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FULL-LENGTH REPORT

Development of the Saini-Hodgins Addiction Risk Potential of Games (SHARP-G) Scale: An International Delphi study

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ABSTRACT

Background and Objectives: As the gaming industry experiences exponential growth, concerns about gaming disorder (GD) also grow. It is crucial to understand the structural features of games that can interact with individual characteristics of gamers to promote GD. This research consolidates the views of an international body of panelists to create an assessment tool for gauging the addictive potential of distinct games. *Methods:* Utilizing the iterative and structured Delphi method, an international panel of researchers, clinicians, and people with lived experience were recruited to offer a multifaceted viewpoint on the addictive risk associated with specific structural elements in games. Two rounds of surveys facilitated consensus. *Results:* The panel initially included 40 members—ten from research, eight from clinical settings, and 22 with lived experiences. The second round included 27 panelists—seven from research, eight from clinical settings, and 11 with lived experiences. The study identified

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25 structural features that contribute to potentially addictive gaming patterns. *Discussion and Conclusions:* Consensus was found for 25 features, which were distilled into a 23-item evaluation tool. The Saini-Hodgins Addiction Risk Potential of Games Scale (SHARP-G) consists of five overarching categories: 'Social,' 'Gambling-Like Features,' 'Personal Investment,' 'Accessibility,' and 'World Design.' SHARP-G yields a total score indicating level of addiction risk. A case study applying the scale to three games of differing perceived risk levels demonstrated that that score corresponded to game risk as expected. While the SHARP-G scale requires further validation, it provides significant promise for evaluating gaming experiences and products.

KEYWORDS

gaming disorder, Delphi method, structural features, addiction risk assessment

INTRODUCTION

The video game market revenue worldwide has skyrocketed over the last half-decade, increasing by more than double from 172.65 billion U.S. dollars in 2017 to 369.18 billion U.S. dollars in 2023 (Statista [Internet]). This dramatic trend is expected to continue. By 2027, it is estimated that the market revenue will amount to 533 billion U.S. dollars (Statista [Internet]). While video gaming can serve as an enjoyable pastime, it can also have benefits on the individual level, ranging from its potential to entertain, educate, impart skills, provide opportunities to socialize, and blur socioeconomic boundaries (Granic, Lobel, & Engels, 2014; Griffiths, 2002). However, while being mindful of the benefits of video gaming as an enjoyable hobby, it is also crucial to recognize pathological gaming behaviour that may be conducive to addiction. Accordingly, the inclusion of Internet Gaming Disorder (IGD) and Gaming Disorder (GD) in the Diagnostic and Statistical Manual for Mental Disorders (DSM-5) and the International Classification of Diseases (ICD-11), respectively, as mental disorders has been heavily contested amongst experts (American Psychiatric Association and American Psychiatric Association, 2013; ICD-11 for Mortality and Morbidity). On the one hand, there is a serious and legitimate concern regarding misinformation and overpathologizing an activity that is otherwise normal and healthy (Aarseth et al., 2017). As outlined by Aarseth et al. (2017), doing so can contribute to misinformation about video games being overly harmful, restricting research into a confirmatory approach, and perpetuating unsubstantiated stigma. However, on the other hand, some experts defend the conceptualization of problematic gaming behaviors as a formal mental diagnosis due to the substantial number of gamers who exhibit functional impairment (Király & Demetrovics, 2017). While this debate has settled throughout the years, it is crucial to expand our conceptualization of GD by better delineating the interplay between a player's predispositions and the addictive properties of gameplay.

As with most behavioral addictions, there is a concern about strictly demarcating pathological behavior from nonproblematic behaviors (even at a high level of involvement) to prevent over-pathologizing (Billieux, Schimmenti, Khazaal, Maurage, & Heeren, 2015). In conceptualizing the model behind the etiology of GD, much work has been conducted on the psychological predispositions of players. However, a recent review found GD to be the outcome of the complex interplay between gaming-related, individual, and environmental factors (Király, Koncz, Griffiths, & Demetrovics, 2023). Individual factors included personality traits, demographic background, motivational characteristics, genetic predisposition, neurobiological processes, and comorbid psychopathology (Király et al., 2023). Personality factors implicated with GD included, for example, conscientiousness and neuroticism. A review by King and Delfabbro (King & Delfabbro, 2014) investigated the potential cognitive characteristics underlying GD. Four factors were elucidated, including 'beliefs about reward value and tangibility,' 'maladaptive and inflexible rules about gaming behavior,' 'over-reliance on gaming to meet self-esteem needs,' and 'gaming as a method of gaining social acceptance' (King & Delfabbro, 2014). Although these cognitions are conceivable characteristics of the psychopathological nature of GD, they also underscore the potential motivations of players who suffer from disordered gaming behavior. For instance, the potential to gain social acceptance can serve as a strong motivation for some players; therefore, by capitalizing on socialization features, games can be designed to play on the vulnerabilities of certain players. Numerous attempts have been made to construct instruments for screening and assessment of GD, including the Scale for the Assessment of Internet and Computer Game Addiction—Gaming Module (AICA-S gaming), 7-Item Game Addiction scale (GAS-7), and Ten-Item Internet Gaming Disorder Test (IGDT-10) (Király et al., 2017; Lemmens, Valkenburg, & Peter, 2009; Wölfling, Müller, & Beutel, 2011).

