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The influence of intolerance of uncertainty on decision making in individuals with high trait-anxiety

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Summary

Previous studies have found an influence of trait-anxiety (TA) on decision-making. However, results are inconsistent in the literature. According to the findings, intolerance of uncertainty (IU) is an inseparable feature of trait-anxiety (Carleton, 2016; Grupe & Nitschke, 2013; Hong & Cheung, 2015, Rosser, 2019) and these individuals tend to experience more anxiety in ambiguous situations (Freeston, Rhéaume, Letarte, Dugas, & Ladouceur, 1994 & Rosser, 2019). Iowa gambling task (IGT) has been designed to simulate real-life decision-making by constraining punishments and rewards in uncertain situations. The present study examined if intolerance of uncertainty influences decision-making in individuals with anxiety traits. A sample consisting of 100 participants completed the STAI-T, IUS-12 and the IGT. According to the results, a non-significant difference was found, indicating more advantageous decision-making among low IU and low TA individuals. Although, intolerance of uncertainty did not affect this relationship. Further research is needed to investigate the interaction between trait-anxiety, intolerance of uncertainty and decision-making.

Introduction

The tendency to experience anxiety is a relatively persistent individual trait (Spielberger, 1972); which may affect daily behaviours, including the ability to make decisions. Anxiety is characterized by a tendency to anticipate a potential threat (Lazarus 1991), determining one's reactions. A realistic prediction of the situation is therefore needed for an adaptive response (Grupe & Nitschke, 2013); while anxious individuals tend to show "judgment bias" – overestimating the likelihood of events happening- and higher levels of pessimism (Mitte, 2007). Many studies show evidence for the influence of anxiety on cognitive tasks as well as a reduction in the working memory capacity (Visu-Petra, Miclea & Visu-Petra, 2013; Qi, Chen, Hitchman, Zeng, Ding, Li & Hu, 2014). Individuals experience this cognitive impairment by intrusive, negative thoughts (Cassady and Johnson, 2002) and deficits in expanding the scope of attention (Najmi, Kuckertz, & Amir, 2012). An increased physiological response is also associated with high anxiety (Paulus & Yu, 2012), expressed in elevated heart rate, muscular tension, respiration and sweating (Grecucci, Giorgetta, Bonini & Sanfey, 2012). It is assumed that these cognitive symptoms, along with increased somatic arousal, influence decision making negatively (Ernst and Paulus, 2005). Although, distinguishing anxiety in terms of "state anxiety" and "trait anxiety" has been suggested. State anxiety refers to the current emotional state while trait anxiety is a relatively stable personality trait (Endler & Kocovski, 2001). In other words, Trait anxiety (TA) reflects individual differences in sensitivity to threat and negative stimulus (Spielberger, 1966, Endler and Kocovski, 2001, Gray and McNaughton, 2000). These differences cause attentional, memory and interpretative biases affecting how individuals process environmental information (Bishop, Duncan, Brett & Lawrence, 2014; Calvo, Avero, Castillo & Miguel-Tobal, 2003), especially in ambiguous situations when one needs to make a decision (Zhang, Wang, Zhu, Yu & Chen, 2015). Studies show that the inseparable feature of anxiety is uncertainty (Carleton, 2016; Grupe & Nitschke, 2013; Hong & Cheung, 2015, Rosser, 2019). According to Boelen and Reijntes (2009), anxious individuals have difficulties tolerating uncertainty and are inclined to reduce it in their decisions by for instance choosing low-risk jobs (Raghunathan & Pham,1999). Intolerance of uncertainty (IU) can be defined as "the tendency to react negatively to uncertain situations on an emotional, cognitive, and behavioral level" (Buhr & Dugas, 2009). In ambiguous or uncertain situations, a person with a high intolerance of uncertainty experiences greater anxiety and discomfort (Dugas, Buhr & Ladouceur, 2004; Freeston, Rhéaume, Letarte,

