Demo Abstract: Funergy, a hybrid game for energy awareness

Piero Fraternali[1*], Spartaco Albertarelli[2] and Sergio Luis Herrera Gonzalez[1]

*Correspondence:
piero.fraternali@polimi.it
[1]Dipartimento di Elettronica, Informazione e Bioingegneria, Politecnico di Milano, Piazza Leonardo da Vinci 32, 20133 Milan, IT
Full list of author information is available at the end of the article

Abstract

In this demo we present FUNERGY, a hybrid game, consisting of a card game enhanced with a digital mobile application. FUNERGY aims at promoting energy knowledge and awareness in children and their family, integrating best practices of board and digital game design. Attendees will play a round with the game designers and learn the principles at the base of the construction and evaluation of the game.

Keywords: energy saving; serious games; game design

Introduction

Energy saving is a social and collective effort and thus energy efficient habits should be taught as early as possible, to become part of people's lifestyle. Games are powerful educational tools, because they foster user enjoyment and at the same time improve knowledge retention and sparkle change in mindset and behavior[1]. Digital games exploit a wide variety of platforms and devices: websites, mobile apps, personal computer and consoles; the design process of such sophisticated products is complex and costly. For educational purposes, a purely digital game strategy targeting children is ineffective, because the commercial offer of digital entertainment is so huge that capturing the users' attention, with a limited budget, is almost impossible. Board games have a potentially stronger impact on millennials, because they create an original (for them) form of interaction among players, who must sit around the same table and compete and cooperate face-to-face. The above considerations, and the lessons learned from a previous project[2], motivate the design of FUNERGY, a card game with a digital extension aimed at children (age 6+) and families. When playing with FUNERGY, children are exposed to fundamental energy saving concepts, but the didactic purpose does not compromise the fun part: the game is challenging, exciting, and at the same time stimulates the curiosity to discover more about energy and its uses. The demo will involve the attendees in the game design process of the FUNERGY card game and of its digital extension, discussing the essential design decisions that led to the concept of FUNERGY, while playing with it.

Related work

Games have been applied in different ways for environmental awareness. An example is Power House[3], an online game in which the player must assist the other characters by overseeing turning on and off appliances (lights, TV set, etc.) and

keeps track of the activities of every member of the family to reduce waste. A similar approach is used in ecoPet [4], where the player must take care of a virtual pet's needs in a energy efficient way. EnerGAware [5] is mobile simulation game in which the objective is to reduce the energy consumption of a virtual house. The player can execute actions such as changing the location of the lamps in a room or turning off appliances. At the end of every week, the players receive points based on the energy saved. Funergy differs from these games in the possibility of playing the game in an integrated manner with the Funergy non-digital, card game.

FUNERGY

FUNERGY was designed in the context of the enCOMPASS project, an EU funded project under the Horizon 2020 research programme. It is a simple and engaging card game, coupled to a mobile app, designed to inform children and their families about the European Energy Scale and to improve their awareness about energy and sustainable consumption.

The card game does not require any specific knowledge about the topic to be played, but at the same time introduces concepts such as positive energy attitudes, shared responsibility, etc. through the game mechanics and the card illustrations, which meaning is explained in the rule booklet of the game. The mobile digital extension provides useful energy saving information in a concise and entertaining way, without distracting the attention from the ongoing gameplay.

The card game and the mobile app interact during the play; the rules reward players for their acquired knowledge and promote both competition and collaboration, to convey the principle that energy saving is a collective and societal effort.

Gameplay

The game rules were designed to avoid arithmetic operations during gameplay and show that sharing good and bad things affects all players. The game is divided into seven rounds, one round for every Energy Scale Level. The game begins with the G level (the lowest one) and finishes when players reach the A level (the highest one). At the beginning of the game, seven decks of cards with the letters and colours of the Energy Scale are placed on the table(Fig.1), as score points, then each player receives seven cards from the playing deck, the rest of the cards are put at the centre of the table as the drawing deck. The objective of the players is to form a combination of cards numbered from 1 to 7(Fig.1), discarding as soon as possible all the "negative" cards (representing old appliances) and exploiting wild cards. The player in turn draws from the deck and exchanges a card with another player, to complete the hand. If she completes the combination from 1 to 7, she closes the round, shows her cards, picks up the scale cards of the current level, keeps the card with the highest score, and distributes the other cards, with lower values, to the other players. The values of the scale card increase level by level, so winning the last one can be crucial for determining the winner of the game.

When the player closes the round using wildcards, she uses the mobile app to answer an energy quiz; she scans the QR code on the card and receives a quiz with 2 possible answers; she makes her choice and the app gives feedback and displays a brief, yet informative, explanation of the quiz topic. If the answer is correct, the player keeps the card for herself; otherwise, she must "donate" it to another player.

