
The Effectiveness of Computer Games in Social Campaigns: A Case Study

Submitted 11/04/20, 1st revision 30/04/20, 2nd revision 26/05/20, accepted 20/06/20

Mariusz Borawski¹, Anna Borawska², Konrad Biercewicz³, Jarosław Duda⁴

Abstract:

Purpose: The objective of this article is to present an experiment in which social campaign messages could be embedded in different types of computer games and to propose a framework to assess effectiveness of such approach with the use of cognitive neuroscience techniques (for example electroencephalography and eye-tracking) and questionnaires.

Design/Methodology/Approach: The research is designed to gather data from two different sources, survey and cognitive neuroscience tools and to integrate obtained information.

Findings: The obtained results, focusing mostly on recall and interest of experiment's participants allow to state that using computer games for the purpose of social campaigns is very promising. Moreover, evaluating the efficacy of the messages and the medium itself using two very distinct methods, considering both conscious and subconscious opinions of examined subjects offers an additional quality to this type of research.

Practical Implications: The proposed solution of testing the effectiveness of computer games in social campaigns can be used both by practitioners that develop such campaigns and by scientists aiming to conduct advertising research.

Originality/Value: Taking into account data from two different sources allows to capture both conscious and subconscious opinions about the social advertising in the game, which shows the comprehensive image of the advertising's effectiveness.

Keywords: Social campaign, computer game, effectiveness, cognitive neuroscience.

JEL codes: M30, C91.

Paper type: Research article.

Acknowledgements:

The project was financed with the National Science Centre funds allocated according to the decision DEC-2016/21/B/HS4/03036.

¹West Pomeranian University of Technology Szczecin, Szczecin, Poland,
e-mail: mborawski@wi.zut.edu.pl

²Corresponding author, University of Szczecin, Szczecin, Poland,
e-mail: anna.borawska@usz.edu.pl

³West Pomeranian University of Technology Szczecin, Szczecin, Poland,
e-mail: kbiercewicz@poczta.onet.pl

⁴Maritime University of Szczecin, Szczecin, Poland,
e-mail: j.duda@am.szczecin.pl

1. Introduction

A public awareness campaign (also known as social campaign) is the element of social marketing techniques (Andreasen, 2004; Kotler *et al.*, 2002; Kotler and Zaltman, 1971), and it is a set of different activities planned for a specific time, addressed to a specific target group, whose aim is to increase knowledge and awareness, lead to change in attitudes and in behavior towards a specific social problem in order to improve the welfare of individuals and society (Coffman, 2002; Donovan, 2003; Fundacja, Komunikacji, and Społecznej, 2010; Missaglia *et al.*, 2017). It can concern various issues related to human life, such as the perception of national or sexual minorities (attitude change), eating habits, healthy lifestyles, safe driving or financial support for various charities (behavioral change).

As part of the campaign, information, intervention or information and intervention measures may be taken (Lee and Kotler, 2011). They include multiple components (messaging, media relations, government affairs, budget, etc.) that are used to help reach a specific goal (Bouder, 2013). Social campaigns attempt to communicate positive ideas and practices via mass media, social media and interpersonal communication (Grigoryan, 2019). Among the most widespread activities that are undertaken within the framework of social campaigns, one can mention, communication campaigns, press publications, brochures, events and happenings, and sometimes more direct educational actions. They also include advertising through different types of media – television, radio, internet and print. In addition to these channels, the usage of computer games can be considered. This type of entertainment is widely popular and provides a deep recipient's engagement. It is already widely used by commercial marketing. In 2015 profits from the advertisements in the games amounted to 2.75 billion dollars. It is foreseen that the gains will increase to 5.05 trillion dollars in 2020 (Statista, 2017). There are two tendencies to use games in the commercials:

- in-game advertising (IGA) – usage of the game as a medium of advertisement;
- advergaming (advertising + gaming) – the advertisement games created especially for promoting specific product or service.

There are various ways to use game as a mean of advertisement. The easiest approach is placing advertising billboards. In the 3D games, they are placed according to the same principles as in the real world. An example might be the advertising campaign of President Barack Obama from 2008, which used 18 games, including *Need for Speed*, *Carbon*. In this game, the player drives a car and advertisements of the presidential candidate are presented to him on big billboards allocated along the road (Yenigun, 2012). The products might be also placed in the games, as items used by the characters. A good example might be placement of the phone Sony Xperia Z5 in the *Uncharted 4* game (Peckham, 2015).

