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# The Effects of Gamification on Driver Behavior: An Example from a Free Float Carsharing Service

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# THE EFFECTS OF GAMIFICATION ON DRIVER BEHAVIOUR: AN EXAMPLE FROM A FREE FLOAT CARSHARING SERVICE

*Research in Progress*

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## Abstract

*It has been argued that information systems have the potential to support the pursuit of becoming more environmentally sustainable. The majority of studies in green IS has been focused on investigating the organizational level. Accordingly, the proportion of studies pertaining to green IS used by individuals in comparison has been neglected and only recently garnered more interest in research. Thus, to add to this increasing interest field, our research aims at expanding the knowledge of green IS on an individual's level by examining how a gamified information system can change customers' behaviour towards an improved level of personal environmental sustainability. More specifically we are proposing an international field experiment in cooperation with a leading carsharing service to study whether the application of gamification during car rides can lead to effects which decrease CO<sub>2</sub> emission caused by driving behaviour of individual drivers. Furthermore, we suggest the application of Self-Determination Theory to explain behavioural change induced by gamification.*

*Keywords: Green IS, Gamification, Behaviour Change, CO<sub>2</sub> Emission*

## Introduction

In recent years a broad variety of actions have been taken and regulations have been implemented to address the issue of environmental sustainability on various levels of society. Particularly the reduction of greenhouse gases such as CO<sub>2</sub> has attracted attention from policy makers and enterprises (e.g., Dedrick, 2010; Corbett, 2013). For example, Germany's Federal Government has pledged to reduce the country's CO<sub>2</sub> emissions by 40% (compared to the emission level in 1990) by the year 2020 through investing 2.6 billion EUR every year until then and through implementing strategies to increase energy efficiency and transitioning to regenerative energy resources (Federal Government of Germany, 2014).

A major part of the efforts to reduce CO<sub>2</sub> emission is addressing the emissions caused by road traffic. Although automobile manufacturers have started to build more environmentally friendly cars, which emit less CO<sub>2</sub> (JATO, 2014), still traffic and transportation are a major cause for CO<sub>2</sub> emission. For the year 2011 the International Energy Agency estimated that transportation was responsible for 22.3% of worldwide CO<sub>2</sub> emissions, ranking it the second largest source of CO<sub>2</sub> emissions after electricity and heat production (IEA, 2013). Furthermore, motorized individual transportation alone contributed 58.3% to the CO<sub>2</sub> emission caused by traffic in 2013 in Germany (Statista, 2014).

Information systems have been shown to facilitate and enable the reduction of CO<sub>2</sub> emissions in an organizational context (e.g., Watson et al., 2010b; Corbett, 2013; Marett et al., 2013; Seidel et al., 2013) and with the reduction of CO<sub>2</sub> emission being also addressed by the government and the automobile industry, the consequent next step now is to also involve individuals and engage them in the endeavour of sustainability. However, research on green information systems has been mostly focusing on organizations and businesses, as shown by literature reviews by Elliot (2011) and Loeser (2012). In comparison, the application of green information systems on an individual level and particularly research examining individuals' motivation to act sustainably are scarce. Only in recent years has the individual level gained more attention in research. Exemplary papers include Dedrick (2010), who calls for research on individual behaviour in an sustainability context, because individual behaviour can be the starting point for a host of decisions (e.g., in organizations). Other individual level studies look at the effects of a persuasive system on residential energy consumption (Graml et al., 2011), how different types of feedback can positively influence the energy consumption of individuals (Loock et al., 2011) or how IT can help consumers in overcoming challenges regarding green consumption decisions (Zhang, 2012).

For our research we apply the definition of green information systems of Melville (2010) and Chen et al. (2008), i.e., we consider an information system to be "green" or sustainable if it enables or facilitates processes or practices which lead to improved environmental performance, eco-efficiency, eco-equity or eco-effectiveness. As for gamification, we will adopt the following definition: Gamification is the use of game design elements (such as rewarding points or badges and visualization of progress towards a certain goal) in a non-game context to intrinsically motivate and alter an user's behaviour towards a more preferred outcome (Deterding et al., 2011; Blohm and Leimeister, 2013). We are particularly looking at gamification as a motivational tool, as it has been shown to be effective in changing user behaviour for the better in diverse contexts such as learning (Simões et al., 2013) or service marketing (Huotari and Hamari, 2012) and because gamification can be viewed as promising paradigm to drive user engagement (Kankanhalli et al., 2012).

