Creativity Support in Serious Games for Dementia Care

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ABSTRACT

This paper advocates the use of computer-based serious games as a form of creativity support tool. Whilst the use of serious games has grown considerably in recent years, support for players to think creatively is often implicit in the game, and does not exploit the wide range of creativity techniques and software tools available. This paper makes the case for explicit creativity support in serious games, explores how implicit creativity support can be delivered in game play, and extends one reported model of serious game play with activities in which players deploy different forms of supported creative thinking. The model is then applied to inform 2 versions of a serious game developed to train carers in creativity techniques to deliver more person-centered care to people with dementia. Each version of the game was delivered as a prototype to support playtesting of the game and its effect on carer training.

Author Keywords

Creativity; serious games; dementia care; problem solving; model; reflective learning; game-based learning; design; playtesting; storytelling.

ACM Classification Keywords

H.5.m Information interfaces and presentation: Miscellaneous; K.8.0 Personal computing: Games; K.3.1 Computers and education: Collaborative learning.

INTRODUCTION

Whilst different technologies have been developed to deliver creativity support to individuals and groups, there has been relatively little use of computer-based serious games to foster and support more effective creative problem solving. Computer-based serious games employ game mechanics to deliver social change and motivated learning rather than entertainment [25, 28], and interest in such game forms has increased significantly over the last 5 years. For example, Gartner [12] predicts that by 2015, more than 50% of organizations that manage innovation processes will have gamified those processes. Examples of domains for which serious games have been effectively delivered include defence, education, science, health care, city planning, engineering, religion, and politics. One typical such game is *FloodSim*, a flood prevention simulation game in which the player takes control of the United Kingdom's flood policies to protect its people and economy from flood damage [9].

Although many current serious games appear to have been designed to support creative exploration by users, most do not explicitly support creative problem solving using established creativity techniques [30] and software tools [37]. Most support for creative exploration is implicit in the design of the user experiences in *FloodSim* that encourage flow [1], self-organization [33] and fun [23]. An example of such a user experience is exploring the effect of different policies and spending on UK flood defences. However, different types of creativity technique could be added to this *FloodSim* game to encourage creative thinking about flood policies. For example, *assumption challenging* [30] could be used to explore whether to change population densities in different regions, and *analogical reasoning* [26] with defence tactics from the military world could seek to transfer these tactics creatively to protect areas in need of flood defence. We believe that this current gap creates a research opportunity – to integrate explicit forms of creativity support techniques and software tools into serious games to train people more effectively to be more creative in their work tasks.

To this end, our first integration of creative problem solving techniques seeks to develop and evaluate a serious game in the domain of dementia care. Dementia is a condition related to ageing with major consequences for health and social care provision. For example, there are current 750,000 people in the UK alone with dementia, a figure expected to double by 2050 [43]. Dementia care is often delivered in residential homes, and in the UK, two-thirds of all home residents have some form of dementia [e.g. 43]. Serious games have already emerged as an important means of training care staff in residential homes, for example as an immersive virtual care home in which trainee carers can experience, resolve and reflect on challenging situations in a virtual, and hence safe environment [31]. However, an emerging need for creative thinking in dementia care has arisen from the shift towards person-centred care [6] that recognizes the uniqueness of each resident. Care needs to be adapted to the individual resident, a form of activity that

requires occasional creative problem solving to produce novel and useful care [38] unique to the resident.

In the remainder of this paper, we report research to deliver serious games extended with explicit creativity support to train carers for people with dementia. In next 2 sections we summarize the roles of play in creativity and in games then extend an established model of serious game play with both implicit and explicit creativity support. The paper then describes 2 forms of a serious game developed to demonstrate and evaluate the model, and the playtesting undertaken to inform the redesign of the game and the model. The paper ends with current plans to evaluate the serious game in dementia care training, and future research directions.

