Choose your own risks: measuring risk-taking through an interactive novel

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Declaration of interest

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Running head: RISK TAKING AND INTERACTIVE NOVEL

Abstract

We present elements that support the use of interactive novels as a relevant risk-taking measure instrument. In the introduction, we describe what interactive novels are and how they can be used to study human decision making. Then, we present the results of a study designed to assess how behaviours made in interactive novels relate to real-life behaviours. Participants ($n = 234$) interacted with a novel depicting a student party. During the story, participants could make several risk-taking behaviours (i.e., drug taking). Then, participants completed the Dohmen's one item risk-taking scale, the DOSPERT scale, and a self-report risk-taking scale. Our results show strong correlations between risk-taking in the interactive novel and real life risk-taking behaviours. Notably, risk-taking behaviours made in the novel were globally more correlated with real-life risk-taking than were the Dohmen and DOSPERT scales. This supports the use of interactive novels as an instrument to study risk-taking behaviours and decision making.

Keywords: risk-taking, risk-taking assessment, interactive media, role-playing, serious game, interactive novel

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The main risk-taking behaviour measure instruments have recently encountered a number of criticisms, focusing notably on their lack of convergent validity (Lönnqvist, Verkasalo, Walkowitz, & Wichardt, 2015; Mamerow, Frey, & Mata, 2016; Pedroni et al., 2017; Szrek, Chao, Ramlagan, & Peltzer, 2012) and on their insufficient predictive power and correlations when compared to real risk-taking (Lönnqvist et al., 2015; Szrek et al., 2012; Woelbert & Riedl, 2013). For instance, Pedroni et al. (2017) recently compared participants' choices in 6 of the most popular risk-taking assessment tasks and found important variations in participant's risk-taking evaluations to the different tasks. Actually, the variations were so important that the authors could not affirm the existence of an underlying concept of risk preference. Several flaws have been identified in these instruments that are likely to explain such variations (Bran & Vaidis, 2019; Byrnes, Miller, & Schafer, 1999; Fox & Tannenbaum, 2011; Schonberg et al., 2011; Zhang, Highhouse & Nye, 2018). They relate for instance to the very definition of risk-taking, to the insufficient account of its contextual and subjective natures, to the lack of emotional arousal in risk-taking tasks and to the unrealistic aspect of most risk-taking assessments. Given the insufficient validity of the actual instruments, several scholars have encouraged the development of new instruments that would be more valid and more predictive of real-life risk-taking (Byrnes, et al., 1999; Fox & Tannenbaum, 2011; Rohrman, 2011; Schonberg et al., 2011). In the present paper, we examine the relevance of using interactive narratives and a *choose-your-own-adventure* procedure to assess risk-taking behaviours.

Presentation of interactive narratives

Cho and Friley (2014) define *narratives* as “stories that connect actions and events involving characters with thematic and temporal sequences.” These narratives can take the form of novels, movies, audio stories, etc. Interactive narratives are stories that present choices that allow controlling the sequence of events and the direction of the story. Popular

examples include choose-your-own-adventure novels, interactive videos, video games and serious games. For instance, the following passage is an extract from a digital interactive novel we use in our studies. In this passage, the reader embodies a student that has just watched a close friend (*Ethan*) lose an important amount of money in a poker game:

While looking at the game, you suddenly become aware that you can see the cards of the player in front of you each time that he looks at them. You think fast. As long as you stay where you are, Ethan can see your face and you can see the cards of his principal opponent...

You could take the risk to make discreet signs to Ethan in order to help him. Given his situation, you guess that he would gladly accept your help. However, you also know that this could end badly if you were to be noticed by a gambler or by a spectator...

- *Try to help Ethan.*
- *Don't interfere with the game.*
- *Advise Ethan to stop playing.*

The reader can choose any of the offered choices of action and the story will pursue accordingly. Interactive narratives such as this one are commonly used for entertainment and for education (Green & Jenkins, 2014) but research on their specificities is sparse and it mainly focuses on two elements: *transportation* and *identification*.

