



**Utrecht University**

# Modifying the automatic approach bias toward gambling stimuli in problem gamblers: An online intervention

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## **Abstract**

Many problem gamblers are unwilling to access treatment and current interventions deal with high relapse rates. To target these problems an online intervention program that targets automatic processes was developed. This RCT pilot-study's major aim was to test whether problem gamblers' automatic tendencies to approach gambling stimuli can be altered by using an online cognitive bias modification procedure, and whether this will impact craving and gambling behavior.

Participants completed a baseline assessment session, four sessions of training or sham-training and a follow-up session two weeks later.

Due to technical difficulties and a very small sample, the gambling approach bias could not be analyzed. No significant difference was found across the time points nor between groups in gambling urge scores and mixed results were found on gambling behavior.

However, this study provides an invaluable opportunity to identify the types of challenges that can be encountered when conducting an online RCT of cognitive bias modification.

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## 1. Introduction

In the fifth and newest edition of the DSM (DSM-5; American Psychiatric Association, 2013) the diagnosis of Pathological Gambling was changed into Gambling Disorder (Petry, Blanco, Stinchfield, & Volberg, 2013). To increase its recognition as a psychiatric disorder and to recognize the similarities between behaviors related to problem gambling and behaviors related to substance addiction (Grant, Potenza, Weinstein, & Gorelick, 2010), the disorder was reclassified from an “Impulse-Control Disorder Not Elsewhere Classified” to one of the “Substance-Related and Addictive Disorders” (Petry et al., 2014). These similarities include psychopathological and phenotypical features such as an urge state prior to initiating the behavior, a positive mood state or ‘high’ after the behavior, tolerance, and a dysphoric state while abstaining from the behaviors, similar to withdrawal (Grant, Potenza, Weinstein & Gorelick, 2010). Additionally, like other addictions, gambling problems have large personal, social, and economic costs including impairment or loss of relationships, stress-related medical problems, elevated risk of suicide, criminal offences, and financial difficulties (Hodgins, Stea & Grant, 2011).

Although effective treatment options are available (Grant & Potenza, 2007; Ladouceur et al., 2001; Petry et al., 2006; Toneatto & Ladouceur, 2003), approximately only one in ten people with a lifetime diagnosis of gambling disorder will ever seek treatment (Slutske, Blaszczynski, & Martin, 2009; Cunningham, 2005). The few that do seek treatment only do so in response to a significant life crisis (Clarke, Abbott, De Souza, & Bellringer, 2007). The reasons many problem gamblers are unwilling to access treatment include stigma, embarrassment or a desire to handle their problems on their own (Pulford, Bellringer, Abbott, Clarke, Hodgins, & Williams, 2009; Suurvali, Hodgins, Toneatto & Cunningham, 2012). Additionally, the gambling intervention field deals with high relapse rates (Griffiths, Shonin & Gordon, 2016). In overcoming barriers to seek help, a solution for this problem could be the development of online intervention programs. Internet-based therapy offers several advantages over face-to-face interventions, including greater availability, convenience, accessibility, anonymity, and cost-effectiveness (Monaghan & Blaszczynski, 2009; Crone et al., 2004; Klein, Richards & Austin, 2006; Mihalopoulos et al., 2005). A number of recent systematic reviews have demonstrated the beneficial effects of digital interventions, stand-alone or in combination with standard treatment, including internet-based programs (Andersson, Cuijpers, Carlbring, Riper, & Hedman, 2014; Portnoy, Scott-Sheldon, Johnson, & Carey, 2008; Shingleton & Palfai, 2016; Webb, Joseph, Yardley, & Michie, 2010), to promote healthy behaviors and lifestyle (e.g., smoking cessation, healthy eating, physical activity, or alcohol consumption).

Recently, researchers have started to explore the possibilities of approach bias modification training (AppBM) as an online intervention and it has shown to be effective in treating alcohol addiction (Wiers et al, 2011; Eberl et al., 2013). AppBM treatment works by targeting automatic processes, specifically approach bias, which can be explained via a dual-process model of behaviors. This model suggests that many of our behaviors are the outcome of both automatic and reflective processes (Wiers, Gladwin, Hofmann, Salemink, & Ridderinkhof, 2013). Automatic processes are fast impulsive processes, driven by affective reactivity reflecting associations in long-term memory that automatically trigger a motivational orientation (Wiers et al., 2007; Flemming & Bartholow, 2014). Most of the time we are only aware of the behavior resulting from

these automatic processes (Wiers et al., 2013). In contrast, reflective processes are slower, associated with conscious deliberation and emotion regulation and driven by cognitive control processes (Wiers et al., 2007; Flemming & Bartholow, 2014). Reflective processes provide a higher level of reasoning and can result in 'well considered' behavioral outcomes (Deutsch & Strack, 2006; Cunningham & Zelazo, 2007). Although the term 'dual' suggests two independent systems, contemporary theorists emphasize that there are multiple, qualitatively different processes operating at different levels of the stream of cognitive information processing and which interact with each other (Wiers et al., 2007). According to the dual-process model, the interplay between the automatic and reflective processes becomes maladaptive in addiction (Wiers et al., 2007). This can result in different cognitive biases, which are by nature difficult to voluntarily change and control (Wiers et al., 2013). One of the cognitive biases is approach bias, which can be explained as a maladaptive tendency to automatically approach addiction-related stimuli (Palfai & Ostafin, 2003). In gambling disorder, this results in the automatic tendency to approach gambling cues, such as games or gambling sites, or any stimuli in the environment that have been associated with gambling (Boffo et al., in revision).

The approach bias appears to play a crucial role in the onset and maintenance of addictive behaviors (Wiers et al., 2013) and can be measured with the Approach- Avoidance test (AAT) (Rinck & Becker, 2007; Wiers et al., 2009; Boffo et al., in revision). This is a computerized speeded reaction-time task. Recent pioneering studies on gambling addiction found that problem gamblers display a significantly stronger approach bias towards gambling images (versus control images) as measured with the AAT (Boffo et al., in revision), compared to non-problem gamblers. Furthermore, gambling approach bias significantly predicted prospective frequency and duration of gambling episodes after six months (Boffo et al., in revision). Using the AAT, addiction-related approach bias has also been successfully found in different other addictive behaviors, including smoking (Bradley, Field, Healy, & Mogg, 2008; C. E. Wiers et al., 2013), cannabis use (Cousijn, Goudriaan & Wiers, 2011; Field, Eastwood, Bradley & Mogg, 2006), drinking (Field & Cox, 2008; Wiers et al., 2009; Wiers et al., 2010), and even for unhealthy foods in over-eaters (Havermans, Giesen, Houben, & Jansen, 2011; Veenstra & de Jong, 2010). Moreover, the strength of the approach bias seems to be related to addiction severity and addictive behavior escalation across substances (Cousijn et al., 2011; Kakoschke et al., 2015; Watson, de Wit, & Wiers, 2013; C. E. Wiers, Kühn, et al., 2013; Wiers et al., 2010). Furthermore, research has shown that AppBM has a positive effect on the relapse rate in alcohol dependency (Eberl et al., 2013). Additionally, many people with behavioral addictions report an urge or craving state prior to initiating the behavior (de Castro, Fong, Rosenthal & Tavares, 2007). In recent studies approach bias has been found to be related to craving (Wiers, Stelzel, Park, Gawron, Ludwig, Gutwinski & Bermpohl, 2014; Wiers, Kühn, Javadi, et al., 2013). Investigating ways to reduce this urge or craving can therefore possibly be of great importance when developing interventions to treat gambling disorder. A study regarding food addiction, a behavioral addiction, found CBM, using AppBM, to be effective in decreasing craving towards food (Brockmeyer, Hahn, Reetz, Schmidt & Friederich, 2015). Following this line of research it might be that AppBM also has an effect on the urge for gambling, one of common symptoms between

substance and behavioral addictions and as mentioned one of the reasons for the inclusion of gambling disorder within the addiction disorders category of the DSM-V (de Castro, Fong, Rosenthal & Tavares, 2007; American Psychiatric Association, 2013). However, to date there is no published study exploring the effectiveness of AppBM for gambling disorder.

The primary aim of this pilot-study was to explore whether problem gamblers' approach bias to gambling stimuli can be altered using the online AppBM program. In a next step, we aimed to explore whether the AppBM program impacts several indices of gambling behavior (i.e., frequency, duration, intent (amount of money intended to be gambled), risk (actual amount wagered) and win-loss (the amount of money won or lost during a gambling episode). To do so, a small-scale randomized controlled trial was conducted, in which participants were randomly assigned to either the experimental condition including the AppBM program or to a 'sham' training condition. Participants completed four sessions of training across a maximum of one week and a follow-up session two weeks later. All participants received tailored motivational feedback (see Appendix 1) on their motives to gamble and reasons to reduce or quit gambling, in order to support compliance (Boffo, Pronk, Wiers, & Mannarini, 2015) and promote motivation to change their gambling behavior (Cunningham, Hodgins, Toneatto, & Murphy, 2012). Based on earlier research findings, the following hypotheses were formulated:

1. The AppBM results in a significant decrease in gambling approach bias compared to the control condition.
2. The AppBM results in a significant decrease in multiple aspects of gambling behavior compared to the control condition.
3. Exploratory will be tested if AppBM has any effect on gambling urges.

## **2. Method**

### **2.1 Study design and procedure**

This study has been fully conducted online by means of the experimental online platform Lotus (UvA). Participants were pre-screened for eligibility via a registration page. Upon registration, participants were fully explained the purpose and conditions of the study, after which they provided the informed consent to participation. Upon completing a baseline assessment session, they were randomly assigned to either the AppBM training condition, in which they were implicitly trained to avoid gambling stimuli, or to a 'sham' training condition, in which they made an equal number of approach and avoidance key-presses to both gambling and control pictures. This was stratified by gender and push/pull button assignment in the AAT (see paragraph 2.3 Intervention). At the end of the baseline session, participants in both conditions started the first training session immediately, followed by three sessions (either successively or every other day across a maximum of one week). The participants themselves are able to choose how to plan these three sessions. Two weeks after completing the last training session participants were invited to complete a follow-up assessment session. The total duration of the program per participant was up to three weeks. All training sessions started with the tailored motivational feedback program (see Appendix 1) for both the experimental

and control group. It took approximately 35-40 minutes to complete each session, which consisted of training and motivational feedback. Gambling approach bias, behavior and craving were measured at baseline and follow-up by using the gambling Approach- Avoidance Test (Boffo et al., in revision), the Gambling Timeline Follow-Back questionnaire (G-TLFB; Weinstock et al., 2004) and the gambling urge questionnaire (GUQ; Potenza & O'Malley, unpublished data ). Additionally, participants had to complete other assessments like the Single Category Implicit Association Test (SCIAT) (Karpinski & Steinman, 2006) and a card-cutting gambling game (see Breen & Zuckerman, 1999; Callan et al., 2008) at follow-up. These assessments however, fall outside the scope of this current pilot study.

All participants were compensated for their participation with Bol.com vouchers. This compensation was divided across the required five study sessions as follows: baseline and training sessions 1-4 (€5 each), follow-up assessment session 5 after two weeks (€10). The participants received the vouchers after finishing the last session. This 'back-loaded' compensation structure was designed to encourage retention.