SERIOUS GAMES FOR TRAINING, PLAY AND DEMENTIA CARE

There is increasing evidence that utilizing games to train and educate has been effective [1, 21, 22, 32]. These types of games are exploiting one of our most basic impulses - to play. Recent advances in mobile devices and social media are increasingly blurring the borders between work and leisure. Indeed, McGonigal [28] questioned how games can change how people act and think in their real lives, a challenge that triggered a wave of new games for personal and social change and creating positive impacts. One consequence has been widespread gamification resulting in many different types of serious games [39], for example to train marine staff [3], treat cockroach phobia [4], overcome negative emotions [40], manage large-scale investment resources [18], rediscover cultural heritage [14] and help cancer patients make decisions about their health [25].

One consequence of this trend is not to make games that are better and more immersive versions of reality, but to make the world a better and more immersive reality [28]. Games can be explicitly designed to improve our quality of life by providing opportunities to solve problems and intervene in social situations, and studies have revealed positive effects to acquire skillsets among diverse user groups [34, 36]. However, at this time, we are unaware of much research that has sought to introduce techniques to encourage creative thinking explicitly to support such problem solving and social interventions in computer-based serious games. Therefore, we sought to investigate a new approach to the design of serious gaming experiences – Creative Game-based Learning (CGBL). The approach seeks to deliver creative serious games that will enhance creative problem solving skills in players with learning objectives in various professional environments that require flexibility, self-organization and curiosity.

Playing in Serious Games

Harteveld's [16] design philosophy treats a serious game as a multi-objective problem in which trade-offs need to be made in a space defined by *play*, *meaning* and *reality* that a player must trade-off during a game. Encouraging players to rethink these trade-offs in engaging, non-repeatable and self-regenerating ways has been shown to encourage collaborative creative problem solving in game play. Indeed, the complex strategies and behaviors that a player can demonstrate from a simple set of rules [23] can enable effective learning, in contrast to games in which users simply play digitized versions of quizzes that do not lead to knowledge retention [24].

Of course, the rule sets that each game provides can still constraint creative thinking – perhaps the player generates a new idea or seeks to undertake a new behavior that the game's developer did not consider, and therefore cannot use or do. Indeed, in the online game *World of Warcraft*, there is an in-game term called *working as intended* to describe a game feature that has been overpowered by players who managed to develop new strategies that make the game work counter to what the developers intended [33]. New rule generation appears to be an important characteristic of creative serious games – one that is shifting games from simulation to interaction in order to create new combinations of rules and pervasive environments. If creativity can be incorporated into serious games, then it can allow players not only to immerse themselves in stories that make things meaningful [23], but also to create their own stories, ideas and reflection spaces [2, 5].

Creating Playfully

Play as a means of thinking creatively to generate outcomes that are both novel and useful has been recognized for many years. For example Jung [20] reports that the creative mind plays with the objects it loves, whilst Robinson [35] reports that creative solutions require both intellect and the play instinct. Indeed Katz [21] claims that games can support people to play with ideas, explore possibilities and break the usual patterns of thought, and established creativity techniques such as those reported in the *Creative Problem Solving* method [19] and *Thinkertoys* framework [30] already have elements of play, suggesting an appreciation of play in creative problem solving. We consider the integration of creative approaches to problem solving into pervasive games is a natural extension of play for creative thinking – one that can drive technology-led changes to the facilitation of creative thinking.

Serious Games for Dementia Care

Dementia is an age-related condition describing a collection of symptoms that include a decline in memory, reasoning and communication skills [10]. The symptoms tend to be progressive and are the result of changes to the brain, some of which have physical causes. People with dementia in economies where attaining great age has become the norm are increasingly cared for in residential homes by carers – typically busy women, often mothers and housewives who are not highly paid [17]. Training these carers in person-centered care practices and techniques to deliver care that is often adapted to each individual and hence new to carers

has become a major challenge for care sectors in these economies.