Transportation corresponds to the feeling of being engaged and immersed in the story, sometimes to the point of not paying attention to the real world anymore. Transportation is conceptually similar to concepts such as *immersion* or *presence*. When a person is transported in a story, attention and cognitive processes are focused on the events depicted in the story and these events feel real, as if the person was inside the fictional world (Cho & Friley, 2014; Gerrig, 1993; Green & Brock, 2000). Interactivity facilitates transportation by allowing readers to direct the story towards their preferences, thus making it feel more personalised, and by

making the events feel more important and more relevant (Green, Brock, & Kaufman, 2004; Green & Jenkins, 2014; Yin, Ring, & Bickmore, 2012). People that are transported in a story find it more enjoyable (Escalas, 2004; Green et al., 2004), may be less likely to question its logic or its message (Green & Brock, 2000; Moyer-Guse & Nabi, 2010) and are more likely to adopt attitudes and behaviours consistent with the story (Dal Cin, Zanna, & Fong, 2004; Green & Brock, 2000). Green and Jenkins (2014) also suggest that transportation mediate individual choices in interactive narratives, such that transported individuals tend to make choices that reflect what they would do if they really were in the depicted situation.

Identification relates to the feeling to be in the story's characters shoes, sharing their knowledges, goals, attitudes and emotions (Keen, 2006; Tal-Or & Cohen, 2010). This is very similar to the concept of experience-taking, that is the "imaginative process of spontaneously assuming the identity of a character in a narrative and simulating that character's thoughts, emotions, behaviours, goals, and traits as if they were one's own" (Kaufman & Libby, 2012, p. 1). Interactive narratives that let people direct the actions and attitudes of a character are likely to increase identification with this character. Identification should be even more increased when the narrative permits to directly insert relevant information for the participant (e.g., name, gender, age, place) at the beginning of the story, thus allowing to tailor the story to the reader. Identification with a story's character can motivate people to adopt behaviours realised by this character (e.g., smoking; Dal Cin, Gibson, Zanna, Shumate, & Fong, 2007) and can impact the persuasive effectiveness of preventive messages (Cho, Shen, & Wilson, 2012; Larkey & Hecht, 2010).

Advantages of using interactive novels to study risk-taking

Given the important differences between the various forms of interactive narratives, we will focus from here on the medium used in our study: text-based interactive novels, popularly known as choose-your-own-adventure novels. Despite this focus, most of the following is likely to apply as well to other interactive media. Interactives novels have recently become a research instrument to study human behaviour. They have already been used in research on

prosocial behaviours (Steinemann et al., 2017), personality (Paradedda, Ferreira, Martinho, & Paiva, 2017), persuasion (Figueiredo & Paiva, 2010) and relationship decision making (Turan & Vicary, 2010). To our knowledge interactive novels have not yet been used to study risk-taking, however we identify six reasons suggesting that they could be relevant to assess risk-taking and decision making.

Realistic Situations

The first reason is that decisions made in interactive novels may be more closely related to real decisions and preferences than those assessed by current measure instruments. While most risk-taking measures have been criticised for their lack of correlation with real-life behaviours (Gahagen, 2014; Mamerow et al., 2016; Szrek et al., 2012; Woelbert & Riedl, 2013), interactive novels can provide participants with more realistic description of risk-taking situation. For instance, to assess driving risk-taking, Ben-Ari, Florian and Mikulincer (2000) asked their participant to imagine themselves in 10 briefly described situations, such as:

“You are on your way to a weekend vacation. A very slow truck is driving just in front of you. A continuous white line separates you from traffic in the opposite direction of the road. What do you think are the chances that you’ll go for an overtake?” (p. 5)

