Snow White is Missing: An Interactive Locative Story For Dementia Patients

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Abstract. With the increasing prevalence of powerful mobile technology, interactive entertainment is also becoming increasingly mobile. This can also be said for a range of applications including those pertaining to mental and physical health which are also looking to take advantage of the increase in mobile technology to create digital interventions and other treatment based software for mobile devices that can benefit from the mobile deliver form. In this paper we propose a new form of serious game in this vein: therapeutic locative interactive fiction. These are interactive story experiences, read while on the move, that respond to the readers environment and location context, and have therapeutic value. The locative nature of these stories enables therapeutic activities connected with out door spaces, and allows for content to enrich users, the readers of locational context. We present a demonstration of this concept through our own therapeutic locative interactive narrative: Snow White is Missing, and detail both its design from an interactive narrative and therapeutic activity perspectives.

Keywords: Locative Narrative, Interactive Storytelling, Dementia

1   Introduction

Location Aware Narrative (LAN) promises an entertainment experience that contextually adapts to the users' environment [14]. This might mean asking them to travel to particular locations to view particular content, changing content to include the users surroundings, or a thematic pairing between the users' surroundings and the story. This can be used to enrich the users' experience of the surroundings through virtual tour guides, or fictional works unlocking local history, or enrich the content through games that involve physically travelling to relevant locations. As mobile technology with location sensors, particularly smartphones, becomes more prevalent this form of entertainment reaches a broader audience. A similar trend can be observed in digital Behaviour Change Interventions (dBCIs) [15]. These are programs of activities and supporting materials constructed by behaviour change scientists to elicit positive behaviour change in participants such as losing weight or stopping smoking. While the move to a digital platform enables a great degree of personalisation [16], the move to mobile dBCIs enables context awareness and more timely interaction with the intervention [13].

In this paper we propose Therapeutic Locative Interactive Fiction (TLIF): a locative story which enhances its experience by taking the reader to particular locations while also providing the therapeutic advantages of a mobile dBCI. We present an example of this in '*Snow White is Missing*' - a TLIF built using the StoryPlaces system [8] designed to be therapeutic for dementia patients. At present, over 46 million people live with dementia globally and this is predicted to rise to 131.5 million by 2050 [22]. Unsurprisingly this has resulted in a global focus on dementia, with the World Health Organisation identifying the condition as a priority area that needs to be addressed in the future health agenda. Our intervention is an interactive story that is designed to be read alongside a younger friend or family member, featuring a number of activities the readers can complete while physically moving to different locations set in Poole Park, Bournemouth, UK. This TLIF is a product of co-design between experts both in dementia from the department of psychology, and interactive fiction and game design from the department of creative technology, both from Bournemouth University.

The main contribution of this paper is the concept of TLIFs, including a completed example in '*Snow White is Missing*', the co-designed structure and content of which we detail along with the therapeutic benefits of this approach in the context of contemporary literature in this area.

2   Background

2.1   Location Aware Narrative

Early examples of location-based narrative systems were often tour guides, for example the HIPS system [3] which connected location aware software to a knowledge base of information in order to generate personalised information pages based on current location. In more recent examples the focus has moved to the experience itself, often through the use of more evocative stories, such as location sensitive historical plays or tapestries of personal stories connected to space to build up a cultural picture [18]. Educational tools such as 'Gaius' Day in Egnathia' [1] push the interactive elements of this kind of storytelling by giving participants goals. In the case of 'Gaius' Day' this is in the form of exploration targets that they must identify by collecting location-based clues. The Chawton House project [23] also supports an educational experience, but in Chawton the activities themselves are non-digital, encouraging the participants to perform short creative exercises. A summary of this field should also include more entertainment focused and artist works such as location aware games and fiction. From the games sector works include 'Viking Ghost Hunt' [17] where players hunt down the ghosts of Dublin using an augmented reality system, or 'University of Death' [4] a hybrid reality system that requires its players to adopt specific roles and behaviours and utilise real world props and clues alongside digital information. In contrast, works of location aware fiction such as 'San Servolo, travel into the memory of an island' sometimes have more complex rules, based not just on location but other contextual factors such as weather

and reader's history [21]. Location-based interactive fictions are comparable to 'Walking Sims', games where readers explore virtual spaces and interact with objects triggering narrative sequences, San Servolo even echoes the first popular example 'Dear Esther' which also takes place on an island [20].

