A Digital Solution to Trauma Recovery: EMDR Therapy in the Modern Age

Robert-Eusebiu Palade and Nicolae Goga

September 17, 2024

A Digital Solution to Trauma Recovery: EMDR Therapy in the Modern Age

Robert-Eusebiu PALADE[1], Nicolae GOGA[2]

[1]University Politehnica of Bucharest, e-mail: palade.robert99@gmail.com
University Politehnica of Bucharest, The Faculty of Engineering in Foreign Languages
[2]Department of Engineering in Foreign Languages, e-mail: n.goga@rug.nl

Abstract

Eye Movement Desensitization and Reprocessing (EMDR) is an effective mental health treatment, particularly effective for the post-traumatic stress disorder (PTSD), which was developed in 1987 by Dr. Francine Shapiro. Developed by Dr. Francine Shapiro in 1987, EMDR is based on the idea that unprocessed traumatic memories contribute to psychological distress. The therapy follows an eight-stage process that helps reprocess these memories, reducing emotional and physical symptoms. While traditionally used for PTSD, this therapy has been applied to conditions such as anxiety, depression, and phobias.

This paper explores the theoretical framework, methodology and efficacy of EMDR, highlighting the recent development of computerized systems designed to enhance therapy delivery. Additionally, we introduce a web application that automates this therapy through a self-guided process, utilizing an integrated chatbot to provide users with step-by-step instructions during the therapy session. This innovation offers the potential to expand access to the therapy, making it more accessible for individual sessions without the need for direct therapist involvement. By making the therapy more accessible and structured, this application has the potential to expand access to EMDR and improve outcomes in individual sessions.

Keywords: EMDR, therapy, PTSD, computerized systems

1. Introduction

EMDR therapy is based on the Adaptive Information Processing model, which states that psychological distress is primarily caused by the processing of traumatic memories in a bad manner. EMDR aims to facilitate the processing of these memories, thus reducing their harmful effects. This introduction section will focus on the historical context of EMDR's development and its main principles.

Eye Movement Desensitization and Reprocessing (EMDR) gained recognition in the late 1980s and it was developed by Dr. Francine Shapiro. Its initial and primary application was in the treatment of Post-Traumatic Stress Disorder (PTSD), a condition often found in individuals who have undergone traumatic experiences such as warfare, sexual assault or natural disasters. Over the years, Eye Movement Therapy has evolved and expanded, proving effective in treating a variety of mental health disorders, such as anxiety, depression or phobias.

In this article we present an overview of the EMDR Therapy and some existent applications related to it. Also, it contains the presentation of a new application which consists of a chatbot, which will guide the users through the therapy session. This presentation contains details such as architecture of the application, flow and instructions for how to use it accordingly.

The inception of EMDR can be traced back to 1987 when Shapiro, while taking a walk in the park, observed that eye movements seemed to reduce the negative emotions connected to her own distressing memories. Intrigued by this observation, she conducted further research, which led to the development of this therapy. In 1989, Shapiro published her findings, introducing EMDR to the mental health community.

EMDR is based on the Adaptive Information Processing (AIP) model, which proposes that mental health problems, especially Post-Traumatic Stress Disorder, arise from the incomplete processing of traumatic experiences. These unprocessed memories are stored in a "raw" form in the brain, retaining their initial emotional and physical intensity. EMDR aims to facilitate the accessing and processing of these traumatic memories, thereby enabling their integration into standard memory networks.

EMDR's approach differs significantly from traditional face-to-face therapy. It does not rely extensively on discussions about the traumatic event or direct challenging of beliefs. Instead, it focuses on the internal experiences of the individual such as beliefs and body sensations associated with the trauma.

Recall of distressing images while simultaneously receiving side-to-side eye movements or audio stimulation which are some types of bilateral sensory input are included in the therapy.

Shapiro outlined an eight-phase approach to EMDR, ensuring a structured and comprehensive treatment process. These phases include history-taking, client preparation, assessment of the target memory, desensitization, installation of positive beliefs, a body scan to identify residual somatic stress, closure and reevaluation. This structured approach ensures that the therapy is tailored to the individual's needs while maintaining a consistent methodology.

The rest of the paper contains the following sections. Section 2 contains related work to EMDR Therapy applications. Section 3 contains a detailed description and the architecture of our web application created for EMDR Therapy, including images from the application. In the last section, there are presented the conclusions of this paper, including the future work that can be done to improve the existing applications.

2. Related work

The integration of technology in Eye Movement Desensitization and Reprocessing (EMDR) therapy has gained significant attention in recent research. In the next chapter there are presented some computerized systems regarding EMDR.

