

Bias Blaster – Aiding Cognitive Bias Modification- Interpretation through a bubble shooter induced game-flow

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Abstract

This paper presents the design and development of Bias Blaster. Bias Blaster is a proof-of-concept integrated bubble-shooter game with an evidence-based therapeutic intervention, i.e., Cognitive Bias Modification Interpretation (CBM-I). The game is tailor-made for patients of the Dutch national mental health organization (GGZ) recovering from a First-Episode Psychosis (FEP). Cognitive Bias Modification-Interpretation treats the self-stigma and its associated interpretation bias as experienced by patients recovering from a FEP. The amount and frequency of CBM-I items and training is regulated by the patient, through an integrated game-mechanic of the modified bubble shooter. The game implements a motivational and reinforcement paradigm, which paves the way for the use of the rigorous and demanding CBM-I therapy. Moreover, Bias Blaster exploits the natural game flow of the bubble shooter to increase resilience and adherence throughout the treatment of FEP patients. This paper presents the design and development process of the game. The lessons learned are summarized in implications for the design of serious games: design for “acceptance” and as a “serious therapeutic”.

Keywords

First Episode Psychosis, Cognitive Bias Modification-Interpretation, Casual Video Game, Social Anxiety, Interpretation Bias, Flow, Design for acceptance, Serious therapeutic.

1 Introduction

In this paper we present the design and implementation of the game Bias Blaster, a dedicated game that assist treatment of patients recovering from a First-Episode Psychosis (FEP). The design of the game as therapeutic instrument involves a careful balance among the interests of different stakeholders such as the player/patient, the psychotherapist, and game designer.

Despite many years of research and development into psychosis and schizophrenia it still remains one of the most costly and uprooting illnesses worldwide [1]. A First-episode psychosis typically emerges during the sensitive developmental period of adolescence and emerging adulthood. FEP is most prevalent between the ages of sixteen to thirty-five [2]. Psychosis is a condition characterized by loss of contact with reality and can involve severe disturbances in perception, cognition, behaviour, and feeling [3]. A psychosis manifests symptoms in a range of domains that include positive symptoms, negative symptoms, mood symptoms and cognitive symptoms, each of them underlying specific pathophysiological processes and treatments [4].

The onset of a psychosis can have a variety of causes, including: substance abuse, exposure to severe stress, inherited and/or acquired medical conditions and mood disorders. After a FEP, preventing a 'relapse' by a patient in remission is the primary concern of treatment [5]. Relapse refers to the recurrence of positive symptoms such as delusions and hallucinations. These positive symptoms are typically treated and stabilized with a combination of antipsychotics and therapy. The majority of patients experiencing a first psychotic episode relapse during the 2–5 year period after initial diagnosis [6,7]

Patients recovering from a FEP often experience a syndrome-influenced self-stigma, which affects the patient's perception of themselves as well as the world around them. Patients with a First-episode psychosis (FEP) tend to interpret ambiguous social situations and stimuli in a negative way and attribute these negative experiences to themselves. This cognitive interpretation bias can have serious effects for the patient's self-image and results in a why-try-effect [8]. To prevent relapse, amongst other treatment, psychoeducation is given to the patient as well as the family in addition to other therapeutic interventions. Psychoeducation is defined as 'systematic, structured, didactic information on the illness and its treatment, including integrating emotional aspects in order to enable patients – as well as family members – to cope with the illness or psychiatric disorder' [9]. Self-stigma is one of the subjects encompassed by psychoeducation.

Two problems arise in the deployment of psychoeducation for adolescents with a first-episode psychosis; firstly, psychoeducation shows mixed results [10,11] and secondly, the current form in which it is presented does not seem to fit the target audience [12]. Therefore the mental healthcare is reaching out for new approaches within the realm of serious media.

Serious games and simulations for this specific target audience have mostly been used for exposure therapy and assessment of positive symptoms [13,14]. Some recent advances in serious games for FEP do exist [15,16], but Bias Blaster has unique properties.

Healthcare nowadays is driven by evidence-based practices. The initial scope of the Bias Blaster project was to create a game based on the existing psychoeducation

curriculum [17]. Taking into account the better part of psychoeducation becomes infeasible, since it yields a too abstract therapy and lacks scientific rigor. Therefore a specific subject of psychoeducation has been selected for treatment with a different form of therapy. Cognitive Bias Modification Interpretation was chosen as a suitable treatment for self-stigma and the attached social anxiety. Firstly because, well-documented evidence exists for its effectiveness [18] and secondly, the method is suitable to be seamlessly integrated in a game.

This paper is organised as follows. In Chapter 2 we present the basic elements of Bias Blaster and their integration into the game. Bias Blaster seamlessly integrates CBM-I with a bubble shooter in a way that leaves the player/patient in control. Chapter 3 summarises the lessons learned in the form a design approach, design for acceptance, and a conceptual model of serious therapeutics. Chapter 4 concludes and elaborates on future work.