Dugas, & Ladouceur, 1994 & Rosser, 2019). This goes back to their set of negative beliefs about uncertainty and its implications (Buhr & Dugas, 2009). Anxiety along with IU has a detrimental role in decision-making (Jensen, Kind, Morrison, & Heimberg, 2014; Luhmann, Ishida, & Hajcak, 2011; Miu, Heilman and Houser, 2008; Zhang et al., 2015). Decision-making is the process of choosing the alternatives based on their short-term and long-term costs and gains (Zhang et al., 2015; Mata, Neves, Lage, Moraes, Mattos & Fuentes, 2011). According to the level of uncertainty and the amount of provided information about the consequences, there are two types of decision-making: decision making under ambiguity and decision making under risk (Brand, Labudda & Markowitsch, 2006; Bach, Seymour & Dolan, 2009). Designed by Bechara, Damasio, Damasio & Anderson (1994), Iowa Gambling Task (IGT) simulates real-life decision-making by constraining punishments and rewards in uncertain situations, to estimate decision-making under ambiguity. The IGT involves four decks of cards that will reward or penalize the participants. Some decks are considered advantageous, leading to smaller gain but smaller future loss. Others are considered disadvantageous, offering higher immediate rewards but bigger future loss. Therefore, the choices are full of ambiguity and individuals need to avoid disadvantageous decks based on the feedback they get from previous trials. Miu, Heilman, and Houser (2008) have found out that anxious participants are inclined to choose high-risk decks more than the low anxious ones. This can be described by altered cognitive functioning, disturbing negative thoughts and evaluations in individuals with higher anxiety traits (Cassady and Johnson, 2002; Hembree, 1988); while decision-making relies on correct cognitive and emotional processing (de Visser, van der Knaap, van de Loo, van der Weerd, Ohl & van den Bos, 2010; Miu et al., 2008). Offered by Damasio (2004), the somatic marker hypothesis (SMH) explains that emotions play an important role in decision-making. This means that the somatic markers (heart rate, skin responses, etc.) are stored in the memory for every chosen option and enhance subsequent selections. High TA seems to deteriorate this influence by higher cognitive processes and difficulties controlling them (Bechara and Damasio, 2005). Similar to that, a lower learning pace has been associated with high TA resulting from difficulties inhibiting task-unrelated thoughts (Pajkossy, Dezso, & Paprika, 2009). Preston, Buchanan, Stansfield & Bachera (2007), found that expecting an unpleasant future by high TA individuals, deteriorates performance on the IGT. In this study, they decided to measure the impact of stress on people's performance in IGT and the participants were told that they should give a speech after the Iowa

Gambling Task. The anxiety caused by the anticipation of the unpleasant future resulted in worse performance in IGT. In contrast to these results, some studies report a better IGT performance in individuals with trait anxiety (Mueller, Nguyen, Ray & Borkovec, 2010; Werner, Duschek & Schandry, 2009). However, these findings were mostly among clinical or smaller samples. Furthermore, individuals with higher intolerance of uncertainty, tend to reduce uncertainty by seeking more information (Jacoby, Abramowitz, Buck & Fabricant, 2014; Ladouceur, Talbot, & Dugas, 1997; Rosen & Knäuper, 2009), but lack of confidence in their attempts may impair their subsequent selections because the distress arises every time they need to choose the next option (Jensen et al., 2014). This might affect learning the task resulting in poor performance. All in all, it seems that the influence of trait anxiety and intolerance of uncertainty on decision-making is controversial.

The aim of this study is to investigate whether IU influences decision-making in individuals with trait anxiety. It was hypothesized that 1) Individuals with higher levels of trait-anxiety will show less advantageous decision-making. 2) Individuals with higher trait-anxiety experience higher levels of intolerance of uncertainty, and 3) The relationship between trait-anxiety and decision-making is influenced by the intolerance of uncertainty.

