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Review

Poor insight in psychosis and meta-representation models

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Abstract

Historically, *poor insight* and *self-awareness deficits* in schizophrenia have typically been understood as stemming from psychological defenses or adaptive coping strategies. Perhaps both psychological process and neuropsychological deficit account for the phenomenon of poor insight. Different models of insight exist for different broad categories of mental disorders, like psychotic, neurotic, and neurological, but investigators have increasingly turned their attention to poor insight, as an important feature in schizophrenia. A variety of phenomena might be considered as reflecting impaired insight in psychosis, like failure to recognize signs, symptoms or disease, failure to derive appropriate cognitive representations, despite recognition of the disease, and misattribution of the source or cause of the disease. The unawareness of tardive dyskinesia symptoms in schizophrenic patients points that self-awareness deficits in schizophrenia may be domain specific. Poor insight is an independent phenomenological and a prevalent feature in psychotic disorders in general, and in schizophrenia in particular, but we don't know yet if delusions in schizophrenia are the result of an entirely normal attempt to account for abnormal perceptual experiences or a product of abnormal experience but of normal reasoning. The theoretical approaches regarding impaired insight include the disturbed perceptual input, the impaired linkage between thought and emotion and the breakdown of the process of self-monitoring and error checking. The inability to distinguish between internally and externally generated mental events has been described by the *meta-representation theory*. This theory includes the awareness of ones' goals, which leads to disorders of willed action, the awareness of intention, which leads to movement disorders, and the awareness of intentions of others, which leads to paranoid delusions. The theory of metarepresentation involves mainly output mechanisms, like the frontal cortex, while the input mechanism involves posterior brain systems, including the parietal lobe. There are many similarities between the disturbances of awareness seen in schizophrenia and those seen as a result of known neurological impairment. This is more apparent for the many disturbances of body awareness and delusional disorders resulting from right parietal lobe dysfunction. Neurological models may provide a means for classifying various disorders of awareness. Classic *anosognosia* describes the denial of motor impairment in hemiplegia, *anosodiaphoria* the indifference to the hemiplegia, and a number of disorders are characterized by a specific tendency to confuse identities, like misidentification symptoms, reproductive phenomena, and confabulation. Neuropsychological models of impaired insight typically attribute the disturbance to any of a variety of core deficits in the processing of information. In this respect, lack of insight is on conceptual par with alogia, apraxia or aphasia in reflecting disturbed cognitive processing. In this direction, research have implicated the role of *self-monitoring* in disorders of awareness and many of the core symptoms of schizophrenia, and has been suggested that these symptoms are the result of a disturbance of a medial frontal system involving anterior hippocampus, cingulated gyrus, supplementary motor area, and dorsolateral prefrontal cortex. Poor insight seems to be something more than a symptom or an epiphenomenon and its mechanism may constitute a core factor into the psychosis process. Also, poor insight could arise as a common mechanism for many other mental disorders or even it would be an independent and *trans-diagnostic factor* into the human personality, probably like the dimension of *psychotism*.

Key words: *psychosis, insight, schizophrenia, psychotism, metacognition, meta-representation, self-awareness, self-monitoring*, *anosognosia,* neuropsychiatry

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The notion of insight in psychiatry

