

FOOD-RELATED GAMIFICATION: LITERATURE REVIEW

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ABSTRACT

Food-related games and gamified services is an area that has still received relatively little attention in scientific research. In our literature review, we find out that the scientific literature in this domain examines the phenomenon from the point of view of marketing, educative purposes of healthier living, and healthcare. Particular topics often being in the focus are weight management for children and advergaming as a promotional channel towards young people. Commonly, studies conclude that gamification has an effect in bringing a change in the behavior of the targeted user. However, the studies are currently able to present results based only on short-term empirical experiments or the experiments are even missing. In order to receive more reliable data about the true effectiveness of gamification, longer-term experiments would be needed.

INTRODUCTION

Gamification is the application of game design principles for the purpose of engaging users with a chosen service or products (Deterding et al. 2011). Gamification has been used by various industries and researchers to study and leverage the effect it has on the human behaviour, e.g. in areas of education and marketing. Gamification is utilized in order to engage and motivate the users to concentrate on the subject matter. The term itself was coined by Nick Pelling back in 2002 (Marczewski 2013), but the earliest known example of this kind of an activity dates back to 1910 when Kellogg's cereals offered the Funny Jungleland Moving-Pictures book free with every two boxes bought by the customer (McCormick 2013).

In this paper, we explore the utilization of gamification and digital games in food-related studies through a systematic literature review (Grant and Booth 2009). This is done to gain understanding into 1) in which food-related areas games and gamification are utilized, 2) what are the motivational design elements utilized and 3) what are the results reported.

The paper is organized as follows. First, how the review was conducted. In the next section, we summarize our results in four different categories and examine the design elements utilized. Finally, the results are discussed and findings concluded.

METHOD

In order to find out the adequate number of relevant articles, several search words were tested. In the end, the chosen search words were "gamification" and "food" for the article databases. Google Scholar was also decided to be utilized, but there the search words were decided to be "gamification" and "food industry", since "food" only provided too wide results. In addition, Gamification Research Network, which is a free reference manager in Mendeley for gamification enthusiasts to share the research articles, was utilized without search words. The searches were conducted between 7th April and 16th and the number of results from each database are presented in Figure 1.

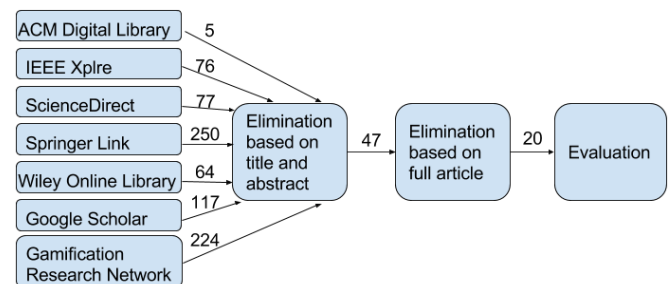


Figure 1. The Research Process

The found articles were gone through with the following inclusion criteria:

- the utilized language was English,
- the type of the text was a scientific article or a book (e.g. thesis works were excluded),
- the article included a description of a game or gamified elements, and
- the article was related to food or eating: e.g. food education, advergaming for food, diets.

The research method can be divided into two rounds, as presented in Figure 1. In the first round two researchers went through the results of the searches and based on the title decided whether the article is relevant. If the title was not explicit, also the abstract of even some parts of the article could be examined. In the second round, the researchers went through the results from the first round, reading the whole article and rechecking whether it was relevant or not. In order to avoid researcher bias, it was mostly a different researcher checking the articles than in the first round. After the second round, there were 20 articles left.

RESULTS

Food-Related Areas

From the selected articles five were related to marketing, five related to education and ten related to healthcare, such as obesity or diabetes.

Marketing (N=5)

The main share of articles concentrating on the use of gamification in the marketing of food products focused on games designed to advertise specific products (advergaming), and the use of advergaming for product or brand promotion to children in particular. The research perspective was thus more often societal, rather than business-driven. Besides providing information regarding the effectiveness of gamification that could be used e.g. by marketers, this topic is characterized especially by discourse regarding the ethicality of promotion to the target group of children, as many times advergaming endeavor to promote nutritionally poor foods (Harris et al. 2012, Kelly et al. 2015, Thomson 2010; 2011). The importance of regulatory measures to restrict this type of promotion is underlined (Harris et al. 2012, Kelly et al. 2015, Thomson 2010; 2011). Harris et al. (2012) notice that while there was no significant difference in the number of children and adolescents visiting food company websites, children represented a significantly higher proportion of the visitors to the advergaming websites of food companies. According to the research conducted (Harris et al. 2012, Kelly et al. 2015), advergaming is able to increase preference for the food products promoted at least in the short term. Kiraci and Yurdakul also noticed that players may even prefer advergaming where the brand forms a central part of the game (Kiraci and Yurdakul 2014). However, there is a need for more longitudinal and robust research on the effects of advergaming, and it could be of interest to conduct more research on the use of gamification for other types of promotion besides advergaming as well.

