A closer understanding to The Iowa Gambling Task

Cognitive Disorders

## Introduction

Quality of life and experiences for humans consists partially of how they manage to select their daily choices. Opposite, impairment in decision making without weighting the consequences of choices can put their life at risk but also the people that surround them can be at risk.

To understand clearly, prediction of a decision is a conscious mechanism which from two choices/selections, gets each output, the outcomes are measured, makes the choice considering the output and requirements to do it, and finally gives feedback to the choice made.

Dysfunctional decision making can become a serious problem conditioning various mental disorders such as pathological gambling, substance abuse, eating disorders and not only.

In considering a lack of punishment in dysfunctional impairment decision it is possible also to relate to psychopathy and schizophrenia.

As a short understanding, a superficial “explanation” of consequences of impaired decision making can be seen in certain adolescent behaviors in how they select their choices without acknowledging the consequences, and this could be related to a not maturated prefrontal brain region (Sharma et al., 2013).

The Iowa Gambling Task is a psychological task created to measure decision making in people. The instrument has been used to measure various psychological disorders as substance abuse, pathological gambling, psychopathy, anorexia nervosa, obesity(Bechara & Martin, 2004)  
Further the paper will describe the tool history, validity and reliability and more detailed brain information related to the test.

## History & Versions

The Iowa Gambling task was created in 1994 to understand the dysfunction in decision making. With the help of neuroimaging the experiment allows to monitor the neural process which are activated in the decision-making process (Bechara, Damasio, Damasio & Anderson, 1994)

The main part of the brain which manages decision making is the prefrontal cortex, later in the paper different regions correlated will be explained. The objectives of the Iowa Gambling Task were to study the mapping of brain regions related to decision making, and to understand how patients with ventromedial prefrontal cortex damage deficit have making decisions but perform well on different cognitive tasks (Bechara, Damasio, Damasio & Anderson, 1994).

The Iowa Gambling task is a test that simulates real life decision making. The participants are given an amount of 2000$ virtual money and are instructed to maximize the profits in the time of 100 rounds. One round consists of selecting one card. The participants are given each four deck cards, with mentioning that some deck of cards which will reward them more and others less. With each selection participants have the possibility to lose an amount of money. Two of these decks have higher rewards but also higher punishments, while the other two have lower rewards but lower punishments. The lower rewards deck will make the participant maximize his profits in long term, while the higher reward deck will make the participant lower his initial money in long term. The participants must figure out the pattern of the deck cards, and to make his selection accordingly to the task to increase as maximum the initial money given. It is expected that pathological gamblers to go for the immediate reward, while the outgroup to go for the more secure winnings.

The test measures the ability to recognize, measure the outcomes of each card, measure the punishment of their choices and make the selection. Participants who do not learn throughout the task to choose the smaller immediate rewards for bigger long-term rewards throughout the certain deck selection are considered to have a decision-making impairment.

Different scenarios were introduced to this task as a game with EFGH decks where EF decks were the ones high rewarding/high punishing (loss in long term) and the GH decks were the opposite(Bechara, Tranel & Damasio, 2000).

In 2001 van den Bos and Pijlman created an altered version for the IGT, which helped them validate their assumptions on animal behavior(de Visser, 2011). The neurobiological mechanism of search for food in animals have positive outcomes to long term rewards decision making(reference). The IGT model for animals developed with a choice-box with one choice containing 1(8 wins per 10 choices) sugar pellet and the other one containing 3 sugar pellets (3 wins per 10 choices) (reference). In this way there was implemented the similarity between the long-term rewards and the short-term rewards. The results showed similarities with humans in ways of recognizing patterns and choosing the long-term rewards(de Visser, 2001).

The decision making is a mechanism which activated different parts of the brain to give the outcome. The main region responsible for this is the prefrontal cortex

The selection between two choices is a mechanism which combing two different types of reasoning a cognitive one and an emotional one. This can be understood as affective choices and rational choices. Both influence the process.

Cognitive choices are associated with a mechanism of valuing the outcomes of the selections. This consists in keeping the consequences of the outcomes in the working memory and valuing. There exist also costs to taking a certain choice and all these weights are considered before taking a rational decision. Simultaneously, the choices costs are weighed in consideration to past experiences.

On the other hand, emotional decisions involve an affective answer in deciding (Seguin et al. 2007).

The somatic marker hypothesis (Bechara, Damasio, Tranel & Damasio, 2005) sustains that the emotional choices are tied to the rational ones and assist when taking choices. The affective choices come from an unconscious level but consciously can be understood as a “gut feeling”. Bechara(Bechara, 2000) sustained that the types of decisions are interrelated between them. He sustained that in valuing rational a decision, the experiences in which the person values it comes from an emotional perspective and this are called somatic markers. When damage occurs either onto the emotional or rational decision making, the whole mechanism is affected. Here can be sustained a word in the validity of the IGT on finding decision impairment, but not understanding clearly which part of the two selected regions is affected and in what measure. Study showed when conducting first experiment using the IGT on pathological gambling, healthy participants showed a different anticipatory skin conductance response when assessing the riskier decks. Individuals with ventromedial prefrontal cortex damage, in this case the pathological gamblers group did not show any skin response (Bechara, 1996).

## Reliability and Validity

The IGT has been used in studies with different brain imaging techniques, methods have been used to help spot blood flow of brain activated in used previously and in-time of a decision making.