## 2.2 Participants

Participants were recruited through online advertisements, with use of banners on local relevant gambling websites and posts on social media like Facebook and on gambling-forums. Adults (>18) who gambled at least three times in the past month and were at least moderate-risk gamblers, as indicated by a score of three or higher on the Problem Gambling Severity Index (PGSI; McCready & Adlaf, 2006; Ferris & Wynne, 2001) were eligible for this study. Participants should not yet be interested in, or currently changing their gambling behavior or seeking help for gambling problems. This last exclusion criteria was added because of the card-cutting gambling game offered to them at follow up. In our opinion it is unethical to offer this group of people to play a gambling game. In total seventy-six people applied to participate, twenty-five of them were eligible and fourteen started the intervention (see figure 1). Only five women applied, with a mean age of  $M=35.8$  ( $SD=14.46$ ) but none of them were eligible. The participants who started the intervention included seven problem gamblers in the control condition with a mean age of  $M=27.43$  ( $SD=5.7$ ) and seven problem gamblers in the experimental condition with a mean age of  $M=27.43$  ( $SD=10.3$ ). Two participants were excluded from analysis of follow-up data, since they only completed the baseline session, and another two participants were excluded since they did not complete the follow-up session, resulting in a sample of ten participants for the follow-up measurement. Participants ( $N=10$ ) who completed the intervention did not significantly differ in PGSI scores with participants allocated ( $N=15$ ) but who did not complete or started the intervention (mean rank=13.65 versus mean rank=12.57;  $U=68.5$   $p=.71$ ). Additionally, the participants ( $N=10$ ) who completed the intervention did not significantly differ in age ( $M=28.9$  ( $SD=8.8$ ) versus  $M=27.4$  ( $SD=8.5$ )  $p=.68$ ) compared to the participants who did not complete or start the intervention ( $N=15$ ). Because of insufficient data on the other tested variables (e.g. AAT, gambling behavior, gambling urge) differences on these aspects could not be analyzed.

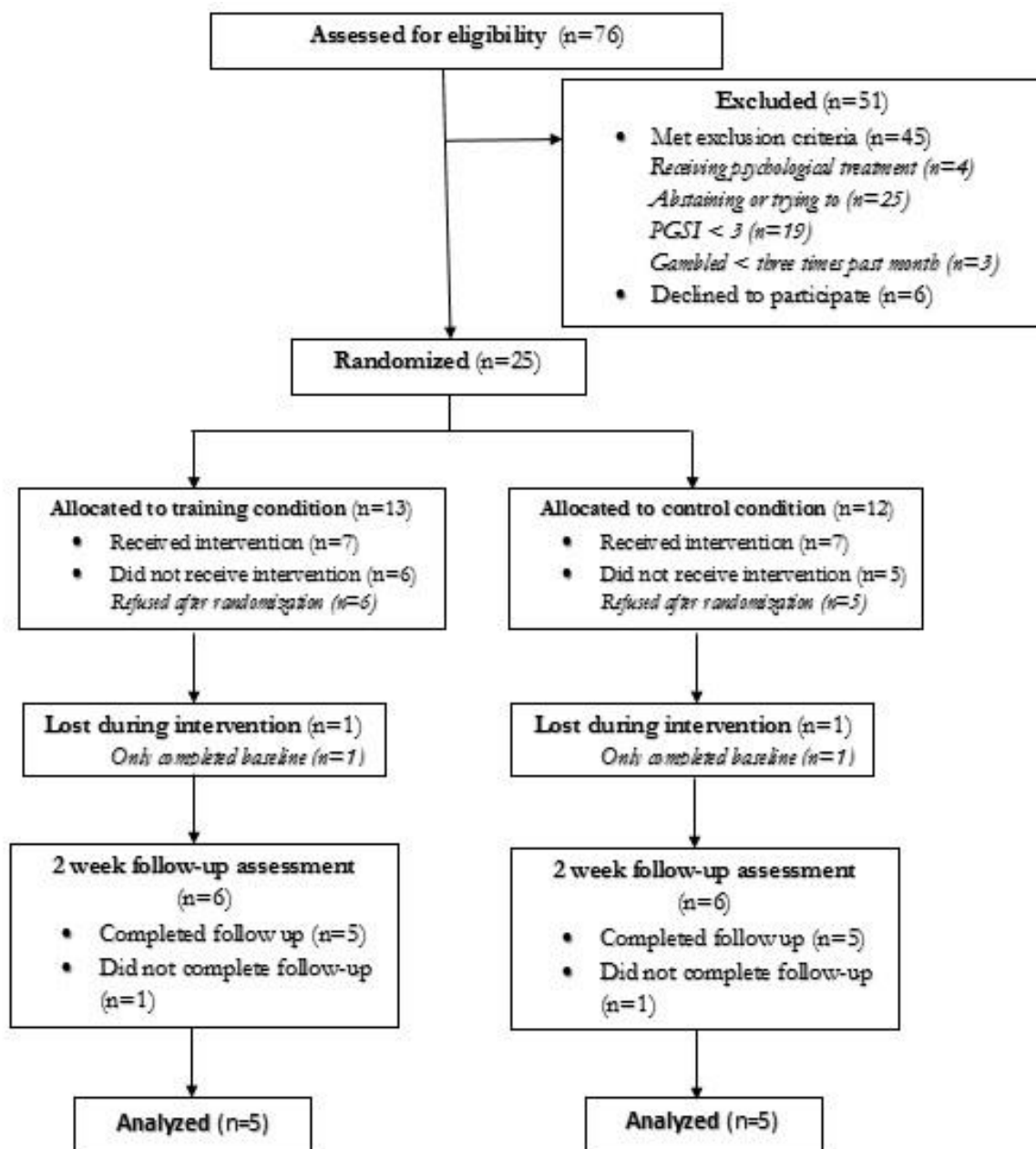


Figure 1: Flowchart participants

## 2.3 Intervention

### *Approach-Avoidance Training*

For the cognitive bias modification training, participants were randomly assigned to either a condition in which they were implicitly trained to avoid gambling stimuli (i.e., the Approach-Avoidance Training) or to a sham training condition. The Approach-Avoidance Training (Rinck & Becker, 2007; Wiers et al., 2009; Boffo et al., in revision) is a computerized speeded reaction-time task in which participants were asked to react to the presentation format of a stimulus and ignore the stimulus content. The Approach-Avoidance Training is structurally identical to the key-press version of the Alcohol Approach-Avoidance Training (Peeters, et al. 2012), except that the pictures comprised gambling stimuli (instead of alcohol stimuli) and control stimuli



that had nothing to do with gambling (Boffo, Willemsen, Pronk, Wiers, & Dom, in press). Participants learned to press the push or pull key (up or down arrow) in response to picture orientation (rotated 5 degrees to the left or right). The stimuli appeared until the participant made a response, with a response window of 3000ms. The interval between the presented stimuli was 500ms. Incorrect responses were followed by a red “X” for 750 ms. During the training sessions the participant then had to ‘redo’ the same trial. The training also consisted of a zooming feature, therefore when the participant had to push the picture the key needed to be pressed until the picture was fully zoomed out. In case of pulling the picture the participant had to press the key until the picture was fully zoomed in. For participants randomized to the experimental condition, all of the gambling pictures appeared in the ‘push’ format, with the reversed contingency for the control pictures (all in ‘pull’ format). For participants randomized to the sham training control condition, the task involved making an equal number of pull and push key-presses to both gambling and control pictures. The Approach-Avoidance Training consisted of one practice block with 8 trials presenting neutral pictures, followed by 240 training trials with a short break occurring after the first 120 trials. This makes a total of 960 training trials divided over the four sessions. Each training session lasted about 15 minutes for both the experimental and control condition.

#### **2.4 Assessment**

The level of gambling problems, for inclusion into the study, was assessed with the Problem Gambling Severity Index (PGSI). To assess approach bias the Approach-Avoidance Test was used. Approach bias was the primary outcome of this study since this is the variable directly targeted by the intervention. Secondary outcomes, gambling behavior and gambling urge were assessed by using the Gambling Time Line Follow Back (G-TLFB) and Gambling Urge Questionnaire (GUQ).

##### ***Problem Gambling Severity Index (PGSI) (selection criterion for inclusion)***

To assess level of gambling problems, the PGSI was used (McCready & Adlaf, 2006; Ferris & Wynne, 2001). The PGSI consists of nine items assessing the following problem gambling symptoms: exceeding spending limits, increasing expenditures, chasing losses, incurring debt or selling possessions, self-identification as a problem gambler, criticism from others about gambling, feelings of guilt, health problems from gambling, and financial insufficiency. Each of the items is scored on a 4-point Likert scale (0=never, 1=sometimes, 2=most of the time, 3=almost always). The total score for severity of gambling problems was calculated by summing up the responses to the 9 items, with higher scores reflecting more severe gambling problems. The results are interpreted as follows: 0=Non-problem gambling, 1-2=Low level of problems with few or no identified negative consequences, 3-7=Moderate level of problems leading to some negative consequences, 8 or more=Problem gambling with negative consequences and possible loss of control (Ferris & Wynne, 2001). Only participants with a moderate level of problems or higher were selected to participate. The PGSI has demonstrated good internal consistency (Cronbach’s  $\alpha=0.84$ ) and test-retest reliability over three to four weeks ( $\rho=0.78$ ) (Lesieur & Blume, 1987).

### ***Approach- Avoidance test (primary outcome variable)***

To assess approach bias, the assessment version of the Approach- Avoidance training was used. This instrument consisted of a first practice block with eight practice trials, presenting neutral stimuli, in which participants learned to press the push or pull key (up or down arrow) in response to picture orientation (rotated 5 degrees to the left or right), followed by 128 test trials divided in two blocks. The trial structure is similar to the Approach- Avoidance training except that after an incorrect response the task presented a new trial instead of repeating it. Stimuli were presented equally often in push- or pull-format, 16 gambling and 16 control stimuli. The Approach-Avoidance test lasted about 10 minutes and was used at baseline as well as follow-up. The conventional calculation of the Approach-Avoidance test scores was based on median reaction time (RT) scores (in ms) rather than mean RT score, to minimize the influence of outliers (Peeters et al., 2012; Wiers et al., 2010). The approach bias score was calculated as the difference between the median RT for pushing (avoidance) and the median RT for pulling (approach) for both stimulus categories (gambling/push – gambling/pull and neutral/push – neutral/pull) and as final difference between the two category-specific approach bias scores (Cousijn, Goudriaan, & Wiers, 2011; Rinck & Becker, 2007; Wiers et al., 2009).

### ***Gambling Time Line Follow Back (G-TLFB) (secondary outcome variable);***

To measure gambling behavior, the G-TLFB was used (Weinstock et al., 2004). This screening instrument uses a retrospective calendar that assesses a variety of aspects of gambling behavior including amount of money spent and time spent gambling over the past two weeks. Five dimensions of gambling behavior were assessed: Frequency, duration, intent (amount of money intended to be gambled), risk (actual amount wagered) and win–loss (the amount of money won or lost during a gambling episode). A sum of scores for each dimension was calculated at baseline and follow-up. In this study the difference between baseline and follow-up session were analyzed to measure a difference, in the five dimensions of gambling behavior mentioned earlier, before and after intervention. Weinstock et al. (2004) found good test-retest reliability for the G-TLFB over a two-week period, with reliabilities for each of the gambling dimensions ranging from  $r=0.74$  to  $0.96$ .