Nutritional education and life-style changes(N=5)

The articles of nutritional education and lifestyle changes concentrated on changing the eating behavior of children and educating teenagers about nutrition, but included also an article about educating in recycling.

The target of gamified solutions described in three articles was to change the eating behavior of children, such as picky eating (Kadomura et al. 2013), slow eating (Kadomura et al. 2013, Lo et al. 2007) and fruit and vegetable consumption (Jones et al. 2014). A "playful tray" decreased the negative behavior of all parents and three out of four children in the test group (Lo et al. 2007). The consumption of vegetables increased in the school days the children were challenged to eat more of them (Jones et al. 2014). Jones et al. noted though that the results were not long-lasting: on the days the challenge was not utilized, the consumption of the vegetables did not increase. The concept of a fork, which could recognize different food items, and a mobile application in article (Kadomura et al. 2013) had been proven to work, but no empirical research of the effects of this approach had been conducted.

Educating teenagers about nutrition was discussed in two articles. Nutritional knowledge was questioned from the teenagers playing a game and correct answers were rewarded with better abilities in a game in (Dunwell et al. 2015). Also the responses in the focus group interviews were positive. Similarly, having incorporated game mechanics into food consumption recording, the user engagement of the piloted service was seen to have improved (Caon et al. 2015). Yet another objective for gamified mechanisms was to motivate participants to recycle and reduce the amount of food waste (Comber et al. 2013). There the participants quickly lost interest in the gamified mechanisms, but the service resulted in significant changes in the social aspects of recycling and in improving awareness about recycling and food waste behaviour.

Healthcare (N=10)

Many of the gamified solutions in the articles focused on obesity prevention. Two articles describe gamified solutions aimed for children, and in both of them the completion of small real-life tasks and quests related to healthy choices are rewarded (Hu et al. 2014, Durga et al. 2014). Durga et al. found out that players were likely to repeat actions that aligned with their existing routines, and these recurrent tasks were a strong motivator for participants to continue to log in their activities. However, Durga et al. concluded that the game content should evolve in order to attract the players to find out new healthy things they can do in the game, instead of sticking on the same repetitive actions. Hu et al. did not yet conduct any empirical evaluation of the effects of their solution.

In a gamified intervention program aiming to prevent obesity, González et al. set out to examine a gamified program including nutrition education and physical activity (González et al. 2016). After the eight-week intervention, biometric measurements showed little change in the participants, but the children were described as eager to implement the activities, see their weekly progress and receive feedback, and the results indicated an improvement in the lifestyle of the children. Kamal et al. conducted a survey about their software application for obesity prevention: positive changes were seen in individual determinants but not on social determinants (Kamal et al. 2014). Focus group discussions revealed that the social aspects could be tackled e.g. with better system intelligence for displaying the most interesting posts of other people. Obesity prevention was targeted also through the prevention of snack cravings: Hsu et al. found that the users that managed to perform the imagery tasks within their mobile application efficiently consumed fewer snacks or were more likely to choose healthy snacks (Hsu et al. 2014). Pannese et al. also described a system for obesity prevention providing support for moving towards healthful behavior through gamified daily life processes, however, it was still in conceptual development phase (Pannese et al. 2014).

Besides obesity, also diabetes and eating disorders were the targets of gamification. User satisfaction was queried in two articles. In (Tregarthen et al. 2015), an application for the treatment of eating behaviours through logging the food

eaten was downloaded over 108 000 times, 89% logged at least three meals and 84% rated the application five out of five. According to a questionnaire for the 30 beta version users, (Burda and Novák 2015), the users were mostly satisfied with the application meant for diabetes compensation. Chuang et al. also presented a concept for a service aiming to provide social connectivity, self-management through personalized recommendations and health analytics for diabetics, and gamification is utilized to make tracking more enjoyable and rewarding. In the first nine-month period, there were 146 registered users, the tracking module was the most attractive part of the system (Chuang et al. 2014).

Gamification

As gamification mechanisms, motivational design elements are often utilized. Table 1 presents the motivational design elements found in the articles, according to Weiser et al. (Weiser et al. 2015), with the addition of time constraint (Hamari et al. 2014). Three of the articles (Harris et al. 2012, Kelly et al. 2015, Kiraci and Yurdakul 2014) described various gamified solutions, and are thus excluded from the table.

