

## Support dementia carers in game

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### Abstract

Dementia is an important public health priority. Caring for a person with dementia can be very challenging. A better understanding of dementia is important for both patients and carers. The main objective of this research was to help to improve the quality of interaction between dementia patients and carers. The aim of this research is to investigate how games could support dementia carers through, initially developing a conceptual framework. The research analysed 10 existing games within health education. Game content, such as Game play, Avatar portrayal, Gameworld graphics, Sound/Music and Storyline, were examined in order to help family members who may be carers. This paper discusses the different ways in which various aspects of games could be used to help and support dementia carers from their own perspectives.

**Keywords:** Serious game, Games for Change, Games for dementia and carers.

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### 1. Introduction

Dementia is major cause of disability (WHO, 2015). Misconceptions create problems, often leaving dementia sufferers isolated and locked within themselves. Negative reactions can lead to hopelessness and frustration. Dementia carers need strong support in various ways. Carers and family need to have ability to cope with dementia patients through patience and kindness (Graham, et al., 1997, p.931). Being a carer with ongoing responsibilities in the long term is physically and mentally exhausting. A dementia carer might have to change his or her lifestyle to accommodate a patient and as a result can become depressed from the pressures of caring. (McDougall, et al., 2014, p.82) (Robinson, et al., 2010, p.659).

In some instances, games can be used to solve complex problems and also to develop practical skills (Hildmann & Hirsch, 2008), and can be a platform for education, brain training or to change user's behaviour (Hamari, et al., 2014, p.3026). Such a serious game is created for a serious intervention in health, business or education rather than entertainment. For instance, an Advergame can be used to create interactive situations with brands, thereby developing marketing communications tools for particular products. Gamification is the addition of game elements within a given situation, to increase a user's motivation and engagement. Games for social change have been used to raise public awareness of social issues, such as human rights, climate change and public health. Hence games can be used to help address these problems (Hildmann & Hirsch, 2008).

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This research focuses on the application of games as motivation tools for dementia carers. The three main elements looked at include education, health and social. Specifically, it is about how games can be used to engage dementia carers for their education, improve their health and help them be involved in the community. In other words, the purpose of the game is to support family carers to understand dementia and sharing their daily life, experience and recourse.

The outline of this paper is as follows. Section 2 summarizes the findings of related researches into the needs of dementia carers, with emphasis on differentiating these from those of the patients. Section 3 describes the methodology used in the game analysis undertaken in this research based on characteristics such as genre, content, platform and purpose. Section 4 presents the results of the analysis of ten existing games designed for education, health and social interaction. Section 5 outlines the desirable aspects, such as game system, content and purpose, of games for dementia carer support. Then the conclusion summarizes the findings.

## 2. Related work

The findings of related researches are surveyed to identify the most important needs of dementia carers, with special attention to highlight the differences between these and those of the patients.

Currently, there is no definitive cure for dementia, so the focus of its treatment is on slowing down the progression of the disease and reducing memory loss (Alzheimer 2013, Hughes 2014). Trials of different combinations of psychotherapy, environmental modification and medication have been explored for this purpose. As it is postulated that stimulation and positive reinforcement could reduce dementia-related impairment (Mulvena 1 & Nugent 2, 2012), many researches have been focused on the investigation of the effectiveness of using interactive games for the purpose of dementia treatment. The findings of such researches might be useful in educating and informing the carers about the care of the patients. However, more importantly, the research about dementia carers point out that most carers need: to be supported in their psychiatric health. Additionally, being properly informed about their care for their patient will improve the carer's emotional state, too. The interventions are very important to help combat stress and depression (Kurz, et al., 2010) (Graham, et al., 1997). There is help available related to dementia patients and carers in the local communities, but they are focused on the patient rather than the carers. However, there is some support for local groups such as "Dementia Friends". Dementia Friends run sessions to understand dementia

that will help dementia carers get essential knowledge to take care of their patients.

### 2.1. Interactive games with dementia

From studies of memory and learning, it is known that, in response to external stimuli, brain cells send out signals to other interconnected brain cells as well as adjusting these interconnections (Takeuchi 1 & Funaki 2 & Kaneko 3 & Kline 4, 2015). Learning occurs when a connection is formed or strengthened between a stimulus and the desired response. The act of recall happens when a stimulus triggers the response through this link. Conversely, forgetting occurs when such link is removed or weakened so that recalling cannot happen. Normally, there are multiple connections for the same response (Camic 1 & Springham 2, 2012; Miller 1 & Hughes 2 & Westcott 3, 2006). The more a link is triggered, the more reinforced connections there will be, and the stronger the link will become. The more these connections there are, the more certain the learned response will be triggered, and the less likely the memory will be lost. Hence this reinforcement is a mechanism that safeguards against the loss of memory and learning from brain damage (Hoey 1 & Mihailidis 2 & Zutis, 2010). Therefore, it is important to provide stimuli to the brain to encourage brain cells to maintain important interconnections. As different parts of the brain are responsible for different bodily functions and are responsive to different stimuli, it is important to provide different kinds of stimuli, not just verbal ones. This is where art and interactive games can contribute (Ang 1 & Siriara 2, 2014).

