the STEQ suggested that some initial training in basic game design principles and theories would help them understand how to develop design concepts. To address this feedback, this stage ensures basic principles are addressed so that participants who do not come from a design or technical field benefit from understanding basic game design concepts when undertaking LBE design and development.

Within the workshop different levels of technical expertise were exhibited from the participants. Due to the variance in skill, some training material and activities may have been too novice or too advanced for the participants. Following this, the authors propose the Technical Requirement Planning stage in which software and hardware that is to be used in the training program are considered by both facilitator and participant. Participants are made aware in training of the technical elements that are to be used in training and that are needed for LBE design and development. In order to deliver a successful training workshop, careful planning regarding how the training was to be delivered to the participants was required.

The Training Delivery phase informs this process and is split into 4 stages; Training Agenda, Training Structure & Delivery, Training Resources and Training Set-Up. Planning for the training resources to be used at the training workshop helped inform the development of the training materials, the amount of materials and how the participants would access the materials. Feedback concerning the

training resources indicated that participants felt the style and content of the materials helped their learning but some additional resources such as a 'handbook' would have been beneficial. This stage uses theories and methods developed from the Training Action Plan stage to inform the development and delivery of any training materials and resources to be given to the participants.

7. CONCLUSIONS AND FUTURE RESEARCH

Presented in this paper is the first iteration of the LBE Training Framework that has been informed through the development and trial application of the MAGELLAN Training Framework at a training workshop and the subsequent participant data, qualitative and quantitative, received from the trial. Developed from the data, the LBE Training Framework presents some main areas for consideration to aid training end-users in the design and development of location-based games and experiences. Through an examination of the quantitative data it is recognised that the evaluative measures need to be refined for clearer data in future assessments of the frameworks proposed. Furthermore, more in-depth qualitative data regarding the efficacy of the individual stages proposed in the LBE Training Framework will aid assessment and future iteration developments. Future work will include further expansion of the MAGELLAN Training Framework to continue to inform the LBE Training Framework's development throughout the process of the MAGELLAN project. Furthermore, future trials that obtain facilitator-based data are proposed to observe factors such as perception, usefulness and efficacy of the LBE Training Framework from the facilitator's perspective.

REFERENCES

Balet, O. et al. 2015, Authoring and Living Next-Generation Location-Based Experiences, in proceeding of EEE Virtual Reality 2015. March 23-27, Arles, France (to appear).

Easton, R.L., Buisson, J.A., McCaskill, T.B., 1978. Initial Results of the NAVSTAR GPS NTS-2 Satellite. [Department of Defense, Navy Department, Office of Naval Research], Naval Research Laboratory.

Ting, Y.-L., 2013. Using mobile technologies to create interwoven learning interactions: An intuitive design and its evaluation. Comput. Educ. 60, 1–13.

Whyte, W.H., 2012. City: Rediscovering the Center. University of Pennsylvania Press

AKNOWLEDGEMENTS

This paper leading to these results has received funding from the European Community's FP7 programme under grant agreement no. ICT-FP7-611526, MAGELLAN Project.

AUTHOR CONTACT DETAILS

Samantha Clarke, Petros Lameras, Ian Dunwell
The Serious Games Institute, Coventry University, PLameras@cad.coventry.ac.uk

Olivier Balet, Thibaut Brados
Diginext, olivier.balet@diginext.fr

Elena Avantagelou
Research and Development, EXUS, elav@exus.co.uk

A GAME BASED APPROACH TO IMPROVE TRADERS' DECISION-MAKING

Mark Fenton-O'Creevy, Marc Adam, Gill Clough, Gráinne Conole, Mark Gaved, Jeffrey Todd Lins, Craig Lindley, Gilbert Peffer, Eileen Scanlon, Ale Smidts

ABSTRACT

Purpose: The development of a game based approach to improving the decision-making capabilities of financial traders through attention to improving the regulation of emotions during trading.

Design/methodology/approach: The project used a design-based research approach to integrate the contributions of a highly inter-disciplinary team. The approach was underpinned by considerable stakeholder engagement to understand the 'ecology of practices' in which this learning approach should be embedded.

Findings: Taken together, our 35 laboratory, field and evaluation studies provide much support for the validity of our game based learning approach, the learning elements which make it up, and the value of designing game-based learning to fit within an ecology of existing practices.

Originality/value: The novelty of the work described in the paper comes from the focus in this research project of combining knowledge and skills from multiple disciplines informed by a deep understanding of the context of application to achieve the successful development of a Learning Pathway, which addresses the transfer of learning to the practice environment

Key words: Design-based research, emotion-regulation, disposition–effect, financial traders, serious games, sensor-based games

1. INTRODUCTION

This paper describes the xDelia project (http://www.xdelia.org), which was concerned with developing approaches to improving financial decision-making. The primary target group was investors who trade their portfolio regularly (typically via online trading platforms). This is a large and increasingly economically important group around the world. Such traders invest their own funds in investing and speculating in markets for financial assets. Most national (and trans-national) regulatory regimes are concerned with the need to ensure that citizens participating in such activities are well informed about risks including behavioural risks such as systematic biases.

1.1 The Problems of Previous 'De-biasing' Approaches

Many forms of de-biasing training, which seek to reduce propensity to systematic biases in decision-making, have been, at worst, counter-productive and at best had very limited impact even in laboratory settings (Bazerman, 2002; Fischhoff, 1982; Lilienfeld, Ammirati, & Landfield, 2009). A key problem with de-biasing training approaches has been the focus on shifting cognition from System 1 (fast intuitive pattern recognition mediated by the emotion system) to System 2 (conscious, reflective analysis) (Lilienfeld, Ammirati & Landfield, 2009). As Baumeister and colleagues (1998) have shown, human capacity for self-monitoring and effortful System 2 cognition is limited and is rapidly depleted. Attempts to reduce biases by learning about biases and engaging in self-monitoring, rapidly come up against human cognitive limits.

1.2 Emotions and Emotion Regulation

There is an increasing body of research which shows many systematic biases in human decision-making to be shaped and mediated by emotional reactions (Fenton-O'Creevy et al, 2011). However, recent research on emotion regulation makes it clear that humans do not just experience emotions; we actively regulate them (Gross & Thompson, 2007). Recent empirical research has begun to address the role that emotion regulation processes play in individual susceptibility to biases. For example, a large-scale field study of investment bank traders showed important differences between novice and expert traders in emotion regulation strategies and showed many traders and their

managers to be concerned with the regulation of emotion to avoid the biasing effect of strong emotions on trading decisions (Fenton-O'Creevy et al., 2011, 2012).

1.3 Developing an Alternative Approach

As we note above, prior approaches to de-biasing training have been especially ineffective in the transfer of learning into real-world settings. Our approach, to learning to avoid systematic biases in financial decision-making, does not rest primarily on shifting cognition from System 1 to System 2. Rather we recognise first, the importance of enhancing domain-specific task feedback and, second, the role of emotions in mediating System 1 decision-making. In particular a wide range of decision-biases can be shown to be underpinned by emotion processes (Loewenstein & Lerner, 2003) and a central proposition of the project is that such biases can be reduced through more effective regulation of emotions. We have a particular focus on biases in financial decision-making which have the following characteristics: i) the bias has been demonstrated to be significant in naturalistic settings as well as in the laboratory, ii) there is reason to believe that emotions play an important role in the operation of the bias and iii) the bias is tractable to detection at the level of the individual, for example, though the analysis of past trading decisions. Whilst there may be merit in embedding learning in the real trading context, this carries evident risks of, at least initially, harming performance. Thus we aimed to design a game based learning environment, for play based learning, with a structured process for transfer of learning into the context of application.

To develop and establish a 'proof of concept' for a game based approach to decision-bias reduction, we chose to focus initially on one particular bias which fits the above criteria: the disposition effect. The disposition effect is the tendency to hold assets that would sell at a loss for longer than assets that would sell at a gain (Shefrin & Statman, 1985). In colloquial terms an investor who suffers from the disposition effect cuts their wins and runs their losses. This bias arises out of the desire to avoid the emotional pain of realising a loss. So long as the investor does not convert a paper loss into a realised loss they can console themselves that 'it will probably increase in value again'.

2. METHODOLOGY

The methodology we adopted was Design-Based Research. Design-Based Research (DBR) has emerged in recent years as an approach for studying learning in context through systematic design and study of instructional strategies and tools (Brown, 1992). Barab (2006, p. 155) argues that the value of Design-Based Research (DBR) is that it offers a methodology for dealing with the complexity of real learning contexts by "iteratively changing the learning environment over time – collecting evidence of the effect of these variations and feeding it recursively into future designs" (citing Brown, 1992; Collins, 1992). DBR provided an appropriate methodology because it is agile, iterative and is useful when developing for and evaluating complex contexts. It also provided a broad framework within which the different methodological approaches and theoretical perspectives of a very interdisciplinary team could be integrated.

A first important underpinning for our DBR approach was very considerable stakeholder engagement to understand the 'ecology of practices' (Scanlon et al., 2013) in which this learning approach would need to be embedded. This involved working closely with a commercial partner, Saxo Bank, who provided in depth knowledge of the industry setting, trader profiles and behaviour and were also an active research partner. It also involved a series of exploratory observational and interview studies which looked in depth at the practices used by professional traders to effectively regulate their emotions; and the practices, including learning practices, of private traders and investors with which any learning approach would need to integrate. This led to our understanding the technological artefacts that we sought to produce as only one element in a technology enhanced learning 'complex' (Scanlon et al. 2013) of technology, software, learning design, learning practices and learning support which would need to successfully integrate with the existing practices of our target audience, including their, largely informal, and highly self-motivated learning practices.

The second key underpinning for the work was the highly cross-disciplinary team which included expertise in financial economics, the psychology of financial decision-making, neuro-economics, behavioural economics, serious games, technology enhanced learning, and physiological sensors.

