

**Can playing Dungeons and Dragons be good for you? A registered exploratory pilot program using offline Tabletop Role-Playing Games (TTRPGs) to mitigate social anxiety and reduce problematic involvement in multiplayer online videogames**

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## Abstract

**Background.** Gamers with poor self-concept, high social anxiety, and high loneliness are more at risk of problematic involvement **in videogames and particularly in** massively multiplayer online role-playing games (MMORPGs) than other players. There is a research gap concerning treatment approaches to cater ~~to~~ socially anxious **MMORPG** gamers with problematic patterns of gaming involvement. This **registered exploratory pilot** ~~pre-registered study~~ tests the feasibility and initial ~~efficacy~~ **effect** of a structured protocol in which socially anxious online gamers are exposed in offline social skills and exposed to real-life social interactions while playing **an offline** tabletop role-playing game **(TTRPG)**. **Methods.** Our ~~intervention~~ **structured** protocol lasts 10 weeks and involves 10 sessions organized within 3 modules in which participants play a ~~tabletop role-playing game~~ **TTRPG** inspired from the game “Dungeons and Dragons”. Each module deploys a written role-playing scenario designed to challenge the players in game terms, as well as to involve them in a story based on maturing relationships with other characters and on solving challenges by social means and investigation. Our study uses an experimental **multiple** single-case design with multiple baselines across groups (4 groups of 5 gamers with sub-clinical **problematic MMORPG-videogame use** and social anxiety) and a 3-month follow-up. Outcomes assessed include social skills, self-esteem, loneliness, assertiveness, and gaming disorder symptoms. **Results.** Ethical clearance has been obtained. Data collection is planned to begin on ~~March~~ **April 1**, 2023 and to end in ~~October~~ **November** 2023. **Conclusion.** Our proof-of-principle study is intended to provide pilot data for use in developing new types of interventions which, given their game-based social nature, may be more accessible

and engaging for persons with problematic involvement in **online videogames** and concomitant social anxiety.

**Keywords:** TTRPG; MMORPG; Registered Report; Treatment; Gaming Disorder; Social Anxiety; Problematic Gaming; Role-Playing Game

## Introduction

Video games are one of the most popular leisure activities worldwide. It is expected that the number of gamers will reach 3.07 billion players in 2023 (Newzoo, 2021). Although the majority of players enjoy gaming as a recreational activity, some individuals report uncontrolled and excessive gaming that has negative consequences (e.g., addiction symptoms, health consequences, conflicts with family) and is functionally impairing (Billieux et al., 2021; Reed et al., 2022). In 2019, gaming disorder was included as a mental disorder in the 11<sup>th</sup> edition of the *International Classification of Diseases* (World Health Organization, 2019) and its worldwide prevalence is estimated around 1-2% (Stevens et al., 2021). Various psychological models posit that overinvolvement in video games and virtual worlds may serve to fulfill needs unachieved in real life through a compensatory process (Di Blasi et al., 2019; Kardefelt-Winther, 2017; Schimmenti & Caretti, 2010). A systematic review on maladaptive player-game relationships reported that gamers who report diminished self-concept (e.g., poor self-esteem), high social anxiety, and high loneliness are at risk of being problematically involved in video games that have role-playing and social interaction components, such as massively multiplayer online role-playing games (MMORPGs) (King et al., 2019).

In Switzerland, the country in which the current study takes place, data from an outpatient clinic that specializes in the treatment of “behavioral addictions” (also called “non-substance-related addictive behaviors”) ~~at the Geneva University Hospitals~~ reported that overinvolvement in MMORPGs was a frequent treatment motive, and that social phobia was the most frequent comorbid psychiatric disorder encountered among these gamers (Thorens et al., 2014). Despite gaming-related harms increasingly being accepted as a public health theme (Stein et al., 2018), we still lack needed evidence-

based psychological interventions to support those seeking help with problematic video game use (Basenach et al., 2023; King et al., 2017; Stevens et al., 2019). Crucially, an important gap in research concerns a treatment approach adapted to socially anxious MMORPG gamers.

### **Massively multiplayer online role-playing games (MMORPGs)**

In MMORPGs, players create a character that evolves within a digital virtual world where they can interact with thousands of other players, as well as with the game environment itself. Players assume the roles of fictional characters who act and evolve in virtual worlds that are often inspired by heroic fantasies such as J.R.R. Tolkien's saga, *The Lord of the Rings* (Tolkien, 1954). One example is *World of Warcraft*, which is still considered one of the most iconic and representative MMORPGs, and which numerous psychological studies have centered on in the two last decades (e.g., Bessièrè et al., 2007; Billieux et al., 2013). In MMORPGs, character creation involves components like the selection of a class (e.g., warrior, mage, rogue, priest), race (e.g., human, elf, orc), and avatar appearance (a visual representation of the character in the virtual world). The concept of progression is a central component in most MMORPGs, meaning that a player's character will acquire new skills and powers and amass virtual currency and belongings as rewards for exploring and succeeding in missions or quests (e.g., defeating a powerful monster, finding a specific item).

Another fundamental aspect of MMORPGs is social interaction, which is often mechanically necessary for obtaining, progressing, and resolving quests, as well as to harness the social cooperative resources needed to overcome challenges. When playing, it is possible to communicate easily with other players (written chat or audio) and players frequently group themselves in guilds (hierarchical organizations of

characters with common objectives) which are organized both in-game and on platforms like *Discord*. Crucially for our purposes, most of these MMORPG features (e.g., character creation, progression system, teamwork) find their roots in *Dungeons and Dragons* (DnD), the first broadly available tabletop role-playing game (TTRPG) created by Gary Gygax and Dave Arneson in 1974. Since its creation, DnD has been a cornerstone of role-playing adventure games, inspiring similar games across the world, and its current popularity extends to the broader cultural zeitgeist (e.g., references on globally popular TV shows such as *The Simpsons*, *The Big Bang Theory*, and *Stranger Things*).

### **Tabletop role-playing games (TTRPGs)**

In TTRPGs, a group of players (usually 3 to 5 players) plays together and forms a party composed of characters involved in an adventure. Together, the players must coordinate their efforts and competencies to engage in interactions with the world that they construct in their shared imagination supported by rules and sometimes artifacts like maps, drawings, or miniature models. The story and exchanges may be fully improvised, but they commonly follow a written scenario, known only fully by one participant taking on the role of Game Master who describes new events and referees how player decisions affect the world (see Figure 1). Typically, players will have to solve problems, do detective work, tackle social issues, engage in epic battles, and gather treasure and knowledge. Through this process, the characters earn experience to gain “levels” and become increasingly powerful over a series of separate gaming sessions. In this way, players often become increasingly invested in their character and develop their role in the group and the wider world of the fantasy game. Beyond these similarities, there are major differences between tabletop role-playing games

such as DnD and MMORPGs. In MMORPGs, the game master is replaced by artificial intelligence, player options are limited to what has been pre-programmed into the game engine, and the interactions between players are mediated by technology and no longer take place in a classic offline (or “real-world”) setting.

-- INSERT FIGURE 1 HERE --

### ***TTRPGs as therapeutic tools***

An emerging literature suggests that playing TTRPGs can be used in a therapeutic way to improve mental health (Arenas et al., 2022; Baker et al., 2022; Henrich & Worthington, 2021). It has been proposed, for example, that TTRPGs can be used as a tool in psychodynamic-oriented therapy (e.g., to unveil aspects of the self) or to promote social support and bonding in group therapy (Ascherman, 1993; Blackmon, 1994). **Of particular relevance to the present study**, a series of recent studies **have shown** that TTRPGs are efficient in reducing social anxiety (Varrette et al., 2022), increasing social connectedness (Abbott et al., 2022), and improving social skills in children and youth with autism spectrum disorder (Katō, 2019). Because social skills training and exposure to social interactions constitute evidence-based and effective treatments for social anxiety (Acarturk et al., 2009), it can be hypothesized that playing games such as DnD is likely to reduce social anxiety in problematic MMORPG gamers.

### ***Current study***



Against this background, the current study proposes an exploratory pilot experiment that aims to test the feasibility (e.g., number of dropouts, ability of the participants to understand and engage in a tabletop role-playing game, ability of the participants to complete regularly the online assessment) and initial efficacy effect of a 10-week structured protocol in which persons with sub-clinical problematic MMORPG videogame use and a proneness towards social anxiety will be actively involved in offline social interactions while playing a TTRPG with peers. ~~Assuming a compensatory model of video game overinvolvement (Kardefelt-Winther, 2017; Schimmenti & Caretti, 2010), we hypothesize~~ This pilot also aims to explore whether ~~that~~ our program, which is designed to mobilize social skills by exposing the participants to socially engaging situations in real life, ~~has the potential to improve~~ affects social skills (e.g., assertiveness) and self-concept (i.e., perceived discrepancy between the ideal and actual selves, see Higgins, 1987; Philippot et al., 2018), ~~reduces gaming involvement (i.e. time spent gaming), and mitigates~~ problematic gaming, social anxiety, and feelings of loneliness.

