

# Learning Digital Skills for Elderly People by using Touch Screen Technology and Learning Games: A Case Study

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**Keywords:** Elderly People, Game based Learning, Touch Screen Table, Case Study.

**Abstract:** The problem of learning digital skills among elderly addressed in this paper is focused on an approach focused to overcome the barriers in adoption of touch screen digital technology faced by older adults, by using the game based learning approach. The paper provides an overview of some early results and findings from an exploratory study based on use of an alternative learning approach with games enabled to facilitate the digital literacy and digital skills adoption by elderly people. The learning was carried out with designed games offered on big tablets with touch screen technology. The study results presented in the paper were collected within the project GIRDA – Gameplay foR Inspiring Digital Adoption from the European ERASMUS+ program. The paper describes the research setting, the experiments and the results that are accompanied by discussion and conclusion.

## 1 INTRODUCTION

The place of Europe in the future of the ICT will depend on its ability to work and to manage the digital innovation brought by the new technology for benefit of all in the continent. In June 2016, a new Skill Agenda was launched by the EU Commission with digital skills as a key component of the European development. The Agenda presents a number of actions and initiatives that seek to improve the digital skills at all levels and among all citizens with a specific attention to elderly people. The problem of learning digital skills among elderly addressed in this paper is focused on the overcoming the barriers in adoption of touch screen digital technology faced by older adults, by using the game based learning approach. The elderly European citizens may either be in retirement or in middle age and they often have no digital skills required for use of the services offered on modern phone or similar devices with touch screen interfaces. Increasingly, digital skills are required for performing instrumental tasks such as searching for contacts, medical help, measuring medical indicators in an e-health service, paying bills, and taking part in democratic processes. Access to cultural resources, social connectedness and emotional well-being are also activities related to the

adoption of digital technology skills among the elderly people.

Several barriers for learning digital concepts among older adults were identified relatively early (Tang et al., 2006). These barriers partly appear because the learning of digital skills is different in its fundamental nature from what these people have previously experienced. It was also found that acquisition of digital concepts occur more easily through hands-on trials and with use of the error-based learning principles developed by some researchers (Damodaran and Sandhu, 2016). Hands-on exploration approach used by the learners was found to be more effective than using secondary assistance such as manuals or procedural descriptions of concepts. This becomes typical approach for the way in which these devices are learned in the last ten years (Häikiö et al., 2007). However, this is type of learning is not familiar to many older citizens because its use involves a number of problems in approaching them. One of the barriers is the sense that learning is too difficult task, and is discomforting or potentially stigmatizing prospect for the elderly due to the lower physical ability and more difficult understanding of the digital concept. In addition, many older people are also not comfortable to learn something that they perceive to be a 'classroom' setting by trying to pick up concepts and skills through a third party. Also, many of them have not

been in touch with the digital technology and rely for their digital based service need on visits to public day centres for use it where help can be expected. Sometimes, additional concern appears among them when a mentor is present without specific knowledge for elderly learning.

A game concept for elderly was designed to foster social interaction and physical activity. This was investigated in several case studies (Gerling, Schulte and Masuch, 2011). One of the studies has found that playing brain training games on a portable game console had a positive correlation with the reported fun and the learning within an elderly age group. Similar studies has recognized some cognitive challenges that are aimed to provide a satisfying gameplay mechanics for the elderly (Al Mahmud et al. (2008) and consequently better learning. Finally, the Elder Games project by Gamberini et al. (2008) proposed gaming solution specifically designed to test and train cognitive abilities of elderly persons.

Previous research in this area tried to address mainly (Gerling, Schulte and Masuch, 2011) the digital game design for elderly persons from different perspectives, by focusing on the creation of enjoyable gaming experience for seniors, while trying to motivate them to engage in healthy behaviour through engagement in playing.

The work presented in this paper is to provide another aspect in elderly learning by focusing the research work to the development of digital skills in an attempt to make the elderly people capable of using modern digital devices with touch screen interfaces. This paper provides an overview of some early results and findings from an exploratory study based on the use of an alternative learning approach with games that facilitate the digital literacy and digital skills adoption by elderly people by gaming and socializing. The learning was carried out with designed games offered on big tablets with touch screen technology. The study results presented in the paper were collected within the project GIRDA – Gameplay foR Inspiring Digital Adoption from the European ERASMUS+ program by the partner from Slovenia. The paper introduces the research setting, the experiments and the results that are accompanied by discussion and conclusion.