In case of advergaming, games are created to advertise specific goods, services, etc. In 2006 Burger King launched the game Sneak King created by Blitz Games. The game was sold with the meal at a special price of 3.99 USD. In total there were three games created, which were not well accepted by the critics but generated great income. The main character of the game was a king toy of Burger King and his task was to deliver burgers to hungry people (Hyman, 2007). Other example of such game was America's Army: Proving Grounds (U.S. Army, 2017). Its aim was to promote army and encourage young people to join it. According to the motion monkey (2017), the main advantages of using advergaming are:

- combining advertisement and entertainment;
- interactivity – the recipient of the advertising message is a participant rather than a passive viewer;
- creating positive associations;
- long lifetime of the computer game (in comparison to a standard advertisement);
- enabling presentation of the company or product story.

These are the main reasons why advergaming is more and more often used in the advertising, including social campaigns as well. An example of a game created for social campaign is Food Force. It was published by United Nations World Food Programme (WFP) in 2006. The players participate in missions related to campaigns against hunger. In this way they learn about problems related to hunger and activities of WFP (United Nations World Food Programme, 2017).

Such games might be also addressed to children in order to develop specific behaviors. As an example, there are games available on the Nourish Interactive website, which promotes healthy diet. Good example of this type of game is Kevin's Build-a-Meal Game (Nourish Interactive, 2017). During the game, a child has to compose properly balanced meals for an entire day. Meals have to include specific amounts of products of four types. It gives the opportunity to teach the child how much of which group of products they should eat in order for the meals to be balanced. The increasing popularity of the games as the means of advertisement causes the researchers to try to find out to what extent the information included in the game have the impact on the players. The main ways of gathering information are questionnaires, interviews and observations. The examples of research on the impact of advertising in games are presented in Table 1.

Effectiveness of the social campaign, that uses IGA or advergaming, depends mainly on the game playability and strength of its message. These are the key factors, although they are not always taken into consideration during planning of the campaign. In most cases it is difficult to state, if the game would be interesting for the players to such extent that it could achieve its goal connected with the topic of the campaign. Therefore, it is essential to perform some tests, that could measure the

involvement of players in games. In order to determine it, data obtained on the basis of various measurement techniques are used.

Table 1. Examples of research on the impact of advertising in games

Author/s of the study	Name of the study	Description of the study
(Dias and Agante, 2011)	"Can advergames boost children's healthier eating habits?"	The study in which the impact of advertising on a healthy diet was studied. The results showed, among other things, that children have tendency to choose what was advertised in the game.
(Buller et al., 2009)	"Marketing Fruit and Vegetable Intake with Interactive Games on the Internet"	The study has shown that games do not increase the consumption of fruit and vegetables but increase confidence in the benefits associated with the consumption of large quantities of fruit and vegetables.
(Russell-Bennett et al., 2016)	"A Hierarchy-of-Effects Approach to Designing a Social Marketing Game"	The work presents research that specified impact of the online game related to physiological effects of water drinking on our body. The results of the research indicate that elements of the game related to joy (feeling), knowledge (learning) and challenge (to) significantly influenced the attitude of students. Similar research has been carried out in the study by Mulcahy et al. (2015).
(Brown et al., 1997)	"Educational video game for juvenile diabetes: results of a controlled trial"	The work focuses on examining impact of the game teaching diabetics rules of proper diet and taking medicines.
(Pempek and Calvert, 2009)	"Tipping the balance: Use of advergames to promote consumption of nutritious foods and beverages by low-income African American children"	An online advergame was used for the research in order to verify its influence on the selection of snacks by poor Afro-American children. The research proved that the games influenced the choice of snacks and children playing the games promoting healthy snacks choose them more often.
(Yam et al., 2017)	"How does serious m-game technology encourage low-income households to perform socially-responsible behaviors?"	The study examined impact of the game for mobile devices on energy-saving behavior.

Source: Authors' elaboration.