We set out below an account of our learning design, with an account of the underpinning assumptions, theory, and data.

3. A LEARNING DESIGN FOR REDUCING INVESTOR SUSCEPTIBILITY TO BIAS

In designing a learning approach to reduce investors' vulnerability to bias we have framed learning objectives at four levels:

- Level 1: Propositional Knowledge. Understand the disposition effect and emotion regulation strategies and how they relate to investor trading.
- Level 2: Self-awareness. Improve awareness of own profile in relation to disposition effect, habitual emotion regulation strategies; and propensity to defensive emotion regulation.
- Level 3: Skill development. Develop skills in recognising and avoiding the disposition effect and in effective emotion regulation in a learning environment.
- Level 4: Transfer. Support the transfer of skills from the learning environment into the practice context.

To achieve these outcomes we needed to engage investors in the acquisition of propositional knowledge, provide opportunities for feedback, develop a learning environment for skill acquisition and practice, and develop a supported approach to transfer of skills into investors' real-world practice of trading.

3.1 Overview of the Learning Pathway

We developed a Learning Pathway which has multiple elements: didactic elements, diagnosis and feedback on behavioural biases (both game-based and based on real-world trading), learning and practicing emotion regulation strategies in a serious game environment, practicing emotion regulation strategies in the practice context, and support for reflective practice.

The learning approach can be broken down conceptually into three key aspects: diagnosis and feedback, skills development, and transfer (see Figure 1). While the diagram represents this as a linear pathway, we would emphasise that in practice it is iterative, with learners returning to earlier diagnostic and skill development phases as they work on transferring these skills into the trading context.

We are clear that didactic, knowledge-focused learning approaches to de-biasing have largely failed in the past (Bazerman, 2002; Fischhoff, 1982; Lilienfeld et al., 2009). However, that does not mean that we entirely reject the utility of didactic approaches. First, some element of knowledge transmission is necessary to support the other approaches we espouse, namely diagnosis and feedback, and critical reflection. For example, feedback on susceptibility to a disposition effect or training in improving emotion regulation is unlikely to be effective without an understanding of the nature of the disposition effect and the meaning of emotion regulation. Second, the impact of didactic approaches on real-world practice should be significantly enhanced to the extent that the

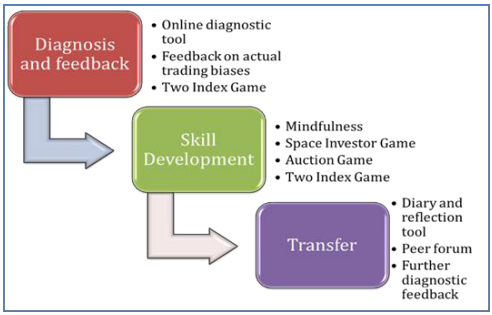

Figure 1 – The xDelia Learning Framework

learning is brought alongside and placed in the context of the specific domain of practice (in this case investors trading on a trading platform). We describe below the three games which formed the core of the learning journey.

3.1 The Games

3.1.1 The Two Index Game

Figure 2: The Two Index Game

The Two Index Game is a fast paced serious game which challenges a single player to buy and sell assets in a set number of timed levels and perform as close as possible to playing perfectly relative to a benchmark. The game emulates decision making processes within investment and trading, in a non-specific manner, and can perform diagnostics about exhibited cognitive biases, including disposition effect, as well as incorporate feedback derived from these into game play in real-time. The game is available in both diagnostic and didactic modes. The first, to diagnose the extent to which a participant may be subject to the disposition effect, and provide post-gameplay feedback; the second provides in-game visual feedback on current disposition effect to the participant and enables them to use it as a training tool to reduce the extent to which they are affected by this bias.

When playing the game, the participant is presented with two indices: the Value Index, showing current asset prices, and the Predictor Index, which partially determines the tradable index value (with lag and some random component). The player's task is to buy and sell the assets using these indices at the best moment to maximise profit and perform as close as possible to a benchmark: their performance is presented as a percentage distance from optimum, changing during game play.

The participant is taught the game through an initial tutorial which walks them through the game demonstrating key features, and gives them the opportunity to practice before the real game starts. The game is structured so as the levels progress more options are made available, allowing for more possibilities for taking risk and ways of transacting. To begin with the player can only buy single assets, then they are able to buy multiple assets at a time, and finally they can short sell.

The game is available as an online version, or can be installed as a standalone local version for computers that are not connected to the internet. Both versions offer the same functionality.

3.1.2 Space Investor

Figure 3: Space Investor - showing arousal bar

Space Investor takes the form of an asteroid shooting game that helps to train a player's emotion regulation strategies. Two variants have been produced: a didactic version which provides live feedback to the player, and a diagnostic version (no live feedback).

The purpose of the game is to assist investors in becoming aware of their own arousal state as well as training them in regulating their arousal. This is important, as emotions and arousal are strongly linked phenomena. Space

Investor provides participants with a game environment in which to practice awareness and regulation of arousal. The game both gathers biofeedback on the participant's arousal state and also requires participants to self-report their own perceived arousal level (from 0-4) at the end of every game play level. Playing the game supports development of emotion regulation skills in three ways. First, it provides an environment in which management of arousal levels can be practiced and rewarded. Second, by directing attention to the participant's own physiological state it encourages improved interoception (awareness of internal physiological state); there is empirical evidence for a link between interoception and perception and regulation of emotion state (Damasio, 2000). Third, it provides a context for the practice and consolidation of emotion regulation approaches developed in other contexts (for example mindfulness approaches, which require effective interoception).

Playing Space Investor, the participant has to shoot down asteroids, selectively, to avoid them hitting their space ship and avoid hitting other asteroids to collect resources to gain upgrades. The player wears an ECG sensor, which communicates with the game via Bluetooth and as the player becomes aroused, the game records the player's arousal levels (as measured by heart rate). In diagnostic mode, the game simply records how the player's arousal levels vary. In the didactic mode version of the game, the player is both presented with visual feedback displaying their arousal level, and the game increases in difficulty if the player does not manage their arousal level by down-and up-regulating their arousal level to within bounds indicated on the arousal bar; providing motivation to focus on bodily signals of arousal (interoception).

3.1.3 The Auction Game

Figure 4: The Auction Game

This is a simple financial decision making game simulating a stock exchange. The participant takes part in an auction, buying and selling stocks, aiming to achieve maximum profits by making the correct decisions when presented with options to either buy or sell at different prices. The game has the same fundamental learning design as the Space Investor Game but aims to train investors in emotion regulation in a more financial context. By observing their level of arousal the player can gain an awareness of his/her

emotional state and the influence of emotion regulation on decision making. Additionally, in didactic mode, the arousal level will influence the game play. To be able to play successfully the player has to regulate his or her arousal. Players get feedback about their behavioural and physiological (galvanic skin response or heart-rate) responses to losses and missed gains. This provides important process feedback to aid understanding of the reactions which underpin the disposition effect. In particular the players can observe their asymmetric responses to the pain of losses and the pleasure of gains. The Auction Game provides participants with an environment in which management of arousal levels can be practiced and rewarded in the context of a fast-paced financial decision task, to become more aware of their own physiological state, and provide a context for the practice and consolidation of emotion regulation approaches developed in other contexts (for example, mindfulness approaches).

During game play, the participant is presented with three prices for a stock. The participant must quickly calculate the mean of these prices to understand the true price. Having been presented with these estimates, the participant is given the opportunity to buy or sell (or not trade) on an offered price against the true price of the stock. The decision has to be made within 3 seconds of the final estimate being shown or a financial penalty is imposed and the game continues to the next decision.

The participants are required to regulate their arousal to within bounds indicated by the on-screen dial. The more distant the participant's arousal level is from the ideal, the more the price estimates deviate from the true price with higher variance, while the closer the participants are able to regulate their arousal level to the ideal, the closer the stock price estimations approach the true price enabling buy or sell decisions to be more easily made. In diagnostic mode, the game continues for a set number of decisions, while in didactic mode the participant has to reach a financial total within a set amount of time to successfully complete a level and move on to the next; failing to do so finishes the game.

3.2 The Learning Pathway

1) The Learning Pathway starts with an opportunity to gain diagnostic information on propensity to disposition effect and own approach to emotion regulation. The aim here was to, first, develop the investor's self-awareness in relation to the disposition effect and emotion regulation approaches. Second, the diagnosis process provides a vehicle for delivery of propositional knowledge in relation to the disposition effect, the role of emotion in trading biases and emotion regulation strategies and how they relate to investor trading. This should increase investor engagement with the concepts by making them highly personally salient. Diagnosis was achieved through:

a) Questionnaire measures on emotion regulation strategies

b) For investors with existing trading history, diagnosis of level of disposition effect shown in past 'real world' trading behaviour

c) For investors without available trading history, playing the 'Two Index Game' to diagnose propensity to disposition effect. This game uses a simple trading task under time pressure to induce a disposition effect in players. Players varied in their susceptibility to the bias.

2) Alongside the feedback, the investor is given access to multimedia didactic materials on disposition effect and emotion regulation and the likely meaning of the feedback in relation to their own investment practices.

3) In the next stage the Two Index Game becomes a learning space where the investor can try out and get feedback on different strategies for avoiding the disposition effect. In a first iteration they can play the game multiple times and experiment with monitoring and modifying their own behaviour.

4) In this stage investors get the opportunity to engage with learning elements, which support the development of enhanced emotion regulation. Two approaches are involved here: a) mindfulness inductions; b) Space Investor, the first person shooting game incorporating physiological

sensors in which effective management of physiological arousal is rewarded by in-game upgrades. This is followed by further opportunities to play trading task games (Two Index Game and Auction Game) but this time accompanied by physiological feedback on arousal and regulated responding (heart rate and high frequency heart rate variability).