It can be clearly seen, that the utilization of points, credits and levels, as well as assignments, quests and goals is favored in food-related gamification. These can be seen to be simple and easy ways to introduce gamification. In addition

to the mentioned motivational design elements, some of the described solutions went further and implemented more complicated game mechanics, such as a story evolution during game play (Jones et al. 2014, Durga et al. 2014, González et al. 2016). In four games also social elements were utilized (Kamal et al. 2014, Tregarthen et al. 2015, Durga et al. 2014, Chuang et al. 2014).

CONCLUSIONS

This paper found that the main areas related to food where gamification has been studied are marketing, healthier living (nutritional education and lifestyle changes), and healthcare (e.g. obesity and diabetes). The most common motivational design elements that were deployed were assignments and points. The studies commonly showed that gamification can be applied in various food-related scenarios and the empirical results displayed a change in the behavior or mindset of test subjects in accordance with the objectives of the games or gamified services. However, there was no evidence of these effects extending further than the duration of the short-term studies. Also, many of the articles focused on the description of the gamified application or service, and the effects of the gamification were left out of scope. Therefore, we recommend that more longitudinal studies be conducted to assess the effectiveness of gamification within this domain.

Table 1. Motivational design elements.

	Story	Time constraints	Assignments, Quests and Goals	Points, Credits, Levels	Achievements or Badges	Virtual Goods	Leaderboards and Collections	Friends, Teams and Groups	Reminders
(Comber et al. 2013)				x	x		x	x	
(Thomson 2011)					x	x			
(Thomson 2010)							x		
(Caon et al. 2015)				x	x	x			
(Kadomura et al. 2013)		x		x					
(Dunwell and Dixon 2015)				x					
(Jones et al. 2014)	x		x					x	
(Lo et al. 2007)			x						
(Durga et al. 2014)	x		x	x					
(Pannese et al. 2014)									
(Gonzalez et al. 2016)	x	x	x	x	x		x	x	
(Hsu et al. 2014)			x						
(Hu et al. 2014)			x	x	x	x		x	
(Kamal et al. 2014)			x	x			x		
(Tregarthen et al. 2015)			x			x			x
(Burda and Novak 2015)				x		x			x
(Chuang et al. 2014)			x						

