

Examining the predictive effect of impulsivity levels and personality traits on metacognitive thoughts

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Abstract

The aim of this study was to determine the predictive effects of impulsivity levels and distinct personality traits (neuroticism, extraversion and psychoticism) on metacognitive thoughts across a healthy population. The study was carried out with 60 female and 9 male students whose ages ranged between 18 and 28. Eysenck Personality Questionnaire (EPQ), MCQ-30 Metacognition Scale (MCQ-30), Barratt Impulsiveness Scale-Short Form (BIS) were used to assess personality traits, metacognitive thoughts and impulsivity levels respectively. Regression analyses were used for data analysis. Statistical findings revealed a significant positive effect of neuroticism on overall metacognitive thoughts. According to statistical analysis, there was a predictive effect of non-planning subscale scores of impulsivity on cognitive awareness subscale scores of metacognition. Furthermore, there was statistically significant predictive effect of attention subscale scores of impulsivity on cognitive confidence subscale scores of metacognition scale. The results were discussed in accordance with the findings of the previous studies, and limitations of the present study and suggestions were provided for future studies.

Keywords: metacognition, impulsivity, personality

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1. Introduction

Metacognition can be defined as thinking about thinking or as a psychological phenomenon including someone's feelings and motives about him/herself and about others (Karsli, 2015; Tosun & Irak, 2008). On the other hand, metacognition is a higher cognitive function related with self-regulation behaviour that involves the performance of sufficient cognitive processes in a given situation. In this respect, persons do not only have cognitive functions to process the ongoing changes in their environment but they also do have knowledge about their knowledge itself (Karsli, 2015). In effect, metacognition is closely related with higher-order cognitive functions such as decision-making and locus of control of planned and executed behaviours (Karsli, 2015). Metacognition plays an important role in cognitive functioning and in adaptive behaviours. A dysfunction in metacognitive system may lead a person to exhibit maladaptive behaviours, and provide a basis for developing various psychopathologies (Wells & Cartwright-Hatton, 2004). This hypothesis is based on the notion that dysfunctional cognitive and coping strategies are results of a dysfunctional metacognition system (Cartwright-Hatton & Wells 1997; Gwilliam, Wells & Cartwright-Hatton (2004).

There is a growing body of literature examining the relationships between various psychological variables and metacognition. Previous studies examined the role of metacognitive thoughts on behavioural differences, and provided a considerable number of evidences that indicated significant relationships between emotional processes, cognition, metacognitive beliefs, and behaviors (Quattropiani, Vittorio, Mucciardi & Toffle, 2015). The effects of metacognition on psychopathologies have been studied in patient groups with generalized anxiety disorder (Wells, 2005), obsessive-compulsive disorders (Fisher & Wells, 2005; Myers & Wells, 2004; Wells & Papageorgiou, 1998; Irak & Tosun, 2008), posttraumatic stress disorder (Holeva, Tarrier & Wells, 2001), psychotic disorders (Bacon et. al., 2001; Morrison & Wells, 2003; Weiss et. al., 2002), depression (Papageorgiou & Wells, 2003), and substance abuse (Toneatto, 1999). According to a theoretical model, dysfunctional metacognitive beliefs employ susceptibility for development and maintenance of psychological disorders (Quattropiani, Vittorio, Mucciardi & Toffle, 2015). In particular, susceptibility to having a psychological disorder and maintenance of a psychological disorder for a long time are associated with a non-specific style of thinking which is known as Cognitive-Attention Syndrome (CAS). In fact, symptoms of CAS include positive beliefs about worry, negative beliefs about worry concerning uncontrollability and danger, and cognitive resource limitations and beliefs regarding the need to control thoughts (Quattropiani, Vittorio, Mucciardi & Toffle, 2015). A distinct model of metacognition proposes that a psychological disorder is related with one's style of reacting to his/her self-thoughts with sustained anxiety, rumination, fixation of attention over threat and maladaptive coping behaviors (Solem, Hjemdal, Vogel & Stiles, 2015). Having metacognitive beliefs which relies on a notion that thoughts are dangerous and/or uncontrollable may lead an individual to possess a sustained negative thinking style. MCQ-30 subscale of need to control thoughts has particularly strong relationships with having symptoms of mood and anxiety disorders (Spada, Nikcevic, Moneta & Wells, 2008). In a further study exploring the relationships between metacognition, perceived stress and negative emotions, metacognition was found to be positively and significantly correlated with both perceived stress and negative emotions (anxiety, depressions, and neurotic problems). Positive and significant correlations were also observed between perceived stress, anxiety and depression (Spada, Nikcevic, Moneta & Wells, 2008). The results of the studies are in line with the outcomes of psychotherapy methods that are used in metacognitive therapy such as attention training which is designed to aim increasing mental flexibility and control awareness of patients (Solem, Hjemdal, Vogel & Stiles, 2015).

