Gamification in a Prototype Household Energy Game

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Abstract: Research where gamification is used to influence household energy consumption is an emerging field. This paper reviews design features of the prototype *Powersaver Game*. The aim of this game is to influence household energy consumption in the long-term. The evaluation of the design of the prototype, which is presented in this paper, is part of a larger research project that will give insight into what the influence of gamification is on energy consumption in households by means of electricity and gas usage and on attitudes towards sustainable energy use at home. In the first design step, a comparative literature analysis of eight games developed for related research purposes, provided first suggestions for the design of our game. In the next design step potential players have evaluated its match with the real world. Since our aim is an effective transfer between the game world and real world, we introduced gamification elements from the real world, by energy saving activities, in the game. The perceived match between in-game scenes and activities in the real world indicated improvements for a number of scenes. In the second evaluation the respondents suggested that the design of *Powersaver Game* is satisfactory, with the exception of some artwork. By involving potential players in the evaluation process we extract promising suggestions for design improvements. The outcomes of these evaluation studies contribute to effectively embedding of real world elements in the game and to improving aspects of the prototype in clarity and attractiveness. In the next stage the *Powersaver Game* is used in a series of experiments. First, the game will be compared with a control (non-game) version. Next, features such as feedback, personal relevance and competition will be examined.

Keywords: Game design evaluation, gamification, energy consumption, persuasive games, attitude change, behaviour change

1. Introduction

Serious games are built on the element of fun that games entail, but include an educational component as well (Ritterfeld et al., 2009). We classify persuasive games as a sub-category of serious games. The 'educational component' in persuasive games is leveraged to persuade people to change their attitude or behaviour (Bogost, 2007; Fogg, 2003). Persuasive games can be an effective means to change people's energy-related attitude (Fijnheer & van Oostendorp, 2015). When people are highly engaged in the game they are apt to adopt the attitude that is promoted in the game (Rugiero, 2013). This can lead to a higher awareness of relevant factors involved in, for instance, energy saving. In effect, attitude may positively change and as such subsequently trigger a change in energy saving behaviour itself. The assumed chain of events awareness (knowledge)-attitude change-behaviour change is what persuasive games try to influence (Aronson et al., 2013; Chen & Chaiken, 1999; Soekarjo & van Oostendorp, 2015). Incorporation of game design features can be a valuable strategy for making non-game products, services, or applications, more enjoyable, motivating, and/or engaging the user (Deterding et al., 2011).

In this paper the design features of the household energy game *Powersaver Game* are presented and evaluated. The review of design features of *Powersaver Game* is part of a larger research project that will give insight into what the influence of playing in the real world is on sustainable behaviour in the long term, and on attitudes towards sustainability. We focus specifically on energy consumption in households by means of electricity and gas usage. The target is to contribute to the stimulation of individual sustainable behaviour by studying how gamification can be a positive incentive for people to change their behaviour regarding energy use at home. It aims to study whether transfer from game play to real life behaviour has a long-term character (Gustafsson et al., 2009-A). For this research project *Powersaver Game* is designed that is to be used as a research instrument that will allow us to investigate different factors and that could strengthen the change in attitude and behaviour. During some experiments that take place is the near future one group will play our game and a control group will receive the same information in equal time intervals using a dashboard website and results will be compared. The constructing of the dashboard website for the control condition is not discussed in this paper.

In Sections 2 and 3 an overview of the design steps is presented. In Section 2 the first step that results in a game prototype is discussed. In related work the designs of energy games are reviewed and a novel Gamification process is presented. In Section 3, outcomes of the evaluation of the design of the prototype *Powersaver Game* (Step 2) are presented. The outcome of the user evaluation 'match in-game scenes and activities in the real world', which is part of the novel gamification process, is described, and the user evaluation of design features of the complete system is presented. Finally in section four, we draw conclusions and discuss how we will continue our research with the *Powersaver Game*.