2.2 Dementia Care and Intervention

'Dementia' is often used to describe a group of clinical syndromes [12]. These are associated with increasing age and are characterised by a progressive decline in cognition of sufficient severity to interfere with social and/or occupational functioning and may include other symptoms such as language and navigational difficulties, deterioration in the ability to perform activities of daily living and behaviour changes [10].

Although the global focus remains firmly on 'cure rather than care' [24], there is a growing recognition that without a silver bullet cure, more needs to be done to support people to live well with dementia. As such, a key aspect of the UKs current dementia policy directive has focused on promoting the social inclusion of people with dementia particularly those living in the community, where around two thirds of people diagnosed with the condition reside [7]. This involves using nonpharmacological or 'ecopsychosocial' initiatives to raise awareness of dementia and tackle the stigma and discrimination associated with the condition, as well as provide opportunities for people living with dementia to engage in activities that promote learning and personal growth and ensure they can continue to contribute economically, socially, culturally and politically [9].

Research has supported this policy agenda and demonstrated that enabling social inclusion through community activities, can promote physical, mental and social benefits, as well as address important psychological needs for people with dementia [19]. It provides them with opportunities to retain autonomy and identity, and experience pleasure, enjoyment, social connection, belonging and growth [5]. This is particularly the case for outdoor activities that enable connection with the natural environment [6]. Despite this focus, research has shown people with dementia still struggle to uphold their social inclusion. For instance, Innes et al. [11] found community-dwelling people with dementia faced difficulties when accessing leisure activities and spaces in Dorset, UK. This was attributed in part to the potential psychological stress people with dementia might incur if they became lost or encountered people who were misinformed or intolerant of their condition. This demonstrates the importance for further research that facilitates the social inclusion of community-dwelling people with dementia and offers them opportunities to engage in new activities that promote learning and personal growth as well as socially connect with their local environment and others who reside there.
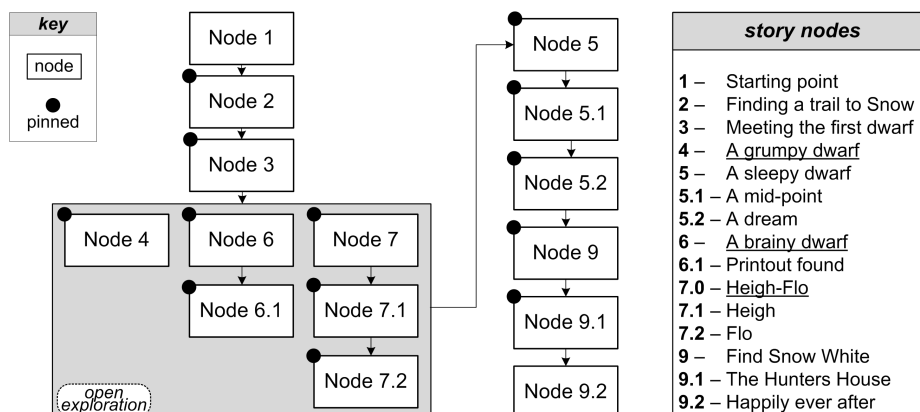
3   Snow White Is Missing!

Snow White Is Missing is a TLIF designed to be therapeutic for those suffering dementia. It is designed to be experienced as a pair: a dementia sufferer and a young family member. The story has been written for a younger target audience, to engage the younger reader whilst providing an entertaining outdoors activity for the individual affected by dementia to enjoy for 1-2 hours. The TLIF helps to both raise awareness and understanding of dementia, as well as providing a focus for someone affected by it to leave their home and spend time with others.

