

ReWIND: A Story-based Serious Game to Reinforce Learning of CBT Strategies for Anxiety Disorders

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Abstract. We present ReWIND, a story-based serious game to help players learn cognitive behavioral therapy (CBT) strategies that are useful for tackling anxiety disorders. ReWIND artfully weaves CBT into the anxiety-relevant sub-stories encapsulated as quests in the game and implements game mechanics simulating CBT strategies such as cognitive restructuring. Finally, ReWIND reinforces learning of the CBT strategies through reflection dialogs, quest summaries and repetition of a CBT strategy across different quests. ReWIND offers a scalable framework to extend the game to cover many different anxiety scenarios and CBT strategies.

Keywords: Cognitive behavioral therapy, serious game, anxiety, psychoeducation, mental health.

1 Introduction

Cognitive behavioral therapy (CBT), a series of cognitive and behavioral interventions aimed at regulating dysfunctional patterns of thinking and maladaptive behaviors to prevent the development of and maintain emotional distress for mental health problems [7], has been proven to be effective in the treatment of anxiety disorders [10]. Traditional CBT is usually conducted within 12 to 20 sessions with the patient in the presence of the psychotherapist [4]. Psychotherapists attempt to assist patients in challenging their negative thoughts while providing advice during the sessions so patients can think in a more balanced and functional manner and subsequently overcome the self-defeating patterns. Continuously providing information through psychoeducation is crucial to facilitate the change of thought and behavior [1] but treatment cost and sustainability are among some of the barriers to long-term therapy [8].

We present ReWIND, a story-based serious game designed to artfully incorporate CBT strategies into the game narrative and mechanics for the purpose of anxiety

psychoeducation. Unlike prior games for anxiety that have only integrated CBT in games as a series of goal-oriented tasks [2, 3, 9, 12, 14, 15] and required therapists for guidance during the intervention, ReWIND allows players to explore different anxiety scenarios and CBT strategies through different sub-stories encapsulated as quests in the game without needing external assistance. ReWIND was co-designed with psychology experts to ensure an accurate implementation of CBT in the game. In this paper, our main goal is to demonstrate how CBT can be realistically weaved into the game narrative and artfully incorporated into the game mechanics through ReWIND.

2 Related Work

SuperBetter (SB) is an example of task-driven game solution targeting anxiety [12]. SB leverages CBT and positive psychotherapy targeting depressed people while also expected to reduce anxiety symptoms at the same time as the secondary outcome, given the high comorbidity of anxiety and depression. There are no interactive stories in SB, such that users make progress through the game in the form of completing activities such as describing a goal, taking recommended steps toward the goal, and completing recommended mood-boosting activities.

Another relevant gamified solution, SmartCAT2.0, was introduced as an adjunctive component to CBT treatment in an open trial for childhood anxiety disorder [15]. SmartCAT2.0 consists of several interactive Skillbuilder Activities that award users with digital points upon completion. The points can then be used to redeem various rewards such as pens, accessories, and certificates. Players are also rewarded with digital trophies after finishing all the required activities for each session. Similar to SB, the game does not support story features, and all activities are delivered in the form of session tasks.

MindLight, on the other hand, is a biofeedback-based serious game that integrates neurofeedback reinforcement in its gameplay design to prevent anxiety in children [13]. MindLight is distinct from the SB and SmartCAT 2.0 in that it comes with a story. Players explore the game as a character named Arty to save his grandmother from evil forces. As the game progresses, players are exposed to various fearful events, and they will learn to overcome their fears by changing their state of mind. The relaxation state of players is reflected in the brightness of the game world, whereby the light gets brighter when players are more relaxed. In MindLight, the story plays a peripheral role in the delivery of exposure training, the main CBT strategy incorporated in the game.