Method

Participants

The data of this cross-sectional experiment was part of a larger study. A sample consisting of 100 non-clinical participants of both males and females was enrolled in this study. In line with a power calculation with G*Power version 3.1.9.2, it is sufficient to detect differences of small to medium effect size (η=.25) with an alpha level of .95. 100 participants were at least 18 years old and fluent in Dutch. Participants were recruited in response to the advertisements at the SONA website (which is used in researches and people can sign up to take part as a participant) and flyers at Utrecht University; as well as through convenience sampling and at the grounds of the University of Utrecht. The participants were told that the study is about cognitive processing in relation to psychological characteristics and all they need to do is to play a card game and complete some tasks on the computer. Decision-making was not mentioned to be measured because it could influence the results. Therefore, we asked the participants if they are familiar

with this task or if they have heard anything about it. In the end, people who were familiar with IGT and its aims were excluded from this study.

Instruments

STAI-trait: The STAI is commonly used to measure state and trait anxiety (Spielberger, Gorsuch, Lushene, Vagg, & Jacobs, 1983). It has 40 items, 20 items for assessing state anxiety and 20 for trait anxiety. The State Anxiety scale evaluates how the participants feel at that moment rating on a 4-point scale 1) not at all, 2) somewhat, 3) moderately so, and 4) very much so. The items include: “I am worried”, “I feel secure”, “I am tense” etc. Trait anxiety includes more general statements such as “I am a steady person” and “I am content”. It measures how the participants generally feel by reporting a frequency of their feelings 1) almost never, 2) sometimes, 3) often, and 4) almost always. Reliability and validity of α=0.83 have been reported for the short form of the Dutch translation. The short form is highly correlated with the full version (r = 0.95). The high reliability of α=94 has also been found for the full form (Van Der Bij, De Weerd, Cikot, Steegers, & Braspenning, 2003). Trait-anxiety subscale was used in this study. This subscale appeared to have good internal consistency and the reliability was α=83.

Intolerance of Uncertainty Scale Short Form (IUS-12): The IUS-12 is a shortened version of the original 27-item Intolerance of Uncertainty Scale (Freeston, Rhéaume, Letarte, Dugas, & Ladouceur, 1994). It measures responses to uncertainty, ambiguous situations and future situations (Carleton, Mulvogue, Thibodeau, McCabe, Antony & Asmundson, 2012). The IUS-12 consists of two factors (Carleton, Norton, et al., 2007; McEvoy & Mahoney, 2011), prospective IU (7 items) and inhibitory IU (5 items) which have high internal consistencies of α = .85 (Carleton, Norton, et al., 2007). Prospective IU expresses the tendency of individuals toward active information seeking as a way to reduce uncertainty/increase certainty. The inhibitory IU refers to avoidance-oriented responses to uncertainty, i.e. an inhibition of actions or experience which is caused by uncertainty (Birrel, Meares, Wilkinson & Freeston, 2011; Carleton et al., 2007 & McEvoy & Mahoney, 2011). These items are rated on a 5-point Likert scale ranging from 1 (not all characteristic of me) to 5 (entirely characteristic of me). The IUS-12 was found to be strongly correlated with the original scale, rs = .94 to .96. It also demonstrated good test-retest reliability and convergent and divergent validity (Carleton, Norton, et al., 2007; Khawaja & Yu, 2010). IUS-27 was used in this study which showed a good internal consistency α =93

Iowa Gambling Task (IGT): The IGT is a computer task designed by Bechara et al, (1994), to assess decision-making under ambiguity. The goal of the game is to win as much money as possible by choosing one out of four virtual deck cards (named A, B, C & D). The four decks are not created equal in the balance of reward versus penalty and they unpredictably yield loss or won. Participants are free to choose them and switch one to another at any time. Also, they won't be told how many card selections they can have. The task consists of 100 trails in which the individuals will receive feedback about the amount of money they have lost or gained by choosing that card. They start with a "loan" of 2000$, trying to make a profit. Decks A and B are considered disadvantageous; because they tend to produce high immediate rewards, however, leading to long-run loss (with a net value of -250 euro per 10 cards). On the other hand, C and D are advantageous cards; they hold smaller immediate gains resulting in a positive outcome in the long term (with a net value of 250 euro per 10 cards). In addition, decks A and C tend to punish only 50% of trials while deck B and D punish on 10% of trials. Impairment in decision-making can be concluded if the individuals have chosen more disadvantageous cards than advantageous ones. This will be assessed by looking at each participant's performance on the task over time. In order to do so, the 100 trials will be divided into 20 trials each including 5 blocks. The net score for each block will be calculated by looking at selections between advantageous decks and disadvantageous decks [(C+D)-(A+B)]. More selections from disadvantageous decks and lower net scores indicate poor decision-making. IGT has only shown to have moderate re-test reliability (Schmitz, Olga, Andrea, Klaus & Oliver, 2018).