Although a considerable effort has gone to identifying the personal determinants contributing to problematic gaming behavior, there has been limited research on the intrinsic properties of the games that may increase the risk of GD. Games vary in their perceived risk of addiction with some—notably Massively Multiplayer Online Role-Playing Games (MMORPG)—viewed as very high because of their specific structural features (Eichenbaum et al., 2017; Ng & Wiemer-Hastings, 2005; Smahel, Blinka, & Ledabyl, 2008). Two of the lead authors of this study, N.S. and D.C.H., recently (Saini & Hodgins, 2023) conducted a broad scoping review to examine the literature on the associations of gaming structural features and GD. We summarized the findings in a novel taxonomy that included two broader categories: 'structural features promoting game realism' and 'gambling-like structural features' (Saini & Hodgins, 2023). This review summarized the preliminary work done towards understanding the potential of problematic game design in promoting GD. However, this approach to research is confirmatory and not necessarily comprehensive as it is largely predicated on prior research on structural

features promoting gaming behaviors and/or addiction (Saini & Hodgins, 2023). Therefore, there is a need for further research to identify, describe, and quantify potentially addictive gaming structural features that may have been overlooked.

This study seeks to extend current research by proposing a quantitative assessment model. Our approach draws inspiration from the 'Assessment Tool to Measure and Evaluate the Risk Potential of Gambling Products' (ASTERIG), which utilized a Delphi methodology to construct an assessment scale that allowed for the quantitative measurement of gambling product risk based on their structural features (Blanco et al., 2013). The Delphi process has been used in several ways, from research to the generation of evidence-based healthcare initiatives (Taylor, 2020). Three key characteristics of the Delphi technique are: (Statista [Internet]) the inclusion of a panel of experts who provided opinions on a contested issue (Griffiths, 2002); administrating data collection to panel experts in rounds; and (Granic et al., 2014) following each subsequent round by providing experts with the overall results of the previous round(s) relative to their responses (Barrett & Heale, 2020). A Delphi methodology was adopted due to its unique advantage of systematically bridging consensus in an emerging area of inquiry that is otherwise complex—such as GD (Thangaratinam & Redman, 2005). By collecting and analyzing the collected expert opinions, the present research strives to propose a robust model identifying potentially problematic structural features in video games and their relative contributions to addiction risk.

The primary objective of the present study is to synthesize insights from an international expert panel to create an assessment tool that quantitatively measures the addictive potential of distinct games based on their intrinsic structural features. Furthermore, by rigorously gathering and evaluating expert opinions on this emerging topic, this research can serve as a foundation for future assessment tools. It can also provide further insight to developers and thereby steer ethical game design to minimize addiction potential.

METHODS

Implementation of Delphi

In the present Delphi methodology, a facilitator (N.S.) managed the logistical considerations, including panel member recruitment, survey administration, data collection, and communication with panelists. Only the facilitator had access to the responses to the survey questions. Participants were asked to provide their names, country of residence, gender, and email addresses.

A list and description of structural features that might be linked to addiction were devised from the existing review (Saini & Hodgins, 2023). In the first round of this study, participants were asked to rate the potential of these structural characteristics to illicit addictive gameplay behaviors. The survey was concluded with an open response form, where participants were asked to suggest additions, exclusions, and/or summarizations for the presented items. By design, the Delphi method is a quasi-anonymous technique—that is, panelists were aware of other panel members' participation, but the responses were anonymous to the group.

Panel formation

To consolidate a multi-faceted understanding of addictive game structural features, the three groups of informants were researchers, people with lived experience, and clinicians. Inclusion criteria for researchers consisted of having published ≥2 research publications in a scientific journal relevant to GD. This threshold was designed to be broadly inclusive of researchers who had some focused attention on GD. For clinicians, the criteria consisted of being licensed and having ≥6 months of experience with treating GD or treating or having treated ≥3 cases of GD. Finally, people with lived experience who indicated a problem with gaming in the last 12 months were recruited. Prospective researchers were firstly identified by systematically developing a search strategy with the aid of a librarian; this search strategy included variations and synonyms of terms "Gaming Disorder" AND "Structural Characteristics" AND "Video Games." Seven databases, including Medline, PsycInfo, Embase, Academic Search Complete, Social Work Abstracts, Scopus, and Web of Science, were then searched for first authors and/or last authors with at least two relevant publications. A search was also conducted on Google Scholar. Those eligible for recruitment were then emailed asking for their participation, with the email containing a link to the study and the ethics form. Clinicians were recruited using either direct email or an online forum for members of the mental health and addictions system in Ontario. People with lived experience were recruited by an interest survey that was hosted and promoted on a newsletter by Game Quitters (an online community for people with GD).