3 ReWIND: CBT-based Game for Anxiety

ReWIND is a PC-based game implemented using the Unity game engine. In ReWIND, players play as Lucas, the main character of the game, and assist quest givers, a type of non-playing character (NPC), in resolving their anxiety-related problems. As Lucas engages with each quest giver, the player is drawn into an anxiety-related sub-story encapsulated within a quest. The linear narrative structure in each sub-story follows the five principles in Ellis' **ABCDE** model [5], a CBT model based on rational-emotive

behavior therapy (REBT) [6]. Through a series of interactive dialogs, players first learn the quest giver's **beliefs (B)** about certain **activating events (A)** which overly affect their emotional and behavioral responses and subsequently lead to negative **consequences (C)** (i.e., an anxiety episode). After recognizing the cause of the anxiety, players then proceed to the **disputation (D)** stage, in which two appropriate CBT strategies are introduced to help dispute irrational beliefs and substitute them with effective rational beliefs to bring forth positive behavioral **effects (E)**. To make gameplay more fun, CBT strategies are implemented through game mechanics such as item gathering (collecting items requested by the NPC), maze-solving (reaching the end of the maze), and interaction with NPCs.

To demonstrate how players can learn CBT strategies while playing ReWIND, we walk through Lars' quest in the game revolving around anxiety caused by health fear. Players start a quest by guiding Lucas to interact with Lars, the quest giver (Fig. 1a). At the beginning of the quest, players learn the **ABC** leading to Lars' irrational beliefs through a series of interactive dialogs (Fig. 1b and Fig. 1c). The story then transitions into disputation as Lucas recommends the next action to seek an NPC known as Master Yamato in Asiantown. Control transfers to Lars and players set out in search of Master Yamato with the help of the circular compass arrow surrounding Lars and the map of the game world (Fig. 1d).

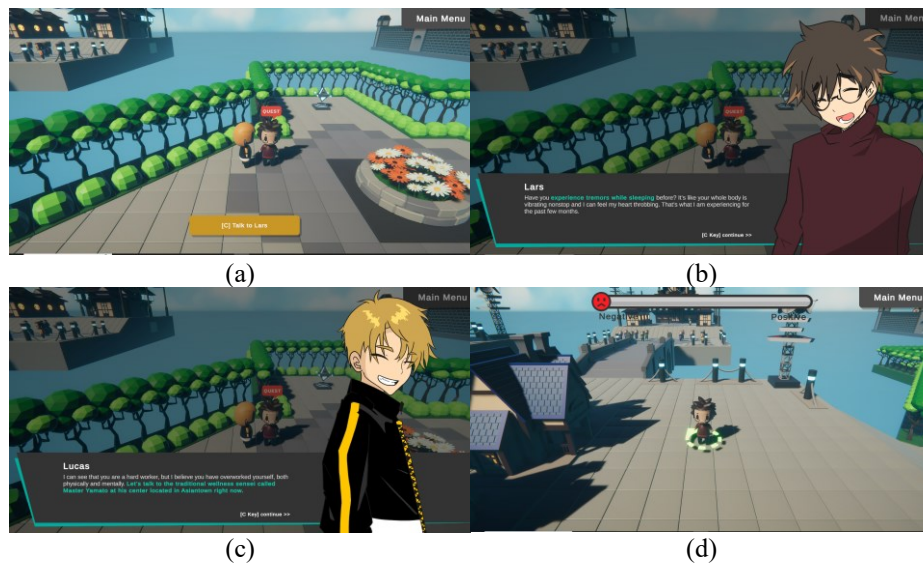


Fig. 1. Quest initiation through interactive dialogs

Upon finding Master Yamato, players are then guided to learn two CBT strategies: 1) relaxation and 2) cognitive restructuring. Instead of merely explaining the CBT strategies through linear dialogs, ReWIND simulates the two CBT strategies through game mechanics. For relaxation, players are given the task of finding a waterfall spa and follow a visual guide to taking deep breaths (Fig. 2a and Fig. 2b). Cognitive

restructuring is implemented using a maze tower in which players are probed with questions by a Floor Guardian related to actions to be taken in the onset of anxiety (Fig. 2c and Fig. 2d). Players are given three different door choices to choose from (i.e., one positive, one negative and one neutral option). Choosing the positive choice moves players up the levels to the top of the maze tower at a quicker pace while the negative choice moves players down to the bottom. The maze tower simulates the process of reshaping negative or inaccurate thinking into a more positive and supportive thinking that would lead to positive outcomes.