Our research contributes to green IS research by examining whether information systems can support individuals in pursuing environmentally friendly goals such as reducing one's own carbon footprint. For this, we investigate the effects of a gamified information system aiming at reducing CO<sub>2</sub> emissions by inducing a more environmentally friendly driving behaviour. Through collecting and analysing data from a field experiment with a carsharing company we address the following research questions:

*RQ1: Which effects does gamification aimed at sustainability have on driving behaviour?*

*RQ2: Are these effects persistent or to which extent do they vanish over time?*

The remainder of this paper is structured as follows: First, we review the extent to which gamification has been addressed in the IS discipline. Afterwards, we position our research project in an existing framework in the green IS area and then introduce our proposed field experiment. At the end of this research-in-progress paper we present an outlook on how we plan to analyse the findings and possible contributions.

## 1 Gamification in the IS Discipline

Although gamification has been practiced and applied by companies for several years and in various contexts, e.g., for education (Khan Academy, 2014) or health and fitness (Nike, 2014), this phenomenon has remained mostly in the shadows for academia until recent years. A systematic literature review conducted within the IS discipline (including the Senior Scholars' Basket of Eight and Proceedings of ICIS, ECIS, AMCIS and HICSS) has shown that the term "gamification" was mentioned the first time only three years ago in four IS conference proceedings (Hallerstede et al., 2012; Li et al., 2012; Romero et al., 2012; Schulze et al., 2012). Table 1 shows that since then a total of 42 articles were published in the above mentioned outlets containing the word gamification. The fact that more than a third of these papers are in an early research stage (research-in-progress) also indicates that gamification has only started to attract interest in the IS discipline. For a full list of all papers refer to appendix 1.

Outlet	EJIS	ISJ	ISR	JAIS	JIT	JMIS	JSIS	MISQ	AMCIS	ECIS	HICSS	ICIS
<i>Year</i>												
2012	-	-	-	-	-	-	-	-	1	1	0	2
2013	-	-	1	-	-	-	-	-	3	3	4	2
2014	-	-	-	-	-	-	-	-	3	8	8	6
<b>Sum</b>	-	-	<u>1</u>	-	-	-	-	-	<u>7</u>	<u>12</u>	<u>12</u>	<u>10</u>

Table 1. Number of papers containing the term "gamification" in searched outlets

Our literature review also showed that the majority of these papers so far have not looked at gamification as a new motivational phenomenon worthy of sole investigation but rather addressed or used gamification merely as minor matter or as a means to an end. However, we also found exceptions to this, i.e., papers which discuss gamification explicitly in distinct contexts: In the area of education Wu and Wang (2014) investigated the positive effects of gamification in an mobile education environment and Romero et al. (2012) hint at the potential of game based learning; the papers of Hamari and Koivisto (2013) and Pletikosa Cvijikj et al. (2014) address the area of fitness and health by describing how gamified information systems can help in the treatment of obese patients and how gamification can foster social motivation to do physical exercise. Other authors discuss pointification as a game element which can affect user behaviour on social networking sites (Sjöklint et al., 2013) or hint at the benefits of a gamified knowledge management systems with regard to better experience and knowledge sharing (Schacht et al., 2014). Table 2 shows an overview over full research papers which examine the use of gamification explicitly and indicates the involved game design elements as well as the context in which gamification was embedded.

Completed research paper	Title	Context	Game design elements
Halavais et al. (2014)	Badges of Friendship: Social Influence and Badge Acquisition on Stack Overflow	Learning	Badges
Hamari and Koivisto (2013)	Social motivations to use gamification: An empirical study of gamifying exercise	Fitness/health	Team building
Melville (2010)	Crowd-Sourced Peer Feedback (CPF) for Learning Community Engagement: Results and Reflections from a Pilot Study	Learning	Badges, feedback (progress)

Pletikosa Cvijikj et al. (2014)	Health information systems for obesity prevention and treatment of children and adolescents	Fitness/health	Achievements, badges, goal setting
Romero et al. (2012)	Learning through playing for or against each other? Promoting collaborative learning in digital game based learning	Education/learning	Team building, competition
Schacht et al. (2014)	The project world-gamification in project knowledge management	Knowledge management	Achievements, pointification, levels
Sjöklint et al. (2013)	Numerical representations and user behaviour in social networking sites: Towards a multi-theoretical research framework	User engagement	Pointification
Wu and Wang (2014)	Understanding the Effects of Mobile Gamification on Learning Performance	Education/learning	Pointification leader boards

Table 2. Full research papers in searched outlets addressing aspects of gamification

Only two papers put gamification at the centre stage of their research: Thiebes et al. (2014) explicitly look into gamification mechanics and dynamics and how they can lead to behavioural change, while Codish and Ravid (2014) approach this topic more from a user perspective by investigating how different personality types perceive and react to gamification.