One of these techniques is based on psychophysiological data. For example, using the encephalography (EEG) to measure the involvement of tasks is not a new concept. Pope *et al.* (1995) built a system to control the level of automation of tasks based on whether the operator had increased or decreased his involvement. Freeman *et al.* (1999) extended this system by evaluating the performance of each task with

the use of absolute values of commitment. Berka *et al.* (2007) has invented a more accurate and effective method for people to interact with technology, with the ability to develop more productive work environments that increase motivation and productivity. The results suggest that the commitment measured using the EEG reflects information gathering, visual processing, and attention allocation. Smith and Gevins (2005) used a flight simulator to study the reactions of the human brain to low, medium and high difficulty exercises. Such studies have shown increased activity of the frontal lobe waves together with decreased activity of parietal lobe alpha waves during demanding tasks. In turn, Yamada (1998) measured the activity of theta waves along with blinking of the eye and discovered that children playing video games had higher activity of theta waves during more frequent blinking.

These results suggest that interesting tasks cause higher activity of theta waves, while the task inhibits the activity of blinking eyes. Kamzanova *et al.* (2011) compared the sensitivity of a series of EEG engagement indices by examining time pressure individuals performing tasks of varying degrees of stress to determine which one was most effective. McMahan *et al.* (2015a) investigated in Super Meat Boy game whether there is a connection between engagement and arousal in events of death and general entertainment. On the other hand, Ewing *et al.* (2016) investigated the sensitivity of EEG power in the (front) theta and (parietal) alpha bands to changing levels of demand for play. Vourvopoulos's *et al.* (2017) research focuses on the impact of how gaming experience has on modulating brain activity, as an attempt to systematically identify elements that contribute to high BCI control and that can be used in the design of a neurogame.

The above mentioned techniques are often combined with traditional methods for measuring player engagement (Martey *et al.* 2014):

- self-report questionnaires—the examined person determines the level of involvement in particular elements of the game;
- attention-based engagement (ABE)—the time during which the tested person looked at the monitor is measured. Relating this to the time when the person did not look at the monitor one can deduce how much attention of the tested person was focused on the game;
- mouse clicks, mouse movement – measurements of the number and places of clicks and mouse movement allow to determine the level of player activity during the game.

Taking that into account, the objective of this article is to present an experiment in which social campaign messages were embedded in different types of computer games and to propose a framework to assess effectiveness of such approach with the use of cognitive neuroscience techniques (electroencephalography and eye-tracking) and questionnaires. Moreover, the analyses aim to determine, which approach – in-game advertising or advergaming is more effective in case of social advertisements.

2. Materials and Methods

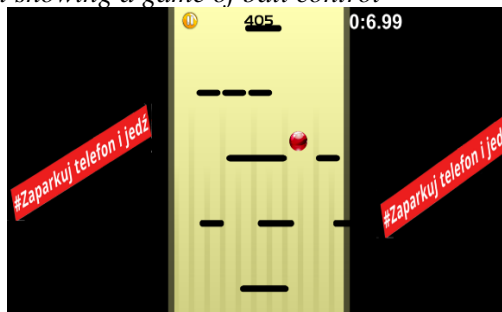
2.1 Participants

The study was conducted with students of two different Polish universities; the West Pomeranian University of Technology Szczecin and the Maritime University of Szczecin. For the experiment, 28 persons (23 men) with mean age 23 all right-handed, have participated.

2.2 Stimuli

For the purpose of experiment, two different types of games were created. They represented both approaches to using games in advertising – IGA and advergaming. In-game advertising was used in a simple arcade game – ball control (Finalboss, n.d.) in which the player's task was to avoid obstacles and achieve the highest possible result (Figure 1). Advergaming was presented on the basis of jigsaw puzzles (Ehthesham, n.d.), where player need to arrange a large picture from small fragments (Figure 2). The games were downloaded from the Unity Asset Store and adapted to the needs of this research in the Unity engine in C # language. Social advertisements used in games were still images concerning the topic of safe driving.

Figure 1. Screenshot showing a game of ball control



Source: Authors' elaboration.

Figure 2. Screenshot showing a game of ball control



Source: Authors' elaboration.