We have already delivered some forms of dementia care training using an immersive virtual care home as part of a serious game called *Think Better CARE*. This environment supports reflection about typical forms of challenging behaviour exhibited by residents [31]. A trainee carer can experience, resolve and reflect on different challenging situations in a virtual and hence safe environment. During a training session, carers use different modes of interaction to experience different challenging situations, and train carers to assess and make correct decisions at the speed needed in real challenging situations involving violent and anti-social behavior. It poses questions that generate a series of different care dilemmas in each virtual situation, then captures each carer response and the time taken to reach it. Trainee carers receive tutorial guidance from a virtual learning companion, called *Maria*, to reflect on the strengths, weaknesses and effectiveness of the care given to each individual, similar to the guidance provided by human trainers in dementia care. Rather than explore a well-defined space of learning outcomes, each carer learns by independent problem solving under the companion. Maria was designed to be a valuable and trustworthy colleague of the carers without authority over them, developing each carer's capabilities through constructive feedback. Initial evaluations of the environment in pilot residential homes have been positive, revealing that carers are able to navigate, interact with and engage with the it.

That said, the environment provided no explicit support for creative thinking in order to generate novel plans to manage challenging behavior and at best limited support for implicit creative problem solving in the form of game simulations that carers can run. Other research that we have undertaken has revealed the potential for creative thinking by carers to enhance person-centered care, for example using a mobile app to support different forms of the *other worlds* creativity technique in response to encountered challenging behaviors [26], During evaluations of the app use in residential homes, carers were both receptive to face-to-face training in creativity techniques and able to use the creativity support app to change resident care. Therefore, pulling these 2 threads together, we investigated how to extend computer-based serious games with different forms of creativity support to enhance carer training, both conceptually in the form of the CGBL model, and technically in the form of a new type of serious game to enhance training in person-centered dementia care. These 2 investigations are reported in the next 2 sections.

A MODEL OF CREATIVE GAME-BASED LEARNING

Several authors have developed descriptive models of user behavior during the play of serious games [15, 42, 44]. One such model from Garris *et al.* (2002) [11] reports that games should enable and allow the user to choose to enter them to accomplish a goal or overcome a problem, and introduce a model of user behavior accepted within the serious games research community. We selected this model as the baseline upon which to develop a new model of creative game-base learning (CGBL) by extending it with descriptions of goals and behavior associated with creative thinking.

The first stage in our development of the CGBL model was to analyze the characteristics of environments and climates common to both serious games and creative problem solving. We mapped established characteristics of climates that encourage creativity and innovation from the established *Creative Problem Solving* method [19] to characteristics of effective serious games reported in the serious games research literature discovered through selected keyword searches. The result was 6 characteristics shared by creative thinking and game play, each of which is summarized in turn.

Challenge

In a creative climate, the overcoming of challenges can guide people to find joy and meaningfulness in tasks, as well as inspire them to initiate more motivated involvement with their work. Likewise, in game play, a challenge is met when a learner "gets ample opportunity to operate within, but at the outer edge, of his or her resources, so that (...) things are felt as challenging but not 'undoable'" [13].

Freedom

In a creative climate, allowing and rewarding active learner control can directly influence the level of acquisition and sharing of information about the task, and subsequently new modes of methods emerge from the interaction. The concept of freedom in game play is closely related to personalization of navigating obstacles. If freedom is supported during play, "people genuinely feel they have something individual to them that they can shape" [7].

Trust and safety

In a creative climate, trust is connected with openness and emotional safety in relationships – it assumes that people have respect for one another and give credit where it is due. Similarly, one reason that serious game play is recognized as an effective learning tool is because it provides a space in which to explore hypotheses and to fail safely [28]. Any consequences remain safely within the training setting, thereby encouraging greater risk-taking and debate to question ideas in a positive context.

Humor and playfulness

This characteristic of a creative climate manifests itself through the spontaneity and ease of the people in it and the effect on their social, emotional and cognitive behavior in the climate. Likewise, humor has been used in game play for "smoothing and sustaining game mechanisms, enhancing communication, learning and social presence, making it richer and more fun" [8].

Idea support

In a positive creative climate, new ideas are treated attentively and professionally. A similar level of support for ideas is needed in serious games, because ideas need to be preserved for the assessment of learning outcomes and to respond to the learner's actions – "performance feedback should be presented in a way that minimizes the possibility of damage to one's self-esteem" [27]. Idea support can also be linked to concepts of reward in creative climates.