Interestingly, through our literature we did not find any articles describing the application of gamification for the higher purpose of environmental sustainability, despite the potential it offers to intrinsically motivate (Ryan and Deci, 2000a) people to act more environmentally friendly. Thus, our proposed research project would be the first to take advantage of the first insights on gamification and to apply these to a sustainability context within the IS discipline.

## 2 Theoretical Foundation

For our research project we apply the Energy Informatics Framework proposed by Watson et al. (2010a), as this framework has been shown to aptly embrace the setting of automobiles and traffic (Watson et al., 2010a; 2010b). More specifically, the Energy Informatics Framework describes any energy management system which consumes energy and consists of three different components which are connected or integrated in an information system: a flow network, a sensor network, and sensitized objects (Watson et al., 2010a). Applied to the setting of our research project the energy (resource) consumed is fuel and the goal is to minimize this consumption. Besides higher energy efficiency, less fuel consumption would also lead to the environmental goal of less CO<sub>2</sub> emissions. Roads and streets in any given region or city constitute the flow network, in which automobiles are embedded as sensitized objects which in turn are equipped with various telematics sensors to measure and evaluate the performance of each single automobile. Using the framework gives us the opportunity to systematically address different questions related to each of the components of the Energy Informatics Framework (information system, flow network, sensor network, sensitized objects) from different perspectives (e.g., company/supplier view, consumer view). Such questions can relate to the type and granularity of information which companies have to collect and how this information has to be provided to customers in order for them to manage their energy efficiency (Watson et al., 2010a).

Or put in other words: The role of the information system here is to collect the data provided by the sensors as well as to process and visualize this data to inform, for example, drivers about their driving behaviour and fuel consumption, respectively. According to Watson et al. (2010a; 2010b) having

information about one's energy consumption (here also the CO<sub>2</sub> emission caused) should enable and facilitate decisions and behaviour which lead to a more efficient and thus more sustainable consumption.

Upon conducting the field experiment depicted in the following session, we will apply a theory that addresses behavioural change. As we believe that the application of gamification will intrinsically motivate customers to drive more environmentally friendly, Self-Determination Theory (Ryan and Deci, 2000b) could be applied to explain the behavioural change. Self-Determination Theory is particularly suitable for two reasons: First, a customer's decision to act environmentally sustainable can be considered to be self-determined, especially when this decision was made in a gamified context. This fits well in the spectrum of motivated behaviours suggested by the Self-Determination Theory, which posits a person's behaviour can range from being self-determined, i.e., intrinsically motivated, to various levels of controlled behaviour, i.e., extrinsically motivated (Ryan and Deci, 2000b). This also reflects, why Self-Determination Theory (e.g., Wati and Koo, 2012; Wunderlich et al., 2013a; 2013b) or its sub-theories, e.g., Organismic Integration Theory (Wunderlich et al., 2012), have been used in previous green IS research. Secondly, the three constructs Self-Determination Theory uses to explain intrinsic motivation can be easily connected to gamification:

- *Autonomy*, which is the need to control one's own life or to make free decisions (Deci and Ryan, 2000) is highly relatable to gamification, as the decision to start, to continue and to end playing a game is solely up to the customer and thus completely based on voluntariness.
- *Competence*, which is the need to be effective and to know that one is or can become capable of solving a problem at hand (Deci and Ryan, 2000). Gamification can accommodate this need by providing stimulating (i.e., not too difficult but also not too simple) challenges and providing feedback which acknowledges success or points out potential to improve.
- *Relatedness*, which is the need to interact with others or to connect and identify with a meaning or goal (Deci and Ryan, 2000). In gamified contexts, customers get the opportunity to compete with others or work together in teams to achieve goals, which serve a higher purpose or overlap with personal goals.

### 3 Field Experiment and Data Collection

To collect the necessary data we cooperate with a car sharing company. This company operates a free floating car renting company in numerous cities worldwide and can be considered as one of the market leaders in this business. As opposed to traditional car rental services, upon registering as a customer, drivers are not required to come to a fixed renting station first to start renting a car. Instead, customers are able to use their mobile communication devices (e.g., smartphones) to locate one of usually hundreds of available cars, which are spread throughout the city, and start the renting period at any location and drive to their desired location. At the end of the rent, customers may leave the car at any place in the city and do not have to return the car to a specific station (thus the free floating car sharing system).

As soon as a customer starts to drive the car, internal telematics sensors start measure numerous indicators which eventually are summarized in three numerical scores ranging from 1 (bad) to 100 (good):

1. *Acceleration*: Measures how slowly and smoothly a customer is driving. If the customer is accelerating unnecessary or often, this will increase fuel consumption and thus also CO<sub>2</sub> emission.

