myView: End-user Authoring of Virtual Environments for Therapy

Sérgio Alves
sfalves@fc.ul.pt
LASIGE, Faculdade de Ciências, Universidade de Lisboa
Lisbon, Portugal

Pedro Caldeira
pedrocaldeira91@gmail.com
LASIGE, Faculdade de Ciências, Universidade de Lisboa
Lisbon, Portugal

Filipa Brito
filipa.brito@campus.ul.pt
ISAMB, Faculdade de Medicina, Universidade de Lisboa
Lisbon, Portugal

Luís Carriço
lmc@di.fc.ul.pt
LASIGE, Faculdade de Ciências, Universidade de Lisboa
Lisbon, Portugal

Tiago Guerreiro
tjvg@di.fc.ul.pt
LASIGE, Faculdade de Ciências, Universidade de Lisboa
Lisbon, Portugal

ABSTRACT

Virtual environments for therapy are scarce and lack personalization. The creation of these environments is done by specialists, is time-consuming, and expensive. We present a smartphone tool that allows non-specialists to create navigable virtual environments by taking and linking sequences of panoramic photo spheres, analogly to Google Street View. Editing the environments is then possible in a web platform, myView, where text, images, videos, sounds, and pick-up objects can be added. myView allows users to navigate their environments as well as sharing those environments with others. In a preliminary study with two psychologists, where myView was used as an elicitation probe, the approach was found to be useful for creating meaningful activities for reminiscence and cognitive training. The platform showed to be promising in the democratization of the crafting of virtual environments.

CCS CONCEPTS

• **Human-centered computing** → **User studies**.

KEYWORDS

Virtual Environments, End-user Authoring, Therapy.

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1 INTRODUCTION

Virtual reality (VR), both immersive and non-immersive, have been used in therapeutical contexts (e.g., rehabilitation or management of dementia [4, 6, 11, 17, 18], mild cognitive impairment (MCI) [5, 19], traumatic brain injury (TBI) [16] or stroke [9]) as a way to immerse the person in a clinically-significant environment or context. The type of environments brought to VR is diverse (e.g., museums [1], apartments [7, 17], libraries [16], pubs [1], gardens [1, 14, 18], pharmacies [7] or grocery stores [5, 7, 9, 15]), and part of these enriched by developers with tasks or information points (e.g., find a path [13], pick up items [3, 5, 7, 19], or click on an item for details [1, 15]). The use of tasks is seen by users as a way to improve the environments [14] and by neuropsychologists as a way to increase adherence and motivate participants to stick with a training program [10, 12].

The use of images of real-world scenarios results in highly visual realistic environments, in an increased sense of presence [2] and may increase the likelihood of transfer the skills learned in training to everyday life [8]. Unfortunately, there are few works able to use realistic environments [1, 5]. The creation of these environments is time- and human-resource consuming and beyond the reach of a non-technical user. Exceptions are the usage of mainstream applications and games and the occasional VR touring experience. In all those cases, there is no opportunity to create an interactive VR experience tailored to a specific therapeutical context or person [5].

We present myView, a system that allows non-technical users to create personalized and enriched virtual environments (VEs): 1) a mobile application guides the users in the creation of a photo-based virtual environment (Figure 1); 2) in a web application (Figure 2), VEs can then be edited and enriched with goals, graphical, audio and textual elements, and triggers; 3) the environment can be navigated (in an immersive or non-immersive way), tagged, and shared. Results from a preliminary study where two psychologists were engaged in the creation and navigation of VEs, suggest that the use of personalized VEs is feasible and a promising approach for reminiscence and cognitive training contexts. The participants also revealed a variety of different environments and enrichment options that may be particularly relevant to create future interactive personalized environments.