We believe that interactives novels can depict more precise and detailed description of such situations. In turn, this should favor participant’s transportation and thus increase the link between assessed risk-taking and real-life risk-taking. Likewise, most risk-taking tasks guide participants and only allow them a very restricted set of options. For instance, the Balloon Analogue Risk Task (Lejuez et al., 2002) allows only two choices: to pump a balloon or to stop pumping. By allowing readers to take choices throughout the story and giving them the feeling to influence the events, interactive novels can provide a feeling of control that may more closely mimic real-life situations. Last, anticipated emotions and sensation seeking are considered as core motives in risk-taking (Kerr, 1991; Loewenstein, Weber, Hsee, & Welch, 2001) but risk-taking tasks have been repeatedly criticised for not inducing strong emotions to

their participants (Anderson & Brown, 1984; Schonberg et al., 2011). In contrast, novels are generally prone to induce emotions to their readers, and even more so if they are transported in the story or if they identify with a character (Bal & Veltkamp, 2013; Oatley, 1999).

For all these reasons, taking risks in an interactive novel may be more closely related to real-life risk-taking than taking risk in current measure instruments. While there are currently few empirical results comparing decisions made in interactive novels and decisions made in real-life, Green and Jenkins (2014) report that readers of an interactive novel mostly attribute their decisions to the choices they would make in real-life, especially if they are transported in the story. This self-attribution is not a strong evidence, however decisions made in a more realistic setting, such as the one provided in detailed interactive novels, are more likely to correspond to decisions made in real-life (Camerer & Mobbs, 2017).

Subjective Nature of Risk-taking

A second benefit is that interactive novels could account for the subjective nature of risk-taking. In current risk-taking assessments, the risk is rarely the same for every participants because the significance of the potential loss and its chances of occurring differ depending on the participant (Yates & Stone, 1992). For instance, money is the most common incentive in risk-taking tasks, yet the subjective value of money depends on the context and the individual (Bernoulli, 1954; Buechel & Morewedge, 2014; Kahneman & Tversky, 1979). Likewise, there are many situations in which the personal knowledge or skills of a participant can help to mitigate a risk (Miller & Byrnes, 1997). For instance, experienced drivers are less likely than novices to have an accident when they take a risk while driving (Klauer et al., 2014). These differences are rarely taken into account in current risk-taking measure instruments, however they may seriously bias studies as those who engage in risk-taking behaviours might be those for whom the behaviour present few or no risk (Made & Elmqvist, 2004; Ruedl et al., 2015). Interactive novels can partially standardise this subjectivity bias by letting every participant embody a character with the same characteristics. For instance, in our study, every participant embody the same student, except for the name and gender that are customised. Whenever

the character can make a risky behaviour where its abilities may have an influence, such as participating in a dangerous game, the story clarifies its skill and prior experience, for instance precising that the character has played this game before. This helps to put every participant in the same situation, thus reducing the subjectivity bias.

Concealed experimental manipulation

Interactive novels may be an interesting way to do discreet experimental studies where the experimental manipulation is concealed within the story itself. For instance, Figueiredo and Paiva (2011) designed an interactive novel in which participants embody an adventurer on a quest. At one point in their adventure, participants may save another character out of a perilous situation. Studying the concept of reciprocity, Figueiredo and Paiva discreetly measured how being previously confronted and helped by the endangered character would influence participants' choice. Likewise, Figueiredo and Paiva (2010) also used interactive novels in the persuasion field and inconspicuously assessed how differences in a character description would influence the participant's choice to follow or not the advices given by this character.

Interactive novels could be used in many experimental contexts such as these. Thanks to their immersive narrative, they allow for discreet manipulations and assessments, and thus limit biases such as demand characteristics. To illustrate with another example, if one is interested in the effect of a specific emotion on risk-taking, one could write an interactive novel designed to induce this emotion and then look at risk taken in the rest of the story. We believe that these experimental studies would be more ecological than the traditional use of several tasks usually presented as unrelated studies.

Customizable Context

Interactive novels can easily be contextualised to researchers' interests. For instance, the story we developed in our study focuses on risk-taking behaviours during a student party. Likewise, most contexts can be adapted, such as driving risk-taking or financial risk-taking.

