Effect of agency on gambling behaviour in schizophrenia

The Effect of Agency on Gambling Behaviour in Paranoid Schizophrenia

Introduction

Our sense of agency is a form of self-consciousness which allows us to distinguish between ourselves and other individuals; it makes us aware of which thoughts and actions are our own (Haggard & Chambon; 2012). This construct can be measured through the use of the intentional binding task (Moore & Obhi; 2012). When an individual preforms an action that is then followed by an effect such as an auditory tone, there is a perceived reduction in the length of the interval between the action and the effect. Since this only occurs for actions that are intentional, this phenomena is called ‘ intentional binding’ and has been suggested as a reliable measure of agency (Haggard, Clark & Kalogeras; 2002).

A disturbed sense of agency is symptomatic of schizophrenia, a long term psychotic disorder marked by severely impaired thinking and abnormal behaviour, including delusions and hallucinations (Andreasen & Olsen; 1982). Sufferers of the disorder may either feel that external forces are controlling their actions or thoughts, or they may feel in control of events that in fact are not caused by their actions. Martin (2013) called this experiences of activity; patients form the grandiose delusion that they can control some external events by the sole means of their mind.

The first intentional binding patient study (Haggard, Martin, Taylor-Clarke, Jeannerod, & Franck, 2003) compared the magnitude of intentional binding in patients with schizophrenia to a healthy control group. They established that intentional binding was significantly more robust in patients compared

to controls. Using the same task, a more recent study (Voss, Moore, Hauser, Gallinat, Heinz & Haggard; 2010) found that the predictive component is either absent or faulty in schizophrenia, therefore a greater reliance on the external effect rather than the intended action leads to hyper-binding. The severity of positive symptoms, as in the paranoid schizophrenic subtype, was also found to correlate with impairments in action-effect predictions.

Various studies have documented a high level of comorbid psychiatric disorders among individuals with gambling disorders, including Schizophrenia. Pathological gambling was first recognised by the APA as an impulse control disorder in 1980, and can be defined as the recurring behaviour of gambling on games of chance despite the resulting negative consequences, leading to the individual becoming incapable of controlling the time and money spent, even when losing. Research conducted by Desai & Potenza (2009) investigated the co-occurrence between pathological gambling and schizophrenia. The researchers interviewed a sample of 337 patients diagnosed with schizophrenia. Using the DSM-4 criteria for pathological gambling, the researchers found that these patients may be at a particularly high risk; 19 percent were classified as either problem or pathological gamblers. Just under 10 percent met the diagnosis for pathological gambling, the most severe form of the disorder; recent studies have estimated the rate among the general population at less than one percent.

Wegner and Wheatley (1999) suggested that the sense of agency also plays a role in phenomena such as superstition and gambling, in which individuals experience subjective control over uncontrollable entities; this is often know

as illusion of control. Similar to delusions of activity in schizophrenics, various studies have shown that an irrational sense of personal control over the outcome, even in games of pure chance, is a possible factor in the maintenance of problem gambling. A study by Moore and Ohtsuka (1999) assessed the association between beliefs about illusion of control or internal locus of control and their relationship to gambling frequency in young people. The results indicated that irrational control beliefs were strongly associated with problem gambling; the illusion of internal control over gambling significantly predicted gambling frequency and problem gambling.

Toneatto, Blitz-Miller, Calderwood, Dragonetti, Tsanos (1997) found that scoring highly on the South Oaks Gambling Screen (Lesieur & Blume, 1987) was correlated considerably with exhibiting cognitive distortions during an interview, in which individuals expressed the belief that they are able to control the outcome of their gambling, along with an extravagant level of self-confidence. Heavy gamblers also made more active attempts to influence the outcome using gambling systems, rituals and superstitions. Sense of control over gambling appears to have cultural differences; Majamäki & Pöysti (2012) found that Finnish gamblers stress their individual competence and will to take more risks than gamblers in France, even in games of chance, imagining a greater sense of control.

Taken together, research suggests that Pathological Gamblers may experience a similar heightened sense of agency to Schizophrenics, in that they exhibit the illusionary idea that they are able to control outcomes which are not within their personal influence. Although the experience of agency between two disorders have not been directly compared, this could perhaps

explain the high comorbidity between the two disorders. I therefore propose that a disturbed sense of agency will be present in both schizophrenics and pathological gamblers during a gambling task and may contribute to the development of gambling disorders.

Methods

In order to study the possible effect of agency on pathological gambling in schizophrenia, I intend to use as many participants as possible in order to obtain the largest, most generalizable sample; participants will be age and gender matched to eliminate extraneous variables. I will use the age range of 16-35, encompassing the peak ages of onset and acute psychosis whilst avoiding using minors for ethical reasons. I will be using a healthy control group, a group of pathological gamblers and a group of paranoid schizophrenics, as they present more positive symptoms than the other subtypes, which correlate with experience of activity delusions. In order to participate individuals must have a professional medical diagnosis for their disorder, as well as normal or corrected hearing and eyesight.

