An Idea Generation Game Design Tool for Health Behavior Change Games

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Abstract: Serious games (SGs) must engage, be entertaining and have a serious purpose to be effective. A health behavior change game (HBCG) can help change poor health behaviors but are difficult to design. One problem is there are few design tools to support developers of these types of games. This paper describes a card-based design tool for use during the idea generation phase of game design. The research question is: To what extent does an idea generation card tool have perceived value for SG designers generating ideas for behavior change games? This paper reports on the deployment of the tool for an HBCG to help individuals improve their diet and levels of physical activity. An evaluation was undertaken using qualitative data gathered through interviews with serious game developers and a focus group conducted with student game designers. Emergent common themes across both data sets were that the tool had practical and emotional value. Practical value in using the cards was found in the card structure, card content and sorting process. Emotional value included the positive feelings of having physical cards in front of them to use, the presentation of ideas and support provided on a topic they knew little about which brought some relief, increasing confidence and allowing for a more creative environment by freeing up their imagination. Negative feelings were also experienced and included participants remaining anxious about the range, complexity and interrelatedness of the concepts they needed to consider.

Keywords: Idea Generation, Health Behavior Change Games, Serious Game Design Tool, Behavior Change Techniques, Card Sorting Design Tool.

1. Introduction

Serious Games (SGs) have become a popular mechanism to encourage healthy behavior change. If they are designed well, they can satisfy effectively both education and entertainment requirements. They should aim to motivate through engagement and fun but also meet a specific, serious purpose. Engagement refers to the concentration immersion a player may experience while playing games. Fun refers to enjoyment. Purpose is normally expressed as a set of learning objectives. A significant challenge for SG designers is to ideate the foundations of a game that meets these three criteria. This paper describes a card sorting tool for use during the Idea Generation phase of the design of SGs that set out to change health behaviors. A Health Behavior Change Game (HBCG) seeks to change attitudes or behaviors by making desired health outcomes easier to achieve. One challenge of creating effective HBCGs is realizing complicated psychological theories and frameworks using game design elements. Even if an expert on these theories is part of a development team; a game designer requires their own understanding of them to properly weave them into a game's design.

In Shanks et al, (2020) we described Version 1 of a card-based idea-generation design tool to support idea generation for a HBCG SG designer/developer. Behavior change techniques (BCTs) and Self-Determination Theory (SDT) in combination with game principles informed the design of the cards. Final year University game design participants followed instructions and used the cards as if they were designing an HBCG. They were interviewed after this to gather insights. Subsequent qualitative data was analyzed using thematic analysis and as a result, the number of cards were reduced from 34 to 29. Some changes were made to some card content and to the instructions for the card sorting process. In Shanks et al (2021) we presented the results of deploying Version 2 of the design tool to participants in the academic SG field. We discovered that the cards had some value for idea generation but often had too much information thereby stifling creativity. The cards were reduced from 29 to 12 as a result.

In this paper, we present Version 3. This has changes to the card structure, content and guidance of the sorting process made as a result of the analysis of the previous data. Version 3 was subsequently tested with SG developers and a focus group of final-year University game design students. Both groups were given a tutorial using the design tool, SG developers had an online tutorial and the focus group had an in-person tutorial. In this paper, Section 2 offers an overview of SG design. Section 3 presents a brief description of SGs and Behavior

Change. Section 4 describes Version 3 of the Idea Generation Game Design Tool. Section 5 provides an overview of the study method and a discussion of the results. Section 6 touches on threats to validation, Section 7 states future work and Section 8 offers some conclusions.

2. Serious Game Design

The lifecycle of an SG typically starts with an initial research period to understand and develop the game context after which initial user requirements are gathered. The Planning and Design Solution stages include idea generation and the development of an increasingly refined product. Each version of the product is evaluated until a decision is made that it is ready for the market and a product launch. These stages are normally an iterative process. Figure 1 below shows a typical development lifecycle of an SG.