Moreover, even within a specific context, different domains of risk can be assessed such as drinking, taking drug or cheating in a game. In comparison, traditional risk-taking tasks often focus on active risk-taking in financial gambles and lotteries, and often imply notions of probability that may be difficult to understand by participants (Hammitt & Graham, 1999). Other risk-taking behaviours, such as health risks, are usually assessed through self-report scales (e.g., Blais & Weber, 2006). On their part, interactive novels could be used to study a broad variety of risk-taking behaviours, even including passive risk-taking which is rarely studied (Keinan & Bereby-Meyer, 2012).

Engagement in the task

Interactive novels may be more pleasant for participants than traditional decision making tasks. Their mechanisms are usually straightforward and they can provide a feeling of control that should be appreciated by the reader (Klimmt, Hartmann, & Frey, 2007; Hand & Varan, 2008; Roth, Vermeulen, Klimmt, & Vorderer, 2012). If participants enjoy the experiment, they are more likely to commit to the task, to get involved and thus less likely to satisfice.

Easy as pie

Interactive novels can easily be implemented for experimental purposes. A number of open-source softwares are available to design interactive novels (e.g., Twine, www.twinery.org; Squiffy, <http://textadventures.co.uk/squiffy>). This can be done with minimal programming and writing skills (for a tutorial, see Freedman, Seidman, Flanagan, Green, & Kaufman, 2018).

Limitations of using interactive novels to study risk-taking

Although they may present several advantages, we have also identified a number of potential limitations to the use of interactive novels to study risk-taking. First, novels require reading skills from the participants. Even if interactive novels have been written for people of

all ages, including young children, this may precludes the participation of people with limited reading skills.

Second, there may be several moderator variables influencing the appreciation of an interactive novel and the choices made inside the story. In an extensive model, Green and Jenkins (2014) suggest that participants' comfort with technology, need for control, need for cognition and transportability (i.e., the ability to be transported) would all influence their appreciation and enjoyment during the story, and also impact any potential attitude and behaviour change after the reading. These moderators may also influence the choices made through the story, as participants that are not transported or identified may make choices that are irrelevant to what they would do in real life (Green & Jenkins, 2014).

Third, there is a specific case in which links between story-choices and real-choices are likely to be low: this is if the readers are detached from the story and consider it as simple game (see Vallacher & Wagner, 2012) which could alter the relevance of the risk-assessment (Bran & Vaidis, 2019). In this case, readers are not fully transported in the story and might just choose the option that seems the most exciting or the most prone to induce a scene they want to see, and this is likely to be represented by more risky actions. This limitation could also apply if participants choose to roleplay their character in a specific way, thus making their choices based on a fictitious personality. Likewise, if readers have the feeling that their choices are meaningless (e.g., that they do not really influence the story), they are unlikely to develop a feeling of responsibility (Steinemann et al., 2017) and may detach themselves from the story. These issues are all related to participants' transportation and identification within the story and it is possible that specific instructions could help coping with these limits, such as suggesting participants to act as they would do in real life or to personalize their character close to their self.

Fourth, as a last drawback, interactive novels may take more time to create than other risk-taking tasks. This mostly depends on the length one is aiming for. Longer novels are likely to facilitate transportation and identification as readers have more time to immerse themselves in the story and to live experiences within. However, longer novels may cause tiredness and

will take significantly more time to set up. On a positive note, this issue can be partly circumvented if authors and researchers willingly share their materials, thus reducing the need to create new ones.

Overall, we believe that interactive novels could be a very interesting instrument to assess behaviours that would be difficult to assess in real-life, and more specifically to study risk-taking. However, one major concern is the lack of data comparing choices made in interactive narratives and real-life behaviours. Interactive novels would be an interesting means only if decisions taken during the story reflect decisions taken in real life. To empirically test this hypothesis, we realised a correlational study to observe how people's risk-taking choices in an interactive novel are related to their real-life risk-taking behaviour.

