Developing a Ludic Prevention Intervention Tool for Eating Disorders

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Abstract: Traditional health related computer applications target full-blown illnesses through the use of persuasive techniques. Yet, as health experts point out, few of them aim at preventing an affliction from occurring while few symptoms are present. Also, to our knowledge, a methodology that supports a ludic approach to preventive interventions does not exist. To solve those issues, and to provide what we consider is a novel approach to computer based prevention interventions, we introduce Amigo, a Visual Novel with Multiple Composite Scenarios (MCS), implemented on iPads and designed for the prevention of anorexia nervosa. We tested our tool in trial sessions and evaluated its results with parameters of grounded theory. We discuss our limitations, elaborate on areas for improvement and talk about our future work.

Keywords: Prevention, Serious Games, Health Games, Unconscious Thought Theory, Multiple Composite Scenarios

1. Introduction

According to the National Academy of Sciences [20], the health intervention spectrum can be divided, depending on the developmental stage of an affliction, into: promotion, prevention, treatment and maintenance. To our knowledge, other than treatment and maintenance, the sub-areas of promotion and prevention remain unexplored in the HCI field with few examples [19]. Promotion refers to all informative and educative efforts to raise awareness in society of the risks of a certain illness, prevention to the interventions which occur prior to the onset of a disorder, treatment to the direct actions necessary to cure a disease, and maintenance to the patient's compliance with long-term treatment and rehabilitation [20]. To entertain while persuading individuals of living a healthier lifestyle, making use of validated persuasion techniques and what we consider is a new approach to health games, we studied the benefits of our propose approach: Amigo, a tool to prevent eating disorders.

Amigo uses a methodology we call Multiple Composite Scenarios (MCS) to present information and allow for reflection using Visual Novels (VN), a sub-genre of Adventure Games (AG), and puzzles to evaluate recently learned topics. We created the MCS inspired by the three step method of the Unconscious Thought Theory (UTT), an approach that to our knowledge remains unused within the Human Computer Interaction (HCI) community. We tested our approach in a trial version consisting of a two session experiment. For it, we divided participants into treatment and control conditions, to validate the efficacy of our application. We managed to measure empathy, knowledge, response to requests, intention to diet and quality of nutrition following validated methodologies, and used parameters from grounded theory to analyze our results. Taking into consideration our results, including user feedback, we discuss our limitations, and also show possible areas for improvement, in an aim to develop a methodology of use.

2. Background

Prevention is by definition, an intervention that occurs before a disorder is full-blown based on prevalence and incidence cases within a population [20]. The type of interventions depend on the group and individuals it targets. Prevention interventions may be universal (addressing a large population), selective (targeting groups or individuals with an elevated risk), or indicated (aimed at individuals with early symptoms). The goal of prevention is to emphasize the avoidance of risk factors and the promotion of protective factors. It makes use of positive behavior reinforcement, education and involvement to tackle the origin and misconceptions of a condition, in order to truncate its development.

2.1 Eating disorders

Previous research suggests that reducing risk factors and promoting protective factors does have a positive impact on the individuals and may successfully stop health deterioration. Our work consists of a selective ludic prevention intervention to prevent eating disorders in young japanese scholars. Eating disorders refers to a persistent or severe disturbance, of regular eating habits, that results in impaired physical health or psychosocial functioning, and is not due to medical disorders or a psychiatric condition [9]. Our main characters were used to depict a case of anorexia nervosa. Two features of anorexia are: attitudes towards shape/weight in which self-worth is judged almost exclusively based on physical appearance, and the active maintenance of low body weight. Redefinition and understanding of the self, specially through reflection on their condition, and trust, particularly learning to trust others and themselves, have been reported to help recovery. If the player followed treatment, improvements would be shown [6, 9].

2.2 Unconscious Thought Theory

Current research has proven that individuals can think about complex information, output sound judgements and be persuaded, even after a distraction takes place [22]. The basic process to apply UTT is: 1) topic presentation, 2) distraction and 3) deliberation. With a minimum of 3 minutes to distract, we are able to continue with the narrative without disturbing the persuasion process. To maximize results, we decided to take advantage of all the elements in a game (visual, narrative and interactive). We sought to persuade using the story of the game through narrative engagement with regulatory fit, affect framing of messages for the dialogues, and coping/fear techniques for the interactive options in the game [22, 23, 26].