Interactive games could be used to stimulate sensory activities and thus provide stimulation to the brain for its treatment. These give the opportunity for the patients to reinforce their memory through recalling. Such games have also been used to reduce the loss of short-term memory (Mulvena 1 & Nugent 2, 2012). Some of these games have also been based on creative arts and have been used to stimulate the brain through physical and mental activities such as vision, hearing, touching, and movement.

Advancements in computer hardware and software technology provide a feasible means of implementing and deploying interactive games (Mulvena 1 & Nugent 2, 2012). Hence, instead of table games used in aforementioned research to train the brain, digital technologies could be utilised to provide digital interactive games as alternatives that are easier to deploy, allowing patients with early stage dementia to play at the time and place of their own choice, assisting their treatment in delaying the progression of

dementia and sustaining an acceptable level of quality of life.

According to a previous research, a virtual world was built for people with dementia, focusing on physical problems such as physical and cognitive abilities related to their social relationship and their quality of life. The aim for the virtual world project was to enable interaction with the computer using body motions (Ang 1 & Siriaraya 2, 2014) in, for example, playing games to attain the result of exercise. Although the project was successful, it still had some weaknesses (including needing excessive physical motion, high cost, extra workload for staff and not being able to use wheelchairs in the virtual room) which need to be rectified in future design and research work.

There is a computer game called Smartbrain used in homecare in Spain for dementia (<http://www.smartbrain-games.com/en/>). It is a simple computer game including naming professions, pairing flags, completing additions, rejecting objects, among other activities. From these games, people with dementia can improve cognition as the Journal of Neurology, Neurosurgery and Psychiatry reports (Mulvenna 1 & Nugent 2, 2013: 26). Puzzle games (such as Pair memory game, Crossword, Scrabble) can stimulate people's brains. Recently, a famous leading interactive company called King Digital Entertainment created Candy Crush Saga, Farm Heroes Saga, Pet Rescue Saga, Bubble Witch 2 Saga, Diamond Digger Saga and Alpha Betty Saga. These games can also be used for brain stimulation.

Though these developments concentrate on assisting the therapy of the patients, they also provide tools for either facilitating patient-carer interaction or elevating burden on the carers. They could also be used by carers for recreational purposes to improve their quality of life.

## 2.2. Dementia carer support

There is quite a number of research into dementia itself but there is little research about dementia care. This chapter focuses on support for dementia carers.

Individuals have used social media to create online groups for people with dementia, but most of these online communities concentrate on dementia physiotherapy and mediation information; there is currently no research and online community

specifically for helping dementia carers. CarersUK is an organization connected with the NHS, which supports carers in general. On their website,<sup>2</sup> they have some information about how to help in different ways, such as financial, practical and health. This website provides an online forum, which is for carers to discuss and share their information, but every thread is very specific and does not provide an easy gateway for people to get advice about their precise problems. It shows a lot of information, but the information is grouped by topic too generically and vaguely that discourages a user from engaging with it. It has limited professional advice for people about how to look after dementia patients. A better way would be to create online regional community for individuals to connect with each other in a meaningful manner, focusing specifically on dementia carers. It is also possible to use a game as a support tool to help carers be more aware of issues related to dementia care, and to develop better coping strategies.

There are different ways to help dementia carers, such as psycho-education, support and information, training courses and involvement of other family members, etc. (Nice, 2006, p.34). Dementia patients normally need physiotherapy and medication. Both dementia patients and carers need information about dementia and training courses to understand how to face the issues that living with dementia brings. Dementia patients and carers might need psychological education and also might need to have a community to share their experiences (Nice, 2006, p.34). Psychological education is the education in understanding how best to cope with a mental health condition so that a mental health patient can live as good a life as possible.

There are platforms that could be used to support dementia carer such as social marketing, social media and games. Social marketing is 'transtheoretical' (Corner & Randall, 2011, p. 1007). The transtheoretical model (TTM) shows how a person transitions to a healthy life (Levit, et al., 2015). Social marketing includes a build-up in conversation and creating communities to engage people. Social media is about engagement and communication (Hanna, et al., 2011, p.268). Social media through games can also educate people about dementia. Games collaborations with social networks can impact on the well-being and quality of life of an individual by exposing them to an online support community (Michailidou, et al., 2014, p.282). A social network game is a digital game played via a social network. Social networks allow a person to interact with friends, establish relationships and engage in teamwork or compete with other people.

