TBM

PRACTICE TOOL

Game playbooks: tools to guide multidisciplinary teams in developing videogame-based behavior change interventions

Lindsay R Duncan, PhD,[1,4] Kimberly D Hieftje, PhD,[2,4] Sabrina Culyba, MET,[3] Lynn E Fiellin, MD,[2,4]

[1]Department of Kinesiology and Physical Education, McGill University, 475 Pine Ave, West, Montreal, Quebec H2W 1S4, Canada

[2]Department of Internal Medicine, University School of Medicine, Yale University, New Haven, CT 06520, USA

[3]Schell Games, 313 E Carson St. No. 200, Pittsburgh, PA 15203, USA

[4]play2PREVENT Lab, Yale University School of Medicine, New Haven, CT, USA

Correspondence to: L R Duncan
lindsay.duncan@mcgill.ca

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ABSTRACT

As mobile technologies and videogaming platforms are becoming increasingly prevalent in the realm of health and healthcare, so are the opportunities to use these resources to conduct behavioral interventions. The creation and empirical testing of game style interventions, however, is challenged by the requisite collaboration of multidisciplinary teams, including researchers and game developers who have different cultures, terminologies, and standards of evidence. Thus, traditional intervention development tools such as logic models and intervention manuals may need to be augmented by creating what we have termed "Game Playbooks" which are intervention guidebooks that are created by, understood by, and acceptable to all members of the multidisciplinary game development team. The purpose of this paper is to describe the importance and content of a Game Playbook created to aide in the development of a videogame intervention designed specifically for health behavior change in young teens as well as the process for creating such a tool. We draw on the experience of our research and game design team to describe the critical components of the Game Playbook and the necessity of creating such a tool.

KEYWORDS

Videogame, Behavior change, Intervention manual, Intervention

Implications

Policy: Resources should be directed toward "games for health" that propose to develop a Game Playbook to guide the development, implementation, and testing of important health behavior change interventions.

Research: Game Playbooks are critical for the creation and empirical testing of videogame interventions because they help to ensure fidelity and reproducibility.

Practice: Game Playbooks may be a critical tool for individuals seeking to develop games for health to ensure that proven mechanisms of change are implemented into the game play.

In the field of health behavior change, logic models and intervention manuals are traditionally used to lay the groundwork for establishing intervention goals and content. Indeed, these tools are essential for ensuring the appropriateness and effectiveness of intervention development, the fidelity of intervention implementation, and the reproducibility of research results [1–3]. In health research, logic models are graphic depictions of the causal paths from intervention activities through the targeted behavioral determinants and behavioral goals to the attainment of an ultimate health goal [1]. Manuals outline the essential components of an intervention from the guiding theory, to the intervention goals, to the means by which those goals will be attained [3–5]. The development of logic models and intervention manuals ensures that the fundamental mechanisms of change being targeted by the intervention are established and clearly outlined prior to the development and administration of the intervention [1–3]. Materials and techniques developed directly from logic models and intervention manuals are more likely to be successful and aligned with the study goals and hypotheses than materials and techniques developed in the absence of such tools [1, 6, 7]. Thus, there is widespread agreement that the creation of logic models and intervention manuals is a necessary step in the process of conducting health interventions research. Traditional logic models and intervention manuals, however, are the tools of researchers and they do not necessarily align with the language, culture, and practices of other members of multidisciplinary teams.

Recently, gaming (i.e., playing games, especially videogames) has emerged as a vehicle for the delivery of health behavior interventions [8]. With regard to lifestyle behavior change, there is empirical support for interactive communication channels such as the internet and videogaming as a means to increase the reach of interventions [9]. Indeed, researchers have demonstrated that interventions that target individuals within the context of their day-to-day lives may be more effective than interventions that are conducted in separate environ-

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ments in which the intervention effects must somehow transfer into the participants' everyday lives [10, 11]. Clinical studies have demonstrated that videogame-based interventions are effective for the management of asthma [12–14], diabetes [15, 16], cystic fibrosis [17], and cancer [18]. Additionally, games developed for mobile phones also have been found to be effective for increasing physical activity among adolescents [19]. Recent reviews strongly suggest that electronic media-based health interventions, including videogames, are effective for increasing health behaviors [8, 20, 21].