## 2 DIGITAL SKILLS LEARNING AND TOUCH SCREEN TABLETS

Contemporary digital skill training for older citizens usually reflects a 'behaviourist' metaphor of teaching and learning. Typically, learners are tutored and thought with basic manipulations for specific key tasks offered over the e-services such as filling claim forms. Frequently reported problems in building these skills with that approach include difficulties in acquiring and retaining the skills as fear appears among the learners that errors will be made. General reluctance to explore the technics or the technology is present in the part of many elderly participants. Those acting in mentoring role are often not highly skilled or trained teachers, and many of them have only recently acquired digital skills themselves. Therefore, being placed in a 'teacher-like' role for such tasks is something that can be discomforting for the mentors as well. This interpretation of the roles of teacher and learner is often also problematic for learners, particularly if they had bad previous experience of formal learning in classical classrooms setting. By contrast the approach taken in the study presented in this paper reflects constructivist and socio-cultural methods that encourage learners to develop confidence and skill through hands-exploration and discovery in a supportive environment that includes mentorship and collaborators from their own environment. In such environment mentors are expected to easily interact with learners, to observe them and to demonstrate the tasks through action, and by providing direct support rather than being put under pressure to 'teach' the class in the traditional sense.

The approach taken in the study explicitly separates learning from any specified instrumental context by using games generally available on big tablets. In doing so the approach the intention is the learning process "to be hidden" from the users. The attractiveness and low-pressure nature of the selected games in the experiment addresses the affective and culturally-situated barriers to learning. Academic studies (Haikio et al., 2007) of novice older users playing touch table games have suggested that older users are capable to rapidly acquire manipulation skills and that they exhibit a willingness to explore the new tool in a way that naturally develops cognitive and motor skills. This suggests that effectively 'hiding' the learning of digital concepts in games that are also carried out in socializing environment allows users to acquire the skills and the

confidence to progress towards full digital literacy. Furthermore the 'reality-based interaction' of touch screens is also very likely capable to transfer the adopted skills in the use of key modern carriers such as the mobile smart phones, a non-avoidable tool for many e-health and other e-services.

In setting the research in the GIRDA project all interrelated areas for this type of learning were taken into consideration. Serious games have increasingly attracted the attention of professional trainers and educators' due to the empirical evidence, notably from the 2014 PISA project that surveyed the relationship between the ICT technology used and learning outcomes evaluated through scores achieved by the students in 17 European countries. The authors of the PISA report, Biagi and Loi (2013) found that the relationship between the domain-specific PISA test scores and the measure of the intensity of the student's gaming activity (playing any game) is the only information technology indicator that had a clear positive correlation with the achieved subject scores, such as mathematics, science and the language of instruction in the majority of the surveyed European countries. All the other IT-activities measures in the same study indicated only negative correlations with the scores. The positive association between the intensive use of gaming and the test scores indicates that gaming during learning positively stimulates the development of the necessary skills, competences and abilities, such as problem solving, strategic thinking, memory, fantasy, interaction and adaptation to the learning subject, which are elements well captured by the standardized tests in particular subjects, such as those used in the PISA survey. Earlier findings by Wilson et al (2008) on 'Relationships between Game Attributes and Learning outcomes contributed to the accepted assessment of the "game based learning value." This type of learning was supposed also to be re-enforced and easier with the abilities offered by touch screen tablets.

### 3 STUDY DESIGN

#### 3.1 General Approach

The main objective of the Gameplay for Inspiring Digital Adoption study was to use games as a learning tool to develop and practice skills critical for using touchscreen technology such as tap, drag and rotate n objects on the screen. Our initial criteria for selection of the games included familiarity from the 'real world', such as card games, crossword puzzles and jigsaw puzzles, chess and backgammon. Regarding

the previous knowledge of the participants was decided to select participants for the study without any skills in playing games. The selection of games was based on that decision.