Delphi collection and analysis

Panelists were sent a link to an online survey asking them to rank the addictive risk potential of various gaming structural features. Each feature was presented on a 7-point Likert scale, ranging from "very low risk potential" to "very high-risk potential." If participants were uncertain of a design feature, they were asked to select an option labelled "I don't know." They were also asked to provide suggestions for eliminations, additions, and/or modifications to the structural features presented through an open-ended response. Following the first round, the data were weighted to assess whether there was cross-group agreement. The threshold for consensus was 60% agreement, which was achieved through either an overall weighted average or by a single group. A second round was then administrated, presenting the participants with items from the previous that did not achieve sufficient agreement, in addition to new items based

on feedback of informants in the previous round. Panel members were also provided with their responses relative to the group trends.

This study protocol was approved by the Conjoint Faculties Research Ethics Board of the University of Calgary (REB21-1671). The present Delphi study was also pre-registered under the Open Science Framework on November 18, 2022, which can be found at: https://osf.io/4kw7v.

RESULTS

Panel characteristics and retention rates

There was a total of 40 informants in the first round of the Delphi (ten researchers, eight clinicians, and 22 people with lived experience). Nearly twice as many people with lived experience were recruited due to the potential for a higher rate of attrition. There was a 67.5% retention rate from the first and second round (70% of researchers, 100% for clinicians, and 54.5% for people with lived experience). Consequently, 27 informants participated in the second round. Background characteristics of the participants are provided in Table 1.

As can be noted in Table 1, more males (67.5%) than females (32.5%) were participating in the first round; although, this distribution became more equal in the second round with 55.6% males and 44.4% females. Canada was the most represented country in both rounds of the survey, making up 30.0% and 40.7% of the panel in rounds 1 and 2, respectively. This is followed by the United States which made up 25.0% and 22.2% of the sample in rounds 1 and 2, respectively. While many of the participants identified as living in European countries ($n = 7$), there was also representation from Australia and Africa ($n = 2$).

Table 1. Round 1 socio-demographic data and geographical distribution

		Round 1	Round 2
Sex	male	67.5% ($n = 27$)	55.6% ($n = 15$)
	female	32.5% ($n = 13$)	44.4% ($n = 12$)
Age	18 – 20 years	7.5% ($n = 3$)	3.7% ($n = 1$)
	21–30 years	10.0% ($n = 3$)	7.4% ($n = 2$)
	31 – 40 years	35.0% ($n = 14$)	33.3% ($n = 9$)
	41–50 years	22.5% ($n = 9$)	25.9% ($n = 7$)
	51 – 60 years	15.0% ($n = 6$)	14.8% ($n = 4$)
	61 – 70 years	5.0% ($n = 2$)	7.4% ($n = 2$)
	71 – 80 years	5.0% ($n = 2$)	7.4% ($n = 2$)
Geographical Distribution	Canada	30.0% ($n = 12$)	40.7% ($n = 11$)
	USA	25.0% ($n = 10$)	22.2% ($n = 6$)
	United Kingdom	10.0% ($n = 4$)	7.4% ($n = 2$)
	Denmark	5.0% ($n = 2$)	3.7% ($n = 1$)
	Norway	5.0% ($n = 2$)	3.7% ($n = 1$)
	Singapore	5.0% ($n = 2$)	7.4% ($n = 2$)
	Australia	2.5% ($n = 1$)	3.7% ($n = 1$)
	Mexico	2.5% ($n = 1$)	3.7% ($n = 1$)
	Poland	2.5% ($n = 1$)	3.7% ($n = 1$)
	Romania	2.5% ($n = 1$)	3.7% ($n = 1$)
	South Africa	2.5% ($n = 1$)	3.7% ($n = 1$)
	Spain	2.5% ($n = 1$)	3.7% ($n = 1$)
	Switzerland	2.5% ($n = 1$)	3.7% ($n = 1$)
	Hungary	2.5% ($n = 1$)	3.7% ($n = 1$)
Panel Distribution	Researchers	25.0% ($n = 10$)	25.9% ($n = 7$)
	Clinicians	20.0% ($n = 8$)	29.6% ($n = 8$)
	Lived Experience	55.0% ($n = 22$)	44.4% ($n = 11$)

Criteria for inclusion, exclusion, and re-rating

In the first round of the survey, agreement for inclusions and exclusions was found for numerous structural features. When aggregating the responses of all the informants, regardless of their identification to expert categories, there was agreement across each of the three groups on all the 'multiplayer/social gameplay' sub-features, including multiplayer, tournament, guilds, user-to-user interactivity, and leaderboard. There was also unanimous agreement on 'portability' as a structural feature. The panelists excluded 'expensiveness'. Within the 'intrinsic to games' category, there was only one feature that the panelists unanimously agreed upon as having an increased risk of addiction: goal-oriented virtual worlds. Virtual demographics, skin, physical attributes, verbal and non-verbal interactivity, violence, and drugs were excluded. While there was not unanimous agreement on 'virtual reality' and 'augmented reality' as structural features, these were also included because there was agreement within a single informant category (clinicians). A recurring theme within the descriptive feedback provided by the panelists was an advocation to eliminate the gaming genres category due to its redundancy. Thus, all the sub-features within the 'genres of games' category were eliminated.