Given the preliminary evidence for the effectiveness of videogame-based interventions for improving health behaviors, it is not surprising that the field of "games for health" is growing at a rapid rate in terms of both the number of games being developed as well as research being conducted in this area [22]. The creation and empirical testing of games for health, however, is challenged by the requisite collaboration of multidisciplinary teams, including researchers and game developers who exist in different cultures and possess different goals, terminologies, and metrics of success [23]. Researchers are positioned to apply theoretical constructs and empirical findings to conventional behavioral interventions but may not be as attuned to the elements that make videogames challenging and fun for players. In contrast, game developers may have expertise in the creation of an optimal player experience but know little about the mechanisms of health behavior change [23]. To create a game that is both effective for achieving health behavior goals and engaging for players, the game designers must weave the behavior change elements into the fun elements of gameplay [24]; thus, game developers must acquire an understanding of the fundamental, theory-based behavior change mechanisms to be included in the game. However, the language and culture in which these theory-based behavior change mechanisms are typically discussed by researchers differs substantially from the language, culture, and expertise of game designers. Indeed, bridging the gaps in the language and culture of education, health, medicine, content, game design, and education has been identified as a key challenge in the advancement of the games for health field [25]. Our own experience working with a multidisciplinary team of researchers and game developers in the creation of a videogame intervention for health behavior change among young teens exposed this significant challenge. Through our own process of trial-and-improvement, we established a process to address this challenge and foster effective collaboration between the multidisciplinary members of our team. Our process involved the creation of Game Playbooks–documents that are guided by a logic model, contain intervention manual-style content, and most importantly, are created by, understood by, and acceptable to all members of the multidisciplinary team.

Creating Game Playbooks that accommodate the specific needs of a multidisciplinary game development team is essential for a number of reasons. First, establishing one document that outlines the theoretical foundations and gameplay elements will ensure that the targeted theoretical principles and behavior change mechanisms are included in the game. Second, a Game Playbook allows for the identification and assessment of critical moments within the gameplay that contribute effectively to behavior change. Third, a Game Playbook will be essential for translating the components of a successful intervention to subsequent interventions. Because the field of games for health is relatively new, examples and discussions of intervention development tools created specifically for the development, implementation, and assessment of videogame interventions are absent from the literature. Thus, the purpose of this paper is to describe the content and utility of a Game Playbook as well as the process involved in creating such a tool.

THE VIDEOGAME INTERVENTION

PlayForward: *Elm City Stories*, developed by play2PREVENT®, is a videogame intervention designed to provide at-risk, young teens with the knowledge and skills necessary to avoid engaging in behaviors that put them at higher risk for the human immunodeficiency virus (HIV) and other sexually transmitted infections. In PlayForward, players acquire *Me Power* by creating an *Aspirational Avatar* (i.e., a virtual character that reflects their future goals and dreams) and they use that character to travel through life. In their travels, players face challenges and must make decisions that bring about different risks, benefits, and consequences. Drawing on the principles of social learning theory, self-efficacy, message framing, and delay discounting, players acquire knowledge related to risk, safety, and health; learn to understand and navigate social (i.e., peer) relationships; negotiate against peer pressure; and learn to understand the benefits and consequences of selecting certain priorities. The players have the ability to see how their actions in the game might influence their future. The game involves a series of realistic stories representing risky situations faced by teens in middle school and high school such as sneaking a boyfriend or girlfriend into the house at night, vandalizing property, and getting in the car with someone who has been taking drugs. Successfully resolving each story requires players to acquire "senses" and "powers" by playing a series of skill-based minigames (i.e., small games within the larger PlayForward game). In the *People Sense* minigame, players learn how to navigate peer relationships by learning to identify people who may be more likely