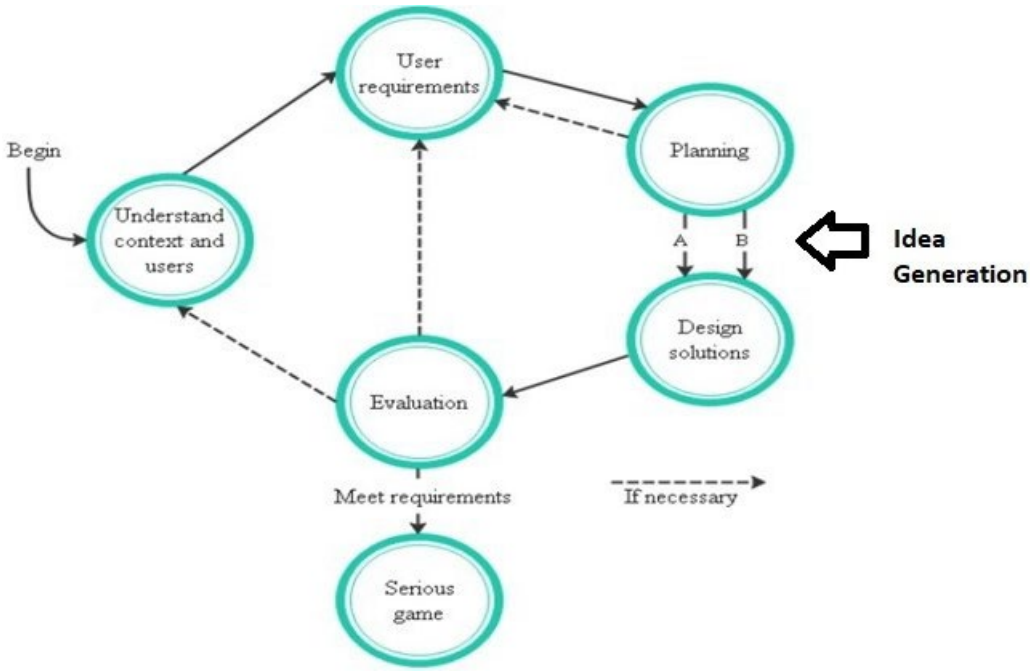

Figure 1: Serious game development lifecycle (Beristain-Colorado et al, 2021).

Idea generation draws upon many influences. There are many different techniques for generating ideas e.g. card-sorting, mind maps, role-playing, drawing a picture, attribute listing, storytelling, and brainstorming. Our interest is card sorting. Card-sorting has often been used to support idea generation for educational games e.g. (Pelser-Carstens, Matthew and Za, 2023). Tahir and Wang (2020) produced an ideation card-based toolkit to support the development of game-based learning concepts. Game design tools such as the Deck of Lenses (Schell, 2008) and the Playful Experience Cards (Lucero and Arrasvouri, 2013) provide concepts to follow during various design stages including ideation. However, there are few idea-generation card-sorting tools to support the development of HBCGs.

3. Serious Game (SG) Behavior Change

Behavior change through games often relies on the use of psychological Behavior Change Techniques (BCT) and the components of self-determination theory (SDT). A BCT is an active element of an intervention designed to change behavior (Michie et al, 2011). Self-determination theory (SDT) is a theory of human motivation. It identifies three basic psychological needs (autonomy, relatedness and competence) that drive an individual's behavior (Deci and Ryan, 1985). There are a wide variety of BCTs including goal setting, giving feedback, and providing information about the consequences of behavioral actions. There are many challenges when deploying BCTs to address a specific behavioral problem e.g. selecting an appropriate set of BCTs that fit the problem context, designing a consistent application of the BCTs, and developing a non-expert's complete understanding of behavior change. For example, the BCTs needed for an intervention to support the adherence to drug use in a patient may not all apply to an intervention for improving diet in adolescents.

Michie et al (2011) describe a taxonomy of 93 distinct BCTs. Duff et al (2017), Limone, Messina and Toto (2022) and Martin-Martin et al (2021) build on this taxonomy by setting out BCTs that can be assigned to an HBCG. These include feedback, prompts/cues, self-monitoring, goal setting, action planning, rewards, knowledge, motivation and tailoring. If a player is not engaged in the HBCG or does not find it fun, it is unlikely that the learning objectives will be achieved. Games tend to include enabling mapping to game design components that support behavior changes, so deploying SDT in games can increase engagement and enjoyment. Research suggests that games that satisfy the need for competence through optimal challenges are the most important contributor to the enjoyment of games (Rigby and Ryan, 2011; Tamborini et al, 2010). Autonomy and competence are positively associated with enjoyment, engagement and well-being (Ryan, Rigby and Przybyski, 2006).