Our hypothesis is that such locative narrative technology may provide a means to support social inclusion by enabling people living with the dementia condition to overcome some of the challenges they encounter. Research in this rapidly developing field has challenged the assumption that people with dementia are disinterested or incapable of using modern technology, as well as demonstrated how it can support the social inclusion of this population [2]. TLIFs therefore have the potential to offer an innovative and interesting activity that can both facilitate social inclusion amongst community-dwelling people with dementia and promote mental, physical and social well-being.

In *Snow White Is Missing* TLIF, GPS technology is integrated to support safer walking for people with dementia by reducing their navigational difficulties and so decreasing their fear of getting lost, and so encourage people with dementia to re-engage with their local environment. The proposed technological device, therefore, has the potential to offer an interesting activity that can both facilitate social inclusion amongst community-dwelling people with dementia and promote mental, physical and social well-being. The interactive story can provide a fun method for people with dementia to socially connect with their younger relatives and care partners, while the process of engaging with the activity may offer important mental and physical stimulation as well as an opportunity to learn something new.

3.1   The Story

The story is designed with dementia patients and young children as intended readers, specifically, it needs to have simple and easy-to-follow narrative and understandable vocabulary. Given these pertinent pre-conditions for our story, *Snow White Is Missing* leverages an existing story which the users both older and younger generations can more easily identify with and relate to. Being locative aware narrative, the setting should be as relevant to the story as possible, while being easily accessible to people with dementia. This includes but is not limited to facilities such as places to rest, café/restaurant, ease of parking and lavatories. We highlighted various potential venues in Bournemouth and surrounding areas, and settled upon Poole Park as it met all criteria, and also included facilities for children such as play areas, while also being large enough to facilitate a reasonably-sized location aware narrative without difficulty to navigate. The next stage was to explore the location, retrieve photographs and their accompa-

Fig. 1. Story nodes from *Snow White Is Missing.*

nying GPS co-ordinates for generating narrative nodes, whilst noting potential 'problem-spots' for those of limited mobility or navigation.

The story of Snow White featuring multiple dwarves led to the design of multiple narrative arcs (about each dwarf) that the reader could explore in any order. Given the scenario, each dwarf was designed to subtly refer to issues that people with dementia generally encounter after diagnosis: a dwarf that is intelligent but frequently forgetful; a dwarf that intends to help but is always too physically tired to do so; a dwarf who is angry for always being labelled as angry; and a pair of dwarves in which one means well, but ultimately causes the other to depend on him too much, to the point of losing independence. The story nodes can be read and reached in any order, affording the reader an indirect feeling of choice (albeit control). The nodes are positioned in such a way that present an easily recognisable optimal route on the map for participants to follow.

Structurally we can describe our story in terms of the CDP model [14] as a hybrid of the form Canyon-Plain-Canyon, this is due to its open exploration element sandwiched between two linear stretches as shown in figure 1. This is a common structure within interactive fiction where the author retains narrative control over the beginning and end but allows for immersive agency in-between in the manner of a foldback pattern [8].

3.2   The Accompanying Activities

A key focus of the story was to raise awareness and understanding of dementia, and the problems they encounter. The intention was for readers with dementia to be accompanied by children; either their own or grandchildren. To retain attentiveness of the children, as well as to promote interaction between the readers, we included activities for them to complete as they explore the story. These activities were made explicit to the readers as part of the narrative, and designed alongside the story. The activities could be completed with or without the ac-