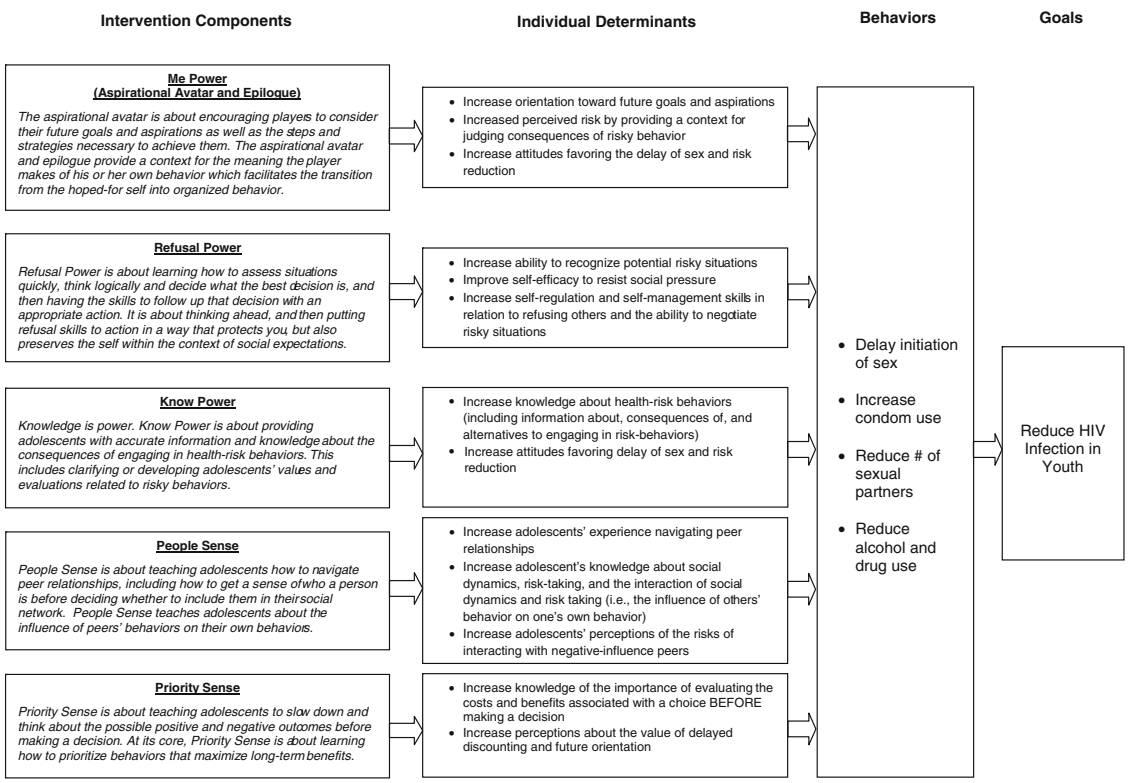


Fig 1 | Logic model for the PlayForward videogame intervention

to engage in risky behaviors and learning how the behavior of their friends (and the behavior of their friends' friends) may influence their own behaviors. In the *Priority Sense* minigame, players learn the realities (i.e., consequences) that accompany balancing multiple priorities such as health, family, friends, and academic achievement. In the *Know Power* minigame, players acquire knowledge about risk and risk reduction and practice reinforcing their knowledge with facts. Finally, in the *Refusal Power* minigame, players learn to identify techniques that people use to pressure others and risky situations in which peer pressure might arise and practice refusing peer pressure in a manner that allows them to maintain their role and credibility within their social network. The logic model for the PlayForward intervention is depicted in Fig. 1.

THE GAME PLAYBOOK

In PlayForward, the primary intervention content from which players acquire knowledge and skills to reduce risky behaviors is concentrated within the minigames (described in the "interventions component" column in Fig. 1). Each minigame targets a distinct set of behavioral or motivational outcomes (e.g., knowledge, self-efficacy, attitudes, refusal skills); thus, separate chapters of the Playbook were created for each minigame (five chapters in total).