This section reviews some studies that explore the efficacy and innovation of computerized systems in EMDR. Each of them contributes to a better understanding of how technology can help to enhance the efficacy and accessibility of EMDR therapy. The

integration of VR, AI and telehealth platforms not only broadens the scope of EMDR, but also opens new avenues for research and clinical practice.

Several comparative studies [1][2][3] between EMDR and Cognitive Behavioral Therapy (CBT) have been conducted. While both therapies have shown effectiveness in treating PTSD, EMDR often requires fewer sessions and can be less distressing for patients, as it does not require detailed descriptions of the traumatic event.

Neuroimaging studies [4][5][6][7] have demonstrated changes in brain activity following EMDR therapy, particularly in regions associated with emotional processing and stress response. These findings suggest a neurobiological basis for the therapy's effectiveness.

EMDR's applications extend beyond PTSD to include treatments for anxiety disorders, depression and other symptoms. Eye Movement Desensitization and Reprocessing (EMDR) has garnered significant attention for its applications beyond its initial use in treating Post-Traumatic Stress Disorder (PTSD). Its unique approach, involving bilateral stimulation (often through eye movements), has been adapted to treat a variety of psychological disorders.

The integration of computerized systems into EMDR therapy holds several potential benefits. Enhanced standardization, increased treatment accessibility and improved data collection and analysis are among the advantages. Computerized systems may also facilitate the delivery of EMDR in telehealth settings, overcoming geographical barriers and increasing the reach of this evidence-based therapy. Initially developed for PTSD, this therapy has shown promising results in treating other conditions. These include anxiety disorders, depression, addiction and substance abuse or eating disorders.

In article [8] there are some app-based self-help interventions. The first one is called Self Care Traumatic Episode Protocol (STEP) and showed some good results regarding anxiety and depression. This consists of a video recorded session treatment which lasts about 90 minutes and was used to process some memories from the Covid pandemic period. The other one was composed of six sessions and was for the patients diagnosed with PTSD. In this case a therapist was involved for telephonic guidance, but the instructions were web-based.

The main focus of article [9] is on the intersection of post-traumatic stress disorder (PTSD) and the chronic conditions among veterans from war zones, which intensifies the severity of their symptoms, complicating their treatment and management. In this study there is presented a system which consists of ten 60-minute EMDR treatment sessions and another one which consists of sixteen 60-minute sessions. The software for the second one is built upon the Pattern Information Processing System (PIPS), which is essential for learning how to process general, social and educational information. This program allows users to tailor training programs according to their needs, incorporating personalized exercises and configurations. Notably, all exercises within the program consist of 15 stages, progressively increasing in difficulty. The results revealed a notable disparity in the cognitive bias among veterans with PTSD between the EMDR and computer-based cognitive rehabilitation groups. Interestingly, the computer-based cognitive rehabilitation approach exhibited greater efficacy compared to the EMDR method.

Compared to the studies presented below, our web application has an integrated chatbot which asks questions to the user, which has to respond to them in order to perform

the therapy session developed by Shapiro. There is no need for the medical personnel to perform the therapy session.

3. Web Application for EMDR Therapy

In this section it is presented our computerized system developed for EMDR Therapy. It consists of a web platform where the user can introduce his personal data, then he can interact with a chatbot responsible for the therapy. Firstly, the user needs an account on the platform, then he can interact with the chatbot.

The user has to respond to some personal questions, accept the terms of processing the personal information and after that he has to respond to the questions related to his trauma. Then the effective therapy begins by focusing on the ball which is moving horizontally on the screen. The therapy consists of two sessions, where the user has to think about his trauma experience and try healing them without the interaction of a physical therapist. The client has to give scores for his experience after every session. An usual therapy session lasts about one hour.

In the first step, the user has to think about a negative emotion, then he has to describe it. After this, he has to think about the sensations that come to his mind and give a score regarding the actual feeling of that sensation in the present moment. Also, a score has to be given to the emotions feeled when he was thinking about that trauma. Then the actual session begins and the user has to focus on the ball which will move horizontally. At the end of the session which lasts about an hour, the user has to evaluate again his actual emotions and thoughts after the ball watching session. Now the user has to think about that memory and a new session will begin. Again, he will have to evaluate his thoughts and emotions after this and the therapy session comes to an end.