Insight is defined as a person's ability to view oneself, including his psychological functioning, as if from the perspective of an external observer **[1].** In neuropsychiatry, the terms "anosognosia" and "lack of awareness" are synonyms, relating to an individual's pathology. The term "anosognosia" is used primarily to describe the lack of awareness of specific functions following brain damage, an example found in hemiplegia. The term "insight" is positioned more closely to the concept of "denial" and is used mainly in psychiatric disturbances, such as schizophrenia and bipolar disorder or even personality disorders, Alzheimer Disease or conditions related with judgment impairment. David (1990) **[2]** suggested three dimensions of *insight: (a) the acknowledgment of the existence of a psychiatric disorder, (b) therapeutic compliance, (c) the ability to name unusual internal experiences, such as hallucinations.* Amador & David (1998) **[3],** suggested five dimensions of *insight: (a)* the lack of awareness of their mental disorder, (b) the lack of awareness of the effects of medication, (c) the lack of awareness of the consequences of their pathology, (d) the lack of awareness of specific symptoms, and (e) the lack of awareness regarding the contribution of symptomatology to their pathology. The most renown scales developed for the measurement of insight are the Schedule for the Assessment of Insight **[2],** the Schedule for the Assessment of Insight – Expanded Version (SAI-E) **[4]** and the Scale to Assess Unawareness of Mental Disorder (SUMD) **[5].** In relation to *clinical insight* **[6],** research points out that patients with schizophrenia present lower levels of insight, compared to patients with depression or bipolar disorder **[7].** Similarly, low levels of insight have been found in individuals with schizo-affective disorder or mood disorders, with or without psychotic symptoms **[8,9],** although some researches failed to establish significant differences between the different groups of patients **[10].**

One of the most consistent and reliable literature findings concerns the positive relationship between *metacognitive capacity*, which leads to the recognition of the pathology, and low mood or depression. Similarly, an association has been established between pathologically elevated mood and the respective lack of awareness in multiple diagnostic groups **[3, 11].** Increased symptoms of depression in schizophrenia tend to be associated with increased levels of insight **[12]**.

Similar results were found in a meta-analysis by Mintz et al (2003) **[13],** analyzing 40 studies that explored the effect size between insight and symptoms domain in schizophrenia. Negative relationships of small effect size were established between insight and the total constellation of symptoms, but also individually between insight and positive and negative symptoms. In addition, a positive relationship was found between insight and depressive symptoms in schizophrenia, although the effect size remained small. The negative relationship between insight and positive symptoms was stronger in the most acute phase of schizophrenia, but decreased as patients reached stabilization. Guided by the hypothesis that depression is developed when patients are more aware of the presence and consequences of their psychosis, the authors described a *cognitive model of insight*, according to which the lack of insight reflects a form of self-denial in an attempt to target depressed feelings. Indeed, *poor insight* can often be interpreted as a form of *denial,* with the aim of maintaining an intact self-esteem. Conversely, *good insight* can be viewed as an example of "depressive realism". The exception that proves the rule is found in the case of psychotic depression, where the common link between low mood and good insight is eliminated, and psychosis ends up being the core symptomatology **[14].** A relationship was also supported regarding cognitive abilities (IQ) and insight in patients with schizophrenia **[15]**. A related study of 500 patients with psychosis showed that the lack of insight primarily reflects general cognitive ability, rather than a specific cognitive function **[16]**. Similarly, low insight was associated with low performance on the WCST, and in particular, performance on the WCST revealed a greater association with awareness compared to other cognitive features, such as IQ or memory **[17].** Beck & Warman **[18]** distinguished *cognitive insight* from *clinical insight,* as the latter is characterized by the recognition and acceptance of one's pathology. Cognitive insight is associated with the ability of attributive metacognition; the flexibility of a person to navigate between his beliefs, experiences and judgment. Within this context, the self-report Beck Cognitive Insight Scale **[19]** was developed.

The most prominent theoretical perspectives that attempt to account for the development of lack of insight are summarized as follows: (1) The *perceptual input* is impaired, as occurs with the loss of hearing or vision, which may in turn lead to paranoid ideation or other abnormal perceptual experiences, such as hallucinations. (2) There is a disruption in the *inferential process*, where the patient fails to recognize the consequences or the results of actions. (3). The *process of self-monitoring* is disturbed, and the experience of consciousness altered, disturbing the distinction in the perception of internally and externally produced phenomena. For instance,