### ***Gambling Urge Questionnaire (GUQ) (secondary outcome variable);***

The GUQ is an eight-item questionnaire (Potenza & O'Malley, unpublished data) assessing participants' urge towards gambling. The questions assess the current experienced urge to gamble on a Likert scale from 1 (strongly disagree) to 7 (strongly agree). The final score is calculated by adding up all responses to the different items. This results in a minimum score of 8 and a maximum score of 56. The higher the score, the greater the urge.

### ***Randomization of the stimuli***

Stimuli used across all tasks (AAT assessment and approach avoidance training) were defined once the participant selected the two favorite gambling activities. After choosing the two preferred categories (e.g.,

betting and cards), three sets of stimuli were randomized for AAT assessment out of a big pool of 80 gambling and 80 control stimuli (Boffo et al., in revision). The remaining stimuli are used for training. Randomization of gambling stimuli was always stratified by gambling category.

## **2.5 Data Analysis**

Before computing AAT approach bias score, error trials were removed from the task and reaction times for correct response were checked for extreme outliers (<200ms), these were not removed due to the extreme small sample. The analyses plan involved the use of parametric tests (t-test and repeated-measure ANOVA) to test the study hypotheses and thus analyze the difference in scores between the experimental and control condition. First was analyzed if the AppBM results in a significant decrease in gambling approach bias compared to the control condition, since this is our primary outcome variable. Subsequently secondary outcome variables were analyzed to see if the AppBM results in a significant decrease in multiple aspects of gambling behavior compared to the control condition and if it has an effect on gambling urges. All dependent variables were screened for normality assumptions. In case the variable was not normally distributed, a non-parametric version of the same test was used.

## **3. Results**

### ***Demographics and assumptions***

Participants in the experimental condition (N=7) did not differ from participants in the control condition (N=7) in age (mean=27.4, sd=10.33 versus mean=27.4, sd=5.65,  $p=0.59$ ) or gender (both 100% male). The assumption of homogeneity of variance between the two groups was met for gambling urge ( $p=0.78$ ), but not for all five aspects of gambling behavior ( $p<0.05$ ). Additionally, the assumption of normality was violated for all variables ( $p<0.01$ ). Therefore to analyze these variables a nonparametric test; Mann-Whitney U, was used. This same test was used for the post hoc descriptive statistics, given the small sample size.

### ***Approach Bias***

Due to technical problems and the limited sample size there was only a limited amount of valid data for the AAT assessment (N=3), which did not allow us to run the planned, nor alternative analysis. These problems were not due to scientific reasons, but to a bug in the system of the online platform program (Lotus) that was used as the base to present the intervention. This bug caused a technical issue which namely, affected participants did not complete some of the baseline measures including the Approach- Avoidance test. In a couple of other cases the internet connection was disrupted, as discovered by going through the activity logs, therefore task data was not stored and got lost.

### ***Gambling Behavior***

Given the small sample size (N=6), three in each group, that completed the GLTFB at baseline as well as post assessment, the Mann-Whitney U test was used to analyze the difference scores (table 1.3) between

baseline and post assessment per group of the GLTFB variables (table 1 and 1.2). The duration of gambling diminished significantly for the experimental condition compared to the control condition (mean rank=5.00 versus mean rank=2.00;  $U=.00$ ,  $p=.05$ ) (see Figure 2). Furthermore the risk (actual amount wagered) diminished significantly for the experimental condition compared to the control condition (mean rank=5.00 versus mean rank=2.00;  $U=.00$ ,  $p=.05$ ) (see Figure 3). Participants in the experimental condition did not significantly differ from participants in the control condition in their change in frequency of gambling (mean rank=4.83 versus mean rank=2.17;  $U=.500$ ,  $p=.100$ ), intent (amount of money intended to be gambled: mean rank=2.33 versus mean rank=4.67;  $U=1.00$ ,  $p=.100$ ) or wins (mean rank=4.33 versus mean rank=2.67;  $U=.200$ ,  $p=.200$ ) (see Figures 4, 5 and 6).

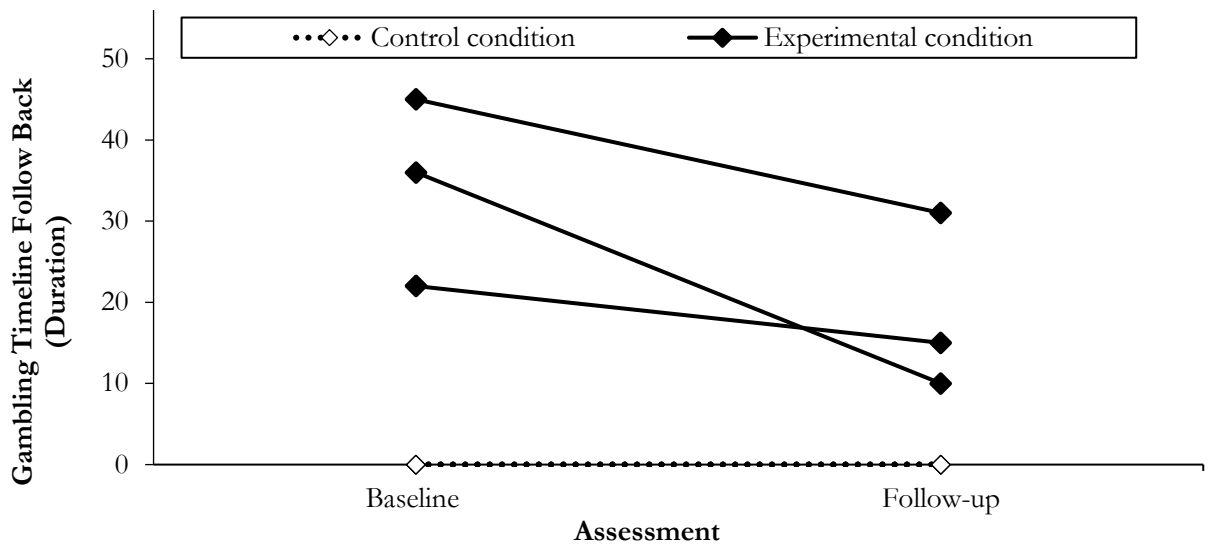


Figure 2: Gambling Timeline Follow Back duration scores at baseline and follow up for experimental and control condition

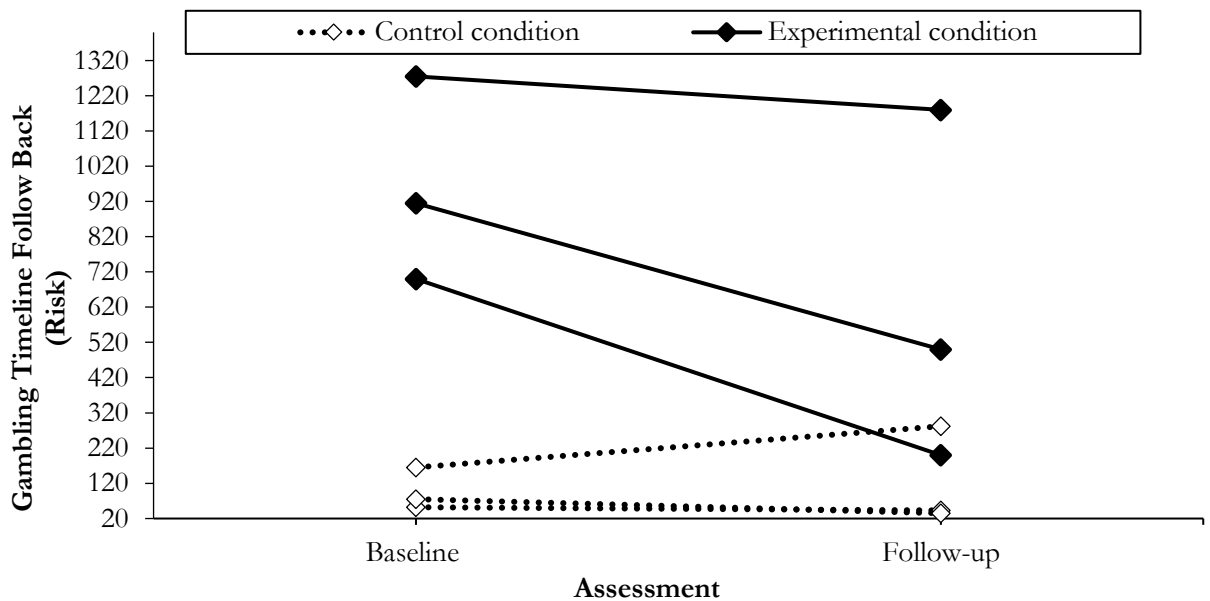


Figure 3: Gambling Timeline Follow Back risk scores at baseline and follow up for experimental and control condition

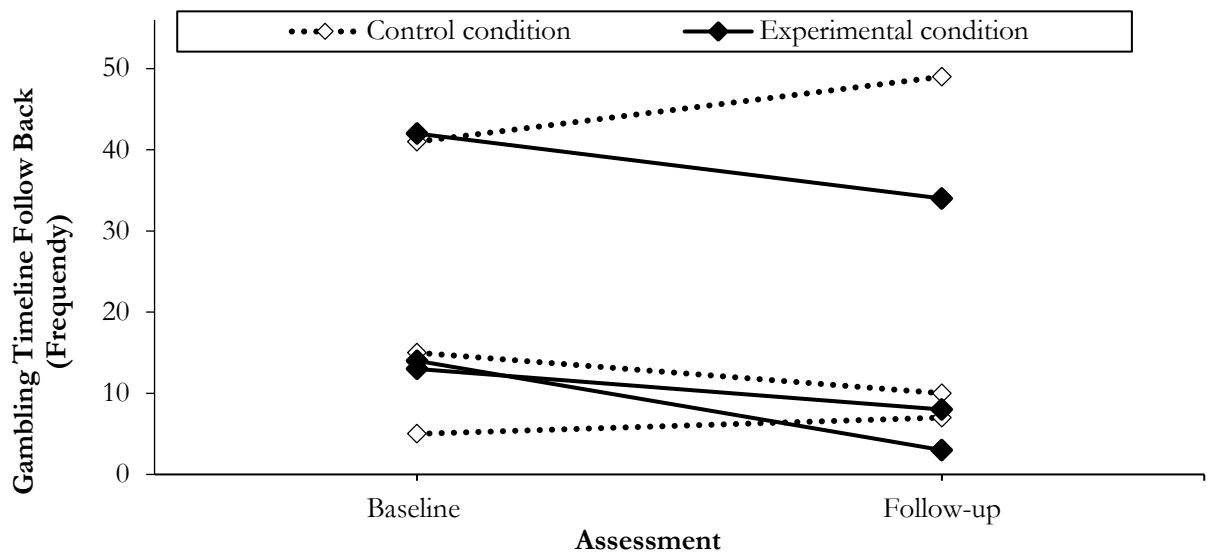


Figure 4: Gambling Timeline Follow Back frequency scores at baseline and follow up for experimental and control condition