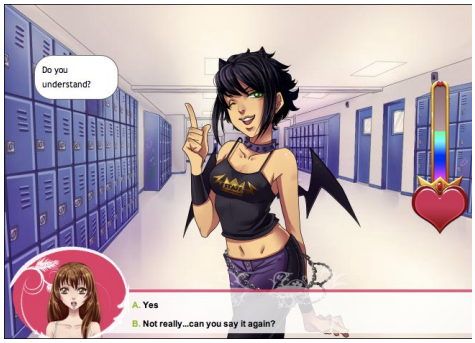

Figure 1. Screen captures of 'My Candy Love' (art by Stephanie Sala, property of Beemov Games)

2.3 Visual Novels

The premise of Visual Novels (VN) is to submerge the user in a complex narrative, allowing him or her to decide possible outcomes and the path the story takes at will [21]. Character level upgrade follows literary conventions of personal and emotional growth, instead of level upgrade. Players interact with characters by choosing from pre-written options in a menu. Every action triggers a response. Conversing reveals clues about how to solve a puzzle, continue through the story, disclose secrets, and provides hints for future cooperation (figure 1).

3. Multiple Composite Scenarios (MCS)

The concept of scenarios in games is not new, although these often refer to multiple perspectives from a same scene. In our approach, a scenario is the depiction of a particular step in the prevention process. They are multiple because, in order to introduce one single concept it took us seven steps. Our seven step approach consists in: 1) introducing the basic aspects of a health condition, 2) depicting deterioration or recovery due to treatment, 3) informing of easy-to-use gain-framed content transmitted through authority figures or loss-framed disinformation from deviant minorities, 4) distracting through the narrative of the game, 5) evaluating knowledge through puzzles and on-game tasks, 6) reflecting on recently learned topics by applying them in the virtual world, and 7) getting involved and gain points for contributing to the treatment.

Figure 2. Steps 1 to 4 of the MCS

4. Amigo

Amigo is spanish for friend. Becoming friends with the user allowed us to have emotional involvement and create an atmosphere in his or her mind that facilitated persuasion through likeability, trustworthiness, empathy, among others [2, 12]. To prevent we sought to cover all requirements set by experts, including for example the persuasion of users to have a better nutrition [12, 25]. We achieve narrative engagement through regulatory fit thanks to the strong story approach of VN [23]. We use affect by framing health positive attitudes as gains, and negative attitudes as losses [22]. And we prompt coping techniques to teach about nutrition [26].

Following our MCS model, we decided to introduce players to 5 topics on nutrition, influenced by Wither's five topic presentation with videotapes [25]. We would inform about food groups at class, having a virtual professor provide gain-framed related keywords and their benefits.

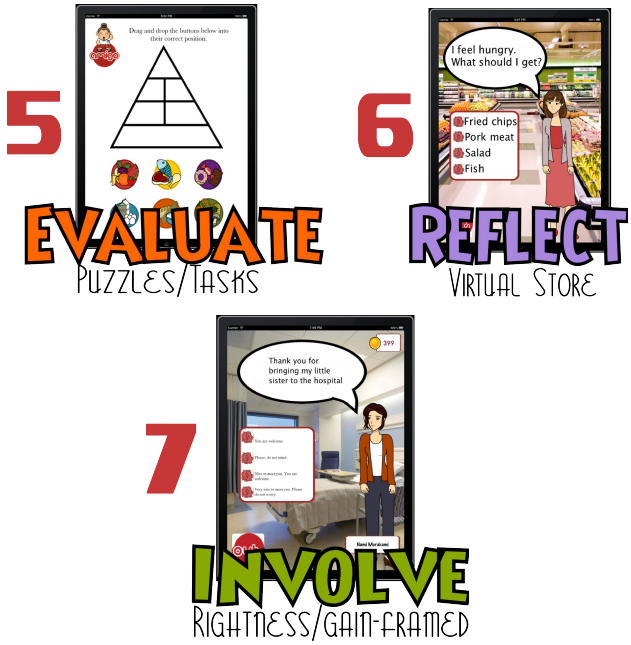

Figure 3. Steps 5 to 7 of the MCS

We had the player talk to the main character to pursue a narrative oriented goal, as a distraction. A main character may get sick and would be taken to the hospital, which would prompt the player to use coping strategies (steps 1 to 3 of figure 2). Puzzles like the nutritional pyramid would appear to evaluate what was learned (steps 5 figure 3). We also had occasions to reflect, like applying knowledge at a virtual store (step 6 figure 3). And lastly, we gave them opportunities to get involved in treatment, by helping the family of the main character keep an eye on him/her (step 7 figure 3). In Amigo we introduce players to a magical reality, under attack by a mysterious group, who seek to control the parallel universe.

