Ludo Modi Varietas: A Game-architecture inspired design approach for BCSS

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Abstract.

The design of Behavior Change Support Systems (BCSSs) is a multi- and interdisciplinary process that involves a deep understanding of the user, mediator, social contexts and ultimately the socio-technical system. This paper attempts to demonstrate the benefit in the design process of combining four abstract modes of use (Trigger, Intervention, Assessment and Participation) from gaming, the Ludens Modi Varietas Model. MATTIE (Mobile adaptive therapeutic tool in psycho-education), a BCSS for youngsters (aged 12-18) with a mild intellectual disability aiming at behavior change in their social information processing, is used to exemplify the inner workings of the design model.

Keywords. Behavior Change Support System, Serious Gaming, Ludens Modi Varietas Model, Persuasive Technology.

1 Introduction

All games are meant to be persuasive, and try to form and reinforce compliance to keep the user playing. Though persuasive design is inherent to game design, persuasive games have become a genre on their own merit. Bogost [1] defines persuasive games as depending on successful procedural rhetoric's, while Visch [2] outlines the essentials of user experience, gamification and transfer.

Not all persuasive games are developed with behavioral change in mind and vice versa not all games with behavioral change in mind are in design persuasive. Simulations often don't aim to be persuasive in nature and are often positioned as training tools without specific entertainment goals. Serious games [3] often attempt to find a mix between entertainment and the serious content [4]. In Persuasive technology [5], Oinas-Kukkonen [6] found two main modalities to persuade, either computer-human or computer mediated persuasion. Rao [7] found similar modalities for persuasive games and outlined the need for a model similar to the Persuasive Systems Design model (PSD) [8] to effectively design games as Behavior Change Support Systems (BCSSs) [9,10]. Designing serious games through a model similar to the PSD is intricate, in particular because of the mechanisms, dynamics and aesthetics that are inherent to game design [11]. There-

fore often game elements, i.e. gamification, are used in BCSSs. Gamification has proven to be a promising tool towards behavior change, compared to captology and persuasive technology [12]. Some argue however that, gamification strips away the essence of a game [13]. Without taking away the essentials of game design, games with different goals and within differing domains can have very similar architectures. From a model-based approach and the authors experiences with serious gaming [14,15,16], the Ludens Modi Varietas (LMV) Model is being developed. The abstract modalities model focuses at the modes of use in serious media and uses them as a starting point for designing persuasive game artifacts. The essential goal of the model is to develop a framework for different game dynamics, mechanisms, aesthetics and overall design patterns that fit the different modes of use in games, leading to specific changes in attitude, behavior and/or compliance.

This paper focuses on the model as a design tool, illustrated through a BCSS named MATTIE [14]. This application demonstrates all four modes of use as a BCCS for adolescents with a mild intellectual disability, attempting to alter, form and reinforce the target audience's social decision-making behaviors.

2 The Ludo Modi Varietas Model

The abstract modalities model (Figure 1) was developed from the users perspective, as well as the mediator's perspective. The different social contexts in which the game can be used as well as the sociotechnical system in which the game will be implemented, both influence the design parameters of the artifact. The archetypical modes of use can potentially singularly be a game. However when combining more than one at the same time, a game can function as a tool that facilitates the needs of the user, the mediator and the social as well as socio-technological system in which it will be embedded. The model consists of four archetypical modes of use;

- **Intervention*:*** From a healthcare perspective, an intervention is an evidence-based method that has been proven successful as an analog version. However, in BCSS it can also be any newly developed method or barrier aimed at behavior change. The translation of an existing method to a digital game-version often proves to be difficult. The intervention is usually from the domain-specific field in which the game will be implemented and depending on the context can be metaphorically re-contextualized [17].
- **Trigger [**18, 19]: Fogg's functional triad and behavior model for persuasive technology describe a trigger as the onset for behavioral change in a medium. A Trigger gives feedback with persuasive features that lures the user into participation.
- **Participation** [20, 21]: Murray [22] defines participation as on of the four essential properties of digital artifacts. The rational behind participation lies in different user-perspectives as well as the specific qualities of the medium. Participation can go beyond in-game participation and manifest in adding comments, ratings or even desired features to the game itself.

- **Assessment** [23]: Assessment of skill, knowledge, attitude or behavioral change all can be core purposes of a game. Assessment within a social or sociotechnical system can also take place outside of the game; this however often creates a mismatch between the content in the game and the measurements. Therefor more often the assessment is the game, or part of the game; i.e. embedded assessment. The embedded assessment can also go completely unnoticed by the user through hidden design, leading to unobtrusive measurements. Embedded assessment can take place on persuasion appeal of the product as well as the didactic transfer related potential.