2 The evolution of Bias Blaster

2.1 Cognitive Bias Modification-Interpretation

The term cognitive bias was first coined by, Tversky & Kahnemann [19], and is defined as “a pattern of deviation in judgment, whereby inferences of other people and situations may be drawn in an illogical fashion” [20]. A cognitive bias is an automatic response of the mind, a mental shortcut in decision-making. Cognitive biases are unconsciously prevalent within the standard population, cognitive biases can be assessed by performing an Implicit Association Test (IAT). Cognitive Bias Modification (CBM) is a technique to modify specific Implicit Associations, i.e., an interpretation or attention bias. CBM trains individuals to interpret ambiguous stimuli in a positive way, rather than following their automatic response of interpreting them in a negative manner.

Cognitive bias modification training provides appropriate content to address self-stigma and interpretation bias in social situations as experienced by the FEP-patients [21]. Psychotherapists make a distinction between attention bias and interpretation bias. An attention bias manifests in the prevalence of noticing negative cues and stimuli over neutral or positive ones, whereas an interpretation bias is the tendency to interpret ambiguous information in a threatening manner [22]. CBM has proven to be suitable to modify interpretation bias [23], CBM-I is regarded a promising tool for treating psychosis and schizophrenia [21]. Unfortunately, sessions typically contain more than a hundred items of uninterrupted text-based exercises, which are exhausting, demanding and boring for patients.

2.2 Bubble shooter

Casual Video Games (CVG) are run of the mill, are simple to understand, have easy access and use, and require no special video game skills. Moreover they allow for short and irregular play time [24]. Interestingly, positive effects on stress reduction as well as on depression were found by playing CVGs [25].

There are countless types of CVGs. Bubble shooters are a well-known class of casual video games, with a wide range of implementations. The game mechanics of a bubble shooter is a juxtaposition of Tetris, Connect-four, and space invaders. The objective of the game is to limit the amount of bubbles that surface in the playing field, by shooting them with similar kind of bubbles. Similar bubbles connect, which subsequently depletes clusters of bubbles.

A Bubble shooter game encompasses the mechanics to create immersion and flow to facilitate fun and engagement. Immersion [26] and flow [27] are phenomena that affect the experience while playing games [28, 29]. The degree to which the player feels integrated with the game is a measure of the players' sense of immersion [30], while flow is experienced when the player has such an intense concentration that time and fatigue disappear [27]. Flow might be determined more by task-factors than by the realism of the game [31]. The influence of realism is less pronounced than that of the relation of possibilities and necessities to act [32].

2.3 Bias Blaster

Bias Blaster is a bubble-shooter based CBM-I game, implemented in unity3D as a web-browser game. Bias blaster combines the rigorous psychometric qualities of CBM-I and the de-stressing and flow-inducing qualities of a bubble shooter. The game play supports the cognitive bias modification interpretation according the motivational and reinforcement paradigm [30]. Bias Blaster implements a modified version of the traditional bubble shooter game mechanics; a bomb (Figure 1) connects the game play and the therapy, acting as a gateway to self-regulated therapy. The bomb serves as a game mechanic to deplete a multitude of bubble clusters independent of their shape and colour. In the game the continuous threat of stacking bubble-masses increases the cognitive task load. Combining a cognitive task load with flow and immersion presumably keeps the player from explicitly processing implicit CBM-I scenarios. When in trouble, the player is left the option to load the bomb to regain further progress in the game. It is consequential to realise that the player controls the frequency and length of the CBM-I sessions.



Fig. 1: Shows the bubble shooting part of bias blaster including a bomb that is the gateway to CBM-I items (you can only load it by working through CBM-I items), as well as the in-game reward (you can deplete a large area of bubbles by using it).

Traditionally CBM-I is presented in a text-only form to trigger the mental imagery of the individuals’ own experience in social situations. Because of the clashing styles of the classic plain-text based CBM-I items and the frivolous bubble shooter some compromises in the design were required. Bias Blaster maintains the traditional CBM-I style as well as the order of elements, however decorated with additional comic-drawn stick figures (Figure 2 & 3). The decorations are interpretation free, thus without social cues and without distracting stimuli.



Fig. 2: From left to right, (a) the implicit onset of the situation, (b) the social implications of the situation, which cues the interpretation bias and (c) the initial unfolding situation is presented and ends with the question how you would interpret this particular situation. The three slides trigger a mental image of the scenario by the patient.

The stick figures are stimuli-free and ambiguous so as to maintain the psychodiagnostic qualities of the CBM-I, in particular the process of mental imagery. If the comics had been richer in context and content, the stimuli and social cues in the comics would have presumably uprooted the modification training.