Each chapter is comprised of five sections. The first section is a list of the *Player Transformation/Learning Goals*. These goals describe the desired end state of the player experience (i.e., what the player will learn from playing the minigame) (Table 1). The player transformation/learning goals are derived from the "individual determinants" outlined in the logic model and represent the factors that will have a direct causal effect on the target behaviors outlined in the logic model [1]. As an example, the player transformation goals for People Sense are to (a) increase adolescents' experience with navigating peer relationships; (b) increase adolescent's knowledge about social dynamics, risk taking, and the interaction of social dynamics and risk taking (i.e., the influence of others' behavior on one's own behavior); and (c) increase adolescents' perceptions of the risks associated with interacting with negative-influence peers. The Player Transformation/Learning Goals section also includes a brief narrative, written in layman's terms, that describes the overall goal of the minigame. The second component of each chapter is the *Curriculum Content*. The curricular component involves a thorough overview of the literature and a clear description of proven strategies for influencing the desired outcome. In the People Sense chapter, we identify concrete factors from the literature that (a) are associated with peer influence, (b) the player should learn to identify, and (c) would help to achieve the player transformation/learning goals. Together, the Player Transformation/Learning Goals and the Curriculum Content

Table 1 | Overview of Game Playbook sections and content

Playbook section	Content and features
Player transformation/ learning goals	Bulleted list of what the player will learn or acquire through game play
	Represents the factors that will have a direct causal effect on the behavioral target of the videogame
	Derived from the "individual determinants" outlined in the logic model
	Written in layman's terms
Curriculum content	Describes proven strategies for influencing the desired outcome
	Represents the bulk of what the game designers use to create content and gameplay system structures in the game design
	Derived from a thorough review of the literature
Targeted variables	Defines the specific behavioral, cognitive, or motivational targets of the videogame
	Drawn directly from the established theoretical frameworks guiding the intervention content
	Closely aligned with the transformation/learning goals
	Valuable for evaluation of effectiveness of the videogame intervention
Theoretical frameworks	Describes the theories from which the target outcome variables are derived
	Describes the mechanisms by which the target outcome may be affected through the intervention
	Provides a deeper context for understanding the target outcome
Game design application	Includes an overview of the narrative setup, the player's objectives, the player progression model, a breakdown of the game's systems, and how feedback of players' success or failure will be incorporated into gameplay
	May also include sketches, images, and diagrams of game play

Due to the iterative nature of videogame design, Game Playbooks are living documents that are frequently being updated and revised. Archived content is retained in the Playbook for reference throughout the design process

provide the bulk of what the game developers need from the researchers in order to begin the process of game design.

Throughout the collaborative and iterative process of developing PlayForward, our team recognized that game developers could benefit from a more detailed description of the theoretical underpinnings of the transformation/learning goals and curriculum content. Indeed, successfully implementing behavior change theory into the game mechanics depended on the game developers having a deep understanding of the theoretical variables and mechanisms that formed the core of the behavioral intervention. Thus, two additional sections–*Targeted Variables* and *Theoretical Frameworks*–were added to the Playbook. In the Targeted Variables section, the specific behavioral, cognitive, or motivational targets of the minigame are listed and described. The targeted variables are closely aligned with the transformation/learning goals, but they are drawn directly from the established psychological and social influence theories that guide the intervention content. For example, "increasing adolescents' knowledge about influence of others' behavior on one's own behavior" was identified as a transformation/learning goal in the People Sense game. Thus, social-normative beliefs (a component of social learning theory), which represent an important factor in understanding the influence that others may have on our own thoughts and behaviors, were identified as a targeted outcome in the People Sense game and defined in this section of the Playbook.