2. *Cruising*: Evaluates the driving style in terms of calmness and consistency. If the driver frequently alternates between speeding and braking, the score worsens indicating inefficient fuel consumption and hence higher CO<sub>2</sub> emission.
3. *Deceleration*: Assesses the foresight and consciousness with which a customer drives. The more often a car is coasting (e.g., downhill or towards a red traffic light) instead of using the breaks, the better this score gets. This indicates a preserving consumption of fuel and thus less CO<sub>2</sub> emission.

Taking these three measurement as indicators for CO<sub>2</sub> emission makes sense as tailpipe emission rates of pollutants such as carbon dioxide have been shown to be sensitive to vehicle speed (Bokare and Maurya, 2013) and researchers have established a linear relationship between CO<sub>2</sub> emission of a vehicle and the speed and acceleration/deceleration of the vehicle (Oduro et al., 2013).

For each of the three measurement scores are computed and depicted in real time on the cars' on-board displays. In addition to this, each numerical value is also represented as a colourful, "living" tree which changes its appearance according to the driving behaviour and value: The better the value is, the "healthier" the respective tree becomes and in its final (preferred) stage all three trees are blooming, with animals living in them and a rainbow appearing in the background. In the opposite case, when the driving behaviour is not fuel efficient, the customer will receive low scores and thus gets to see leafless, bleak trees with dark rain clouds in the background in the worst case. Furthermore, a fourth score, which is the arithmetic mean of the other three scores, is also displayed for a quick assessment of the overall driving style.

By using pointification (the four values) and the illustration of trees (progress visualization and immediate feedback on goal achievement) as game design elements, each drive is gamified. The apparent goal is to encourage each customer to play this mini-game while driving and encouraging everyone to achieve a perfect score (all scores equal 100 points) which implies an environmentally friendly driving behaviour.

To investigate whether gamification does have an effect on driving behaviour we will collect data in several cities from different countries. For each city, we will determine two random customer groups. For the first group (control group) the cars will be set up in such a way that customers will not be able to see or play the "tree game"; however, the scores will still be computed and reported internally. For this group we expect the scores to settle down on a low to mid-range level and to stay at this level throughout the experiment.

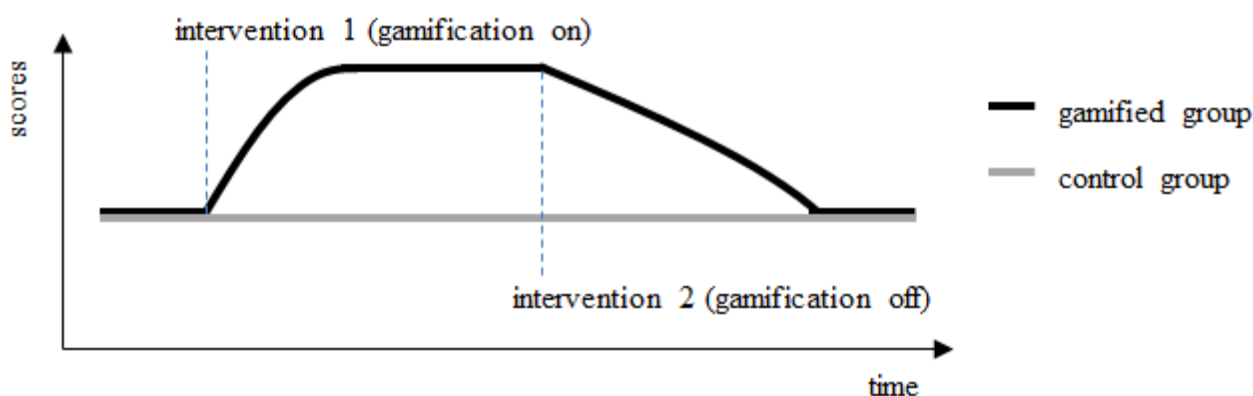


Figure 1. Expected change of scores (driving behaviour) due to gamification

The second group (gamified group) will be manipulated in terms of availability of the game: Similar to the control group, the gamified group will start out renting and driving cars which will not engage them in the game. After we have established a base line – we expect both groups to generate similar scores at the beginning of the experiment –, the game will be activated (intervention 1) for this group giving the customers the possibility to play the game. Here we expect to see positive effects on driving behaviour as soon as gamification is involved, i.e., the scores will improve and settle on a higher level when compared to the scores of the control group. Again, after a certain period of time, gamification will be switched off again (intervention 2) for the second, gamified group in order to see whether the effects of gamification on the drivers' behaviour are persistent, i.e., scores remain on the same level, or waning over time, i.e., scores are worsening or returning back to the level when no gamification was applied.