5) An online diary tool integrated with the trading platform supports a structured approach to writing down and reviewing real-world trading strategies including reviewing emotion state and emotion regulation. .

6) The diary tool is linked to template-based structured reflection tasks. Output from these tasks is stored in the diary tool. This provides opportunities to review progress in a structured way, including additional feedback opportunities on disposition effect and emotion regulation.

7) Alongside such learning opportunities investors should have access to peer discussions in online forums with tools to support development of peer learning groups interested in discussion of their regulation of emotions and management of disposition effect.

4. THE EVALUATION OF THE LEARNING PATHWAY

We have evaluated individual elements of the xDelia Learning Pathway and, where possible, combinations of these elements in 35 laboratory, field, and evaluation studies involving 1,422 students and 793 traders and private investors. Space limits in this paper preclude the presentation of this full set of study and evaluation outcomes (we give example results below). The interested reader may find fuller documentation of these studies at www.xdelia.org. We have targeted two key themes with these evaluations: evaluating effects of the learning elements and evaluating user perceptions of the learning experience.

Data on user experience has been gathered through a combination of surveys and interviews with participants in trials of learning elements, and has included data on usability; user engagement and enjoyment; and on user perceptions of learning outcomes and learning potential. Data on effects has, where possible, been gathered through the use of randomised control design studies. In particular we have examined the effect of learning interventions on improved emotion regulation; improved mindfulness; improved interoception and body awareness; and financial decision-making behaviour (including susceptibility to the disposition effect.).

The outcomes: -

Taken together, our studies provide support for the validity of the learning approach and the learning elements which make it up.

1) There is evidence for the effects of the learning interventions in achieving proximal goals of improving emotion regulation, mindfulness and interoception.

For example: -

a) In a student study (N=108) we conducted a three week course of emotion regulation training using the sensor games. Compared with a control group, participants showed a significant improvement in emotion regulation. First they showed reduced (self-reported) use of emotion suppression strategies and greater use of (more effective) emotion reappraisal strategies. Second while resting HF-HRV (a physiological measure of base emotion regulation capacity) remained unchanged from week 1 to 3 (0.120 vs. 0.119, N= 47, $t(45)=-0.52$, $p=.958$) for the control group, subjects that received ER training had a significantly higher HF-HRV in week 3 compared to week 1 (0.09 vs. 0.12, N= 138, $t(136)=-3.105$, $p=.002$).

b) A study of day traders (N=58) in which participants played both Space Investor and Auction Game showed a significant improvement in interoception from before start of gameplay to after gameplay (F (time) = 6.44, sig=0.014). However, there was no effect of a condition which varied whether they received direct feedback on arousal levels in the game.

2) We have very positive feedback from investors. For example in the day trader study described above traders felt xDelia games could help them learn to manage their emotions (95%), and that they were engaging to play (84% Space Investor, 80% Auction Game, 69% Two Index Game)

3) Our studies support the value of our sensor-based games in diagnosing emotion regulation capabilities and the value of the Two Index Game in diagnosing a propensity to a disposition effect. E.g. : -

a) Both the Auction game and the Space Investor game showed a significant correlation between game performance and effective management of arousal (Auction game: N=104, Pearson's r=.38, p<.001; Space Investor(final game stage): N=32 r = .51; p < .01)

b) The Two Index game reliably induced a disposition effect (in studies with students (N= 100), trading platform clients (N=64) and day traders (N=58). The induced disposition effect showed a significant correlation (0.28, p<.05) with the disposition effect of platform clients measured across their history of real trading (N=64)

4) We show a significant impact of training on disposition effect as measured in real-world trading behaviour of trading platform clients (see Peffer et al., 2012, p11), although effects of sensor game based training on disposition effect in the Two Index Game for a student sample were non-significant.

a) In a test with trading platform clients of the initial diagnosis and feedback phase of the learning journey (N=222), participating clients showed a significant drop in their disposition effect from that in their prior trading history to date to that calculated from their trading in a 14 week follow up period. Compared with a matched group of non-participating clients, DE prior to the intervention was not significantly different at p<0.05) but was significantly lower post intervention (0.21 vs 0.49; p<0.05).

5) Key elements of the learning approach have been adopted by Saxo Bank and the work has influenced its development of a learning platform for client traders.

5. CONCLUSIONS

The novelty of the work described in the paper comes from the focus in this research project of combining knowledge from multiple disciplines informed by a deep understanding of the context of application to achieve the successful development of a Learning Pathway, which addresses the transfer of learning to the practice environment. In this project, work in the areas of cognitive psychology, physiological responses, behavioural and neuro-economics, games design, biosensors, and Technology Enhanced Learning combine to address the learning needs of groups involved in financial decision making. In this game-based learning pathway we have brought together a set of activities which support learning to manage emotions in a financial context, making use of physiological measures of arousal and emotion regulation. We believe this project provides an interesting basis for further game-based learning designs that support effective human decision making in multiple domains and points to approaches which may be useful in ensuring such developments achieve take up by users.

6. REFERENCES

Barab, S. (2006). Design-Based Research - A methodological toolkit for the Learning Scientist. In *The Cambridge Handbook of the Learning Sciences*. Sawyer, R. K. (ed). Cambridge: Cambridge University Press: 153-169.

Baumeister, R. F., Bratslavsky, E., Muraven, M., & Tice, D. M. 1998. Ego depletion: is the active self a limited resource? *Journal of Personality and Social Psychology*, 74(5): 1252-1265.

Bazerman, M. H. 2002. *Judgment in managerial decision making*: Wiley New York.

Brown, A. L. (1992). Design experiments: Theoretical and methodological challenges in creating complex interventions in classroom settings . *The Journal of the Learning Sciences* 2(2): 141-178.

Damasio, A. R. 2000. *The feeling of what happens: Body and emotion in the making of consciousness*: Mariner Books.

Fenton-O'Creevy, M., Lins, J., Vohra, S., Richards, D., Davies, G., & Schaaff, K. 2012. Emotion regulation and trader expertise: heart rate variability on the trading floor. *Journal of Neuroscience, Psychology and Economics*, 5(4): 227-23.

Fenton-O'Creevy, M., Soane, E., Nicholson, N., & Willman, P. 2011. Thinking, feeling and deciding: The influence of emotions on the decision making and performance of traders. *Journal of Organizational Behavior,* 32(8): 1044-1061.

Fischhoff, B. 1982. Debiasing. In D. Kahnman & P. Slovic & A. Tversky. (Eds.), Judgement under uncertainty: Heuristics and biases. Cambridge: Cambridge University Press.

Gross, J. J. & Thompson, R. A. 2007. Emotion regulation: Conceptual foundations. In Gross, J. J. (Ed.), *Handbook of emotion regulation*. New York, NY: Guilford Press.

Lilienfeld, S. O., Ammirati, R., & Landfield, K. 2009. Giving debiasing away: Can psychological research on correcting cognitive errors promote human welfare? *Perspectives on Psychological Science*, 4(4): 390.

Loewenstein, G. & Lerner, J. 2003. The role of affect in decision making. *Handbook of Affective Science*: 619-642.

Peffer, G., Fenton-O'Creevy, M., Adam, M., Astor, P., Cederholm, H., Clough, G., Conole, G., Davies, G., Eriksson, J., & Gaved, M. 2012. *xDelia: emotion-centred financial decision making and learning. Final Report*. Milton Keynes: Open University, CIMNE.

Scanlon, E., Sharples, M., Fenton-O'Creevy, M., Fleck, J., Cooban, C., Ferguson, R., Cross, S. & Waterhouse, P. 2013. *Beyond prototypes: supporting effective research on technology-enhanced learning.* Milton Keynes, UK: Open University.

Shefrin, H., & Statman, M. (1985). The disposition to sell winners too early and ride losers too long: Theory and evidence. *The Journal of Finance*, 40(3), 777–790.

ACKNOWLEDGEMENTS

We gratefully acknowledge the financial support of the European Commission under the 7th Framework Programme, Grant Nº231830, and practical advice and support from Saxo Bank and the traders and managers at the two banks who contributed to the research

AUTHOR CONTACT DETAILS

Prof. Mark Fenton-O'Creevy (corresponding author), Open University Business School, UK, mark.fentonocreevy@open.ac.uk

Prof. Gráinne Conole, School of Education, Bath Spa University, UK

Mr. Jeffrey Todd Lins, Head of Advanced Research and Innovation, Saxo Bank, Denmark

Dr. Gilbert Peffer, Centre for Numerical Methods in Engineering, Technical University of Catalonia, Spain

Dr. Marc Adam, School of Design Communication and IT, The University of Newcastle, Australia

Prof. Craig Lindley, Research Director of the Intelligent Sensing and Systems Laboratory, Commonwealth Scientific and Industrial Research Organisation, Tasmania

Prof. Ale Smidt, Department of Marketing Management, Rotterdam School of Management Erasmus University Rotterdam

Dr. Gill Clough, Institute of Educational Technology, Open University, UK

Regius Prof. Eileen Scanlon, Institute of Educational Technology, Open University, UK

Dr. Mark Gaved , Institute of Educational Technology, Open University, UK

MAJESTIC GAMIFICATION: A CASE STUDY IN THE ADOPTION OF A SERVICE INNOVATION

Victoria Uren, Daniel Andrews, Steve Fitzpatrick and Steve Pitchford

ABSTRACT

Purpose: A case study is presented concerning a gamified awards system designed to encourage software users to explore a suite of tools, and to share their expertise level in profile pages. Majestic is a high-tech business based in the West Midlands (UK) which offers a Link Intelligence database using a Software as a Service (SaaS) business model. Customers leverage the database for tasks including Search Engine Optimisation (SEO) by using a suite of web-based tools. Getting to know all the tools and how they can be deployed to good effect represents a considerable learning challenge, and Majestic were aware that.