<sup>2</sup> <http://www.carersuk.org>, 2016 making life better for carers., CarersUK

Playing an interactive advertising game can be an enjoyable experience, which could increase learning, exploratory and participatory behaviours.

### 3. Game research methodology

Game research analysis categories games in different ways. One of such categorisation, shown in Figure 1, is by genre (Table 1), platform (Table 2), purpose (Table 3) and content (Table 4). The game analysis shows how to find out the suitable intervention for dementia carers, as well as how to build up the intervention as communities, or give education opportunities which link with health issues.

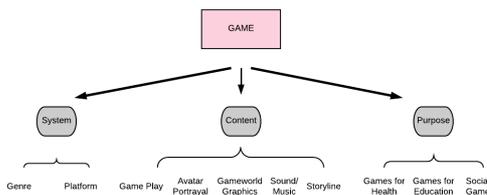


Figure 1. Summary of game analysis

Table 1: Game analysis by system- Genre

Genre	Characteristics	Example
<b>Board</b>	Board games are games played on a table. Most board games involve at least two players. Different board games have different rules. Some games need teamwork or individual strategy to compete with other players.	Monopoly, Pandemic, Mysterium.
<b>Action</b>	Action games are based on physical challenges. Hand eye co-ordination and good reactions are needed.	Watch Dogs, Star Wars, Hungry Shark World
<b>Adventure</b>	Adventure games involve exploration of the games world and the game play involves solving problems.	Monkey island, Lego island
<b>Puzzle/Quiz</b>	Problem solving games.	MahJong, Bubble Shooter, TenTrix
<b>Role Playing Game(RPG)</b>	Players control characters in the story of the game.	Diablo
<b>Simulation</b>	The player interacts with a model of the actual world such as building a house, bank or public transport of an airplane, train and bus. The situation copied from real life.	Euro Truck Simulator, American Truck,

Genre	Characteristics	Example
<b>Sport</b>	Physical or tactical games. Challenge sport games include different athletic models.	FIFA, Mario Golf, Mario Tennis. Olympic Games
<b>Strategy</b>	Players take the third person view with a repetitive story line and combat development	Kingdom Rush, Castaway
<b>Racing</b>	Competitive games based on beating other players across a course.	Mario Kart 8, Gran Turismo
<b>Shooting</b>	These games involve trying to shoot other players/ characters. Normally the aim of the game is to try to survive until the end of game.	Tank! Tank! Tank!, Crysis 3
<b>Platform</b>	These games involve jumping or flying between platforms or obstacles.	Super Mario Bros. U, Sonic Rush

Table 2: Game analysis by system- Platform

Platform	Characteristics
<b>XBOX</b>	XBOX game titles are normally from the shooting, action or sport genre. It is smaller than the PlayStation but the XBOX has more choice of titles.
<b>PLAYSTATION</b>	PlayStation games are of a higher quality than the equivalent XBOX and PC games.
<b>NINTENDO</b>	Nintendo games are more for families or communities to share the time with. Wii U involves small games to play with group. Nintendo 3DS is a small platform easy to take anywhere.
<b>PC</b>	PCs are used to play many different types of games but their quality might not be as good as XBOX or PlayStation versions.
<b>MOBILE</b>	Mobile games are suitable to play for short periods. Users can play while waiting for a short time or during a break. It also can link with social media.

Table 3: Game analysis by system- Purpose

Type of game	Characteristics	Example
<b>Games for Health</b>	Develop game platforms for health care.	Skip a Beat Heart Rate, Gululu Interactive Water Bottle, Fiete Choice
<b>Games for Education</b>	Develop games platforms for education.	In between, Meltdown, Refugee Mario
<b>Social Game</b>	Most social games are played online and also require interaction between players. It also might be able to connect with a user's social network. Social games	Habbo, Royal Story, Happy Farm

	also can be played offline involving multiple players.	
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	how to deal with the markets' needs.	
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Table 4: Game analysis by system – Content