Figure 1 shows how we expect the application and consequently the deactivation of gamification to affect the scores and thus drivers' behaviour.

## **4 Contribution**

Irrespective of the findings, our research project offers contributions which are twofold. First, it expands our knowledge on how information systems can further support in overcoming the society's grand challenge of becoming more sustainable, especially on the level of individuals. Secondly, it offers the possibility to further investigate the potential and effects of gamification in a sustainability context and across countries, which not only offers insights on the persistence of gamification effects but also whether effects may vary depending on cultural backgrounds.



## References

- Blohm, I. and J.M. Leimeister (2013). "Gamification. Design of IT-Based Enhancing Services for Motivational Support and Behavioral Change." *Business & Information Systems Engineering* (4), 275–278.
- Bokare, P.S. and A.K. Maurya (2013). "Study of effect of speed, acceleration and deceleration of small petrol car on its tail pipe emission." *International Journal for Traffic and Transport Engineering* 3 (4).
- Brigham, J., H.S. Javitz, R.E. Krasnow, L.M. Jack, and G.E. Swan (2013). "Lessons from an Online Stop-Smoking Intervention: Adaptations for Mobile Implementation." in *System Sciences (HICSS), 2013 46th Hawaii International Conference on IEEE*, 2705–2714.
- Brigham, J., H.S. Javitz, R.E. Krasnow, L.M. Jack, and G.E. Swan (2014). "A Tailoring Algorithm to Optimize Behavior Change." in *System Sciences (HICSS), 2014 47th Hawaii International Conference on IEEE*, 2645–2654.
- Chen, A.J.W., M.-C. Boudreau, and R.T. Watson (2008). "Information systems and ecological sustainability." *Journal of Systems and Information Technology* 10 (3), 186–201.
- Codish, D. and G. Ravid (2014). "Personality based gamification: How different personalities perceive gamification." in *Proceedings of the 22nd European Conference on Information Systems (ECIS)*.
- Corbett, J. (2013). "Designing and Using Carbon Management Systems to Promote Ecologically Responsible Behaviors." *Journal of the Association for Information Systems* 14 (7), 339–378.
- Crowston, K. and N.R. Prestopnik (2013). "Motivation and data quality in a citizen science game: A design science evaluation." in *System Sciences (HICSS), 2013 46th Hawaii International Conference on IEEE*, 450–459.
- Deci, E.L. and R.M. Ryan (2000). "The 'What' and 'Why' of Goal Pursuits: Human Needs and the Self-Determination of Behavior." *Psychological Inquiry* 11 (4), 227–268.
- Dedrick, J. (2010). "Green IS: Concepts and Issues for Information Systems Research." *Communications of the Association for Information Systems* 27, 173–184.
- Deterding, S., D. Dixon, R. Khaled, and L. Nacke (2011). "From Game Design Elements to Gamefulness: Defining Gamification." in *Proceedings of the 15th International Academic MindTrek Conference Tampere, Finland: ACM*, 9–15.
- Elliot, S. (2011). "Transdisciplinary Perspectives on Environmental Sustainability: A Resource Base and Framework for IT-Enabled Business Transformation." *MIS Quarterly* 35 (1), 197–236.
- Federal Government of Germany (2014). Die Nationale Klimaschutzstrategie URL: <http://www.bundesregierung.de/Content/DE/StatischeSeiten/Breg/ThemenAZ/Klimaschutz/klimaschutz-2006-07-27-die-nationale-strategie.html> (visited on 20/11/2014).
- Graml, T., C.-M. Looock, M. Baeriswyl, and T. Staake (2011). "Improving residential energy consumption at large using persuasive systems." in *ECIS*.
- Halavais, A., K.H. Kwon, S. Havener, and J. Striker (2014). "Badges of Friendship: Social Influence and Badge Acquisition on Stack Overflow." in *System Sciences (HICSS), 2014 47th Hawaii International Conference on IEEE*, 1607–1615.