We reason that the participants can be motivated to commit psychologically given the many similarities between TTRPGs and MMORPGs (e.g., character creation, advancement system, teamwork, heroic fantasy-based world). We will capitalize on an experimental multiple single-case design to test the initial efficacy effect of our program. A single-case design is an evaluation method that can be used to rigorously test the success of an intervention on a particular case (i.e., a specific participant). An extension of this evaluation method is the multiple single-case approach used in the current study, in which several (instead of one) cases are considered to highlight potential differences and similarities between them (e.g., factors influencing dropout, effect of the program on primary/secondary outcomes). Evidence arising from multiple-

case studies is generally considered as stronger and more reliable than from single-case designs (Baxter & Jack, 2008). ~~More precisely, we hypothesize that it will reduce symptom severity of both gaming disorder and social anxiety. Further, we hypothesize an improvement of self-concept and assertiveness and a reduction of perceived loneliness in participants.~~ In summary, the present study represents an important proof-of-principle undertaking which, if successful, could pave the way for new and creative psychological approaches to therapy delivery, particularly tailored to its target population, and may present an attractive alternative to medical interventions.

## **Methods**

Experimental multiple single-case design using TTRPGs playing as a 10-week intervention. All codes, data, and materials used in this study can be found on the Open Science Framework (OSF; <https://osf.io/3pqt7/>). We also report all data exclusions and all measures in the study. Our hypotheses will be pre-registered (after Stage 1 acceptance).

## ***Procedure***

The present study takes place at the University of Lausanne (UNIL), in the French-speaking part of Switzerland. It adopts a single-case experimental design with multiple baselines across 4 groups of 5 participants each. Single-case methodology has unique strengths for assessing the **efficacy effect** of a treatment and is considered a clinically relevant and scientifically well-established alternative to traditional group comparison designs (Dattilio, 2006). The scientific rigor of this methodology for small

scale testing of interventions like the present one has been stressed (Oxford Centre for Evidence-Based Medicine, 2011).

An online survey has first been created to recruit participants who are eligible for the study (see below). Eligible participants will be invited to a full presentation of the study. After agreeing to participate and providing written informed consent, participants will complete an initial pre-experiment psychological assessment (i.e., “baseline”). They will then participate in the 10-week experiment. The psychological assessment will be conducted each week during the program and a follow-up assessment will be conducted after a 3-month interval to test the long-lasting psychological effects of the experiment (see Figure 2). The Game Master in charge of managing the TTRPG sessions will not have access to the results of the various psychological assessments conducted during the study. The study protocol was approved December 22, 2022 by the cantonal ethical committee for research on human subjects (CER-VD; Project ID: 2022-01825). Participants will be compensated 200 CHF (which approximately corresponds to 200 EUR) for being involved in the study (20 CHF per session, 10 sessions).

**-- INSERT FIGURE 2 HERE --**

### ***Participants***

The number of participants was determined by taking into account the expected dropout rate and the requirement to provide enough inter-subject replication of the experimental effect. TTRPGs are well suited to groups of 3 to 5 players plus one game master. We opted for the upper limit (5 participants per group) to compensate for

potential dropout(s). We decided that the minimal number of participants required to continue playing should be 3 to guarantee sufficient social exposure. If more than 2 participants drop out in the same group, the remaining participants will be allocated (if possible) to another group. In this pilot study, dropout occurs when a participant leaves the program permanently, regardless of the number of session(s) completed. Participants who miss a session for acceptable reasons (e.g., being sick) will have the possibility to reintegrate and continue the program (the number of potentially missed session(s) will be recorded for each participant). Participants who are enrolled in this pilot study ( $N = 20$ , 4 groups of 5 participants each) will be engaged gamers with a past or current experience of playing MMORPGs or online RPGs who present sub-clinical gaming disorder and social anxiety symptoms. Participants playing online RPGs (e.g., Borderlands, Diablo, Final Fantasy) – which do not technically qualify as "massive" multiplayer because they involve fewer players – were also considered eligible as those games share most features of MMORPGs (e.g., advancement mechanics, interactions between players). Furthermore, it was decided that participants with an extensive experience of playing MMORPGs or RPGs are also eligible for the study even if they are currently involved in playing other types of videogames (e.g., multiplayer online battle arena). As this study is a pilot study aiming to document the feasibility and initial effect of our TTRPG-based program, we will recruit participants who do not have a clinically relevant gaming disorder or social anxiety disorder (i.e., sub-clinical cases only).

The inclusion criteria are as follows: (1) being aged 18 or older and speaking French (as playing TTRPGs and completing the various psychological assessments requires sufficient language proficiency); (2) being a gamer with past or current experience of playing ~~current~~ MMORPGs or online RPGs; (3) reporting motivation to

commit to playing a TTRPG for 10 consecutive weeks and to undergo weekly psychological assessment during the baseline, experiment, and follow-up phases; (4) agreeing not to use a smartphone (even passively) during the TTRPG sessions (both for privacy reasons and to avoid disrupting the sessions); (5) giving informed consent by signature; (6) endorsing at least one criterion on the Internet Gaming Disorder Test (IGDT-10; Király et al., 2017) assessing gaming disorder symptoms; and (7) having a score  $\geq 56$  (threshold for sub-clinical social anxiety) but  $\leq 96$  (threshold for clinical social anxiety) on the Liebowitz Social Anxiety Scale (LSAS; Liebowitz, 1987) assessing social anxiety symptoms. Details regarding the IGDT-10 and the LSAS scales are provided in the psychological assessment section.

The exclusion criteria are as follows: (1) having prior experience playing TTRPGs<sup>1</sup>; (2) presenting a medical or mental condition which could interfere with the participation to the full experiment (e.g., severe cognitive deficit, physical handicap compromising commuting to the university lab where TTRPG sessions will take place, diagnosed psychiatric condition); (3) and presenting a possible gaming disorder (according to the *ICD-11* diagnostic guidelines). To ensure that participants do not present a clinically relevant pattern of gaming disorder, potentially eligible participants endorsing  $\geq 5$  gaming disorder criteria based on the IGDT-10 will undergo an additional

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<sup>1</sup> We reasoned that prior involvement in TTRPGs might have influenced some key psychological factors assessed in the study (e.g., social skills, self-concepts, loneliness, or social anxiety symptoms) and thus would have constituted a confounding factor. Also, we considered it important that all participants included in the study undergo comparable and progressive exposure to TTRPGs. Eventually, mixing participants with and without prior experience with TTRPGs (or with different levels of prior experience with TTRPGs) would have resulted in unbalanced situations between participants (potentially easier for some participants and harder for others, in function of their prior experience with TTRPGs).

assessment by a psychologist prior to receiving full information about the study and signing informed consent. Those who meet the diagnostic requirements of gaming disorder as defined in *ICD-11* (*ICD-11* code 6C51.0 Gaming Disorder, predominantly online) will be excluded from the study and redirected to the Center for Excessive Gambling at the Lausanne University Hospital (despite its name, this center treats various kinds of behavioral addictions, including gaming disorder). At any time during the study, if a participant develops **signs** of gaming disorder, they will similarly be addressed to the Center of Excessive Gambling. A detailed participant inclusion flowchart (indicating the number of participants included/excluded at each stage of the recruitment process) will be provided at Stage 2 of the present registered report.

**-- DETAILED FLOWCHART WILL BE IMPLEMENTED HERE AT STAGE 2 --**

Eligibility will be assessed via a preliminary online survey disseminated via university channels, social media (e.g., Facebook, Twitter), and specialized gaming forums and associations (e.g., Swiss Gaming Federation). A webpage will be used to advertise the study (<https://www.unil.ch/carla/jdr>). In addition to presenting the rationale and aims of the study, this initial survey will comprise a series of socio-demographic items (i.e., age, gender, education level, current professional status) and questions about gaming preferences and habits (e.g., specific games names, ~~frequency of time spent~~ **self-reported time spent gaming**), as well as a series of psychometric questionnaires (see psychological assessment section for details). The first 20 participants who complete the online survey, agree to participate in the experiment, **are available to attend and play at the time proposed by the research team**, and meet the inclusion criteria will be invited to take part in the study and will be

~~randomly~~ distributed into 4 groups (see Figure 2). Distribution of participants in the various groups will be done according to feasibility constraints, including (1) their availabilities (the various groups play at different times of the day and/or on different days of the week), (2) ensuring that no participants knowing each other are included in the same group, and (3) maximizing heterogeneity in terms of gender, age, and education level.

Participants who do not meet the inclusion criteria will receive personalized feedback (see above for the specific case where a participant might present with a possible gaming disorder) and be acknowledged for their interest in the study. The recruitment phase will stop when 20 participants are enrolled in the experiment. Participants with missing data will not be omitted from the analyses unless the number of measurement points per phase is  $< 3$ , as three measurement points per phase is considered the minimal standard to reach in a single-case methodology (Tate et al., 2015).