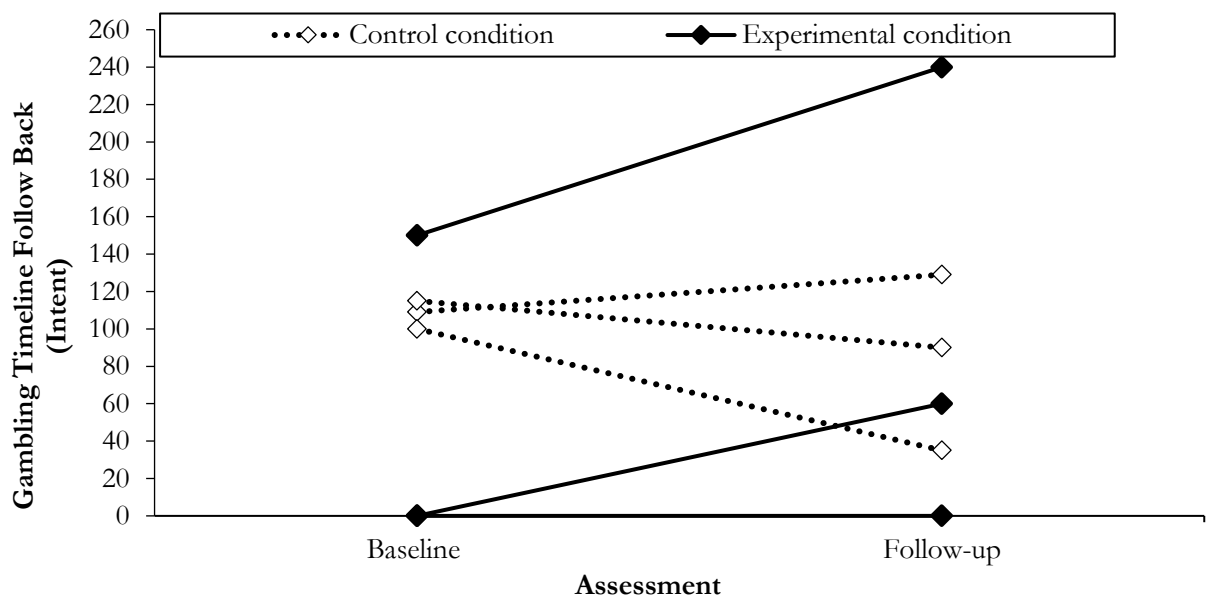


Figure 5: Gambling Timeline Follow Back intent scores at baseline and follow up for experimental and control condition

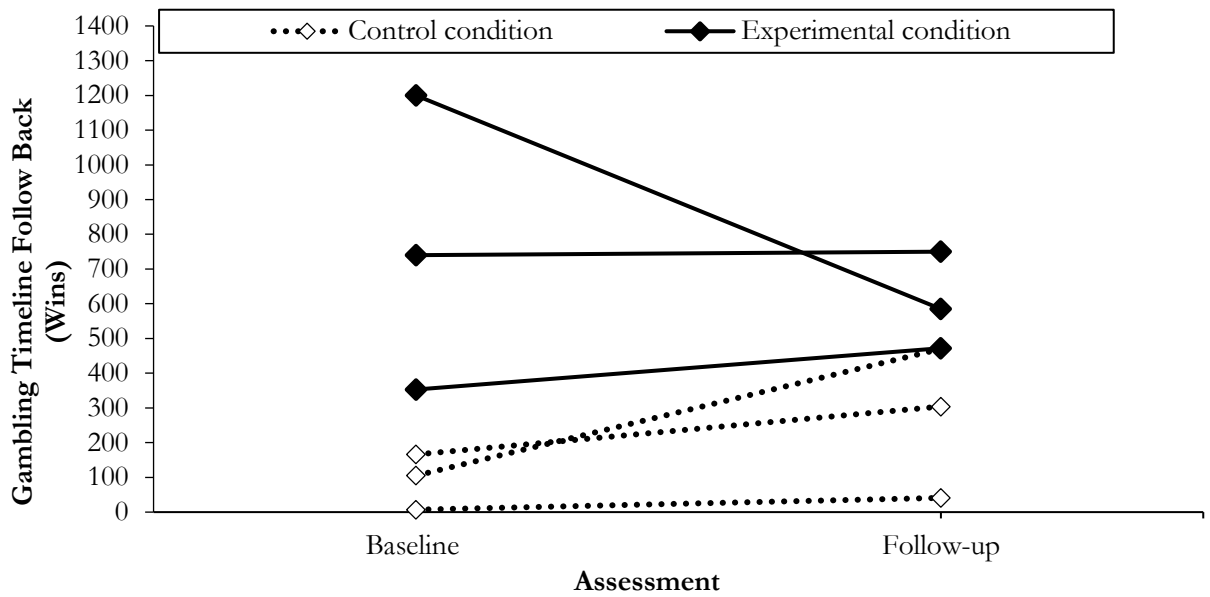


Figure 6: Gambling Timeline Follow Back win scores at baseline and follow up for experimental and control condition

### Gambling Urge

To examine whether the AppBM had an effect on gambling urges an ANOVA mixed design was used to analyze the difference between the scores of the experimental (N=5) and control group (N=5) (see Figure 7, panel A & panel B). No significant differences were found across the time points,  $F(1,8)=1.21, p=.30$  and between the two conditions,  $F(1,8)=.05, p=.83$ , in gambling urge scores.

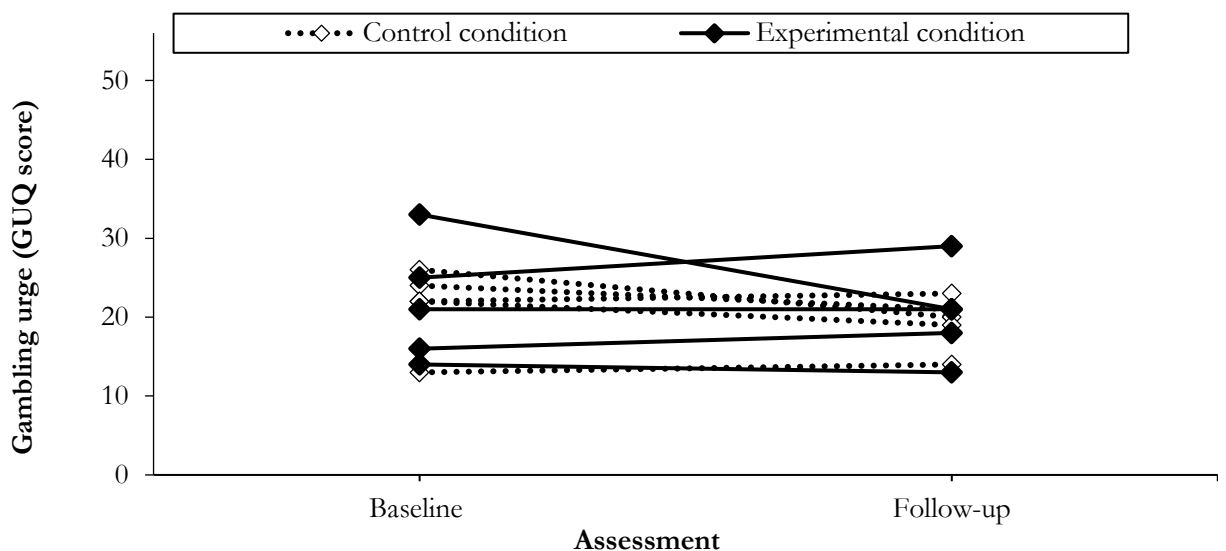


Figure 7, panel A: Gambling Urge Questionnaire scores at baseline and follow up for experimental and control condition

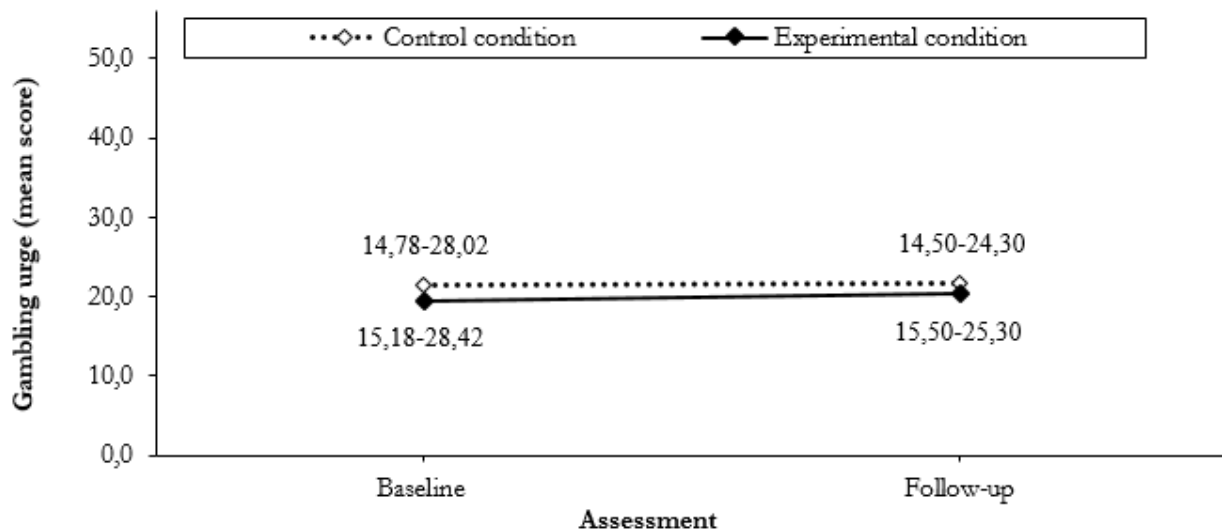


Figure 7, panel B: Gambling Urge Questionnaire, mean score and 95% confidence interval at baseline and follow-up.

#### ***Post Hoc participant descriptives***

Since the analysis of the hypotheses did not result in valuable findings and the number of participants that were included into the study (N=14) was very low compared to the total number of people that signed up (N= 76), this was a reason to take a closer look at the characteristics of the people that were excluded or dropped out. This to explore in what way the exclusion criteria had an effect on the inclusion of participants. The flow of exclusion and inclusion of participants is illustrated in Figure 1. First was looked at the PGSI scores of the participants who were eligible (N=25) and those who were excluded (N=45) based on screening. To determine whether there was a significant difference between the PGSI scores a Mann-Whitney U test was used. No significant difference between the PGSI scores of eligible participants (M=6.44, SD=3.65) and excluded participants (M=6.44, SD=6.87) was found,  $U=444$ ,  $p=.15$ . However data does show a difference in the variation of the PGSI scores between the eligible participants (min=3, max=18) and the excluded participants (min=0, max=26). Therefore, to analyze the group of excluded participants who were excluded solely based on the fact that they were trying to stop gambling, participants excluded based on their PGSI score (<3) and based on frequency of gambling in the past month were removed from the following analysis. The PGSI scores of the remaining group (n= 23) were compared to those of the eligible participants (n=25), using a Mann-Whitney U test. A significant difference between the PGSI scores of eligible participants (M=6.44, SD=3.65) and remaining excluded participants (M=11.13, SD=6.81) was found,  $U=136$ ,  $p=.00$ .