- Hallerstede, S., A. Bullinger, and K. Möslein (2012). "Design and Management of Web-Based Innovation Communities: A Lifecycle Approach." in *Proceedings of the 20th Americas Conference on Information Systems (AMCIS)*.
- Hamari, J. and J. Koivisto (2013). "Social motivations to use gamification: an empirical study of gamifying exercise." in *Proceedings of the 21st European Conference on Information Systems (ECIS)*.
- Hamari, J., J. Koivisto, and H. Sarsa (2014). "Does Gamification Work? -- A Literature Review of Empirical Studies on Gamification." in *System Sciences (HICSS), 2014 47th Hawaii International Conference on Presented at the System Sciences (HICSS), 2014 47th Hawaii International Conference on*.
- Hughes, D., C. Crowley, W. Daniels, R. Bachiller, and W. Joosen (2014). "User-Rank: Generic Query Optimization for Participatory Social Applications." in *System Sciences (HICSS), 2014 47th Hawaii International Conference on 1874–1883*.
- Huotari, K. and J. Hamari (2012). "Defining Gamification: A Service Marketing Perspective." in *Proceedings of the 15th International Academic MindTrek Conference Tampere, Finland: ACM*, 17–22.
- IEA (2013). *CO2 Emissions from Fuel Combustion* URL: <http://www.iea.org/publications/freepublications/publication/co2emissionsfromfuelcombustionhighlights2013.pdf>.
- JATO (2014). *Renault Heads the Volume Brands in Europe as Average New Car CO2 Emissions Continue to Fall* URL: <http://ww11.jato.com/PressReleases/Renault%20heads%20the%20volume%20brands%20in%20Europe%20as%20average%20new%20car%20CO2%20emissions%20continue%20to%20fall.pdf>.
- Kankanhalli, A., M. Taher, H. Cavusoglu, and S.H. Kim (2012). "Gamification: A New Paradigm for Online User Engagement." in *Proceedings of the 33rd International Conference on Information Systems (ICIS) Orlando, Florida*, 1–10.
- Khan Academy (2014). User Profile on Khan Academy Education Platform *User Profile | Khan Academy* URL: <https://www.khanacademy.org/profile/> (visited on 11/01/2014).
- Li, Z., K. Huang, and H. Cavusoglu (2012). "Quantifying the Impact of Badges on User Engagement in Online Q&A Communities." in *Proceedings of the 33rd International Conference on Information Systems (ICIS)*.
- Loeser, F., K. Ereik, and R. Zarnekow (2012). "Towards a Typology of Green IS Strategies: Insights from Case Study Research." URL: <http://aisel.aisnet.org/icis2012/proceedings/GreenIS/9>.
- Loock, C.-M., T. Staake, and J. Landwehr (2011). "Green IS Design and Energy Conservation: An Empirical Investigation of Social Normative Feedback." URL: <http://aisel.aisnet.org/icis2011/proceedings/humanbehavior/10>.
- Marett, K., R.F. Otondo, and G.S. Taylor (2013). "Assessing the Effects of Benefits and Institutional Influences on the Continued Use of Environmentally Munificent Bypass Systems in Long-Haul Trucking." *MIS Quarterly* 37 (4), 1301–A9.
- Melville, N.P. (2010). "Information Systems Innovation for Environmental Sustainability." *MIS Quarterly* 34 (1), 1–21.
- Melville, N.P. (2014). "Crowd-Sourced Peer Feedback (CPF) for Learning Community Engagement: Results and Reflections from a Pilot Study." in *System Sciences (HICSS), 2014 47th Hawaii International Conference on 32–41*.