Persistence

In a supportive creative climate, there should be sufficient time available to people to generate and elaborate ideas over multiple sessions, i.e. their ideas need to persist in the space. This characteristic of persistence is also required in serious game play because "…with a persistent environment, when you go back in, it remembers where you were before: the assets and marks you created, your achievements; there is a kind of mirror image of the real world you can create for yourself" [7].

Other characteristics

Not all the reported characteristics of creative climates could be mapped to the reported characteristics of serious games, which revealed both game characteristics to exclude from creative serious games and new opportunities to introduce new characteristics into serious games through explicit creativity support. For example, one oft-reported game characteristic is the need to foster conflict and competition between players or between the player and the game. However, conflict and competition are undesirable characteristics of a creative climate, and hence were excluded from our model.

The emerging CGBL model

These common characteristics of creative environments and of serious games became the foundations of the new CGBL model, describing both the characteristics required of a serious game to encourage creative thinking and the user behavior needed to demonstrate creative thinking in game play. The model is being developed to be applicable to any serious game in which one or more players are expected to engage in creative problem solving and learning. Its purpose will be to provide domain-independent guidance for the design of such games, and is being developed concurrently with iterative playtesting of prototype games that instantiate model. In particular, the new CGBL model extends the original Garris [11] model with:

1. A required set of characteristics common to creative climates and serious game environments that can impact positively on and support both the process of play and the outcomes from it;
2. Clearer forms of implicit creativity support incorporated into the game's contents, environment and borders;
3. The implementation of explicit creativity support that directly engages the player in the use of one or more creativity techniques during the process of play;
4. A learning component within the process of play that differentiates serious from entertainment games;
5. A distinction between what each player generates in the form of ideas from playing a serious game, more related to the game contents, and the longer-term learning outcomes related to the creative thinking and other skills learned from the game play;
6. Explicit support for reflective learning after game play, as part of continuous learning from reflecting on past actions that individuals engage in to explore their experiences to form new understandings [5].

The current structure of the initial version of the model is shown in Figure 1. A player's experience with a creative serious game is divided into 2 basic activities – exercising judgment during game play, then – reflecting to learn after game play. Game play takes place in an environment that encourages and supports humor, idea support, trust and safety, persistence, freedom and playfulness. The game's content and environment are designed to encourage players to undertake certain types of creative thinking throughout the play process, for example to overcome challenges, but without the use of explicit tools and techniques for creative thinking. In contrast, explicit support for creative thinking is introduced periodically during the play process in order to train and support the players to think creatively in certain sub-processes using creativity techniques. In each discrete period of creative thinking, idea generation is followed with one or more periods of reflection about these new ideas to support idea learning and hence the persistence of these ideas. Reflective learning about new ideas is supported with techniques such as idea playback that we have already demonstrated to be effective in creative work in dementia care, albeit with mobile apps [26].

We plan that future versions of the descriptive model will be developed using iterative playtesting of prototype serious games that instantiate selected elements of the model and answer research questions, for example how characteristics such as challenge and humor impact on creative thinking during play and subsequent reflection about that creative thinking. However, we are currently in the model development phase. The next section describes 2 versions of one prototype creative serious game designed to encourage learning about creative thinking in order to individualize the care for older people with dementia. Feedback on each prototype collected during playtesting with groups of carers was used both to refine the model and redesign the next version of the prototype game.