Design/methodology/approach: We present the development of Majestic Awards as a case study highlighting the most important design decisions. Then we reflect on the development process as an example of innovation adoption, thereby identifying resources and cultural factors which were critical in ensuring the success of the project.

Findings: The gamified awards system makes learning the tools an enjoyable, explorative experience. Success factors included identifying a clear business goal, the process/project fit, senior management buy in, and identifying the knowledge and resources to resolve technical issues.

Originality/value: Prior to gamification of the system, only the most expert users regularly utilized all the tools. The user base is now more knowledgable about the system and some users choose to use the system to publicize their expertise.

Key words: gamification; search engine optimisation; innovation adoption

1. INTRODUCTION

Majestic-12 Ltd is a West Midlands (UK) based SME which surveys and maps the Internet and has created the largest commercial Link Intelligence database in the world. The company was ranked 17th in the 2014 Deloitte Fast 50 technology award programme (http://www.fast50.co.uk/2014-winners/2014-winners.aspx), making it one of the UK's fastest growing technology companies. The Majestic Internet map is used by SEOs, new media specialists, affiliate managers and online marketing experts for a variety of uses surrounding online prominence, including link building, reputation management, website traffic development, competitor analysis and news monitoring. As link data is also a component of search engine ranking, understanding the link profile of websites can empower rational study of search engine positioning.

Majestic offers a toolbox for analysing link intelligence data, including the Site Explorer, Search Explorer, Webmaster Tools, Neighbourhood Checker and many more. These are delivered through a browser based Software as a Service (SaaS) distribution model. While the diversity of the available tools offers many advantages, they are also potentially daunting to prospective users; with considerable knowledge required to understand and exploit the available tools to their fullest. While many of Majestic's customers are experts in the tools, new customers face a learning curve in order to gain fluency.

Gamification has provided an innovative solution to this problem. Since the adoption of gamification at Majestic, feedback has been highly positive, and data indicates that both existing and new users are engaging more with the tools available. This process of integrating gamification into an existing system was highly iterative and rapid, following the principles of agile development. The outcomes

of this process and the lessons learned provide a useful case study in the adoption of gamification as an innovation.

In this case study, we will describe the 'Majestic Awards' gamification system and track its development from initiation to deployment and use. We will reflect on the development as an example of innovation adoption and identify success factors which may be relevant to other practitioners innovating with gamification technology in a business context.

2. THE GAMIFICATION SYSTEM

Majestic's gamification system supports on-boarding of new users, and allows existing users to both rate themselves against their peers and demonstrate their fluency to their clients. At the time of writing, the gamified features contained in the Majestic interface include 110 awards and badges, and a points and levelling system. New users are guided through the interface with tutorials, earning points and badges along the way. Further points and awards are given when the player performs specific actions related to using the system; providing extrinsic motivators for mastering the interface. In addition, levels are reached as points accumulate, and a leaderboard displays the top 10 high scoring users who have opted into disclosing their profile and rank. However, exploration is also an important element, and hidden rewards can be attained without deliberately pursuing them. Examples of these are the 'Early Bird' and 'Pizza Lover' rewards, given to those who are the first to use the system on any given day or those who search for the term 'pizza' respectively. The system allows for the addition and refinement of awards and other mechanics according to the wishes of Majestic's employees and responses from users..

3. DEVELOPMENT

In this section the development of the Majestic Awards system is presented. The development process was agile and thus iterative, however, for narrative purposes only, the content is organized following development lifecycle stages: Initiation, Prototype, Design, Implementation and Deployment.

3.1 Initiation

The project was instigated by the marketing director of Majestic as a loosely framed opportunity to investigate whether gamification had potential. In particular, the Hargreaves Lansdown Stock Market Challenge 'The Big Deal' (https://www.hl.co.uk/the-big-deal), designed to educate users about investments, was identified as an exemplar of how a game could be used to build engagement with a business. Initially, the concept of an awards based system which rewarded knowledge of Majestic's tools was defined for the purposes of developing a prototype.

3.2 Prototype

Development of the prototype was undertaken by an undergraduate Computer Science student, on placement with Majestic as part of a sandwich course, working with a User Experience consultant, in the spring of 2014. The first system comprised a user profile page, a monitoring mechanism to track the registered users' interaction with tools, awards, and three levels of achievement.

The prototype provided an artefact around which discussions of the gamification project between different kinds of stakeholders could be generated and connected. This went beyond a simple feedback process to build a shared terminology, or as Eric Evans (2003) terms it, a 'ubiquitous language'. A tipping point in the language of the discussion came when people started to use phrases associated with enjoyment for both developers and users during system modeling discussions, such as "wouldn't it be fun if …"

This shift in terminology reflected two things in the development process. Firstly, there was acknowledgement that points, awards and leaderboards alone were not sufficient for a successfully gamified system in Majestic's case. Secondly, the gamification of Majestic's system had the potential to be as motivating for its developers as it could be for its users.

This is in keeping with theories of intrinsic and extrinsic motivation in games and education (Malone, 1981), which have been related to theories of gamification (Deterding et al., 2011). Extrinsic motivators can be defined as outputs that are the result of actions but not vice versa, and are therefore related artificially. Intrinsic motivators, on the other hand, result from the direct relationship between actions and outcomes. In the video game Space Invaders, for example, the user controls a ground-based gun that must shoot alien space ships before they successfully descend to the bottom of the screen. The intrinsic outcome of blasting a space ship is the destruction of the ship itself, rather than the points that are awarded. Therefore, blasting aliens is intrinsically motivating in Space Invaders, whilst earning points and a place on the leaderboard are extrinsic motivators.

The understanding of games providing both intrinsic and extrinsic motivators emerged through discussions around the prototype. Both gamers and non-gamers alike within Majestic were able to articulate the necessity for game mechanics that motivated users at a range of intrinsic and extrinsic levels. Of equal importance, however, was the recognition that the implementation of these mechanics would be as motivational for the developers themselves in similar ways. On the one hand, extrinsic results would emerge through the increased usage of the service. On the other hand, developers at Majestic would benefit from increased job satisfaction at an intrinsic level by benefitting users through an enjoyable design and implementation process.

3.3 Design

The team at Majestic used the awards prototype as an exemplar around which to design the way forward, giving individuals a chance to contribute to the development of the system, based upon their own experiences of playing and enjoying games. An example outcome of this was a system of tutorials, where users are guided through the tools at a rudimentary level. The design of these processes lead to iterations of the interface being developed, from a visual representation of the monitoring events to a more accessible, explorative environment where users could comfortably and enjoyably learn about Majestic's tools.

Following the completion of each tutorial, users are rewarded with points and badges, and encouraged to develop mastery of the tools at a more autonomous level in order to achieve more points. This system of integrating tutorials, game mechanics and rewards to help users attain mastery in video game interfaces has been previously identified as being a potentially useful tactic for encouraging learning in general (Gee, 2008). It is therefore noteworthy that the agile development process at Majestic cultivated this model by allowing individuals to contribute ideas and knowledge based upon their prior experiences and responses to the prototype.

Beyond the tutorials, the team at Majestic were aware that fun elements were required in order to sustain engagement. This presented a significant challenge, as the output of SEO is rather dry by nature. Having refined the interface for the tutorials, additional design elements were integrated in order to fully exploit the gamification of the system and encourage users to explore the possibilities within the interface. Some of these awards could be expected, and visual cues given to indicate the presence of a badge and possibility of being awarded it for completing a certain task, such as using the personalization features. Other awards were given to users for less obvious actions, such as hidden 'Easter Eggs', which are not advertised but the user achieves through actions that may not

seem immediately obvious. Example of these are the 'Pizza Lover' and 'Early Bird' awards described in Section 2.

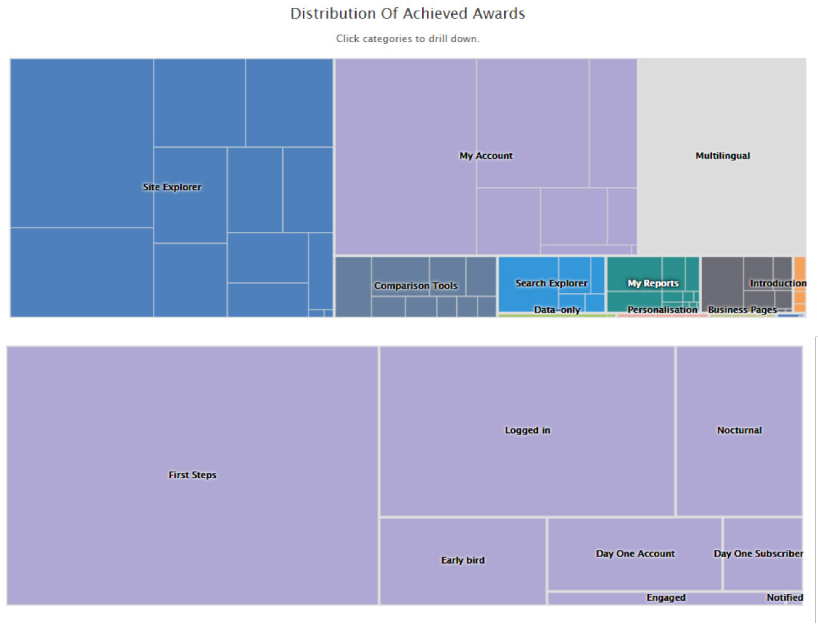

Figure 1: Statistics of awards given as of June 2015: top - all award categories, bottom - drill down into the My Account category.