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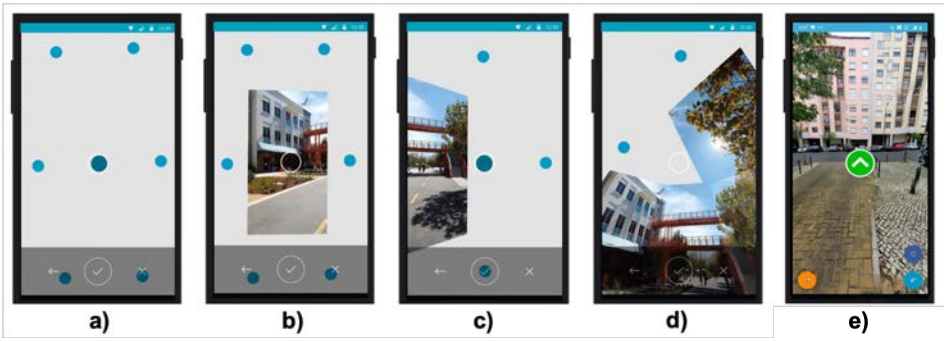

Figure 1: To capture a 360º photo: a) point the center of the screen over one of the various existing circles, keeping the smartphone fixed until the captured photograph appears; and b), c) and d) repeat this process until there are no more circles or users are satisfied (users may capture only the parts that they want, i.e. they can ignore the back part or the ceiling). After taking a photo sphere, e) the users are able to select all positions where new photo spheres will be linked.

2 DEMOCRATIZING VIRTUAL ENVIRONMENTS

The creation of interactive VEs is exclusive. Our goal is to democratize the creation of these. To do so, we mimicked the approach of stitching 360º photo spheres, already common in systems like Google Street View.

Crafting Virtual Environments. We built a mobile application that guides non-technical users in the authoring process. To create a new environment, users start by taking a 360º photo (Figure 1). Then, they can select, in the collected image, all possible paths by touching the section on the image where they want to take their photos next. They select the path they want to explore next and the others are left on hold. Users can go back to unfinished areas, and continue from there, until they complete their VE. The possibility of defining paths is what differentiates our solution from systems like Google Street View. The environments belong to their creator and can be managed in the mobile application. The mobile application was built on top of an improved version of the open-source photo-spheres generation library *spherelib*[1] and the captured locations are organized as a graph.

Enriching Virtual Environments. We developed a web application, called myView, where the users can see, explore, and edit their environments. The users can edit each photo sphere, and individual photo within, by adding text labels, images, videos, or, for the most tech-savvy, pieces of HTML code (Figure 2). Any of these elements can then be associated with events: they can change on proximity, react to "touch", and they can be picked. Our goal was to allow people to add elements to the environment particularly to create tasks and goals in their navigation sessions, approximating the experience as a gaming one and training different cognitive functions.

The users can navigate in the environment by dragging a finger (or the mouse) across the screen to move the view from one side to another and by clicking in an arrow (displayed in the exact position where the users want to walk to) to change the photo. The visualization of the environment is supported by the *Photo Sphere Viewer*[2] library and is optimized for tablets. myView is also adapted to provide an immersive navigation using Google Cardboard, in which case the users need to press a key to interact with certain items (e.g., navigation arrows).

Sharing Virtual Environments. We included sharing mechanisms in our platform: users may decide to make their environments publicly available, and to be notified when they are used by others. Private copies can be created, each of them enriched differently, and shared as is (others may adapt or complete already enriched environments).

3 INTERVIEWS WITH PSYCHOLOGISTS

We conducted a preliminary study with two psychologists (P1 and P2) consisting in: 1) a short semi-structured interview about their current practices; 2) an interactive demo to create, edit and navigate a VE; and 3) an elicitation session where participants were invited to create and enrich an environment. Each session took about 40 minutes. We wanted to understand the perceived utility, benefits and limitations of the approach, as well as the variety of environments and tasks psychologists envision; if non-technical users can use the system; and overall, how the therapy could benefit from end-user authoring of virtual environments.

Both psychologists work with people with dementia and advocate the use of personalized materials in therapy. P1 always tries to adapt the contents of the session to her patients and regularly uses Google Maps to navigate in patients' familiar environments: *"They really enjoy street view"*. P2 never used any type of virtual environments in therapy.