2. Development of the Prototype Powersaver Game

2.1 Design Process

For designing *Powersaver Game* we take several iterative design steps (Figure 1). In the first part of step 1 the design of a game prototype is established by analysing the designs of existing games that have a similar purpose and met the design goals or demands we have formulated. Also the empirical effects of these games are reviewed. We have formulated six design goals or demands in searching other games that can give input for the design of *Powersaver Game*. The first goal is that the game makes players aware of sustainability issues concerning energy use at home. The game raises awareness. The second goal is the transfer of information about energy consumption so that players acquire more knowledge. The third goal is that players will be influenced by the game to change their behaviour concerning energy consumption in real life. The fourth goal is that behaviour in real life is integrated into the game by monitoring behaviour in real life and using this information in the game progression. The fifth goal is that the game is played over a relatively long period of time and has several sessions. The sixth and final goal is that the game has a compelling and complex storyline that is able to engage players. A storyline in a game can be engaging because it stimulates our emotions (Prensky, 2001). A complex storyline includes a setting where game characters have to achieve goals and face multiple obstacles in reaching these goals (Stein & Glenn, 1979). In the second part of step 1 energy saving activities are formulated and are incorporated in the game design by a novel gamification process where activities are transformed in missions. To complete step 1 a game prototype is constructed by combining design principles and energy saving missions. In step 2 potential players evaluate the prototype. It is generally recommended that potential users of the game be involved in the development process (Benyon, 2010). In the first part of step 2 the match between in-game scenes and activities in the real world is evaluated. Improvements will optimize the transfer between the game world and the real world. In the second part of step 2 design features of the complete system are evaluated. Improvements will contribute to clarity and attractiveness of *Powersaver Game*. Our assumption is that when the analysis (Step 1) is done properly and potential users are involved in the design process (Step 2), then this considerate user-centered game design will lead to a high quality game that is effective in reducing household energy consumption.

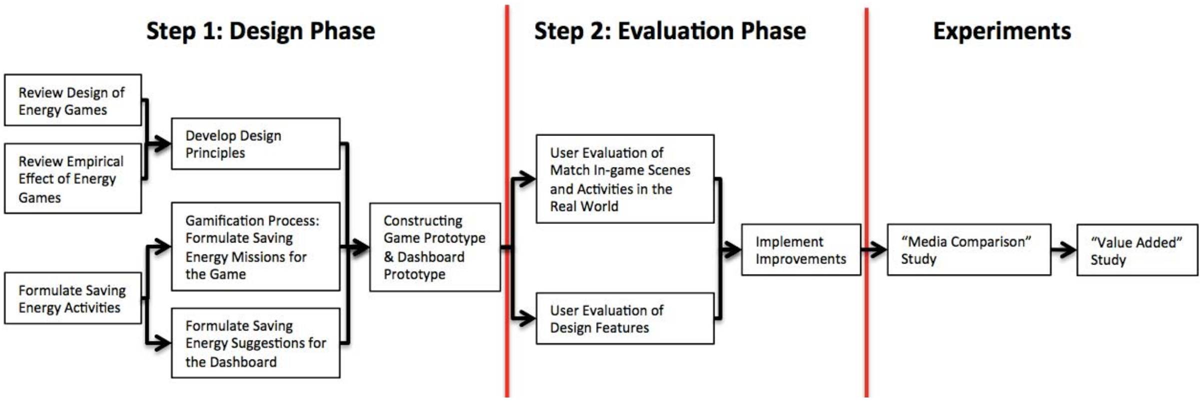


Figure 1: Steps to design a household energy game

2.2 Related Work: The Development of Design Principles

In the first part of step 1 (Figure 1) the designs of related energy games that have a similar purpose and met the design goals that are described in Section 2.1 are analysed. Searches were performed in scientific databases and eight games were found that had been used as a research instrument with similarities to our research (Table 1). The empirical effects of these games in changing knowledge, behaviour and attitude are all positive. Because of this all described design suggestions can possibly be implemented. Next, the designs are analysed by identifying a number of dimensions in the literature that are inspired by Prensky (2001), Adams

(2014) and Schell (2008). Also the most effective features that are reported by authors have been analysed (Table 1). From both analyses we derive the following recommendations on design features to be implemented in the design of our game. Players should be all members of a household and play together. The game should have a compelling storyline and players have to accomplish real life missions that are provided by the game. Knowledge should be provided by questions in in-game quizzes. Missions should become more difficult over time and have a connection with the development of the storyline. The duration of a mission should depend on its intensiveness and vary between one to three days. Depending on the quantity of missions the game should take at least more than a month to play. The game characters/avatars should have similarities with the players (by customization). The world/setting of the game should have similarities with a household. Therefore, specific devices of households should be present in the game world. Feedback should be provided by means of earned points, badges/achievements and include overviews of energy used and saved. Players should be stimulated to achieve high scores and should be in competition with other households. The game should provide readings from the electricity meter and/or, if technically possible, readings from household appliances.

These recommendations constitute the design principles of the prototype *Powersaver Game*.