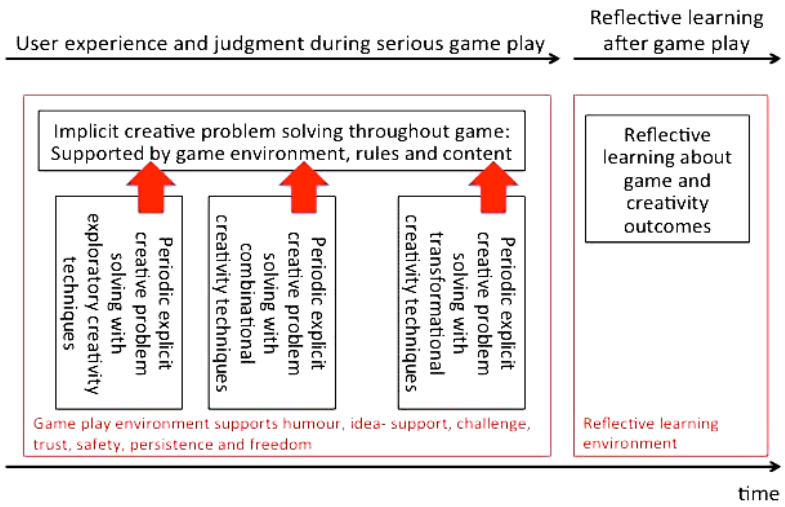

Figure 1 – The Creative Game-Based Learning (CGBL) model depicting the basic components of the model

DESIGNING AND PLAYTESTING A CREATIVE SERIOUS GAME FOR DEMENTIA CARE TRAINING

In order to determine which would be the most appropriate creativity techniques to implement within a creative serious game for dementia care training, one of the authors participated in a two-day training course for carers. During a role-play exercise, the aim of which was to equip future carers with information management skills, it was observed that carers were expected to demonstrate detective-like skills when reviewing fragments of evidence in order to diagnose the possible reasons for resident behaviors. These fragments of evidence were collected from personal care plans, observation notes, and statements from carers, residents and family members. Moreover, the carers were encouraged to create new resolutions to these exercises using problem-solving strategies. Our inference from the observations was that this problem solving would sometimes necessitate creative thinking.

The observations from these training exercises led to a new conception of a creative serious game that supports creative thinking implicitly though game content and environment, and explicitly through the provision of relevant creativity techniques. Good game design practice suggests that a game should be playtested as early and as often as possible in order to evaluate and refine its design [34]. Therefore, an early first playtest investigated whether the posing of detective-style mysteries as a game mechanic as a form of the *other worlds* creativity technique could be at all effective in training of dementia carers (Figure 2).

To this end we introduced a commercial detective board game called *221B Baker Street* based on the fictional adventures of Sherlock Holmes in Victorian London into a real-life carer training exercise, in which carers are put in the role of a care home manager who received anonymous safeguarding referral, with a task to investigate these allegations based on available evidence from life histories, carer notes and staff interviews. The game was played twice by 2 groups of 3 carers each, and an attendant researcher audio-recorded the game, took photographs and made written observations. The results revealed that the use of game was not effective as anticipated, in that both groups of carers were neither able to solve all of the detective mysteries in the game, nor were they able to transfer knowledge and skills from that other world to the dementia care training. The primary reasons identified included the game being too complicated for the carers to play and the semantic distance from it to dementia care being too great. It revealed the need to provide a simpler detective game that was semantically closer to the dementia care domain to facilitate knowledge transfer. In contrast, the playtest did reveal the importance of physical board game elements familiar to most people from childhood to foster communication, collaboration and play. Therefore a decision was made that future versions of the game should combine physical and digital elements of a board-like space and augmented digital spaces delivered using mobile computing devices within the pervasive gaming paradigm.

Using lessons learned from this first playtest, we decided to continue to provide implicit creativity support in the game using the *other worlds* creativity technique, in which carers play the game in a domain analogical to dementia care, but less constrained in order to support creative thinking. We modified the type of detective domain to be semantically closer to dementia care, and made the game simpler to play. The resulting new forms of the game were a mash-up of the commercial murder-mystery board game *Cluedo* and the virtual care home environment reported earlier. Players collaborate to make and justify their choices while solving a detective mystery using a detective-world ontology, the *Cluedo* storyline and borders such as collecting clues. Player judgment and behavior, game feedback, learning

lessons and implicit support for combining clues creativity were all elements of the game that are supported by the 6 characteristics common to creative climates and games identified in the CGBL model.