Personality, as a broad term, can be defined as a characteristic way of thinking, behaving and feeling of an individual, and it is achieved through the interaction of genetically determined and environmental factors (Andersen & Bienvenu, 2011). Eysenck had well established the big three model of personality comprised of neuroticism, extraversion and psychoticism dimensions (Eysenck, 1947; Eysenck & Eysenck, 1976). In this model, Eysenck stated that neuroticism dimension of personality is related with negative emotions and poor coping with stress whereas extraversion dimension of personality is

related with positive emotionality and energy. It has been well known that individuals who have higher neurotic symptoms are more prone to develop emotional disorders than individuals having lower neurotic symptoms. On the other hand, current models suggest that psychopathology and personality may affect each other in three different ways: one can influence the appearance of another, they can share a common underlying etiology, and they can have causal role in development of one another (Widiger, 2011). In the presence of an emotional disorder that is comorbid with anxiety and depression symptoms, dysfunctional metacognitive beliefs may be over imposed, and hence may be followed by a further increase in anxiety and depression symptoms in a vicious circle. Therefore, it may be suggested that there is a relationship between personality traits (neuroticism, psychoticism and extraversion-introversion) and dysfunctional metacognitive thoughts.

Impulsivity corresponds to a range of behaviours including preference for immediate reward, tendency to make immediate decisions, and to exhibit immediate motor responses. It is a dimension of behaviour like personality and it serves as an adaptive function in maintaining normal behaviour (Dalley, Everitt & Robbins, 2011). However, impulsivity is also associated with various negative outcomes of behaviour, and many studies with distinct clinical populations had supported this claim (de Witt, 2009; Winstanley, Dalley, Theobald & Robbins, 2004; Winstanley, Eagle & Robbins, 2006). Different subtypes of impulsivity were found to be related with executive functions. In a review of studies with BISS-11, it was mentioned that non-planning impulsiveness and attentional impulsiveness were found to be predictive dimensions of working memory capacity in several studies (Stanford et. al., 2009). Working memory is a higher cognitive function that is shown to be related with prefrontal cortex activity. Metacognition is also thought to be a function of prefrontal cortex. Hence, a disturbance in prefrontal cortex connections would diminish its functions. For this reason, distinct dimensions of impulsivity may affect metacognitive thoughts. Neuroticism and impulsivity scores are the variables taken as personality traits which were consistently shown to be associated with patients' psychological symptoms (Valero, Daigre, Rodriguez-Cintas & Roncero, 2014).

The term cognitive style refers to an internal factor that has an influence on the information that is being processed during a task comprised of reasoning, learning, and memorizing (Palladino, Poli, Masi & Marcheschi, 1997). Impulsive and reflective cognitive styles are two distinct types of cognitive style (Kagan, 1966). These two types of styles are manifested by subjects whose answers were less accurate despite their quick responses in certain problem situations (impulsive); however; in those whose answers were more accurate than the initial group, their respond times were much longer (reflective). For instance, in a task, participants with impulsive cognitive style demonstrated reduced fixation times to a stimulus as compared to the participants with reflective cognitive style with their eye movements (Messer, 1976). According to another study analysis, subjects who had impulsive cognitive styles had significantly lower scores in monitoring of text comprehension than those having reflective cognitive styles (Palladino, Poli, Masi & Marcheschi, 1997). The level of impulsivity may have a diminishing effect on metacognition scores. In addition, a particular personality trait may act as a positive contributor factor on metacognitive functioning.