Table 1: Comparative Analysis Energy Games

Game Effective Features	**1 The Power House (Bang et al., 2006)**	**2 Power Agent (Bang et al., 2007; Gustafsson et al., 2009-A)**	**3 EcoIsland (Kimura & Nakajima, 2011)**	**4 Power Explorer (Bang et al., 2009; Gustafsson et al., 2009-B)**
Competition		Competition	Competition	
Teamplay/ Social component		Social demand and peer pressure between team and player.	Cooperation	Social component in the household
Gameplay	Timing (info. just before a task), Conditioning (info. through points) and Praise	Simulation and enact in the real world.		Small investments by players
Feedback			Positieve and Negative feedback	Real time feedbackloop: fast and frequent rewards
Game Effective Features	**5 Agents Against Power Waste (Svan, 2014)**	**6 EnergyLife (Gamberine et al., 2011; 2012)**	**7 Power House (Reeves et al., 2011; 2013)**	**8 Energy Chickens (Orlanda et al., 2014)**
Competition		Competition		
Teamplay/ Social component	Parents and children play together		Teamplay	
Gameplay		Progression of challenges and learning, Simple interfaces & Match knowledge and actions	Frequently changing episodes	User Friendly
Feedback		Contextualized feedback & Customized saving tips	Rewards & Achievements	Feedback

2.3 Gamification Process: Related Work and Our Approach

A situated learning experience is provided if a persuasive game and gamification principles are combined. The player/learner applies his/her knowledge directly to solve real world problems (Gustafsson et al., 2009-B). The inclusion of reality by using gamification principles in a persuasive game will optimize the transfer of knowledge from the game to reality (Kors et al., 2015). Some gamification research suggests that the integration of serious games into real life could have positive effects on attitude and behaviour (Gustafsson et al., 2009-A; Hamari et al., 2014). Unfortunately the quality of most studies that evaluate the effect of gamification is poor and the reported results are ambiguous (Deterding et al., 2013). As presented in Figure 2, in a normal gamification process game play elements are implemented in real world processes to stimulate behaviour (Deterding et al., 2011). Deterding (2015) reports that empirical research about the effectiveness of this approach is rare. It is not known what effect a composition of game play elements in a certain context will have. He concludes that there is only a little guidance from academic methods in finding a design solution. In this research project a different and novel approach is chosen. Real world processes in the form of household energy saving activities are implemented in the game design. Wouters et al. (2013) conclude that serious games have strong effects on learning and retention. We assume that implementing real world processes, instead of simulated/fictive processes, in a serious game will have the same effects. Another aim of this approach is to optimize the transfer between the game world and the real world. When the transfer is optimized the game will be more effective in change of attitude and behaviour (Kors et al., 2015).

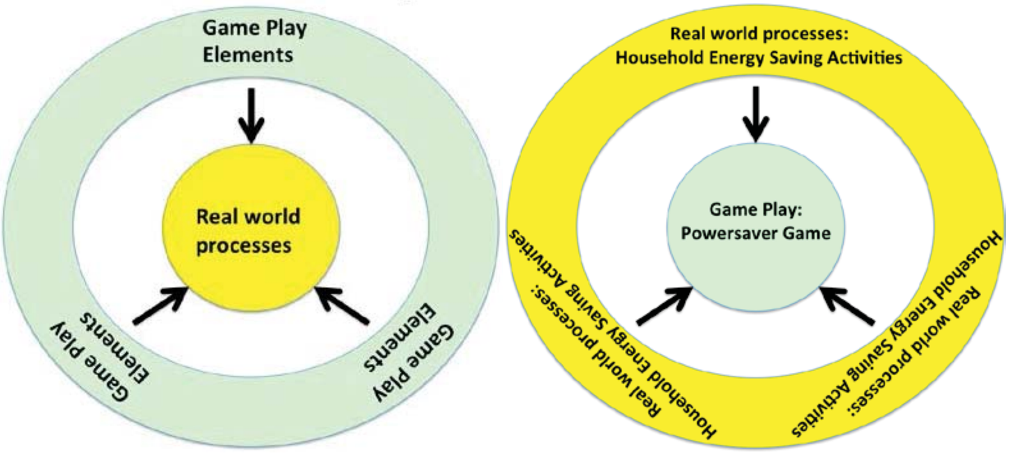


Figure 2: Normal (on the left) and Novel Gamification Process (on the right)

This novel approach is also followed by the games presented in Table 1, except for the game *The Power House* of Bang et al. (2006). Because the empirical effects of the games are all positive we have chosen for this approach. The novel gamification process is used in the second part of step 1 to incorporate energy saving missions in the game design (Figure 1). First, energy saving activities are formulated that can be carried out in every regular household. Different institutions including non-governmental organizations, energy network administrators and energy companies provide these saving activities. Next, energy saving missions for the game and energy saving suggestions for the dashboard are abstracted from these saving activities.