These refinements to the interface and game mechanics encouraged the team at Majestic to take into account the different users that might engage with the system and their requirements. The original interface was maintained in order to accommodate the existing user base that was both familiar with, and may in fact prefer, the preceding system. Additional considerations, such as the implementation of opt-in and opt-out profile settings, allowed users to select the gamification features they participated in. This also gave users the equivalent of privacy control settings over their account, which was deemed important for both legal reasons and general usability. The result was that independent SEO experts could use the Awards system to promote their skills, while other users, whose work was perhaps confidential, could use the system to build knowledge of Majestic's tools without having to disclose their use of the system to competitors. Clauses concerning usage of the Majestic Awards system were consequently added to the Terms and Conditions of use.

3.4 Implementation

Development work on what became the released system began in October 2014. Some exemplar awards, and their associated triggers of user activity were identified, and these awards were weighted using Scrum Poker (also called planning poker) to reach subjective consensus on the value of different actions and knowledge. Typical types of awards to subsequently make the final cut include:

- Everyday Use - revolves around using the main tools. These awards exist to move new users through the toolset during on-boarding.

- Personalisation - a few pages exist where users can tweak how the site behaves. Uptake of this feature was low, therefore some awards were added to promote these sections

- Conference Meet-ups - taking the awards offline, users are encouraged to visit company representatives at conferences, register their visit, and receive an award. A nice side-effect is that all upcoming events are showcased in the website.

- API Mastery – the API is only available to premium account holders and so this rewards some of the company's most valued customers.

- Delighters – designed to amuse while identifying the behaviour of really dedicated users, these include Easter Egg awards associated with events such as public holidays and awards such as the "Early Bird" for users who log in early in the morning.

Awards were rejected for two main reasons:

- Technical – implementing the award posed more technical issues than seemed reasonable for the benefit, e.g. awards for users who interact with Majestic on Social Media was desirable to the business, but presented insufficient ROI for the required technical investment.

- Behavioural – potential gaming behaviour associated with the awards was not actually something to encourage, e.g. a, "Hello Friend," award for contacting the Helpdesk is good for genuine calls but might encourage users to contact the helpdesk just to get the award – causing unnecessary extra work.

Following definition of the initial awards, the development team, led by a technical specialist, then created an environment to do real time monitoring of the SaaS website, tracking users' actions to identify those for which rewards were due. Monitoring and award-giving were considered separately, allowing the monitoring aspects to be optimized for a high performance website. This was achieved using lossy data capture approach resulting in the additional benefit of an improved monitoring system.

Leadership of the development team was then passed from the technical lead to the user experience lead to focus on the user interaction elements needed to build the game. Development was also split into two smaller projects to run sequentially: Business Pages and Awards. Business Pages refers to the opt-in public user profile, and associated user profile management systems. Awards represented the game engine and associated gamification of the website.

Six weeks in, the team realized that they had created something which, if they were to maintain interest, would have to be continuously updated, so that players had new things to discover and do. This was an insight which came from the long term gamers in the team, who were aware that maintaining interest in games such as Grand Theft Auto and Massively Multiplayer Online (MMO) games requires a wide range of existing rewards and the regular creation of new content and challenges. In the Majestic Awards system this currently takes the form of additional Easter Eggs, reminding users who have completed the advertised challenges of the existence of the game mechanics in the background.

An important factor in the success of this stage was the recognition of ownership of the implementation process by different members of the team. Those developing the system were empowered to respond to marketing requirements based upon their understanding of games, and were encouraged to contribute their methods within this context. The resulting system was therefore designed from both gaming and marketing perspectives; providing both enticing interfaces for prospective users and engaging experiences for existing ones.

Beta testing took place in two phases. First, around January 2015, the monitoring system was run in the background to get a picture of what normal usage patterns were and to tweak the weightings on rewards. Then the system was released to players for feedback etc. Players at this point were a mixture of members of staff and expert SEO users.

3.5 Deployment

By February 2015 the business pages were launched and the Majestic Awards system went live. To bootstrap the leaderboard, Majestic Ambassadors (a worldwide group of peer-respected brand advocates) were given an initial boost award. Similarly, as awards that Beta testers won during testing were to be reset on launch, they received an exclusive award as a "Thank You." The points-based leaderboard was very volatile early on as ambassadors publically competed for high positions, but the initial frenzy settled down.

As of June 2015 the system had been in successful operation for four months. Some users of the system had reached Level 25 (see Figure 2), and the pattern of awards had stabilized (see Figure 1). Site Explorer awards, associated with everyday use were the most awarded class, being given to most active users, followed by the My Account awards. Similarly within award categories some such as the 'First Steps' award in My Account are held be almost all players, whereas awards associated with the most active user behaviour (like Early Bird) are much more rarely used. Awards for a selected active user are shown in Figure 3. The pattern of awards can identify particular user behaviours: this user is a heavy data user with 50% of his awards being in the Data Only category. Our example is in fact a Majestic employee, but analysis of the awards given can potentially be used to profile the Majestic user base for communications purposes, e.g. marketing, or indeed to detect uses of the system that breach the terms of use, such as site scraping.

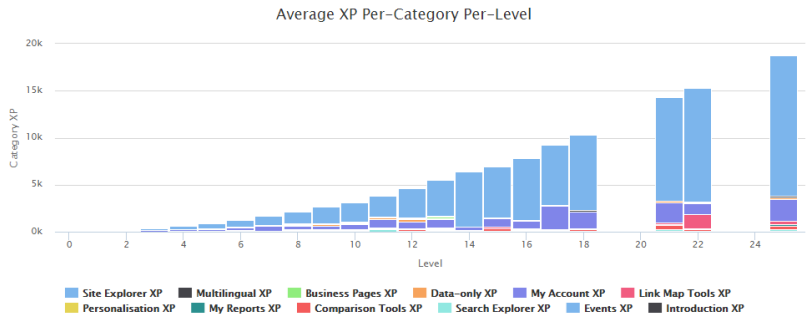

Figure 2: Average points (XP) per level as of June 2015.

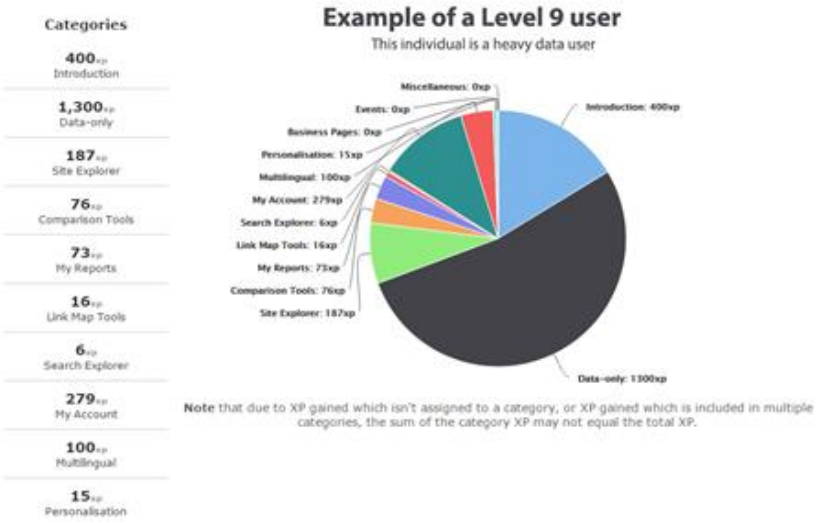

Figure 3: Distribution of awards per category for an individual user.

4. INNOVATION ADOPTION

An extensive literature on innovation adoption has developed over recent decades. In this section, we will reflect on the Majestic case from the perspective of this literature, identifying the dimensions of the innovation adoption process that are relevant to the case and, in particular, factors which contributed to the success of the gamification initiative.

Building on the seminal work of Rogers (1983) the innovation process is a foundation of adoption theory. This takes the form of a sequence of steps: Awareness, Consideration, Intention, taking the Adoption Decision and Continued Use (Frambach & Schillewaert, 2002). In the Majestic case, Awareness came via the Marketing Director, giving the project senior management support from the outset. Consideration involved an assessment of the technical capabilities of the enterprise. Intention was marked by the point the project moved from a loosely framed opportunity to setting a clear business goal for the gamified system (growing customer awareness of the company's products). The Adoption Decision led to development of Majestic Awards and its launch. The company is currently at the Continued Use stage, exploring the ways in which games must continue to evolve to continue generating interest.

This case study can be seen as taking an Organizational Technologist perspective on innovation adoption (Gopalakrishnan and Damanpour, 1997) in so far as it concerns adoption of a technology within a specific organization. With an organizational perspective identified, the resource-based view of the firm is a common and useful theory to apply to organizational innovation adoption (Crossan & Apaydin, 2010). The resource-based view holds that firms build competitive advantage as a result of creating and controlling resources which are rare, or valuable, or difficult to imitate or substitute (Barney, 1991). From this viewpoint we can see that the gamification approach allowed Majestic to exploit and develop resources to gain competitive advantage. Specifically, resources identified by the case are:

- The SEO tools themselves, which are sufficiently numerous and complicated to require a game to help users explore and learn them. Though individually easy enough to replicate, the sheer number of these is hard to substitute.

- The monitoring environment, which underlies the automated awards, allowed a system to be built that did not disrupt the core business of the SaaS site. The effort required to build such a technology means that, while not inimitable, it is relatively difficult to replicate quickly.

- Not only did Majestic employ personnel with the technical skills to build the gamification features but also, critically, staff who were gamers themselves brought the insight that for a gamified solution to be sustainable it needs to be fun. Although gamers are certainly not rare in groups of programmers, the agile culture of the firm, and in particular its ability to develop a ubiquitous language shared by all stakeholders, allowed this insight to surface. Hence the working process of the firm is identified as a difficult resource to imitate.