Content	Component describes	Reference
<b>Game Play</b>	Game play is about relevance to knowledge and skill transfer, as well as how engage, immerse and motivate through the game.	(Charles, et al, 2005)  (Lindley & Sennersten, 2008)
<b>Avatar portrayal</b>	Avatar representation is about the personalisation, appearance and behaviour of the character. The player may be able to modify their avatar by gender selection and features. Characters/avatars are selected by character gender such as asexual, androgynous, multi species, etc. The portrayal/avatar are customised by allowing the user to choose clothing and physical appearance such as formal, traditional, culture, western, eastern, etc. The behaviour of the avatar is usually determined by the avatar's role and personality trait. For example, male characters could be strange and female characters could be spies, etc.	(Jansz & Martis, 2007)  (Burgess, et al., 2007)  (Consalvo & Dutton, 2006)
<b>Gameworld graphics</b>	The graphics in a game, including the colour, shape etc. Different colours and shapes can show different emotions i.e. happy colours or sad faces can be depicted. The Gameworld is about the scenes or realistic graphics such as the showing of shadows or realistic characters.	(Klastrup, 2006)  (Squire, 2006)
<b>Sound / Music</b>	How sound and music are used in the game. Normally within a game a user can choose different sound effects or music. For example, players can choose their background music, such as classical, jazzy, pop, etc.	(Collins, 2008) (Hébert, et al., 2005)
<b>Storyline</b>	This is related to the story line which gives the game its meaning. It will give the game a purpose and help in the development of the game. For example, if the aim is to have a successful farm, the players will need to learn how to grow different type of vegetables or flowers and	(Eladhari & Lindley, 2004) (Crawford, 2003)

## 4. Game analysis

A subsection of games, which improve a user's health, education or social connections were analysed by their component parts and content. They were categorised by genre and platform, and their benefits to the user were described. The content analysis components were used to analyse the different games. All 10 games were analysed across each different elements: health, education and social. The games were analysed by the volume of sales, popularity, success and features. The game analysis was used to analyse the different purposes of the games, in order to find out which of these is suitable as the focus to create a game for this research.

### 4.1. Game analysis by category

The games chosen were focused on health, education and social interaction and were categorised by genre and platform. Genre and platform was analysed according to the categories in Table 1 and Table 2. The game analysis scores correspond to percentages (where 1=100%, 0.5= 50%, and 0=0%), according the game analysis methodology. Games for health tend to improve a user's physiological or psychological health. "*Pokemon Go*" concentrates on improving a user's physiological health. "*Sea Hero Quest*", "*Re-Mission*", and "*Win the White House*" train a user's brain or tell a story in order to help users understand how to deal with particular problems. Educational games can tell a story which influences a user's behaviour. A user's thinking can be influenced and knowledge about how to deal with certain problems can be passed on. For example, "*That Dragon, Cancer*" tells a story about how to look after children who have had cancer. "*Aviation Empire*" explains about how to run an airline. The game "*Backpacker*" explores how to tackle the problems faced when a person spends time travelling to different countries. Games can help social communication, and many games that were looked at encourage this behaviour. Board games are normally played with two or more players, which is very social within a small group. Online games spread the interaction with a large number of people; while it is not very easy to achieve, it will only improve as the technology matures.

Table 5: Game analysis by category

Name of Game	Health	Education	Social	Genre	Platform
Inside the Haiti Earthquake	0	1 This is a portrayal of a real story about the earthquake in Haiti.	0.5 This game is not linked to any social network, but there is multimedia content, including films and videos, which show the story's issues.	Simulation	Online
Win the White House	0.5 This game addresses questions on different issues, including global warming and education. Some issues also convey knowledge on health issues.	1 In this game, the user must run a successful presidential campaign. Throughout this process, important country and worldwide problems are highlighted to the user.	0.5 The game shows a leader board, which displays everyone's score, but there is no online community where people can share their ideas.	Adventure	Online
Cancer Game	0.5 The message this game aims to deliver is how to live well.	1 This game's levels are comprised of different body parts and show the user how to look after each organ	0	Adventure	Online
Ice Flows	0	1 This game delivers information on climate change.	0	Adventure	Online/ Tablet
SideKick Cycle	0	0.5 This game gives an insight into impoverished communities.	0.5 This game engages people to play the game, hoping to convince people to donate a bike to the cause.	Racing	Online/ Tablet
Eldue	0.5 This game shows the issues faced by people with mental problems.	1 This game gives greater understanding about the causes of depression.	0	Adventure	Online
Zombie Castaways	0	0.5 The game also shows how to build a village and learn to become human.	1 This game is linked with different social media.	Simulation	Online / Mobile / Tablet
Let the Cat in	0	0.5 This game helps people rethink the problems faced by stressed animals.	1 The game can be played on different platforms and is linked to social media. It allows competition with other players.	Puzzle	Online / Mobile / Tablet
Homeland Guantamos	0	1 This game is an advocate for human rights.	0.5 This game displays the offline community's events to the user.	Simulation	Online
Endgame: Eurasia	0	1 This game shows the story of the Syria war, as well as how to fight in the war.	1 A news game linked with the social media to explore the issues experienced by the people in Syria.	Simulation	Online / Mobile / Tablet
Sea Hero Quest	1 This game helps improve people's navigational skills.	0	0.5 Users can share their score on their social media account, but does not include its own community within the game.	Adventure	Mobile
That Dragon, Cancer	1 This game focuses on how to face the problems posed looking after a person who has cancer.	1 This game enables sharing experience with others about looking after a child who had cancer with others.	0	Adventure	Online / Tablet
ReachOut Orb	1 This game improves the user's psychological wellbeing.	1 Encourages students to be more positive and face difficult situations in their life.	0	Adventure	Online / Tablet
Re-Mission	1 This game gives a player a positive way to face their problems and fight cancer.	1 This game shows different types of cancer and the treatments used, along with its effect on the body.	0	Shooting	Online / Mobile
Fugue	1 During the game play, the player explores their personality and solves problems.	0.5 The game helps a user to explore themselves and express their thinking but does not teach them how to deal with problems they encounter.	0	Adventure	Online
Aviation Empire	0	1 The story is about KML and teaches a user how to manage their airline.	1 A user can share their usage statistics via social media and compare high scores with friends.	Strategy	Mobile
Pokemon Go	1 Engages with people, encouraging them to go out, walk around and visit new places.	0.5 It shows the stories and history of different places.	0.5 In this game, a player can compete with other players but there is no community within the game. In addition, it does not connect with a social media platform, unless a player prints their screen and posts it on their own social media to show the creatures that they have captured.	Adventure / Sport	Mobile
Backpacker	0	1 Shows the problems you might face when back-packing and how to deal with problems when you travel.	1 As a card game, a player needs at least one more player to join. During the game, the player needs to think about other people's strategies and work together or be independent.	Card game / Strategy	Card game