2.4 Design Prototype Powersaver Game

To complete step 1 a game prototype is constructed by combining design principles and energy saving missions. *Powersaver Game* will be played in a household whereof the whole family is involved. It is an Eco-feedback, Multiplayer, Roleplaying and Point & Click Adventure game (Adams, 2014). The navigation by the player is done by point and click on a tablet. *Powersaver Game* is basically an Internet page. Avatars of the family members are the central characters of the game. The family composition in the game is customized to the household. The game starts with an introduction of the story. A family arrives at a dilapidated country house where a professor had caused a failed experiment (Figure 3). The family enters the main hall of the house that contains several doors (Figure 4). Behind each door a room is situated where a game character in the form of a confused electrical device is placed. A ferret (former pet of the professor) called Kyoto guides the family in the game (Figure 9). Every mission session the family is asked to enter a preselected room. Before the door opens a quiz has to be played. A quiz contains questions that will prepare players for the missions that are occurring in that specific room. When the family enters the room a character in the form of a device that is in a confused state is shown (Figure 5). The family has to accomplish missions to help the device to get in a normal state. All missions (e.g. washing clothes on low temperatures) take place in the real world. During the game the missions are getting more difficult. The total period of playing the game is seven and a half weeks. The game has thirteen missions, eight quizzes and an end-battle/scene. It will take two to three days to complete a mission. A real time connection between the household energy meter and game server is accomplished by dataloggers with an Internet connection (Figure 6). Energy consumption is monitored a month before the game starts to set a good baseline of average energy consumption. The player is getting feedback (energy use and savings) during playing. The results of the quizzes are shown and achievement of a completed mission is displayed with a badge. A household is in competition with five virtual households, but assumes to play against real households.

Figure 3: House of the professor; Bad State (on the left) and Normal State (on the right)

Figure 4: The Main Hall

Figure 5: Scenes Living Room; Bad State (on the left) and Normal State (on the right)

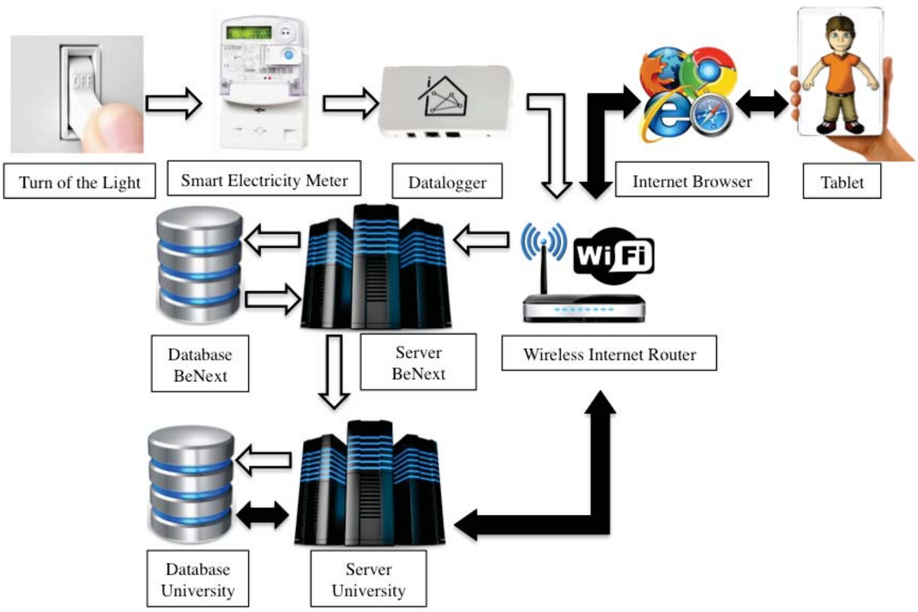


Figure 6: Technical Architecture *Powersaver Game*

In the next section the user evaluation of the prototype (Step 2) is described.

3. User Evaluation Prototype Powersaver Game

In the first part of step 2 potential players evaluate the match between in-game scenes and activities in the real world. Suggestions from this study will optimize the transfer between both worlds. In the second part of step 2 another group of potential players evaluated the design features of the complete system in order to possibly improve clarity and attractiveness of *Powersaver Game.*

3.1 Evaluation of the Match of Scenes and Appliances

In a pilot study the implementation of household energy saving activities in the game is evaluated. Four potential players of *Powersaver Game* have evaluated the perceived match between in-game scenes and activities in the real world. The aim is to measure the transfer between the game world (scenes and cartoons of electrical appliances) and the real world (energy saving activities). The participants were instructed to read a text about the situation of an in-game scene and how this situation can be solved by carry out energy saving activities in a household, for instance missions involving activities in lightning, media, washing, cooking, etc. In total there are fifty energy saving activities distributed over eight scenes. To improve the situation of the electrical appliance(s) in a scene, multiple energy saving activities have to be carried out. An example is presented in Figure 7. The freezer and refrigerator are sick and can be cured when energy saving activities concerning cooling are carried out, like cleaning the isolating rubbers on the door and resetting the temperature.

