“Journey” – guided, non-linear storytelling supported by eye tracking

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Summary

The guided non-linear storytelling tool “Journey” is geared towards caregivers for people with depression or dementia. Based on reminiscence therapy, “Journey” aims to revive positive memories through stimulating material: Audio-visual stories can be adapted to the individual interests of the patients, even if they are unable to communicate their needs because of their disease. The software identifies images that appeal to the patients by using eye tracking and links them with related contents. The low-cost open-source tool can even be expanded with additional sensors.

1 Introduction

Reminiscence therapy (Woods, Spector, Jones, Davies, & Orrell, 2005) is a psychological method to improve people’s well-being: it makes use of positive memories from the age of approximately 16 to 25. This period is referred as the reminiscence bump. Reminiscence therapy is especially suitable for elderly with depressions and/or dementia to help them open up again to the outside world. The benefits of this procedure are improved cognitive functions and by this an improved quality of life. The therapy is performed in single or group sessions which are accompanied by qualified carers. The used stimulus material often comes from old photo albums, letters, or books. More recent generations as Digital Natives (Palfrey & Gasser, 2008) will also benefit from a lot more documented memories during the relevant time span on digital media. Former studies with digital picture frames – containing visual and auditory stimulation (Sixsmith, Gibson, Orpwood, & Torrington, 2007), (Gowans, et al., 2004) – already showed that the appropriate use of technology can have a positive influence on patients wellbeing, and at the same time take pressure from the carers (Oppikofer, Breitschmid, Schachtler, Neysari, & Aeschlimann, 2012). The problem with digital picture frames in reminiscence therapy is that the user feedback is on a low level. Many patients sit in front of their screens but cannot express themselves in a way healthy people would do. Consequently, it is

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hard for the carers to estimate whether the stimulus material is perceived or even (dis)regarded. This is especially relevant for those elderly who are locked in themselves and thereby do not proactively communicate with their surrounding. Therapists and family members can often just make assumptions if the stimulus material is interesting for them. As there are not enough sufficient tools to support this kind of digital reminiscence therapy this paper describes an approach for a low-cost, open-source reminiscence tool for guided storytelling with real-time feedback. The software was developed during a two day hackathon and is currently under further development.

2 Concept

The idea behind "Journey" is to create a reminiscence therapy tool that supports guided, non-linear storytelling. Therefore, the gazes of patients during reminiscence therapy should be tracked with a standard webcam to capture certain fields of interest. Besides finding areas of attraction, this method also enables the detection of the time needed to watch these areas. The eye tracking data then should be visualized as heat maps on a second screen (e.g. a tablet) for the carer: Which areas of the image attract attention? Which areas are being neglected? Thereby, the therapists should be able to get a more precise feedback, especially from locked-in patients, whether the stimulus material is actually working and in best case which detail of it is suitable for deeper storytelling. From the interaction design perspective, a deeper story-telling means:

- **stronger verbal narration:** The therapists can describe the focused area with more words to make it become more present.
- **more related visual content:** The therapists can show more pictures with the same or similar topic. In this case, digital content that is tagged with keywords will make it even easier to achieve valuable results.
- **a higher multimodal output:** The therapists can emphasize the moment by using multi-modal feedback, like magnifying effects combined with appropriate environmental sound.

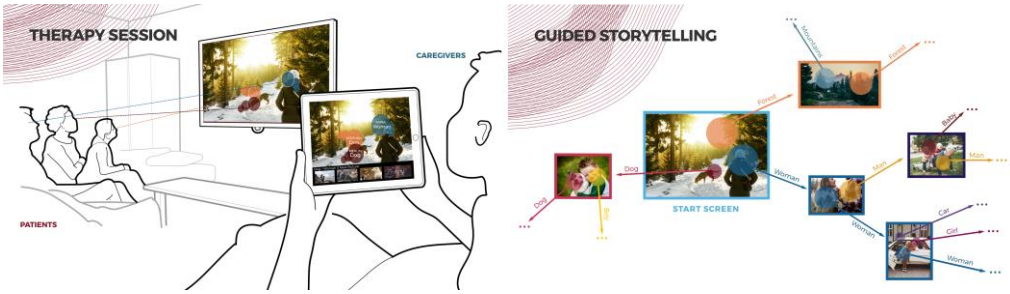

Figure 1: Therapy session with "Journey"; Figure 2: "Guided storytelling"

An example for this could be the following: Patients get shown a picture of a farm with a tractor, a barn, a barking dog and kids playing. If the patient reacted positively on the tractor, the chugging of an engine could be played. Furthermore, more images of tractors from the personal photo library could be shown. With the second screen application, the therapist is able to navigate through the images based on a visual hyperlink structure. Based upon their findings the therapists can perform the therapy at a user-defined speed.