Each game was presented in three different variants that differed in social advertising shown on the screen. Versions for the ball control are shown in Figure 3, and for the jigsaw puzzles in Figure 4.

Figure 3. Screenshots of social campaign used for ball control game – “Zaparkuj telefon i jedź” (“Park the phone and drive”): a) image and text; b) only image c) only text



Source: Authors' elaboration based on (#Zaparkuj telefon i jedź, 2018)

Figure 4. Screenshot of social campaign used for jigsaw puzzles – “Jedna sekunda może zmienić życie” (“One second may change life”): a) medium intensity of negative emotions; b) low intensity of negative emotions c) high intensity of negative emotions



Source: Authors' elaboration based on (“A fake DUI Car Crash,” n.d.)

The differentiation of game variants has been applied in order to check additional elements that could influence effectiveness of the game in social advertising. In case of ball control game, it was the impact of the form in which advertising was presented (image or text, or both) and for the jigsaw puzzles it was the intensity of negative emotions appeal in the image (low, medium and high).

2.3 Procedure

The experiment involved the presentation of the stimuli in a laboratory environment with the use of cognitive neuroscience tools. The participants were informed about the course of the study. Then they signed a consent to participate in the study and were seated on a comfortable chair with access to a keyboard and mouse. Before the

start of the game, on the computer screen there was a short description of the purpose of the game and the instruction how to play. Each game lasted a minute. Everything what happened on the screen during this time was saved as a movie clip in the resolution of 1920x1080 using the programmed registration in the game. Additionally, all events in the game were recorded and saved to an Excel file for later synchronization with psychophysiological signals. After playing games, participants answered a series of questions evaluating previous experiences with video games and other personal characteristics. They had to choose from a list which type of games they like the most. They were also asked, if they qualify themselves as “recreational players”. At the end they were questioned about the recall of social advertisements that they could observe during the experiment. The inquiry concerned both spontaneous and aided recall.

2.4 Psychophysiological Data Recording and Processing

The brain activity was recorded using a g.Nautilus device (sampling frequency of 500 Hz). The channels have been distributed according to the international EEG electrode distribution system, namely 10-10 system (Jurcak *et al.*, 2007). The cap with 21 electrodes placed in AF3, AF4, F3, F4, F7, F8, FC5, FC6, P7, P8, T7, T8, O1, O2, P3, C3, Pz, Fz, Cz, FPz, P4 was used. The EEG signal analysis started with signal filtering, i.e. from removing frequencies above 50 Hz. Then, the EEG spectral signal was analyzed by means of Morse waveform, where an average frequency for the peaks in the frame of half a second was calculated. In the next step, signal was divided into appropriate bands: theta (4-8Hz), alpha (7-13Hz) and beta (13-25Hz).

Eye movements were registered using EyeTribe device (binocular, sampling rate of 30 Hz). For each participant the eye-tracker was properly calibrated using a sixteen-point calibration routine followed by a nine-point validation routine.

2.5 Measures

On the basis of psychophysiological data recorder with the use of EEG measurements, an index allowing for the assessment of the social advertising effectiveness was calculated and it was Engagement Index, which is a measure of information gathering, visual processing and attention allocation. It can be determined according to the following formula (McMahan *et al.*, 2015b):

$$\text{Engagement} = \frac{\text{Beta}}{(\text{Alpha} + \text{Theta})}, \quad (1)$$

3. Results

First, an analysis of in-game advertising approach was conducted. The data recorded for the ball control game allowed to examine the relationship between social advertising banners and player’s engagement.

We completed a repeated-measures analysis of variance assessment (ANOVA) across the index of engagement to check if there is a difference between the overall engagement in the game and the type of ads shown. The results from repeated ANOVA measurements using the Engagement Index as an object factor for the general engagement dependent variable showed no difference between the three groups ($F(2,26) = 1.16; p = 0.3314; p > 0.05$). The result shows no significant difference in average exposures.

The next step was to check whether there is a relationship between commitment and specific advertising. The Chi-Square test was used for this purpose. The calculated statistical value for the Chi-Square test was $\chi^2_{0.05;4} = 7.3167$. In contrast, the critical value of CHI Square for 4 degrees of freedom and $\alpha = 0.05$ equals 9.48773. The result is that $7.3167 < 9.48773$, which proves that there are no grounds for rejecting the null hypothesis ($H_0 =$ the variables are independent). In view of the above, we can conclude that advertising doesn't affect the overall engagement of the player during the game. This can also be seen in the involvement of individual groups (Table 2).