5. Implementation

We implemented Amigo on iPads, as we consider that they offer three main beneficial features: a) freedom of mobility, b) internet accessibility and c) interactivity thanks to its multiple sensors. We made use of original cartoon characters, free photographies and BGM available online, and a database for dialogues. The software of Amigo, it was created using ObjectiveC, C++ and SQLite3. We had multiple classes and event handlers with which we distributed the actions. The game system consists of a game-loading, user registration and settings sections through which the user may navigate freely.

6. Evaluation

It is important to note that for Amigo we sought to avoid demand characteristics and social desirability forms of bias by emphasizing to participants that the goal was to develop a game for nutrition, thus "hiding" the goal of prevention [1, 7]. We conducted a two-session set of experiments that included: 1) intensive interviewing, 2) questionnaires and surveys (all 5-scale Likert instruments), and 3) on-game performance estimation. Results were analyzed using textual analysis, theoretical coding, and theoretical sampling. To evaluate the benefits of our method, we conducted two sets of experiments, treatment and control.

For the control group we kept all multimedia elements from our Visual Novels for Prevention (VNP), six out of seven steps of the Multiple Composite Scenarios (MCS), and our approach to

persuasion (minimal intervention). For the treatment group we had our full Multiple Composite Scenarios (MCS) for Prevention on Visual Novels method. Audience for control group was of 7 boys and 2 girls, 22.4 years average, with regular to bad eating habits. For our treatment group we had 8 males and 2 females, average age of 22.5 years, with normal to bad eating habits. Participants came from the Information Science and Liberal Arts departments at Waseda University. Their eating habits were classified using an adaptation of the Eating Disorders Questionnaire (EDI).

We were able to measure empathy, knowledge, response to requests, intention to diet and quality of nutrition. Empathy was estimated using validated techniques to measure presence, perception, trustworthiness and likeability [2, 8]. Response to requests were obtained with each player's overall performance (including puzzles and secrets unlocked). Quality of nutrition was rated by making comparison in diets before/after play. Knowledge was calculated using pre- and post-game surveys to measure knowledge on 5 topics introduced with Wither's method [25]. And intention to diet was also estimated through the requirements established by Withers.

Table 1 presents the results divided into sample 1 and 2 (necessary to calculate changes) using the 5-element Likert instrument and Wither's 5 concept introduction as basis. For both empathy and knowledge we include the mean and standard deviation. Empathy was practically identical between Treatment (T) and Control (C) groups, improving 0.25 points (out of a 5-point Likert scale) in both cases. This trend was similar for the case of Knowledge. Participants on treatment group, showed a positive increase (1.75 point) in knowledge after the second session, moving from an average of 2.25 out of 5 per student (Sample 1) to 4 by the second session. Volunteers in control group also had a 1.75 increase on knowledge only by the second session moving from 1.5 to 3.5. While the difference in knowledge before starting to play was lower on the (C) condition, they also managed to learn.

		Sample 1		Sample 2	
		M	SD	M	SD
Empathy	T=	3.75	1.26	4	1.41
	C=	3.75	1.5	4	0.71
Knowledge	T=	2.25	2.47	4	0.71
	C=	1.5	2.12	3.25	0.36

Table 1. Results of second experiment.

On table 2 response to requests, intention to diet and quality of nutrition may be appreciated. The values on them correspond to Treatment (T) and Control (C) groups and show the percentage of participants who fulfilled with the pre-established conditions. Response to requests was slightly higher for the treatment group, which may point out to the engaging and entertaining characteristics of our gaming style. Intention to diet was 5% higher on control group, which may be attributed to the difference in participant number. Last but not least, quality of nutrition was remarkably higher in treatment compared to control (60% to 33%), which may serve to show the opportunity for persuasion of our approach. Overall, our treatment group did result in positive results compared to control specially on knowledge and quality of nutrition, while performing equally to the minimal intervention (control) in the other three.