In our study, metacognition was taken as a dependent variable, and personality traits and attentional and non-planning dimensions of impulsivity were taken as predictor variables of metacognitive thoughts. The primary purpose of the present study was to evaluate the predictive role of having neurotic personality trait on maladaptive metacognitive thoughts, and to evaluate if maladaptive metacognitive thoughts are affected by individuals' impulsiveness level.

2. Participants

60 female and 9 male students at Istanbul Kultur University participated voluntarily in return for course credit. Participants' ages ranged from 18 to 25 ($M \pm SE$, 20.46 ± 1.6). All participants with a lifetime history of psychiatric disorders, neurological disorders, or on current medication were excluded.

2.1 Data Collection Tools

In order to assess participants' metacognition levels, MCQ-30 was used. EPQ and BIS-Short Form were used to assess personality traits and impulsiveness levels respectively, and a self-report form was given to all participants to obtain demographical data and to ensure that inclusion criteria were met.

2.1.1 MCQ-30 Metacognition Scale

A standardized Turkish form (Tosun & Irak, 2008) of MCQ-30 developed by Wells and Cartwright-Hatton (2004) was used to assess metacognition. MCQ-30 is a self-report, Likert-typed scale in which participants rate their answers within a range of 1 to 4 points for each item where 1 corresponds to an answer of strongly disagree and 4 corresponds to an answer of strongly agree. The highest score that can be obtained from the scale is 120 points while the lowest score is 30 points. The higher the score verb is missing here the higher the pathological metacognitive activity. The scale gives an overall score of metacognitive thoughts together with separate scores for five subscales as follows: (1) The Positive Beliefs subscale consists of 5 items that assess participants' positive beliefs about their anxiety levels that accompany their problem solving and planning abilities. According to this factor, anxiety is interpreted as a desirable trait of personality. (2) Uncontrollability and danger subscale includes 6 items and consists of two dimensions. The first one is a belief regarding that a person should control his concerns in order to fulfill (fulfil –BE) his human functions and stay safe. The latter is a belief regarding to uncontrollability of anxiety. (3) Cognitive confidence subscale includes 6 items assessing the level of confidence of subjects' own memory and attention skills. (4) Need to control thinking subscale consists of 6 items assessing one's own beliefs regarding the level of necessity for controlling his negative beliefs through superstitions, feeling of responsibility and punishment. (5) Cognitive awareness subscale consists of 6 items and assesses the level of self-conflicts (Tosun & Irak, 2008). The scale comprised of 30 self-reported Likert-typed questions includes five factors as follows: positive beliefs about worry (e.g. "Worrying helps me cope"), uncontrollability and danger (e.g. "When I start worrying I cannot stop"), need to control thoughts (e.g. "I should be in control of my thoughts all of the time"), cognitive confidence (e.g. "I do not trust my memory"), and cognitive self—consciousness (e.g. "I am constantly aware of my thinking") (Solem, Hjemdal, Vogel & Stiles, 2015). The scale's original forms' Cronbach alpha reliability value was .93 and factors' reliability values were between .93 to .72 (Wells and Cartwright-Hatton, 2004). According to Tosun & Irak (2008) the Turkish form of MCQ-30's Cronbach alpha reliability coefficient was .86 and a high level of internal consistency for MCQ-30 Turkish version was obtained (Tosun & Irak, 2008).

2.1.2 Eysenck Personality Questionnaire

Eysenck personality theory allows the measurement and evaluation of personality subscales such as neuroticism, extraversion-introversion and psychoticism. It consists of 4 subscales and a total of 24 yes or no typed self-report items. Validity and reliability of the Turkish study was carried out by Karanci et al. in 2007 and was standardized by N.A. Karanci et.al. in 2007 (Zincir, Zincir, Sunbul, & Kaymak, 2012).