At the conclusion of the first round, several panel members suggested additional structural features, including 'the ability to recover an account,' 'the grinding mechanic,' 'game extenders,' 'daily log-in features,' 'auditory feedback,' 'real-life rewards,' 'no endpoint,' and 'collectables.' Thus, these features were included in the second-round survey. Notably, features that failed to receive consensus for inclusion in the first round were also included in the second round: the capacity to customize avatar skin, verbal and non-verbal interactivity, experience-oriented virtual world, violence, substances, and punishment feature. Definitions of features that failed to achieve consensus are included in Table 2. Of these features, there was unanimous agreement across the panel groups for only three structural features: 'daily log-in features,' 'no endpoint,' and 'collectables,' Some features failed to receive unanimous agreement, but were included by virtue of receiving sufficient agreement within at least one informant category. People with lived experience agreed on including the 'freemium model,' 'experience-oriented virtual world,' 'the grind mechanic,' and 'game extenders;' clinicians agreed on including 'the grind mechanic,' 'game extenders,' and 'real-life rewards.' There were no structural features that were exclusively agreed upon by the research experts. Numerous features were discarded from consideration following a lack of consensus, including 'account recovery,' 'virtual demographics,' 'skin,' 'verbal and non-verbal interactivity,' 'violence,' 'substances,' 'punishment,' and 'auditory feedback.'

Panel consensus

By the conclusion of the Delphi process, 25 structural features were identified as having addictive risk potential. The full list of structural features that were included in each round of the survey, in addition to the final consensus agreement, can be found in Table 3.

Table 2. Definitions for features that failed to reach consensus in the first round

Structural sub-feature	Definition
Capacity to Customize Avatar Skin	Changing how the avatar looks that is not tied to their stable identity. For instance, using a 'Batman' skin in Fortnite.
Verbal and Non-Verbal Interactivity	How the player's avatar interacts with other characters in the game. For instance, an avatar changes their facial expression.
Experience-Oriented Virtual World	Virtual worlds that encourage players to explore and discover on their own. For instance, players can explore the world in Minecraft.
Substances	Players can engage in and/or witness addictive substances. For instance, in Grand Theft Auto, characters can drink and take drugs.
Punishment Features	How the player is punished for failing to achieve a goal. For example, losing a life, losing in-game currency, restarting the level, etc.

Preliminary assessment tool

Similar to the strategy used in ASTERIG for gambling games, a preliminary assessment tool to quantitatively rank the addictive potential of a game based on their intrinsic design was developed (see Fig. 1). Each of 23 structural features in five categories are rated on a three-point scale designed to capture the degree to which they are present in the game. For instance, given the structural feature "multiplayer," a game that is being rated could be scored differently depending on whether that game possesses "no multiplayer," an "optional multiplayer" mode, or a "required multiplayer" experience, with the former being the lowest addictive potential and the latter being the highest. As seen in Table 3, several modifications were made to the structural features to simplify the ratings. For instance, "Augmented Reality Capacity" and "Virtual Reality Capacity" were combined into the single item "Realism" given their high degree of similarity. Furthermore, an additional broader category called "Accessibility" was constructed to better capture the structural features of 'Highly Portable' (modified to physical game accessibility) and 'Freemium Model' (modified to financial game accessibility). An additional broader category called "Personal Investment" was made to include "Repeated Logins," "Event Duration," "No Endpoint," "Game Extenders," and "In-Game Purchases and/or Micro-purchases." Finally, the broader category called "World Design" includes "Goal-Oriented World," "Experience-Oriented World," "Grinding," and "Realism.". A sum of the ratings of the 23 items (23–69 points) is computed. The total score a game can, therefore, range from 23 (minimum) to 69 (maximum). We propose four preliminary interpretation categories: low risk if the total score ranges from 23–35, moderate risk from 36–50, high risk from 51–65, and very high risk from 66–69. The delineation of scoring thresholds was initially ad hoc, reflecting the innovative aspect of this scale. Consequently, these categories must undergo thorough validation in future research. The decision to divide the scale into separate ranges aimed to construct broad yet equitable intervals across the 'low,' 'moderate,' and 'high' risk levels. An additional 'very high risk' category was added to identify games displaying extremely addictive potential, albeit expectedly rare. In doing so, the goal was to potentially enhance the scale's specificity and sensitivity, anticipating future empirical validation to refine these preliminary thresholds.