The process of organizational innovation can also be analysed taking a knowledge based approach as proposed by Gopalkrishnan and Bierly (2001), who characterize innovations on three dimensions: tacit-explicit, systemic-autonomous and simple-complex. The gamified solution is by its nature explicit, as its whole purpose is to be accessible and encourage users to learn. Gopalkrishnan & Bierly found that explicit innovations were typically perceived as being effective because users had positive experiences of them, and this seems to be the case with Majestic. The solution is systemic in nature because it requires the SEO tools and infrastructure to be in place. As predicted by the theory, this means that an internally sourced solution was required, as a high degree of coordination was needed to implement the system, for example selection of the awards was an activity in which input was sought from the whole company, and finalised by the Marketing Director in line with the company's strategic aims. Finally, the knowledge embedded in the system could be perceived as complex, because it incorporates the complex underlying infrastructure. Complex choices are on the one hand harder for competitors to imitate but on the other harder for innovators to understand, leading to them being sometimes perceived as less effective.

5. CRITICAL SUCCESS FACTORS

A single case cannot provide definitive conclusions concerning success factors. However, in this section we summarise the factors which led to success within the specific context of the Majestic working environment as a contribution towards the growing body of case knowledge on gamified solutions in business.

5.1 Clear Business Goals

The definition of business goals emerged slowly but once established the project picked up momentum. The goal was to promote user engagement with the diverse product, to encourage exploration of new features, and to provide on-boarding support for new users.

5.2 Process/Project Fit

Within the Majestic context, which is a software company and therefore used internal resources for developing the system, the Agile development process made a significant contribution to the success of the project. The Agile Manifesto (http://agilemanifesto.org) is the development philosophy in the company and had a positive influence. For example, valuing Responding to Change allowed problems to be found and fixed quickly, valuing Individuals and Interactions meant that several online gamers on the team were empowered to feed in their insights to make it a more enjoyable experience, and valuing Customer Collaboration meant that beta testers' input was acted on and rewarded at the roll-out of the Game with a special award.

5.3 Senior Management Buy-in

Like many organizations using agile development methods, Majestic has a relatively non-hierarchical structure. Nonetheless the support of senior management figures was critical. The initial push to explore gamification came from the Marketing Director who also gave input into the design of the awards. The support of senior management remained important for ensuring the project had sufficient resources (in particular accommodating a significant overrun that was demanded by the team to make the game fun). Estimating time to completion on innovative development projects is difficult and the team began with a degree of uncertainty about the scale of the task.

5.4 Technical and Knowledge

Developing the Majestic Awards system required technology solutions. Being a software company meant these were sourced internally and the contribution of developers who also had expertise in the product was significant. However, the prototype, developed by a placement student, was critical as a focus for communication, and allowed ideas to be generated and key technical issues to emerge. The latter included building the monitoring system in such a way that it could never crash the main site, and preventing undesirable user behaviour by restricting the user's view of the game mechanics (the users are SEO professionals and therefore gaming online systems, for example to improve the ranking of a client's site on a search engine, is a part of their job).

6. CONCLUSIONS

The case study presented here concerns a single gamification project at a company with agile working practices. This specificity limits the application of the conclusions which may be drawn. However, we note that many of the observations in the case study align with theories published in the innovation literature. In particular, the resource-based view of the firm provides an appropriate lens for understanding how the working processes, knowledge and technical resources of Majestic supported the company in developing the design model for the gamified system and the ubiquitous language that supported free exchange of insights between different stakeholder groups.

In addition, the processes of implementing gamification features at Majestic reflect the selection processes of similar features within the literature. Of particular note in this case study, however, is the acknowledgement of different user groups, and the suitability of different gamification features, such as intrinsic and extrinsic motivators, within the same service. Again, this was facilitated by agile development processes, where the features that reflected the different perspectives of the development team members could be implemented quickly. Future research can build upon these findings by exploring the potential for working environments to encourage such developments, and how combinations of gamification features could be incorporated in various contexts in order to accommodate different users.

REFERENCES

Barney, J. (1991) Firm resources and sustained competitive advantage. Journal of Management, 17(1), p. 99-119.

Crossan, M.M. & Apaydin, M. (2010) A Multi-dimensional framework of organizational innovation: a Systematic review of the literature, Journal of Management Studies, 47(6), p. 1154-1191.

Deterding, S., Dixon, D., Khaled, R. and Nacke, L. (2011) From game design elements to gamefulness: defining "Gamification". In Proceedings of the 15th International Academic MindTrek Conference: Envisioning Future Media Environments, p. 9-15.

Evans, E. (2003) Domain-Driven Design: Tackling Complexity in the Heart of Software.

Frambach, R.T. & Schillewaert, N. (2002) Organizational innovation adoption: a multi-level framework of determinants and opportunities for future research. Journal of Business Research. 55, p. 63–176.

Gee, J. (2008) What Video Games Have to Teach Us About Learning and Literacy, New York: Palgrave Macmillan

Gopalakrishnan, S. & Bierly, P. (2001) Analyzing innovation adoption using a knowledge-based approach, Journal of Engineering Technology Management, 18, pp.107-130.

Gopalakrishnan, S. & Damanpour, F. A (1997) Review of Innovation Research in Economics, Sociology and Technology Management, Omega, International Journal of Management Science, 25(1), p.15-28.

Malone, T. W. (1982) Toward a Theory of Intrinsically Motivating Instruction, in Cognitive Science 5:4, p.333-369

Rogers, E. M. (1983) Diffusion of Innovations. Free Press, New York.

ACKNOWLEDGMENTS

This work was supported by EPSRC Grants Ref EP/K014064/1, EP/K014072/1, EP/K014080/1 'Transforming the adoption of Product -Service Systems through innovations in applied gaming technology'; a joint project with Aston Centre for Servitization Research and Practice, Aston Business School and the Advanced Manufacturing Research Centre, University of Sheffield.

AUTHOR CONTACT DETAILS

Victoria Uren
Aston Business School, Aston University, Birmingham, B4 7ET, UK, v.uren@aston.ac.uk
Daniel Andrews
Aston Business School, Aston University, Birmingham, B4 7ET, UK, d.andrews@aston.ac.uk
Steve Fitzpatrick
Development Team, Majestic-12 Ltd, Birmingham, B7 4BB, UK, stevef@majestic.com
Steve Pitchford
Development Team, Majestic-12 Ltd, Birmingham, B7 4BB, UK, stevep@majesticseo.com

SMARTEGE: GAMIFICATION FOR ENERGY PROFILE MODIFICATION

Christos Tatsiopoulos, Aphrodite Ktena, Enea Mele, Christos Manasis, Charalambos Elias, Yannis Koutsoubis, Eugenia Tsalkitzi, Anna Tatsiopoulou

ABSTRACT
The gamified application presented in this work combines persuasive and serious game technologies to educate users in electrical energy consumption, production, and markets and engage them in energy saving behavior, relevant techniques and technologies, while, at the same time, enabling them to transfer the skills and knowledge acquired to the real world. Contrary to the conventional grid paradigm, demand side management requires the end user to interact with the grid, even in real time, to be an agent rather than a user. Survey findings so far, verify the low levels of technological literacy among users regarding the basics of electricity, emerging trends and markets as well as their unreadiness for further developments in the sector. SMARTEGE uses the cognitive approach to develop educational material for the users' capacity building; gamification to motivate, engage and trigger users to form their own-shaped learning curves towards controlling their energy profiles; and SCADA-like technology to link the virtual to the real world. SMARTEGE is a device unaware application, for smartphones, tablets and desktops, which is both a game and a service. The proposed methodology for the development of gamified applications can be used for commercial as well as for educational purposes.

Keywords*:* Gamification, energy user profile, electricity markets, consumer behavior, process mining

1. INTRODUCTION
Steadily rising energy needs of our civilization and emerging trends in electricity grids and markets converge in the need for demand side management, in which the end user has a pivotal role. Over the last decades, the deregulation of electricity markets and the renewable energy sources (RES) technology have accelerated the emergence of distributed generation. This along with advances in ICT technology have led to the smart grid and demand side management technology as opposed to the conventional transmission grid and supply side management. The new paradigm calls for an educated, technologically literate electricity user, who will be able to monitor and control his/her consumption profile, interact with the electricity markets (Burgess & Nye, 2008), understand the idea of and contribute towards net zero energy buildings (nZEB).

However, survey findings (Constantos, 2015) suggest that electricity users, at least in Greece, are environmentally conscious in an abstract, idealistic way and are willing to adopt 'green' practices as long as they are not too costly or inconvenient but are not adequately informed of the policy framework and regulations, the basics of electricity use, or the potential, limitations and trade-offs of relevant technologies such as, the use of energy efficient equipment, RES, home and office automation etc. On the other hand, younger and more educated people are comfortable with ICT use and open to new applications.

SMARTEGE, the application presented in this work, uses gamification for user behavioral modification through education. It is based on the working hypothesis that there is a variable degree of motivation among people to modify their attitude towards the use of electricity and a ground base understanding that they should. However, they are not able to do so as long as they are not educated, informed and triggered enough, but they would welcome facilitators in that direction.

Existing energy applications or games fall under three major categories: a) they target energy awareness of younger children b) they are adult strategy games employing energy related narratives with no clear educational goal c) they allow users to monitor their electricity consumption and/or production, calculate their electricity bill or remotely control their appliances. No application exists to train today's electricity adult user on the virtual smart grid while allowing him/her to interact in real time with the real grid. SMARTEGE comes to cover exactly this need with an innovative, knowledge based way, employing gamification processes, scenarios and strategies.

SMARTEGE aspires to engage adult users in their role as active agents of the smart grid, educate them on relevant issues and train them to make informed decisions so that when they have reached the highest level of the game they will be allowed to monitor and control an actual electricity installation in real time, using appropriately designed hardware, and apply their newly acquired knowledge. SMARTEGE is therefore an online application for PCs, tablets and smart phones which is both a service and a game: a) a service which offers the user knowledge and control of his/her electricity profile b) a game of simulation, strategy, learning & training and quizzes.