A study conducted by Maher et al focused its understanding on recognizing if gambling behaviors affect in a certain way pathological gambling (LINNET, ROJSKJAER, NYGAARD & MAHER, 2006). The study had two groups, one of 63 participants pathological gamblers and one of 39 non pathological gamblers. The study used two measures to analyze the level of decision-making, one was the Iowa Gambling Task, and the other was the South Oaks Gambling Screen questionnaire. The Iowa Gambling Task was reinterpreted under the name of the Mouse Effect. The Mouse Effect is a reinterpretation of the Iowa Gambling Task but doesn’t contain any money, or deck of cards but they are changed with a mouse seeking for cheese with the same rewards and punishments. The reinterpretation of the test is to not induce abstinent gamblers episodes of gambling.   
A three way MANCOVA has been used to analyze the data of the study (age \* gender \* test\_results). The results showed that there was no interaction between age, gender and the Iowa Gambling Task. This means that significant results do not differ between Pathological female or male gamblers. The results showed a significant difference on the difference of advantageous choices, where the pathological gamblers had significantly lower results(p<.05).

A study by Briere M focused its investigation on alcohol usage disorders (Brière et al., 2019)

. The test was comprised of sixty-seven subject’s half of them selected for a rehabilitation program and the other half rejecting a rehabilitation program and continuing the harm. The study measured the decision impairment with the Iowa Gambling Task. The results showed a that decision making in alcohol usage disorders patients is dysfunctional. Between the two control groups, the results differ, and this could be a starting point in selecting a therapeutic process for this disorder.

Another study by Charles Cotrena et al focused its investigation on difference in decision making between healthy and patients who suffered a Traumatic Brain Injury (Cotrena et al., 2014). The selected participants were 110 of which 65 had suffered severe or mild TBI and the other 65 were healthy patients. The study used as measure the Iowa Gambling Task. Significant differences were found between the test results of patients who suffered TBI and healthy ones. However, no significant difference was found between the TBI patients with or without frontal lobes damages, and this could be related to the inter relation between different part of the brain in assessing a decision.

Studies significance differ from study to study, and this could be related according to different theory, as the somatic one which sustains that decision making is a complex mechanism which is developed by two different regions of the brain which work simultaneously, when one impaired even the other one works at a deficit. This could explain the last study. Were no significant differences in IGT scores are seen between frontal and non-frontal brain damages, but both have a decision-making deficit.

## Diagnostic Criteria

The Iowa Gambling Task started as a test to measure the decision impairment of pathological gamblers. The tool measuring decision-making impairment was defined on a prefrontal cortex damage basis. Studies using the Iowa Gambling Task found out that pathological gamblers in contrast to healthy controls showed lower functionality on the ventral tegmental-orbitofrontal cortex(Bechara, Tranel & Damasio, 2000). While other studies show that both healthy controls and pathological gamblers have different brain regions activated to decision making as the occipital and parietal lobes (Tanabe et al., 2007).

The Iowa Gambling Task has been used to recognize substance abuse, gambling problem and substance abuse gambling problem. Study showed that from all three categories mentioned above the participants were likely to have reduced functionality of the ventral tegmental orbitofrontal cortex.

The tool has been used mainly to discover frontal cortex damages to the brain throughout the test. As presented above, the tool has been used in several studies and showed significant differences in contrast to healthy controls in assessing alcohol drug usage, traumatic brain injury, pathological gambling, substance abuse.

The tool can be reinterpreted in different ways as the mouse effect to not cause harm on the patients. The tool is usually used on computers by participants, and there are multiple sources of the game on internet. The tool is easy to complete and easy to interpret.

## Limitations

A study by Brand et al (Bull, Tippett & Addis, 2015) suggested that the first round of the trial of Iowa Gambling Task, the participant making the decision randomly, because had not enough time to understand which deck is favorable and which is not. As well the last round, can be interpreted as the moment in which the patient understands which deck is favorable and make the decision consciously knowing the rewards and punishments.

In considering evaluating a prefrontal cortex damage throughout the decision making, there can be limitations. As mentioned above, the decision is a mechanism which requires working memory to evaluate all the outcomes of each choice. Working memory uses front-parietal regions of the brain, a damage in that area would interfere with the results of test in measuring a prefrontal brain damage. As well considering the somatic theory where part of the brain works inter-related with multiple regions to deliver a choice, a damage to any other part of the brain would interfere with an evaluation of a prefrontal cortex. The study mentioned above validates that there was no significant difference between mild and severe TBI patients in the IGT, although they were significant difference in contrast to healthy controls. Even if the Iowa Gambling Task originated for measuring a prefrontal cortex, several studies showed that different damages to the brain can exist simultaneously to a prefrontal damage and affect decision making.

## Evaluation

There exist some limitations on the tool regarding other brain damage that could interfere or of the scores. From the studies presented the test can find a prefrontal cortex damage and can help understanding several other mental disorders. In the case of using for assessing a prefrontal cortex damage other tests should be used to be certain that the damage is coming from the prefrontal cortex. The patients should have one round to accommodate with the decks and understand which decks are rewarding in long term and which are not, the results could exclude the first round.

The test can help in assessing a therapeutic process for alcohol substance usage, and it can be used also for different abuse disorders.

Concluding, the test is easy to use, easy to interpret, and showed significant results in assessing prefrontal cortex damages, traumatic brain injury, and other mental disorders as pathological gambling, substance abuse and eating disorders.

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