tivity booklet, whilst promoted interaction between the person with dementia and the younger person. For instance, the activities were to list unique qualities about one another or taking a souvenir photograph.
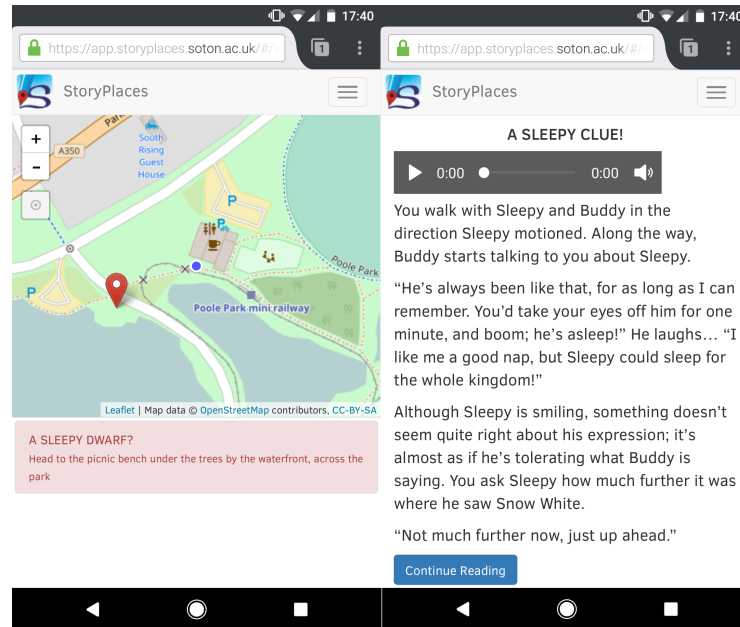

Fig. 2. Screenshots of Snow White Is Missing! as rendered by StoryPlaces

3.3   Implementation and StoryPlaces

We have implemented *Snow White Is Missing* using the StoryPlaces system [8] as a general location aware narrative platform that is able to support the delivery of content paired to locations - all as a web application. The TLIF itself is constructed as a StoryPlaces story and then uploaded to the server where it is available to read on smartphones browsers as depicted in figure 2. Our co-design approach for this story between our experts from both game design and psychology underwent a four stage process:

1. **Concept**: initially experts from both game design and psychology met to share their own approach to content design for a TLIF, and a number of candidate locations and themes for the story were reviewed.
2. **Structure and Activity Design**: regular meetings were held to discuss both the location and story structure of the TLIF and its activities. Game design experts provided advice on engaging structures, while advice from a psychology expert was used for creating effective activities.

3. **Writing**: following the structure and activity design our writer prepared a script for the story that included the required locations and activities. This was reviewed over several meetings between experts from both game design and psychology from both perspectives.
4. **Implementation**: finally the agreed story was codified for StoryPlaces to deliver the TLIF, audio recordings were made for the text on every page, and photographs to illustrate the story were taken.

4 Conclusions and Future Work

In this paper we have proposed TLIF - Therapeutic Locative Interactive Fiction - as a serious application of interactive entertainment for health. We presented an example of this, *Snow White is Missing*, implemented within the StoryPlaces framework as an example of how the TLIF concept might be applied. The story makes use of a number of techniques to both take advantage of its delivery form and deliver effective intervention. Tailoring content to the users surroundings provides additional context to the intervention, both giving motivation to travel to these places and to use the setting to provide thematic backing to the story itself. The use of real world activities in this particular story also bring this in line with the work on mixed reality games, as part of the motivation for our work is to increase time spent together between the dementia patient and a friend/relative this mixed reality approach with real world interaction allows us to encourage this without the use of digital interaction which may be less effective as well as increasing development cost.

While this work has served to propose and prototype the TLIF concept future work points in two directions. First is an exploration of the efficacy of TLIFs as treatment, which would require user evaluation, possibly using a larger or greater variety of stories to explore the impact of this application. Secondly, if the efficacy of the approach is shown to be positive work would need to be done to explore design guidelines for TLIFs to better enable others to be created.

References

1. Ardito, C., Buono, P., Costabile, M., Lanzilotti, R., Pederson, T.: Mobile games to foster the learning of history at archaeological sites. Visual Languages and Human-Centric Computing (2007)
2. Bowes, A., Dawson, A., McCabe, L.: Remodem: Delivering support for people with dementia in remote areas. Dementia 1471301216643848 (2016)
3. Broadbent, J., Marti, P.: Location aware mobile interactive guides: usability issues. In: Proceedings of the Fourth International Conference on Hypermedia and Interactivity in Museums. pp. 162–172 (1997)
4. Bunting, B., Hughes, J., Hetland, T.: The player as author: Exploring the effects of mobile gaming and the location-aware interface on storytelling. Future Internet 4(1), 142–160 (2012)
5. Fortune, D., Mckeown, J.: Sharing the journey: Exploring a social leisure program for persons with dementia and their spouses. Leisure Sciences pp. 1–15 (2016)