Prospective SHARP-G scale case study

This section of the paper provides a case study applying the proposed scale to three games: Fortnite, World of Warcraft (WoW), and Monument Valley. These games were chosen because they differ markedly in their mechanics and design —Fortnite is a multiplayer battle royale game, WoW is an MMORPG, and Monument Valley is a single-player puzzle game. Due to their stark contrasts, they may target different

Table 3. A list of the total structural features that were rated in Rounds 1 and 2. The results of these two rounds are shown in the "Final Consensus" column. Note: Only features that failed to receive consensus in Round 1 were re-rated in Round 2

Category	Round 1	Round 2	Final consensus
Multiplayer/Social Gameplay Features	• Multiplayer • Online In-Game Competition/ Tournaments • Guilds/Clans/Teams • User-to-User Interactivity Features • Leaderboard		• Multiplayer • Online In-Game Competition/Tournaments • Guilds/Clans/Teams • User-to-User Interactivity Features • Leaderboard
Extrinsic to Game Features	• Expensive Games • Highly Portable	• Freemium Model • Ability to Recover Account	• Highly Portable • Freemium Model
Intrinsic to Game Features	• Capacity to Customize Avatar Virtual Demographics • Capacity to Customize Avatar Skin • Capacity to Verbally and Non-Verbally Interact with other Game Avatars • Experience Oriented Virtual World • Goal-Oriented Virtual World • Virtual Reality Capacity • Augmented Reality Capacity • Violence • Drugs, Alcohol, Tobacco, and Other Addictive Substances • Sexual Themes and Nudity	• Capacity to Customize Avatar Virtual Demographics • Capacity to Customize Avatar Skin • Capacity to Verbally and Non-Verbally Interact with other Game Avatars • Experience Oriented Virtual World • Violence • Avatar Uses Addictive Substances • Grind Mechanic • Game Extenders	• Experience Oriented Virtual World • Goal-Oriented Virtual World • Virtual Reality Capacity • Augmented Reality Capacity • Sexual Themes and Nudity • Grind Mechanic • Game Extenders
Gambling-Like Game Features	• Near Miss • Scheduled Rewards/Payout Intervals • In-Game Gambling Capacity • Loot Boxes • Meta-Game Rewards • Punishment Features • Event Duration Features • In-Game Purchases	• Punishment Features • Daily Log-In Reward • Positive Auditory Feedback • Real-Life Rewards • No End-point • Collectable Items/Characters	• Near Miss • Scheduled Rewards/Payout Intervals • In-Game Gambling Capacity • Loot Boxes • Meta-Game Rewards • Event Duration Features • In-Game Purchases • Daily Log-In Reward • Real-Life Rewards • No End-point • Collectable Items/Characters
Genres of Games	• Sports • FPS/Shooter • Racing/Driving • Action/Adventure • MOBA • MMORPG/RPG • Puzzle • Strategy • Music/Rhythm • Platformer	(Genres removed from consideration)	

gamer groups. Furthermore, these three games are playable on different consoles: WoW is predominantly a PC game, and Monument Valley a mobile game. In contrast, Fortnite is cross-platform and can be played on PCs, consoles, and mobile.

Four independent raters rated Monument Valley and WoW, yielding a intraclass correlation coefficient (American Psychiatric Association and American Psychiatric Association, 2013; Granic et al., 2014) of 0.88 (95% CI 0.77, 0.94) and 0.83 (95% CI 0.69, 0.92), which indicates good to excellent agreement (Koo & Li, 2016). The rating for Fortnite was independently done by the lead author, N.S. The total SHARP-G scores were 29 for Monument Valley (low addictive risk potential), 48 for Fortnite (moderate addictive risk potential), and 51 for World of Warcraft (high addictive risk potential). Figure 2 displays the ratings

PERSONAL INVESTMENT	**(Time) Repeated Login** Bonuses are given to players for logging on every day.	**None** Player can play whenever, login not required. (1)	**Moderate** Player incentivized by a built-in time limit for levels/quests. (2)	**Regular** Daily login rewards that may be incentivized with reminders and/or push notifications. (3)
	(Time) Event Duration The length of time required for game activities (such as quests, levels, fights, etc.). If there are a variety of event durations, the most salient should be chosen.	**Short or N/A** <10 minutes. (1)	**Medium** 10 - 30 minutes. (2)	**Long** >30 minutes. (3)
	(Time) No Endpoint The degree to which games are designed with a defined conclusive ending, narrative or defined in terms of progression. Games that are designed without a clearly specified conclusion (i.e., with 'no endpoint') create the illusion of endless progression by offering new goals and rewards.	**Clear Endpoint** There is a clear narrative and/or non-narrative conclusion to the game, beyond which there is no additional content. (1)	**Hybrid Design** There is a clear narrative and/or non-narrative conclusion to the game, beyond which players can experience additional in-game content. (2)	**No Endpoint** The game has no definitive conclusion marking the ending of a game, narratively or otherwise. Each gameplay experience may be unique and there is no clear linearity of play. (3)
	(Time) Game Extenders Ability to play content beyond what the original game offered.	**None** (1)	**Some** (2)	**DLC** Including content for levels, story, and quests. (3)
	(Financial) In-Game Purchases and/or Micro Purchases The player can buy in-game items, resources, skins, etc. using real-world money.	**Cosmetic or N/A** Includes skins. (1)	**Gameplay** If these enhance, alter, or otherwise modify gameplay. Includes levels and DLC. (2)	**Pay to Progress** Payment needed to advance or be competitive in game. (3)