2.1.3 Barratt Impulsiveness Scale (11th Version)

The BIS-11, as noted, is a 30-item self-report questionnaire that was developed to assess impulsiveness. All items are evaluated on a 4-point Likert scale (1=rarely/never; 2=occasionally; 3=often; 4=almost always/always). The factor analysis revealed three subscales as follows: (1) attentional impulsiveness, (2) motor impulsiveness, and (3) non-planning impulsiveness. Subscales were identified by the second-order factor analysis for the primary six factors. Four generally indicates the most impulsive response, but certain items are scored in reverse order to avoid a response bias.

The higher the BIS-11 total score is, the higher the impulsiveness level is (Tamam, Gulec & Karatas, 2008).

3. Analysis and Findings

The data were analysed with the Statistical Package for the Social Sciences for Windows, version 23.0 (SPSS Inc., Chicago, IL). Whether the distributions of continuous variables were close to normal was examined by using Shapiro-Wilk test.

Multiple regression analysis was applied to investigate the predictor effects of distinct personality traits (neuroticism, extraversion-introversion and psychoticism) and impulsivity levels on overall metacognitive thoughts and on metacognitive dimensions (positive beliefs, uncontrollability and danger, cognitive confidence, need to control thoughts and cognitive self-consciousness) as dependent variables of the study. For interpreting the results a significant $p < 0,05$ value was determined as statistically significant.

Table 1. Predictive Effects of Personality Traits, BIS-Attentional and BIS-Non Planning Subscale Scores on Total MCQ-30 Scores

Variables	Standardized Coefficients (B)	t	p
Psychoticism	,244	1,983	,052
Exroversion-introversion	-,084	-,716	,477
Neuroticism	,429	3,618	,001*
BIS-Attentional	,155	1,171	,247
BIS-Non Planning	-,162	-1,197	,236

* $p < 0.05$

The results of the multiple regression analysis showed that scores of Neuroticism subscale had a statistically significant predicting effect on total metacognition scores ($p < 0.05$). However, Psychotism, Extroversion-Introversion, BIS-Attentional and BIS-Non Planning subscale scores had no predictor effect on metacognition total scores ($p > 0.05$).

Table 2. Predictive Effects of Personality Traits and BIS-Attentional and BIS-Non Planning Subscales' Scores on Cognitive Confidence Subscale Scores of MCQ-30

Variables	Standardized Coefficients (B)	t	p
Psychoticism	,108	,792	,432
Exroversion-introversion	-,014	-,106	,916
Neuroticism	-,015	-,117	,907
BIS-Attentional	,300	2,047	,045*
BIS-Non Planning	,155	1,042	,302

* $p < 0.05$

The results indicated that scores of BIS-attentional subscale had a statistically significant predicting effect on cognitive confidence subscale scores of MCQ-30 ($p < 0.05$).

Table 3. Predictive Effects of Personality Traits and BIS-Attentional and BIS-Non Planning Subscales' Scores on Cognitive Awareness Subscale Scores of MCQ-30

Variables	Standardized Coefficients (B)	t	p
Psychoticism	,122	,919	,362
Exroversion-introversion	-,023	-,185	,854
Neuroticism	,348	2,716	,009*
BIS-Attentional	,105	,734	,466
BIS-Non Planning	-,414	-2,833	,006*

* $p < 0.05$

The scores of Neuroticism and BIS-non Planning subscales had a statistically significant predicting effect on cognitive awareness subscale scores of MCQ-30 ($p < 0.05$).