#### **4. Discussion**

The aim of this study was to test whether the online AppBM program decreased gambling approach bias (primary outcome) and several gambling behaviors (secondary outcomes) in problem gamblers. We identified a small sample of adult Dutch problem gamblers in this clinical randomized control pilot-study to

test these hypotheses. Due to technical difficulties there was not sufficient data available to analyze the gambling approach bias. However, AppBM did result in a decrease of gambling duration and risk, but not in any of the other gambling behaviors. It is, however, important to note that these inconsistent results are likely a consequence of the very small sample included in the analyses.

This study was the first to test an AppBM program targeting gambling behavior, therefore no comparisons can be made between earlier studies and current study. However, there are several studies testing AppBM targeting alcohol addiction. Ebelr et al. (2013) found that cognitive bias modification increased abstinent rates in alcohol dependent patients one year after treatment. They found that older patients profited best and a stronger bias was associated with higher effectiveness. These findings were in line with earlier findings of the effectiveness of cognitive bias modification in alcohol dependency (Wiers et al., 2011; Wiers et al., 2010). Additionally, research investigating cognitive bias modification in the eating domain also found that approach bias can be altered by using AppBM and that consumption can be affected (Kemps, Tiggemann, Martin & Elliott, 2013; Schumacher, Kemps & Tiggemann, 2016). These studies however had bigger samples to analyze, were not conducted online and used the joystick version of the Approach-Avoidance training. Furthermore, it should be taken into consideration that in current study, because of the small sample, outliers and other extreme scores or suspicious data were not excluded from the sample, which also might have influenced the outcomes of the analysis. Lastly, there is still the possibility that AppBM might simply not have the hypothesized effect on gambling behavior. Therefore, these findings should be considered carefully, in the light of the small sample used and should be better explored in a larger sample.

To analyze the reasons for drop-out and such a small sample size, post hoc analysis were conducted. This resulted in an interesting finding concerning the gambling severity of those excluded, because they met the exclusion criteria, and those of eligible participants, randomized to participate in the study. The gambling severity of those excluded was significantly higher than the gambling severity of eligible participants. It could be that a PGSI score above a certain point increases the chance that people are willing to quit, maybe because at that point the negative consequences have such a severe impact on someone's life that wanting help is the logical next step. Excluding this group of people might be a risk for the generalizability of the intervention. Especially when this intervention will also be used in clinical settings. Additionally, excluding this group could have resulted in an increased difficulty of recruiting participants. This last argument in itself might not be enough to extend your population, but it is a reason however to adapt your research design to one, for example, that takes the possibility of a small population into consideration.

Fundamental to the process of science is the critical evaluation of research and results, therefore some potential limitations must be taken into account. Firstly, gambling research in the field is complicated by difficulties in accessing gambling venues and patrons, cost and complications, ethics and regulatory approval required and problems in controlling extraneous variables (Gainsbury & Blaszczynski, 2010). This study had to deal with a number of these difficulties as well (see Appendix 2). Consequently, in many studies participants for gambling research are sourced directly from gambling help services (e.g. Morasco,



Weinstock, Ledgerwood, & Petry, 2007; Potenza, Steinberg, McLaughlin, Wu, Rounsaville, & O'Malley, 2000). However, clients of gambling help services are a specific group of people; they are likely to have a significant gambling problem and have made the difficult decision to seek help for their problem. In this particular study this group was excluded from the population because of the opportunity participants got to play the card-cutting gambling game at follow-up. In our opinion offering people who are quitting or trying to quit gambling a gambling game is unethical. Therefore this study specifically looked for people who had at least a moderate level of problems leading to some negative consequences, as measured by the PGSI (McCready & Adlaf, 2006; Ferris & Wynne, 2001) and were not yet interested in quitting or currently trying to quit their gambling behavior. And so a very specific population group remained. Reaching this population within two to three months has proven to be a challenge and resulted in only twenty-five suitable candidates for this study (see Appendix 2). The balance between establishing an interventions efficacy and effectiveness is challenging. This because establishing efficacy might necessitate a less restrictive range of participants and effectiveness may require greater exclusions and a circumscribed population. This also shows in the pilot-study we have conducted. When conducting the full scale randomized control trial (RCT) it is important to take this into account and the amount of time it could possibly take to reach the gambling population aimed for. Additionally should be considered to use the expertise and channels of organizations providing gambling opportunities. In reaching these organizations there might be some hurdles to overcome and it is important to emphasize the fact that the research will not promote their company nor their actions. However, collaboration with these type of organizations and companies can result in reaching a larger part of the gambling population aimed for and might speed up the recruitment process.

Secondly, to assess gambling behavior the GTLFB was used. In the development of the GTLFB Weinstock et al. (2004) found a pattern of underreporting. Additionally, it is a time-consuming questionnaire which requests patience and attention (Sobell, Agrawal, Sobell, Leo, Young, Cunningham & Simco, 2003). A combination of underreporting and the requested patience and attention might explain the control group reporting no duration of gambling, but nevertheless reporting frequency of gambling. An alternative could be the development of a daily diary system for the follow-up assessment. Past research on alcohol use found that participants report more alcohol consumption with this type of assessment than with retrospective methods (Lemmens, Tan, & Knibbe, 1992; Searles, Helzer & Walter, 2000; Simpura & Poikolainen, 1983). An addition to the GTLFB could be the use of the outcomes of a gambling game such as the card-cutting game (see Breen & Zuckerman, 1999; Callan et al., 2008), which may contribute to measuring gambling behavior in a more objectified way. Furthermore, all assessments were conducted online and because of the lack of supervision, opportunities to give erroneous reports were possibly higher than in a more controlled environment. However, especially the online gambling community values anonymity (Griffiths & Barnes, 2008; Griffiths & Christensen, 2006). Online assessments make this anonymity possible and facilitates a bridge between researchers and the gambling community, which is hard to reach. Research even indicates that the privacy and anonymity of online help services motivates gamblers to seek help (Cooper, 2004). Thus online assessment remains the preferable method.

Finally, the compensation that the participants received should be taken into account. This could have had an effect on their motivation to participate in the study. This is shown by different researches conducted by Verheggen, Niemen and Jonkers (1998), Willis et al. (1998) and Singer (2003) who found that participants will be more likely to participate when they perceive that the benefits (e.g. compensation) outweigh the risks (e.g. privacy concerns). Additionally, compensation might have compromised their accuracy in performance on the task and completing the questionnaires and might have tempted those who outside of the target group to try and participate anyway. However, because of the dedication and time we asked of the participants (the desire to complete five sessions of approximately 30-45 minutes) a compensation does seem appropriate and without it the willingness to participate would probably decrease.

Although there are some limitations to consider in this study, there are also strengths. This study is the first study that developed and conducted an online intervention using AppBM to alter approach bias in problem gamblers. It aimed to respect the anonymity the gambling community desires and to enhance availability, convenience, accessibility, and cost-effectiveness. This study can be seen as a pilot-study and provides the researchers with invaluable opportunity to identify earlier mentioned challenges before conducting a full-scale RCT. Therefore this study provides valuable information for future studies and for further elaboration and improvement in investigating online interventions in gambling addiction.

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## REFERENCES

- American Psychiatric Association. (2000). Diagnostic and statistical manual of mental disorders (4th ed., text revision). Washington, DC: American Psychiatric Association.
- American Psychiatric Association (2013). Diagnostic and Statistical Manual of Mental Disorders. Fifth Edition. Washington, DC: American Psychiatric Association
- Arkowitz, H., Miller, W.R., Westra, H.A. & Rollnick S. (2008). *Motivational interviewing in the treatment of psychological problems: conclusions and future directions*. In: Arkowitz H, Westra HA, Miller WR, Rollnick S, editors. *Motivational interviewing in the treatment of psychological problems*. New York (NY): Guilford Press. p. 324–342
- Andersson, G., Cuijpers, P., Carlbring, P., Riper, H., & Hedman, E. (2014). Guided Internet-based vs. face-to-face cognitive behavior therapy for psychiatric and somatic disorders: a systematic review and metaanalysis. *World Psychiatry, 13*(3), 288-295.
- Beevers, C. (2005). Cognitive vulnerability to depression: A dual process model. *Clinical Psychology Review, 25*(7), 975–1002.
- Boffo M, Pronk T, Wiers RW & Mannarini S. (2015). Combining cognitive bias modification training with motivational support in alcohol dependent outpatients: study protocol for a randomized controlled trial. *Trials*.16(1):1.
- Boffo, M., Smits, R., Salmon, J.P., Cowie, M.E., de Jong, D.T.H., Saleminck, E., Collins, P., Stewart, S.H., & Wiers, R.W. (in revision). The role of automatic approach tendencies towards gambling cues in problem and non-problem gamblers.
- Boffo, M., Willemen, R., Pronk, T., Wiers, R.W., Dom, G. (in revision). Web-based Cognitive Bias Modification intervention for gambling problems: study protocol for a randomized controlled trial. *BMC Trials*.
- Bradley, B. P., Field, M., Healy, H., & Mogg, K. (2008). Do the affective properties of smoking-related cues influence attentional and approach biases in cigarette smokers? *Journal of Psychopharmacology, 22*(7), 737–745.
- Breen, R.B. & Zuckerman, M. (1999). 'Chasing' in gambling behavior: personality and cognitive determinants. *Personality and Individual Differences, 27, 6*, 1097–1111
- Brockmeyer, T., Hahn, C., Reetz, C., Schmidt, U. & Friederich, H. (2015) Approach Bias Modification in Food Craving—A Proof-of-Concept Study. *European Eating Disorders review, 23, 5*, 352–360
- Callan, M. J., Ellard, J.H., Shead, W.N. & Hodgins D.C. (2008). Gambling as a Search for Justice: Examining the Role of Personal Relative Deprivation in Gambling Urges and Gambling Behavior. *Personality and Social Psychology Bulletin, 34, 11*, 1514 - 1529
- Castro, de, V., Fong T., Rosenthal R.J. & Tavares H. (2007). A comparison of craving and emotional states between pathological gamblers and alcoholics. *Addict Behav., 32*, 1555–1564.

