Path of Trust: A prosocial co-op game for building up trustworthiness and teamwork

Konstantinos C. Apostolakis[1], Kyriaki Kaza[1], Athanasios Psaltis[1], Kiriakos Stefanidis[1], Spyridon Thermos[1], Kosmas Dimitropoulos[1], Evaggelia Dimaraki[2], and Petros Daras[1]

[1] Information Technologies Institute,
Centre for Research and Technology Hellas, Thessaloniki, Greece
{kapostol,kikikaza,at.psaltis,kystefan,
spthermo,dimitrop,daras}@iti.gr
http://www.iti.gr
[2] Ellinogermaniki Agogi, Pallini, Greece
dimaraki@ea.gr
http://ea.gr

Abstract. In this paper, a two-player digital game is presented, that attempts to balance the exciting game content and story-driven elements mostly associated with games in the entertainment industry with a serious game agenda. The latter focuses on teaching children aged 7-10 the importance of understanding the benefits of cooperation as well as expressing trustworthiness. Gamification of Prosocial Theory has led to several game mechanics being redefined, in order to turn traditional games' elements of competition into cooperation evaluation mechanisms. Using these mechanisms, children are called upon to adapt their gameplay behavior towards expressing prosociality and understanding each other's needs. Our experiments solidify this concept, by showcasing promising indications on the game's potential to help children understand when it is a good idea to adopt a prosocial behavior.

Keywords: serious games, prosocial behavior, game design, multiplayer games

1 Introduction

Current digital games targeting the education sector carry an unfortunate reputation among gamer communities in general. "Edutainment" is often mistakenly linked to low quality, as players feel such games fail to captivate their imagination. This fact leads to a significant blow to their effectiveness. Indeed, serious games can provide a very efficient means for skills acquisition, as they are usually defined in constrained environments that allow players to subliminally concentrate on the accomplishment of their task. In this respect, serious games categorized under the educational [9, 16], recreational [4] or mind exercising character [5, 17, 18], strive to achieve their goals with the use of proper structures, all while

presenting an attractive package. This however, often deliberately sacrifices the element of sheer enjoyment in favor of players achieving the desired progress [7]. In contrast to that, games developed purely for the entertainment industry tend to revolutionize society and culture, by offering engaging storylines, memorable characters and exciting game content. In many cases, such game titles have propelled the emergence of multi-billion dollar franchises, whose protagonists are unanimously regarded among our age's pop-culture icons. Such games however also receive criticism; often stemming from their depiction of violence and desensitization, elements around which most modern multi-million unit selling game plots revolve. In fact, studies that explore the impact of game violence on players' general behavior suggest the existence of certain relations between game content and attitudes related to aggression [2, 3]. If we were to accept however that exposure to violent games breeds anti-social and aggressive behaviors in minors, we should not overlook the opposite: Positively affecting the formation of a child's personality through non-violent, "prosocial" games, in which helping and caring for others will assist children in comprehending that trusting and exhibiting prosocial behaviors have long-term and well-grounded beneficial results. In this respect, studies showing the relationship between violent and continuous gameplay habits and anti-social behaviors should be extended towards prosociality. Prosociality is in itself a complex concept and is comprised of many core domains, which include empathy, social competence, emotional intelligence, trust, fairness, compassion, generosity and cooperation [19, 13]. Already, strong findings are exhibited in related studies [11]. Yet, only a few games exist wherein main characters model helpful and completely non-violent behaviors [1], while the scope of prosociality is usually not intended, it rather manifests itself by chance, in an attempt to gear the game towards certain groups of players, with intent on entertainment.

In this paper, we present a digital co-operative game that focuses on helping young children acquire prosocial skills necessary for developing positive relationships, understand the importance of teamwork and evaluate trustworthiness. Our goal is that children in danger of social exclusion will benefit from our game, which is tailored to teach prosocial skills that can help them appreciate and recognize the value of understanding other people's needs. More specifically we focus on the skills of identifying the benefits of cooperation and expressing trustworthiness, by fabricating these concepts into certified game mechanics that we show are capable of producing favorable gameplay experiences while subliminally promoting prosociality traits to children in need of developing a sense of accomplishment based upon self-control and school performance [15].