The explicit creativity techniques integrated in the game were designed to provoke players to explore the idea space, generate ideas about how to improve quality of life in a care home, then reflect on these ideas after game play as part of a reflective learning cycle. The game deploys adaptations of 3 established creativity techniques:

1. The *brainstorming* technique for exploratory creativity to support the generation of ideas about improving care in the residential home;
2. The *random combinations* technique [29] for combinational creativity to combine ideas generated by different people during the brainstorming;
3. The *excursion* technique [30] for transformational creativity to support the generation of ideas by viewing the world from different perspectives through role-play.

Moreover the game was designed to be a pervasive game, which turns the environment into a playable space that is controlled by the players rather than the technologies [2, 41]. As such, it was not restricted to the board or the computer, but involved spaces and objects in the environment in which the game is played, thereby connecting the playing of the game more closely to the care environment and the use of other training techniques in it.

Figure 2 - An early first playtest investigated whether the posing of detective-style mysteries as a game mechanic as a form of the *other worlds* creativity technique could be at all effective in dementia care training.

A paper prototype of the Hazel Court serious game

A first version of the game was named *Hazel Court*, the fictional name of a residential care home in which the game takes place. The objective of the game as implemented was to investigate the reasons for the unusual behaviour of 2 residents of *Hazel Court* – in this case of the playtest 2 residents called Mr and Mrs Black. The game was divided into 3 stages, and each stage was played sequentially.

In the first stage of the game, each player plays the role of a different character in the home and moves about the home investigating evidence. This part is played on the *Cluedo* board game – the characters are based on the game, for example *Miss Scarlet* and *Professor Plum* – and *Hazel Court* has the same two-dimensional layout as the country house described on the *Cluedo* board. The players move around this board from room to room and explore different options of a storyline initially composed of 8 possible scenarios, depending on their choices, guided by clues and character statements provided in physical envelopes. The game does not impose any right or wrong answers or assessment of the ideas generated by the players, and there is no time limit to the game, although each play was expected to last 30-40 minutes.

In the second stage of the game, all of the players were given a mini-game task in the physical space in which the game was being played. As a team they were prompted to engage with this environment by searching for physical objects represented by the types of weapon provided in the *Cluedo* game. This stage was used to explore carer reactions to an invitation to search and explore their own environments.

In the third stage of the game, the players were provided with *read-me* envelopes containing explicit guidance for combinational creativity and debrief questions in the format of the storyline. Using post-its and a flipchart, they were asked to brainstorm ideas from the point of view of their character in the story about how to improve care of Mr & Mrs Black using the clues and other information gathered during the game. Afterwards they were asked to reflect on situations when they considered their work to be detective-like, and to share these situations. Finally, to support knowledge and skills transfer from the game environment to their own work environment, they were requested to discover a Mr & Mrs Black in their own residential home.

A playtest of this paper-based version of the Hazel Court game took place at 2 care homes. There were a total of 4 playtests, each involving 3 carers (see Figure 3). The playtest was undertaken to explore the usability of the game's contents, the player experience, and the appropriateness of chosen explicit creativity techniques.

Overall, the playtesting was more successful than with the pre-design version reported in the previous section. Three of the 4 groups of players played all of the stages of the game, and all 4 groups generated new ideas from the process of play. The successful use of the board game reinforced the importance of physical elements of the game. Indeed, the tabletop nature of the game, with the game board, and paper elements provided horizontally on the table enhanced the user experience and encouraged collaboration and communication between the players.

Some of the players were unclear about the purpose of the second part of the game – the mini-task of searching for objects in the physical space – indicating a need to link both the objects and the searching for them more closely to the storyline of the game. The need for greater facilitation also emerged. For example, the combinational creativity task in the third part of the game was not effective without clearer, more integrated facilitation of the technique and explicit creativity prompts.