Hornecker (2010) argues that often frameworks and tools designed to support the creation of games in general tend to be too constraining and burdensome to use in a creative process. The challenge is how to combine the freedom of an SG design exploration process within the structure of an orientating framework that integrates BCTs and SDT. Consider the design of an HBCG, *Escape from Diab* created by a large, multidisciplinary design team. It is a behavior change intervention designed to lower the risk of type 2 diabetes in 10-12-year olds through improving diet. Several different parts of SDT and BCTs were deployed such as intrinsic motivation from SDT and several BCTs e.g. goal setting and tailoring. Yet much of the in-game narrative is displayed through passive gameplay (cutscenes) where a player is sitting watching a scene take place without any input from them. Passive gameplay may not encourage players feelings of being in control or feelings of competence, both of which are required to inspire intrinsic motivation. This can impact players' feelings of being in control and undermine the application of SDT.

Two-thirds into the *Escape from Diab* project, close to half of the participants did not initiate any gameplay, indicating a real lack of sustained engagement. This might indicate that there was an insufficient balance of fun and entertainment present in the game to keep players engaged and motivated to play. Also, between the pilot of the game and the actual trials, 10 years passed and players now gravitate towards different types of games like mobile games with less passive cutscenes. The results of a subsequent study (Baranowski et al, 2019) found that it had little impact because it may not have included the right combination of behavior change and game design elements. Employing a flexible card sorting tool using SDT and targeted BCTs for HBCGs could be a way to address these shortcomings.

4. An Idea Generation Card Tool

To provide support for the generation of ideas during the development of an HBCG, we developed Version 3 of a card-based sorting tool grounded in ideas from SDT and BCTs. Version 1 had 34 cards in the deck, Version 2 had 29 cards and Version 3 has 12 cards. The size of the cards was increased from playing card size (64mm x 89mm) in Version 1 and 2 to A5 size cards in Version 3 (148mm x 210mm). From analysis of participant feedback, reducing the number of cards but placing more information on the larger cards should make the card content easier to recall and reduce cognitive load while still providing enough support. Font size was also increased in Version 3. The research question was:

RQ: To what extent does an idea generation card tool have perceived practical and emotional value for SG designers generating ideas for health behavior change games?

Practical value is concerned with the perceived value of the card structure, card content and sorting process so that it enables the generation of ideas and game flow without stifling innate creative freedom. Emotional value is concerned with how the cards invoke positive feelings such as relief, confidence, and inspiration or negative feelings such as anxiety, skepticism, or feeling unimaginative.

In Version 3, the headings are Tailoring to Player Values, Goal Setting: the Basics, Goal Setting: Looking Closer, Goal Setting: Action Planning, Rewards, Consequences, Autonomy, Competence, Relatedness: the Social Element, Knowledge, Feedback and Self-Monitoring. Each card is color-coded and describes what the BCT is (yellow), prompts under the heading Ask Yourself to stimulate idea generation (red), How the BCT can be applied under the heading How To (green) and a Practical Prompt (Blue). Figure 2 below shows the Tailoring to Player Values card:

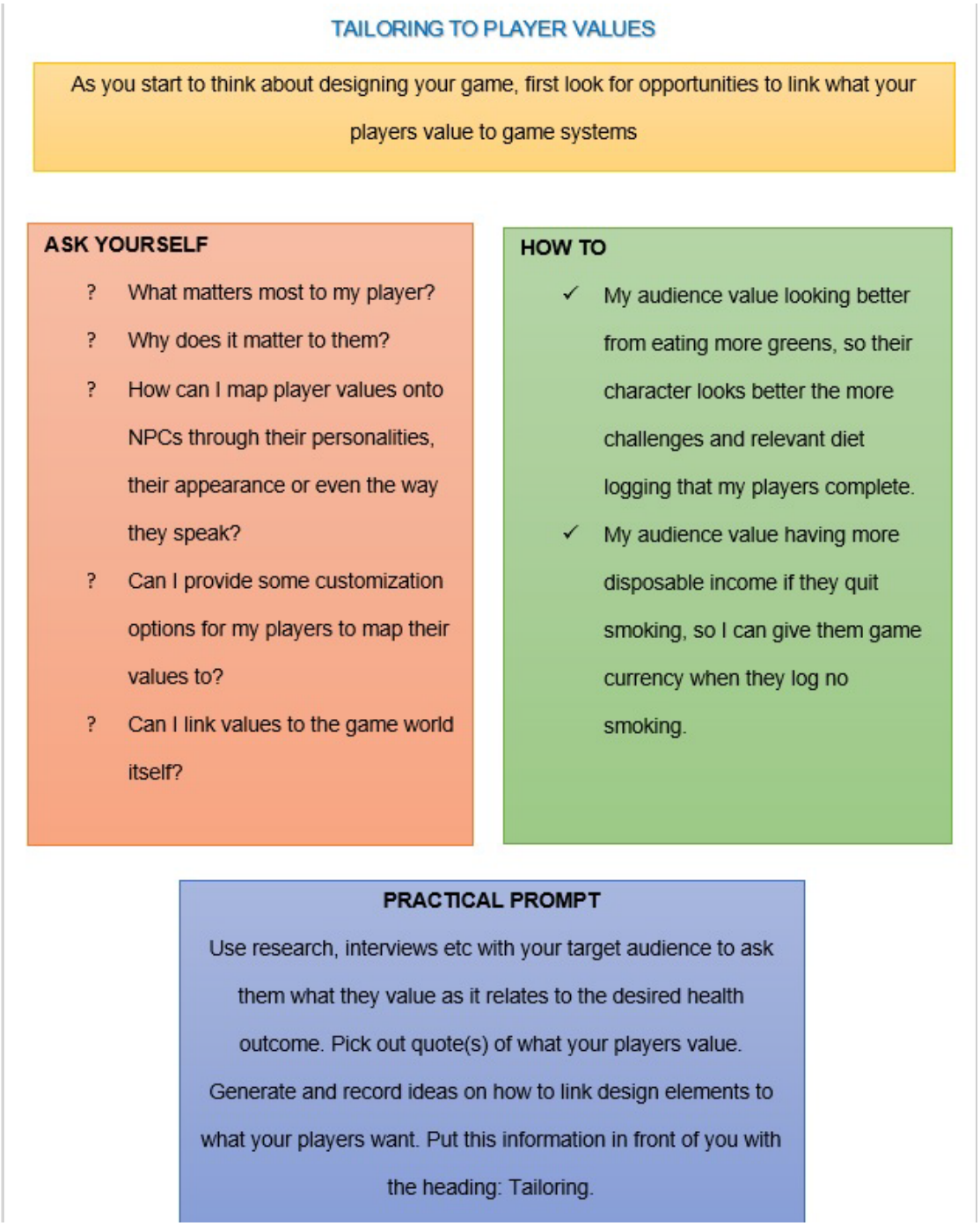

Figure 2: Tailoring to Player Values Card.

Tailoring to Player Values Card is the starting card, then users are free to draw another at random from the deck. Figure 3 below is an abstract overview demonstrating the role of all the other cards with two key takeaways of each card:

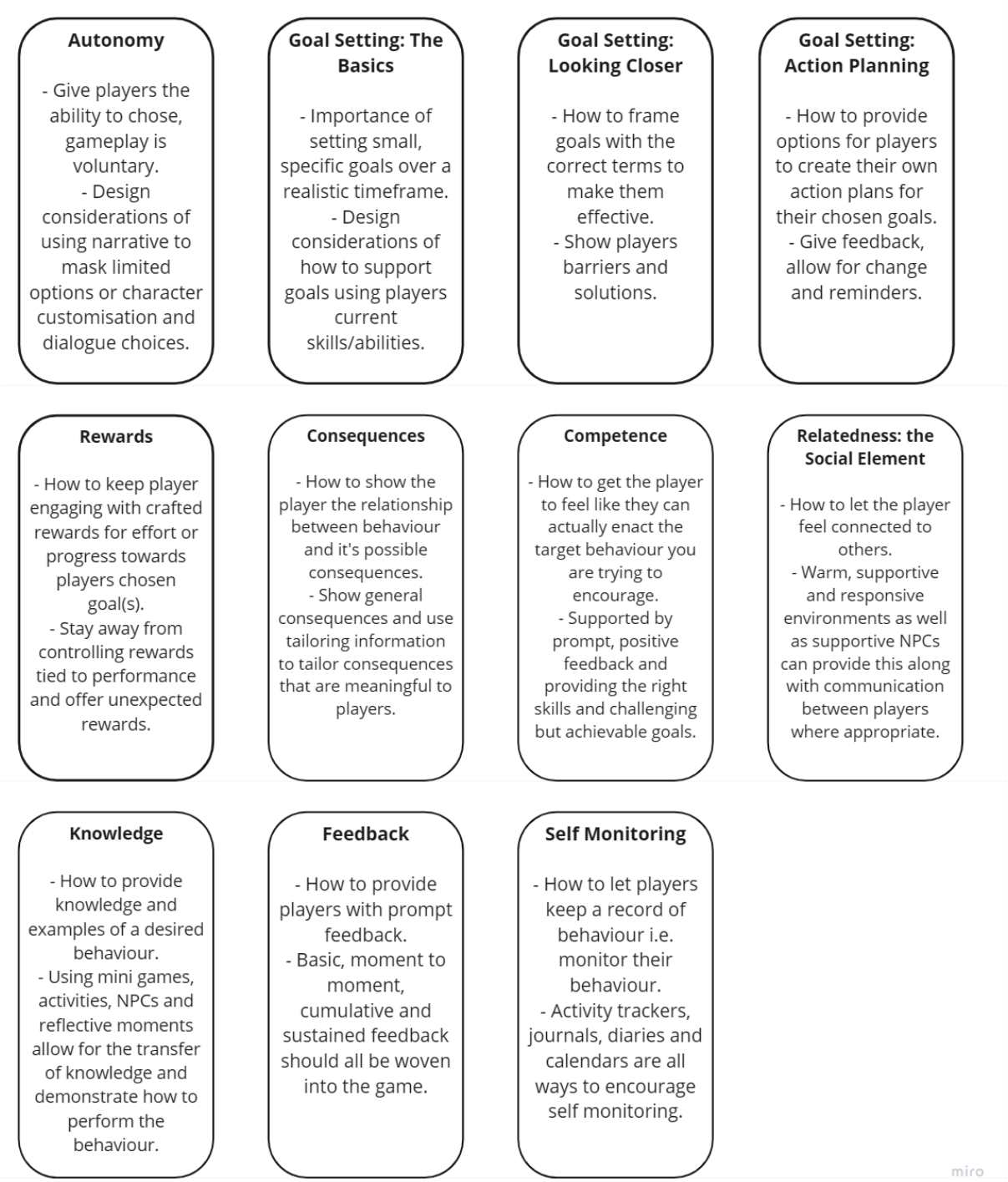

Figure 3: Overview of other cards and their key takeaways.

Relevant ethical considerations were applied including participant involvement, voluntary and informed consent, data handling and subsequent circulation of knowledge. Additional assurances were given to participants who were current students that grades received would not be influenced by their participation, withdrawal or statements. Data protection legislation was followed to ensure data was handled appropriately.

5. Idea Generation Card Tool Evaluation

To evaluate the card-sorting tool, two different data collection methods were used. Each stage of data collection influenced the design of the tool. In the first method, 2 male SG Developers were recruited through LinkedIn. Both had over 5 years of professional experience working on SGs. Each developer completed a separate online

tutorial where the cards were used in a digital tabletop. Each one was given a date and time that was convenient for them and they moved through the online tutorial and the use of the cards for one hour. Semi structured interviews (lasting 30 minutes) over Teams were conducted after the tutorial for each SG Developer. The questions focused on both practical and emotional value by asking how the SG Developers found the process of the cards as well as how they felt using them at different stages.

In the second method, 13 final year undergraduate students on the BSc(Hons) Game Development course were recruited (with one participant also working in the game industry) for an in-person ideation workshop and subsequent focus group, 11 males and 2 females. Student selection was achieved with non-probability, purposive sampling to select those who knew of or had worked within game design. Students were placed in groups of 3-4 and were given a copy of the card sorting tool and instructions. They were observed as they moved through the ideation workshop. This session lasted 1 hour and 40 minutes. There was a 10-minute break before the participants were randomly assigned into two focus groups. Focus group 1 consisted of 7 students, 6 males and 1 female and lasted for 30 minutes. Focus group 2 consisted of 6 students, 5 males and 1 female and lasted for 23 minutes. 7 questions were asked with probes included.

Critical realism and interpretivism were the ontological and epistemological approaches underpinning the project. Data was analyzed using reflexive thematic analysis i.e. a method for identifying themes, patterns and meanings across a dataset as they relate to the research question. The approach was inductive. Codes were extracted from the content of each data set and common themes developed from these codes. The data suggests that the design tool appeals to different audiences: beginners, experienced and highly experienced. Practical value was inferred by participant descriptions of how well the cards allowed them to apply BCTs and SDT without stifling creativity. Emotional value was determined by an analysis of qualitative data about how participants described how the cards made them feel.