Table 4. Predictive Effects of Personality Traits and BIS-Attentional and BIS-Non Planning Subscales' Scores on Uncontrollability And Danger Subscale Scores of MCQ-30

Variables	Standardized Coefficients (B)	t	p
Psychoticism	,360	3,122	,003*
Exroversion-introversion	,127	1,155	,253
Neuroticism	,416	3,750	,000*
BIS-Attentional	,102	,819	,416
BIS-Non Planning	-,022	-,170	,866

* $p < 0.05$

For the uncontrollability and danger subscale of MCQ-30, scores of neuroticism and psychoticism subscales had statistically significant predicting effects ($p < 0.05$).

3. Discussion

Research findings revealed that scores of neuroticism subscale had a statistically significant predicting effect on total scores of MCQ-30. However, no significant predicting effects of psychoticism, extroversion-Introversion subscale scores were found on overall MCQ-30 scores. For the impulsivity, scores of BIS-Attentional and BIS-Non Planning subscales had no predicting effects on total scores of MCQ-30. It was found that scores of BIS-attentional subscale had a statistically significant predicting effect on cognitive confidence subscale scores of MCQ-30 and significant predicting effects of neuroticism and BIS-nonplanning subscales' scores were found on cognitive awareness subscale score of MCQ-30. Finally, it was found that neuroticism and psychoticism subscales' scores had statistically significant predicting effects on uncontrollability and danger subscale scores of MCQ-30.

The findings of several previous studies are in line with the results of this research. In present study, our first finding was the significant predictor effect of neuroticism on metacognition. Individuals having higher neuroticism scores show a disposition to develop psychopathologies and therefore might possess maladaptive metacognitive thoughts. For instance, attention-training treatment may be used to obtain an increase in level of control for metacognitive thoughts and it might be effective to lead a long term reduction in rumination, pathologic metacognition, and depressive symptom levels in patients with recurrent major depressive disorder (Papageorgiou & Wells, 2000).

Our second finding is the predictive effect of attentional impulsivity on cognitive confidence. This subscale of BISS-11 assesses individuals' confidence levels concerning to their attention processes based on their self-assessments and having a higher score from this subscale corresponds having an impulsivity level that lead to reckless behaviors. Individuals who have higher scores on attention subscale do not trust their attention processes and yet it is very expectable to obtain a significant predictor effect of these scores on cognitive confidence subscale scores of MCQ-30. Participants, who do not have confidence on their attention, do not have confidence on their memory either. This finding might also be argued in context of cognitive styles. In a study of Palladino, Poli, Masi & Marcheschi (1997) adolescents with impulsive cognitive styles had significantly higher scores on Children's Depression Inventory when compared to adolescents with reflective cognitive styles. In addition to this finding, adolescents with impulsive cognitive styles had significantly lower scores in monitoring of text comprehension as compared to those with reflective cognitive styles. Therefore, it may be argued that subjects with lower levels of impulsivity also have higher levels of cognitive awareness compared to those with higher levels of impulsivity. There are only a small number of studies that examined the relationship between meta-cognitive processes (e.g., "feeling of knowing") and attentional processes (Irak, 2005). In such study, findings revealed that metacognition was influenced by different attention performances as well (Irak, 2005). The participants who completed the tests involving attention tasks in a short time had better recall performances in memory tasks together with better "feeling of knowing" performance (Irak, 2005). In addition to this, a relationship between attention and metacognition was found (Irak, 2005). For this reason, it may be considered that given the reason that impulsive individuals have reduced attention performances, these attention problems may have negative effects on maintaining functional metacognitive thoughts.

Our third finding is that neuroticism as a personality trait has a positive and non-planning as a type of impulsivity has a negative predictive effect on cognitive awareness. Individuals who have higher neurotic symptoms show higher anxiety and have dysfunctional beliefs regarding to their personality. They tend to develop obsessive-compulsive symptoms. In a study examining the relationship between metacognitive beliefs and negative emotions of university students, four dimensions and total scores of metacognition (positive beliefs about worry, negative beliefs about worry concerning uncontrollability and danger, cognitive confidence and need to control thought) were found to be positively and significantly correlated with negative emotions (anxiety and depression). Considering this finding, individuals with higher pathological metacognitions may feel heightened negative emotions