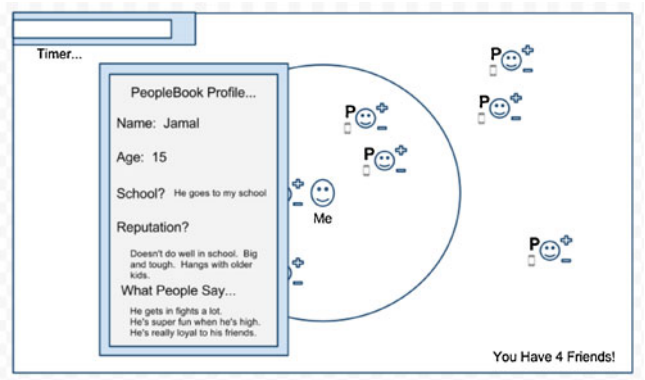
In the Theoretical Frameworks section, the theories from which the target outcome variables are derived are explained to provide a deeper context for understanding the target outcome. The description of the theoretical framework also points to mechanisms by which the target outcome may be affected through the intervention. In the Playbook for People Sense, we describe and discuss the components of social learning theory, thus presenting an overview of the mechanisms by which the theory suggests that the target variables can be influenced. Although the Targeted Variables and Theoretical Framework sections of the Playbook may not appear to be essential reading for the game developers on such a multidisciplinary team, we discovered that they are, in fact, very helpful. Including these sections in the Playbook allowed our team to institute a common language from which we could discuss the mechanisms of behavior change and how these mechanisms could be incorporated into gameplay.

The first four sections of the chapter, (1) Player Transformation/Learning Goals, (2) Curriculum Content, (3) Targeted Variables, and (4) Theoretical Framework, are all drafted by the researchers. Together, these four sections provide a clear overview of what we aim to change within the player during their gameplay experience and how that change should occur from a theoretical and behavioral standpoint. Although each of these sections includes terms from the health behavior literature, care is taken to define each term, to eliminate jargon, and to create a

a

Description of game play (excerpt)

As you connect to people, they might text you. When that happens, your cell phone on the screen vibrates. Click it to see what they have to say to you. This element of the game simulates the fact that people who otherwise seem ok might actually harbor risky ideas of drugs, alcohol, sex, or otherwise. When you receive a text you must respond to them and in this case you would also learn to practice refusal skills in a modern context.



Instruction to players (excerpt)

Next to each face are four icons you can click:

+	Move this person closer to you - the closer they move to you the more time you are spending with them and the more they can positively or negatively affect you.
-	Push this person away from you - the further they move away from you the less time you are spending with them and the less they can positively or negatively affect you. People you push past a certain radius are disconnected from you.
Cell phone	When you click this you can see what they have to say about you...this sort of rhetoric is designed to create a pressure on the player with things like ("they suck! Never want to hang with us the right way").
P (profile)	When you click this you can find out more about someone based on basic information people tell you, and their status updates on their "Profile".

Game results/ scoring (excerpt)

The game ends at a certain time or move interval with overall time spent per level being 10-15 minutes tops. An assessment of the players' actions is then provided and an overall score given (F, C, B, or A). If the player gets a C or better you graduate to the next level. There are X levels in total.

Fig 2 | a Excerpt from the initial Game Design Application section of the People Sense Playbook. Based on the previous sections of the playbook, the game designers created this initial sketch to demonstrate how adolescents will learn to navigate peer relationships through game play. b Excerpt from a revised Game Design Application section of the People Sense Playbook. Through an iterative process, several versions of the People Sense game are created and tested and all sections of the playbook are revised accordingly. c Excerpt from the final version of the Game Design Application section of the People Sense Playbook. The game design application section includes a summary of game play followed by detailed descriptions of the game components, rules, instructions to players, and scoring protocol

document that can be easily understood by individuals without expertise in behavior change theory.