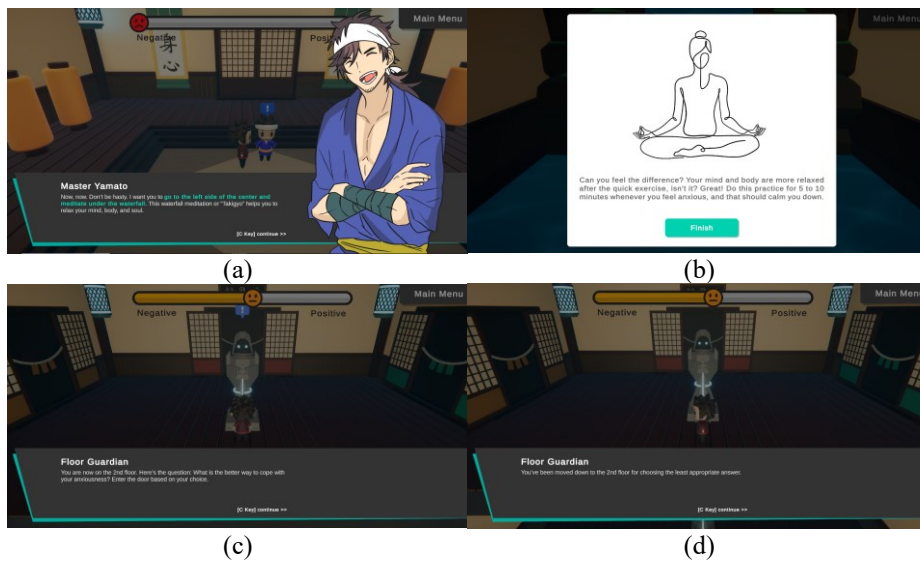


Fig. 2. Simulating CBT strategies through game mechanics in the disputation stage

Finally, ReWIND reinforces the CBT strategies through reflection dialogs (Fig. 3a) and quest summaries presented at the end of a quest (Fig. 3b). The second form of reinforcement is implemented by repeating the same CBT strategy to solve different anxiety-related problems in other quests. The full game flow of Lars' quest is illustrated in Fig. 4 and each quest follows a similar structural flow. Upon completion of a quest, Lucas once again reappears into the game world and players continue the game by seeking the next quest. ReWIND currently contains six quests. The quests are presented in a diegetic manner through quest giver NPCs located around the game world. Players explore different areas in the game world and are required to complete quests to make progress in the game.

Aside from game mechanics that implements CBT principles, additional game mechanics are also used to make ReWIND more entertaining. For example, an incentive system is introduced, whereby players can purchase character skin to change the appearance of Lucas using tokens earned from quest completions and treasure boxes. Players can gain a random number of tokens from treasure boxes scattered around the game world. It is crucial to have constant engagements not just with the NPCs but also

the surroundings to keep the game alive and have players remain motivated throughout the game, especially for long-term psychoeducation.