The possibility of using personalized environments was pointed out as an improvement to their sessions. P1 highlighted that *"I can do this [the environment] with the person's room or the kitchen"*. Capturing these environments, however, can be challenging from the social perspective. P1 suggests that myView would be more useful with home care patients, as she does not have access to biographical spaces of patients living at the nursing home: *"My only concern is to have access to personal spaces, because that's really the interesting part. It is not just creating any environment. I think*

[1] https://github.com/dipahalder/Sphere

[2] https://photo-sphere-viewer.js.org

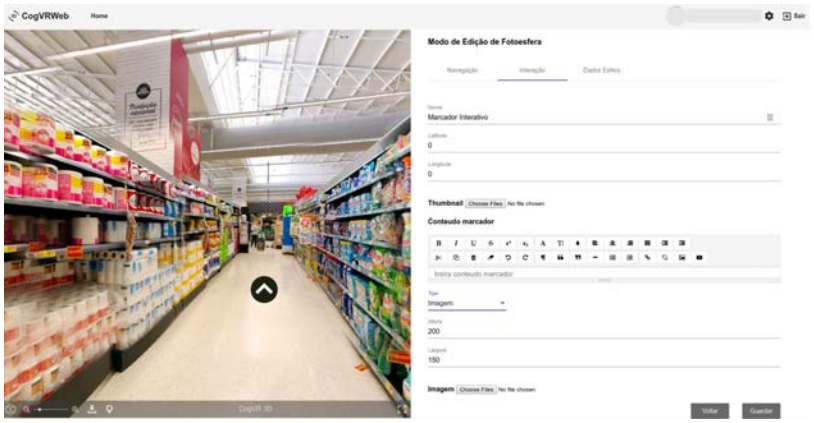

Figure 2: Enriching an environment. The environments can be enriched for instance with interactive images or transparent areas that trigger a sound or a message; or with HTML content to guide the user during navigation. At the left side of the screen the users may see the environment and click to define the position of the interaction points. At the right side the users may for instance add interactions to a photo sphere or define the navigation paths.

it is creating an environment that is fundamental for our patient. That's why I insist that this [myView] should be used by everyone". The involvement of caregivers in the process was pointed out as the key to use personalized environments in sessions: *"it would be interesting if family members could take the photos and send them to the therapist"*. P1 highlights that contact with caregivers can be laborious. On the positive side, she states that part of caregivers are skilled enough to create the environments by themselves.

The ability to add interactivity and tasks to the environment was pointed out as a positive aspect of the platform: *"I can do a thousand things here [enriching the environment]. For example, I can capture a garden near a patient's home and ask her to pick a flower or to follow a path. It would be fantastic for them to be able to follow a path, I did it before, elsewhere, but it was a projection, and here they are the ones to do it, this is fantastic. For example having a red line that they [patients] had to follow, that would be fantastic, or a maze and ask the person to get to the other side. It is important to define paths, colors; all this in an environment that means something to the person"*. Another suggestion is to enrich the VE with interactive photographs of family members.

Regarding usability, participants have different opinions. P2 had experience creating VR images with other applications therefore using our android application was not a problem: *"It's very intuitive. It's just following the the blue circles. The part of indicating where I came from or where I want to go makes perfect sense"*. For P1, without previous experience, the task seems to be more complex, highlighting more than once that this is a task that requires training: *"The creation of the environments using the smartphone is initially a little complicated and confusing, sometimes we lose track of where we should aim the camera to, but I am sure I can overcome this with some training"*. Editing and enriching the environments didn't seem problematic. Both participants found it easy to interact and navigate in the environment. P1 highlighted that the tool would also be very useful to work with people recovering from stroke or TBI.

Overall, the opinion about the platform was positive and the effort required to users to create an environment seems to compensate: *"I have to spend some time creating the environment, but for example some time ago I took pictures almost of the whole house of a patient, because she has so many things on the walls. So I lost, maybe the same amount of time I would have used to create a virtual environment"*. Additionally, a VE may work as a mean to aggregate multiple sources of information: *"If I had created a virtual environment, perhaps I would have kept all those references in one environment, instead of having taken several photographs"*. P1 asked to use the platform after the study.

4 CONCLUSION

VR is seen as a promising technology for therapy, even more if recurs to photo-realistic and personalized environments enriched with tasks. The tool presented in this paper aims to allow non-technical users to create, enrich and share photo-realistic environments, therefore facilitating the work of therapists and improving the overall quality of therapy sessions. Results from a preliminary study confirm the potential and interest in this type of environments. Participants were able to create the environment on their own, and to enrich them in the web platform. They enjoyed the realism of the environment and were critical to the noticeable photo stitches and light variations, as they can interfere with the users' immersion in the task. Future work should focus on improving the connection between caregivers and clinicians.

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