- Nike (2014). What Is Nike Fuel? *Nike+* URL: [https://secure-nikeplus.nike.com/plus/what\\_is\\_fuel/](https://secure-nikeplus.nike.com/plus/what_is_fuel/) (visited on 11/01/2014).
- Oduro, S.D., S. Metia, H. Duc, and Q.P. Ha (2013). "CO2 vehicular emission statistical analysis with instantaneous speed and acceleration as predictor variables." in *Proceedings of the 2013 International Conference on Control, Automation and Information Sciences (ICCAIS)*.
- Pflanzl, N. and G. Vossen (2014). "Challenges of Social Business Process Management." in *System Sciences (HICSS), 2014 47th Hawaii International Conference on IEEE*, 3868–3877.
- Pletikosa Cvijikj, I., T. Kowatsch, D. Büchter, B. Brogle, A. Dintheer, D. Wiegand, D. Durrer-Schutz, D. L'Allemand-Jander, Y. Schutz, and W. Maass (2014). "Health information system for obesity prevention and treatment of children and adolescents." in *Proceedings of the 22nd European Conference on Information Systems (ECIS)*.
- Prpic, J. and P. Shukla (2013). "The theory of crowd capital." in *System Sciences (HICSS), 2013 46th Hawaii International Conference on IEEE*, 3505–3514.
- Prpic, J. and P. Shukla (2014). "The Contours of Crowd Capability." in *System Sciences (HICSS), 2014 47th Hawaii International Conference on IEEE*, 3461–3470.
- Romero, M., M. Usart, M. Ott, and J. Earp (2012). "Learning through playing for or against each other? Promoting collaborative learning in digital game based learning." in *Proceedings of the 20th European Conference on Information Systems (ECIS)*.
- Ryan, R.M. and E.L. Deci (2000a). "Intrinsic and Extrinsic Motivations: Classic Definitions and New Directions." *Contemporary Educational Psychology* 25 (1), 54–67.
- Ryan, R.M. and E.L. Deci (2000b). "Self-Determination Theory and the Facilitation of Intrinsic Motivation, Social Development, and Well-Being." *American Psychologist* 55 (1), 68–78.
- Schacht, S., S. Morana, and A. Maedche (2014). "The project world-gamification in project knowledge management." in *Proceedings of the 22nd European Conference on Information Systems (ECIS)*.
- Schulze, T., S. Krug, and M. Schader (2012). "Workers' task choice in crowdsourcing and human computation markets." in *Proceedings of the 33rd International Conference on Information Systems (ICIS)*.
- Seidel, S., J. Recker, and J. vom Brocke (2013). "Sensemaking and Sustainable Practicing: Functional Affordances of Information Systems in Green Transformations." *MIS Quarterly* 37 (4), 1275–A10.
- Simões, J., R.D. Redondo, and A.F. Vilas (2013). "A social gamification framework for a K-6 learning platform." *Computers in Human Behavior* 29 (2), 345–353.
- Sjöklint, M., I. Constantiou, and M. Trier (2013). "Numerical Representations And User Behaviour In Social Networking Sites: Towards A Multi-Theoretical Research Framework." in *Proceedings of the 21st European Conference on Information Systems (ECIS)*.
- Statista (2014). Verteilung Der CO2-Emissionen Durch Den Deutschen Verkehr Im Jahr 2013 Nach Verkehrsträgern URL: <http://de.statista.com/statistik/daten/studie/13150/umfrage/co2-emissionen-im-deutschen-personenverkehr/> (visited on 11/01/2014).
- Thiebes, S., S. Lins, and D. Basten (2014). "Gamifying Information Systems - A Synthesis of Gamification Mechanics and Dynamics." in *Proceedings of the 22nd European Conference on Information Systems (ECIS)*.

- Tootell, H., M. Freeman, and A. Freeman (2014). "Generation alpha at the intersection of technology, play and motivation." in *System Sciences (HICSS), 2014 47th Hawaii International Conference on IEEE*, 82–90.
- Wati, Y. and C. Koo (2012). "Toward Green IS Adoption Behaviors: A Self-Determination Perspective." Presented at the 2012 45th Hawaii International Conference on System Science (HICSS), 1207–1216.
- Watson, R.T., M.-C. Boudreau, and A.J. Chen (2010). "Information Systems and Environmentally Sustainable Development: Energy Informatics and New Directions for the IS Community." *MIS Quarterly* 34 (1), 23–38.
- Watson, R.T., M.-C. Boudreau, S. Li, and J. Levis (2010). "Telematics at UPS: En Route to Energy Informatics." *MIS Quarterly Executive* 9 (1), 1–11.
- Wunderlich, P., J. Kranz, D. Totzek, D. Veit, and A. Picot (2013). "The Impact of Endogenous Motivations on Adoption of IT-Enabled Services The Case of Transformative Services in the Energy Sector." *Journal of Service Research* 16 (3), 356–371.
- Wunderlich, P., J. Kranz, and D. Veit (2013). "Beyond carrot-and-stick: How values and endogenous motivations affect residential Green IS adoption." URL: <http://aisel.aisnet.org/icis2013/proceedings/HumanBehavior/21>.
- Wunderlich, P., D. Veit, and S. Sarker (2012). "Examination of the Determinants of Smart Meter Adoption: An User Perspective." URL: <http://aisel.aisnet.org/icis2012/proceedings/HumanBehavior/13>.
- Wu, Y.-L. and W.-T. Wang (2014). "Understanding the Effects of Mobile Gamification on Learning Performance." in *Proceedings of the 20th Americas Conference on Information Systems (AMCIS)*.
- Yoda, L.U., D. Nahl, and M.E. Crosby (2013). "Stage-Based mHealth Communication Interventions for HPV Education." in *System Sciences (HICSS), 2013 46th Hawaii International Conference on IEEE*, 2715–2724.
- Zhang, Y. (2012). "IT enabled environmentally friendly consumption: IT features addressing challenges in consumer decision making." in *ECIS 2012 Proceedings* URL: <http://aisel.aisnet.org/ecis2012/233>.