Figure 3 – Carers playtesting the Hazel Court paper prototype, showing use of the Cluedo board and paper clues. The iPad was only present to audio-record the game play

A first digital version of the Hazel Court serious game

Using results from the first playtest, we implemented a new first version of the game that combined digital and physical elements. The digital element is a HTML5 app optimized for use on internet-enabled iPad 2. The digital element was implemented to be equivalent to the board in a game. The original *Cluedo* board, character figures and cards can still be used as a map to support the storyline, but have no direct influence on the process of play. Other physical elements of the game included material required for recording generated ideas such as a flipchart, post-it notes, marker pens and a pair of dice to decide when consensus among players could not be reached. There were also 6 physical clues supporting the storyline hidden in the room in which training was held – in this version a postcard from the seaside, a doll, a car toy, computer headphones, a shawl and a music record. Otherwise, the game supported the content and game mechanics playtested in the paper-based prototype.

The game was designed to support 2-6 players and last for 30-45 minutes, but in this version a human game master was added to facilitate the game. The players again investigated the unusual behavior of the Blacks during the same 3-stage game as in the paper-based version. The digital app provides the players with instructions to play the game, introduces the Blacks as shown in Figure 4a, then describes the characters shown in Figure 4b for the players to role-play. These characters include Miss Scarlet as a less-experienced carer, Mrs Peacock as the head nurse and Mr Green is a fellow resident and Blacks' good friend. The players then enter the hall of Hazel Court where the game begins, as shown in Figure 4c.

Figure 4 – Different images from the Hazel Court serious game: (a) the introduction to Mr and Mrs Black; (b) player selection of each character to roll-play in the game, and: (c) the entrance hall in which the game begins

In the first stage of the game the players are invited to visit different rooms and meet the game characters. Each character reports different thoughts and reflections in audio form to the players and provides different clues about the Blacks' behavior – clues such as a driver's hat and fishing net. The characters also direct the players to other rooms to search for other clues. This exploration of the residential home and interactions with the characters continues for 3 rounds. The branching designed into this version of the game allows for 8 different ways for the game to unfold.

In the second stage of the game the game master informs the players that one character – Mrs Peacock – has asked them to find additional clues in the room in which the game play is taking place. The players search the room to find these additional clues. Afterwards, the digital app provides

a whiteboard showing all of the clues collected in the first and second stages of the game, as well as new statements from the characters in text form to enable their use during the third stage.

In the third stage of the game the players generate, combine and reflect on ideas to understand and address the unusual behavior of the Blacks under the guidance of the game master who ensure a playful, challenging and trustworthy climate in which ideas persist. The stage is divided into the following 4 sequential sub-stages:

1. The players decide whether each fragment of evidence about Mr and Mrs Black collected during the game is true, false, or undetermined;
2. The players seek to categorize and combine clues then brainstorm new means of handling Mr and Mrs Black – use of explicit creativity in the form of brainstorming and random combinations, as depicted in Figure 5;
3. The players reflect on occasions requiring detective-like work during their care activities and share them with the other players – explicit use of reflective learning;
4. The players are asked to return to their care activities and transfer the detective and creative problem solving skills applied to these activities, as depicted in Figure 6.

Each step of this stage is supported using physical materials such as flipcharts and post-it notes as well as the interactive whiteboard and its contents.

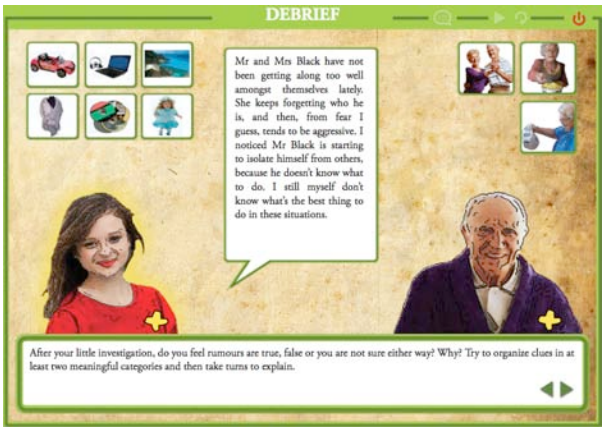

Figure 5 – The interactive whiteboard provides an overview of the clues players collected in the game, and a set of creativity triggers for random combinations and brainstorming.