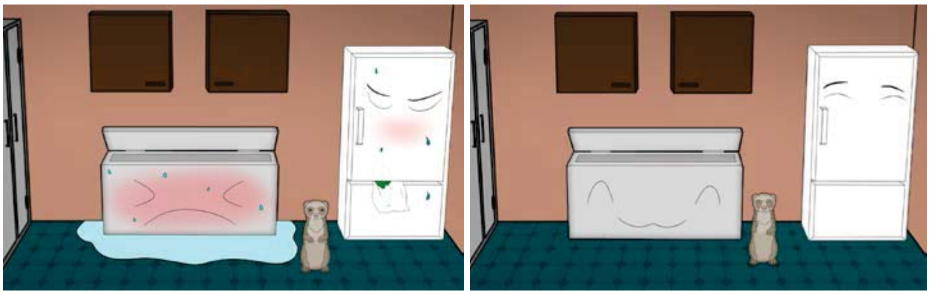


Figure 7: Scenes Scullery; Bad State (on the left) and Normal State (on the right)

The participants have rated the strength of the match between the situation of the electrical appliances (e.g. sick freezer and refrigerator) and the energy saving activities that have to be carried out (e.g. reset the temperature). They were also invited to give comments in writing to make clear what possibly could be improved. The perceived match between the eight in-game scenes and the fifty activities in the real world has an average score of 3.9 on a 5-point scale. The standard deviation is 1.3, suggesting that it is still possible to improvements. In order to get an impression of the reliability of the rating method, we calculated Cronbach's alpha. The value of 0.777 suggests a sufficent internal consistency. In total there are eleven electrical appliances and one plant (Figure 8) that are placed in one of the eight scenes.

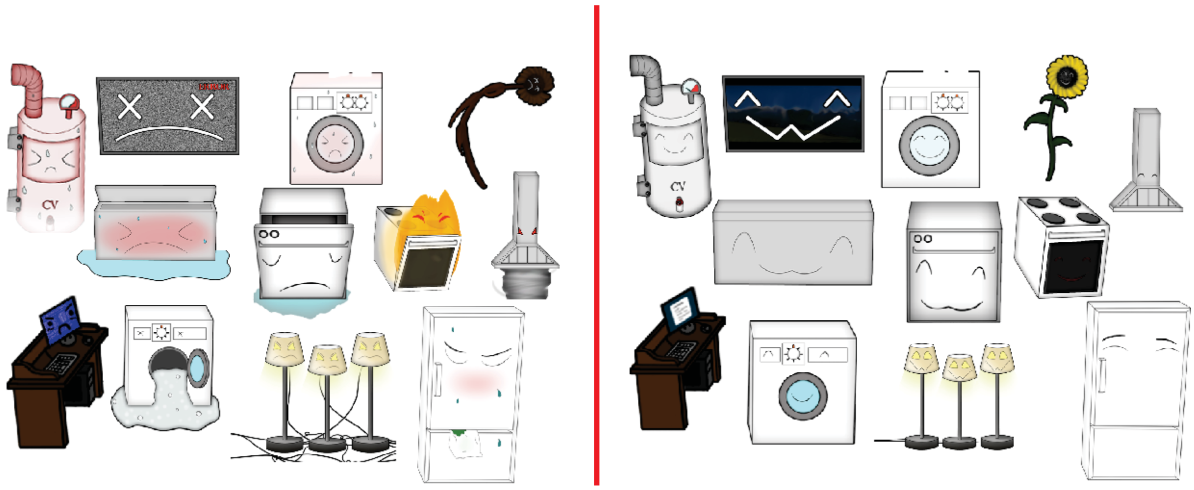


Figure 8: In-game objects; Bad State (on the left) and Normal State (on the right)

In Table 2 the match between the electrical appliances and missions and in Table 3 the match between scenes and missions are presented. The scores of the first five scenes and objects are the same because each of these scenes has only one object.