The study was designed as two-player gaming on a touch-table device (basically a giant tablet e.g. the Lenovo table) to introduce older learners to touchscreen functionality, in a low pressure immersive environment where the fact that participants are learning was 'hidden'. The Lenovo touch table used in the study offers a selection of preinstalled games that can support up from one to four people playing simultaneously. However we decided the game playing to be performed by a pair of elderly people composed by the same gender or mixed. Exploring the diverse range of game categories available on a Windows touchscreen device presented certain challenges - which might be off-putting for new users trying to find their way in using the screen functionality. The main property of the game to be selected was the game to create non-stressful and enjoyable paths to learning cognitive motor skills. This implied such type games that avoid placing a cognitive burden on the learner that distracts unduly from the skill learning process. The same applies for games that apply complex set of rules that may burden the working memory. The featured 'popular' games were generally overly sophisticated; 'educational' games were clearly aimed at pre-school and primary school age children, while 'adult games' were found to be x-rated. More useful were the genres which included puzzles, board games and casual games. It was decided the first game to introduce a basic drag action as an introductory lessons for using touch screen device. The selection was not very difficult as there are a number of games that introduce dragging in a variety of ways. The drawing game was selected as most appropriate for users that have not been in touch previously with touch screen technology and computer games. The simple drawing tool in our repertoire of games was sort of introductory element so that our participants were enabled to have a first experience of just touching the tablet and getting an immediate visual result - be it a fingerprint sized dot, a line, a house or a ship. The game enabled also using the tablets key for change of the colour. The second game was decided to introduce the rotate action and to enable learning of object moving on the screen. Koala puzzle was selected as second game. Puzzles are games that are popular as entertaining games and it was supposed that not much explanation will be needed for explanation of the game. However, this game enabled learning other skills, moving, rotating

in dragging objects to come in right position. The third game was selected from the list of games with a matter of in-situ judgment, so the very popular heavy traffic Cross road game was selected. The player is moving an object over very busy roads and is trying the object to not crash under the fast moving vehicles. If the crash happens before the object reach the other side of the last road the game closes and start again. This game is focused on coordination of the vision/recognition and motor activity of the fingers. The three selected games proved useful in identifying how key variations and their pros and cons in learning how to act on touch tablet scree can be identified. Figures 6-8 (see Appendix) present the screenshots from the video record of all three games.

The participants were recruited from three nursing homes in Ljubljana, Slovenia (Bokalce, Črnuče and Kolezija). The home care employee selected the participants that had no experiences in novel technical solutions and had never used touch screen device. The age of the participants ranged from 65 to 85. And most of them had no previous experiences with digital technology as we requested novices to form the group. The level of education ranged from high school up to master degree. Most of the participants had weaknesses in some of their motor based capabilities and this governed the way data were collected after each of the carried sessions. The learners have worked in pairs. They were expected to collaborate in helping each other which was considered as a socializing effect enriched with the other members of the particular group. The witness presence is usually considered as a key dynamic of co-learning. Participants take cues from watching the partner interacting with the system and the consequent system response. One of the study tasks was to observe how people interacted with each other as well as with the technology, and how the choice of game or activity influenced to the changes of these interactions.

The role of a mentor was appointed to a person that was paid as a tutor or as a volunteer, or simply someone with a little more experience in ICT. The mentor was expected to be capable to guide the less experienced player and, in the process, improve their own skills, both as a touchscreen user and as an informal teacher. However, he/she was not allowed to intervene on the screen during the session, only in case a restarting of the game was required.

### 3.2 The Applied Study Protocol

The applied protocol of the experiments included several tasks. However, the approach of using hard

protocol' with strictly controlled variables appeared to not be a useful approach for GIRDA's objectives. Therefore, we stated some parameters for study set-up that allow for local adjustments. The nature of the study was based on the spirit of Grounded Theory (Martin and Turner, 1986), where exploratory studies may resolve questions but equally importantly generate issues and questions for the ongoing investigation. Our guidance for generation and analysis of data reflects this. As digital adoption 'landscape' is different in each environment, it was allowed the selection criteria to be affected by local sensitivities in GIRDA participating countries. In Slovenia, we found that there are elderly in the nursing home who have had no exposure to digital technology at all, but more common were those who have had just a small degree of exposure connected to their working environment before they retired. In selecting the participants, as was already agreed elderly with no prior experience of digital technology at all or very limited experience and balanced genders (as far as possible) were asked to be invited to the experiment. In targeting recruitment pairs were asked to be formed from both genders as sociality was one of the key elements of the strategy in learning. It was also supposed that the participants know each other. We asked the maintaining personnel in the nursing home to propose pairs by presenting them the action as "playing of games" and that as a major part of the experiments. The action was illustrated additionally as a 'gift-based' incentive. The gifts were provided at the end of each experiment.