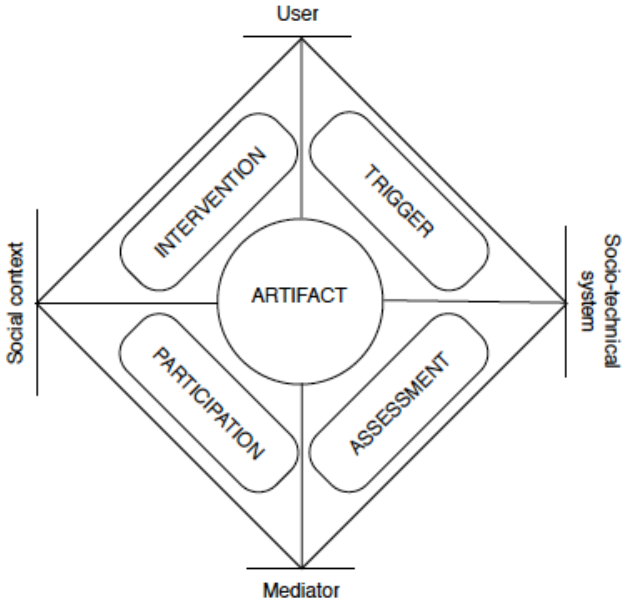

Fig. 1. Ludens Modi Varietas Model: shows the abstract modes of use as well as the users and environments for which and in which the artifact is developed.

The socio-technical system [24], attempts to facilitate the interactions between human and technology in the environment(s) where the application will be implemented. The different social contexts the users take place in outside of the initial scope of the system are also taken into account. The design of BCSSs is often a multi-disciplinary process that involves a deep understanding of the user, mediator, social contexts the user and mediator take part in and socio-technical system. The LMV model uses modes from design (trigger & participation) as well as from analytical science (intervention & assessment), thereby attempting to represent both the communities of practice as well as the communities of observers [25]. The LMV model offers a multi-view-centered design approach that attempts to isolate the specific mechanics as well as behavioral outcomes linked to the abstract modes of use.

3 Case Studie: Mattie

In this paper Mattie is used to exemplify design through the LMV because of the relatively transparent game architecture and the uses all the four modes of use in regard to design for behavior change.

MATTIE is a BCSS for adolescents with a mild intellectual disability (clients) and their therapists (mediator). The onset of the project was to create a digital application out of the analog psycho-education folder that was developed for the target audience. The application was created for the general healthcare facility as well as for the different social environments outside of the facility the client takes part in, in daily life.

"The mobile application introduces a simulated facetime call by an actor that is in a social predicament wherein social decision-making is warranted. The patient is asked to advise in the presented dilemma, making a decision and is afterwards confronted with the outcome. Important design choices in the workings of the application are the choice of actors alike the target audience enhancing the para-social interaction, the presentation of video-cases outside of the therapeutic setting, empowerment and self-efficacy of the patient through role reversal and an answering system befitting the social information processing of the target audience. Furthermore it gives therapists the opportunity to gather valuable input for their sessions and an adaptive system that gives them the control over the video-cases that are presented to the patient, thus picking the content befitting the specific needs of the patient." [cf.12]

Mattie as a BCSS operates from three connected platforms.

1. The Mobile Application Mattie
   Which is used by the clients and runs on their mobile devices, prompting video-cases: featuring Face time conversations that contain an avatar-mediated social dilemma. Through use of the mechanic of role reversal, the client get's asked for advice by the avatar, breaking with the traditional dynamics of the therapeutic environment, where the client gets told what to do.
2. A backend behind the application Mattie
   Which gives the therapists the options to;
   (a) Select video-cases based on subject or answer possibilities for the clients.
   (b) Select timeslots on the week schedule of the clients to prompt the video-cases.
   (c) Look at the answer-patterns of the clients through the week.
   (d) Walkthrough and remediate the presented video-cases during the week. Talk the motivations and circumstances behind the decisions.
3. A website platform named *www.maakmattiemee.nl*;
   (a) Which gives the clients and therapists the possibility to rate video-cases and inform whether they've been in similar situation themselves.
   (b) Give suggestions about dilemma's they've been in themselves, or subjects they would like video-cases about.