The remainder of this paper is organized as follows: Section 2 delivers a complete description of the game design and backstory, Section 3 outlines the technical details of the game architecture and user motion control configurations available, while Section 4 offers a look on small-scale experiments held in school environments for children aged 7-10. Finally, section 5 concludes with a discussion on interesting findings and future work.

2 Gamification of Prosocial Theory

As mentioned before, we set out to build a game based on prosocial theory, and the definition of expressing trustworthiness and identifying the benefits of cooperation [19]. Our ultimate goal was to produce an engaging storyline and game content; elements primarily associated with the entertainment games industry, but fused with scientifically proven game mechanics in order to create a serious game for a non-leisure context (prosociality), in a way that delivers beneficial outcomes for players. We then set out to shape an imaginative game world around these game mechanics. We chose the endless running games genre as a basis for our prosocial game. Endless, or infinite running games, are platform games in which the player character is continuously running through a procedurally generated, seemingly endless game world in an attempt to go as far as possible or collect as many points as they can, before the character inevitably "dies". We chose this genre as it requires a limited set of game controls making it well-suited for our target audience of children aged 7-10. Furthermore, the genre is representative of the influential impact games in the entertainment industry bring to society and culture, being especially popular and enjoying particular success in mobile platforms [20].

2.1 Gameplay Example and Background

Path of Trust (PoT) is a cooperative game where the objective is to collect treasure while navigating through a maze inside an Egyptian tomb, avoiding mummies and traps. The player who assumes the role of wandering around (henceforth referred to as the Muscle) is attributed with Sensory Deprivation (see next paragraph) while their partner, unable to directly determine the course of movement, uses a top-down map view to navigate both of them safely through the maze, without being caught (henceforth referred to as the Guide). A sense of trust must be built between both players in order for the game to be completed; the Muscle player must trust their partner to provide guidance away from danger and the Guide must trust their partner to follow directions. We enrich this basic idea with a colorful backstory and cheerful, immersive 3D graphics to flesh out these characters' world. Screenshots of the final product are shown in Figure 1.

2.2 Game Mechanics

As previously mentioned, PoT is a serious game intended to help children understand a) the benefits of cooperation; and b) when it is the right time to express trustworthiness. Prosocial theory dictates that people often make the mistake of believing there is a fixed pie of benefits and negotiation or that cooperation is an act of dividing the pie. However, the benefits of cooperation are rooted in the expansion of the pie and identifying how they might be increased, a core part of knowing when it is a good idea to cooperate [8]. This dictates that an element of competition must be apparent as the game progresses: players must not be

Fig. 1. Gameplay screenshot of the Guide top-down map view (left); player is briefly shown the contents of the three adjacent rooms. Gameplay instance of the Muscle 3D endless running platform view (right); direction input from the Guide displayed with an arrow on the top.

explicitly told to cooperate in order to win the game, lest the concept of adopting this behavior is diminished as a means to a reward. Instead, we intend to help children comprehend the notion of beneficial results tied to the decision of whether to cooperate or not. Our ultimate goal is for players to realize they can achieve far greater results when following a shared agenda, by agreeing to obey particular and specific rules of conduct. In our case, the benefits correspond to collecting pieces of treasure found in the Tomb. We also introduced the element of time, where players race against time trying to collect as much treasure as possible. **Unequal Pay** [6] is a game mechanic designed to introduce the element of competition and a desire to switch roles. It dictates that one player (e.g. the Muscle) is rewarded higher for accomplishing a task (i.e. collecting a treasure piece) than the other. Both players are meant to realize the benefits, as well as formulate a desire for re-routing resources. Hence, we introduce the mechanic of **Switching Places**, which allows players to pass through a 3D Magic Portal, after which the character roles, gameplay, graphics and benefits are switched. As the weaker party at the end of the bargain (e.g. the Guide) is aware of when the opportunity to switch places presents itself, it is up to the player to determine when to propose a bargain for the benefits to be exchanged. Likewise, it is up to the other player to evaluate the proposition and understand whether the offer was birthed out of a justified feeling of fairness or pure greed.