5.1 Practical Value

Observations about the practical value of the cards have been arranged into subheadings on card content, card structure and the card sorting process. Key themes are presented in bullet points at the start of these sections.

5.1.1 SG Developers Card Content Themes

- Theme: Valuable for beginners.
- Theme: Ambiguous value for experts.

SG Developers found value in the information on the cards provided though it was slightly different for each one. For those with little or no experience with health behavior concepts, the information on the cards was regarded as striking a reasonable balance between knowledge acquisition and usability. For experienced SG Designers the information on the cards was regarded as of some but less value e.g. "*They were good for brushing up on my knowledge on behavior change, some of them I didn't know about. I felt like they were more for beginner devs, just from the wording. I would have liked to see some way to customize them a bit for more advanced projects*". It seemed to serve largely as a reminder of general BCTs, which was helpful, but more value came from additions to their specialist knowledge base. The BCTs provided seemed to be sufficient depending on the audience. For example, the SG developers noted that they felt more would be needed for more experienced designers of HBCGs: *"Like I said before maybe something for a developer who has perhaps made a few games like this and wants to improve them or see if they're applying useful things rather than going on instinct. An expertise deck almost?".*

5.1.2 Students Card Content Themes

- Themes: Tailoring as a filter.
- Theme: Restrictive questions.

The Tailoring to Player Values card emerged as the most beneficial aspect of the design tool as ideas were filtered through this card for both the SG developers and The Students. This card was popular as an anchor to ensure that ideas were on track enabling user-centered design. They used the Tailoring to Player Values card as a filter for ideas and to keep focus on ideas e.g. when they felt like they were going off track, they used this card to refocus on what was important. It was frequently mentioned by The Students especially that the cards helped to shape the start of the game e.g. "*We found that it was really good to generate ideas. So we had some ideas of what we can do as a project and then going through these questions like oh we could do this as well."* It was

noted by one Student that they did not find all of the card content useful e.g. *"I felt like generally a lot of the cards I was only looking at the left side with the ask yourself questions. It was only every now and again I'd be like, Okay, I'm not exactly sure what's with this one I'd look over to the other side."* Another Student mentioned that this may be because the content was too restrictive e.g. "*.. I think, possibly the questions and the first box was possibly a bit too restrictive. I think that's why people were possibly focusing on them so much."* This suggests that the questions on the cards may be too focused and not open ended enough to support creativity.

5.1.3 SG Developer and Student Card Structure Themes

- Theme: Flexible structure.
- Theme: Valuable information.

Emerging SG Developer and Student themes on the card structure were very similar. All the participants liked how the information was displayed on the cards, appreciating that there was flexibility about what part to read and the examples used. One SG developer did note that there *was "a ton of writing on them",* but the layout of *"short bullet points for each does help".* The SG developers noted the practical value of the layout and the color-coding of the advice and guidance. One did mention that the blue box on the cards containing the practical prompt didn't seem to add any value compared to the other color-coded boxes on the card. The Students mentioned that the separate color boxes drew the eye's attention and helped to provide a familiarity and comfort with the navigation process.

5.1.4 SG Developer and Student Card Sorting Process Themes

- Theme: Supportive design tool.
- Theme: Systematic but not stifling.
- Theme: Flexible process.

SG Developer and Student themes on the card sorting process were similar. Although the SG Developers and Students acknowledged that a rigorous systematic approach would be too formal and too inhibiting, most of them liked the step-by-step approach that the cards offered, because they provided sufficient guidance which was helpful but the flexibility to consider each card in any order they preferred (beyond the first card) which allowed them freedom to support their approaches to problem-solving. The SG Developers also explained that the process supplemented their approaches to ideation. Most Students felt the process helped them focus on ideas and enabled the linking between ideas and information during the ideation process.

5.2 Emotional Value

Participants noted positive and negative feelings within themselves as they engaged with the card-sorting tool although these feelings manifested themselves in different participants in different ways. The positive feelings emerged from (i) the comfort of having physical cards in front of them to use if they got stuck for ideas and (ii) the presentation of ideas and support provided on a topic they knew little about which reduced anxiety and brought some relief (iii) having some form of structure to guide their thinking which increased confidence and allowed imaginations to be freed up from anxiety. Negative feelings arose in some participants who remained anxious about the range and the complexity and the interrelatedness of the concepts they needed to consider. As a result, they lacked a degree of confidence that sometimes bordered on skepticism that the card-sorting tool would provide much help. Observations on the emotional value of the cards are organized into Students and SG Developers. Key emerging themes are noted in bullet points. Thematic analysis of the emotional value is still on going.