Table 2: Match of Appliances

Match Appliances	Mean	Std. Deviation	Match Appliances	Mean	Std. Deviation
1. Lamps	3,0	1,3	7. Washing Machine	3,3	1,5
2. Computer	4,1	1,0	8. Freezer	4,8	0,5
3. Central Heating	4,3	1,0	9. Refrigerator	4,5	0,9
4. Plant	3,0	1,7	10. Kitchen Hood	4,7	0,5
5. Television	3,6	1,3	11. Dishwasher	4,4	0,7
6. Clothing Dryer	3,1	1,5	12. Oven	3,1	1,7

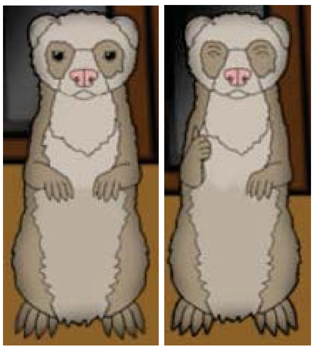
Table 3: Match of Scenes

Match Scenes	Mean	Std. Deviation
1. The ferret is captured in the wires of angry laps in the living room.	3,0	1,3
2. A stressed computer in the study room.	4,1	1,0
3. An overheated central heater in the bathroom.	4,3	1,0
4. A sick plant in the bedroom.	3,0	1,7
5. An exhausted television in the television room.	3,6	1,3
6. A sweating clothing dryer and washing machine with foam in the mouth in the washing room.	3,6	1,5
7. A freezer with flu and a refrigerator with a cold in the scullery.	4,5	0,8
8. A wild blowing kitchen hood, overflowing dishwasher and fire-breathing oven in the kitchen.	4,0	1,3

The scores below four (in the tables darkly colored) indicate that improvements can be made. Based on comments of the participants, energy saving activities, scenes and objects could be changed. In total 15 energy saving activities from the scenes 1, 4, 5, 6 and 8 are adjusted (as indicated in Table 2 and 3). The artwork of scene 4 (the plant) is improved and one scene is added. This new scene is placed after scene 6 and is called 'tea-time'. The participants commented about the mismatch between scene 6 and the 'tea-time missions'. With these improvements we are in a good position to enhance the match between in-game scenes and activities in the real world. This should have a positive effect on the transfer between the game world and the real world, which can makes the game more effective (Kors et al., 2015).

3.2 Evaluation of Design Features

After the match was optimised as a result of the first part of the user evaluation, the features storyline, missions, quizzes, artwork, gameplay, feedback and reward systems, personal relevance and competition have been evaluated in a second user study. Twenty-one respondents, potential players of *Powersaver Game*, from seventeen households have filled in an extensive survey of 55 pages (Word-file), consisting more than 200 statements, options to give comments and pictures of game scenes (Figure 9). Respondents specify their level of agreement on statements with a 5-point scale and it was possible to place comments. In order to get an impression of the reliability of the rating method, we calculated Cronbach's alpha. The value of 0.841 suggests a high internal consistency. In Table 4 the mean results are presented. The scores of individual queries are grouped together by the design features as indicated in Table 4.



Statements and Question	1-Strongly Disagree 2-Disagree 3-Neutral 4-Agree 5-Strongly Agree
Figure 1a is a clear representation of a ferret.	
Figure 1b is a clear representation of a happy ferret lifting his thumb.	
Could the figures of the ferret be improved?	

Figure 9: Survey Example

All mean scores, with the exception of artwork, are rated above 3. Although this is promising, the standard deviations of some features are high. This suggests that improvements can still be made. The storyline is attractive and match with the theme. A respondent suggested to add more "side-stories" in the scenes to make clear what is wrong with each appliance and how this happened. The clarity of formulation and level of challenge of missions and quizzes are good. A respondent suggested that more explanation is required. The style of the art is sufficient, but not attractive for all respondents. In general, respondents mentioned that it is important that contrasts in different emotions and states of in-game objects can be more expressive (Figure 4). Especially the state of the house of the professor, the emotions of the ferret, the art style of the computer and study-room and the evil state of the professor need some improvements. The respondents are positive about gameplay, feedback, customization options and the size of competition. Based on this evaluation the most important improvements have to be made in the artwork of the *Powersaver Game*.

Table 4: Evaluation Design Features

Design Features		Mean	Std. Deviation	Design Features		Mean	Std. Deviation
Storyline	Attractive	3,2	1,0	**Gameplay**	Challenging	3,2	0,8
	Match with theme	3,7	1,1		Attractive	3,3	0,9
Missions	Clarity of formulation	4,2	0,6		Effective	3,7	0,8
	Level of challenge	3,7	0,9		Fun	3,3	1,0
Quizzes	Clarity of formulation	4,1	0,8		Educative	3,5	0,7
Artwork	Presentation	3,7	1,0		Clear goal	4,2	0,6
	Contrast bad/good state	3,4	1,1		Duration	3,2	1,0
	Art style	2,8	1,0		Balance progress and activities	3,7	0,9
Personal Relevance	Customisation options	3,9	0,7	**Feedback and Reward systems**	Relevance	3,6	0,7
Competition	Six households	3,8	0,9		Quantity of information	4,0	0,7
					Clarity of overviews	4,1	0,9