- Clarke, D., Abbott, M., DeSouza, R., & Bellringer, M. (2007). An overview of help seeking by problem gamblers and their families including barriers to and relevance of services. *International Journal of Mental Health and Addictions*, 5, 292–306.
- Cooper, G. 2004. Exploring and understanding online assistance for problem gamblers: The pathway disclosure model. *International Journal of Mental Health & Addiction*, 1: 32–38.
- Cousijn, J., Goudriaan, A. E., & Wiers, R. W. (2011). Reaching out towards cannabis: approach-bias in heavy cannabis users predicts changes in cannabis use. *Addiction*, 106(9), 1667–1674.
- Cowie, M.E., Stewart, S.H., Salmon, J.P., Collins, P., Salemink, E., Boffo, M., de Jong, D.T.H.A., Smits, R., & Wiers, R.W. (under review). Distorted Beliefs About one’s own Luck and Gambling-Related Skill are Associated with Independent Dimensions of Gambling for Dutch Gamblers. *Frontiers in Psychology*.
- Cox, W. M., Fadardi, J. S., Intriligator, J. M., & Klinger, E. (2014). Attentional bias modification for addictive behaviors: clinical implications. *CNS spectrums*, 19(03), 215-224
- Crone, P., Knapp, M., Proudfoot, J., Ryden, C., Cavanagh, K., Shapiro, D.A., *et al.* (2004) Cost effectiveness of computerized cognitive-behavioral therapy for anxiety and depression in primary care randomized controlled trial. *The British Journal of Psychiatry*, 185, 55–62
- Cunningham, J.A. (2005) Little use of treatment among problem gamblers. *Psychiatr Serv*, 56, 1024–1025.
- Cunningham, J.A., Hodgins, D.C., Toneatto, T. & Murphy, M. (2012). A randomized controlled trial of a personalized feedback intervention for problem gamblers. *PLoS One*, 7(2):e31586.
- Cunningham, W.A. & Zelazo, P.D. (2007). Attitudes and evaluations: a social cognitive neuroscience perspective. *Trends Cogn Sci.*,11:97–104
- Den Uyl, T. E., Gladwin, T. E., & Wiers, R. W. (2015). Transcranial direct current stimulation, implicit alcohol associations and craving. *Biological Psychology*, 105, 37-42.
- Deursen, van, D.S., Salemink, E., Smit, F., J. K. and R. W. W. (2013). Web-based cognitive bias modification for problem drinkers: protocol of a randomized controlled trial with a 2x2x2 factorial design
- Deutsch, R., & Strack, F. (2006). Reflective and impulsive determinants of addictive behaviors. In R. W. Wiers & A. W. Stacy (Eds.), *Handbook of implicit cognition and addiction* (pp. 45– 57). Thousand Oaks, CA: Sage
- Dupree, C.H., Magill, M. & Apodaca, T.R. (2016). The pros and cons of drinking: A qualitative analysis of young adult drinking discussions within motivational interviewing. *Addiction Research & Theory*. 24:40–47
- Eberl, C., Wiers, R. W., Pawelczack, S., Rinck, M., Becker, E. S., & Lindermeier, J. (2013). Approach bias modification in alcohol dependence: Do clinical effects replicate and for whom does it work best? *Developmental Cognitive Neuroscience*, 4, 38-51
- Fadardi, J.S. & Cox, W.M. (2009). Reversing the sequence: reducing alcohol consumption by overcoming alcohol attentional bias. *Drug Alcohol Depend.*, 101, 137–45

- Ferris, J. & Wynne, H. (2001). The Canadian problem gambling index: final report. In: Canadian Centre on Substance Abuse.
- Field, M., & Cox, W.M. (2008). Attentional bias in addictive behaviors: A review of its development, causes, and consequences. *Drug and Alcohol Dependence*, 97, 1–20.
- Field, M., Eastwood, B., Bradley, B. P., & Mogg, K. (2006). Selective processing of cannabis cues in regular cannabis users. *Drug and Alcohol Dependence*, 85(1), 75–8
- Flemming, K.A. & Bartholow, B.D. (2014). Alcohol Cues, Approach Bias, and Inhibitory Control: Applying a Dual Process Model of Addiction to Alcohol Sensitivity. *Psychology of Addictive Behaviors*, 28(1), p 85–96
- Gainsbury, S & Blaszczynski, A. (2010) The Appropriateness of Using Laboratories and Student Participants in Gambling Research. *J Gambbl Stud*, 27, 83–97
- Grant, J.E., & Potenza, M. (2007). Treatments for pathological gambling and other impulse control disorders. In P.E. Nathan & J.M. Gorman (Eds.), *A guide to treatments that work* (3rd ed., pp. 561–577). New York: Oxford University Press.
- Grant, J. E., Potenza, M. N., Weinstein, A., & Gorelick, D. A. (2010). Introduction to behavioral addictions. *The American Journal of Drug and Alcohol Abuse*, 36, 233–241.
- Griffiths, K. & Christensen, H. (2006). Review of randomized controlled trials of Internet interventions for mental health and related conditions. *Clinical Psychologist*, 10: 16–29
- Griffiths, M., Shonin, Á. E., & Gordon, Á. W. Van. (2016). Mindfulness as a treatment for Gambling disorder: Current directions and issues. *Journal of Gambling and Commercial Gaming Research*, 1(1), 47–52.
- Havermans, R. C., Giesen, J. C. A. H., Houben, K., & Jansen, A. (2011). Weight, gender, and snack appeal. *Eating Behaviors*, 12(2), 126–130.
- Hodgins, D.C., Currie, S.R., Currie, G., & Fick, G.H. (2009). Randomized trial of brief motivational treatments for pathological gamblers: More is not necessarily better. *Journal of Consulting and Clinical Psychology*, 77(5), 950–960
- Hodgins, D.C., Currie, S.R., & el-Guebaly, N. (2001). Motivational enhancement and selfhelp treatments for problem gambling. *Journal of Consulting and Clinical Psychology*, 69(1), 50–57.
- Hodgins, D.C., Stea, J.N. & Grant, J.E. (2011): Gambling disorders. *Lancet*, 378:1874–1884.
- Kakoschke, N., Kemps, E., & Tiggemann, M. (2015). Combined effects of cognitive bias for food cues and poor inhibitory control on unhealthy food intake. *Appetite*, 87, 358–364.
- Kakoschke, N., Kemps, E., & Tiggemann, M. (2016). Modifying approach bias in the health domain: a systematic review of the literature. *European Health Psychologist*, 18(S), 498.
- Karpinski, A., & Steinman, R.B. (2006). The single category implicit association test as a measure of implicit social cognition. *Journal Of Personality And Social Psychology*, 91, 16.
- E. Kemps, M. Tiggemann, R. Martin & M. Elliott (2013). Implicit approach–avoidance associations for craved food cues. *Journal of Experimental Psychology: Applied*, 19, 30–38.

- Klein, B., Richards, J.C. & Austin, D.W. (2006) Efficacy of Internet therapy for panic disorder. *Journal of Behavior Therapy and Experimental Psychiatry*, 37, 213–238
- Kopetz, C. E., Lejuez, C. W., Wiers, R. W., & Kruglanski, a. W. (2013). Motivation and Self-Regulation in Addiction: A Call for Convergence. *Perspectives on Psychological Science*, 8(1), 3–24.
- Ladouceur, R., Sylvain, C., Boutin, C., Lachance, S., Doucet, C., Leblond, J., & Jacques, C. (2001). Cognitive treatment of pathological gambling. *Journal of Nervous and Mental Disease*, 189, 774–780.
- Lesieur, H. & Blume, S. (1987). The South Oaks Gambling Screen (SOGS): A New Instrument for the Identification of Pathological Gamblers. *American Journal of Psychiatry*, 144, 9, 1184-8
- Lewis, M. (2015). *The Biology of Desire: Why Addiction Is Not a Disease*. NY: Public Affairs.
- Lindgren, K. P., Neighbors, C., Teachman, B. A., Wiers, R. W., Westgate, E., & Greenwald, A. G. (2013). I drink therefore I am: Validating alcohol-related implicit association tests. *Psychology of Addictive Behaviors*, 27(1), 1–13.
- Linke, S., McCambridge J., Khadjesari, Z., Wallace, P. & Murray, E. (2008). Development of a Psychologically Enhanced Interactive Online Intervention for Hazardous Drinking. *Alcohol & Alcoholism*, 43, 6, 669–674,
- McCready, J., & Adlaf, E. (2006). Performance and enhancement of the Canadian Problem Gambling Index (CPGI): Report and recommendations. Health Horizons Consulting.
- McInnes, A., Hodgins, D.C. & Holub, A. (2014) The Gambling Cognitions Inventory: scale development and psychometric validation with problem and pathological gamblers, *International Gambling Studies*, 14:3, 410-431,
- Mihalopoulos, C., Kiropoulos, L., Shih, S., Gunn, J., Blashki, G. & Meadows, G. (2005). Exploratory economic analyses of two primary mental health care pathways: Issues for sustainability. *The Medical Journal of Australia*, 183, s73–s7
- Miller, W.R.& Rollnick, S. (1991) *Motivational Interviewing: Preparing People to Change Addictive Behaviour*. New York: Guildford Press.
- Miller, W.R. & Rollnick, S. (2002) *Motivational Interviewing: Preparing People For Change*. New York, NY: Guildford Press.
- Miller, W. R. and Rollnick, S. (2013) *Motivational interviewing. Helping people change*. New York, The Guilford Press.
- Miller, W. R., & Rose, G. S. (2009). Toward a theory of motivational interviewing. *American Psychologist*, 64, 527–537.
- Monaghan, S. & Blaszczynski, A. (2009) Internet therapy for problem gambling: A literature review and environmental scan. Ontario Problem Gambling Research Centre.
- Morasco, B. J., Weinstock, J., Ledgerwood, D. M., & Petry, N. M. (2007). Psychological factors that promote and inhibit pathological gambling. *Cognitive and behavioral practice*, 14(2), 208–217.

- Peeters, M., Monshouwer, K., van der Schoot, R.A.G.J., Janssen, T., Vollebergh, W.A.M. & Wiers, R.W. (2013) Automatic Processes and the Drinking Behavior in Early Adolescence: A Prospective Study. *Addiction*, *107*, 1939-1946.
- Petry, N.M., Blanco, C., Auriacombe, M., Borges, G., Bucholz, K., Crowley, T. J., Grant, B.F., Hasin, D.S. & O'Brien, C. (2014). An Overview of and Rationale for Changes Proposed for Pathological Gambling in DSM-5 *J Gambl Stud* *30*,493.
- Petry, N. M., Blanco, C., Stinchfield, R., & Volberg, R. (2013). An empirical evaluation of proposed changes for gambling diagnosis in the DSM-5. *Addiction*, *108*, 575–581.
- Petry, N., Ammerman, Y., Bohl, J., Doersch, A., Gay, H., Kadden, R., ... Steingberg, K. (2006). Cognitive-behavioral therapy for pathological gamblers. *Journal of Consulting and Clinical Psychology*, *74*, 555–567.
- Prochaska, J. O., & DiClemente, C. C. (1992). Stages of change in the modification of problem behaviors. In M. Hersen, R. M. Eisler, & P. M. Miller (Eds.), *Progress in behavior modification* (pp. 184-218). Newbury Park, CA: Sage
- Portnoy, D. B., Scott-Sheldon, L. A., Johnson, B. T., & Carey, M. P. (2008). Computer-delivered interventions for health promotion and behavioral risk reduction: a meta-analysis of 75 randomized controlled trials, 1988–2007. *Preventive medicine*, *47*(1), 3-16.
- Potenza, M. N., Steinberg, M. A., McLaughlin, S. D., Wu, R., Rounsaville, B. J., & O'Malley, S. S. (2000). Illegal behaviors in problem gambling: analysis of data from a gambling helpline. *Journal of the American Academy of Psychiatry and the Law*, *28*(4), 389–403.
- Pulford, J., Bellringer, M., Abbott, M., Clarke, D., Hodgins, D. & Williams, J. (2009). Barriers to help-seeking for a gambling problem: the experiences of gamblers who have sought specialist assistance and the perceptions of those who have not. *J Gambl Stud*, *25*, 33–48.
- Rabinovitz, S. & Nagar, M. (2015). Possible End to an Endless Quest? Cognitive Bias Modification for Excessive Multiplayer Online Gamers. *Cyberpsychol Behav Soc Netw.*, *18*(10), 581-7.
- Robinson, T.E. & Berridge, K.C. (2008). The incentive sensitization theory of addiction: some current issues. *Phil. Trans. R. Soc. B*, *363*, 3137-3146
- Schumacher, S.E., Kemps, E. & Tiggeman, M. (2016). Bias modification training can alter approach bias and chocolate consumption. *Appetite*, *96*, 219-224.
- Shingleton, R. M., & Palfai, T. P. (2016). Technology-delivered adaptations of motivational interviewing for health-related behaviors: A systematic review of the current research. *Patient education and counseling*, *99*(1), 17-35.
- Singer, E. (2003). Exploring the meaning of consent: participation in research and beliefs about risks and benefits. *Journal of Official Statistics*, *19*(3), 273–285.
- Slutske, W.S., Blaszczyński, A. & Martin, N.G. (2009) Sex differences in the rates of recovery, treatment-seeking, and natural recovery in pathological gambling: results from an Australian community-based twin survey. *Twin Res Hum Genet*, *12*, 425–432.