Name of Game	Health	Education	Social	Genre	Platform
<b>Cortex Challenge</b>	1 This is a brain training game.	0.5 This game helps train a player's brain but does not give strategies explaining how a player could improve their cognition.	1 In this game at least two players are needed. During the game, every player tries to answer questions in order to get points.	Card / Puzzle/Quiz	Card game
<b>Stressed Eric</b>	0.5 This game shows players about the effects of stress on the life of Eric.	1 This game explains to the user about stress, but does not offer advice about how a user could face stressful situations in their own life.	1 The game is for up to 2 players.	Board / Role Playing Game (RPG)	Board

\*1: Strongly agreed, 0.5: Partly agreed, 0: Disagreed

The percentages of agreed and disagreed replies regarding statements related to the health, education and social elements of the ten chosen games are presented in Table 6. The percentages of strongly agreed and partly agreed amongst the agreed replies are also shown. According to these figures, the majority of responses agree with the statements regarding these three elements. The highest percentage of agreements is with the education elements at 95% and the lowest with the health element at 55%. And, amongst the agreed responses, the one with the education element receives the highest percentage of strongly agreed at 68% whilst even the lowest figure with the social element stands at 54%. In other words, the results positively affirm the hypothesized framework formulated at the end of the previous stage of this research.

Table 6: Game analysis with percentages of agreed and disagreed, and percentages of strongly agreed and partly agreed amongst agreed

LIKERT SCALE	HEALTH	EDUCATION	SOCIAL	
<b>DISAGREED</b>	45%	5%	35%	
<b>AGREED</b>	55%	95%	65%	
Amongst AGREED	Partly agreed	40%	32%	46%
	Strongly agreed	60%	68%	54%

There are many games available that focus on a user's health and education. Some of these games also have a social aspect allowing a user to share their gaming experience with other users.

Of the sample of games chosen, half were aimed at the health market, which fell into three distinct categories: action games, which improve a user's health during game play; brain training games, which help improve a user's cognitive ability in some way; and informative titles that teach users how to prevent and fight certain diseases.

The data suggests that both online and board games can be educational. Table games seem to have a greater social aspect to them, probably partly due to the number of players that play a board game in one place. Most board games are played by two or more

players. Online games can be played with huge numbers of people: in a survey of more than 8,800 gamers conducted earlier this year, 72 percent of US respondents said they played games online, up from 67 percent last year (Statista, 2016). However, despite the increase of online games, the board game format seems to encourage social interaction to a greater extent. Some online games are focused on a social aspect such as "Happy Farm". In this game, a player can play anytime with other players and send online gifts to others. As Figure 2 shows, both genres of games (Brain and Action) delivered an educational message. This is not very surprising as all the games were chosen with an educational slant. The results also show that action games are less social than games that tax the brain. This may be due to the sample chosen, in which most of the action games chosen were online games, or it could be a feature of that type of game.