Procedure

At the beginning of the assessment, a letter of informed consent needed to be signed by the participant and they were informed about the duration of the experiment, the tasks, and the compensation. In addition, they could also have the chance to win a 10€ voucher or get course credit if studying Bachelor of Psychology at Utrecht University. Participants were asked to sit down in front of a computer, answering to various questionnaires and perform a task. There were random conditions in which the participants would complete either the computer task or the questionnaires first. All participants were chosen randomly, and each condition was performed for 25 people. These four conditions included placement of the test battery (at the beginning or at the end) and feedback (with audiovisual feedback or without audiovisual feedback) which were

part of a larger study: 1) first filling out the questionnaires, then performing the IGT task without audiovisual feedback, 2) first completing the IGT task with audiovisual feedback and then filling out the questionnaires, 3) first performing the IGT task without audiovisual feedback and answering the questionnaires at the end & 4) filling out the questionnaires in the beginning and then complete the IGT task at the end with audiovisual feedback.

Data-analysis

IBM SPSS 25.00. was used to analyze the data of this study. To determine whether higher scores on trait anxiety can predict lower scores in IGT (H1), a one-way repeated measures analysis of variance (ANOVA)was used to predict the value of the dependent variable (IGT scores) based on the values of the independent variable (scores on trait anxiety). The same statistical test was used to test if higher scores in intolerance of uncertainty result in lower scores in IGT (H2). A one-way repeated measures analysis of variance (ANOVA) was conducted to determine whether intolerance of uncertainty moderates the effect of trait anxiety on IGT scores (H3).

Results

A total of 100 participants took part in this study. Since two participants only chose 1 deck through the 100 IGT trials, these were excluded from the analyses. Among the remained 98 participants, 35 men and 63 women took part in this study. Participant's age ranged from 19 to 66 (M= 26.48, SD= 8.98). The assumption of a normally distributed data was violated for each of the 5 IGT blocks. However, a repeated measure ANOVA is suggested to be robust to non-normality (Blanca, Alarcon, Arnau, Bono, & Bendayan, 2017). According to the results, a general learning effect in the Iowa gambling task was shown among the participants.

IGT checks

Position of the Iowa Gambling Task (IGT). In order to examine the influence of position of the Iowa Gambling Task in the battery, a one-way repeated measures analysis of variance (ANOVA) was conducted. The results show no significant effect of position of the task on decision-making $F(3.6,35)=.83$, $p=.49$, $\eta p^2 = .009$.

Audiovisual feedback in the Iowa Gambling Task (IGT). In order to examine the influence of audiovisual feedback in the Iowa Gambling Task in the battery, a one-way repeated measures analysis of variance (ANOVA) was conducted. The results show no significant effect $F(3.6,35)=.87$, $p=.47$, $\eta p^2 = .009$ of the audiovisual feedback on decision-making.

Higher trait-anxiety leads to less advantageous decision-making

Mauchly's test indicated that the assumption of sphericity had been violated for trait-anxiety in relation to decision-making. Therefore, degrees of freedom were corrected using Huynh-Feldt estimates of sphericity, ($\varepsilon=.91$) instead of Greenhouse-Geisser. A one-way repeated measures analysis of variance (ANOVA) was run to examine the relationship between decision-making (IGT scores per block) and trait-anxiety. According to the results, a significant main effect of IGT blocks was found F (4,4) =4.21, $p=.002$, $\eta p^2 = .042$. However, no main effect of trait anxiety was found in the results F (1,96) =.23, $p=.63$, $\eta p^2 = .002$. Results of the ANOVA showed no significant main effect of trait-anxiety on decision-making $F(3.6,34)=1.39$, $p=.23$, $\eta p^2 = .014$. This suggests that higher levels of anxiety did not result in the lower IGT performance (see also figure 2).