ACCESSIBILITY	**Physical Game Accessibility** Whether players can engage in playing a video game while on the go (higher score) or in one single place (lower score)	**Low** (1)	**Moderate** (2)	**High** (3)
	Financial Game Accessibility The degree to which money is required to initially access (purchase) the game. If the initial access of the video game is free but requires purchase for additional game content such as DLCs, this would still be considered high.	**Low** ≥ 50% of market price of current video game. Also includes subscription models. (1)	**Moderate** ≤ 50% below the average market price. (2)	**High** Free for all games. (3)

Fig. 1. The proposed 23-item 'Saini-Hodgins Addiction Risk Potential of Games' (SHARP-G) assessment tool for predicting the potential addiction risk of games

(Figure 1 continued on next page)

GAMBLING -LIKE FEATURES	**Near Miss** In-game events strategically designed to create an intense anticipation of winning among players by closely resembling winning outcomes, ultimately leading to a loss.	**Low** The game appears to display negligible or no discernible near miss elements. (1)	**Moderate** The game appears to have infrequent near miss events that are not a central aspect of gameplay. (2)	**High** The game appears to have a high frequency of near miss features present within the game. (3)
	Immediacy of Rewards How frequently and at what time intervals the player is rewarded for achievements.	**Extended Time or N/A** > 24 hours. (1)	**Moderate Time** 1–24 hours. (2)	**Instant** < 1 hour. (3)
	In-Game Gambling Players can gamble virtually in the game.	**None** (1)	**In Game Currency** Definition includes cosmetic upgrades. (2)	**Real World Money** (3)
	Loot Boxes A virtual item that randomly gives players a reward. The player has no background knowledge of the reward they will receive.	**None** (1)	**Cosmetic** (2)	**Enhance Gameplay** Definition requires an in-game advantage such as a stat change. (3)
	Meta-Game Rewards Supplementary reward mechanisms designed to extend gameplay beyond the immediate, traditional gameplay experience. These are contrasted with in-game reward systems resulting from specific in-game actions.	**Low** (1)	**Moderate** (2)	**High** (3)
	Real Life Rewards Player receives rewards in real life outside of the game.	**None** (1)	**Minor** (2)	**Significant** (3)
	Collectables Player can obtain unique items (weapons, power-ups, cosmetic items, etc.) or characters as they progress in the game.	**Minimal** No tangible collectables. (1)	**Moderate** Collectables that do not help with progression, such as cosmetics. (2)	**Extensive** Collectables that help with game progression, such as weapons/power-ups. (3)

Fig. 1. Continued

(Figure 1 continued on next page)

SOCIAL	**Multiplayer** Players can play collaboratively, online or Offline.	**No Multiplayer** (1)	**Optional** (2)	**Required** (3)
	Tournaments/Competitions Players can compete against one another through a tournament ranking system. Only Tournaments/Competitions built within the game count.	**No Option** (1)	**Optional Online or In- Game** (2)	**Required** (3)
	Guilds Players can play together in an organized group who frequently play together.	**No Option** (1)	**Optional Online** (2)	**Required** (3)
	User-to-User Interactivity Players can interact in the game, whether by audio or in-game chat.	**No Option** (1)	**Optional Online** (2)	**Required** (3)
	Leaderboard A ranking system showing players' performance relative to one another. Note, only leaderboards against other players count; leaderboards showcasing NPCs do not count. Furthermore, the leaderboard functionality must be built in within the game.	**No Option** (1)	**Optional Online** (2)	**Required** (3)
WORLD DESIGN	**Goal-Oriented World** Virtual worlds that encourage players to advance in the game through objective driven progress. Games having a higher score have directionality in the game.	**Low** Open world. (1)	**Moderate** Optional quests. (2)	**High** (3)
	Experience-Oriented World Virtual worlds that encourage players to explore and discover on their own accord.	**Low** (1)	**Moderate** (2)	**High** (3)
	Grinding Gameplay is designed to demand greater player engagement in repetitive tasks that provides unique stat advantages to overcome a desired outcome with a pre-defined level of difficulty.	**No Grinding** There appears to be no grinding element within the game. (1)	**Pseudo-Grinding** There is a grinding element, however it does not provide stat advantages that contribute to progression within the game. (2)	**High** The game is designed with a built-in grinding element necessary for advancing player in the game. Engaging provides unique stat advantages allowing the player to the pre-set difficulty of a level, that would otherwise not be possible. (3)
	Realism The degree to which a computer-generated world allows players to engage in a simulated experience, specifically using augmented or virtual reality.	**Low** (1)	**Moderate** Includes augmented reality. (2)	**High** Includes virtual reality. (3)