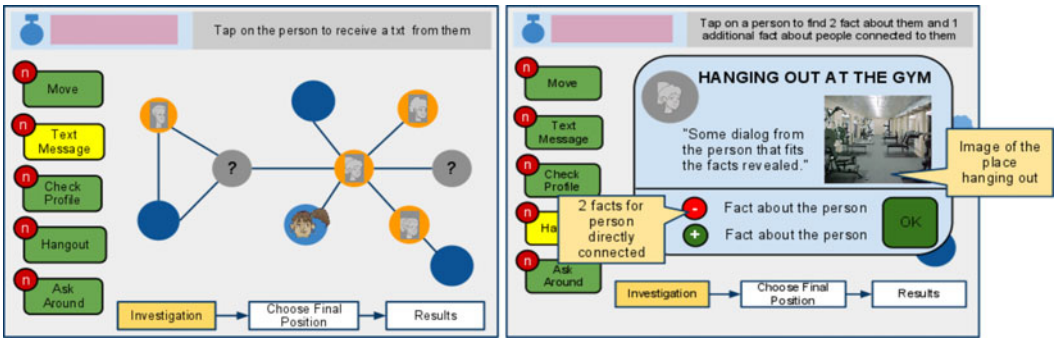
The fifth section of the chapter, the *Game Design Application* is written by the game designers. This section includes an overview of the game play, including the narrative setup for the game, the player's objectives, the player progression model in the game, a breakdown of the game's systems, and how feedback of players' success or failure will be incorporated into gameplay. It may also call out specific applications of content and concepts from the first four sections of the playbook into the gameplay framework. This section may also include sketches, images, and diagrams of gameplay (see Fig. 2 for sample diagrams from three different iterations of Game Design Application section in the People Sense Playbook).

To create the Game Design Application, the game-development team first must review and digest the first four sections of the Game Playbook. This review process involves multiple conversations between the development team and researchers, in which the playbook is at the core of the discussions. The game development team then creates the first iteration of game concepts that could embody the intervention components as a game. This game concept has, at its heart,

b

Description of game play (excerpt)

The player is presented with social network graph with unknown people. Distributed within the graph are some empty location which the player can use to move around. Using these location and the options available to the player, they can find out facts about these unknown people. The more negative facts an individual has, the more negative their influences and the more positive facts an individual has, the more positive their influence. The player needs to find out the ideal position in the network and place themselves close to positive influence people to maximize their points.



Instructions to players (excerpt)

Find out facts about these individuals and then place themselves close to individuals who display positive influence and distance themselves from people with negative influence. You can find out facts in several ways:

> *Text Message*: When you select *Text Message*, all the individuals who are *Known* (at least one fact about that individual is known) get highlighted. You can then select an individual to get 1 piece of fact from.
>
> *Ask Around*: This mode lets you see facts about known or unknown individuals. The number of facts displayed depends on the number of known connections to that individual. e.g selecting the unknown individual with no known facts "?" would display two facts about that individual as there are 2 direct known links connected to that individual.

Game results/ scoring (excerpt)

Once the player makes their selection about the position they want to place themselves in, they are scored and given points based on their selection. Each connection is scored based on two things:

1. The distance from the positive/negative individual
2. Number of unknown, positive, negative and neutral facts

Unknown facts are the worst for the player, idea being it's better to know the negatives about a person then not know it at all. The unknown facts yield maximum negative points. Direct connections are worth more than indirect connections. The scoring represents how well the player has investigated this social network and evaluated the most positive location at which to place themselves.

Fig 2 (continued)

the goals outlined in the Player Transformation/ Learning Goals section of the Game Playbook. The gameplay systems created for the game are designed to reflect the theories outlined in the fourth section, the Theoretical Framework. These systems generally should result in gameplay metrics that provide at least limited measurement of the Targeted Variables described in section 3. Additionally, the gameplay systems should support the type and scope of content that the researchers believe the player must learn or engage with in order to be successfully transformed.

The process of building the gameplay design upon the theoretical framework outlined in sections 1–4 of the Game Playbook should be iterative. Some examples of common calls for iteration that we observed in our process are described below. For each one, the Game Playbook provided a guide for the multidisciplinary team to recognize and address places where gameplay and behavior change goals could be brought into better alignment. It should be noted that the following represent examples, rather than a comprehensive list, of when iteration may be necessary.