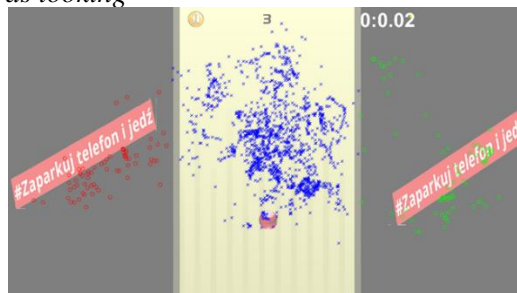
Table 2. Values of engagement in individual groups

	Image and text	Only image	Only text
mean	1,257374	1,224614	1,257529
std	0,037825	0,050636	0,059798
min	1,166063	1,157792	1,147264
max	1,296856	1,288351	1,340803

Source: Authors' elaboration.

In order to examine the average time of looking at social advertising banners, the game was divided into 4 parts - left banner, right banner, clock and game. Figure 5 shows an example of a screenshot of the game with the points where the person examined was looking. Red points are only on the left banner, green on the right, yellow on the clock and blue on the game itself.

Figure 5. Screenshot of social advertising (only text) showing the points, where the person examining was looking



Source: Authors' elaboration.

The time spent by players on each element shown on the screen during the play is shown in Table 3. It can be noticed, that among the three variants used in the experiment, the advertising with text only was observed longer than other two.

Table 3. Average viewing time for all subjects on particular parts of the screen with a distinction for types of advertisements.

Average Time	Image and text	Only image	Only text
Left banner	0,6545	1,2697	2,0267
Playing area	51,397	50,3879	50,0533
Right banner	0,9636	1,6364	2,9133
Clock	0,4242	0,4152	0,1733

Source: Authors' elaboration.

Questionnaires have shown that most of the respondents, i.e. 70% of people remembered the banner showing only text - "Zaparkuj telefon i jedź" ("Park the phone and drive"). This was due to the almost twice as much time spent on the banner when the text itself was displayed as when there was a colorful image attached to it. This is equivalent to spending less time on the game itself (see Table 4). Nevertheless, the engagement in that case was above the average, which was approximately 1.247 for all respondents.

For advergaming approach (jigsaw puzzles game) an analysis was also made of the relationship between engagement and the variant of a social campaign. Table 4 presents the distribution of engagement.

Table 4. Distribution of engagement by group.

Engagement	Low intensity of negative emotions	High intensity of negative emotions	Medium intensity of negative emotions
$\geq 1,31$	2	1	0
1,244 - 1,31	2	5	6
$\leq 1,244$	5	3	3

Source: Authors' elaboration.

The value of the test statistics CHI-Square was $\chi^2_{0,05;4} = 4.727273$. In contrast, the critical value of Chi-Square for 4 degrees of freedom and $\alpha = 0.05$ equals 9.48773. The result is that $4.727273 < 9.48773$, which proves that there are no grounds for rejecting the null hypothesis ($H_0 =$ the variables are independent). In view of the above result, we can conclude that the advertisement does not affect the overall engagement of the player during the game. As in the previous game, we can see how engagement was shaped (Table 7).

It can be seen that despite the change in the background and using images with different levels of negative emotions intensity, the engagement was quite similar, what reinforces the conclusion of the Chi-Square test.

Table 7. Values of engagement in individual groups.

	Low intensity of negative emotions	High intensity of negative emotions	Medium intensity of negative emotions
mean	1,2432	1,2633	1,2565
std	0,0649	0,0565	0,0289
min	1,1625	1,1339	1,203
max	1,3504	1,3159	1,2967

Source: Authors' elaboration.

The visibility of social advertising was also examined by analysis whether the "Show image" button (a hint of what picture we should finally assemble) was used, and how much time the examined person looked at it. The results are shown in Table 8.

Table 8. Average viewing time for all subjects in the smaller picture.