At the time of writing, this digital version of the creative serious game is being playtested to ensure the usability of the digital app, the effective integration of the digital and physical elements of the game, and the correctness of the game contents in the dementia care domain. First evidence indicates that, in spite of the need for some improvements to the usability of the digital app, the game can support both creative problem solving and reflective learning by players. In the remainder of this paper we outline our plans for more playtesting with dementia care professionals, as well as our plans to evolve the CGBL model incrementally with the playtesting.

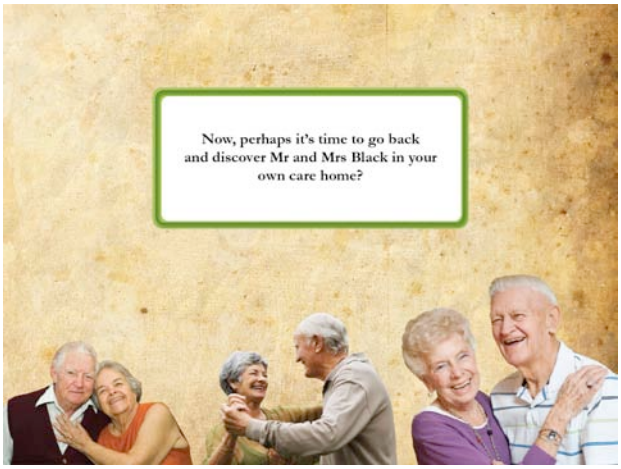

Figure 6 – End of the game as an explicit creativity trigger.

CONCLUSIONS AND FUTURE WORK

This paper has reported the first results of research to extend computer-based serious games with both implicit and explicit support for creative problem solving. A first version of a model to describe creative game-based learning has been developed from established models of serious game play and creative problem solving. This CGBL model will be developed and evaluated through regular playtesting and serious games that implement the model. To this end we have used the model to inform the development of a pervasive serious game that provides training in creative thinking in dementia care as part of the person-centered care approach [6]. Early playtesting of both a paper-based prototype of this game and a first partially digital version have demonstrated that the game can be effective, and that game play can provide important formative feedback with which to improve both the game and the CGBL model. Our longer-term vision for the model is to provide solid theoretical foundations with which to guide development of pervasive computer-based systems that support interleaved creativity and learning, using different combinations of implicit and explicit creativity support to achieve different learning outcomes.

After the current round of playtesting, we will deploy the revised digital version of the Hazel Court serious game in residential homes to support the training of person-centered care through creative thinking. This deployment will be in 2 stages. In first stage the serious game will be playtested on its own in a professional care training workshop setting in residential home facilities such as the staff meeting room. There will be 4-6 separate playtests with 3 carers in each, and our focus will be on the creativity-related learning outcomes that include the perceived novelty and utility of the ideas in that residential home generated by the players and the detective and creative thinking skills learned and

transferred by the carers to their care practices. Expert peer review will be used as a method to determine the novelty and usefulness of the ideas generated. In the second stage, we will deploy the serious game as part of a wider strategy to deliver creative thinking for more person-centered care into one or more residential homes over a 5-month period. This strategy will be implemented in 3 phases that will seek to: (i) prepare the climate of each residential home so that it support and encourage creative thinking by carers; (ii) train care staff in creative thinking techniques and related climate characteristics; (iii) deliver a set of creativity support apps that enable the carers to use the creative techniques more effectively with software support. The Hazel Court serious game will be deployed in phase ii) as part of training carers in the use of creative thinking and creativity techniques. To do this we will need to expand Hazel Court with more storylines and branches.

The emerging focus on pervasive environments for creative serious game play has revealed another research direction, which is the use of other computing technologies to support the digital elements of the serious game. Whilst the current app is optimized for the iPad, the role of the board in a board game to foster play communication and collaboration suggests that the digital component can also be delivered effectively through technologies such as digital tabletops. Therefore, in parallel to the playtesting of the game in the residential homes, we will investigate new affordances that arise from playing the game on different forms of digital tabletop, from top-down displays onto non-interactive surfaces to touchscreen tables such as the Microsoft Surface. If these investigations are successful, we will expand the current research to exploit new forms of digital interactions within creative serious game play.

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