3 Prototype

The hardware of the prototype for “Journey” consists of commercially available components. A webcam (“Logitech C922”) connected to a laptop equipped with an Intel Core i7 processor is used to do the eye tracking. A large screen which is connected to the laptop is used as primary display and a tablet (“iPad”) is the second screen. After successful validation the software part should be published under an open-source license. The system is easy to setup and inexpensive to operate. The “Journey” main application is running on the laptop and shows stimulus material in full screen mode on the large screen. The stimulus material is organized in a hyperlink-based data structure and can be modified by using an editor. The main application provides communication interfaces which other applications can use to change image content on the large screen. The main application is using the open source real-time facial behavior analysis system “Open Face 2.0” (Baltrušaitis, Zadeh, Lim, & Morency, 2018) to do head pose estimation and eye gaze estimation of tracked persons using the webcam. This tracking data is mapped to screen coordinates to identify region of interests (ROI) of the viewed image material. The ROIs are visualized as live heatmaps by the “Journey” second screen application that runs in the browser of the tablet. The user interface of this application presents also related image material and provides functionality to change the image content on the large screen by using the communication interfaces of the main application.

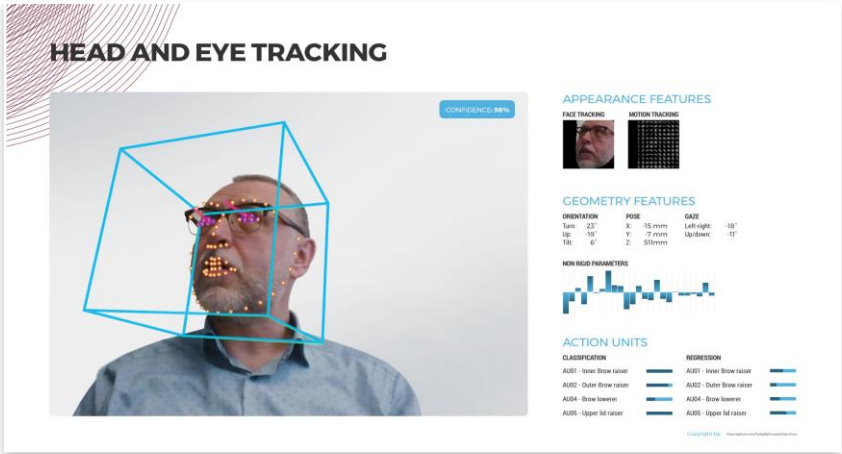

Figure 3: Head and eye tracking using Open Face 2.0

4 Conclusion

The next step in the ongoing process is to reflect ethical implications of the implemented concept and to work on further user-centered improvements.

4.1 Ethical implications

From the current perspective the project mostly faces the challenge to offer an experimental low-cost tool for therapists. A first technological breakthrough has been achieved, but a valid evaluation phase with qualitative feedback is still pending.

Nevertheless, it is obvious that the use of eye tracking during sessions raises privacy protection issues as the carer is able to see what the patient is perceiving. Therefore, after finishing the project a public discussion about trust, ethics and misuse will be needed. Nevertheless, the opportunities for helping especially locked-in people seem to outweigh the disadvantages so that the work will be continued.

4.2 Iterations in the context of dementia

Different studies have examined eye movements during graphical scene exploration for demetia patients. The studies have different conclusions, but they all show that affected people have different eye movements compared to healthy people is common.

“Altered visual search patterns implicate changes to attention and visual processing in patients. Similar attentional impairments, in addition to increased apathy, may explain changes to scene exploration, but the limited number of studies investigating eye movements during scene exploration necessitates further research." (Molitor, Ko, & Ally, 2015)

In addition to these studies, “Journey” integrates the therapists’ feedback into the interaction loop to keep the patients’ motivation on a high level. The therapist is challenged to create stories around the users’ active focus. Even a minimal gain of knowledge through the software can help getting a better insight into the patient’s mind. To enhance the precision of the software, further external sensory parameters are considered to be part of the concept. These may include: heart rate (Electrocardiography), stress level (Electrodermal activity), muscle tension (Electromyography), body movement (Accelerometer).

In the next phase of the project these values could help to verify whether a glance is filled with hidden emotions which are not recognizable at first sight. The integration into the existing scenario could be, for instance, implemented with wearable sensors.

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6 Autoren

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Martin Ecker ist Software Engineer bei der User Interface Design GmbH. Basierend auf Nutzer- und Kundenanforderungen entwickelt er komplexe Softwareprodukte. In Kunden- und Forschungsprojekten macht er innovative Interaktionskonzepte in Form von Hard- und Softwareprototypen erfahrbar.

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Merlin Schuster arbeitet als User Experience Designer für User Interface Design GmbH (UID). Er gestaltet Screens und Icons für Kunden aller UID Branchen. Merlin Schuster absolvierte seine Ausbildung zum Mediengestalter mit der Fachrichtung Konzeption und Visualisierung bei UID.

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Als Senior User Experience Consultant unterstützt Martina Uhlig ihre Kunden dabei, Software und Apps nutzerfreundlich zu gestalten. In enger Zusammenarbeit mit Nutzern erarbeitet sie Anforderungen und gestaltet Interaktionskonzepte, die in Form von Prototypen getestet werden. So steht sie ihren Kunden im gesamten Umsetzungsprozess zur Seite.

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Dr. Peter Klein ist Director User Experience und Head of Research & Innovations. Er ist Diplom-Informatiker und promovierter Informationswissenschaftler mit Spezialisierung auf Information Design und Visualisierung. Als verantwortlicher Leiter des UID Bereichs Research & Innovation kümmert er sich um das gezielte Aufgreifen disruptiver Technologien und deren gestalterischen Transfer in nutzerzentrierte Produkt- und Prozessgestaltung.