## Appendix

### Full list of IS papers containing the term “gamification”

Outlet	Authors	Publication Year	Type of Paper	Title
Information Systems Research	Nandhakumar et al.	2013	Full paper	From knowing it to "getting it": Envisioning Practices in computer games development
Americas Conference on Information Systems	Crowley et al.	2013	RIP	Decision support using linked, social, and sensor data
	Hallerstede et al.	2012	Full paper	Design and Management of Web-Based Innovation Communities: A Lifecycle Approach
	Kaleta et al.	2014	RIP	Achieving Business Goals with Gamification: An Informational and Motivational Perspective
	Küpper et al.	2014	Full paper	Features for Social CRM Technology—An Organizational Perspective
	Roth et al.	2013	Full paper	Facilitating conflict resolution of models for automated enterprise architecture documentation
	Shang and Lin	2013	RIP	An Understanding of the Impact of Gamification on Purchase Intentions
	Wu and Wang	2014	Full paper	Understanding the Effects of Mobile Gamification on Learning Performance
European Conference on Information Systems	Codish and Ravid	2014	Full paper	Personality based gamification: How different personalities perceive gamification
	Feldmann et al.	2014	Full paper	Using serious games for idea assessment in service innovation
	Füller et al.	2014	Full paper	Web-based customer integration for product design: The role of hedonic vs utilitarian customer experience
	Hamari and Koivisto	2013	Full paper	Social motivations to use gamification: an empirical study of gamifying exercise
	Ononiwu and Brown	2013	Full paper	Theorisation In Critical Realist Is Research And Its Implications On Structure And Agency Interplay: A Morphogenetic Approach
	Pletikosa Cvijikj et al.	2014	Full paper	Health information system for obesity prevention and treatment of children and adolescents
	Romero et al.	2012	Full paper	Learning through playing for or against each other? Promoting collaborative learning in digital game based learning

	Schacht et al.	2014	Full paper	The project world-gamification in project knowledge management
	Sjöklint et al.	2013	Full paper	Numerical Representations And User Behaviour In Social Networking Sites: Towards A Multi-Theoretical Research Framework
	Sørensen and Landau	2014	Full paper	We've got 99 problems, but a phone ain't one: Mobile ICT and academic agility in information systems research
	Thiebes et al.	2014	Full paper	Gamifying information systems - a synthesis of gamification mechanics and dynamics
	Zogaj and Bretschneider	2014	Full paper	Analyzing governance mechanisms for crowdsourcing information systems: A multiple case analysis
Hawaii International Conference on System Sciences	Brigham et al.	2014	Full paper	A Tailoring Algorithm to Optimize Behavior Change
	Brigham et al.	2013	Full paper	Lessons from an Online Stop-Smoking Intervention: Adaptations for Mobile Implementation
	Crowston and Prestopnik	2013	Full paper	Motivation and data quality in a citizen science game: A design science evaluation
	Halavais et al., 2014	2014	Full paper	Badges of Friendship: Social Influence and Badge Acquisition on Stack Overflow
	Hamari et al.	2014	Full paper	Does Gamification work? A literature review of empirical studies on gamification
	Hughes et al., 2014)	2014	Full paper	User-Rank: Generic Query Optimization for Participatory Social Applications
	Melville	2014	Full paper	Crowd-Sourced Peer Feedback (CPF) for Learning Community Engagement: Results and Reflections from a Pilot Study
	Pflanzl and Vossen	2014	Full paper	Challenges of Social Business Process Management
	Prpic and Shukla	2013	Full paper	The Contours of Crowd Capability
	Prpic and Shukla	2013	Full paper	The theory of crowd capital
	Tootell et al.	2014	Full paper	Generation Alpha at the intersection of technology, play and motivation
	Yoda et al.	2013	Full paper	Stage-Based mHealth Communication Interventions for HPV Education
International Conference on Information Systems	Burleson et al.	2014	RIP	The Same, Yet Different: Using Hedonic Systems in Utilitarian Settings
	He et al.	2014	RIP	Towards Understanding IT Value Co-creation in Crowdsourcing: the Multiple

				Stakeholders' Perspective
	Kankanhalli et al.	2013	RIP	Gamification: A New Paradigm for Online User Engagement
	Kari and Makkonen	2014	Full paper	Explaining the Usage Intentions of Exergames
	Lenarcic	2014	RIP	Use the Difficulty through Schwierigkeit: Antiusability as Value-driven Design
	Li et al.	2012	RIP	Quantifying the Impact of Badges on User Engagement in Online Q&A Communities
	Mutter and Kundisch	2014	Full paper	Behavioral Mechanisms Prompted by Badges: The Goal-Gradient Hypothesis
	Schulze et al.	2012	RIP	Workers' task choice in crowdsourcing and human computation markets
	Teh et al.	2013	RIP	Can Work Be Fun? Improving Task Motivation and Help-Seeking Through Game Mechanics
	Wahle et al.	2014	RIP	Towards the Design of Evidence-based Mental Health Information Systems: A Preliminary Literature Review