Method

Material

All our materials, including the interactive novel, and our data can be accessed at <https://osf.io/z2wrd>. We created a 8000 words interactive novel using the Twine software (Harlowe, version 2.1.0). On average, one reading took about 12 minutes. The story depicted a student party in which the reader could make various choices and participate in different activities, some of them being risky. Interactive novel can have very different structures. For instance, some of them give complete liberty to the readers to go where they wish, and some allow readers to type in the program the actions they want to make. To ensure that all our participants would experience a similar story and to keep it intuitive, we based the novel on a linear form in which determined situations successively occur during the party, each situation giving several choices to the readers to react. We will detail the course of the story in the procedure section below. Every choice made by the participants during the flow of the story was recorded.

To compare risks taken in the story to real-life risk-taking behaviours, we used three different instruments. The first instrument is the one-item risk-taking tendency scale used by

Dohmen et al. (2011). Participants were asked “are you generally a person who is fully prepared to take risks or do you try to avoid taking risks?” and answered on a 11-point-scale ranging from “1” (not at all willing to take risks) to “11” (very willing to take risks). This one-item has been several times reported to be a good predictor of real life risk-taking (Coppola, 2014; Dohmen et al., 2011; Szrek et al., 2012).

The second instrument is the French version of the Domain-Specific Risk-Taking scale (Dospert, Blais & Weber, 2006). This 30 items scale assess projected risk-taking on five different domains. Each item asks participants their likelihood to take a specific risk-taking behaviour, rated with a 7-point-scale ranging from “1” (Extremely unlikely) to “7” (Extremely likely). The Dospert scale is currently one of the most popular instrument used in the risk-taking field. As previous studies reported the financial items to be difficult to understand for French students (Richert, 2017; Richert, Erdlenbruch, & Figuières, 2017) and as they were less relevant to the story, we did not assess them, thus reducing the scale to 24 items.

The last instrument was a self-report risk-taking questionnaire that was specifically built to mirror the risk-taking behaviours available during the interactive novel. This questionnaire asked the participant’s frequency of taking 8 specific risk-taking behaviours during the last six months (i.e., taking recreational drugs) through a 4-point-scale ranging from 1 (never) to 4 (often). Specific questions about alcohol consumption and driving licence were added to estimate the relevance of these related activities for participants.

Procedure

We recruited 260 participants to take part in a research presented as a study of transportation in interactive novels. Participants were mainly recruited from the faculty and from online forums. We excluded a total of 26 participants: 14 did not finish the study, 8 reported participating more than once, 2 reported having answered unseriously, and 2 did not fill in the main character name. The final sample consisted in 234 adult participants (123 women, 105 men, 3 non-binary, 3 unspecified; $M_{age} = 25$; $SD_{age} = 8.6$). The whole procedure was set online and was the same for every participant.

Participants were first asked to give their sex, name and age. We advise them to give their real informations in order to facilitate their transportation in the story. These informations allowed us to customise the story, for instance by making characters interact with the readers by using their name and by consistently referring to their gender. Additionally, in the eventuality of the reader's name already being one the story character's name, this allowed us to change that character name to avoid a potential confusion. Once participants entered their informations, they were recommended to transport themselves into the story, to imagine that they were really exposed to the depicted situations and to make the choices that they think they would do in real-life. Then, the story began.

In the novel, every reader embodied the same main character: a student at the end of the university year, preparing to go to a student party with two close friends: one male and one female. The first part of the story took place during the trip to the party and presented the main character, introduced the two friends and allowed the reader to make their first choices in a conversation. While these choices had no important consequences, they served as an introduction to show readers how they would be able to interact with the story and how characters would remember and react to their choices.

The second part of the story started with the arrival to the party. During the party, the reader was exposed to different situations, some of them being mostly inconsequential and some of them allowing to make risky choices. The available risk-taking choices appeared in the story in the following order: (1) get a first drink, (2) get a second drink, (3) cheat to help a close friend win a high stakes poker game, (4) get a third drink, (5) check on an uneasy person in potential need, (6) play a risky knife game for fun, (7) take recreational drugs, and (8) choose how to go back home. In each of these situations, the reader had the choice between risky behaviours (e.g., *playing the knife game*) and safe behaviours (e.g., *watching the knife game*). The story finished once the reader chose how to go home (e.g., *drive back* or *call a taxi*).