Having one another's trust is vital to cooperation [12]. It is important to have the skills necessary to communicate to others that one can be trusted and will make a good cooperation partner. We model the expression of trustworthiness through a second set of game mechanics. **Sensory Deprivation and Game World Navigation** [10] affect the ability to move from one place to another, when the correct way is not always obvious. Spatial immersion is achieved and heightened by having the player maneuver through the game world while aware of the latter size and depth. The game uses this heightened immersion to provide

an exciting game-play experience, where the player navigating through the 3D world is constantly in the thrill of what lurks around the next corner. By removing the sensory element of a mechanic such as Game World Navigation in a cooperative game, we provide a platform for which trust between both players is essential to survive. We further enhance this platform with **Fog of War**, a lack of information about the game world until a specific area is observed or explored [14]. These elements can help build trust between both players; if the trust is broken, the Muscle is caught by one of the traps, which means both players do not succeed.

3 Game setup and Natural User Interface (NUI)

PoT is a browser game, based on a server-client architecture. The game can be played either using a traditional approach (e.g. keyboard) or through a gesture-driven Natural User Interface (NUI). The game clients are responsible for rendering the game and deploying the NUI, while preserving synchronization with the server. The latter handles matchmaking, and actual game instance processes, updating the game state on both clients based on inputs received in the previous game cycle. A web browser is initialized at each client in order to execute game actions and display the two Muscle/Guide game worlds to the users. This setup makes PoT independent of input devices, thus allowing multiple player input configurations to be used for gameplay. A diagram of this server-client architecture and flow of game data is depicted in Figure 2.

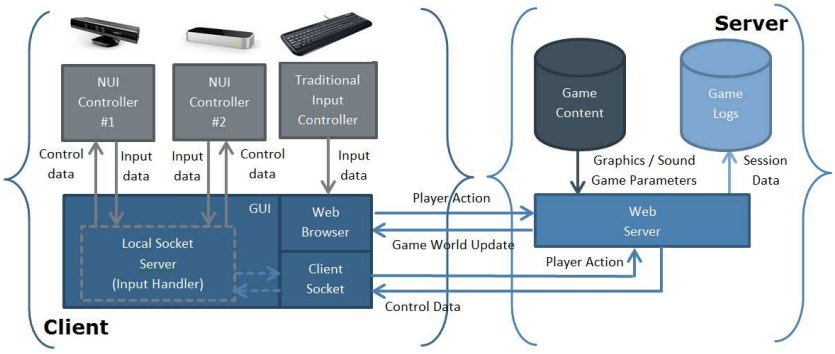

Fig. 2. PoT architecture diagram.

PoT offers three distinct configurations for receiving input from the players. Each player is free to choose his/her preferred configuration. Players are presented with a choice of using a traditional keyboard interface (controlling

actions via the arrow keys), or gesture-driven NUI controllers built for the Microsoft Kinect and Leap Motion 3D controller. Simple gesture recognition using the Kinect sensor is done by tracking skeletal joints on the players' hands to determine whether a valid gesture (left/right arm extended, both arms extended forward) is performed. Gesture recognition with the Leap Motion controller on the other hand, is modelled as a subsequence-matching problem. Enabling and disabling sensor tracking is determined via control signals received from the server, which specifies the time frames in which input from the sensor is expected. If applicable, keyboard input on the other hand, is passed directly via the browser module.