### 3.3 Conducting the Session

Session began with welcoming the participants with brief introductions to the people involved and purpose of the study. Then the participants signed the consent form and agreement to take part and to the fact that they will be video recorded but without disclosure of their identity. The camera was focussed on the screen and their hands. The session started with an introduction of the first activity in a form of drawing game accompanied with the drag action on the screen. In the introduction an encouragement to touch the Lenovo table was provided. The mentor was asked to inform the participants that his engagement or struggling to work actions out was not allowed, however prompting the participants by making suggestions was recommended. One of the mentor tasks was to ensure both participants to take a turn, to discuss progress and to express the first impressions. The time for drawing was not limited. After drawing the second activity was introduced, the Game with

Rotate and moving objects activity. Giving encouragement to touch and move pieces to complete the puzzle was done but in same time it was allowed the participants to explore first the rotation unprompted unless stuck. The mentor was supposed to encourage less active partner to try actions. The third activity within the third game was more demanding and it was introduced with an explanation from the mentor regarding the game gestures and the goals of the game e.g. crossing successfully several roads with heavy traffic. Again, the time for playing was not limited strictly. Each session lasted from one hour to two and after the gaming was ended post-test open questions were passed to the participants. These open questions were intended to give participants their own opportunity to comment, and reflect on their experience. The questionnaires (2 of them) were prepared in advance, each of them with several questions. They are presented in the Appendix.

#### 4 RESULTS

We have collected data from 30 participants from three nursing homes aged between 65 and 85 in collaborative performances on touch-screen devices over two months. After each session, the participants were asked one by one to take part in an interview with several open questions. They were also asked to fill the template with answers that contained closed number of questions. The collected data were analysed with an intention to reveal how elderly people react and accept the new digital technology with touch screen, what are their attitudes towards learning with it, do they accept the way for learning new skills, do they experienced some difficulties in development of the motoric skills necessary to act on the screen, how big was the players immersion with the games (obtained by observation of the mentor), if collaboration among the pairs was present and was observed as a support in solving the game e.g. in the puzzle game and if the participants within the group that accompanied the players provided support during the learning with instructions how to play a game or with instruction for the move on the tablet. Selections of the processed data are presented as Figures 1-5 below.

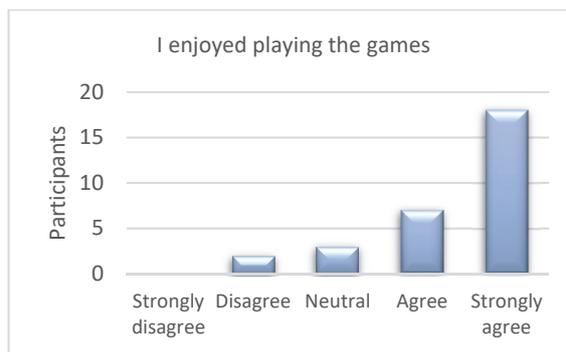


Figure 1: Question №1.

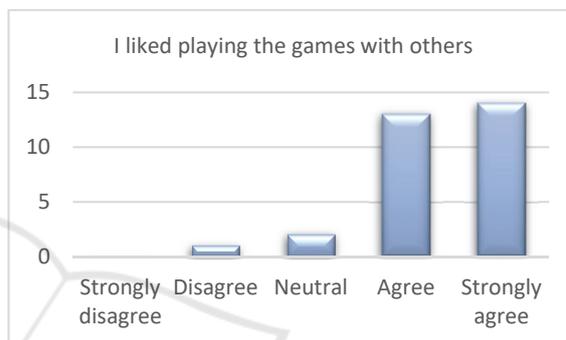


Figure 2: Question №2.



Figure 3: Question №3.

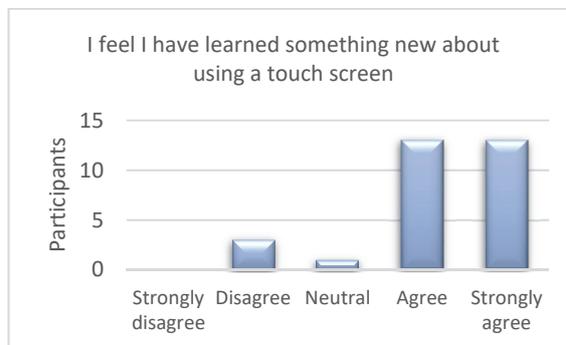


Figure 4: Question №4.