After the story, participants were invited to complete several measures, starting with feedback questions measuring their attitude towards the story and their transportation during

the reading. Then participants successively answered the Dohmen scale, the Dospert scale and the self-report risk-taking questionnaire. After completing the questionnaire, participants were debriefed and thanked.

Results

Risk-taking behaviours

To evaluate if risk-taking behaviours made in the story were related to real-life risk-taking behaviours, we computed the correlation between story behaviours and reported real-life past behaviours. One of the 8 self-reported item was not analysed (i.e., *Drove after taking drugs, including cannabis*) due to only 10 participants reporting occurrences of this behaviour.

Participants could drink alcohol at three occasions and always had the choice between a non-alcoholic beverage, a light alcoholic beverage (e.g., beer) and a strong alcoholic beverage. We computed an alcohol consumption score by adding 1 point for each light alcoholic beverage drunk during the story and 2 points for each strong alcoholic beverage. Therefore the total score for alcohol consumption could range from 0 to 6. At the end of the story, participants could choose to go home by driving themselves a car. We considered this to be a risky behaviour for participants having a score of at least 3 on the alcohol consumption score¹.

We calculated correlations for all risk-taking measures: story risk-taking behaviours, the Dohmen's scale, the DOSPERT scale and the self-report risk-taking questionnaire (see Table 2). Because the health/safety subscale of the DOSPERT was more relevant for the purpose of the story and presented stronger relations compared to the full scale, we report here the results with this subscale. Table 1 and Figure 1 show the comparisons between our risk-taking measure instruments. The full correlation table is available in Table 2. Every risk-taking behaviours in the interactive novel is significantly correlated with self-reported risk-taking

¹ This corresponds to having three light drinks or to having at least one light and one strong drinks. This is in accordance with French regulations that prohibit driving while having more than 0.05 blood alcohol concentration, which corresponds approximately to 2 lightly alcoholised drinks.

behaviours. When compared to the Dohmen and the DOSPERT scales, risk-taking in the interactive novel is better correlated with reported risk-taking for six of the seven behaviours, and is on par with the seventh behaviour (i.e., *cheating in a game*). We computed the mean correlations with reported risk-taking following recommendations from Olkin and Pratt (1958). The mean correlations were of .37 (Interactive novel), .27 (DOSPERT health/safety) and .23 (Dohmen).

Table 1. Correlations between self-reported behaviours and each of our risk-taking instruments.

Self-report measure	Related story behaviour	Reported - Story	Reported - DOSPERT health/safety	Reported - Dohmen
Drunked to the point of feeling bad in a party	Alcohol consumption score	.56***	.43***	.39***
Played a game dangerous for your health, such as the knife game	Participating in the knife game	.48***	.25***	.24***
Taken drugs	Taking drugs from a partygoer	.46***	.37***	.37***
Drove after drinking more than two alcohol glasses during a party	Having an alcohol consumption score of at least 3 and choosing to go home by driving a car	.34***	.21*	.09
Seen a person obviously in a bad state during a party, but without intervening	Choosing not to check on the uneasy person	.28***	.13*	.15*

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yourself to check if she is all right				
Cheated in a game with friends	Cheating in the poker game	.25***	.26***	.27***
Drove while feeling dizzy because of alcohol	Having an alcohol consumption score of at least 3 and choosing to go home by driving a car	.22*	.13	.10

Notes: the significance level are * = $p < .05$; ** = $p < .01$; *** = $p < .001$. For all situation, $n = 234$, except for the two driving situations where correlations are computed only with participants having reported to drive a motorised vehicle ($n = 113$).