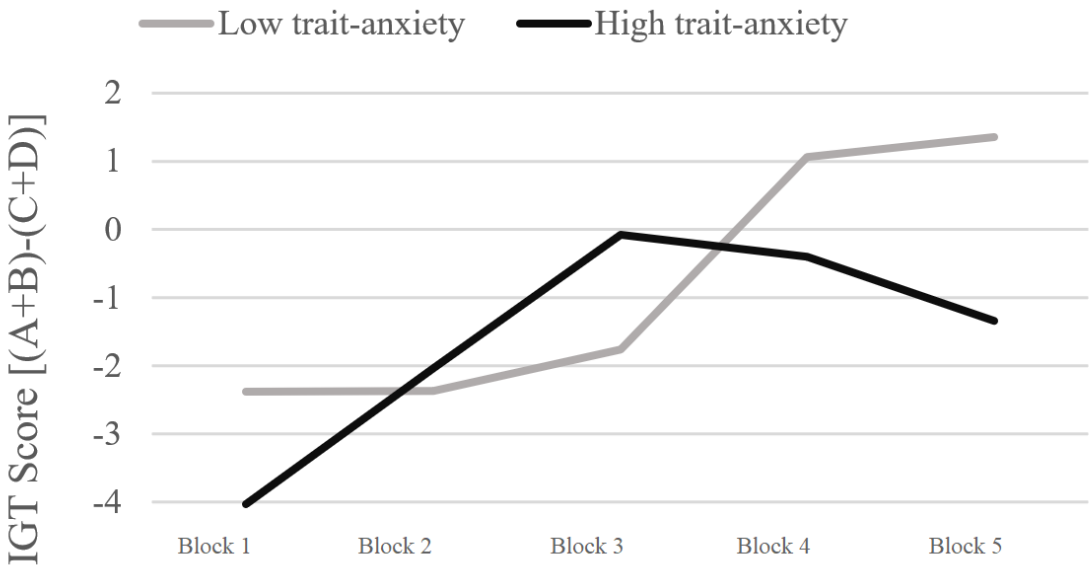

Figure 2. The mean net number of IGT scores per blocks by individuals with high and low levels of anxiety.

Higher intolerance of uncertainty (IU) leads to less advantageous decision-making

A one-way repeated measures analysis of variance (ANOVA) with a Hunyh-Feldt correction (ε=.91) instead of Greenhouse-Geisser, was conducted to examine the relationship between intolerance of uncertainty and decision-making using IGT scores per block. Results found a significant main effect of IGT blocks F (4,4)=4.21, p=.002, ηp^2 =.042. However, no main effect was found for intolerance of uncertainty F (1,96)=.07, p=.78, ηp^2 =.001. Results of the ANOVA showed no significant main effect of intolerance of uncertainty on decision-making F(3.6,35)=.93, p=.43, ηp^2 =.010. Therefore, the higher levels of intolerance of uncertainty did not affect the IGT performance (see also figure 3).