5.2.1 SG Developers

- Theme: Inspired.
- Theme: Confident.
- Theme: Reluctant.
- Theme: Skeptical.

For the SG Developers, at the start of the process, using the cards encouraged positive feelings of inspiration and support. Having the Tailoring to Player Values card as the first card they used and having it available later in the process as a focusing point to filter the project, encouraged them to use the other cards and reassurance that they could come back and check their ideas against this card during the entire process. On the other hand,

the SG Developers expressed a reluctance to embrace the ideas on many of the other cards because they were not sure that using the cards would lead to a "better" HBCG compared to their usual practices of idea generation. This is consistent with other work in that there remains a general degree of skepticism amongst SG Developers about the value of design tools during the design process (Neil, 2012). There seems to be some interaction here between practical and emotional value. When the SG Developers assigned a more negative emotional value through feelings of skepticism, they consequently assigned less practical value to the associated elements of the cards. When they felt positive feelings of inspiration through the use of the Tailoring to Player Values card, they expressed that the information was very useful.

5.2.2 Students

- Theme: Supported.
- Theme: Confident.
- Theme: Distrustful.

For the Students, the Tailoring to Player Values card also emerged as a key point of practical and emotional support, particularly at the start of the process. This card seemed to allow for a filter of ideas as well as an evaluation tool as they moved through the process. Participants felt they could generate creative ideas and have the Tailoring to Player Values card to provide a fallback to evaluate their ideas. This addresses an observation from the requirement survey that any design tool should allow for player insights to have value. The Tailoring to Player Values card may provide this by getting users to find what their target audience values, and use this as a filter for the entire development lifecycle. There was also less skepticism from the students, especially at the end of the process, compared to the SG Developers.

Students mentioned that the cards allowed them to visualize a better end product enhancing their confidence in using the concepts on the cards. There was a stronger feeling of confidence in this group compared to the SG developers. There is still an element of emotional distrust assigned to the information, a concern being that the commonplace use of the same tool by different SG developers may result in several games that appear similar to each other not necessarily in content but in structure. It is difficult to evaluate the efficacy of any design tool, but their anxiety on this point may be because participants were all given the same information on what their players value for the workshop.

6. Threats to Validation

The principal threats to validation are (i) that the sample populations of both the SG Developers and the Students are small and (ii) that the card tool has only been used for one type of HBCG. A follow up study could address these issues by recruiting a wider sample size to use the card tool. Additionally, the cards should be tested between groups by comparing participant usual ideation methods to a group using the card tool. The card tool has also only been tested with prompts for improving diet and physical activity. A follow up study should also investigate if it still has value when using a prompt for designing a SG for other health behavior concerns e.g. stopping smoking. Quantitative data could be collected in the follow up study, alongside additional qualitative, to allow for further validation.

7. Future Work

In addition to a follow up study, future work should also aim at evaluating the quality and long-term impact of the design outcome of the games developed as a result of using the cards during ideation. This could be done using the Consensual Assessment Technique (Amabile, 1982). This involves using a panel of experts to appraise ideas against a set of predefined criteria.

8. Conclusions

The efficacy of existing HBCGs remains an outstanding challenge and this may be a result of the lack of design tools to aid in this process. This paper describes a card-sorting design tool to support idea generation for HBCGs. The cards provide information about different aspects of behavior change theory and offer an iterative framework for game designers to lay over some fundamental principles of good game design including the design of a captivating game story, an appropriate set of game mechanics, and a constructive gameplay environment that allows learning. We report on a deployment of the tool to support idea generation during the design of a HBCG. A user recruitment survey, interviews and a focus group were conducted to explore the

experiences of users of the design tool at different stages of iteration. The main findings are that the tool may have perceived practical and emotional value for game designers by providing structure without stifling the brainstorming process and they envisioned a more effective end product by using the cards. This value was assigned to different elements depending on participants and the stage of iteration. Further work is required to expose the tool to more SG developers and for its use on a wider range of HBCGs.

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