The architecture of our web application is presented in *Figure 1* and consists of two major parts: Front-End and Back-End which have the following components:

a. *Patient UI* - This component is part of the front-end user interface for our web application, which patients interact with. It allows patients to interact with a chatbot and start EMDR Therapy sessions. It provides a user-friendly experience and enables seamless interaction with the application's features.
b. *Web Server*: The web server acts as an intermediary between the frontend and the application server. It handles HTTP requests coming from the frontend and forwards them to the appropriate components. It also communicates with the application server to retrieve and send data, ensuring seamless interaction between the frontend and the backend.
c. *Chatbot*: This component is responsible for asking the proper questions guiding the patient through the therapy.
d. *Authentication*: This component manages user authentication within the application. It ensures that only registered users can access and interact with the application's data.
e. *SQL Database*: This section stores securely the personal data of the users necessary for login in the application.
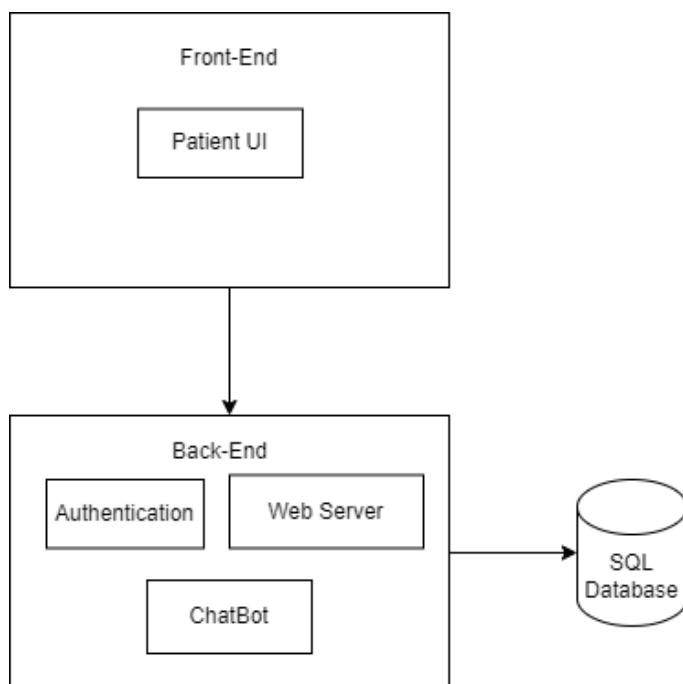
**Figure 1**. Architecture of our web application

One of the major parts of this web application is represented by the chatbot which asks the proper questions in order to guide the user through the therapy session without the direct intervention of a medical personnel. The chatbot is displayed in an intuitive section of the application, where the user can interact flawlessly with the chatbot. The chatbot guides the user through the therapy session, asking the proper questions and after the user answers all of them accordingly, a new screen is displayed where the user has to follow the movement of a ball.

The chatbot is composed of the chatbot engine which is the core logic responsible for the therapy session. It has an EMDR Therapy Question Set which contains the questions that the chatbot will ask the user in order to perform the EMDR Therapy session. This is a predefined set of questions related to this therapy, covering various aspects such as identifying traumatic memories, establishing a safe space or bilateral stimulation techniques. These questions are structured to guide the user through the therapy session and help them engage in the process effectively. There is also session management, which tracks the progress of the therapy session, ensuring that the user completes each step before proceeding to the next.

The EMDR Therapy Question Set is composed of some initial questions where the user has to complete his name, age, gender and has to accept the data processing. Then there are 14 questions that the user will have to answer, guiding him through the therapy session, divided in 2 sections of 7 questions each. In the first part of the session, the user will have to identify some emotions regarding his trauma disorder, then in the next session he will have to reevaluate his emotions.

Another important part of our web application is the visual part, where the user has to follow a ball which is moving horizontally and while he does this, he has to think about his trauma experience. This is a very important part of the therapy session. The user can access this only if he answers the questions that the chatbot asks him and can be reached twice per session. Once this screen opens, the user can set the time of the session and he has the option to terminate the session before the timer ends and he also has some visual options such as full screen.