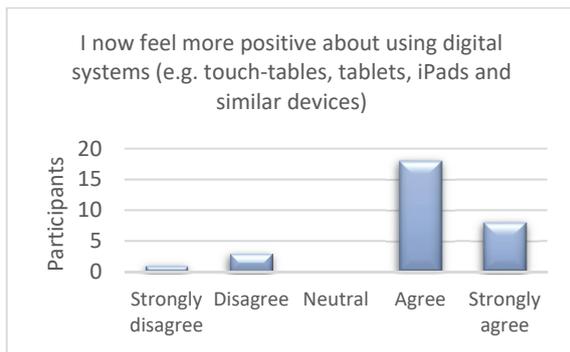


Figure 5: Question №5.

Most of the participants (82%) described the action as pleasant and full of fun, however 18 % found the action tiresome. The most enjoyed game was the puzzle followed by the drawing game. Crossy road from some of them was somehow tiresome and maybe demanding regarding the required speed of action and coordination of the vision and the motor skills required for successful playing. . Most of them (75%) have declared that they did not found the use of touch screen difficult, the other part (25%) have declared that they have encountered some difficulties especially in the Crossy road game. It was important finding that majority of them (95% did not experienced any physical discomfort in using their fingers for playing the games. The same results were obtained about the experienced novelty of the technology used and the attraction of playing games on a touch screen table. Most of the participants did not found that playing of games was difficult (80%) and the assessment of the attractiveness of the approach was also assessed as high (90%). The participants declared that they would describe this experience to others as fun. The collaboration – playing as pair and with group support was also accepted positively by the majority of the participants, The same results was obtained during the interviews about existence or nonexistence of fear in using the technology or learning with this type of digital technology. No fear was reported. Overall the whole experiment was assessed as very positive experience. Some participants asked if there will be a second session with the same technology and the same mentors.

## 5 DISCUSSION

In most cases, the foundations of being a good user - developing trust self-efficacy and perceived value is growing slowly and steadily without anyone giving

the matter much thought, often well before someone e.g. a child in particular case start learning. By the time person is seventeen, he/she can easily understand the benefit of learning to drive a car as this enable better mobility. The person is also well aware of the risks of driving, but also knows how they can be mitigated. It is well known that lots of people learn and apply the skills without too much difficulty.

However, these learning foundations are often absent when it comes to non-users of digital technology, as it was proved to be very hard to teach them through the general system ‘show and tell’. The first step - going from being a complete non-user to an engaged newbie - is the steepest. The challenge for digital inclusion practitioners is ensuring that training provision for new users should be based on fun, social and risk-free, while still building vital interface skills, and encouraging experimentation and adopting self-guided learning. Research shows that these factors are especially important for older learners, for whom the opportunity to play with digital technology, helps to capture interest and build confidence. These findings were confirmed in our study as well. The learning was “hidden” and the adoption of self-learning was present and proven All points towards the importance of game-based learning for digital inclusion have shown to be true even in a group of elderly people with some physical or mental weaknesses. It was shown by majority of our participants that using games to learn is taken as a fun, but it’s also low-risk, and the players were able to run through situations again and again e.g. in the drawing game and in the Crossy road game They explored during the game playing how different actions have different results by the changing the colour in the drawing and assessing when to cross the road. The big difference with classical teaching of skills for digital inclusion by learning by gaming is that the games can be completely familiar, or incredibly easy to learn. In fact, the more familiar and easier are they, it is better for the learner, at least to begin with. The rules for learning for this type of games are not the rules of the game, but the rules of how to interact with a digital device. In our sessions, all participants adopted the touch interaction method easily regardless of their motor skills. Most of them understood the games easily and some outperformed the others especially in playing the second game - Koala puzzle. All of them were capable to draw figure on the tablet and to change colours; however, several trials were necessary to touch the right place on the screen. The differences in flow observed among the participants might be attributed to the fact that the players with some motor weaknesses seemed to encounter more

problems when interacting with Crossy road game. Immersion in the game was present as well collaboration among the players either from the partner in the pair or from the group that gave loud advices how to act on the tablet. Some of the partners were first watching before they entered actively in the game. Observation during the sessions suggested that the cognitive load of managing the session required more than one mentor sometimes. Altogether these findings appeared through participant's observation but as well from the data collected in the interviews and the closed questionnaire. Despite age related cognitive and physical changes, all of the participants were able to understand and answer all questions in the questionnaire. Yet, further research regarding the test criteria like reliability and internal consistency of such shortened first version of GIRDA exploratory study is necessary.