Fig. 1. Continued

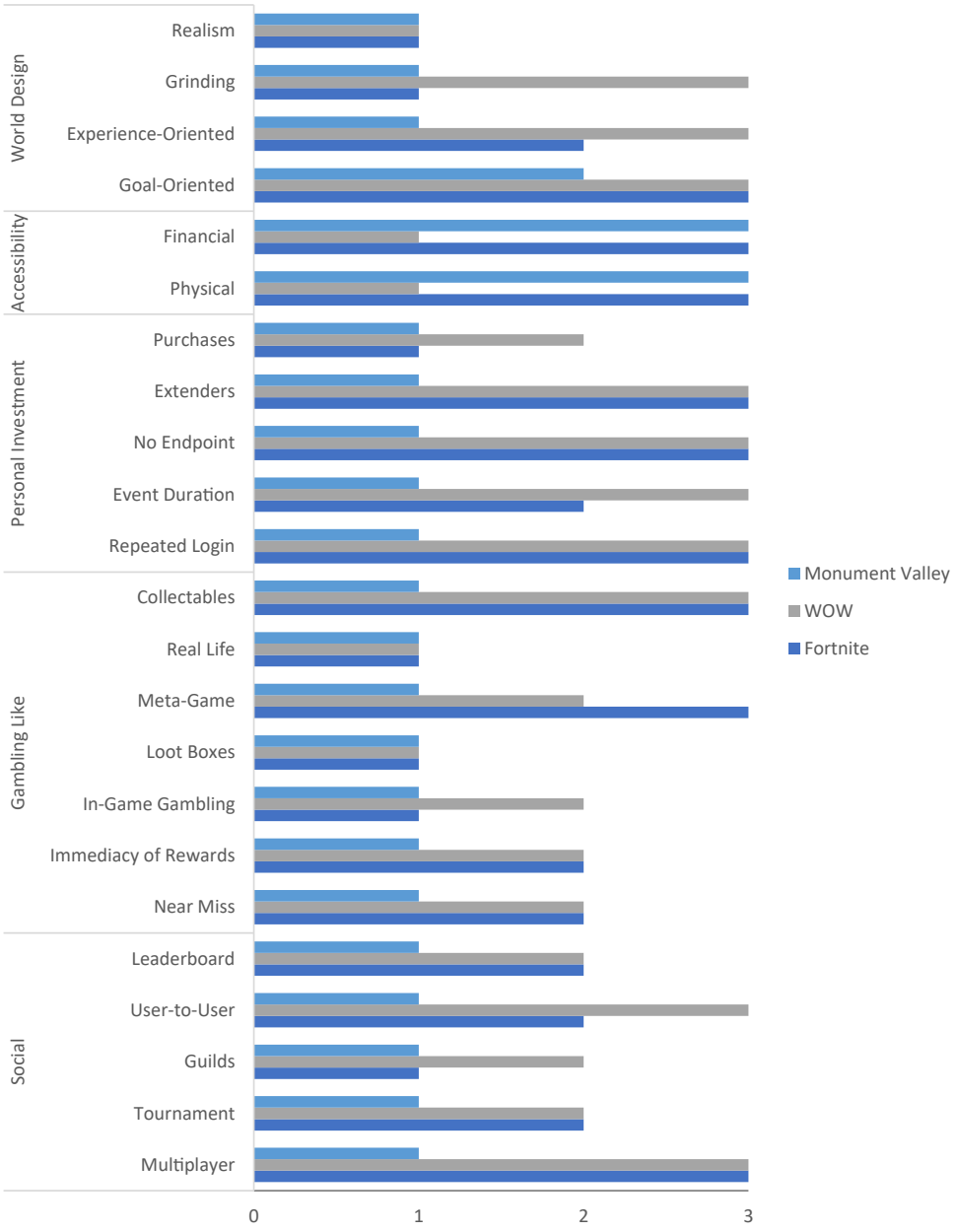

Fig. 2. SHARP-G item scores for Fortnite, WoW, and Monument Valley

for each item for each game. In many respects, there was considerable overlap in the intrinsic design features of Fortnite and WoW. Both obtained a score of 3 for their goal-oriented virtual worlds, the inclusion of game extenders, lack of a defined endpoint, repeated log-in incentives, the inclusion of collectables, and core multiplayer gameplay. However, these games differed markedly regarding three structural features: grinding, financial accessibility, and physical accessibility. For instance, grinding to gain experience (XP) is a core mechanic to being competitive in WoW—it is not present in Fortnite. Alternatively, Fortnite can be played across platforms and has a no-cost barrier to entry; WoW can only be played on PC and requires payment through a subscription model. Monument Valley was similar to WoW and Fortnite regarding low realism and lack of rewards that translated to the real world. However, Monument Valley scored highly on physical accessibility because of its cross-platform capability.