6.1 Discussion

Participants who showed more empathy towards the main character, who could identify with the situations on the game, or who knew someone with a similar problem, felt more obliged to help the virtual character, and were also the most active in sharing perspectives and contributing in interviews. This could have happened because, to a certain degree, the game was a virtual representation of the world they interact with. By taking the risk factor of consequences out of the equation, they felt more motivated to take an active role. As one female participant assessed, *"A previous roommate I had, acted like [character], she would hide and never eat"*. When asked to elaborate she said *"I felt bad for her, she reminded me so much of my friend"*. One male volunteer, who had never met someone like that, said *"I do not know anyone with anorexia, but, I felt so bad for [character] that I wanted to help"*, he then expanded by saying *"I do volunteer work, so I like to help anyone with problems"*. Both cases reflected how empathy plays a decisive factor in prevention. Empathy grows with interactive stories, and other findings show that increased empathy with the source also influences user actions [17]. Without real consequences, whatever they did was okay, and perhaps they felt more capable of doing so.

7. Related Work

MCS is a gaming style that emphasizes user engagement with a story instead of multiple task completion. We make use of attractive characters, multi-branching narrative, and persuasion to achieve prevention. While preventing through persuasion is something relatively new, using a game with attractive characters and a single-line story to persuade users to adopt a desirable behavior is not [10, 15, 16, 27]. Our method differs from carry-on gadgets in that we do not ask for personal user feedback on his or her health, we do not make use of sensors, as our gaming style is non-invasive, and we do not require the user to wear or carry any extra device for measurements [5]. Amigo differs from awareness enabled aesthetic displays in that we use a narrative to emotionally involve the user, as opposed to social pressure and constant reinforcement, we do not need the user to embed into his environment any sort of appliance, and we do not need constant reports [18]. And lastly, Amigo differs from physical-task oriented systems in that we do not ask the user to perform activities to progress in the narrative, and we do not make real-world measurements[16, 27]. Our approach differs from all in that we have a dialogue-based gaming style, multiple story approach and puzzles to measure progress.

	Experiment
Response to requests	T= 90% C= 88%
Intention to diet	T= 50% C= 55%
Quality of nutrition	T= 60% C= 33%

Table 2. Rate of success of end results.

8. Conclusions

We presented Amigo, a Visual Novel with Multiple Composite Scenarios (MCS), that uses Unconscious Thought Theory to prevent anorexia and bad eating habits in young japanese scholars. We elaborated both on its aspects and describe its characteristics. We showed the evaluation and results of our trial version with experiments conducted among different sessions, and discussed our observations from further analysis of the outcomes. With Amigo (trial version), we prevent to a moderate degree bad eating habits from progressing by increasing knowledge, motivating participants to start a diet, and improved in half of the cases their quality of nutrition. We were able to do so while maintaining a good degree of empathy, and obtained a high degree of response to requests. We also elaborated on the technical features of Amigo, including a simple analysis of its

code and added an algorithm to explain its functionality.

9. Future Work

We plan to develop a new version with which we seek to address the key concerns highlighted by Newton et al and the National Academy of Sciences [19, 20] to guarantee the success of our prevention intervention tool: reduce risk factors, promote protective factors, address bias concerns with the design of our game and experiments, and make use of validated instruments to evaluate the effects of our tool such as the Eating Disorder Examination Questionnaire (EDE-Q) and its multiple sub-scales.

We believe that the core contribution of our work to the sub-area of health-oriented applications in Human Computer Interaction (HCI), as well as to User-Centered Design (UCD), is our ludic prevention intervention methodology. In our method, we take into consideration multiple aspects in the progression of a health condition, both at a personal and intervention level. We present material that helps reduce risk factors and which favors the development of protective factors, by relating the content with the narrative of the game. That is, we transmit the message in a contextualized manner. By virtue of being a game that uses puzzles as a form of entertainment and evaluation, our method also provides constant motivation that helps us to keep user attention and interest. Also, we plan to include an organized scheme of parameters to avoid bias, as well as a collection of techniques to validate the quality of our evaluation. If proven successful in a mid- to long-term study, our goal is to develop a guideline of use for ludic prevention interventions.

We intend to create a new version of Amigo based on suggestions given to us by our participants during the usability tests and interviews, in an aim to make our application more appealing to our audience. After verifying the pros and cons of our method, we may be able to implement our approach with different prevention scopes (mental, emotional or behavioral).

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