Table 2. Correlation matrix between all risk-taking measures.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. Dohmen	—													
2. Dospert - health/safety	.55***	—												
3. S- Alcohol consumption score	.37***	.43***	—											
4. R - Heavy drinking	.39***	.43***	.56***	—										
5. S - Knife game	.14*	.11	.09	.05	—									
6. R - Dangerous game	.24***	.25***	.14*	.22***	.48***	—								
7. S - Drug taking	.32***	.32***	.30***	.28***	.26***	.24***	—							
8. R - Drug taking	.37***	.37***	.42***	.48***	.09	.29***	.46***	—						
9. S - Drunk driving	.06	.06	.15	.02	.06	.25**	.13	.09	—					
10. R - Drunk driving (tipsy)*	.10	.13	.19	.25**	.08	.01	.18	.40***	.23*	—				
11. R - Drunk driving (> 2 drinks)*	.09	.21*	.29**	.23*	.03	.07	.31***	.19*	.34***	.57***	—			
12. S - Passive risk	.04	.03	.06	.09	.17**	.20**	.02	.07	.09	.16	.06	—		
13. R - Passive risk	.15*	.13*	.15*	.08	.05	.16*	.21**	.19**	.04	.05	.08	.28***	—	
14. S - Game cheating	.18**	.15*	.19**	.18**	.00	.21**	.08	.09	.13	.05	.00	.06	.08	—
15. R - Game cheating	.27***	.26***	.13*	.27***	.07	.31***	.18**	.32***	.11	.02	.10	.16*	.16*	.25***

Notes : *R*- and *S*- respectively indicate *Reported* and *Story* risk-taking behaviours. The significance level are * = $p < .05$; ** = $p < .01$; *** = $p < .001$. For every situation, $n = 234$, except for drunk driving situations (*), where correlations are computed only with participants having reported to drive a motorised vehicle ($n = 113$).

Figure 1. Correlations between the 7 self-reported risk-taking behaviours and the story risk-taking behaviours, the Dohmen scale and the Dospert health/safety subscale. Error bars represent 95% CI. For every situation, $n = 234$, except for the drunk driving situations where correlations are computed only with participants having reported to drive a motorised vehicle ($n = 113$).

Gender differences

Literature suggests that risk-taking is dependent of gender with men being more prone to engage in risky behaviours than women (Byrnes et al., 1999; Charness & Gneezy, 2012). Therefore, gender differences can be an interesting indicator to compare story behaviours with real-life phenomena. We conducted a two sided t-test on the alcohol consumption score and, given their categorical nature, we conducted 2 x 2 Chi-square tests on the five other story risk-taking behaviours. Due to their very low sample size, non-binary and non-specified gender were not analysed. Results show that male participants were more prone than female participants to take risk in each of the six risky behaviours but this difference was significant for only three of them (see Table 3).

Table 3. Gender differences between women and men on risky choices made in the interactive novel.

Story behaviours	Women (<i>n</i> = 123)	Men (<i>n</i> = 105)	Statistical test	Effect Size
Alcohol consumption score	3.2 (SD = 2.0)	3.5 (SD = 1.9)	$t(226) = 1.23$, $p = .22$	Cohen's $d = 0.16$
Participating in the knife game	1.60%	9.50%	$X^2(1, 227) = 7.09$; $p = .01$	Cramer's $V = 0.18$
Taking drugs from a partygoer	6.50%	20.00%	$X^2(1, 227) = 9.29$; $p = .02$	Cramer's $V = 0.20$
Having an alcohol consumption score of at least 3 and choosing to go home by driving a car	22.70%	23.80%	$X^2(1, 227) = 0.03$; $p = .85$	Cramer's $V = 0.01$
Choosing not to check on the uneasy person	5.70%	25.70%	$X^2(1, 227) = 17.90$; $p = < .001$	Cramer's $V = 0.28$
Cheating in the poker game	22.80%	27.60%	$X^2(1, 227) = 0.71$; $p = .40$	Cramer's $V = 0.06$

Transportation and game aspect

We measured some complementary descriptive indicators towards participants' reaction to the story. First, 85% of the participants reported to have been at least moderately engaged and immersed into the story and 98% considered that they would have made the same choices in real life as those they did in the story (49% *rather yes*; 49% *totally*). This suggest that our interactive novel generates feelings of transportation and identification. However, participants gave mixed answers when asked if they had the feeling to play a game while reading the story

(18% *not at all*, 24% *a little*, 25% *moderately*, 26% *rather*, 7% *very much*). Identifying the interactive novel as a game may decrease the link between story behaviours and real-life behaviours as participants may be more inclined to look after specific passages or outcomes (Bran & Vaidis, 2019). Therefore, we performed 7 exploratory regression analysis to test if perceiving the interactive novel as a game influenced the link between the story risky behaviours and their related real-life behaviours, however none of the interaction was statistically significant (all $ps > .54$).