4. Conclusion and Discussion

In this paper we presented our steps to design the household energy game *Powersaver Game* that will be used for a larger research project that studies how a gamification can be a positive incentive for people to change their behaviour regarding energy use at home. Our considerate user-centered game design methodology includes two design steps to develop a persuasive game. In step 1 design principles are formulated to design a game prototype and in step 2 potential users are involved to evaluate this prototype. See Figure 1. We have shown that following these steps has lead to a high quality persuasive game that is effective in changing behaviour, knowledge and attitude and engage players during playing. Though it is equally important that the game developers have skills to design persuasive games. This approach has an iterative character because the prototype design is adjusted several times before a final design can be used for experiments.

More specific, in the first step we have formulated design goals or demands. These goals concern effects of the games such as awareness, information transfer and behaviour change and involve game characteristics such as integration in real life, duration and storyline. In related work the design features and empirical effects of games that met these goals are reviewed and design features have been recommended for the game prototype. Also, household energy saving missions have been formulated in this step. Based on a novel gamification process these missions have been incorporated in a prototype game design. Implementing real world processes in a game design is still an emerging principle in gamification research and represents a very important step to optimize the transfer of knowledge between the game world and the real world to change attitude and behaviour.

In the first part of step 2 potential players are involved to evaluate the implementation of household energy saving missions in the game, because we strive to develop a game that is based on user-centered design principles. As a result of this part of step 2 improvements in activities, scenes and objects in the prototype game design are made which will result in a better match for transfer knowledge. In the next part of step 2 potential players are involved to evaluate the complete design by judging the storyline, missions, quizzes, artwork, gameplay, feedback and reward systems, personal relevance and competition. As a result of this review improvements in artwork are recommended.

The game developed with this considerate iterative user-centered design approach will be subsequently used in the first real experiment of the research project. In the first experiment, a "media comparison" study (Mayer, 2011), families will play the redesigned game or use the energy dashboard version in the control condition. The dashboard website has an identical look and feel as the menu page of the game. The form, timing and content of the information the control condition receives are as similar as possible as in the game condition, but excluded game elements. Next, in a "value added" approach (Mayer, 2011) the effects of the features feedback (minimum versus maximum information), personal relevance (by means of customized avatars, activities, goals and feedback) and social interaction (by means of competition) on knowledge, attitude and behaviour with respect to energy consumption are examined.

References

Adams, E. (2014) Fundamentals of Game Design, Third Edition, Pearson, Peachpit, CA.

Aronson, E., Wilson, T. D., & Akert, R. M. (2013) Social Psychology, Pearson, Upper Saddle River, N.J.

Bang, M., Torstensson, C., & Katzeff, C. (2006) The PowerHouse: A Persuasive Computer Game Designed to Raise Awareness of Domestic Energy Consumption, In W. Ijsselsteijn et al. (Eds.), Persuasive 2006, Lecture Notes in Computer Science 3962, Springer-Verlag Berlin, Heidelberg, pp 123-132.

Bang, M., Gustafsson, A., & Katzeff, C. (2007) Promoting New Patterns in Household Energy Consumption with Pervasive Learning Games, In Y. de Kort et al. (Eds.), Persuasive 2007, Lecture Notes in Computer Science 4744, Springer-Verlag, Berlin, Heidelberg, pp 55-63.

Bang, M., Svahn, M., & Gustafsson, A. (2009) Persuasive design of a mobile energy conservation game with direct feedback and social cues, Proc. of the 2009 DiGRA Int. Conf.: Breaking New Ground: Innovation in Games, Play, Practice and Theory, Digital Games Research Association.

Benyon, D. (2010) Designing Interactive Systems. A comprehensive guide to HCI and interaction design, Second Edition, Pearson, Harlow, UK.

Bogost, I. (2007) Persuasive games: the expressive power of videogames, MIT Press, Cambridge, MA.

Chen, S., & Chaiken, S. (1999) The heuristic-systematic model in its' broader context, In S. Chaiken, & Y. Trope (Eds.), Dual Process Theories in Social Psychology, Guilford Press, NY.

Deterding, S., Khaled, R., Nacke, L., & Dixon, D. (2011) Gamification: Toward a Definition, CHI 2011 Gamification Workshop Proceedings, ACM Press, Vancouver, BC.

Deterding, S., Björk, S., Nacke, L. E., Dixon, D., & Lawley, E. (2013) Designing gamification: Creating gameful and playful experiences, Proc. of the CHI Conf. on Human Factors in Computer Systems, ACM Press, NY.

Deterding, S. (2015) The Lens of Intrinsic Skill Atoms: A Method for Gameful Design, Human–Computer Interaction, Vol. 30, pp 294-335.