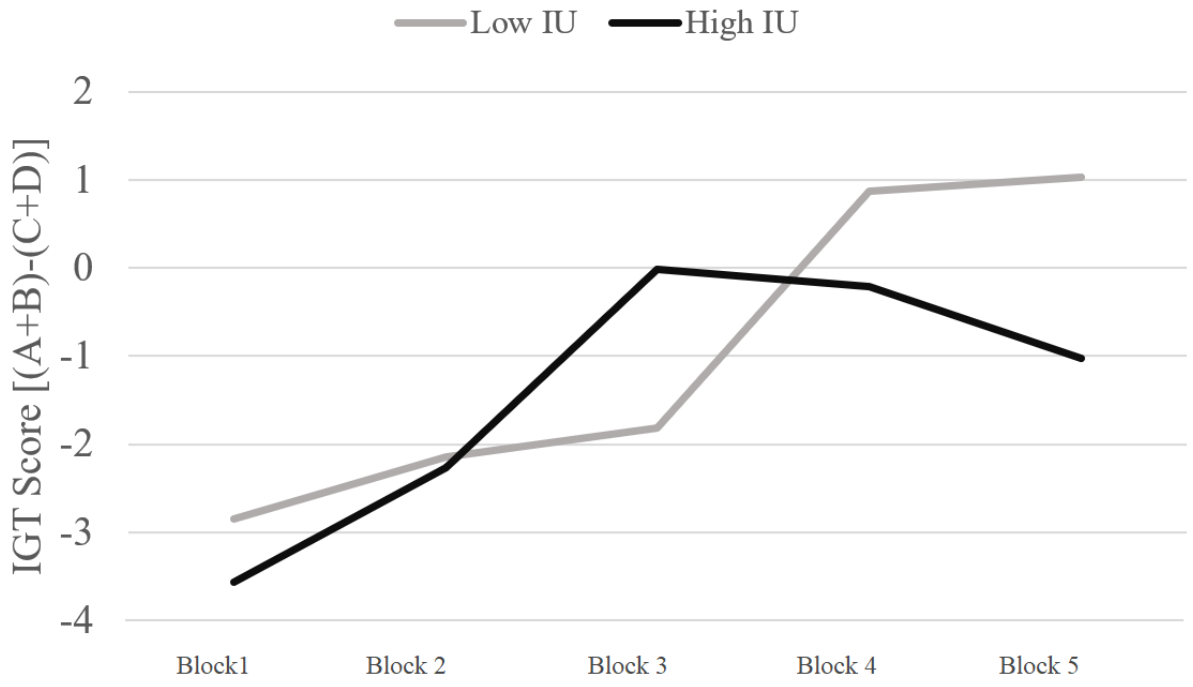

Figure 3. The mean net number of chosen cards [(C + D) – (A + B)] on the IGT by individuals with high and low levels of intolerance of uncertainty.

The relationship between trait anxiety and IGT performance is influenced by IU

In order to see if the relationship between trait anxiety and IGT performance is influenced by intolerance of uncertainty, a one-way repeated measures analysis of variance (ANOVA), was conducted. No interaction effect was found between trait anxiety and IU F (1,94)=.36, p=.54, ηp^2 =.004. A three-way interaction ANOVA was performed to see if the relationship between trait

anxiety and IGT performance is moderated by intolerance of uncertainty. According to the results, a statistically significant three-way interaction between was not found F (14,2) =7, p=.13.

Discussion

The purpose of this study was to assess the impact of trait anxiety and intolerance of uncertainty on decision-making as measured by the Iowa Gambling Task (Bechera et al., 1994). The results did not find support for the hypotheses that individuals with higher levels of trait anxiety have a lower decision-making performance and this relationship was not influenced by intolerance of uncertainty.

Trait-anxiety and decision-making

The present findings demonstrated a general learning effect on the task among the participants, which showed more advantageous decision making as the task progressed (Bechara et al., 1994). In this study, the participants with higher levels of trait anxiety did not exhibit less advantageous decision-making than individuals with lower levels of trait anxiety. However, a non-significant difference on the IGT performance could be seen in the individuals with low and high levels of anxiety. This performance was found to be better among low TA subjects. These results contrast with findings of Zhang et al. (2015) that individuals with lower anxiety performed worse on the IGT. They failed to develop a long-term strategy, which enhanced their performance in the task and showed a tendency to immediate gains. According to the somatic marker hypothesis (SMH), emotions play an essential role in decision making and specifically, in ambiguous and uncertain situations. The somatic markers that the body generates while decision making are heart rate and skin responses as well as related emotional reactions. To develop a long-term strategy, these somatic markers, along with emotional states, need to be stored in memory for every response option to determine one's subsequent selections. Thus, low anxiety failed to develop enough somatic markers due to the weak emotional state, and individuals performed poorly on the task. Moreover, studies demonstrate an association between low anxiety and decreased amygdala and vmPFC which is necessary for activating somatic states (Bechara & Damasio, 2005; Etkin,