The application is designed for both Romanian and English, the user having the possibility to select the language from a dropdown positioned in the navigation bar.
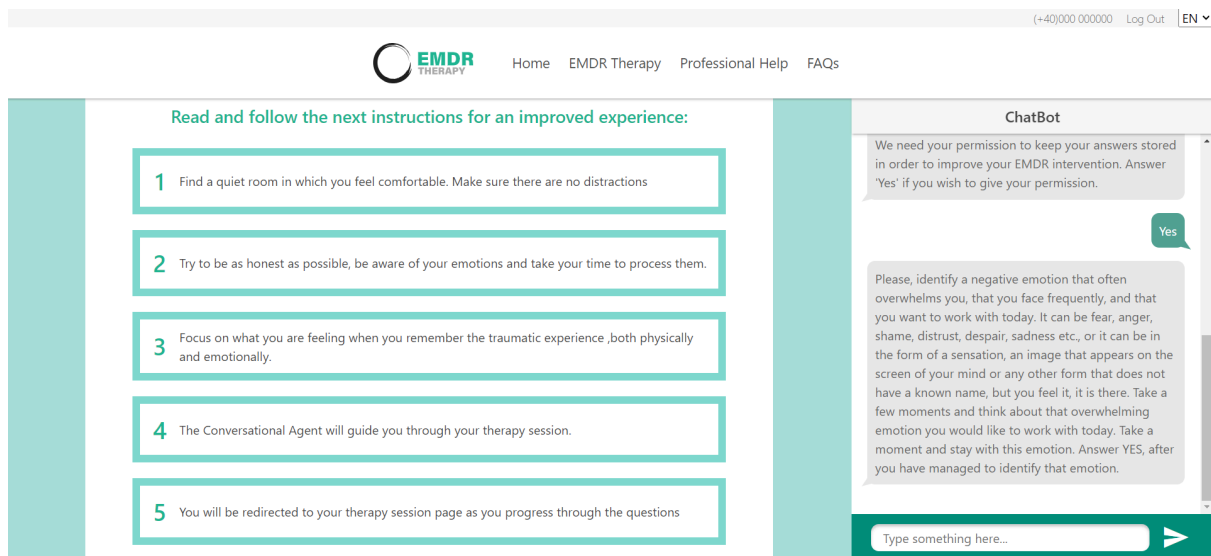
Figure 3. EMDR Therapy instructions and ChatBot

In *Figure 3* it is presented the main interface of the web application, containing the appbar with the menu, login and register sections and a dropdown from where the user can switch between English and Romanian. Next, the application contains some basic information about the therapy, which will help the user to have a better experience while passing through the questions of the chatbot, which is presented on the right side. The interface of the chatbot is pretty simple, the user has to answer the questions that the chatbot asks. After the first set of questions, a new screen appears which can be seen in *Figure 4*, where the actual therapy session begins. After the first session completes, the application goes back automatically to the previous screen where the user will have to answer a few more questions, then the second Therapy Session begins. At the end, the user will have to answer two more questions about his feelings and also give a review for the entire process that he has gone through.
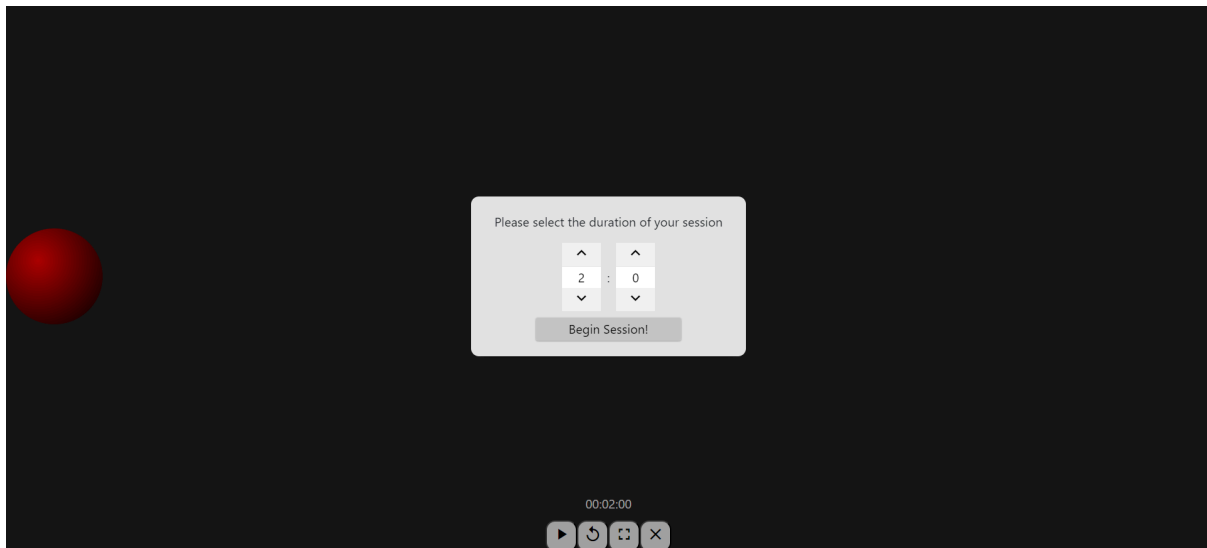
Figure 4: EMDR Therapy Session

4. Discussion

The introduction of a digital guide for EMDR therapy represents a significant advancement in making trauma recovery more accessible. Preliminary user feedback indicates that the application provides a valuable tool for the therapy developed by Shapiro. Users reported positive experiences with the structured guidance and the visual interface, which facilitates engagement with the therapeutic process.