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REFERENCES

- Burda V. and D. Novák, 2015. "Mobiab system for diabetes mellitus compensation." In *Proceedings of International Workshop on Computational Intelligence for Multimedia Understanding (IWCIM)*, 1-3.
- Caon M.; S. Carrino; F. Prinelli; V. Ciociola; F. Adorni; C. Lafortuna; S. Tabozzi; J. Serrano; L. Condon; O.A. Khaled and Mugellini E., 2015. "Towards an Engaging Mobile Food Record for Teenagers". In *Proceedings of New Trends in Image Analysis and Processing*. Springer International Publishing, 417-424.
- Chuang J.; O. Hsiao; P.L. Wu; J. Chen; X. Liu; H. De La Cruz; S.H. Li and H. Chen. 2014. "DiabeticLink: An Integrated and Intelligent Cyber-Enabled Health Social Platform for Diabetic Patients". In *Proceedings of Smart Health: International Conference, ICSH 2014*. Springer International Publishing, 63-74.
- Comber R.; A. Thieme; A. Rafiev; N. Taylor; N. Krämer and P. Olivier. 2013. "BinCam: Designing for Engagement with Facebook for Behavior Change". In *Proceedings of Human-Computer Interaction - INTERACT 2013: 14th IFIP TC 13 International Conference*. Springer Berlin Heidelberg, 99-115.
- 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: Envisioning Future Media Environments*. ACM, New York, NY, USA, 9-15.
- Dunwell I.; R. Dixon and D. Morosini. 2015. "A mobile serious game for lifestyle change: Conveying nutritional knowledge and motivation through play". In *Proceedings of International Conference on Interactive Mobile Communication Technologies and Learning (IMCL), 2015*, 259-263.
- Durga S.; M.S. El-Nasr; M. Shiyko; C. Sceppa; P. Naab and L. Andres. 2014. "Virtual, Augmented Reality and Serious Games for Healthcare 1". In chapter *Leveraging Play to Promote Health Behavior Change: A Player Acceptance Study of a Health Game*. Springer Berlin Heidelberg, Berlin, Heidelberg, 209-230.
- Gonzalez C.S.; N. Gmez; V. Navarro; M. Cairns; C. Quirce; P. Toledo and N. Marrero-Gordillo. 2016. "Learning healthy lifestyles through active videogames, motorgames and the gamification of educational activities". *Computers in Human Behavior*, 55, Part A, 529-551.
- Grant M.J. and A. Booth. 2009. "A typology of reviews: an analysis of 14 review types and associated methodologies." *Health Information & Libraries Journal*, 26, no. 2, 91-108.
- Hamari J.; J. Koivisto and H. Sarsa. 2014. "Does Gamification Work? A Literature Review of Empirical Studies on Gamification". In *Proceedings of 2014 47th Hawaii International Conference on System Sciences*. 3025-3034.
- Harris J.L.; S.E. Speers; M.B. Schwartz and K.D. Brownell. 2012. "US Food Company Branded Advergaming on the Internet: Children's exposure and effects on snack consumption". *Journal of Children and Media*, 6, no. 1, 51-68.
- Hsu A.; J. Yang; Y.H. Yilmaz; M.S. Haque; C. Can and A.E. Blandford A.E. 2014. "Persuasive Technology for Overcoming Food Cravings and Improving Snack Choices". In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*. ACM, New York, NY, USA, CHI '14, 3403-3412.
- Hu R.; G. Fico; J. Cancela and M.T. Arredondo. 2014. "Gamification system to support family-based behavioral interventions for childhood obesity". In *Proceedings of IEEE-EMBS International Conference on Biomedical and Health Informatics (BHI)*. 181-184.
- Jones B.A.; G.J. Madden and H.J. Wengreen. 2014. "The fFITg Game: preliminary evaluation of a gamification approach to increasing fruit and vegetable consumption in school". *Preventive Medicine*, 68, 76-79.
- Kadomura A.; C.Y. Li; Y.C. Chen; H.H. Chu; K. Tsukada and I. Siio. 2013. "Sensing Fork and Persuasive Game for Improving Eating Behavior". In *Proceedings of the 2013 ACM Conference on Pervasive and Ubiquitous Computing Adjunct Publication*. ACM, New York, NY, USA, 71-74.
- Kamal N.; S. Fels S. and M. Fergusson. 2014. "Online social networks for health behaviour change: Designing to increase socialization". *Computers in Human Behavior*, 41, 444-453.
- Kelly B.; S. Vandevijvere; B. Freeman and G. Jenkin. 2015. "New Media but Same Old Tricks: Food Marketing to Children in the Digital Age". *Current Obesity Reports*, 4, no. 1, 37-45.
- Kiraci H. and M. Yurdakul, 2014. "Enjoyable or Humdrum Advergaming: The Effects of Brand Congruity Level on Attitudes Towards Advergaming". *International Journal of Information Technology and Business Management*, 21, no. 1, 22-29.
- Lo J.L.; T.Y. Lin; H.H. Chu; H.C. Chou; J.H. Chen; J.Y.J. Hsu and P. Huang. 2007. "Playful Tray: Adopting UbiComp and Persuasive Techniques into Play-Based Occupational Therapy for Reducing Poor Eating Behavior in Young Children". In *Proceedings of UbiComp 2007: Ubiquitous Computing: 9th International Conference*. Springer Berlin Heidelberg, Berlin, Heidelberg, 38-55.
- Marczewski A. 2013. "Gamification: A Simple Introduction". Andrzej Marczewski.
- McCormick T. 2013. "Gamification: Anthropology of an Idea". *Foreign Policy*, 201.
- Pannese L.; D. Morosini; P. Lameris; S. Arnab; I. Dunwell and T. Becker. 2014. "Pegaso: A Serious Game to Prevent Obesity". In *Proceedings of Digital Human Modeling. Applications in Health, Safety, Ergonomics and Risk Management: 5th International Conference*. Springer International Publishing, 427-43.
- Thomson D.M. 2010. "Marshmallow Power and Frooty Treasures: Disciplining the Child Consumer through Online Cereal Advergaming". *Critical Studies in Media Communication*, 27, no. 5, 438-454.
- Thomson D.M., 2011. "The Mixed Health Messages of Millsberry: A Critical Study of Online Child-Targeted Food Advergaming". *Health Communication*, 26, no. 4, 323-331.
- Tregarthen J.P.; J. Lock and A.M. Darcy. 2015. "Development of a smartphone application for eating disorder self-monitoring". *International Journal of Eating Disorders*, 48, no. 7, 972-982.
- Weiser P.; D. Bucher; F. Cellina and V. De Luca. 2015. "A Taxonomy of Motivational Affordances for Meaningful Gamified and Persuasive Technologies". In *Atlantis Press*. Atlantis Press, 271-280.