Klemenhagen, Dudman, Rogan, Hen, Kandel & Hirsch. 2004; Simpson, Drevets, Synder, Gusnard & Raichle, 2001). This result is also supported by Werner, Duschek, and Schandry (2009), who reported a positive correlation between trait anxiety and IGT performance. They suggest that for each of the four deck options, a new somatic marker needs to be developed so that learning happens, and the individuals figure out which options are more advantageous. However, the latter studies rely more on physical measurements (through heart rate or skin response), and a good performance is suggested to depend on emotional processing measured by physiological reactions during the task. Thus, the influence of trait-anxiety may not be entirely explained by state factors during the task. Interestingly, high TA subjects did not have a better performance on the task in this study. According to SMH (somatic marker hypothesis), these individuals were thought to experience stronger emotional states and, therefore, perform better. This outcome is in line with findings of de Visser et al. (2010) and Miu et al. (2008), who found a long-term prediction of the decks in high TA participants (de Visser et al., 2010). This can be explained by more negative thoughts and worries resulting in lower cognitive control, which maintains the disadvantageous choice decision-making. Another factor that influences decision making is being distracted by emotions which are unrelated to the task (Miu et al., 2008; Preston et al., 2007). This has been shown in individuals with high trait-anxiety (Spielberger, 1966, Endler and Kocovski, 2001), in a way that they disrupt the learning ability during the task and individuals fail to determine the loss and gains of their choices (Bechera et al., 2005). This can be explained by the uncertain nature of the IGT, which provokes anticipation of stress in high TA individuals (Bechera et al., 2005; Eysenck, 2007; Krug & Cater, 2010). This stress anticipation can disrupt attention and, therefore the task learning ability. Moreover, studies showed a detrimental role of stress on cognitive performance (al'Absi, Hugdahl & Lovallo, 2002; Veltman & Gaillard, 1993) and how it reduced the learning pace. This means that it took the subjects longer to shift from disadvantageous choices to advantageous ones due to the increased anxiety, arousal, and their disposition toward fearful thoughts during the task (Bechera et al., 2005). Although, the results of the latter study are based on a small sample and need to be conducted on a larger sample. In contrast with these findings, some studies show a positive correlation between trait anxiety and IGT performance (Maner & Schmidt, 2006; Raghunathan & Pham, 1999; Werner, Duschek and Schandry, 2009; Mueller et al.,2010). Found by Werner, Duschek, and Schandry (2009), high anxiety was associated with better performance in decision-

making, and these individuals chose more advantageous options on the task. This can be explained by good perception of bodily signals (specifically cardiac perception), which guides the behavior, meaning that the result of choosing each deck on the task caused body arousals. Anxious individuals seem to be more sensitive to these bodily signals and, after experiencing greater losses in decks A and B, they began to select C and D more often. A study by Pollatos and Schandry (2008) demonstrated a better recognition performance in subjects with good heart beat perception as well as better emotion processing, which helped them predict the future better. This is also in line with Demasio's theory regarding the association between the results of the cards, perception of somatic markers, and better decision-making (Damasio, Everitt, Bishop, Roberts, Robbins & Weiskrantz, 1996). Another study by Mueller et al. (2010), also found better decision-making in anxious individuals. They suggest that these individuals are more sensitive to unpredictable long-term loss; therefore they learn how to avoid the disadvantageous decks by being hypervigilant to negative feedback they get from them. An explanation to the inconsistencies in the literature might be what aspect of trait-anxiety they focused on. Some of these studies focused on physiological arousals and some on the cognitive aspect, which can lead to different outcomes.