### ***Psychological assessment***

Establishing a comprehensive and repeated baseline is crucial when applying a single-case design. For this reason, after being accepted into the study but before performing the experiment, participants will complete a pre-experiment psychological assessment with 3 to 6 measurement points (over 3 to 6 weeks; see Figure 2). This 3- to 6-week baseline corresponds to international standards for defining an adequate single case methodology with enough data points per phase (Tate et al., 2015). Onset of the experimental phase will be randomly determined (Group 1 starts after a 3-week baseline, Group 2 starts after a 4-week baseline, etc.). The baseline will assess gaming disorder symptoms and social anxiety symptoms, as well as a series of psychological factors that we expect to improve with our experiment (i.e., assertiveness, self-

concepts, loneliness, see below for a comprehensive description of the questionnaires used). In adopting the criteria for a single-case experimental design, we will not limit psychological assessment to the pre-experimental phase (baseline) but will also perform such assessments during the experiment (i.e., after each session) and at the 3-month follow-up. Self-reported gaming time and questionnaires assessing gaming disorder symptoms, social anxiety symptoms, and loneliness will be administered at baseline, at each week during the experiment, and at follow-up. Questionnaires assessing self-concepts and assertiveness/social skills, which assess more stable psychological dimensions (i.e., less susceptible to fluctuate on a weekly basis), will be administered only three times, namely in the first baseline assessment, at the end of the experiment (week 10), and at the 3-month follow-up. Figure 2 depicts which questionnaire is used at which step of the study, for the four groups of participants.

All questionnaires used in the current study are validated in French and present adequate psychometric properties. The next section describes the various scales used to assess the abovementioned symptoms (i.e., gaming disorder and social anxiety disorders symptoms) and psychological dimensions (i.e., self-concept, assertiveness/social skills, and loneliness). These sections also describe potential adaptations of the scales made to adjust to our multiple-single case design. All questionnaires used in the current study are available from the OSF repository: <https://osf.io/3pqt7/>.

### *Internet Gaming Disorder Test (IGDT-10)*

The French version of the IGDT-10 assesses gaming disorder symptoms based on the *DSM-5* framework (Király et al., 2019). This scale was considered among the most valid, reliable, and psychometrically sound screening tools to assess gaming disorder



in a recent systematic review (King et al., 2020). It comprises 10 items targeting the various diagnostic criteria proposed to define “Internet Gaming Disorder” in the *DSM-5* (American Psychiatric Association, 2013). This scale assesses criteria such as loss of control, withdrawal-like manifestations (when deprived of gaming), or continued involvement in gaming despite negative consequences. Each item is scored based on frequency statements (0 = “never”; 1 = “sometimes”; 2 = “often”). For the eligibility screening, we will follow the suggestion by Király et al. (2009) and consider responses “never” and “sometimes” as an absent criterion (0 point) and responses “often” as a present criterion (1 point). As two items refer to the last *DSM-5* criterion (i.e., items 9 and 10), they will be combined during the scoring procedure (Király et al., 2017). This coding is used to match with the categorical structure of the *DSM-5* (in which criteria are either present or absent) and identify potentially problematic gamers during the eligibility screening (endorsement of  $\geq 5$  criteria according to the *DSM-5* guidelines). For all statistical analyses conducted, a total score ranging from 0 to 20 will be used instead to increase the variance of the scores and thus increase the likelihood to evidence change. The items will refer to gaming behaviors taking place “over the past 12 months” in the eligibility screening, “over the past week” for the baseline and during the program, and the “over the past 3 months” for the follow-up (see Figures 2). The internal consistency (Cronbach’s alpha) of the French IDGT-10 using the same scoring method as in the current study was equal to .77 (Király et al., 2019).

#### *Liebowitz Social Anxiety Scale (LSAS)*

The French version of the Liebowitz Social Anxiety Scale (LSAS; Heeren et al., 2012; Yao et al., 2015) is a 24-item scale that assesses a range of social interaction and performance situations that individuals with social phobia may fear and/or avoid. For

each item, a score is provided for fear (from 0 = “no fear” to 3 = “severe fear”) and for avoidance (from 0 = “no avoidance” to 3 = “frequent avoidance”). The total score of the scale thus ranges from 0 to 144. Based on the cut-off scores proposed by Bouvard & Cottraux (2010) for the French version of LSAS, we will consider participants as eligible for the study if they present a LSAS total score  $\geq 56$  (sub-clinical social anxiety) but  $\leq 96$  (probable clinical social anxiety). For all statistical analyses conducted, the total score of the LSAS will be used. The internal consistency (Cronbach’s alpha) of the total score on the French LSAS was equal to .94 in the most recent study having tested its psychometric properties (Heeren et al., 2012). This scale will be administrated at baseline (each week), during the program (each week), and at the 3-month follow-up (see Figure 2 for details).

#### *Self-Discrepancy Scale (S-DS)*

The Self-Discrepancy Scale (S-DS) was developed in French by Philippot and colleagues (2018) and is anchored in the self-discrepancy theory (Higgins, 1987). It consists of two sections, one defining the ideal self and estimating the discrepancy between the ideal self and the actual self, and one defining the socially prescribed self and estimating the discrepancy between the socially prescribed self and the actual self. In the first section, participants are first asked to generate a list of characteristics (maximum 8) that they ideally wish to have (desired traits) and a list of characteristics (maximum 8) that they ideally wish not to have (undesired traits). For each trait, participants are asked to estimate whether they possess the latter characteristics on a scale ranging from 0 to 100%. Then, participants are asked to estimate (1) the perceived gap between their ideal and actual selves (on a Likert scale from 1 = “I feel very near to this ideal” to 7 = “I feel very far to this ideal”) and (2) the resulting distress

of this potential discrepancy (on a Likert scale from 1 = “I experience no distress related to this discrepancy” to 7 = “I experience a strong distress related to this discrepancy”). The same procedure is then repeated in the second section assessing the discrepancy between the actual self and the socially prescribed self. This procedure allows for computing various scores, including desired ideal trait percentage, undesired ideal trait percentage, desired prescribed trait percentage, undesired prescribed trait percentage, the gap between the actual and ideal selves (ideal gap), the distress elicited by that discrepancy (ideal distress), the gap between the actual and the socially prescribed selves (prescribed gap), and the distress elicited by that discrepancy (prescribed distress). Details concerning the computation and psychometric properties of these various scores are provided in Philippot et al. (2018). In the current study, the SD-S will be used three times (first week of baseline, end of the program, follow-up, see Figure 3 for details) and only two indices will be retained for the pre-registered hypotheses: (1) the ideal self-discrepancy (obtained by summing the ideal gap and ideal distress items) and (2) the socially prescribed self-discrepancy (obtained by summing the prescribed gap and prescribed distress items).

#### *Rathus Assertiveness Scale (RAS)*

The French version of the Rathus Assertiveness Scale (RAS; Bouvard et al., 1986) is a 30-item self-report instrument initially designed by Rathus (1973) to measure assertiveness and, more broadly, the efficiency of social skills. Each item is scored on a six-point Likert scale ranging from “totally true” to “totally false”. In the current study, the RAS will be administered three times (first week of baseline, end of the program, follow-up, see Figure 2 for details) and a global score of assertiveness/social skills will

be used for all statistical analyses. The internal consistency (Cronbach's alpha) of the total score on the French RAS was found to be .82 (Bouchard et al., 1975).

#### *UCLA Loneliness Scale (UCLA-LS)*

The French version of the UCLA Loneliness Scale (UCLA-LS; de Grâce et al., 1993) is a 20-item scale designed to measure one's subjective feelings of loneliness ~~as well as feelings of~~ and social isolation. Each item is scored on a four-point Likert scale (ranging from 1 = "never" to 4 = "often"). The internal consistency (Cronbach's alpha) of the total score on the French UCLA-LS was found to be .89 (de Grâce et al., 1993). For all statistical analyses conducted, the total score of the UCLA-LS will be used. This scale will be administrated at baseline (each week), during the program (each week), and at the 3-month follow-up (see Figure 2 for details).

#### ***Tabletop Role-Playing Game (TTRPG) program***

Participants will be involved in playing TTRPGs in the context of a *pre-established* and *structured* protocol. Our program lasts 10 weeks and is divided into 10 weekly sessions organized within 3 modules (see Table 1 for details). Each module will deploy one written role-playing scenario designed to challenge the players in game terms, as well as to involve them in a story based around maturing relationships with other characters and on solving challenges by social means and investigation. These professionally designed scenarios will ensure that the experiment is comparable in each group and coherent across the experiment as a whole. Each session will last 2 hours. The TTRPG-based program will be delivered sequentially to 4 groups of 5 participants (see Figure 2). All sessions will be managed by the same member of the

research team who is a seasoned game master having played TTRPGs for more than 30 years. The scenarios used in our program are adapted from the free DnD introductory adventure *Lost Mine of Phandelver* (<https://www.dndbeyond.com/sources/lmop>) and we opted for the rule system of the game *Chroniques Oubliées Fantasy* (<https://black-book-editions.fr/catalogue.php?id=13>), which is very similar to DnD, yet a bit simpler to play and especially adapted for persons who have never played TTRPGs. Progressively, the participants will be exposed to more and more challenging tasks, and their characters will simultaneously become more powerful and acquire new skills (i.e., they will “gain levels”). At any time during the TTRPG sessions, if a participant is not feeling well regarding what is going on in the game (e.g., someone afraid of spiders in the real world has to confront a giant spider in the game), they can use an “X card” that signals that they want to skip the current scene. A participant doing that will not be asked why they used the “X card”, but they can tell the GM afterwards to avoid future incidents.

In the first module, the *Wanderer* module, the participants will discover the game and create their characters (e.g., dwarf fighter, human mage, gnome rogue) under the supervision of the game master (session 1), learn and test the rules of the game (sessions 1 and 2), and play their first introductory adventure (sessions 2 and 3). This first module mobilizes a low level of social skills and assertiveness and is thus considered *low* difficulty.