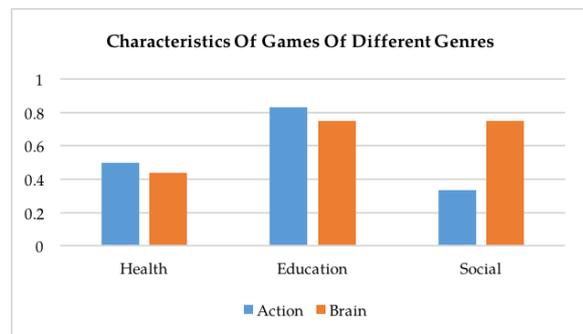


Figure 2: Characteristics of Games of different Genres

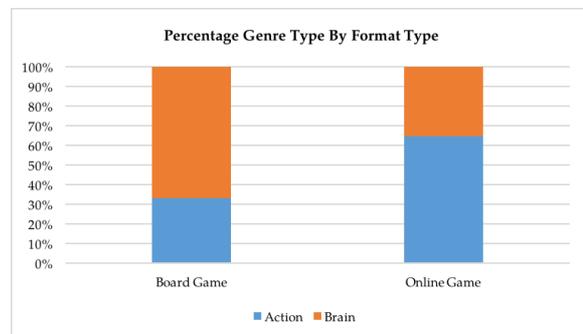


Figure 3: Percentage of Genre Type by Format Type

In fact, most video games (which include all online games) tend to be action games (see Figure 3). Is this fact the reason why most online games do not have a big social aspect, or are online games simply less sociable than their board game counterparts?

Board games seem to involve a user using their brain to a greater extent, whereas online games seem more likely to be action games, involving quick reaction speeds. Board games tax the user's brain to a greater extent. Strategy and teamwork is often involved in board games in order to win and hamper other players. Some brain games can involve quick reactions too, like "*Cortex Challenge*". Online games often require more practice to complete. In the game "*Eldue*", a user can start to understand how depressed people feel and practice how to get out of darkness using ice flows to control the snow and attempt to get stars; the user must practice repeating the same quick actions in order to complete the game.

## 5. Games for dementia carers

Through the educate, health and social elements, games for dementia carers help them to understand dementia itself and build up the positive relationship with their patients and peers. Health is the main component in games for dementia carers. Education games provide the knowledge of health issues to support carers. In this research, the games are analysed. The social element constitutes additional support. It is complex because it includes both the online and offline cases. The online ones attain its social functionality by linking the social media and social marketing to raising the awareness of dementia as well as facilitating the discussion and sharing of carers' experiences. The offline alternatives achieve this by being able to connect with the local communities. In summary, the ideal of the social element is connect with online and offline platforms.

### 5.1. Game system for dementia carers

As online technologies would be able to spread the message quickly, choosing the online platform to be able to link with actual communities would achieve more meaning for the game. From the game analysis, it is found that two types of genres are usable for dementia carers. These are:

- **Simulation:** by building up the actual world for players. It can depict actual situations to help people understand dementia. Simulation provides the reality of living with dementia. In the game,

player can gain experiences about the symptoms of dementia and feel what the patients may feel.

- **Adventure:** by using an adventure game to explore the real problems and solve them, thus helping dementia carers face them in real life.

In order to provide the knowledge of the health issue, the suitable game system for dementia carers should be able to bring awareness to the internal feelings of the patients as well as providing information on the best solution to deal with particular problems.

### 5.2. Game content for dementia carer

Games for dementia carers are for family carers as general players to understand dementia. The game content is focused on the health issues. Thus, the message conveyed by such a game is more important than entrainment.

The game content for dementia carers can be delivered in four sections including game play, game world graphics, sound and music and story line.

- **Game Play:** The health related knowledge and skill for dementia carers can be provided through game play, such as giving suggestion via messages to anyone supporting a dementia patient as a family carer.
- **Game World Graphics:** Game world Graphic can be used to help dementia carers connect with the game environment to real life, such as constructing a virtual environment to resemble the physical one to resonate with the players.
- **Sound and Music:** The game stories for dementia carer focus on the dementia patients' life and their feelings. These also help the carers share their experiences. Sound and music could be used to tell the stories of dementia patients and carers in their daily lives.
- **Storyline:** The games could provide knowledge about dementia and how to look after dementia patients, by creating the stories about the dementia situation.

### 5.3. Game purpose for dementia carer

The purpose of a game for dementia carers could be health, education or social. Through games for health, once players understand dementia, they will be able to live with dementia more positively and manage themselves better. Through games for education, the players receive education and information about dementia, receiving the knowledge about how to living with dementia. Games for social, on the other hand, can be used to link with more online network and local communities to increase community size,

and to engage people to discuss their problems and to help and support one another.

## 6. Conclusions

This paper discusses the games for exciting dementia patients and supporting dementia carers. Whilst games for dementia therapy focus on braining training, games can be as an education, health and social platform for supporting dementia carers. Games can have different purposes, such as health, education and social. Most of the analysed games focus on one of these purposes, but a few games have up to two purposes. The findings show that the games most valued by dementia carers are those that improves the carers' education, health and community connections. Games could be used to circulate more issues facing the players' own lives. Games could also be used to improve the relationship between dementia patients and their carers. The intervention could be a platform to educate people, as well as being a type of therapy to release their stress and negative emotions. The intervention could also help by increasing the size of a user's community, so the carer will experience less feelings of isolation and become better equipped to face the problems of looking after their family member.