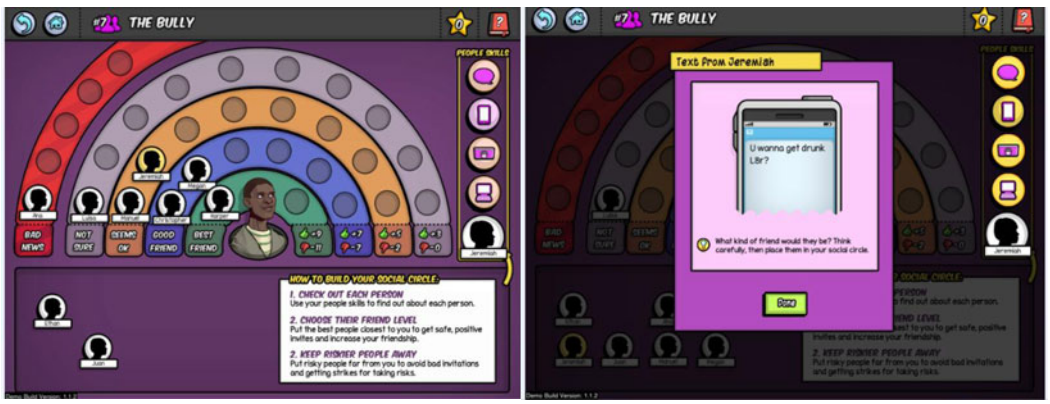
The first situation in which iteration may be necessary occurs if a player's success in the game does not require them to internalize the curriculum content. For example, one iteration of the People Sense gameplay had the player building social connections by moving players in real time through a space. Although this gameplay had a fun physicality to it, it asked the player to master controls more than it asked the player to master the cognitive

C

Description of game play (excerpt)

In the People Sense minigame, the player is presented with a list of people, each represented by node. First the player investigates each person through interactions that mirror in a simple way the various social interactions we have in real life. While investigating, the player arranges each people node along a gradient from Best Friend to Friend to Nice Enough to Unknown to Bad News.

When the player feels they've learned enough about each node and has finished placing each node, they can start to receive invitations. Each invitation includes the person inviting the player, the other people participating, and a description of the invitation. The player must decide if they will do the invitation or not based on this information. Each invitation is worth points based on how the player ranked the invitee. The goal of the player is to maximize their points by accepting only safe invitations and maximizing the value of these invitations by correctly placing the people nodes.



Game results/scoring (excerpt)

After all the invitations have been dealt with, the player gets their results. The higher their earned social points, the higher their star rating for the level. Social Points can be negative. The results panel also contains a brief story on how the players efforts have helped their character and their game stats. For example, if the level situation is:

> "Lamar just joined the basketball team. He's meeting new kids from his team and the cheerleaders. Help him figure out who he should be friends with and who he should avoid."

If the player does everything perfectly, they get close to max possible social points and earn three stars. The results panel says:

> Missed Safe Invitations: 0
> Accepted Unsafe Invitations: 0
> 50 Social Points

Fig 2 (continued)

skills at the heart of the game's transformational/learning goals.

A second scenario in which iteration may be necessary occurs when the gameplay structure does not have a place to present the desired curriculum content. This can often be traced back to issues of scope–either the gameplay does not have a place for that content and would need to be expanded or the curriculum attempting to be taught is too large and should be more focused. For example, in the People Sense game, part of the initial curriculum content included teaching adolescents how to end a bad friendship. Although this is an important social skill, it was not within the scope of the gameplay system to extend the gameplay to include this skill; thus, this piece of curriculum content was removed.

The third situation in which iteration is necessary occurs when an important concept, key to the desired behavior change, is not conveyed adequately in sections 1 through 4 of the Playbook. When this error occurs, sections 1 through 4 of the Playbook must be updated so that the game design can modified. For example, after several design iterations of the People Sense minigame, we felt that the way in which adolescents' choices of friends impacts the social cost of turning down invitations from friends and, therefore, their ability to avoid risky situations was not conveyed in the gameplay. Comparing the gameplay designs to the Game Playbook revealed this discrepancy and allowed the team to formalize this need in the first four sections of the Playbook and address it in the game design.