3.1 Mattie as an Intervention

As an intervention Mattie, harnesses the core principles of the Attitudes towards Social Limits (ASL) [26], a reaction response model in social information processing, that is used in the therapeutics setting as an assessment of the social information processing of the clients. The four standard reaction responses (Adjust, Avoid, Negotiate or Exceed) are used to create two answer possibilities to every case onset in the database. Per case dilemma two options from the ASL are given, after a scripted interval depending on the case subject and the consequence of the chosen response for the avatar. The mediator in the therapeutic setting will facilitate relevance and sense making by working through the application with the client. The social context or situation where the client was in while getting the prompt from the application can also be taken into the remediation conversation.

3.2 Mattie as a Trigger

Several design principles were used to attempt to make Mattie a persuasive trigger;

- In the choice of the perceived similarity of the actor with the user;
  - The actor acts and looks like a youngster with a mild intellectual disability.
- The framing of the message;
  - The actor asks the client for help (role-reversal from the traditional therapeutic setting) and trusts them enough to follow their advice (empowerment and self-efficacy for the client).
  - The message is portrayed similar to a video chat-conversation, giving it an authentic look and feel.
- The Use and User context;
  - The timing and onset of the application reaches beyond the context of the therapeutic setting. Placing Mattie in the social contexts where authentic dilemmas in social decision-making take place.

3.3 Participation in and through Mattie

As the client forms a para-social relationship [27] with the avatar, engagement concerning the consequences of the video-cases increases, as well as compliance with the application. This engagement in the use of the application can result in *liking* of video-cases on the site as well as creating video-cases of their own, by the clients as well as the therapists, through filling out the dilemma text-based at the hand of a number of questions. The self-made case descriptions and likes or dislikes are all displayed on the site as social proof and social comparison. The designer can use these ratings and the generation of video-cases can be used to develop new video-cases and extract salient features of video-cases that make them more persuasive and effective.

3.4 Assessment in and through Mattie

The therapist, to mediate and determine the content of the video-cases for the client, uses Mattie as a therapeutic tool. Through the logging of the decisions

made for the avatar by the client, the therapist gains insights in the social decision-making of the client and their tendencies towards specific contexts, situations and social limits. Through iterations, the therapist can adapt the video-cases, based on specific needs of the patient, video-case-load and subjects as well as answer possibilities of the cases. In this way the content on the mobile application can be tailored to the specific needs of individual clients.

4 Discussion

Mattie aims to be a therapeutic tool that aids the needs of the therapist as well as the client and fit seamlessly in the socio-technical and social contexts of the users. Reinforcing compliance towards answering video-cases from the application and reinforcing compliance through the website. Forming and altering behavior related to social information processing in social dilemmas. Finally through mediation and assessment the mediator can attempt to alter the attitude of the client towards social dilemmas.

In the design of Mattie through the use of the LMV model, an intervention from analytical science was designed and complemented by a trigger with persuasive features from the design science. Through participation and assessment both the trigger and intervention are refined and co-developed into a more effective and more persuasive BCSS. During this iterative development social and socio-technical system development around the development and implementation of Mattie, also take place through participation and assessment.

Mattie as a BCSS has to potential to, after several iterations, act as an adaptive therapeutic tool and use case-patterns (patterns in the exposure of certain case topics and certain case answers) for co-morbidity or other specific patient characteristics. Designing through the use of the four modalities in the LVM model. Through its cross-medial nature and different platforms it aims at creating a self-sustaining BCSS, wherein the therapist and clients can create continuous input into the design process.

Mediation can take place trough computers as social actors. However remediation of a BCSS within a clinical setting will involve human healthcare professionals. Therefore the LVM model uses the mediator as an incremental stakeholder in the development of the BCSS artifact. Remediation of altering, reinforcing or forming of compliance, behavior or attitude change is vital whether by a machine as a social actor or a human operator. The involvement of a human mediator as remediation of the BCSS also contributes to the social system development around the BCSS.

The LVM as a design model aims to facilitate design for the major stakeholders of the BCSS in use and co-development of BCSS artifacts. The model, as of now, harbors little to no information about the actual aesthetics, mechanics and dynamics that lead through the proposed behavior change [28], as well as the specific persuasive cues. However through the use of the four modes from the LMV create a multi-view of the juxtaposition of the mechanics in place. This way the mechanics, dynamics and aesthetics can be divided into the framework according to the four modes of use. Through the modes of use, different results from and me-

chanics leading to the Outcome/Change Design Matrix [10] can be identified and isolated in one artifact. The model offers a novel way of looking at product system design, attempting to simplify the overlap of mechanics and goals in one product.

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