Intolerance of uncertainty and decision-making

In the present study, individuals with higher levels of intolerance of uncertainty did not show worse decision-making. Although a non-significant difference in the IGT performance could be seen in individuals with low and high levels of IU. This performance was found to be better among individuals with lower intolerance of uncertainty. Previous studies found that higher IU was related to worse decision-making (Ladouceur, Dugas & Freeston 1997; Luhmann, Ishida & Hajcak, 2011). This can be explained by the uncertain nature of the IGT and the emotional arousal that it provokes. High IU individuals seem to have difficulties tolerating these feelings and overestimate them (Ladouceur, Dugas & Freeston 1997). This tendency can interrupt cognitive processes such as attention and therefore affects their performance in the task. Luhmann, Ishida & Hajcak (2011) also found that high IU subjects chose immediate rewards which led to long-term loss more often. This could be due to their cognitive tendencies, including increased worry or negative beliefs about uncertainty that leads to an inability to develop a learning strategy. However, findings of the latter study might not be attributable to our research because IGT was not used to measure the decision-making and other factors were

involved, which might affect the outcomes. Another study indicated that individuals with higher levels of intolerance of uncertainty are less likely to change their decisions even in the presence of new information (Jensen, Kind, Morrison & Heimberg, 2014) because they do not want to face uncertainty again. Therefore, these people might not change their decision when they figure out the advantageous decks and perform better in the task.

Intolerance of uncertainty and trait-anxiety

The third aim of the study was exploring the relationship between intolerance of uncertainty and trait-anxiety in the prediction of decision-making outcomes. Our results did not confirm the study's speclation that there is an interaction between these two variables. In contrast to our results, this relation has been supported by previous studies (Sternheim, Startup & Schimdt, 2015; Jensen, Cohen, Mennin, Fresco & Heimberg, 2016; Rotomskis,2014). It is suggested that individuals with higher levels of IU interpret uncertainty more negatively (Oglesby & Schimdt, 2017), which can provoke more anxiety. Krohne, Pieper, Knoll, and Breimer (2002), also argue that anxiety intends to reduce uncertainty by means of behavior. These individuals are more likely to consider ambiguous situations negative and feel more anxious, which results in more deficits in decision-making (Garami, Haber, Myers, Allen, Misiak, Frydrecka &Moustafa, 2017). In consistent with the previous literature, it was hypothesized that individuals with higher levels of anxiety show worse decision-making, and intolerance of uncertainty intensifies this relation. Therefore, the present outcomes were not expected. This might be because most of our participants showed low or mild levels of IU and TA; therefore, this lack of interaction between trait-anxiety and intolerance of uncertainty cannot be concluded from our study.

Limitations

The findings of this study should be seen in the light of some limitations which influence the generalizability of our findings. The first is the small number of participants with high levels of trait anxiety and intolerance of uncertainty. This problem can affect the reliability of our study and fail to provide precise estimates which can be taken into account by future studies. The second limitation concerns the use of self-reported questionnaires (STAI-trait and IUS-12, Spielberger, 1983; Carleton et al., 2007). One of the limitations regarding these types of questionnaires is being prone to biases such as social desirability bias, meaning that subjects may give more socially acceptable answers than being truthful. Future studies can add other assessment strategies to self-reported questionnaires like measuring physiological responses

(body temperature, heart beat, etc.). The other limitation is associated with the violation of normally distributed data that can arise when dealing with smaller samples. However, ANOVA was used, which appears to be robust to non-normality (Blanca, Alarcon, Arnau, Bono, & Bendayan, 2017). Thus, future studies might consider a larger sample size to get more reliable results and generalize them to the population. Also, limited research has been done to investigate the role of trait anxiety or intolerance of uncertainty on decision-making using the Iowa Gambling Task among non-clinical samples. Therefore, further research is recommended to determine the effect of anxiety on decision-making and the role of IU in this relation.

In conclusion, the results of our study extend the view that trait anxiety and intolerance of uncertainty influence decision-making. However, so many factors can affect IGT outcomes, and further research is required to investigate this interaction according to the inconsistencies in the literature.

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