4 User Study Results

We set out to test our game and proof of concept in small-scale studies held in a suburban private school located near Athens, Greece. The game sessions took place in two adjacent classrooms in order to assure that no physical communication between the participants was feasible. Therefore, the players' only means of communication was restricted to the commands given inside the game. PoT was played on mid-end laptops, connected via LAN. Each laptop was equipped with a different sensor configuration; one equipped with the Kinect sensor while the other with the Leap Motion controller. One laptop was arbitrarily selected to host the PoT server; both were synchronized using an NTP synchronization scheme. The study included 16 students at the age group of 8-9 years old (4 boys 12 girls). Approximately, 62% of the participants had played some type of videogame before, while less than half had played games that involved any kind of interaction with other players. Each session consisted of anonymous pairing of players, i.e. participants were unaware of their teammate's identity. A brief description of the game background, as well as an explanation on the gestures for each respective sensor was given separately to each participant before the session. Each session had a predefined time limit set at 5 minutes. As an additional endgame condition, the game was declared victorious for the player who first accumulated 10 treasure points, leaving the possibility open for both players to reach that goal simultaneously. At the end of each session, the participants were asked to fill in a questionnaire about the game, as well as the conditions of the experiment.

Our results were derived from short, open-ended questionnaires, adjusted in language and presentation to the particular age group. A visual evaluation question for rating the game on two axes (easy-hard and boring-fun) along with a few open-ended, short-answer questions about the game experience were included in each questionnaire form. The questionnaires were distributed to students in groups of four after their game session. Questions were read out-loud and students were allowed time to fill in their answer. Answers were grouped and represented by key words in students' responses. Students generally rated their experience as rather enjoyable, and while assessments on the game challenge were varied, most students found the game to be relatively easy to play. Regarding

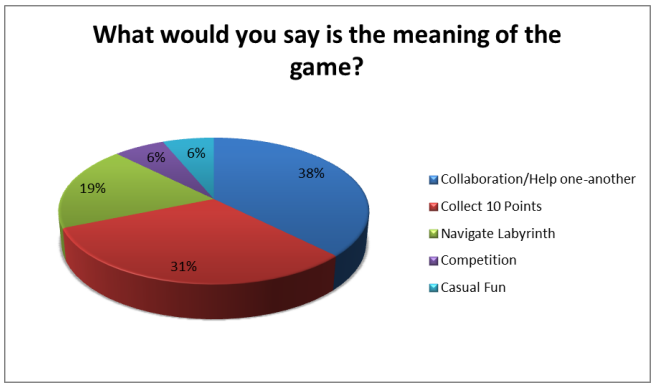

Fig. 3. Experimental results obtained from questionnaire studies, regarding players assessments towards the meaning of the game.

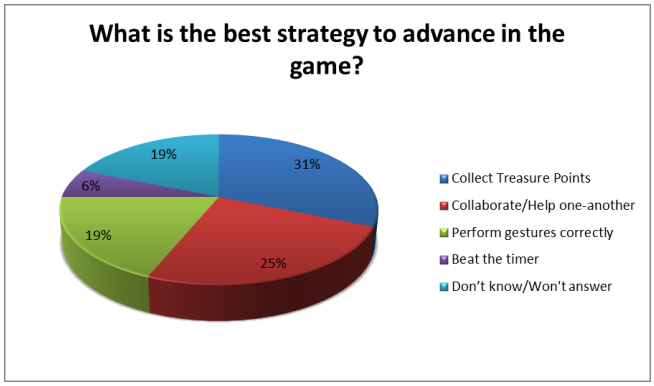

Fig. 4. Experimental results obtained from questionnaire studies, regarding players assessments towards the strategy required to win the game.

the participants' grasp of the true meaning of the game, the most common open answers involved the general concept of collecting treasure, players' collaboration, helping one another, and navigating the labyrinth. Interestingly, as can be seen in Figure 3, only one of the participants focused on the competitive element of collecting points to win. A similar trend in assessments was observed with regard to the question of what it takes to win in the game, as demonstrated in Figure 4, where "collecting treasure" and "collaboration" were the most salient elements for students.