SMARTEGE employs gamification processes for informal education and behavior modification (Carr, Taylor, Hunt and Mejia, 2014; Mohr, Schueller, Montague, Burns and Rashidi, 2014) along the lines of Fogg's Behavior Model (FBM) (Fogg, 2009) which postulates that individuals are convinced to change their behavior on an issue, when three conditions are satisfied: sufficient motivation, adequate ability and efficient activation.

Furthermore, SMARTEGE aspires to also propose a novel methodology for developing gamified applications for user behavior modification and online learning material, utilizing Business Process Modelling (BPM) based on data and information from behavioral user profiles stored in the SMARTEGE backend platform and modeled processes sequences. Currently, SMARTEGE, models these profiles based on supporting certain use case scenarios while in the future, it is expected to introduce process mining technology, methodology and tools to intelligently draw conclusions about user activities and interactions in a non-static way, thus providing dynamic user behavior modeling.

2. SMARTEGE ARCHITECTURE AND BUILDING BLOCKS

The SMARTEGE application consists of the following components:

a) The Frontend, a web and mobile application developed on the UNITY platform
b) The Backend which consists of a content management system (CMS), a gamification platform and a subsystem based on a REST API responsible for the communication between the frontend and backend components.
c) A layer between the real world and SMARTEGE serving the 'MyHome' level of the game. It is designed as a Supervisory Control and Data Acquisition (SCADA) system linking monitoring and controlling equipment of the physical layer to the SMARTEGE environment.

Figure 1 depicts the three logical nodes of the SMARTEGE architecture and the visualization of the overall platform. Node 1, represents the backoffice (gamification) platform, along with the interfaces through which the user interacts with the application (game). This subsystem provides two types of user interfaces, the "standalone" and the "social" mode. The latter supports additionally the social dimension of the game and related mechanics such as leaderboards, communication with social networks, relevant virality processes etc.

Node 2, represents the software acting as middleware between the gamification platform and the "MyHome" (real time environment control component). This layer supports the necessary functionalities through which the users access real time statistics of actual installations they monitor

as well as the user-friendly graphical interface of web services offered for real time monitoring and control of these installations.

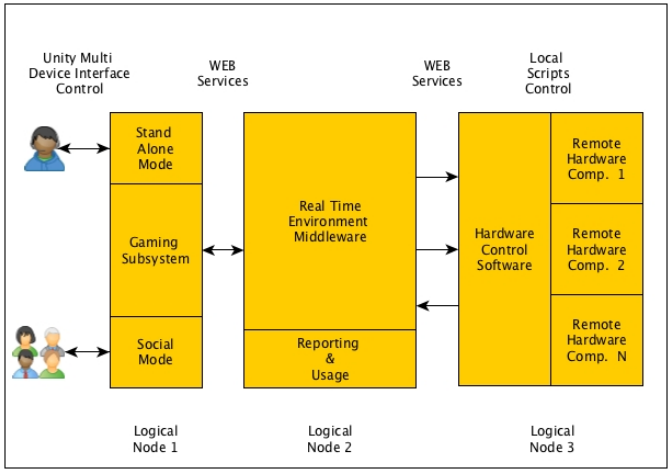

Figure 1: Logical Architecture Diagram of the SMARTEGE platform

Node 3 represents, the actual hardware components. These are assigned and used on a per registered user basis. Each user may have more than one installations (home, office) and each installation more than one pair of sensors / actuators, controlled by a local micro controller. This controller receives and sends signals from the hardware as a result of "commands" received by Node 2 (the middleware layer), via web services. Therefore, Node 2 controls and reports usage, upon request, to the end-user, assuming, in this sense, the role of a small-scale SCADA system.

It is worth mentioning at this point, the open, flexible and distributed nature of the client application and the overall SMARTEGE platform. The application may run in any client device, mobile or not, independent of the specific hardware and operating system. As for the gamification backend and the intermediate middleware platforms, these may reside in the same physical installation, servers, databases or be completely separated residing in a cloud based type architecture.

3. THE SMARTEGE GAME & GAMIFICATION PROCESS

Our approach is based on Fogg's Behavioral Model - FBM (Fogg, 2009), a model developed for persuasive design targeting behavioral modification. The proposed methodology uses the cognitive approach (Bloom & Krathwohl, 1956) for the educational content development and gamification mechanics along the lines of the flow model (Csikszentmihalyi, 2000) for user engagement.

According to FBM, people are ready to implement change in a desired direction when they are 1) sufficiently motivated by the emotional dipoles pain/pleasure, hope/fear, social acceptance/rejection 2) able to do so in terms of resources (time, money, mental or physical capacity, non-routine, social deviance) 3) triggered by sparks, facilitators or notifications at the right moment. The right timing is when a person is able and motivated enough to implement change and the only thing missing is the trigger that will activate it.

SMARTEGE users are expected to 1) increase their ability to modify their attitude towards electricity use, grids and markets through education in order to increase their mental capacity and technological literacy 2) be sufficiently motivated to enter and stay engaged in the learning process 3) implement change when triggered at appropriate timing.

The educational content, designed to increase the ability of users, is based on the cognitive learning model where the student from passive knowledge receiver becomes an active partner in the process. First, the learning outcomes must be defined following the learning pyramid of Bloom's taxonomy (Bloom et al, 1956). In a gamified application, to achieve maximum motivation and high educational impact, the learning outcomes must a) be precise, clear, and in line with the game's objectives and environment b) refer to incremental goals of increasing difficulty and complexity in line with the game's levels c) produce the feeling of challenge to the user (Ling, K., Beenen, G., Ludford, P., Wang, X., Chang, K., Li, X., et al. 2005).

The SMARTEGE user, as a consumer, is expected to: *know* the basic notions and definitions of electrical energy; *understand* the relationships between the electrical energy quantities; *apply* this knowledge to a building's energy management; *analyse* the energy profile of a building; *evaluate* the energy performance of a building; *create* energy efficient scenarios for energy management. As an electricity producer and agent, he/she is expected to: *know* the basic notions and definitions of electricity production and market; *understand* the relationships between the electrical energy production and consumption; *apply* this knowledge to the management of small RES installations and electricity trading; *analyze* the techno-economical profile of a nZEB; *evaluate* the performance of a nZEB; *create* energy efficient scenarios for nZEBs.

Next, the educational content, consisting of definitions, explanations, advice, reading material, libraries, quizzes and problems, is developed also based on Bloom's taxonomy and the defined learning outcomes.

To increase motivation and trigger behavioral change, towards the defined objectives, gamification mechanics are employed according to the flow model (Csikszentmihalyi, 2000) which postulates that if the task of the person is too easy, the user's status is converted to laziness while if the task is very demanding, the user becomes frustrated, anxious and usually abandons the effort. First, the motivation matrix is developed consisting of the following levels: acquisition, education, attraction, involvement, motivation, conversion, conservation, excitement (Constantos, 2015). Next, the content is gamified according to this matrix using the mechanics and processes described below.

The motivation level is raised employing the three FBM motivator dipoles (Fogg, 2009): a) pleasure/pain: the user is pleased when he/she sees his/her wallet points grow through successful missions or correct and timely moves and experiences pain and frustration when he/she loses points or sacrifices a certain amount to improve his/her position in the game in the long-run; b) hope/fear which is activated by the opportunity to exploit the benefits of the application, *e.g.* to unlock a level c) social acceptance/rejection since the user, via social media and the game's leaderboard, he/she is given the opportunity to shape his/her profile / position, compare positions, actions and achievements with others, view other user profiles, *etc*.

For low motivation users, appropriate triggering is generated in the form of sparks, *ie* messages, based on the three abovementioned motivators, aiming to motivate the user in the desired direction: *e.g.* "you are 20 Tesla points away from "The Prosperous" badge: Upgrade your office appliances!" For low ability users, facilitators, messages guiding the user through the learning process, are generated, *e.g.* "answer this quiz to win 100 Wallet points". Finally, for able and motivated users, signals at the right timing are issued as reminders: *e.g*. "You have enough Wallet points to install more PV units."

3.1 The game mechanics, design and elements

The game has four counters: a) 'Wallet points' which accumulate when tasks and missions are accomplished; are spent when higher energy class devices are acquired and installed; are lost when resources are managed poorly b) the 'Electrical Energy counter' which emulates the energy meter recording energy consumption and production in kWh c) the 'Green bar' which monitors the virtual buildings' energy class d) the 'Comfort bar' which monitors the comfort level in the building, according to existing standards and design specifications (Constantos et al, 2014). All counters must be within acceptable ranges in order for the user to advance in the game.

There are four levels in the pilot version:

- The first level is a *Tutorial* intended to attract and engage the user, offering a virtual 'tour' of the application and game elements. The user is asked to answer a set of quizzes to accumulate points. If users fail, they are prompted to read appropriate educational material available in the 'library' and take the test again. This level is of high educational value and therefore mandatory.

- When the second level, *Flat* (or Residential) level (Figure 2) unlocks, the user is guided to select from the application's "inventory" typical home electrical and electronic appliances and position them in the virtual flat he/she is going to manage. With the help of appropriate triggering and educational material, such as recommendations, explanations and definitions, the user is led to schedule the operation of the selected appliances and optimize electricity consumption and comfort level in the Flat.

Figure 2: The 3D GUI of the Flat level

Figure 3: The 3D GUI of the Office level

- The next level is the *Office* (or Professional) level (Figure 3) which unlocks after the user has obtained the required number of points from managing the Residential level. Office appliances are less diverse and their use results in a significantly different energy profile than the residential one. Hence, the user must develop a different strategy to optimise the building's energy profile. To attain the ultimate goal of net zero energy consumption in all buildings managed by the user, electricity microgeneration is enabled from this level on: the user, after learning how to optimize the electricity use and consumption of all buildings, residential or professional, is allowed to use 'Wallet points' for the installation of electricity generation components. The user is granted access to educational material concerning electricity generation and storage devices, such as photovoltaics, wind turbines and batteries, as well as the relevant legal framework.