	Low intensity of negative emotions	High intensity of negative emotions	Medium intensity of negative emotions
Mean	0,366909091	0,841366667	0,804666667

Source: Authors' elaboration.

For comparison, Table 9 shows the average duration of the game.

Table 9. The overall average game time in each group.

	Low intensity of negative emotions	High intensity of negative emotions	Medium intensity of negative emotions
Mean	42,73745455	40,3438	38,151

Source: Authors' elaboration.

In order to achieve such results, the area in which the image appears, has been delineated and the viewing time was counted. Figure 6 shows an example with red dots, where the subject looks in case of a miniature picture.

Figure 6. Screenshot of social campaign (third option) showing the points where person examined is looking.



Source: Authors' elaboration.

This made it possible to determine which location in the game has the most views and how much time is needed to remember the social campaign, as well as whether we pay more attention to banner ads in case of greater involvement.

Analysis of questionnaires have shown that 89% of respondents for each group remembered the social campaign in the form of puzzles. It was probably due to the fact that participants of the experiment could see the advertising image all the time during the gameplay, plus they were able to tune in on the view of its final arrangement.

4. Discussion

The research has shown that it was helpful to evaluate the involvement and viewing time indicators when playing various types of computer games, which had a maximum duration of 1 minute with the use of EEG and eye-tracker. As a result, it was determined which method and how the ads should be shown in order for the player to remember them. Comparing both IGA and advergaming methods we see that each has its advantages and disadvantages. In case of placing a social campaign in a regular game, it can be seen that not every person examined remembers the message. It has been observed that the approach where only text is visible works best. Probably the combination of a text with image does not work, because there are too many elements in the picture that a person has to remember, and additionally he/she has to focus on the game in order to achieve a better result. In such type of game, we can put more ads, but their effectiveness will be questionable.

As far as the advergaming method is concerned, it was obtained that almost all respondents remembered the presented campaign. It only took 40 seconds to remember the image. Basing on this result, it seems that the advergaming method is more effective than IGA. This may be due to the fact that the game is typically geared towards presenting a social campaign and all elements are associated with it. Then by force, a person remembers it.

These conclusions should be understood in the context of certain constraints. At this point it was checked which method is better, but only for 2D static games. The next step will be to prepare other types of games (2D and 3D) in order to establish the reliability of the chosen method, to make sure that the current results can be confirmed.

5. Conclusion

The article aimed to present an experiment in which social campaign messages were embedded in different types of computer games and to propose a framework to assess effectiveness of such approach with the use of cognitive neuroscience techniques (electroencephalography and eye-tracking) and questionnaires. The results of research allow also for comparing the impact of social advertisements in games using IGA and advergaming approach. Based on the findings, we can state

that advergames is better than in-game approach. However, it should be taken into account that these findings are based on two types of games and two social advertisements only and further research will be needed to confirm the results of the methodological approach to assessing which method is more effective, not only by analyzing the player's involvement, but also by adding further indicators from other categories, such as micro-expression. However, these results confirm the view that the advergame method can be judged to be more effective in making the social campaign remembered by more people.

References:

- A fake DUI Car Crash [WWW Document], n.d. Alamy. URL <https://www.alamy.com/stock-photo-a-fake-dui-car-crash-24140307> (accessed 6.1.20).
- Andreasen, A.R. 2004. A Social Marketing Approach to Changing Mental Health Practices Directed at Youth and Adolescents. *Health Marketing Quarterly*, 21, 51-75. https://doi.org/10.1300/J026v21n04_04.
- Berka, C., Levendowski, D.J., Lumicao, M.N., Yau, A., Davis, G., Zivkovic, V.T., Olmstead, R.E., Tremoulet, P.D., Craven, P.L. 2007. EEG correlates of task engagement and mental workload in vigilance, learning, and memory tasks. *Aviat Space Environ Med.*, 78, B231-244.
- Bouder, S. 2013. Advocacy Unleashed [WWW Document]. URL <https://advocacyunleashed.kontribune.com/articles/1371> (accessed 2.24.20).
- Brown, S., Lieberman, D., Gemeny, B., Fan, Y., Wilson, D., Pasta, D. 1997. Educational Video Game for Juvenile Diabetes: Results of a Controlled Trial. *Medical Informatics*, 22, 77-89. <https://doi.org/10.3109/14639239709089835>.
- Buller, M., Kane, I., Dunn, A., Edwards, E., Buller, D., Liu, X. 2009. Marketing Fruit and Vegetable Intake With Interactive Games on the Internet. *Social Marketing Quarterly*, 15, 136-154. <https://doi.org/10.1080/15245000903038316>.
- Coffman, J. 2002. Public communication campaign evaluation: An environmental scan of challenges, criticisms, practice, and opportunities. Harvard Family Research Project, Cambridge, MA.
- Dias, M., Agante, L. 2011. Can advergames boost children's healthier eating habits? A comparison between healthy and non-healthy food. *Journal of Consumer Behaviour* 10, 152-160. <https://doi.org/10.1002/cb.359>.
- Donovan, R. 2003. *Social marketing : principles and practice* / Robert J. Donovan, Nadine Henley. IP Communications Pty Ltd, Melbourne.
- Ehthesham, n.d. Drag And Drop Puzzle Lite - Asset Store [WWW Document]. URL <https://assetstore.unity.com/packages/templates/systems/drag-and-drop-puzzle-lite-75674> (accessed 9.2.19).
- Ewing, K.C., Fairclough, S.H., Gilleade, K. 2016. Evaluation of an Adaptive Game that Uses EEG Measures Validated during the Design Process as Inputs to a Biocybernetic Loop. *Front Hum Neurosci*, 10, 223-223. <https://doi.org/10.3389/fnhum.2016.00223>
- Finalboss, n.d. Crazy Ball Complete Game Template (free tutorial game) - Asset Store [WWW Document]. URL <https://assetstore.unity.com/packages/templates/tutorials/crazy-ball-complete-game-template-free-tutorial-game-55646> (accessed 9.2.19).

- Freeman, F.G., Mikulka, P.J., Prinzel, L.J., Scerbo, M.W. 1999. Evaluation of an adaptive automation system using three EEG indices with a visual tracking task. *Biol Psychol* 50, 61-76.
- Fundacja Komunikacji Społecznej, 2010. Definition of public awareness campaign [WWW Document]. URL http://kampaniespoleczne.pl/wiedza_definicje,2324,kampania_spoleczna_definicja_fundacji_komunikacji_spolecznej (accessed 2.24.20).
- Grigoryan, N. 2019. Ethics of a Social Marketing Campaign: An Integrative Assessment Model. *Journal of Media Ethics* 34, 1-14. <https://doi.org/10.1080/23736992.2019.1600406>.
- Hyman, P. 2007. Burger King has it their way with advergame sales.
- Jurcak, V., Tsuzuki, D., Dan, I. 2007. 10/20, 10/10, and 10/5 systems revisited: their validity as relative head-surface-based positioning systems. *Neuroimage* 34, 1600-1611. <https://doi.org/10.1016/j.neuroimage.2006.09.024>.
- Kamzanova, A.T., Matthews, G., Kustubayeva, A.M., Jakupov, S.M. 2011. EEG indices to time-on-task effects and to a workload manipulation (Cueing). *World Academy of Science, Engineering and Technology* 80, 19-22.
- Kotler, P., Lee, P.K.N.R.N., Roberto, E.L., Roberto, N., Lee, N.R. 2002. *Social Marketing: Improving the Quality of Life*. SAGE Publications.
- Kotler, P., Zaltman, G. 1971. Social Marketing: An Approach to Planned Social Change. *Journal of marketing*, 35, 3-12. <https://doi.org/10.2307/1249783>.
- Lee, N.R., Kotler, P. 2011. *Social Marketing: Influencing Behaviors for Good*. SAGE Publications.
- Martey, R., Kenski, K., Folkestad, J., Gordis, E., Feldman, L., Zhang, H., Kaufman, N., Rabkin, A., Shaw, A., Stromer-Galley, J., Clegg, B., Shaikh, S., Strzalkowski, T. 2014. Measuring Game Engagement. *Simulation & Gaming: An Interdisciplinary Journal of Theory, Practice and Research* in Press. <https://doi.org/10.1177/1046878114553575>.
- McMahan, T., Parberry, I., Parsons, T.D. 2015a. Evaluating Player Task Engagement and Arousal Using Electroencephalography. *Procedia Manufacturing*, 3, 2303-2310. <https://doi.org/10.1016/j.promfg.2015.07.376>.
- McMahan, T., Parberry, I., Parsons, T.D. 2015b. Evaluating Electroencephalography Engagement Indices during Video Game Play. In: *Proceedings of the 10th International Conference on the Foundations of Digital Games*. Presented at the 10th International Conference on the Foundations of Digital Games, Pacific Grove, CA.
- Missaglia, A.L., Oppo, A., Mauri, M., Ghiringhelli, B., Ciceri, A., Russo, V. 2017. The impact of emotions on recall: An empirical study on social ads. *Journal of Consumer Behaviour*, 16, 424-433. <https://doi.org/10.1002/cb.1642>.
- Nourish Interactive, 2017. Kevin's Build-a-Meal Game [WWW Document]. URL <http://www.nourishinteractive.com/kids/healthy-games/6-kevins-build-a-meal-game-balanced-meals> (accessed 2.24.20).
- Peckham, J. 2015. Well of course every character in Uncharted 4 uses a Sony Xperia Z5 | TechRadar [WWW Document]. URL <https://www.techradar.com/news/phone-and-communications/mobile-phones/well-of-course-every-character-in-uncharted-4-uses-a-sony-xperia-z5-1310986> (accessed 2.24.20).
- Pempek, T., Calvert, S. 2009. Tipping the Balance: Use of Advergames to Promote Consumption of Nutritious Foods and Beverages by Low-Income African American Children. *Archives of pediatrics & adolescent medicine*, 163, 633-637. <https://doi.org/10.1001/archpediatrics.2009.71>