However, it is important to recognize its limitations. The lack of real-time interaction with a trained therapist may impact the therapeutic outcomes for some users. While the application is designed for standalone use, it could also complement traditional EMDR therapy. Hybrid models where the digital tool supports in-person therapy might offer a balanced approach, leveraging the strengths of both modalities.

Future research should focus on expanding the application's features, such as incorporating artificial intelligence for personalized feedback and integrating advanced data analytics for monitoring user progress.

5. Conclusion

In this paper it is also presented a web application which can guide any user through an EMDR therapy session with no direct intervention of a medical personnel, which is done with the help of a chatbot. It also contains a comprehensive description of the application's architecture. The integration of computerized systems into EMDR therapy represents a promising frontier in trauma-focused treatment. While challenges exist, the potential benefits of enhanced treatment outcomes, increased accessibility and improved research methodologies make this an exciting area for further exploration. As technology continues to advance, the collaboration between mental health professionals and technologists will play a crucial role in harnessing the full potential of computerized systems to augment and refine

EMDR therapy. Future research directions should focus on systematically evaluating the efficacy of computerized EMDR tools, identifying the demographics that could derive the greatest benefit from these technologies, and refining the integration process into clinical practice. Additionally, exploring the potential of artificial intelligence to personalize and optimize EMDR interventions based on individual client characteristics represents a promising avenue for future development.

References

1. Khan, Ali M., et al. "*Cognitive behavioral therapy versus eye movement desensitization and reprocessing in patients with post-traumatic stress disorder: Systematic review and meta-analysis of randomized clinical trials.*" Cureus 10.9 (2018).
2. Zeighami, R., et al. "*Comparison of the effect of eye movement desensitization reprocessing and cognitive behavioral therapy on anxiety in patients with myocardial infarction.*" The European Journal of Psychiatry 32.2 (2018): 72-76.
3. Hudays, Ali, et al. "*Eye Movement Desensitization and Reprocessing versus Cognitive Behavior Therapy for Treating Post-Traumatic Stress Disorder: A Systematic Review and Meta-Analysis.*" International Journal of Environmental Research and Public Health 19.24 (2022): 16836.
4. Thomaes, Kathleen, et al. "*Degrading traumatic memories with eye movements: a pilot functional MRI study in PTSD.*" European Journal of Psychotraumatology 7.1 (2016): 31371.
5. Santarnecchi, Emiliano, et al. "*Psychological and brain connectivity changes following trauma-focused CBT and EMDR treatment in single-episode PTSD patients.*" Frontiers in psychology 10 (2019): 129.
6. Pagani, Marco, et al. "*Correlates of EMDR therapy in functional and structural neuroimaging: A critical summary of recent findings.*" Journal of EMDR Practice and Research 7.1 (2013): 29-38.
7. Rousseau, P. F., et al. "*Neurobiological correlates of EMDR therapy effect in PTSD.*" European Journal of Trauma & Dissociation 3.2 (2019): 103-111.
8. Maxfield, Louise. *"Low-intensity interventions and EMDR therapy."* Journal of EMDR Practice and Research (2021).
9. Bonyadi, Tahereh, Rezvan Homaei, and Alireza Heidari. *"Effectiveness of Eye Movement Desensitization and Reprocessing Therapy and Computer-Based Cognitive Rehabilitation on the Cognitive Bias of Veterans with Post-Traumatic Stress Disorder."* Annals of Military and Health Sciences Research 21.2 (2023).
10. Goga, Nicolae, et al. *"An efficient system for eye movement desensitization and reprocessing (EMDR) therapy: a pilot study."* Healthcare. Vol. 10. No. 1. MDPI, 2022.
11. Gancea, Ionatan Octavian, et al. *"AN INTELLIGENT EMDR SYSTEM FOR HELPING STUDENTS WITH PSYCHOLOGICAL PROBLEMS."* eLearning & Software for Education 2 (2020).
12. Marotta-Walters, Sylvia A., et al. *"A review of mobile applications for facilitating EMDR treatment of complex trauma and its comorbidities."* Journal of EMDR Practice and Research 12.1 (2018): 2.
13. Perlini, Cinzia, et al. *"The potential role of EMDR on trauma in affective disorders: a narrative review."* Journal of affective disorders 269 (2020): 1-11.