6. Gilliard, J., Marshall, M.: Transforming the Quality of Life for People with Dementia Through Contact with the Natural World. : Fresh Air on My Face: : Jessica Kingsley, London (2012)
7. Green, G., Lakey, L.: Building dementia-friendly communities: A priority for everyone. London: Alzheimers Society (2013)
8. Hargood, C., Hunt, V., Weal, M., Millard, D.E.: Patterns of sculptural hypertext in location based narratives. In: Proceedings of the 27th ACM Conference on Hypertext and Social Media. ACM, New York, NY, USA (2016)
9. Hicks, B.: Exploring the use of a commercial digital gaming Technological Initiative to enable social inclusion for community-dwelling older men with dementia in rural England. Ph.D. thesis, Bournemouth University (2016)
10. Innes, A., Manthorpe, J.: Developing theoretical understandings of dementia and their application to dementia care policy in the uk. Dementia 12(6), 682–696 (2013)
11. Innes, A., Page, S.J., Cutler, C.: Barriers to leisure participation for people with dementia and their carers: An exploratory analysis of carer and people with dementia's experiences. Dementia (2015)
12. Kitwood, T.: Dementia reconsidered: The person comes first. Open University Press, Buckingham (1997)
13. Lathia, N., Pejovic, V., Rachuri, K., Mascolo, C., Musolesi, M., Rentfrow, P.J.: Smartphones for Large-Scale Behaviour Change Intervention. IEEE Pervasive Computing 12(3), 66–73 (2013)
14. Millard, D.E., Hargood, C., Jewell, M.O., Weal, M.J.: Canyons, deltas and plains: Towards a unified sculptural model of location-based hypertext. In: Proceedings of the 24th ACM Conference on Hypertext and Social Media (2013)
15. Morrison, L.G., Hargood, C., Pejovic, V., Geraghty, A.W., Lloyd, S., Goodman, N., Michaelides, D.T., Weston, A., Musolesi, M., Weal, M.J., et al.: The effect of timing and frequency of push notifications on usage of a smartphone-based stress management intervention: An exploratory trial. PloS one 12(1), e0169162 (2017)
16. Nahum-Shani, I., Smith, S.N., Tewari, A., Witkiewitz, K., Collins, L.M., Spring, B., Murphy, S.: Just in time adaptive interventions (jitais): An organizing framework for ongoing health behavior support. Methodology Center technical report (2014)
17. Naliuka, K., Carrigy, T., Paterson, N., Haahr, M.: A narrative architecture for story-driven location-based mobile games. In: New Horizons in Web-Based Learning. pp. 11–20. Springer (2010)
18. Nisi, V., Oakley, I., Haahr, M.: Location-aware multimedia stories: turning spaces into places. Universidade Cátolica Portuguesa pp. 72–93 (2008)
19. Nyman, S.R., Szymczynska, P.: Meaningful activities for improving the wellbeing of people with dementia: beyond mere pleasure to meeting fundamental psychological needs. Perspectives in public health 136(2), 99–107 (2016)
20. Pinchbeck, D.: Dear esther: an interactive ghost story built using the source engine. In: Joint International Conference on Interactive Digital Storytelling (2008)
21. Pittarello, F.: Designing a context-aware architecture for emotionally engaging mobile storytelling. IFIP Conference on Human-Computer Interaction (2011)
22. Prince, M.J.: World Alzheimer Report 2015: the global impact of dementia: an analysis of prevalence, incidence, cost and trends (2015)
23. Weal, M., Cruickshank, D., Michaelides, D., Millard, D., Roure, D., Howland, K., Fitzpatrick, G.: A card based metaphor for organising pervasive educational experiences. In: Pervasive Computing and Communications Workshops (2007)
24. Whitehouse, P.J.: The end of alzheimer's disease - "from biochemical pharmacology to ecopsychosociology: A personal perspective. Biochemical pharmacology (2014)