The concept of electricity production is a very important one in the game since it trains the user to think of electricity as a resource and not simply as a costly comfort enabler. Also, the user is educated in the idea of "trade-off" in the use of technology. Installing new appliances, replacing existing ones for higher efficiency, increaing the energy class of all the buildings he/she manages, or

investing in microgeneration, comes at a price. He/she must spend 'Wallet points' which, on the other hand, can be earned through the successful completion of tasks and missions. The user's main quest is to maintain the values of three of the four counters, namely Wallet points, Green bar and Comfort bar, at levels that can 'unlock' the next building interface and thus progress in the game.

- 'My Home' is the last level described in detail in the following section. At this last level, the user is given the opportunity to relate what he/she has learned in the game to the real world utilizing appropriate hardware and a SCADA-like system developed by the SMARTEGE team.

The mechanics described above are combined with progression metrics that calculate the user's progress and address all three areas, cognitive, emotional and social. The leaderboard is called 'Tesla's Followers' and the user's ranking in it depends on the total number of points accumulated from all types of user actions. Several badges have also been designed to reward the user's achievements in various areas and levels. Levels, rewards, leaderboards, missions, quizzes, library and personalized content such as messages adapted to a user's actions and data entered, all seek to transform negative emotions to positive ones and keep the user in the 'flow' zone of the game.

4. THE 'MYHOME' LEVEL

The 'MyHome' level is intended as the final level of the pilot application. The user having completed successfully the Tutorial, the 'Flat' and the 'Office' level is given two advanced options:

- Emulate the electricity use of an actual building: the user enters the power characteristics of the appliances of an actual home or office and sets their operating times according to their actual operation. This way the user can simulate the energy profile of a building of his/her choice, calculate the cost, understand the electricity usage of his/her appliances.

- Obtain hardware compatible with the application and using the SCADA like component of *'MyHome'* to actually monitor and control the appliances of a chosen building in real time. This hardware consists of metering sensors and relay type actuators and a Linux based controller which communicates with the middleware layer and interacts, via the graphical interface, with the user. In terms of WEB services, we consider this as an Application Programming Interface (API).

The *SMARTEGE* SCADA is responsible for the input, management and output of data external to the system as well as the generated databases. These data are coming from the metering devices and relays installed at the distribution panel of the building that is monitored remotely by the user via the application (Christopoulos, 2010). A layer of middleware composed of WEB services and a central SQL based database are used to maintain contact with and receive information from all remote installations. The watthour (wh) counters are installed in each appliance or power line and transmit a pulse for every half 0.5wh consumed or produced. Any commercial digital energy counter, of any granularity, may be used. The pulses counted by each sensor are transmitted wirelessly (IEEE 802.11b/g/n or XBee) or via Ethernet (IEEE 802.3). The platform receiving the pulses can be "hosted" by any computing device provided that it is implemented in a very light way. The selected implementation, currently installed at the TEISTE Laboratory of Electrical Installations, is based on a ALIX.3D3 system, small enough to be wrapped in a cigarette size box, easily integrated into an apartment's central distribution panel. The ALIX.2D3 unit supports the Linux operating system and the following software components: a) *Wire File System (OWFS),* a software component for the monitoring and control of the physical environment of the 1-Wire sensors / counters; it uses dedicated bash scripts to switch on / off an electrical relay, read from a sensor, write to a file data from sensors et. al. b) *MySQL database,* is the database required for the storage of the time series data from the sensors and the source for the graphical representation of these data c) *PHP Engine,*

used by the server to execute specific queries to the database (*e.g.* show me electrical consumption for a specific period of time). The JSON format is used for all reporting.

This way, the user controls the energy use of an actual installation with real time interventions and representations in a user friendly graphical way. The user becomes aware of the building's energy profile, per power line and as a whole, and is able to anticipate future electricity consumption and adjust behaviour accordingly.

5. DISCUSSION

The following diagram (Figure 4) depicts the positioning of SMARTEGE application in terms of game thinking and primary design goal, based on http://www.gamified.uk.

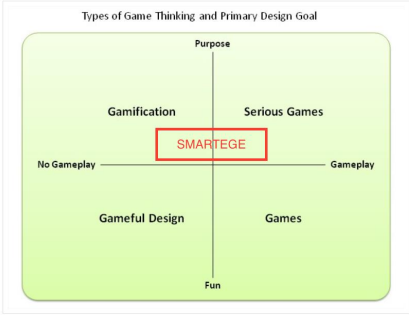

Figure 4: Positioning of SMARTEGE application

SMARTEGE proposes a process to educate the user on the subject of choice. To test this methodology, the domain of electricity use has been chosen as a major topic of technological literacy. SMARTEGE is a hybrid application combining gamification and serious game technologies. The gamification approach to educating users on a given topic has been chosen as the most promising one in terms of engagement and involvement in the process. In the future, educational processes will be enriched with process modelling and mining. SMARTEGE is also a "gameful" application since the user is involved in game scenarios with real life narratives linked to the educational process's learning outcomes. The final level of the game links the game world to the real world by a) emulating the energy profile of an actual building b) allowing actual energy profile shaping through appropriate hardware. The presented hardware and interface allowing remote monitor and control is just one way of achieving this and is not proposed as a novel application in the field of "Internet of Things" (IoT) though it belongs in that technology.

SMARTEGE is currently being tested among student populations of two higher education institutions. In the beginning of the project, a questionnaire-based survey was conducted among the students (Constantos, 2014) to establish a reference level concerning knowledge, attitudes and beliefs concerning the electricity use. The survey will be conducted again after the testing of the application has been completed to measure SMARTEGE's intervention in these fields.

6. CONCLUSIONS

SMARTEGE is an application, developed for PCs, tablets and mobiles to educate the electricity users of the smart electricity grid in assuming their role as active agents in the demand side management of the grid and shift towards practices and technologies necessary for near Zero Energy Buildings. It has been designed both as a knowledge based gamified educational application, as well as a service offering the users control over their electrical energy behavioural profile. It consists of four levels a)

Tutorial b) Flat c) Office d) MyHome. In the first three levels the user learns in a gamified way about electricity basics, use, billing, consumption, production, markets and regulatory framework while in the last level, the user is offered the opportunity to apply the acquired knowledge in the real world and manage the electrical energy profile of an actual building. Future work will include, among other aspects, increase of intelligence of the SMARTEGE platform and support of dynamic user behavioural modelling, by using process mining techniques.

REFERENCES

BJ Fogg, A Behavior Model for Persuasive Design, Persuasive'09, April 26-29. Retrieved from: http://bjfogg.com/fbm.html

Bloom, B.S., Krathwohl, D. R. (1956) Taxonomy of Educational Objectives. Handbook I: Cognitive Domain. NY, NY: Longmans, Green

Burgess J, Nye M, 2008. Re-materialising energy use through transparent monitoring systems, Energy Policy 36 (12): 4454-4459 Sp. Iss. SI

Carr D., Taylor H., Hunt R., Mejia T. (2014). Gamification and adult literacy, Report of Literacy Link South Central's Job Creation Partnership Project.

Constantos E., Elias, C., Ktena, A., Manasis, C., Skarpetis, N., Tatsiopoulos C., Tatsiopoulou A.,et al, Zamani, E. (2014), SMARTEGE user requirements, Deliverable D1.1

Constantos E., Elias, C., Ktena, A., Manasis, C., Skarpetis, N., Tatsiopoulos C., Tatsiopoulou A., et al, Zamani, E. (2015), SMARTEGE gamification design and methodology, Deliverable D2.1

Csikszentmihalyi, M. (2000). Beyond boredom and anxiety. San Francisco, CA, US: Jossey-Bass.

David C Mohr, Stephen M Schueller, Michelle Nicole Burns, Parisa Rashidi, The Behavioral Intervention Technology Model: An Integrated Conceptual and Technological Framework for eHealth and mHealth Interventions, J Med Internet Res. 2014 Jun; 16(6): e146, Published online 2014 Jun 5. doi: 10.2196/jmir.3077

Ling, K., Beenen, G., Ludford, P., Wang, X., Chang, K., Li, X., et al. (2005). Using social psychology to motivate contributions to online communities. Proceedings of the 2004 ACM conference on Computer supported cooperative work (pp. 212–221).

Nikos Christopoulos (2010). Smart electricity meter, Senior Thesis, TEI of Sterea Ellada (ex- TEI of Chalkida).

ACKNOWLEDGMENTS

This research has been funded by the project SMARTEGE – Smart system of educational gamified processes - 1605-BET-2013

AUTHOR CONTACT DETAILS

Dr Christos Tatsiopoulos
EPIS Ltd, ctatsio@gmail.com

Anna Tatsiopoulou
EPIS Ltd, atatsio@gmail.com

Prof. Christos Manasis
Department of Electrical Engineering,
TEI of Sterea Ellada, manasis@teiste.gr

Asso. Prof. Aphrodite Ktena
Department of Electrical Engineering,
TEI of Sterea Ellada, aktena@teiste.gr

Assi. Prof. Yannis Koutsoubis
Department of Electrical Engineering,
TEI of Sterea Ellada, ykoutsoubis@gmail.com

Dr Charalambos Elias
Department of Electrical Engineering,
TEI of Sterea Ellada, xelia@hlk.forthnet.gr

Enea Mele
SAICON SA, dimitrismele@gmail.com

Eugenia Tsalkitzi
SAICON SA, eugenia.tsalkitzi@gmail.com

Proceedings of the International Gamification for Business Conference 2015 (IGBC15)