DISCUSSION

The goal of the present research was to construct an assessment tool to quantify the addictive potential of distinct video games based on their structural features by rigorously collecting perspectives from a heterogeneous pool of informants. Panel member opinion was hoped to be reached by getting the perspectives of three groups: clinicians, researchers, and people with lived experience. The goal of

achieving consensus was accomplished by conducting a Delphi methodology, which was considered suitable given the exploratory nature and lack of understanding of the intrinsic determinants of GD. A scoping review of the available literature provided an initial pool of features that the experts supplemented based on their expertise (Saini & Hodgins, 2023). The final set of features fell into four categories: "Multiplayer/Social Gameplay Features," "Extrinsic to Game Features," "Intrinsic to Game Features," and "Gambling-Like Game Features." A preliminary scale, termed the SHARP-G tool, was hypothesized to assess the potential addictiveness of specific games was proposed and illustrated by a case example.

Although this study has made substantial progress in disseminating the potential risk factors of the games that are being played to GD, there are also numerous limitations that should be addressed in future research. First, while this present study tried to include a heterogenous pool of informants to ensure a diversity of views, an important perspective is still missing: that of the game developers and stakeholders. Therefore, future research should consider eliciting the views of those designing games to contrast which features are deliberately designed for their addictive tendencies compared to features players find problematic. Although including such a distribution of panelists may be difficult to achieve in practice due to potential conflicts of interest, such a group can help provide a more well-rounded understanding of addictive game design. An additional limitation of this study was its reliance on previous work as a starting point for ideation of potentially addictive features (Saini & Hodgins, 2023). As such, this can further perpetuate confirmation bias and lead to the exclusion of additionally relevant structural features that have not been adequately considered in the scientific community. This limitation should be at least partially overcome by the inclusion of people with lived experience. This study, in the same vein as other studies on GD, is limited by its conceptualization of games as a broader category. There is also a potential for a bias toward underscoring particular categories of games, notably those on consoles or PCs, while discounting others, like mobile games. Accordingly, even though mobile games might be popular among individuals displaying GD symptoms, the addictive structural features of these games could differ from the features identified by this study's international panel members. A final limitation—which may also be considered a strength—to this study may include the uneven distribution of panel members (that is, the higher representation of people with lived experience relative to the other groups). Consequently, even after we weighted the group contribution to the consensus assessment, this would still have led to the lived experience potentially dominating the other groups by providing a greater quantity of subjective opinion on additions, deletions, and changes to the proposed structural features.

The SHARP-G scale can catalyze regulatory changes to ensure consumers are aware of the inherent addictive risks of specific games. For instance, the gaming industry might be required to provide "addiction ratings" for their games and to update these ratings for each new version of their games. Furthermore, from a policy-level, SHARP-G could be used to regulate the gaming industry through more stringent taxing for games with higher addictive risks. Consequently, a tax system could financially support prevention and intervention programs. By applying high-level pressure to promote non-addictive gameplay, SHARP-G could compel the industry and developers to modify specific structural characteristics of their games—including gambling-like features—to make them less addictive. Finally, an important application of SHARP-G could be the establishment of independent bodies dedicated to overseeing and regulating the gaming sector to circumvent customer exploitation.

Crucially, content within individual games can dynamically change with time, which means the game rating might also change. For example, loot boxes were present previously in Fortnite in the form of Loot Llamas but were later removed after settling a class action lawsuit where Epic Games was required to credit 1,000 V-bucks (Fortnite's in-game currency) to players that had previously purchased them (Published, 2021). Therefore, prior versions of Fortnite may have obtained a higher SHARP-G rating. This presents a unique challenge generally with ratings/safety warnings related to modern gaming whereby games can update over the web and consequently no longer fit into the ESRB/PEGI/SHARP-G rating that was originally provided when an individual purchased the game either digitally or, especially, physically.

This preliminary assessment tool should be further subjected to rigorous validity and reliability testing prior to being widely adopted. Future research should strive to utilize longitudinal designs and larger sample sizes to validate SHARP-G's applicability across diverse gaming environments. A critical aspect currently under investigation is the inter-rater reliability of the SHARP-G assessment tool. Future work should investigate whether its scoring mechanism is uniformly consistent or if certain elements are vulnerable to subjective interpretation. It is likewise crucial to further investigate how the inclusion of multiple structural features can interact to enhance addictive potential—particularly in MMORPG—which may be perceived as more addictive. Furthermore, additional research is merited to refine the quantitative thresholds that discriminate varying levels of game addictiveness.

CONCLUSION

This paper examined the perspectives of a heterogenous panel of GD informants—consisting of researchers, clinicians, and people with lived experience—on the relative addiction risk potential of different gaming structural features. This was conducted by using the Delphi methodology. The findings of this study elucidated 25 structural features that were agreed upon by the panel as conferring a high risk to GD etiology. From these findings, we have proposed a 23-item assessment tool to quantitatively determine the level of addictiveness of a game. In the future, SHARP-G may

offer practical utility across various sectors: consumers can employ it for informed decision-making before purchasing games, the gaming industry can employ it for self-evaluations, and its function could be comparable to ESRB ratings for guiding responsible gameplay. While promising, this scale needs to be subjected to extensive validation and further work needs to be done to assess for reliability.

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