Firstly, I would like to establish the level of individual sense of agency for each group during an intentional binding task. Following a voluntary or involuntary key press, participants will experience an interval followed by an auditory tone; they will then be asked to estimate the length of time between preforming the action and producing the effect in milliseconds. Research has shown that there is a perceived reduction in the length of the interval between the action and the effect where the participant believes that they produced the action voluntarily.

Secondly, participants would complete a computer gambling task (Rachlin 1986) in order to simulate real life tendency to make a safer or riskier choice during a game of chance. This is a task in which they are asked to choose between two spinning wheels, where the pointer landing on a white coloured section would indicate a monetary win. On one wheel, a win is less likely but twice as substantial, on the second the win is less valuable but more consistent. In order to increase the ecological validity of the situation and hold the attention of the participant, they will have the opportunity to win the money collected during the task. This task will take place within a functional magnetic resonance imaging (fMRI) scanner. This machine uses the Blood-oxygen-level dependent contrast (Huettel, Song & McCarthy (2009) in order to detect changes in cerebral blood flow during the task, indicating neural activity in different brain regions.

Results and Implications

My predicted results would be that based on prior research the schizophrenic group will experience substantially more hyperbinding on the intentional binding task than the healthy controls; however I also hope to see the same with the pathological gamblers. Amongst that group, those who experienced the strongest feeling of agency would take the most risks during the task. I would expect to see similar, and greater, patterns of activation in the areas associated with agency, specifically self-agency, during the task in the fMRI machine for the PG and Schizophrenic groups. This would include the TPJ Precuneus, which has been implicated in a large number of studies during tasks relating to agency (Brass et al. 2009; Nahab et al. 2010; Schnell et al. 2007; Spengler et al. 2009; Yomogida et al. 2010) and has been suggested

to contain a mechanism which allows us to determine mismatches in sensory feedback (Tsakiris et al. 2008) and attribution of external cause for events (Seidel et al. 2010). A second area involved is likely to be the dMPFC, active during agency tasks due to its role similar role in predicting events. (Volz et al. 2003, 2004, 2005). Thirdly, I would also expect so see activation in the pre-SMA, which is involved in the development of intention to create voluntary movements(Picard and Strick 1996). Transcranial magnetic stimulation (tms) supressing neural activity of this area results in a decrease in intentional binding (moore 2010).

Although increased blood flow will be present in these areas during all forms of agency experience, these areas have been found to be more strongly associated with external agency attributions; therefore it is possible that I will see more activation of these three regions in the healthy control group. This was suggested as the result of a met-analysis performed by Sperduti, Delaveau, Fossati & Nadelfound (2011), recognising that the bilateral insular cortex, premotor and primary somatosensory cortex are only active during the production of voluntary movements (Ciccarelli et al. 2005; Francis et al. 2009; Tatsuya et al. 1999 and therefore experiences of self-agency. The bilateral insular cortex is of particular interest in this study as it has been noted in the impairment of attribution of self-agency in schizophrenic patients, and is correlated with positive symptoms. (Wylie and Tregellas 2010, Voss et al. 2010)

Although the high level of comorbidity between Schizophrenia and Pathological Gambling is well documented, the effect of agency has not been studied directly in relation to the disorders, so results are difficult to predict.

However, this area of study is worthwhile as it establishes the significance of screening patients with Schizophrenia for gambling disorders and helps to detect the aspects of the population that may place these patients at particular threat of developing pathological gambling.

Patients who exhibit both these disorder have been found to respond less favourably to treatment, and may experience longer and more frequent durations in hospital, due to poor response and adherence to medication; this increases both the cost and encumbrance to society. Other negative consequences include increased aggression, alcoholism, depression, homelessness and likelihood of becoming a victim of crime. (Green, Drake, Brunette, & Noordsy, 2007, Desai & Potenza, 2009). The stress caused by gambling disorders, such as financial and relationship problems, may increase the risk of episodes of psychosis. (Borras & Huguelet, 2007)

Discovering reliable therapies for this group is of importance for future research because current research trials developing treatment for gambling addictions usually do not permit the inclusion of participant who have been diagnosed with a psychoticdisorder such as Schizophrenia; so far there has been no clinical studies of treatments for individuals with these co-occuring disorders. (Enrique Echeburúaa, b,*, Montserrat Gómezc, Montserrat Freixac) 2011. Most significantly, this research could provide insight into the brain regions and theoretical processes involved in the maintenance of gambling disorders, in a population in which it is not only incredibly prevalent but also particularly harmful.