Fijnheer, J.D., & van Oostendorp, H. (2015) Steps to Design a Household Energy Game, Games and Learning Alliance conference, Rome, Italy.

Fogg, B. J. (2003) Persuasive Technology: Using Computers to Change What We Think and Do, Morgan Kauffman, San Francisco, CA.

Gamberini, L., Jacucci, G., Spagnolli, A., Corradi, N., Zamboni, L., Perotti, M., Cadenazzi, C., Mandressi, S., Tusa, G., Björkskog, C., Salo, M., & Aman, P. (2011) Saving is Fun: Designing a Persuasive Game for Power Conservation, Proc. of the 8th Int. Conf. on Advances in Computer Entertainment Technology, ACM, NY.

Gamberini, L., Spagnolli, A., Corradi, N., Jacucci, G., Tusa, G., Mikkola, T., Zamboni, L., & Hoggan, E. (2012) Tailoring Feedback to Users' Actions in a Persuasive Game for Household Electricity Conservation, Persuasive Technology, Design for Health and Safety, vol. 7284, Springer-Verlag, Berlin, Heidelberg, pp 100-111.

Gustafsson, A., Katzeff, C., & Bang, M. (2009-A) Evaluation of a Pervasive Game for Domestic Energy Engagement among Teenagers, ACM Computers in Entertainment, 7, 4, pp 1-19.

Gustafsson, A., Bang, M., & Svahn, M. (2009-B) Power Explorer – a casual game style for encouraging long term behaviour change among teenagers, Proc. of the Int. Conf. on Advances in Computer Entertainment Technology, ACM, NY, pp 182-189.

Hamari, J., Koivisto, J., & Sarsa, H. (2014) Does Gamification Work? – A Literature Review of Empirical Studies on Gamification, Proc. of the 47th Hawaii Int. Conf. on System Sciences, pp 3025–3034.

Kimura, H., & Nakajima, T. (2011) Designing Persuasive Applications to Motivate Sustainable Behavior in Collectivist Cultures, PsychNology Journal, 9, 1, pp 7 – 28.

Kors, M., Van der Spek, E., & Schouten, B. (2015) A Foundation for the Persuasive Gameplay Experience, Proc. of the Int. Conf. on the Foundations of Digital Games, CA, USA.

Mayer, R. E. (2011) Multimedia Learning and Games, In Tobias, S. & Fletcher, J. D. (Eds.) Computer games and instruction, Charlotte, NC: Inf. Age Publishing, pp 281–305.

Orlanda, B., Ramb, N., Langc, D., Houserd, K., Klinge, N., & Coccia, M. (2014) Saving energy in an office environment: A serious game intervention, Energy and Buildings, 74, pp 43-52.

Prensky, M. (2001) Digital Game-Based Learning, Paragon House, St. Paul, MN.

Reeves, B., Cummings, J.J., & Anderson, D. (2011) Leveraging the engagement of games to change energy behavior, CHI May 2011, ACM Press, Vancouver, BC.

Reeves, B., Cummings, J.J., Scarborough, J.K., & Yeykelis, L. (2013) Increasing Energy Efficiency with Entertainment Media: An Experimental and Field Test of the Influence of a Social Game on Performance of Energy Behaviors, Envir. and Behav., 20, 10, pp 1–14

Ritterfeld, U., Cody, M., & Vorderer, P. (2009) Introduction, In Ritterfeld U., Cody M., & Vorderer P., (Eds.), Serious Games: Mechanisms and Effects, Routledge, London, pp 3-9.

Ruggiero, D. (2013) The Effect of a Persuasive Game on Attitude towards the Homeless, Unpublished thesis, Purdue University.

Schell, J. (2008) The Art of Game Design: a book of lenses, Elsevier, Burlington, MA.

Soekarjo, M., & van Oostendorp, H. (2015) Measuring Effectiveness of Persuasive Games Using an Informative Control Condition, Int. Journal of Serious Games, 2, 2, pp 37-56.

Stein, N., & Glenn, C. (1979) An analysis of story comprehension in elementary school children, In R. D. Freedle (Ed.), Advances in discourse processes: Vol. 2. New directions in discourse processing, Ablex, Norwood, NJ, pp 53-119.

Svahn, M. (2014) Persuasive Pervasive Games: the Case of Impacting Energy Consumption, Dissertation, Stockholm School of Economics, Stockholm, Sweden.

Wouters, P., Nimwegen, C. v., Oostendorp, H. v., & Spek, E. v. (2013) A meta-analysis of the cognitive and motivational effects of serious games, Journal of Educational Psychology, 105(2), pp 249-265.