In the second module, the *Adventurer* module, the participants will continue their adventure through playing two different scenarios managed by the game master (sessions 4 to 7). The participants will need to cooperate, to be assertive when necessary, and to be collectively engaged in order to master and succeed at the scenario. Assertiveness, for example, will be mobilized through role-played

interactions between the players and non-player characters encountered in the game impersonated by the game master. Examples of these non-player characters include a nice and collaborative druid or a non-collaborative and selfish green dragon (see Table 1 for details). In the second module, the participants will also be attributed a personal backstory (related to the background of their character) involving a specific quest or mission. To achieve it, each participant will need to dialogue with non-player characters (played by the game master) and potentially negotiate (and thus being assertive) with the other participants. These personal quests are used to ensure that each participant is sufficiently exposed. This second module mobilizes a medium level of social skills and assertiveness and is thus considered of *moderate* difficulty.

Finally, in the third module (sessions 8-10), the *Hero* module, the participants will be invited to take on the role of the game master to propose a short scene themselves (with the help of the former game master from the research team when necessary, see Table 1 for details). The adventure takes place in the *Wave echo cave*, a magical maze with dozens of different caves and areas involving various dangers and events. This final module engages the players in new ways, as each participant will have the possibility to take control of the game, tell the story, and guide the other participants into an adventure. To reach this objective, each participant will successively take on the role of the game master and elaborate the scene they want to play with the other participants. The research team will support this transition from player to game master through light tutoring and providing ideas and tips when necessary. This third module mobilizes a higher level of social skills and assertiveness and is thus considered of *elevated* difficulty. The final session (session 10) will also include a debriefing, and qualitative feedback about the experiment will be collected.

At the end of each session, the game master (who will not have access to the results of the psychological assessments) will code for each participant what session objectives are achieved, partially achieved, or not achieved (see Table 1 for details). Exploratory non-pre-registered analyses will be conducted to explore the relationships between the study variables and the participants' achievements based on the game master perspective.

-- INSERT TABLE 1 HERE --

### **Data analytic strategy**

Because no gold standard exists for statistical analyses in single-case studies, and because the different analyses available focus on different data features, all of which have advantages and flaws (Tate et al., 2015), we will use a series of complementary steps to analyze the data. This approach will allow us to use several effect size measures than can be compared in order to assess the consistency of the results (Kratochwill et al., n.d.). ~~First, structured visual analysis will be performed to examine within- and between-phase data patterns according to six features: level (average), trend, variability, immediacy of the effect, overlap, and consistency of data patterns across similar phases (Kratochwill et al., n.d.).~~ ~~Second,~~ First, non-overlap indices (Non-overlap of All Pairs index and, in the case of a linear trend in the baseline, Tau-U) will quantify the proportion of data points in the experiment phase [B] that have improved with respect to the baseline-phase [A] measurements (Parker et al., 2011; Parker & Vannest, 2009). This measure will thus provide separate values for each [AB] comparison individually, with values between 0.51 and 0.66 indicating a small effect

size, values between 0.67 and 0.92 indicating a medium effect size, and values between 0.93 and 1.00 indicating a large effect size. Third, the between-cases standardized mean difference will be used to quantify the difference between the baseline and experiment phases' scores of each primary outcome (see below), providing overall quantification across all study participants (similar to Cohen's *d*) while dealing with autocorrelation (Hedges et al., 2013). Third, the Reliable Change Index/Clinically Significant Change method will be used to determine whether participants have undergone considerable changes after the program, so that such changes can be considered clinically significant. This method will be performed by considering the 20 participants for all outcomes separately. The first scores (for all outcomes) from baseline will represent the pre-experiment scores, and the last reported scores will represent the post-experiment scores. The Reliable Change Index/Clinically Significant Change calculations will be obtained from means and standard deviations (i.e., established norms) reported in published articles and/or manuals of the various measurement tools used (Jacobson & Truax, 1991). The following study outcomes are expected:

- **Primary outcome 1:** A reduction of self-reported gaming ~~frequency~~ **time** (average hour per day) at the end of the TTRPG-based program (P1A) and at the 3-month follow-up (P1B).
- **Primary outcome 2:** A reduction of gaming disorder symptoms (assessed by the IGDT-10) at the end of the TTRPG-based program (P2A) and at the 3-month follow-up (P2B).
- **Primary outcome 3:** A reduction of social anxiety symptoms (assessed by the LSAS) at the end of the TTRPG-based program (P3A) and at the 3-month follow-up (P3B).



- **Secondary outcome 1:** An increase in assertiveness and self-perceived social skills (assessed by the RAS) at the end of the TTRPG-based program (S1A) and at the 3-month follow-up (S1B).
- **Secondary outcome 2:** An improvement in self-concept indexed by a lower ideal self-discrepancy and a lower socially prescribed self-discrepancy (assessed by the S-DS) at the end of the TTRPG-based program (S2A) and at the 3-month follow-up (S2B).
- **Secondary outcome 3:** A decrease in loneliness (as indexed by the UCLA-LS) at the end of the TTRPG-based program (S3A) and at the 3-month follow-up (S3B).

The data analytic plan will be pre-registered upon in-principle acceptance of the Stage 1 Registered Report on the following Open Science Framework repository: <https://osf.io/3pgt7/>. Any deviation from this pre-registered data analytic plan will be discussed with the recommender and described and justified in the final version of the registered exploratory pilot. NAP tests and between-case standardized mean difference will be computed on R 4.2.2 (R Core Team, 2022) with the following packages:

- *SingleCaseES* package (Pustejovsky, Chen, Grekov, & Swan, 2023; <https://jepusto.github.io/SingleCaseES/>)
- *scdhl*m package (Pustejovsky, Chen, & Hamilton, 2023; <https://CRAN.R-project.org/package=scdhlm>)

**Author contributions [future contributions are written in the future tense]**

Joël Billieux submitted a grant application and obtained the research funds necessary to conduct the study (including a 1-year 20% research associate position for Jonathan Bloch and a 6-month 10% research associate position for Lucien Rochat). Yasser Khazaal, Olivier Simon, Jonathan Bloch, Andreas Lieberoth, Marc Malmdorf Andersen, and Daniel King participated in the elaboration and writing of the grant application, which included the operationalization of the study hypotheses and the selection of assessment instruments. Joël Billieux wrote the first draft of the Stage 1 Registered Report in collaboration with Lucien Rochat (for the data analytic strategy section) and Charlotte Eben (for open science-related aspects). All other authors reviewed and edited the Stage 1 Registered Report and approved its final version. Joël Billieux and Jonathan Bloch managed the various steps leading to the ethical approval of the study by the cantonal ethical committee for research on human subjects (CER-VD). Loïs Fournier supervised the design and implementation of the online surveys used in the various steps of the study (eligibility screening, baseline, during the experiment, and follow-up psychological assessments). Joël Billieux, Jonathan Bloch, Loïs Fournier, and Iliyana Georgieva monitored the recruitment process. Loïs Fournier, and Iliyana Georgieva will include the eligible participants in the study, collect the informed consent forms, and distribute the participants among the various groups. Joël Billieux will provide the necessary data to the person in charge of the external monitoring of the study (which will take place at four occasions: (1) before starting the baselines, (2) one time during the program, (3) at the end of the program, and (4) at the follow-up). Jonathan Bloch elaborated the various modules of the 10-week TTRPG-based program under the supervision of Joël Billieux. Jonathan Bloch and Iliyana Georgieva will collect the qualitative feedback after sessions 3 and 10 (see Table 1). Jonathan Bloch will administrate – as the game master – the TTRPG program to the four groups

of participants. Olivier Simon and Yasser Khazaal will coordinate and supervise the medical appointments at the Center for Excessive Gambling (Lausanne University Hospital) proposed to the participants excluded from the study for presenting a possible gaming disorder. Loïs Fournier will be responsible for pre-registering the hypotheses in the Open Science Framework (OSF) and uploading all study materials, and will be responsible for making the data open access prior to submission of the Stage 2 Registered Report. Charlotte Eben will serve as the open-science co-pilot of Loïs Fournier, helping with the pre-registration and data sharing principles. Lucien Rochat will conduct the statistical analyses. All authors will approve the final version of this registered report at Stage 2.

### **Disclosure statement**

The authors declare no conflict of interest. No author of the present manuscript is financially or personally linked to Wizards of the Coast (the society commercializing “DnD”) or Black Book Edition (the society commercializing “Chroniques Oubliées Fantasy”).