when compared to individuals with lower metacognition scores. These findings may provide a preliminary finding for demonstrating the influential effects of metacognitive beliefs on maintaining negative emotions (Tajrishi, Mohammadkhani & Jadidi, 2011). As stated in another study results, metacognitive beliefs are reliable predictors for need to control thoughts, thought–action fusion, and negative beliefs about cognitive competence (Myers & Wells, 2004). In accordance with this finding, metacognitive beliefs are positively correlated with obsessive-compulsive symptoms (Myers & Wells, 2004). According to Bailey (2015), metacognition appears to be an important factor for the relationship between catastrophic misinterpretation and anxiety in having particular negative beliefs concerning the uncontrollability and danger of thinking. There are positive relationships between metacognition, catastrophic misinterpretation, and anxiety.

Cognitive awareness subscale assesses the individual's level of thinking about his/her thinking processes. According to our findings, it might be said the neurotic structuring of one's personality provide a basis for overthinking of one's own thoughts. Therefore, the presence of a relationship between neuroticism and metacognition may reveal important implications for treating psychopathologies (Pagani, Derevensky & Japel, 2009). In present study, a similar positive predictor effect of neuroticism was found on both total metacognition scores and on cognitive awareness subscale scores. Having higher non-planning scores from BISS-11 indicate the level of an individual's level of self-control and his/her level of tendency o involve in complex cognitive situations. As expected, this type of impulsivity has a negative predictive effect on cognitive awareness. Individuals who have lower level of self-controls and avoid of being in complex situations, do not think about their own thoughts.

Our fourth and last result was the predictive effects of neuroticism and psychoticism on uncontrollability and danger subscale scores of MCQ-30. In a study of Solem, Hjemdal, Vogel & Stiles (2008), higher negative beliefs concerning the “uncontrollability and danger of thoughts” and beliefs concerning the “need for control” loaded with high levels of non-judgement of inner experience and high levels of acting with awareness. These two emergent sub-factors of metacognition showed the strongest association with symptoms of psychological disorder. Similarly, metacognitive beliefs about uncontrollability and interference of illness thoughts had stronger associations with health anxiety than any of the dysfunctional beliefs (Melli, Carraresi, Poli & Bailey, 2015). Metacognitive beliefs about uncontrollability and interference of illness thoughts predicted health anxiety symptoms and depression, general anxiety, anxiety sensitivity, and health-related dysfunctional beliefs (Melli, Carraresi, Poli & Bailey 2015). Personality characteristics related with psychoticism and neuroticism might both induce an insecure cognitive pattern that leads to high anxiety levels as assessed by MCQ-30.

Metacognition may also be related with executive functions. Involving in risky behaviors is thought to have a relationship with impairments in executive functions. There are numerous studies that examined executive functions in gambler population. Besides, metacognition was found to be positively associated with risky behaviors such as alcohol use and smoking dependence (Tajrishi, Mohammadkhani & Jadidi, 2011). Through executive control perspective, executive functions are associated with cognitive functions such as risk estimation, decision-making and feedback processing related with gambling behavior (Pagani, Derevensky & Japel, 2009).). It is well known that executive functions are associated with prefrontal cortex. Early childhood is considered as a critical period for cognitive self-regulation development. Self-regulation has an influence on developments of general learning and social skills during adolescent (Pagani, Derevensky & Japel, 2009). Both the cognitive and behavioral impulsivities are symptoms in children and adolescents with Attention Deficit Disorder with Hyperactivity. These children do not show a significant deficit in metacognitive knowledge; however they have major problems in metacognitive monitoring ((Palladino, Poli, Masi & Marcheschi, 1997). School activities and level of education have a contributor improvement effect on their metacognitive knowledge and monitoring performance (Palladino, Poli, Masi & Marcheschi, 1997). This type of training on cognitive control of attentional processes and working memory has