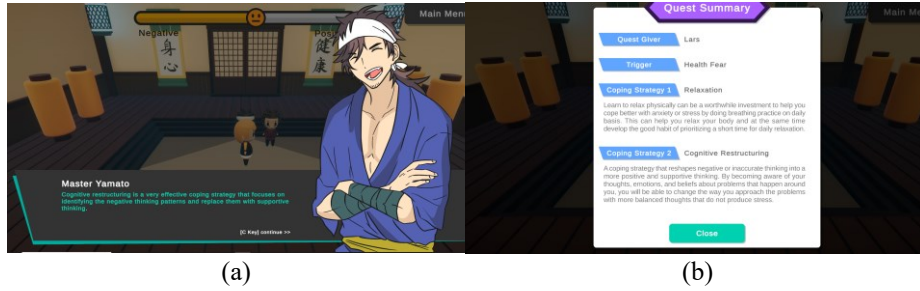


Fig. 3. Reinforce learning of CBT strategies at the end of a quest

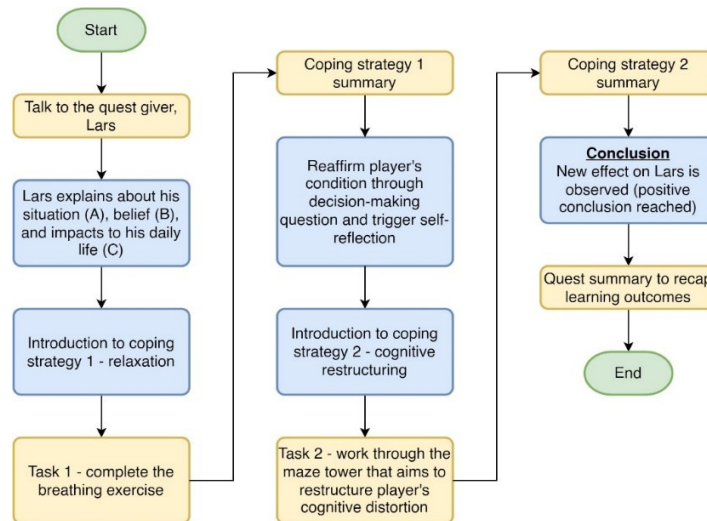


Fig. 4. Game flow of Lars' quest in ReWIND

4 Evaluation

Twenty university students above 18 years old and identified with anxiety risk took part in the evaluation of ReWIND. All participants were asked to play the game and then complete a game usability questionnaire adapted from MEEGA+ [11]. Measures emphasizing the story relevance and satisfaction were selected, and the questions were reframed to fit the context of ReWIND's story-based design. The usability evaluation was rated on a 5-point scale ranging from 1 (strongly disagree) to 5 (strongly agree). Participant feedback on the game was also obtained. Overall, participants enjoyed playing ReWIND.

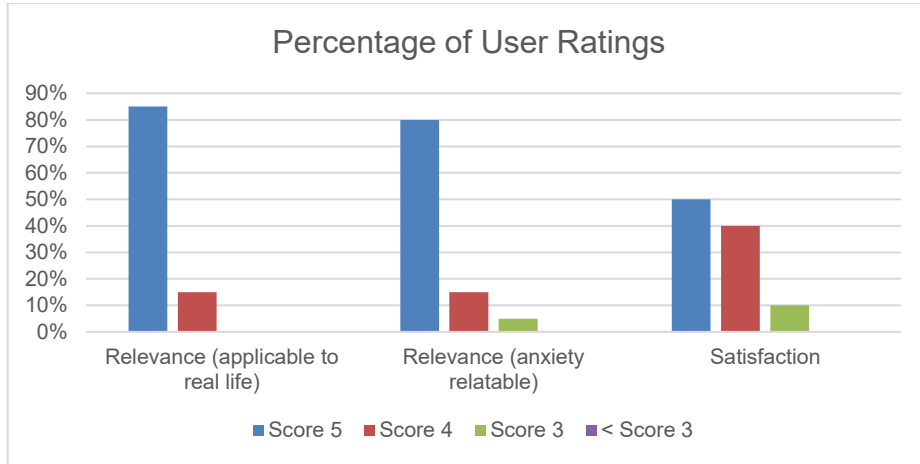


Fig. 5. Percentage of user ratings

The percentage of user ratings for each usability measure is shown in Fig. 5. All the participants agreed ReWIND is applicable to real life with 85% showing strong agreement. On being relevant to anxiety, 95% rated at least a score of 4 whereas 90% reported being satisfied with the game. None of the participants rated ReWIND below the score of 3, thus showing that the game yields satisfactory results.

5 Conclusion and Future Work

This paper presented ReWIND, a story-based serious game designed to deliver CBT psychoeducation targeting anxiety disorders. ReWIND offers an alternative design approach to help players learn CBT strategies through storytelling, rather than following a goal-oriented task-based approach commonly found in existing anxiety games. The game comes with an artfully designed game world with quests scattered in different locations for the players to explore. Each quest contains a sub-story with its narrative structure designed following Ellis' ABCDE model. By playing through each quest, players are exposed to various CBT strategies that are useful for handling anxiety situations. All six quests in ReWIND were co-designed and verified by psychology experts. ReWIND is scalable as it can be easily extended to include many different anxiety sub-stories and CBT strategies in the future to provide long-term psychoeducation.

Acknowledgments

This research was funded by Ministry of Higher Education Malaysia for Transdisciplinary Research Grant Scheme with Project Code: TRGS/1/2020/USM/02/4/2 and L'Oréal-UNESCO for Women in Science Malaysia Fellowship: 304/PKOMP/650943/L117.

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