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## Bibliography

- Abbott, M. S., Stauss, K. A., & Burnett, A. F. (2022). Tabletop role-playing games as a therapeutic intervention with adults to increase social connectedness. *Social Work with Groups*, 45(1), 16–31. <https://doi.org/10.1080/01609513.2021.1932014>
- Acarturk, C., Cuijpers, P., van Straten, A., & de Graaf, R. (2009). Psychological treatment of social anxiety disorder: A meta-analysis. *Psychological Medicine*, 39(2), 241–254. <https://doi.org/10.1017/S0033291708003590>
- Arenas, D. L., Viduani, A., & Araujo, R. B. (2022). Therapeutic Use of Role-Playing Game (RPG) in Mental Health: A Scoping Review. *Simulation & Gaming*, 53(3), 285–311. <https://doi.org/10.1177/10468781211073720>
- Ascherman, L. I. (1993). The Impact of Unstructured Games of Fantasy and Role Playing on an Inpatient Unit for Adolescents. *International Journal of Group Psychotherapy*, 43(3), 335–344. <https://doi.org/10.1080/00207284.1993.11732597>
- Baker, I. S., Turner, I. J., & Kotera, Y. (2022). Role-play Games (RPGs) for Mental Health (Why Not?): Roll for Initiative. *International Journal of Mental Health and Addiction*. <https://doi.org/10.1007/s11469-022-00832-y>
- Basenach, L., Renneberg, B., Salbach, H., Dreier, M., & Wölfling, K. (2023). Systematic reviews and meta-analyses of treatment interventions for Internet use disorders: Critical analysis of the methodical quality according to the PRISMA guidelines. *Journal of Behavioral Addictions*. <https://doi.org/10.1556/2006.2022.00087>

Baxter, P., & Jack, S. (2008). Qualitative Case Study Methodology: Study Design and Implementation for Novice Researchers. *The Qualitative Report*, 13(4), 544-559. <https://doi.org/10.46743/2160-3715/2008.1573>

Bessièrè, K., Seay, A. F., & Kiesler, S. (2007). The ideal elf: Identity exploration in World of Warcraft. *CyberPsychology & Behavior*, 10(4), 530–535.

Billieux, J., Stein, D. J., Castro-Calvo, J., Higushi, S., & King, D. L. (2021). Rationale for and usefulness of the inclusion of gaming disorder in the ICD-11. *World Psychiatry*, 20(2), 198–199. <https://doi.org/10.1002/wps.20848>

Billieux, J., Van der Linden, M., Achab, S., Khazaal, Y., Paraskevopoulos, L., Zullino, D., & Thorens, G. (2013). Why do you play World of Warcraft? An in-depth exploration of self-reported motivations to play online and in-game behaviours in the virtual world of Azeroth. *Computers in Human Behavior*, 29, 103–109.

Blackmon, W. D. (1994). Dungeons and Dragons: The Use of a Fantasy Game in the Psychotherapeutic Treatment of a Young Adult. *American Journal of Psychotherapy*, 48(4), 624–632. <https://doi.org/10.1176/appi.psychotherapy.1994.48.4.624>

Bouchard, M. A., Valiquette, C., & Nantel, M. (1975). Étude psychométrique de la traduction française du « Rathus assertiveness schedule ». *Revue de Modification Du Comportement*, 5, 89–103.

Bouvard, M., & Cottraux, J. (2010). *Protocoles et échelles d'évaluation en psychiatrie et en psychologie : Méthodologie ; outils d'évaluation validés ; principales pathologies ; 11 nouveaux outils* (5<sup>ème</sup> édition). Elsevier Masson.

Bouvard, M., Cottraux, J., Mollard, E., Messy, P., & Defayolle, M. (1986). Validation et analyse factorielle de l'échelle d'affirmation de soi de Rathus [Validation and

- factorial analysis of Rathus's schedule for assessing assertive behaviors].  
*Psychologie Médicale*, 18(5), 759–763.
- Dattilio, F. M. (2006). Does the case study have a future in the psychiatric literature?  
*International Journal of Psychiatry in Clinical Practice*, 10(3), 195–203.
- de Grâce, G.-R., Joshi, P., & Pelletier, R. (1993). L'Échelle de solitude de l'Université  
Laval (ÉSUL) : Validation canadienne-française du UCLA Loneliness Scale.  
*Canadian Journal of Behavioural Science / Revue Canadienne Des Sciences  
Du Comportement*, 25(1), 12–27. <https://doi.org/10.1037/h0078812>
- Di Blasi, M., Giardina, A., Giordano, C., Coco, G. L., Tosto, C., Billieux, J., &  
Schimmenti, A. (2019). Problematic video game use as an emotional coping  
strategy: Evidence from a sample of MMORPG gamers. *Journal of Behavioral  
Addictions*, 8(1), 25–34. <https://doi.org/10.1556/2006.8.2019.02>
- Hedges, L. V., Pustejovsky, J. E., & Shadish, W. R. (2013). A standardized mean  
difference effect size for multiple baseline designs across individuals: effect size  
for multiple baseline designs. *Research Synthesis Methods*, 4(4), 324–341.  
<https://doi.org/10.1002/jrsm.1086>
- Heeren, A., Maurage, P., Rossignol, M., Vanhaelen, M., Peschard, V., Eeckhout, C.,  
& Philippot, P. (2012). Self-report version of the Liebowitz Social Anxiety Scale:  
Psychometric properties of the French version. *Canadian Journal of  
Behavioural Science / Revue Canadienne Des Sciences Du Comportement*,  
44(2), 99–107. <https://doi.org/10.1037/a0026249>
- Henrich, S., & Worthington, R. (2021). Let Your Clients Fight Dragons: A Rapid  
Evidence Assessment regarding the Therapeutic Utility of 'Dungeons &  
Dragons'. *Journal of Creativity in Mental Health*, 1–19.  
<https://doi.org/10.1080/15401383.2021.1987367>

- Higgins, E. T. (1987). Self-discrepancy: A theory relating self and affect. *Psychological Review*, 94(3), 319–340. <https://doi.org/10.1037/0033-295X.94.3.319>
- Jacobson, N. S., & Truax, P. (1991). Clinical significance: A statistical approach to defining meaningful change in psychotherapy research. *Journal of Consulting and Clinical Psychology*, 59(1), 12–19. <https://doi.org/10.1037/0022-006X.59.1.12>
- Kardefelt-Winther, D. (2017). Conceptualizing Internet use disorders: Addiction or coping process?: Conceptualizing Internet use disorders. *Psychiatry and Clinical Neurosciences*, 71(7), 459–466. <https://doi.org/10.1111/pcn.12413>
- Katō, K. (2019). Employing Tabletop Role-Playing Games (TRPGs) in Social Communication Support Measures for Children and Youth with Autism Spectrum Disorder (ASD) in Japan: A Hands-On Report on the Use of Leisure Activities. *Japanese Association for Role-Playing Game Studies*. [https://doi.org/10.14989/jarps\\_0\\_23](https://doi.org/10.14989/jarps_0_23)
- King, D. L., Chamberlain, S. R., Carragher, N., Billieux, J., Stein, D., Mueller, K., Potenza, M. N., Rumpf, H. J., Saunders, J., Starcevic, V., Demetrovics, Z., Brand, M., Lee, H. K., Spada, M., Lindenberg, K., Wu, A. M. S., Lemenager, T., Pallesen, S., Achab, S., ... Delfabbro, P. H. (2020). Screening and assessment tools for gaming disorder: A comprehensive systematic review. *Clinical Psychology Review*, 77, 101831. <https://doi.org/10.1016/j.cpr.2020.101831>
- King, D. L., Delfabbro, P. H., Perales, J. C., Deleuze, J., Király, O., Krossbakken, E., & Billieux, J. (2019). Maladaptive player-game relationships in problematic gaming and gaming disorder: A systematic review. *Clinical Psychology Review*, 73, 101777. <https://doi.org/10.1016/j.cpr.2019.101777>



- King, D. L., Delfabbro, P. H., Wu, A. M. S., Doh, Y. Y., Kuss, D. J., Pallesen, S., Mentzoni, R., Carragher, N., & Sakuma, H. (2017). Treatment of Internet gaming disorder: An international systematic review and CONSORT evaluation. *Clinical Psychology Review, 54*, 123–133. <https://doi.org/10.1016/j.cpr.2017.04.002>
- Király, O., Bőthe, B., Ramos-Diaz, J., Rahimi-Movaghar, A., Lukavska, K., Hrabec, O., Miovsky, M., Billieux, J., Deleuze, J., Nuyens, F., Karila, L., Griffiths, M. D., Nagygyörgy, K., Urbán, R., Potenza, M. N., King, D. L., Rumpf, H.-J., Carragher, N., & Demetrovics, Z. (2019). Ten-Item Internet Gaming Disorder Test (IGDT-10): Measurement invariance and cross-cultural validation across seven language-based samples. *Psychology of Addictive Behaviors, 33*(1), 91–103. <https://doi.org/10.1037/adb0000433>
- Király, O., Slecza, P., Pontes, H. M., Urbán, R., Griffiths, M. D., & Demetrovics, Z. (2017). Validation of the Ten-Item Internet Gaming Disorder Test (IGDT-10) and evaluation of the nine DSM-5 Internet Gaming Disorder criteria. *Addictive Behaviors, 64*, 253–260. <https://doi.org/10.1016/j.addbeh.2015.11.005>
- Kratochwill, T. R., Hitchcock, J., Horner, R. H., Levin, J. R., Odom, S. L., Rindskopf, D. M., & Shadish, W. R. (n.d.). *Single-case designs technical documentation*. Retrieved from *What Works Clearinghouse website*. [ies.ed.gov/ncee/wwc/pdf/reference\\_resources/wwc\\_scd.pdf](https://ies.ed.gov/ncee/wwc/pdf/reference_resources/wwc_scd.pdf)
- Liebowitz, M. R. (1987). Social Phobia. In D. F. Klein (Ed.), *Modern Trends in Pharmacopsychiatry* (Vol. 22, pp. 141–173). S. Karger AG. <https://doi.org/10.1159/000414022>

Newzoo (2021). Global Games Market Report. The VR & Metaverse Edition.