## 6 CONCLUDING REMARKS

To become a proficient user - of anything some absolute essentials are needed. Each person needs an easy and regular access to the thing/device to be used, and skills are needed for effective use of it. But having that access, and learning those skills, are not much useful if there is no trust in the things that are used, and the if the user does not have faith in his/her abilities to use it, or simply does not see the point. Just like skills, these internal conditions are not innate, and there are lots of factors that influence the degree to which someone has them and like with the skills, they can be nurtured and grown with the right kind of support.

The first study carried in GIRDA - Gameplay for Inspiring Digital Adoption project has shown that most these aspects in learning were considered during the study. Elderly people need to know how to use modern devices like smart phone in order to stay socialized and to accept the benefits of modern technology specially designed to help them in aging or staying at home as long as possible. Many e-health applications are developed for elderly but their use and the benefits they bring depends on the user digital skills and understanding of the offered service. Playing games on touch screen table is obviously one of the methods to help them in acquiring these skills more easily and on a friendly manner. Learning without knowing that person learn is simply more acceptable as it is an easy way to adopt what is need in the current and future digital world. GIRDA will continue with similar experiments and studies in the future within the environments from the participating

countries and future reports and findings will be prepared and published. Comparison among the results will be provided as well. The future rounds of data collection and analysis will help the GIRDA team to understand the optimum setup for this kind of peer-to-peer learning, and what kind of games yield the best results. We hope that in future there will be opportunities to use this evidence to create tailor-made games that can build the interface skills and help older learners to overcome the lack of confidence and a feeling that using touch screen computers is risky and impossibly complicated.

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## APPENDIX

The post session open questions carried out as an interview. These open questions were intended to give participants an opportunity to comment, and reflect their experience and to discuss the experiment with the mentors and with the nursing team.

- a. Which game did you enjoy the most (and why?)
- b. Was there anything that struck you as novel or surprising?
- c. How would you describe these actions to someone else?
- d. Was there anything you found particularly difficult about using a touch screen?
- e. Did you experience any physical discomfort?

Closed Elicitation in a questionnaire with Likert scale.

- a. I enjoyed playing the games.
- b. I liked playing the games with others.
- c. I would be interested in playing more Games.
- d. I feel I have learned something new about using a touch screen.
- e. I now feel more positive about using digital systems (e.g. touch-tables, tablets, iPads etc).

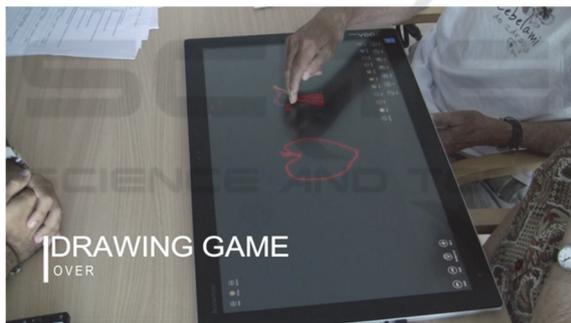


Figure 6: Screenshot from the video – drawing game.

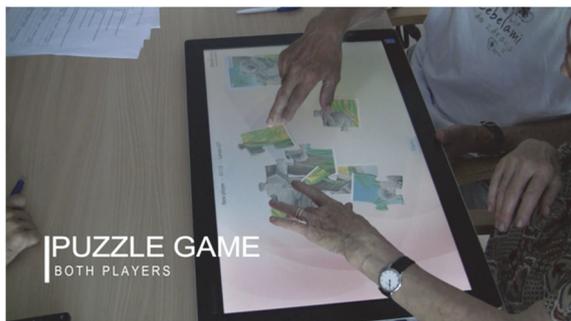


Figure 7: Screenshot from the video – puzzle game.

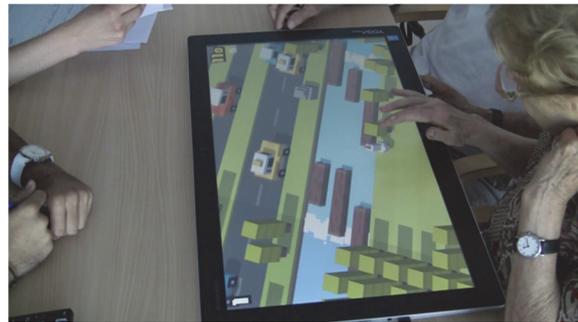


Figure 8: Screenshot from the video – crossy game.

Two edited short videos of the experiments can be found on the following address:

<https://dbox.si/index.php/s/hDv1r3IR8rPdRc0>