Fig. 3: From left to right (a) the completion of the word by inserting a letter that completes the word that creates a plausible interpretation possibility in the training; a positive outcome of the scenario, (b) the control question to check whether the patient understood the scenario and to reinforce the positive outcome (c) the possibility to return to the game or answer another CBM-I item, thereby adding extra power to the bomb.

In the dashboard of the game (Figure 4) the player can choose different environments to play in. The environments, or themes, fit the overall theme of the specific CBM-I items and the in-game environment of the bubble shooter. On top of that the theme determines the portrayal of the bubbles.



Fig. 4.: The dashboard of the game where the avatar can buy swagger and select themes, each representing different social environments (bakery, skateboard and a music concert). The themes drive the environment of the game and set the context in which CBM-I scenarios take place.

3 Implications for Game design

3.1 Design for Acceptance

Innovation in general entails introducing methods and tools in a novel domain, which implies new activities and new customers for the domain where the technique originates from and new technology for the receiving domain. But first and foremost, innovation is about use and actual deployment. For innovation put to work it is instrumental that stakeholders perceive the probability on success as good combined with a plausible good yield. Stakeholders must demonstrate a certain level of belief in order to engage.

In serious gaming projects, again in general, there is a minimum of three stakeholders: the designer, the deployer, and the player or client. Each of them takes a different perspective on the game and the gaming. The designer is typically concerned with the engagement of the player, whereas the deployer is concerned with the behaviour and learning goals of the client. The client and player being one and the same thus enrol in the serious gaming paradox. The player presumably engages voluntarily in the game, after all play is free, without purpose, and consequences in reality [33] whereas the deployer has a clear objective to change the player's attitude or behaviour.

Bias blaster has three principal stakeholders: the game designer, the psychotherapist and the first episode psychosis patients. Design for acceptance is a strategy to balance stakeholder's Perceived Usefulness, Perceived Ease of Use, and the consequent Behavioural Intention to Use [34, 35]. Stakeholders will attribute the properties of the game from their own perspective, taking into account their specific expertise, context, and organisational culture.

The psychotherapist comes from the mental health sector, in which evidence-based interventions and programs are the only accepted means of treatment [36]. Prior to accepting novel technologies, such as interactive games, it is crucial for them to have a clear understanding of the underpinning principles and a priori validation of the treatment.

Game designers come from the creative industry, in which entertaining the customer is the principal motivation. Creativity implies a way of work that involves explorative development and experimenting with serendipitous formats. As a for instance, game designers combine proven game mechanics in new forms, hence the wide variety of games in different genres.

The FEP adolescent is challenged to combine two worlds, the world of game play and the world of psychotherapy. As a player, he or she is familiar with different game genres such as FPS (first person shooters), MMPORG (massive multiplayer online role playing games), social games, and a wide range of casual games. Each

of these commercial titles have in common that they are entertaining, can be played smoothly and intuitively, have well structured levels, are rewarding, can be played any time, and for as long as the player desires. As a client the FEP patient is used to follow a tedious psychoeducation program to remedy his health disorders. But only because he has been told that the programme is good for his mental health.

3.1.1 How to design for acceptance

Design for acceptance is in its essence a practical approach to multicriteria optimisation problem of the perceived Usefulness and perceived Ease of Use of the principal stakeholders. This emerging approach to design for acceptance includes multiple iterations with tangible experiments and the assessment of acceptance from different points of view.

The first step in design for acceptance is the exploration of the design space. Each stakeholder creates a view on the product. In case of Bias Blaster that resulted in a wide range of topics taken from psychoeducation that should be solved simultaneously. Topics were supported by a set of evidence-based interventions and their respective assessment tests. The game designers outlined a range of potentially suitable game mechanics and game designs. These too were supported by user test procedures. The player/client finally sketched a Utopia of a triple A game with an integrated non-patronising intervention.

The perceived Ease of Use includes feasibility. Given the limited amount of resources and time the first iteration of the design process should be a small yet effective step. Hence the choice for a casual game with a proven engagement, hence the choice for an isolated objective, i.e., mitigating self-stigma, and the choice for an accepted intervention, i.e., CBM-I. From the perspective of the player/client this may seem a small step, however it is a step on the route towards a serious therapeutic [12].

The perceived Usefulness includes belief and recognition. The first prototype of Bias Blaster involved a squirrel climbing up a tree. This game meets the abstract game model including immersive and flow-inducing principles and creating barriers, which can be overcome through a "voluntarily" engagement in the therapy. However, the disbelief of the psychotherapist experts with this concept urged for a more familiar game type. The behavioural Intention of Use by the player/client depends on the perceived flow and immersion and their perceived disturbance when the intervention kicks in. In case of Bias Blaster, it is the player who chooses to engage in the therapy for the sake of the game play.