Discussion

Our main goal was to examine if risk-taking choices made in interactive novels were related to risk taking behaviours in real life. Our results supports this proposition. Most notably, risk-taking in the interactive novel is systematically significantly correlated to reported real-life behaviours and, when compared to traditional risk-taking scales, choices made in the interactive novel are more predictive of reported real-life risk-taking. This corroborates that choices made in immersive environments are related to real-life choices, and that interactive novels can be used as such immersive environments. Likewise, men have made more risky choices than women in the interactive novel as they do in real-life (Byrnes et al., 1999). All these results strongly support that using choices in interactive novel as a measure of risk-taking is at least as efficient as using traditional questionnaire, and can even be more precise for some forms of risk-taking behaviours. Given the recent calls to develop new risk-taking assessment instruments (Fox & Tannenbaum, 2011; Rohrmann, 2011; Schonberg et al., 2011), we encourage scholars to consider the use of interactive novels as risk-taking measure instruments.

Interestingly, our sample perceived the gaming aspect of the interactive novel very differently. This could have been an issue as perceiving playing a game could reduce the link between story behaviours and real-life behaviour. However, we did not find evidence for this assumption and almost all of our participants reported to have made similar choices to those they would have made in real-life. This is interesting as one potential drawback of interactive

novel -their potential game aspect- seems to have had low influence on our participants' choices.

One limit to our study is that we only assessed the effectiveness of interactive novel in a very specific context: risky choices made in a student party. While this allowed us to test a variety of risk-taking behaviours (e.g., alcohol consumption, dangerous games, drunk driving), we do not have data on how interactive novel perform in other contexts. To our knowledge, interactive novels have only been used in a few other field of research: reciprocity (Figueiredo & Paiva, 2011), persuasion (Figueiredo & Paiva, 2010) and choices in relationship (Turan & Vicary, 2010; Vicary & Fraley, 2007). None of these other studies has focused on risk-taking, however we believe that interactive novels could be tailored to study many contexts with the same success (e.g., risky driving, financial risk-taking, health risk).

A second limit is that our sample is mostly constituted of young adults. Given the context of the novel, this seems adequate as it is likely that young adults will be more easily transported into the story. However, this currently prevents the generalisation of our findings to other populations. It would be interesting to see how different population interact with interactive novels. In particular, interactive novels could also be suited to study decision making in children as they tend be easily transported into a story (Alexander, Miller, & Hengst, 2001).

Overall, this study confirms that interactive novels can be a very relevant tool to study human behaviours. While we have focused here on the assessment of risk-taking, we believe that interactive novels can be a relevant instrument for any field interested in human behaviour and decision making. They can be more immersive, more ecologic and more enjoyable than traditional tasks, thus helping to achieve a better estimation of real-life decisions. They can also be efficiently used to covertly study the effects of many inductions. For instance, Figueiredo and Paiva (2010) used an interactive novel to study reciprocity and how feeling indebted to a character influences our behaviours towards this character. Many experimental paradigms in social sciences could be adapted this way, including fields that are difficult to assess ecologically. Along with risk-taking, aggressiveness is another concept that is difficult to

assess in an ecological way and that could be efficiently assessed with interactive novels.

While interactive novels may take more time to develop than other tasks, we believe that their link to real-life decisions make this investment worthwhile. Their development cost may even be reduced if scholars collaborate to write, share and translate their interactive novels. As long as decisions made in these interactive novels are representative of real-life decisions, they can be a very valuable tool to study human behaviour.

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