A fourth condition that leads to iteration is when player motivations in the game do not align with motivations in the real world, weakening the parallel of the game experience with the player's own real-

world behavior. For example, the literature on peer relationships indicates that in the real world, adolescents accept or decline risky invitations from friends based on complex emotional pressures that we could not replicate in the People Sense minigame. For example, in the real world, it is more difficult and more "socially costly" for an adolescent to turn down an invitation from a close friend than from an acquaintance; but, *feelings* of closeness to one character versus another are difficult to create within the game. Therefore, to ensure that the game reflected the known literature on peer relationships and their impact on risky behavior, we had to establish rules and scoring systems in the game that caused players to experience the interaction between friendship level and the difficulty or ease of declining a social invitation. When players label a character in the game as being a "best friend," declining an invitation from this character, even an invitation to engage in risky behaviors, costs the player more social points than if the character had been labeled as "good friend" or "not sure." Taken together, these four scenarios exemplify the iterative process of game development and the "living" nature of the Game Playbook. Although we did not present specific examples from our own experience, iterations in game development are not exclusive to researcher–game designer interactions. The iterative process of game development continues based on the usability testing and other potential user feedback during development.

DISCUSSION

The purpose of this paper is to describe the importance, content, and development process in creating the Game Playbook–a document that is guided by a logic model and includes intervention manual-style content to provide the foundation for the development and testing of a videogame intervention for health behavior change. There are numerous advantages to creating a Game Playbook. First, as in traditional logic models and intervention manuals, the target variables, theoretical framework, and mechanisms for behavior change are outlined in the Playbook as a first step in intervention development. Once the theoretical framework is established, the game developers have a clear description of the components and processes that are essential for inclusion in the game. The videogame design process is highly iterative and involves frequently revising and discarding ideas related to both game design and to behavior change mechanisms; however, it is essential that through the various iterations of a game, the fundamental behavioral targets remain intact. Thus, the Playbook, which clearly states the player transformation goals and retains archived content, is available for review throughout the game design process and is a critical reference tool.

A second advantage of creating a playbook is that it can be used in the design of the assessments that will be used to evaluate the efficacy of the intervention. Given that the theoretical variables are listed in the Target Variable section of the manual and referenced in the Game Design Application section, the manual can be used as a guide for determining where exactly in the game play the certain theoretical variables and behavior change mechanisms are at work. Videogame interventions can provide time-stamped data which allow for a player's entire game play to be recreated. Such data allow researchers the ability to determine if the actions that players take within the game match the self-report assessments of the target variables. Identifying key behavior change moments within a game play can potentially give researchers valuable insight into the game components which are most effective for behavior change. Similarly, identifying these key moments also allows the researcher to determine the degree of exposure that each player had to the various components of the game, which can help to ensure fidelity to the intervention. This dose–response data may also be used to support or challenge the theoretical mechanisms that underlie the videogame intervention and help to identify modifications that may improve intervention effectiveness. If the videogame were developed in the absence of the Game Playbook, determining critical moments within game play would be exceptionally challenging.

An alternative approach to creating videogame interventions is to have the research team propose a prescriptive list of features to be included in the game to achieve the desired behavior change. This strategy places the researchers and game development team in a transactional relationship where implementation is largely a product of feature requests; however, this may limit the gameplay possibility space to one which the researchers are already familiar or which mimics real-world interventions. It also creates inefficiencies in the game design process when the two sides function under independent guiding models, possibly leading to one of these common scenarios: (a) the gameplay is too dry, covering the material of the behavior change model but failing to engage the player or (b) the gameplay is engaging but superficial in its ability to change the player's real-world behavior. A team that defines a shared vision and understanding of the goals and theoretical foundation of the videogame intervention is better prepared to go beyond the naive implementation of the behavior change in digital format and better able to pivot in response to player feedback while maintaining the intervention's integrity.

As videogame interventions for health behavior change continue to emerge, the design and evaluation of Game Playbooks created specifically for these types of interventions is essential. A well-organized, well-designed Game Playbook can be used to ensure reproducibility of an effective videogame intervention. Likewise, a well-documented Game Playbook allows future design teams to extract particular components

of a videogame intervention to be reproduced and translated into the design of subsequent videogame interventions. Thus, Game Playbooks are critical for the creation, empirical testing, and reproducibility of videogame interventions.

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