<https://newzoo.com/insights/trend-reports/newzoo-global-games-market-report-2021-free-version/>

Oxford Centre for Evidence-Based Medicine. (2011). *The Oxford 2011 Levels of Evidence*. <http://www.cebm.net/index.aspx?o=5653>

Parker, R. I., & Vannest, K. (2009). An Improved Effect Size for Single-Case Research: Nonoverlap of All Pairs. *Behavior Therapy*, 40(4), 357–367. <https://doi.org/10.1016/j.beth.2008.10.006>

Parker, R. I., Vannest, K. J., Davis, J. L., & Sauber, S. B. (2011). Combining Nonoverlap and Trend for Single-Case Research: Tau-U. *Behavior Therapy*, 42(2), 284–299. <https://doi.org/10.1016/j.beth.2010.08.006>

Philippot, P., Dethier, V., Baeyens, C., & Bouvard, M. (2018). Validation of the Self-Discrepancies Scale (S-DS). A tool to investigate the self in clinical and research settings. *Revue Européenne de Psychologie Appliquée*, 68(2), 69–77. <https://doi.org/10.1016/j.erap.2018.04.001>

Pustejovsky, J. E., Chen, M., Grekov, P., & Swan, D. M. (2023). SingleCaseES: A calculator for single-case effect size indices (Version 0.7.1) [R package]. <https://jepusto.github.io/SingleCaseES/>

Pustejovsky, J. E., Chen, M., & Hamilton, B. J. (2023). scdhlmm: Estimating hierarchical linear models for single-case designs (Version 0.7.2) [R package]. <https://CRAN.R-project.org/package=scdhlmm>

R Core Team (2023). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. <https://www.r-project.org/>

Rathus, S. A. (1973). A 30-item schedule for assessing assertive behavior. *Behavior Therapy*, 4(3), 398–406. [https://doi.org/10.1016/S0005-7894\(73\)80120-0](https://doi.org/10.1016/S0005-7894(73)80120-0)

- Reed, G. M., First, M. B., Billieux, J., Cloitre, M., Briken, P., Achab, S., Brewin, C. R., King, D. L., Kraus, S. W., & Bryant, R. A. (2022). Emerging experience with selected new categories in the ICD-11: Complex PTSD, prolonged grief disorder, gaming disorder, and compulsive sexual behaviour disorder. *World Psychiatry, 21*(2), 189–213. <https://doi.org/10.1002/wps.20960>
- Schimmenti, A., & Caretti, V. (2010). Psychic retreats or psychic pits?: Unbearable states of mind and technological addiction. *Psychoanalytic Psychology, 27*(2), 115–132. <https://doi.org/10.1037/a0019414>
- Stein, D. J., Billieux, J., Bowden-Jones, H., Grant, J. E., Fineberg, N., Higuchi, S., Hao, W., Mann, K., Matsunaga, H., Potenza, M. N., Rumpf, H.-J. M., Veale, D., Ray, R., Saunders, J. B., Reed, G. M., & Poznyak, V. (2018). Balancing validity, utility and public health considerations in disorders due to addictive behaviours: Balancing validity, utility and public health considerations in disorders due to addictive behaviours. *World Psychiatry, 17*(3), 363–364. <https://doi.org/10.1002/wps.20570>
- Stevens, M. W. R., Dorstyn, D., Delfabbro, P. H., & King, D. L. (2021). Global prevalence of gaming disorder: A systematic review and meta-analysis. *Australian & New Zealand Journal of Psychiatry, 55*(6), 553–568. <https://doi.org/10.1177/0004867420962851>
- Stevens, M. W. R., King, D. L., Dorstyn, D., & Delfabbro, P. H. (2019). Cognitive–behavioral therapy for Internet gaming disorder: A systematic review and meta-analysis. *Clinical Psychology & Psychotherapy, 26*(2), 191–203. <https://doi.org/10.1002/cpp.2341>
- Tate, R. L., Rosenkoetter, U., Wakim, D., Sigmundsdottir, L., Doubleday, J., Togher, L., McDonald, S., & Perdices, M. (2015). *The Risk of Bias in N-of-1 Trials*

*(RoBiNT) Scale: An expanded manual for the critical appraisal of single-case reports.* The PsycBITE Group.

Thorens, G., Achab, S., Billieux, J., Khazaal, Y., Khan, R., Pivin, E., Gupta, V., & Zullino, D. (2014). Characteristics and treatment response of self-identified problematic Internet users in a behavioral addiction outpatient clinic. *Journal of Behavioral Addictions, 3*(1), 78–81. <https://doi.org/10.1556/JBA.3.2014.008>

Tolkien, J. R. R. (1954). *The Lord of the Rings (Vols. 1–3)*. Houghton Mifflin.

Varrette, M., Berkenstock, J., Greenwood-Ericksen, A., Ortega, A., Michaels, F., Pietrobon, V., & Schodorf, M. (2022). Exploring the efficacy of cognitive behavioral therapy and role-playing games as an intervention for adults with social anxiety. *Social Work with Groups, 1–17*. <https://doi.org/10.1080/01609513.2022.2146029>

Yao, Y.-W., Chen, P.-R., Li, S., Wang, L.-J., Zhang, J.-T., Yip, S. W., Chen, G., Deng, L.-Y., Liu, Q.-X., & Fang, X.-Y. (2015). Decision-Making for Risky Gains and Losses among College Students with Internet Gaming Disorder. *PLOS ONE, 10*(1), e0116471. <https://doi.org/10.1371/journal.pone.0116471>

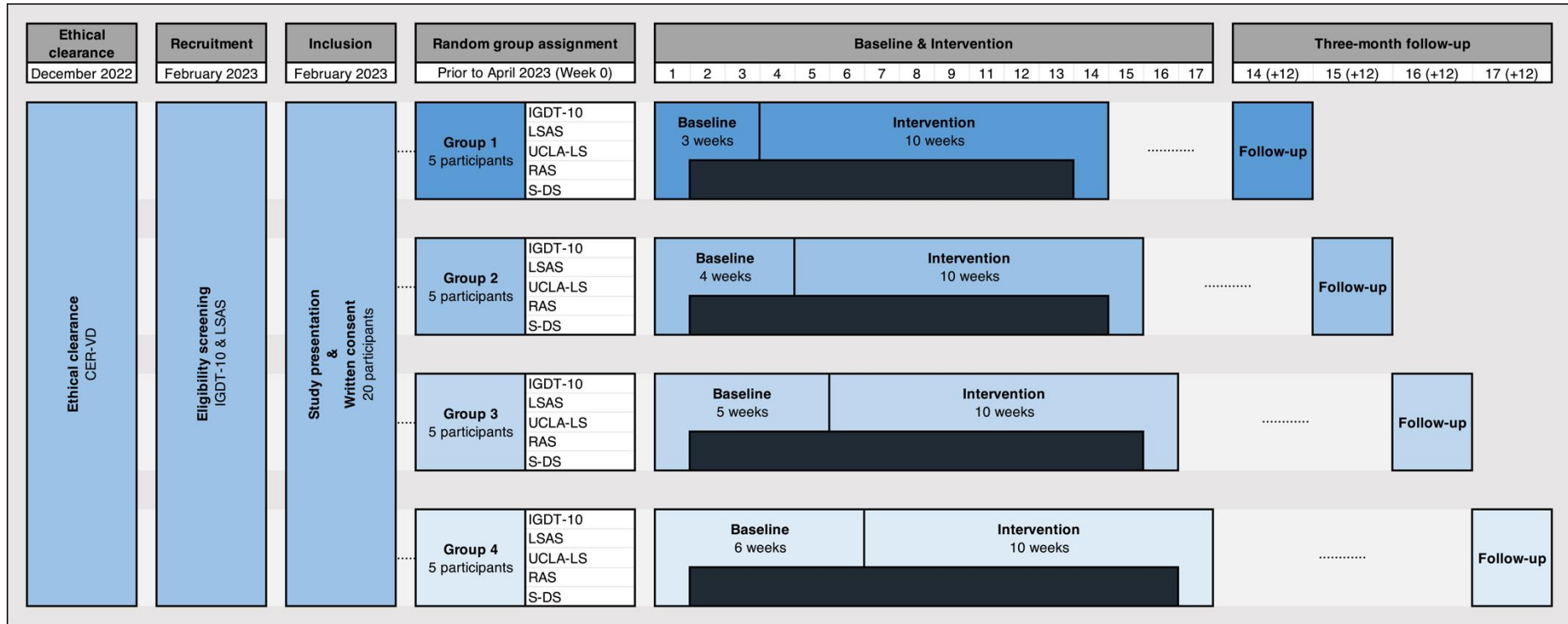
## Figure 1. Tabletop Role-Playing Games (TTRPGs)

*A typical tabletop role-playing game involves 4-6 players (including a game master, here the person with a pink T-shirt) sitting at a table. Each player owns a character sheet (describing the skills and capacities of their character) and gaming actions are resolved through dice rolls. The game master tells the story and manages the results of the actions performed by the players. Miniatures are used to represent characters (played by the gamers) and monsters (played by the game master) when a combat is simulated. Combats/encounters are a crucial part of tabletop role-playing*



**Note.** The picture was retrieved from <https://www.wikihow.com/Create-a-Dungeons-and-Dragons-Character>.

**Figure 2. Study design and representation of the various steps of the psychological assessment**



**Note.** The intersections between the “Week Number” columns and the “Psychometric Instruments” rows indicate which psychometric instrument is administered at which time during the baseline, intervention, and three-month follow-up phases. For example, in Group 1, during the baseline phase, all five psychometric instruments will be administered at Week 1, whereas three psychometric instruments will be administered at Week 2 and Week 3 (i.e., IGDT-10, LSAS, UCLA-LS).