- Sobell, L. C., Agrawal, S., Sobell, M. B., Leo, G. I., Young, L. J., Cunningham, J. a, & Simco, E. R. (2003). Comparison of a quick drinking screen with the timeline followback for individuals with alcohol problems. *Journal of Studies on Alcohol*, 64(6), 858–861.
- Suurvali, H., Hodgins., D.C, Toneatto, T. & Cunningham, J.A. (2012).Hesitation to seek gambling-related treatment among Ontario problem gamblers. *J Addict Med*, 6, 39–49.
- Toneatto, T., & Ladouceur, R. (2003). Treatment of pathological gambling: A critical review of the literature. *Psychology of Addictive Behaviors*, 17(4), 284–292.
- Veenstra, E. M., & de Jong, P. J. (2010). Restrained eaters show enhanced automatic approach tendencies towards food. *Appetite*, 55(1), 30–36.
- Verheggen, F., Nieman, F., & Jonkers, R. (1998). Determinants of patient participation in clinical studies requiring informed consent: why patients enter a clinical trial. *Patient Education and Counseling*, 35, 111–125.
- Watson, P., de Wit, S., & Wiers, R. W. (2013). Motivational mechanisms underlying the approach bias to cigarettes. *Journal of Experimental Psychopathology*, 4(3), 250–262.
- Weinstock, J., Whelan, J. P., & Meyers, A. W. (2004). Behavioral assessment of gambling: Application of the Timeline Followback method. *Psychological Assessment*, 16, 72-80.
- Webb, T., Joseph, J., Yardley, L., & Michie, S. (2010). Using the internet to promote health behavior change: a systematic review and meta-analysis of the impact of theoretical basis, use of behavior change techniques, and mode of delivery on efficacy. *Journal of medical Internet research*, 12(1), e4.
- Wiers, R. W., Bartholow, B. D., van den Wildenberg, E., Thush, C., Engels, R. C. M. E., Sher, K. J. & Stacy, A. W. (2007). Automatic and controlled processes and the development of addictive behaviours in adolescents: A review and a model. *Pharmacology Biochemistry and Behaviour*, 86(2), 263–283.
- Wiers, R. W., Eberl, C., Rinck, M., Becker, E. S., & Lindenmeyer, J. (2011). Retraining automatic action tendencies changes alcoholic patients' approach bias for alcohol and improves treatment outcome. *Psychological Science : A Journal of the American Psychological Society / APS*, 22(4), 490–497.
- Wiers, R. W., Gladwin, T. E., Hofmann, W., Salemink, E., & Ridderinkhof, K. R. (2013). Cognitive Bias Modification and Cognitive Control Training in Addiction and Related Psychopathology: Mechanisms, Clinical Perspectives, and Ways Forward. *Clinical Psychological Science*, 1(2), 192–212.
- Wiers, C.E., Kühn, S., Javadi, A.H. et al. (2013) Automatic approach bias towards smoking cues is present in smokers but not in ex-smokers. *Psychopharmacology*, 229, 187-197
- Wiers, R. W., Rinck, M., Dictus, M., & Van Den Wildenberg, E. (2009). Relatively strong automatic appetitive action-tendencies in male carriers of the OPRM1 G-allele. *Genes, Brain and Behavior*, 8(1), 101–106.
- Wiers, R. W., Rinck, M., Kordts, R., Houben, K., & Strack, F. (2010). Retraining automatic action-tendencies to approach alcohol in hazardous drinkers. *Addiction*, 105, 279-287.



- Wiers, C. E., Stelzel, C., Park, S. Q., Gawron, C. K., Ludwig, V. U., Gutwinski, S., ... & Bermpohl, F. (2014). Neural correlates of alcohol-approach bias in alcohol addiction: the spirit is willing but the flesh is weak for spirits. *Neuropsychopharmacology*, 39(3), 688-697.
- Willis, G. B., Rasinski, K. A., Baldwin, A. B., & Yeh, W. (1998). Cognitive research and responses to sensitive survey questions. Washington, DC: U. S. Department of Health, Centers for Disease Control and Prevention, National Center for Health Statistics, Cognitive Methods Staff Working Paper 24
- Yakovenko, I., Quigley, L., Hemmelgarn, B.R., Hodgins, D.C. & Ronksley, P. (2015). The efficacy of motivational interviewing for disordered gambling: Systematic review and meta-analysis. *Addictive Behaviors*, 43,72–82

## APPENDIX 1

### *Motivational feedback*

Because the approach bias training program can be quite monotonous which could result in drop-outs (Boffo et al., 2015). To promote motivation in the participants, it will be accompanied by a tailored motivational feedback program. Additionally, it is meant to increase retention and adherence to the training program. This motivational feedback program is based on the theory of motivational interviewing (Miller & Rose, 2009) and specifically developed for this study. The promotion of motivation is important since any intervention, including approach bias modification, can hardly produce any effect if the person is not motivated to change his/her behavior. The motivational feedback program motivates participants by helping them develop a long-term perspective, including personal goals that conflict with continuation of the addictive behavior, which is important in treating addiction (Kopetz, Lejuez, Wiers & Kruglanski, 2013; Lewis, 2015). The elaboration and theoretical background of the motivational feedback will be explained in the following paragraph.

### **Motivational Feedback**

Motivational interviewing (MI) is a non-judgmental, non-confrontational counseling approach that uses a collaborative and empathic conversation style for promoting and strengthening a person's own motivation and commitment to change behavior (Miller & Rollnick, 1991, 2002, 2013). It is a method for enhancing intrinsic motivation for change by exploring and resolving ambivalence towards the aimed behavior (Miller & Rollnick 2002). There is starting evidence supporting this motivational approach is effective in targeting problematic gambling behavior (Hodgins, Currie & el-Guebalym, 2001; Hodgins, Currie, Currie & Fick, 2009; Yakovenko, Quigley, Hemmelgarn, Hodgins, & Ronksley, 2015). An important element of the motivational interviewing approach is the empathic, non-judgmental, enabling, non-confrontational and reflective therapeutic attitude adopted by the practitioner. In an online intervention program, this can be reflected by the style of writing (tone of voice) in the text and the construction of interactive exercises that encourage reflection and individual choice (Linke, McCambridge, Khadjesari, Wallace & Murray, 2008).

One of the hypotheses that explains the effectiveness of MI is the conflict resolution hypothesis (Arkowitz, Miller, Westra & Rollnick, 2008). It states that the specific focus on exploring and resolving ambivalence accounts for positive behavior change. This hypothesis formed the basis of the tailored motivational feedback developed for this study. Keeping in mind that the motivational part of the intervention is an addition to the leading approach-bias training program, we chose to only take some principles from MI and adapt them for online use. The resulting motivational feedback consists of four different modules to help the participant elaborate on their gambling behavior and make a well-thought autonomous decision on whether or not to change their gambling behavior. The modules were built in a stepwise fashion alongside the four sessions of training. They aim to progressively stimulate the decision making process related to the gambling behavior. This is done according to the conflict-resolution hypothesis, where first ambivalence is created and subsequently tools were provided to help resolve this ambivalence (Arkowitz, Miller, Westra & Rollnick, 2008).

Module 1 aims to challenge participants' view of their gambling behavior and beliefs about gambling, but also to let participants think about if and how gambling influences their lives. To do so this module provides feedback on their individual scores on the Problem Gambling Severity Index (PGSI; McCreedy & Adlaf, 2006; Ferris & Wynne, 2001) and Gambling Cognition Inventory (GCI; McInnes, Holub, & Hodgins, 2014). The PGSI consists of nine items assessing the following problem gambling symptoms: exceeding spending limits, increasing expenditures, chasing losses, incurring debt or selling possessions, self-identification as a problem gambler, criticism from others about gambling, feelings of guilt, health problems from gambling, and financial insufficiency. For the feedback on the PGSI, all participants saw a list of potentially experienced impairments or distress based on the diagnostic criteria for gambling disorder of the DSM-5 (American Psychiatric Association, 2013). If they had a score in the range of 3 – 7, they received feedback that people with such a score usually experience some distress or impairments and that gambling may have started to have some negative impact on their lives. If they scored 8 or higher participants were told that people with such a score usually experience multiple impairments and more distress and that gambling seems to have a substantial impact on their lives. Subsequently the participants were asked if they expected experience distress or impairment and explained that such evaluations can help them to explore the influence of certain matters in their lives, such as gambling. The GCI assesses gambling-related cognitive disruptions and consists of thirty-three items divided into two subscales; Skills and Attitude and Luck and Chance. The feedback on the scores on the GCI was provided based on a 'high' or 'low' score on 'skills and attitude' and a high or low score on 'luck and chance' (low and high range were computed based on the GCI median scores of problem gamblers in (Cowie, Stewart, Salmon, Collins, Saleminck, Boffo, de Jong, Smits & Wiers, under review ). If the participants score low on skills and attitude, they received general information as to challenge these beliefs. They were asked if they recognize themselves in this thinking style and to think about what they do use to turn the game in their favor and how this turned out. If the participants score high on skills and attitude, they received general information about using strategy in their gambling and they were asked the same questions as people who scored low on the same subscale. Here strategy refers to the

use of for example betting systems. If the participant scored high or low on luck and chance the general information was given on this topic in order to question the beliefs of the participants. Thereafter, the participants were asked if they recognized themselves in that thinking style, how important luck was to them and if they can influence it. All questions were aimed to activate the person's thinking and evaluated process over their own behavior and situation, without explicitly addressing the question directly. The session ended with a short summary on the discussed topics and extra information on the subjects was presented in the form of web links.