During the course of the project many assessments for acceptance have taken place, but rather informally. A method based on questionnaires and quick scans to attribute the properties of the design from the various perspectives is yet to be

developed. These attributes obviously will help to solve the underpinning multicriteria optimisation problem.

3.2 Towards a Serious Therapeutic

Though the design of Bias Blaster is far from ground breaking, the modes of use for the different modalities manifest interesting parameters for the development of games for health. Wartena et al [12] defined a serious therapeutic as “an application that operates on a trade-off between control of parameters by the therapist whilst acting as an assistive aid for the patient”. However that definition is far from complete and too narrow to encompass all the functionalities and modes of use games for health have to offer, and needs revision. Bias blaster has several interesting modalities that impact the potential of the game as well as the modes of use.

In Bias Blaster the healthcare professional has control over the CBM-I items in the database, while the patient has the control on when and how to access the game, a form of self-regulated learning. In case of Bias Blaster any surplus playtime outside of the therapy sessions (therapist-free-therapy) is a direct gain. Through logging, any action in the game can be monitored and analysed to assess the progress of patients throughout the therapy program. This embedded assessment is crucial in the monitoring and validation process of Bias blaster.

Serious games usually lack validation [37]. Even when an attempt is made to engage in a validation study, it is extremely hard to validate games that create completely new interventions, for healthcare. Because of that lack of validation, introducing serious games into an actual healthcare-related treatment-plan usually proves to be a lengthy endeavour. By not or minimally changing the psychometric qualities of the CBM-I in Bias Blaster, the validation process can rely on the same questionnaires and scales used in the non-game version.

Bias Blaster is an adaptive, assistive self-regulatory mobile health game, which integrates monitoring as well as embedded assessment of the patients progress, which facilitates the validation process of the therapy as well as the added value of the game. All of the properties make Bias Blaster a potential cognitive vaccine [38, 39] for mental healthcare, i.e. a serious therapeutic.

4 Conclusion

Bias Blaster integrates an evidence-based therapeutic intervention and a casual game for the mitigation of self-stigma. Self-stigma is a principal obstacle in the treatment of first-episode psychosis adolescents. The intervention method is an adapted form of cognitive bias modification interpretation (CBM-I), whereas the

choice of game play is a bubble shooter. The integration is by means of an add-on game mechanic: the bomb. Contrary to a classical bubble shooter, Bias Blaster creates a barrier that can only be resolved through the use of a bomb. Enabling the bomb is instrumented by an executing series of CBM-I scenarios. Thus the game flow potentially persuades the player to engage in the therapy by free will.

The design of the game balances the interests of the principal stakeholders, being the psychotherapist, the game designer, and the player/patient. In retrospect a design method emerged which we dubbed design for acceptance. Since using a game in psychotherapy is true innovation, the behavioural Intention of Use is crucial for any innovation to succeed.

The iterative approach for design for acceptance involves: exploration, feasibility, belief, recognition, and seamless integration. Exploring the design space puts marks on the horizon for each of the stakeholders. Addressing feasibility yields small steps in two dimensions of innovation, introducing a game technology in psychotherapy and introducing therapeutic activity into game design. Although the initial steps are small, the marks on the horizon can still be attained. In future iterations, steps may possibly be increased without jeopardizing the degree of perceived acceptance. Belief and recognition showed up when the actual game was designed from an abstract game model; all stakeholders must acknowledge the game play, not only the players. Creating a truly integrated game and therapy is essential for exploiting the virtue of game technology. In this case, the player voluntarily engages in the therapy persuaded so through the game play.

Taking design for acceptance one step further yields serious therapeutics. Bias Blaster's properties include the essentials of serious therapeutics such as: facilities to monitor and assess patients in game, instrument self-regulation, stimulate use out of the therapeutics context, and (integrated) support for validation.

5 Future work

Bias Blaster demonstrates several interesting concepts, which call for further research.

In Bias Blaster CBM-I has been used to mitigate self-stigma, however people suffering from more general social anxiety deficits may well benefit from CBM-I [40]. We intend to explore options in these directions. Questions that must be answered are obviously can we extend the range of CBM-I scenarios, in what form will they be implemented, do we have to discriminate between users etc.

The current implementation of CBM-I uses stick figures to link the game with the therapy and to introduce the context of the scenarios. It is an open question

whether different implementation forms can be used. For instance more playful forms can easily be constructed.

Although the choice for CBM-I to mitigate interpretation biases is supported by literature, the actual validation, whether or not CBM-I is effective in this form has to be executed. A Randomised Control Trial (RCT) has been set up for this purpose. The RCT addresses issues such as the form of the CBM-I sessions, number of items, their length and frequency induced by the game play, their effect on the perceived engagement, and general effect on self-stigma and interpretation bias.

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