**Table 1. TTRPG-based program**

Module	Week	Session title and synopsis	Description of the session and TTRPG aspects	Objectives	Outcomes assessed by the GM†
“Wanderer” module (low difficulty)	1	<b>Let’s get started</b> [Introductory session]	<ul style="list-style-type: none"> <li>• Welcome of the participants and summary of the project and its objectives</li> <li>• Participants are invited to quickly present themselves</li> <li>• Introduction about TTRPGs in general</li> <li>• Presentation of the “X card”</li> <li>• Presentation of the Medieval-Fantasy (“medfan”) universe</li> <li>• Basic presentation of the rule system and character progression</li> <li>• Character creation with the participants guiding them through the choice of a race, class, characteristics, and talents</li> </ul>	<ul style="list-style-type: none"> <li>• <u>Objective 1:</u> Being able to present oneself briefly to a group of unknown persons</li> <li>• <u>Objective 2:</u> Being able to describe the character they have created in a role-playing perspective (e.g., “<i>I am Barko Alto the gnome illusionist ...</i>”). The participants are invited to describe how they look, their personality, ambition, skills, etc. The description should not be limited to 1-2 sentences but be as comprehensive as possible</li> </ul>	<ul style="list-style-type: none"> <li>• <u>Objective 1:</u> <ul style="list-style-type: none"> <li>○ reached [enough details provided]</li> <li>○ partially reached [only very basic details like their name]</li> <li>○ not reached [not able to speak up]</li> </ul> </li> <li>• <u>Objective 2:</u> <ul style="list-style-type: none"> <li>○ reached [the participant can impersonate its character and describe it in a comprehensive and vivid way]</li> <li>○ partially reached [the participant only provides a basic and superficial description of their character]</li> <li>○ not reached [the participant is not able to present their character]</li> </ul> </li> </ul>
	2-3	<b>Goblin Arrows</b> [two sessions]  <i>The party of adventurers are attacked by a goblins</i>	<ul style="list-style-type: none"> <li>• General introduction to the world in which the TTRPG will take place, and the region where the participants start their adventure</li> </ul>	<ul style="list-style-type: none"> <li>• <u>Objective 1:</u> Being able to roleplay based on one’s character ability and characteristics (race, class, etc...)</li> </ul>	<ul style="list-style-type: none"> <li>• <u>Objective 1:</u> <ul style="list-style-type: none"> <li>○ reached [successful roleplay, being able to impersonate one’s character with sufficient realism]</li> </ul> </li> </ul>

		<p><i>pack. Then, they need to find and explore their lair and defeat their chief</i></p>	<ul style="list-style-type: none"> <li>• The GM provides each participant with a short and personalized element of background to link its character to the story (hook)</li> <li>• While playing, the GM familiarizes participants with the rule system (e.g., skill checks, combat rules)</li> <li>• The participants have to face their first group challenge (i.e., defeating a pack of goblins)</li> <li>• The participants have to take their first group decisions (i.e., what to do after defeating the goblins? Follow the goblins trail, go fetch some help, ...)</li> <li>• The participants have to find the lair of the goblins (a big cave with branching paths), actively explore it, and define strategies to face and defeat various opponents, including the goblin chief</li> <li>• The participants gain their first level (their character is now level 2 and increases their skills and power)</li> <li>• Feedback 1: the GM asks the participants about their feelings and remarks about these first</li> </ul>	<ul style="list-style-type: none"> <li>• <u>Objective 2:</u> Being actively involved (<math>\neq</math> passive) during the encounter and/or combat scenes (e.g., combat with the goblin pack and the opponents encountered in the goblin cave)</li> <li>• <u>Objective 3:</u> Being able to actively take part in the group decision-making process (e.g., following the encounter and combat with the goblins pack, establishing a strategy on how to explore the cave and defeat their enemies)</li> </ul>	<ul style="list-style-type: none"> <li>○ partially reached [basic roleplay and/or minimal use of one's character specificity]</li> <li>○ not reached [no involvement in roleplaying]</li> <li>• <u>Objective 2:</u> <ul style="list-style-type: none"> <li>○ reached [actively involved in the encounter/combat scenes without the help of the GM]</li> <li>○ partially reached [involved in the encounter/combat scenes but need to be supported and/or guided by the GM and/or the other players to be active]</li> <li>○ not reached [passive attitude during the encounter/combat scenes]</li> </ul> </li> <li>• <u>Objective 3:</u> <ul style="list-style-type: none"> <li>○ reached [actively involved in the group decision-making process without the help or stimulation of the GM]</li> <li>○ partially reached [involved in the group decision-making process but need to be helped or stimulated by the GM and/or the other players]</li> <li>○ not reached [passive attitude during the group decision-making process]</li> </ul> </li> </ul>
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			sessions of TTRPG playing (open feedback)		
<p>“Adventurer” module (average difficulty)</p>	4-5	<p><b>Ruins of Thundertree</b></p> <p>[two sessions]</p> <p><i>The party of adventurers explores the ruins of the town of Thundertree. In addition to defeating monsters and dealing with a group of evil cultists, the adventurers will encounter Reidoth the druid and Venomfang the young green dragon</i></p>	<ul style="list-style-type: none"> <li>The GM introduces and provides the necessary background for a new quest: Exploring the ruins of Thundertree</li> <li>The ruins of Thundertree are a magical and cursed place that can be explored relatively freely by the participants (e.g., they can choose which areas to explore first, and adopt various strategies to discover all secrets of Thundertree)</li> <li>A new element brought in this module is interaction with NPC (i.e., characters played by the DM). In the ruins of Thundertree, the participants encounter three NPCs: (1) Reidoth the druid (nice and collaborative); (2) Favric the cultist (neutral and non-collaborative); and (3) Venomfang the young green dragon (hostile and non-collaborative)</li> <li>As in the <b>first module</b>, the participants will have to face and defeat various enemies (e.g., undeads, twig blights, cultists) and to take group decisions to deal with the characters they encounter, avoid traps, and</li> </ul>	<ul style="list-style-type: none"> <li><u>Objective 1:</u> Being actively involved (≠ passive) during the exploration of Thundertree and combat scenes</li> <li><u>Objective 2:</u> Being able to actively take part in the group decision-making process taking place during the exploration of Thundertree</li> <li><u>Objective 3:</u> Interacting with a collaborative NPC (Reidoth the druid). The GM ensures that all participants have an occasion to interact with the druid</li> <li><u>Objective 4:</u> Interacting with a non-collaborative NPC (Venomfang the dragon or Favric the cultist based on their choices). The GM ensures that all participants have an occasion to interact with the NPC</li> <li><u>Objective 5:</u> Being actively involved in negotiation and problem-solving when it comes to divide the treasure between the various participants</li> </ul>	<ul style="list-style-type: none"> <li><u>Objective 1:</u> <ul style="list-style-type: none"> <li>reached [actively involved in the exploration/combat scenes without the help of the GM]</li> <li>partially reached [involved in the exploration/combat scenes but need to be supported and/or guided by the GM and/or the other players to be active]</li> <li>not reached [passive attitude during the exploration/combat scenes]</li> </ul> </li> <li><u>Objective 2:</u> <ul style="list-style-type: none"> <li>reached [actively involved in the group decision-making process without the help or stimulation of the GM]</li> <li>partially reached [involved in the group decision-making process but need to be helped or stimulated by the GM and/or the other players]</li> <li>not reached [passive attitude during the group decision-making process]</li> </ul> </li> <li><u>Objective 3:</u> <ul style="list-style-type: none"> <li>reached [direct, proactive and efficient interaction with the druid]</li> </ul> </li> </ul>

			<p>progress efficiently. Yet, encounters and missions are more difficult in this second module, and can engender dilemma (e.g., will the participants try to combat the dragon or negotiate?)</p> <ul style="list-style-type: none"> <li>• The participants discover a treasure containing various items (e.g., magic artefacts and weapons, gold, equipment) and have to divide it between them</li> <li>• The participants gain an additional level (their character is now level 3 and increases their skills and power)</li> </ul>		<ul style="list-style-type: none"> <li>○ partially reached [undirect, basic or DM-solicited interaction with the druid]</li> <li>○ not reached [no interaction with the druid]</li> </ul> <ul style="list-style-type: none"> <li>• <u>Objective 4:</u> <ul style="list-style-type: none"> <li>○ reached [direct, proactive and efficient interaction with the dragon/cultist]</li> <li>○ partially reached [undirect, basic or DM-solicited interaction with the dragon/cultist]</li> <li>○ not reached [no interaction with the dragon/ cultist]</li> </ul> </li> <li>• <u>Objective 5:</u> <ul style="list-style-type: none"> <li>○ reached [being proactive and assertive when the treasure is divided]</li> <li>○ partially reached [being involved without being enough assertive when the treasure is divided]</li> <li>○ not reached [being passive and just accept what the other participants propose or give]</li> </ul> </li> </ul>
6-7	<b>City of Phandalin</b> [two sessions]	<ul style="list-style-type: none"> <li>• The GM presents the city of Phandalin, its neighbourhoods and noteworthy inhabitants, and explains to the participants that they will have to explore and</li> </ul>	<ul style="list-style-type: none"> <li>• <u>Objective 1:</u> Being able to roleplay according to their alignment</li> </ul>	<ul style="list-style-type: none"> <li>• <u>Objective 1:</u> <ul style="list-style-type: none"> <li>○ reached [roleplay coherent with the alignment and personal quest]</li> </ul> </li> </ul>	