Players were also asked to evaluate their relationship with the other player, in which, approximately 19% identified their partner as a pure adversary. Interestingly, 31% of the players acknowledged an element of competition, but still admitted to recognizing their partner as team player, identifying the benefits they gained through cooperation. The remaining participants clearly identified

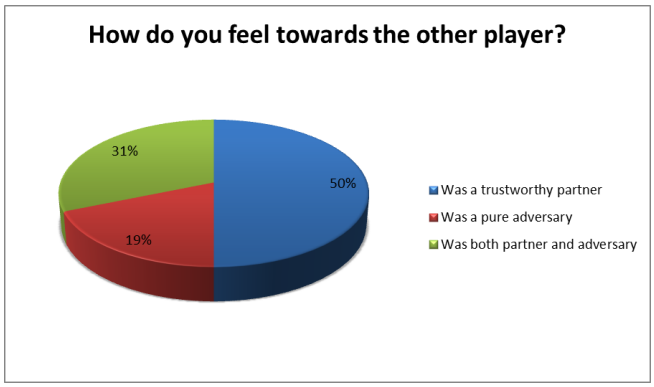

Fig. 5. Experimental results obtained from questionnaire studies, regarding players assessments towards the other participant.

the other player as a trustworthy cooperation partner. This assessment is shown in Figure 5.

Finally, players were asked to evaluate the endgame result. In an interesting observation, ten out of sixteen players declared they felt that they had won or lost the game "as a team", despite some of the participants accumulating fewer points than their partner at the endgame. Players who made this statement noted their partner had benefited from their willingness to cooperate and therefore, felt like they too shared in their partner's success. This trend is demonstrated in Figure 6.

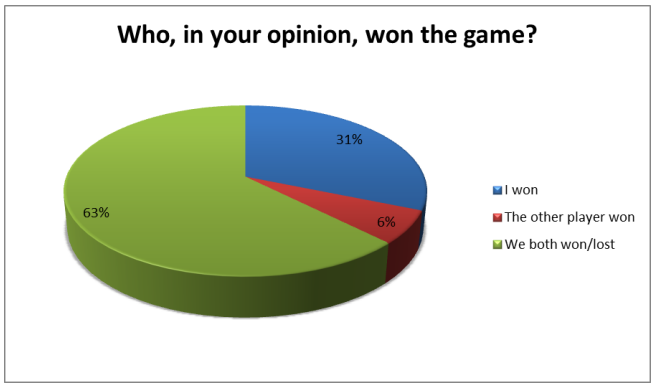

Fig. 6. Experimental results obtained from questionnaire studies, regarding players assessments towards the endgame result.

5 Conclusion

Our user study questionnaire results clearly demonstrate that PoT succeeded in conveying the importance of teamwork to children within the age group 7-10, as the majority of participants felt they had either won or lost the game together or had evaluated their cooperation as a lead towards beneficial outcomes. Also noteworthy is the fact that many players felt they could trust their partner to lead them safely around the labyrinth; even those players who admittedly realized a competitive spirit in their interactions were able to identify whether it was a good idea to trust their partner after propositions of following a certain direction were made. In general, the game received a unanimously favorable reaction from the players, who commented only on the occasional difficulty in getting acquainted with the NUI sensors.

As a foundation for future work, we believe that prosocial skills must be measured efficiently using a series of information cues. Hence, we plan to use our input configurations, so that multimodal signals related to gameplay behavior as well as signals hidden in our game mechanics will be linked to our target prosocial concepts. In our session trials described in Section 4, we have collected vision-based facial and motion analysis data, which we plan to fuse with other gamer profile data, and evaluate in a context-dependent manner to provide quantitative indicators related to engagement. Driven by these signals, the game will be personalized in order to achieve higher levels of player interest and thus, maximize the chances of achieving our prosocial learning objectives. Along these lines, we aim to present game content that differs for each child according to specific learning needs, social background, character, gender, etc. Input has been acquired in the form of questionnaires, as presented in Section 4. We aim to drive game content and mechanics to individualized patterns, maintaining a correct balance between skills and challenge imposed by the game. Personal gamer profiles listing data on gameplay behavior, the amount of prosocial signs, game-related achievements and signs of engagement must be kept. These should then be updated in order to develop adaptation mechanisms so that engagement is maintained at high levels, addressing particular play styles and needs at an individualized level.