The results of this research suggest that there are three interrelated elements of games for dementia carers, namely:

- Games for health for dementia, which provide a platform for the transfer of knowledge about dementia and how to look after dementia patients to improve their health behaviour.
- Games for education for dementia, which provide the platform with an education element to increase the dementia carer's knowledge and understanding of dementia itself.
- Social games, in which the social element is realised through raising awareness of dementia and allowing the player to discuss these issues. This is also achieved by fully supporting dementia carers' need to link with both an online social network and the local community.

The games for dementia carers should have a clear message, should be easy to play and should be suitable for a general public group. A game that relies too much on special effects will lose focus. Players could become confused and feel pressurised to get into the game. Below are some suggestions for game play, avatar portrayal, game world graphics and storyline for dementia carer users:

- Gameplay – Communicate a simple and clear message. Excessive messages create a negative effect.
- Avatar Portrayal – A simple avatar helps create an environment conducive to living well. Supply an environment that focuses on the person rather than the dementia.
- Game-world Graphics – Clear and simple visuals to help the player to remain focused on the game message.
- Storyline – The subject matter of the story could be normal day-to-day life. It could describe the symptoms of this specific issue. The player, given an understanding of the symptoms, will find ways to resolve it.

In general, there are elements to be aware of when designing a game for change, especially health issues. These are:

- Simple design – Ease of accessing and understanding the games. For example, 'Sea Hero Quest' uses simple design to build up the sea environment which is easy to read and retains interest in the game.
- Easy play – Suitable for the general public user. Easy play will help understanding of the game story. For instance, the Dysphagia Game is easy to play and understand, communicating information on Dysphagia issues.
- Provide information and message – Communicate the information and message in a suitable timeframe that raises awareness. Overloading information and message will make the player lose interest and focus as in 'Life in Spain'. The Cancer game communicates the message through the player playing the game. The player will understand the health behaviours during gameplay.
- One task in each level – Too many tasks will confuse the player. The player might be confused about what to do and lose interest. For example, 'Sea Hero Quest' has one task in each level so the player can easily follow the game.

## References

- [1] Alzheimer's Association (2013) "Alzheimer's disease facts and figures". Alzheimer's & Dementia, Vol. 9 (2), pp 1-71
- [2] Ang, C.S., Sitaraya, P. (2014, April 26-May 01) *Recreating living experiences from past memories through virtual world for people with dementia*. Proceedings of ACM. DOI: 10.1145/2556288.2557035.