The goal of Module 2 is to make participants aware of which parts of their lives are influenced by gambling and to potentially create ambivalence. At the beginning of the module the participants are asked to fill in a values compass. This compass asked the participants to indicate how they currently are dividing their time over four different life aspects and gambling. These life aspects included relationships, work and education, personal growth and leisure time, health and physical condition and gambling. After the participants filled in their personal compass they received information on what personal values are and questions were proposed to lead them to discover their own values. Then the participants were asked again to fill in a second values compass, this time with the instruction to indicate how they would like their time to be divided, i.e., an ideal situation. At the end of the module both compasses were shown next to each other, so the participants could compare their current and ideal value balance. Any difference between the two compasses, particularly emphasizing the role of gambling in their lives, was meant to generate ambivalence towards the present situation in the participants. If there is a difference between the current and ideal situation of the participant they were asked what they noticed, why they thought the difference exists and how this could be changed. Again, these questions were not meant to be answered directly. Extra information on life values was presented in the form of web links.

Module 3 is based on the 'decisional balance' principle of the Transtheoretical model of the stages of behavior change (Prochaska & DiClemente, 1992). This model emphasizes the use of a 'decisional balance' process to weigh the pros and cons associated with change (e.g., Dupree et al., 2016). In this case we chose to link the pros and cons to the different life aspects used in Module 2 in order to highlight what the participants would lose by gambling and what they could gain by not gambling or reducing their gambling. This to put a greater focus on reasons to change which might motivate them to reconsider their gambling behavior. We decided not to include pros of gambling and cons of change here, although these are generally used in the decisional balance, because their thoughts on pros of gambling cannot be challenged, due to the fact this being an online intervention. The participants were asked to choose from a broad list of pre-defined disadvantages which cons of gambling fit their situation. They were also given the opportunity to add a personal negative consequence of gambling. Afterwards the participants were asked to choose what could be the pros of changing their gambling behavior from another pre-defined list of advantages, followed by the opportunity to fill in a personal advantage. Both lists of pros and cons were linked to the values compass, meaning that the various pro and con statements were grouped into the different life aspects examined in Module 2. At the end of Module 3, the selected and personal pros and cons were summarized and presented

to the participants. By doing so they could see which life aspects were most affected by gambling, and which life aspects would profit most from changing gambling behavior. In addition, the participants received feedback about the role the chosen pros and cons could have, acting as motivators to achieve or maintain the values they presented in their ideal situation. This is to give the participants a positive perspective in solving their ambivalence. Additionally extra information on the advantages changes in gambling behavior could bring were provided in the form of web links.

Module 4 aims to integrate the steps taken and information given in the previous sessions, so the participants could make a well thought decision on whether or not to change their gambling behavior. To remind the participants about the exercises they had been doing and about the topics they had thought about, a brief summary of the contents of the previous sessions was given at the beginning. The participants also had the opportunity to see their personal values compasses (i.e., current and 'ideal') again, by clicking on a web-link and the personal pros of changing gambling behavior and the cons of gambling. The Module ended with a goal-setting question, which asked the participants to make a decision about their gambling behavior, including the possibilities of stopping, cutting down, or keeping on gambling as they were doing. Additionally extra information was presented in the form of web links and neutral feedback was given on their decision to continue, reduce or quit their gambling behavior.

## APPENDIX 2

### *A more detailed look into the reasons for a small sample*

This study searched for problem gamblers (PGSI >3) that gambled three times or more in the past month and did not follow a treatment program or receive any help in quitting or decreasing gambling behavior or were trying to quit or decrease their gambling behavior by themselves. This last exclusion criteria was set so actual gambling behavior after the intervention could be tested in a card-cutting game (Breen & Zucherman, 1999), making the results of the intervention somewhat more objective. In our opinion presenting this game to people who are trying to quit or are quitting gambling is unethical, resulting in a very specific population group. There are several ways to get in contact with this population group and one of these is through the use of the internet. This is cost-effective, easily accessible, has a disinhibiting effect on users, reduces social desirability and could potentially deliver large scale samples quickly and efficiently (Woods & Griffith, 2007). But these advantages also come with some challenges which cost time and need to be taken into account when starting this type of research. The first challenge lies in motivating people to actually take part in a study. Secondly, there is the problem of finding suitable participants and lastly there is the issue of whether or not they will want to be included in the study. For researchers who aren't familiar with gambling and the gambling culture there is an extra challenge in getting to know the community and finding the right places to promote the research and reach this particular population.

In an attempt to make contact with the population group, we decided to post a message on different forums that had anything to do with gambling. These are forums that for example have different discussion groups on different types of gambling, but also forums that talk about addiction in general. Not all forums allow you to post something. Some of the time this is because they don't want to be associated with research. Other times this is because they fear the consequences that they think the outcome of the research can have. They fear for example that the research will have an impact on policy making concerning gambling laws. However, most of the time they don't give a response or simply delete the message you posted. When sites do give you the permission to post a message, it is up to the researcher to keep the online conversation going, answer questions and deal with the suspicions and reservations of the forum participants towards the research. Additionally, your aim is to reach those gamblers who aren't interested in changing their gambling behavior, but do feel motivated enough to participate in five sessions. This group however might not recognize themselves in the criteria to participate. Especially because often they don't see themselves as gamblers or don't feel like they have 'gambling behavior', let alone a gambling problem.

Another way to reach out to the gambling population is by reaching out to the casinos or lotteries. This allows you to reach another type of player and may give you the opportunity to get closer to the gamblers. Additionally casino holders know a lot more about the gambling community and culture, and using their expertise might help in getting contact with the population group. Unfortunately not all casino holders are willing to cooperate in research, but when they do they can provide you with a large pool of potential participants. In our research we managed to contact Holland Casino, the largest casino company in the Netherlands. They were willing to help us to reach the specific population group and were very interested in innovative gambling research. Getting in contact with the company and scheduling an appointment took a couple of weeks because of the fact that it is a large company and not all emails are handled immediately. That is why they only recently started with the promotion of the study. They estimated that it will take about a year to reach the needed amount of participants. Another great player in the field of gambling in the Netherlands is the Dutch Lottery (Nederlandse loterij) which is an umbrella company for different lottery games. Because they are not easy to reach and like Holland casino are a large company, only recently they offered their help in promoting this study.

In conclusion when planning your research you need not only take into account the time that it will take to setup your intervention, but also the time that it will take to reach your specific population group. When dealing with such a specific population group this can take months and in some cases even years. And so it is important to take all aspects into consideration and ask yourself if your exclusion criteria are really necessary or are there other options? In this particular study it is not impossible to reach the needed amount of participants, but it will cost more time than initially planned. Half a year, for programming the intervention and recruiting participants, has proven to be insufficient. Providing a compensation does not guarantee that recruitment will go faster. But when you do have the time to be patient and recruit the amount of participants needed this will result in very valuable data, especially because there is little research investigating this specific population group.

### ***What I have learned***

This thesis has brought me the opportunity to learn a lot in a short amount of time. Beginning with getting to know a population group that I knew very little about when I started this research. In particular I have learned to see the difference between scientific information about gambling and gambling in practice. Meaning that reading about gambling and its effect on people does not necessarily make you familiar with the gambling scene. Especially when you have never been in contact with this subculture, it is important to physically reach out and see what it is about. This to get a better understanding of their cognitions, culture and ways of communication. Additionally I have learned about motivational interviewing and how to implement that into an online intervention program.

The setbacks that you can encounter in research have also shown themselves. When you have planned your intervention to be programmed at a certain date, but you are dependent of others to make sure this deadline is met, it can be frustrating when it is not done in time. As well as a population group that is hard to reach, which makes you dependent of organizations or people that are in direct contact with this population group. Not everyone is willing to help, and sometimes you need to wait a long time before you'll get a response, if any. Therefore I've learned that it is important to be patient, but also have perseverance when doing research.

Not all type of research is suitable for a master thesis. What I mean by this is that in this case 6 - 8 months was too short to get this research done. It is important for supervisors or organizations that offer a place to do your thesis to have a realistic time schedule. The time schedule that my supervisors at the University of Amsterdam initially had made turned out to be unrealistic, but when I realized that, it was already too late. This doesn't mean that it wasn't a good research to be part of. As mentioned earlier I have learned a lot. Though it would have been better if there was other data available, related to this research, to analyze and write my thesis about or if the thesis had the character of a pilot-study from the start with the appropriate research questions.

### ***Valuable personal lessons and advice***

Looking back there are some things I could have done differently. Therefore I want to take a moment and go through these things so not only I, but maybe also others can learn from my mistakes.

#### **1. Listen to your gut!**

When the researchers I worked with at the University of Amsterdam told me their time schedule I already had a feeling that this was quite optimistic. However, quite naïve, I just trusted their opinion and told myself that I knew too little about their research field to question their opinion. Therefore I did not confront them with my questions. Though I still understand my hesitation to ask critical questions, I would advise myself and others to ask them anyway. Asking questions does not by definition mean that you distrust their planning, but it will help you to better understand it. Additionally asking questions does not mean you're

stupid, it means you're smart enough to know that clarification or additional information is needed. Therefore, listen to your gut and ask questions in order to feel more confident about the situation.

## **2. Make your own plan and stick to it!**

In addition to the time table your external supervisors or the researchers have made, make your own time schedule. The first part of this advice is rather easy to do and so this part did not go wrong. From the beginning of the study I made my own schedule and set deadlines. The second part of this advice however is way more difficult and something I didn't do. When I saw that my deadlines could not be met because the progress in programming the intervention did not went as planned, I did mention this but got reassured that this would not cause any problems. Though it did not feel well (again, listen to your gut) I let it go. Therefore I did not stick to my plan or made sure these setbacks really would not have an effect on my schedule. I think it is important to keep in mind that you did not make a plan without a realistic perspective of when you want, in this case, your thesis to be finished. Getting setbacks is something that regularly happens in doing research, however it is important to take the time and see what kind of effect these setbacks will have and make a new plan.

## **3. When you feel like things are going south, stop the train (before it's too late)!**

This brings to the third advice I would like to give myself and others. When you feel and see that things are really not going according to plan, ask questions, make sure there are other options and possibilities. In this particular situation I tried to find a plan B, because I did feel like things were going south. When I did this, I think it might have been too late. I already invested a lot of time into the study and starting a new one would come with a lot of downsides. It would take a lot of extra time, I would need to start over and I would probably have to extend my study year. Therefore I chose to continue to do what I was doing and to take the consequences that came with it. This was a very hard decision to make and it almost felt like there wasn't even an alternative. Looking back I know that listening to my gut, sticking to my time schedule and stopping the train earlier would have left me with better options and alternatives.

## **4. Trust yourself**

The final and most important advice I would give is trust yourself. I think for a lot of (Psychology) master students it feels like your thrown into the deep on multiple areas all at once and you try to at least stay afloat. In this process it might be hard to hold on to everything you've already learned and your own personal skills because all these new challenges may seem overwhelming. I know this was definitely the case for me. And so, in attempt to stay afloat, I just went with the stream and let it take me anywhere it would go. This made me feel out of control and very dependent of others. Looking back I see that I had (have) the skills and knowledge to make a change in the process but I was to insecure to do so. Therefore this process does not make me focus on my mistakes, but it shows me what my strengths are, I just have to believe in them.