implemented useful results in children with ADHD (Pagani, Derevensky & Japel, 2009). In a study which examined the effects of impulsivity and to what extent it contributes to development of pathological gambling behavior, referring to both to the results of repeated assessments' results and observations of participant teachers, it was found that children who were inattentive, distractible and who were exhibiting hyperactive behaviors were more prone to involve in gambling later in their lives (Pagani, Derevensky & Japel, 2009). Together with the ones that mentioned before in this study, these findings suggest a negative relationship between impulsivity and decision-making. A dysfunction in metacognitive functions is thought to be associated with deficits in decision-making and reasoning (Irak, 2005). In studies that examined metacognition, it was emphasized that metacognition should not be reduced to assessments of memory and recall functions, yet it may have significant relationships with distinct information-processing levels such as attention (Irak, 2005).

In a further study that compared the grammatical test performances of subjects with problematic gambling behaviors with that of the control groups', it was found that the scores of the gambler groups were lower when compared to that of the control groups (Brevers, Cleeremans, Bechara, Greisen, Kornreich, Verbanck & Noe, 2012). The findings of the study also revealed a significant correlation for control group between grammaticality judgments scores and confidence scores which may be an indicator of having metacognitive insight and conscious knowledge; yet, the correlation was not significant for gambler group (Brevers, Cleeremans, Bechara, Greisen, Kornreich, Verbanck & Noe, 2012). Moreover, subjects with problematic gambling behaviors were also impaired in their metacognitive abilities as assessed by a non-gambling task. The results indicate that compulsive gambling behavior is associated with having poor insight as a general factor (Brevers, Cleeremans, Bechara, Greisen, Kornreich, Verbanck & Noe, 2012). Therefore, future studies should examine the nature of metacognitive impairment in individuals with problem gambling behaviors (Brevers, Cleeremans, Bechara, Greisen, Kornreich, Verbanck & Noe, 2012). Moreover, number of studies using functional neuroimaging and other brain imaging techniques may contribute to this research to a very large extent (Brevers, Cleeremans, Bechara, Greisen, Kornreich, Verbanck & Noe, 2012). Number of studies using brain oriented methods should be preferred in order to understand the underlying neurological pathways of metacognition both in healthy and clinical populations (Brevers, et al., 2012). Recent fMRI studies provided findings for the role of prefrontal cortex and especially the dorsolateral prefrontal cortex in metacognition development (Brevers, Cleeremans, Bechara, Greisen, Kornreich, Verbanck & Noe, 2012).

There are studies providing evidence for the hypotheses that emotion enhances metacognition. In a previous study, the effect of anxiety on the quality of confidence was examined. For this purpose, worry was induced experimentally as a negative emotion during a perceptual task (Massoni, 2014). In a numerosity task, subjects were forced to choose from two alternatives and then asked to express their confidence in this decision. Metacognition was assessed in terms of discrimination and calibration abilities. The results showed that metacognition, but not choice, is affected by the level of anxiety that anticipated just before the decision. Under worry, individuals tend to have better metacognition in terms of these two measures (Massoni, 2014). A significant positive relationship was found between worry and neuroticism.

According to The Self-Regulatory Executive Function Theory metacognitive knowledge (metacognitions) predisposes individuals to develop response patterns to particular thoughts and internal processes that are characterized by heightened self-focused attention, cyclical thinking patterns, avoidance and thought suppression, and threat monitoring (S-REF: Wells & Matthews, 1996). Therefore, particular personality traits may provide a basis for one's general metacognitive functions. Besides, personality traits and attentional impulsivity may be thought as a contributor factor on having pathologic metacognitive thoughts.

4. Conclusion and Recommendations

First, for further studies, a wider range of negative and positive features or psychological symptoms should be taken into account to examine the association between metacognitive thoughts and personality traits for a better understanding of individual differences on metacognitive thoughts. The inclusion of these various factors may contribute to a better understanding of the topic and may pave the way for developing further research studies on this subject. Second, the findings of this study should be tested with a large sample of participants to obtain analysis with greater effect sizes and strong significant relationships.

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