- [3] Anthea, I. and Karen, H. (2014) 'Healing Arts Therapies and person-Centered Dementia Care'. London and New York: Jessica Kingsley.
- [4] Burgess, M.C.R., Stermer, S.P. & Burgess, S.R., 2007. Sex, lies, and video games: The portrayal of male and female characters on video game covers. *Sex Roles*, 57(5–6), pp.419–433.
- [5] Bluestein, A. (2013) "WILL DOCTORS SOON PRESCRIBE VIDEOGAMES?" [Online] [ Accessed on 10<sup>th</sup> October 2015] <http://www.fastcompany.com/3032606/innovation-agents/play-two-and-call-me-in-the-morning-inside-the-emerging-science-of-video-games>
- [6] Charles, D., Kerr, a & McNeill, M., 2005. Player-centred game design: Player modelling and adaptive digital games. ... of the *Digital Games ...*, 285(6), pp.285–298. Available at: <http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.97.735&rep=rep1&type=pdf> [http://www.researchgate.net/publication/228636408\\_Player-centred\\_game\\_design\\_Player\\_modelling\\_and\\_adaptive\\_digital\\_games/file/9fcfd514853cb27e1f.pdf](http://www.researchgate.net/publication/228636408_Player-centred_game_design_Player_modelling_and_adaptive_digital_games/file/9fcfd514853cb27e1f.pdf).
- [7] Camic, Paul, Springham, N. (2012) "Art Galleries, Episodic Memory and Verbal Fluency in Dementia: An Exploratory Study". *Psychology of aesthetics creativity and the arts*, Vol. 6 (3), pp 262-272. DOI: 10.1037/a0027499
- [8] Collins, K., 2008. *Game Sound: An Introduction to the History, Theory, and Practice of Video Game Music and Sound Design*.
- [9] Corner, A. & Randall, A., 2011. Selling climate change? The limitations of social marketing as a strategy for climate change public engagement. *Global Environmental Change*, 21(3), pp.1005–1014.
- [10] Consalvo, M. & Dutton, N., 2006. Game analysis: Developing a methodological toolkit for the qualitative study of games. *Game Studies*, 6(1).
- [11] Crawford, C., 2003. *Chris Crawford on Game Design*.
- [12] Eladhari, M.P. & Lindley, C.A., 2004. Story Construction and Expressive Agents in Virtual Game Worlds. In *Proceedings of the Other Players Conference*.
- [13] Hanna, R., Rohm, A. & Crittenden, V.L., 2011. We're all connected: The power of the social media ecosystem. *Business Horizons*, 54(3), pp.265–273.
- [14] Harding, J. (1995) 'Design for dementia: design guidelines: improving the quality of life of people with Alzheimer's disease in continuing care'. Manchester: Art for Health.
- [15] Hébert, S. et al., 2005. Physiological stress response to video-game playing: The contribution of built-in music. *Life Sciences*, 76(20), pp.2371–2380.
- [16] Hildmann, H. & Hirsch, B., 2008. Raising Awareness for Environmental Issues through Mobile Device Based Serious Games. *4th Microsoft Academic Days*.
- [17] Hoey, J., Mihailidis, A., Zutis, K. (2010, Oct 25-27) *A tool to promote prolonged engagement in art therapy: design and development from arts therapist requirements*. Proceedings of ACM. Vol.10, pp 211-218 DOI: 10.1145/1878803.1878841
- [18] Hughes, J. (2010) 'How we think about dementia: personhood, right, ethics, the arts and what they mean for care'. London: Jessica Kingsley.
- [19] Jansz, J. & Martis, R.G., 2007. The Lara phenomenon: Powerful female characters in video games. *Sex Roles*, 56(3–4), pp.141–148.
- [20] Klastrup, L., 2006. Death Matters: Understanding Gameworld Experiences. *City*, 4(3), p.29. Available at: <http://dl.acm.org/citation.cfm?id=1178823.1178859>.
- [21] Lindley, C. a. & Sennersten, C.C., 2008. Game Play Schemas: From Player Analysis to Adaptive Game Mechanics. *International Journal of Computer Games Technology*, 2008, pp.1–7.
- [22] Michailidou, E., Parmaxi, A. & Zaphiris, P., 2014a. Culture effects in online social support for older people: perceptions and experience. *Universal Access in the Information Society*, 14(2), pp.281–293.
- [23] Miller, H., Hughes, P., Westacott, M. (2006, Jun) *An investigation into the effectiveness of the arts therapies for adults with continuing mental health problems*. Psychotherapy Research. Vol.16 (1), pp 122-139 DOI: 1..1080/10503300500268342
- [24] Mulvenna, M., Nugent, C. (2012) 'Supporting People with Dementia Using Pervasive Health Technologies'. London: Springer.
- [25] Nice, 2012. *Dementia: Supporting people with dementia and their carers in health and social care*.
- [26] Novitzky, P., Smeaton, A., Chen, C., Irving, K., Jacquemard, T., O'Brolchain, F., O' Mathuna, D., Gordijn, B. (2012) "A Review of Contemporary Work on the Ethics of Ambient Assisted Living Technologies for People with Dementia". *Science and Engineering Ethics*, Vol. 21 (3), pp 707-765. DOI: 10.1007/s11948-014-9552-x
- [27] Robinson, L. et al., 2010. Primary care and dementia: 2. Long-term care at home: Psychosocial interventions, information provision, carer support and case management. *International Journal of Geriatric Psychiatry*, 25(7), pp.657–664.
- [28] Statistics (2016) "Genre breakdown of computer game sales in the United States in 2015." [Online] [Accessed on 07<sup>th</sup> October 2015] <https://www.statista.com/statistics/189660/breakdown-of-us-computer-game-sales-2009-by-genre/>
- [29] Squire, K., 2006. From Content to Context: Videogames as Designed Experience. *Educational Researcher*, 35(8), pp.19–29. Available at: <http://edr.sagepub.com/cgi/doi/10.3102/0013189X035008019>.
- [30] Takeuchi, A., Funaki, Y., Kaneko, M. and Kline, J. (2015, July). *An Experiment on Behavior, Learning, and Forgetfulness in Inductive Game Theory*. WINPEC: Tokyo. DOI:10.13140/RG.2.1.3938.
- [31] USA Today (2013) "The new study confirms one essential truth about the human brain: It never stops learning". [Online] [Accessed on 10<sup>th</sup> October 2015] <http://www.usatoday.com/story/news/nation/2013/09/04/video-games-brain-power-dementia/2762523/>
- [32] WHO (2015) "Dementia." [Online] [Accessed on 07<sup>th</sup> October 2015] <http://www.who.int/mediacentre/factsheets/fs362/en>