Acknowledgments. The research leading to this work has received funding from the EU Horizon 2020 Framework Programme under grant agreement no. 644204 (ProsocialLearn project).

References

1. Anderson, C. A., Bushman, B. J.: Effects of violent video games on aggressive behavior, aggressive cognition, aggressive affect, physiological arousal, and prosocial behavior: A meta-analytic review of the scientific literature. Psychological science, 12(5), 353-359 (2001)
2. Anderson, C. A., Bushman, B. J.: Human aggression. Psychology, 53(1), 27 (2002)

3. Anderson, C. A., Gentile, D. A., Buckley, K. E.: Violent video game effects on children and adolescents. New York: Oxford University Press. (2007)
4. Anderson, C. A., Gentile, D. A., Dill, K. E.: Prosocial, antisocial, and other effects of recreational video games. (2012)
5. Baniqued, P. L., Kranz, M. B., Voss, M. W., Lee, H., Cosman, J. D., Severson, J., Kramer, A. F.: Cognitive training with casual video games: points to consider. Frontiers in psychology, 4 (2013)
6. Brams, S. J., Jones, M. A., Klamler, C.: Proportional pie-cutting. International Journal of Game Theory, 36(3-4), 353-367 (2008).
7. Buday, R., Baranowski, T., Thompson, D.: Fun and games and boredom. GAMES FOR HEALTH: Research, Development, and Clinical Applications, 1(4), 257-261 (2012)
8. Colman, A. M.: Cooperation, psychological game theory, and limitations of rationality in social interaction. Behavioral and brain sciences, 26(02), 139-153 (2003).
9. Dostál, J.: Educational software and computer games-tools of modern education. J. Technol. Inf. Educ, 1(1), 24-28 (2009)
10. Finnegan, D. J., Velloso, E., Mitchell, R., Mueller, F., Byrne, R.: Reindeer & wolves: exploring sensory deprivation in multiplayer digital bodily play. In Proceedings of the first ACM SIGCHI annual symposium on Computer-human interaction in play (pp. 411-412). ACM. ISO 690 (2014)
11. Gentile, D. A., et al.: The effects of prosocial video games on prosocial behaviors: International evidence from correlational, longitudinal, and experimental studies. Personality and Social Psychology Bulletin. (2009)
12. Jones, G. R., George, J. M.: The experience and evolution of trust: Implications for cooperation and teamwork. Academy of management review, 23(3), 531-546 (1998).
13. Keltner, D., Kogan, A., Piff, P. K., Saturn, S. R.: The sociocultural appraisals, values, and emotions (SAVE) framework of prosociality: Core processes from gene to meme. Annual review of psychology, 65, 425-460 (2014).
14. LeBlanc, M.: Tools for creating dramatic game dynamics. The game design reader: A rules of play anthology, 438-459 (2006).
15. Matysiak Szóstek, A., Soute, I.: Support of social skill development in children age 7-10 through technology aided games. (2010)
16. McClarty, K. L., Orr, A., Frey, P. M., Dolan, R. P., Vassileva, V., McVay, A.: A literature review of gaming in education. Gaming in education. (2012)
17. Nouchi, R., Taki, Y., Takeuchi, H., Hashizume, H., Nozawa, T., Kambara, T., Kawashima, R.: Brain training game boosts executive functions, working memory and processing speed in the young adults: A randomized controlled trial. PloS one, 8(2) (2013)
18. Owen, A. M., Hampshire, A., Grahn, J. A., Stenton, R., Dajani, S., Burns, A. S., Ballard, C. G.: Putting brain training to the test. Nature, 465(7299), 775-778 (2010)
19. Penner, L. A., Dovidio, J. F., Piliavin, J. A., Schroeder, D. A.: Prosocial behavior: Multilevel perspectives. Annu. Rev. Psychol., 56, 365-392 (2005).
20. Purchese, Robert: "Temple Run 2 is the fastest-spreading mobile game ever". Eurogamer, `http://www.eurogamer.net/articles/2013-02-01-temple-run-2-is-the-fastest-selling-mobile-game-ever`