		<p><i>The party of adventurers will freely explore the city of Phandalin, meet its inhabitants, and accomplish personal quests related to their backstory</i></p>	<p>discuss with NPCs to achieve their personal quests</p> <ul style="list-style-type: none"> <li>The GM introduces the concept of alignment, which corresponds to a categorization of the ethical and moral perspective of characters (e.g., lawful good, chaotic neutral). In this module, participants will be invited to play and roleplay according to their alignment. Only alignments that fit for “heroes” will be proposed (e.g., alignments like “chaotic evil” are not used)</li> <li>The GM provides each participant with a personalized backstory and quest. The participants will have to find and interact with specific NPCs (e.g., Boker the retired Paladin, Erik High-hill the halfling innkeeper, Brocc the archmage) in the city of Phandalin. Finding the good NPCs or places will involve group work, but for the first time each participant will have to individually interact with a specific NPC to achieve their personal quest</li> <li>The participants gain an additional level (their character is now level 4 and increases their skills and power)</li> </ul>	<ul style="list-style-type: none"> <li><u>Objective 2:</u> Collaborating with the other participants so that each character is able to achieve their personal quests (e.g., being assertive, collaborate with other participants, making compromises)</li> <li><u>Objective 3:</u> Interacting individually with a specific NPC to achieve their personal quest</li> </ul>	<ul style="list-style-type: none"> <li>partially reached [basic roleplay not necessarily related to the alignment or personal quest]</li> <li>not reached [no involvement in roleplaying]</li> <li><u>Objective 2:</u> <ul style="list-style-type: none"> <li>reached [successful collaboration and assertiveness with the other participants]</li> <li>partially reached [limited collaboration and assertiveness with the other participants]</li> <li>not reached [passive attitude and poor collaboration with the other participants]</li> </ul> </li> <li><u>Objective 3:</u> <ul style="list-style-type: none"> <li>reached [proactive and efficient interaction with the NPC related to their personal quest]</li> <li>partially reached [basic or DM-solicited interaction with the NPC related to their personal quest]</li> <li>not reached [no interaction with the NPC related to their personal quest]</li> </ul> </li> </ul>
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"Hero" module (elevated difficulty)	8-9	<p><b>Wave Echo Cave</b></p> <p>[two sessions]</p> <p><i>The party of adventurers will explore the Wave Echo Cave, a gigantic maze of magic and doom</i></p>	<ul style="list-style-type: none"> <li>The GM introduces and provides the necessary background for a new quest: Exploring the Wave Echo Cave</li> <li>In this last module, the participants will again encounter NPCs, some of them they have encountered previously. The degree of interaction will be higher as the NPCs use past decision from the group to provoke them and to stimulate dissension among the participants</li> <li>The specificity of this last module is that each of the participants is invited, each in turn, to endorse the GM role and play a unique scene corresponding of one of the room/area of the Wave Echo Cave</li> </ul>	<ul style="list-style-type: none"> <li><u>Objective 1:</u> Being able to roleplay when it includes being in opposition with characters played by other participants</li> <li><u>Objective 2:</u> Being able to play an entire scene as the GM. The GM facilitates the process when necessary (e.g., the GM can provide participants with a series of "ready to play" script when the participant do not want to create their own scene). The participants are not forced to endorse the GM role if they do not want to do so</li> </ul>	<ul style="list-style-type: none"> <li><u>Objective 1:</u> <ul style="list-style-type: none"> <li>reached [successful resolution of conflicts, proactive to find compromise]</li> <li>partially reached [limited interaction, avoid conflict rather than resolve it]</li> <li>not reached [passive attitude, unable to deal with conflicts]</li> </ul> </li> <li><u>Objective 2:</u> <ul style="list-style-type: none"> <li>reached [the participant is able to create and play their own scene as the GM]</li> <li>partially reached [the participant uses a script provided by the research team but is then able to endorse the GM role]</li> <li>not reached [the participant refuses to endorse the GM role]</li> </ul> </li> </ul>
	10	<p><b>To be continued</b></p> <p>[Closing session]</p>	<ul style="list-style-type: none"> <li>In case all scenes of the <b>Wave Echo Cave</b> have not been played (typically the scene of the fifth participant), playing the remaining scene(s)</li> <li>The participants are confronted with a final boss that they have to confront together</li> <li>The participants gain an additional level (their character</li> </ul>	Unless a participant has not yet had the occasion to play their own scene in the <b>Wave Echo Cave</b> , the last session has no specific objective. It is about fun and feedback	Not applicable

			<p>is now level 5 and increases their skills and power)</p> <ul style="list-style-type: none"><li>• Feedback 2: The participants are invited to provide open feedback about the whole experience they lived together</li><li>• The GM thanks the participants for having completed the program, and they are reminded that there will be a follow-up assessment in three months. They also receive a 20 sided dice as a reward gift</li><li>• Interested participants are encouraged to continue playing on their own and possibilities are discussed (e.g., participants continue to play as a group, one of them becoming the new GM, participants join a club...)</li></ul>		
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Question	Hypothesis	Sampling plan	Analysis plan	Rationale for deciding the sensitivity of the test for confirming or disconfirming the hypothesis	Interpretation given different outcomes	Theory that could be shown wrong by the outcomes
<p>Assuming a compensatory model of video game overinvolvement (Kardefelt-Winther, 2017; Schimmenti &amp; Caretti, 2010), we hypothesize that our program, which is designed to improve social skills, assertiveness, and self-concept (i.e., perceived discrepancy between the ideal and actual selves, see Higgins, 1987; Philippot et al., 2018) has the potential to mitigate problematic involvement in MMORPGs and reduce social anxiety symptoms and feelings of loneliness.</p>	<p><b>Primary outcome 1:</b> A reduction of self-reported gaming frequency (average hour per day) at the end of the TTRPG-based program (P1A) and at the 3-month follow-up (P1B)</p>	<p>Non-relevant in the context of our multiple single case approach (see methods)</p>	<p>Non overlap of all pairs (NAP) test, between-cases standardized mean difference, Reliable Change Index/Clinically Significant Change</p>	<p>Non-relevant in the context of our multiple single case approach (see methods)</p>	<p>Our study adopts a multiple single case design.</p> <p>We will not provide “general” interpretation (unless in the unlikely case where all participants present with the same pattern of results).</p> <p>We are rather interested in testing the feasibility and initial <b>effect</b> of our program.</p> <p>The comprehensive baselines conducted will allow to analyze for each participant what kind of symptoms (e.g., social anxiety, problem gaming) or psychological factors (self-concepts, assertiveness, loneliness) is affected by our experimental program.</p>	<p>Our study is not testing a specific theory or model</p>
	<p><b>Primary outcome 2:</b> A reduction of gaming disorder symptoms (assessed by the IGD-10) at the end of the TTRPG-based program (P2A) and at the 3-month follow-up (P2B)</p>		<p>Non overlap of all pairs (NAP) test, between-cases standardized mean difference, Reliable Change Index/Clinically Significant Change</p>			<p>Our study is not testing a specific theory or model</p>
	<p><b>Primary outcome 3:</b> A reduction of social anxiety symptoms (assessed by the LSAS) at the end of the TTRPG-based program (P3A) and at the 3-month follow-up (P3B)</p>		<p>Non overlap of all pairs (NAP) test, between-cases standardized mean difference, Reliable Change Index/Clinically Significant Change</p>			<p>Our study is not testing a specific theory or model</p>
	<p><b>Secondary outcome 1:</b> An increase in assertiveness and social skills (assessed by the RAS) at the end of the TTRPG-based program (S1A) and at the 3-month follow-up (S1B)</p>		<p>Reliable Change Index/Clinically Significant Change</p>			<p>Our study is not testing a specific theory or model</p>
	<p><b>Secondary outcome 2:</b> An improvement in self-concept indexed by a lower ideal self-discrepancy and a lower socially prescribed self-discrepancy (assessed by the S-DS) at the end of the TTRPG-based program (S2A) and at the 3-month follow-up (S2B)</p>		<p>Reliable Change Index/Clinically Significant Change</p>			<p>Our study is not testing a specific theory or model</p>
	<p><b>Secondary outcome 3:</b> A decrease in loneliness (as indexed by the UCLA-LS) at the end of the TTRPG-based program (S3A) and at the 3-month follow-up (S3B)</p>		<p>Reliable Change Index/Clinically Significant Change</p>			<p>Our study is not testing a specific theory or model</p>