- Pope, A.T., Bogart, E.H., Bartolome, D.S. 1995. Biocybernetic system evaluates indices of operator engagement in automated task. *Biological Psychology*, 40, 187-195. [https://doi.org/10.1016/0301-0511\(95\)05116-3](https://doi.org/10.1016/0301-0511(95)05116-3).
- Russell-Bennett, R., Leo, C., Rundle-Thiele, S., Drennan, J. 2016. A Hierarchy-of-Effects Approach to Designing a Social Marketing Game. *Journal of Nonprofit & Public Sector Marketing*, 28, 105-128. <https://doi.org/10.1080/10495142.2014.988081>.
- Smith, M., Gevins, A. 2005. Neurophysiologic monitoring of mental workload and fatigue during operation of a flight simulator. *Proceedings of SPIE - The International Society for Optical Engineering* 5797. <https://doi.org/10.1117/12.602181>.
- Statista. 2017. Video games advertising spending worldwide from 2010 to 2020 (in billion U.S. dollars) [WWW Document]. URL <https://www.statista.com/statistics/238140/global-video-games-advertising-revenue/> (accessed 2.24.20).
- The motion monkey. 2017. UK Advergame Design & Development [WWW Document]. URL <https://www.themotionmonkey.co.uk/advergames/> (accessed 2.24.20).
- United Nations World Food Programme. 2017. Food Force [WWW Document]. URL <https://web.archive.org/web/20050605073447/http://www.food-force.com/> (accessed 2.24.20).
- U.S. Army. 2017. America's Army [WWW Document]. URL <https://www.americasarmy.com/> (accessed 2.24.20).
- Yam, A., Russell-Bennett, R., Foth, M., Mulcahy, R. 2017. How Does Serious M-Game Technology Encourage Low-Income Households To Perform Socially Responsible Behaviors? *Psychology & Marketing*, 34, 394-409. <https://doi.org/10.1002/mar.20996>.
- Yamada, F. 1998. Frontal midline theta rhythm and eyeblinking activity during a VDT task and a video game: useful tools for psychophysiology in ergonomics. *Ergonomics* 41, 678-688. <https://doi.org/10.1080/001401398186847>.
- Yenigun, S. 2012. Presidential Campaigns Rock The Gamer Vote: NPR [WWW Document]. URL <https://www.npr.org/2012/10/01/162103528/presidential-campaigns-rock-the-gamer-vote?t=1582567815999> (accessed 2.24.20).