Figure 1: Left: European Energy Scale Cards, Right: Playing Cards
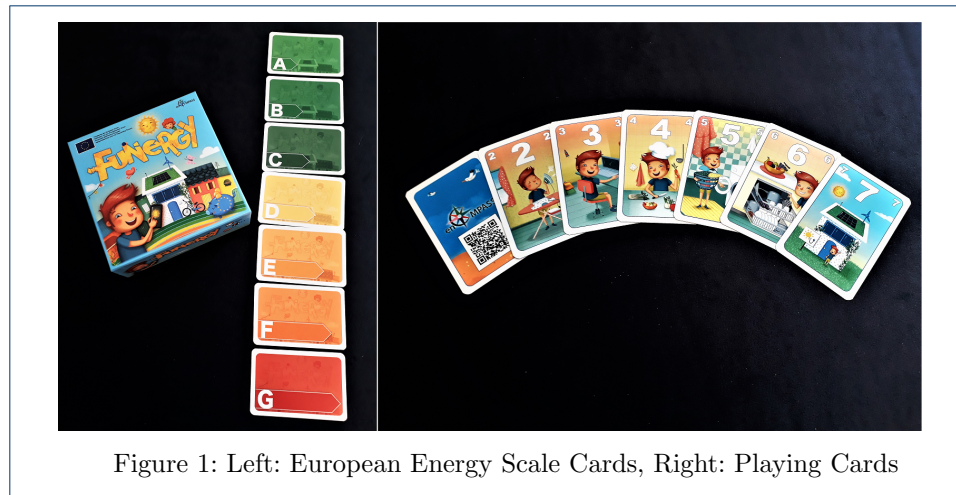
At the end of the 7 rounds, all players reveal their score showing the scale cards received during the game and adding 3 points for every wildcard in their possession. The winner is the player with the highest score.

Digital Game Extension

FUNERGY is a quiz game that challenges the players with energy questions. There are 3 levels of difficulty: as the player improves, the questions become harder.

There are 2 modes in the digital game:

- Decode a Card: When a player closes a round using an enCOMPASS wild card, she must use the app to decode the QR code on the card, and answer the quizz shown by the app.
- Single Player: The player receives a series of questions; as the game progress, the difficulty level will increase if the user answer correctly or decrease otherwise.

Both modes and the settings option can be reached from the Home screen of the app(Fig.2a). On the Quiz screen (Fig.2b) the app presents the quiz and the 2 possible answers, a badge with a number on the top right corner of the screen represents the players current level when the player levels up or down a pop-up will notify about the change and the badge number will be updated.

The application gives feedback to the players whether the answer was right or wrong(Fig.2c). On the feedback screen, the players can read an explanation about the topic of the question, which helps them understand why they were right or wrong; the explanation is short but precise, to be easy understandable and to avoid interruptions in the play.

Evaluation and conclusions

FUNERGY is currently under evaluation in an experiment supported by the behavioral research on the determinants of energy consumption performed in the PENNY H2020 Project; the field test involves 89 classes of 10 primary and first intermediate schools in Italy and Switzerland. A total of 1500 children, from 6 to 14 years old, with their families have been engaged; 480 children more have been recruited as a control group. The experiment settings comprises 3 stages:

Figure 2: FUNERGY Digital Game App.

- Initially the children and their parents fill out a questionnaire, which assesses their knowledge and attitude towards energy saving.
- The second stage consists of an activity at the school, where project representatives present the objective of the game and explain the rules; then a game session of 30 to 45 min takes place. After the intervention, a copy of the game is given to all pupils, so that they can play with their family and friends.
- Finally, a second questionnaire is provided to the children and their parents, to measure the changes in the family attitude towards energy saving due to the experience with the game.

The evaluation stage is currently ongoing and a significant increase in energy awareness in children and families is expected. At the time of writing, around 70% of the pupils downloaded the app autonomously, to continue playing autonomously at home.

Author details
[1]Dipartimento di Elettronica, Informazione e Bioingegneria, Politecnico di Milano, Piazza Leonardo da Vinci 32, 20133 Milan, IT. [2]Kaleidos Publishing Srl, Viale Lunigiana 46, 20125 Milan, IT.

References
1. Albertarelli, S., Fraternali, P., Herrera, S., Melenhorst, M., Novak, J., Pasini, C., Rizzoli, A.-E., Rottondi, C.: A survey on the design of gamified systems for energy and water sustainability. Games **9**(3), 38 (2018)
2. Albertarelli, S., Fraternali, P., Novak, J., Rizzoli, A.-E., Rottondi, C.: Drop and funergy: Two gamified learning projects for water and energy conservation. In: 11th European Conference on Games Based Learning, ECGBL 2017, pp. 935–938 (2017). Academic Conferences and Publishing International Limited
3. Reeves, B., Cummings, J.J., Scarborough, J.K., Flora, J., Anderson, D.: Leveraging the engagement of games to change energy behavior. In: Collaboration Technologies and Systems (CTS), 2012 International Conference On, pp. 354–358 (2012). IEEE
4. Yang, J.C., Chien, K.H., Liu, T.C.: A digital game-based learning system for energy education: An energy conservation pet. TOJET: The Turkish Online Journal of Educational Technology **11**(2) (2012)
5. Casals, M., Gangolells, M., Macarulla, M., Fuertes, A., Vimont, V., Pinho, L.M.: A serious game enhancing social tenants' behavioral change towards energy efficiency. In: 2017 Global Internet of Things Summit (GIoTS), pp. 1–6 (2017). IEEE