a patient with auditory hallucinations may be engaged with inner speech, but he may not be aware of the fact that this speech is self-produced. (4). The processes of error checking may be disturbed, resulting in the disruption of the ability to doubt and discriminate what is indisputable from what may be possible or impossible. (5). The linkage between thought and affect is disrupted, leading to out of proportion affective reactions. (6) There are weaknesses in certain capacities, such as the capacity to hold on to a memory representation, organize a task and maintain the effort until successful completion **[3]**. Reviewing cases of schizophrenia, Carpenter **[20]** identified four subtypes of schizophrenia: (1) *typical schizophrenia*, with poor insight, paranoid and passivity delusions, auditory hallucinations and restricted affect, (2) *flagrant schizophrenia*, with irritable or bizarre behavior, incongruent affect and absence of anxiety or depression, (3) *insightful schizophrenia*, that appears similar to typical schizophrenia, but the person presents good insight, and (4) *hypocondriacal schizophrenia*, characterized by moderate insight and multiple somatic concerns and visual hallucinations.

Extending the boundaries of *insight*, we find notions related to other *self-awareness phenomena*. The concept of *self-deception* is defined as the eclectic and self-motivated absence of understanding of material that is psychologically comprehensible **[21, 22]**. It has been theorized as a defiant expansion of self-awareness, which concerns the lack of awareness regarding the presence of the pathology. In the case of self-deception, the lack of awareness tends to be global and incorporates large chunks of psychological material. Moreover, it is often associated with an individual's motivational components, something not evaluated in the cases of insight in schizophrenia**.** Sackeim & Gur (1978) **[23]** suggested the following criteria to describe the phenomenon of *self-deception*: (1). the person has two mental contents, that are conflicting when expressed as propositions, (2). these two mental contents occur simultaneously, (3). The individual is not aware of one of the two mental contents, (4). The process that defines which mental content is subject to awareness depends on the individual's motivation. The aforementioned researchers distinguished self- from other-deception, and created a related questionnaire, the Self-Deception Questionnaire. This scale comprises of 20 items, such as "*have you ever felt hatred toward either of your parents?, "Do you ever feel attracted to people of the same sex?", "Do you have sexual fantasies?".* The application in college students showed that levels of self-deception were negatively associated with self-reported depression, but also with overall presence of psychopathology **[24]**. Higher levels of self-deception were consistently associated with less or less severe symptoms of depression. It was supported that people with high levels of self-deception simply deny or minimize their perception of symptoms, negating the presence of symptoms primarily to themselves. It could be hypothesized that self-deception may have a protective role against depression. Conversely, depression on its own may reduce mechanisms of self-deception. Research has shown that a *denial component* remains consistent during emotionally heightened situations, both in the duration of the disorder but also following rehabilitation **[24]**. It is therefore likely that during depression the phenomenon of self-deception is maintained, and adopts the function of a trait, as much as a state, characteristic. Possibly, the absence of denial reflects a trait characteristic of depressed individuals. The absence of denial could be conceptualized as a form of depressive realism**.** Research has shown that at least one component of depressive realism is independent from the affective part of depressed patients. No particular association has been found between insight and psychosis in depressed patients, nor between levels of self-deception and psychosis. However, it was established that depressed patients with low levels of insight reported less depressive symptoms and it was hypothesized that a link between poor insight, high use of self-deception and less depressive symptoms exists in affective disorders. **[25]**. The *phenomenon of self-awareness* in affective disorders can be viewed on a continuum, with severe depression occupying one end, followed by mildly depressed patients with low levels of self-deception (the so-called *depressive realism*), and in the other end of the spectrum a group of healthy individuals with high levels of self-deception. This continuum appears to be independent of the psychotic process **[25]**.

Insight and neurological disorders

Clinicians working in neuropsychiatric contexts often notice that some patients develop a range of unusual disorders of *awareness* and *insight*. The quality of symptoms is so peculiar that they are classified as psychotic patients, until a potential brain damage is detected by a neurological examination. In 1914, Joseph Francois Felix Babinski **[26]** introduced the term *anosognosia*, in an effort to describe the denial of awareness of motor disorders. Today, the term is synonymous with "unawareness", "lack of insight" and "imperceptions of disease". Babinski had observed that these individual's lack of insight was not complemented by an overall loss of cognitive

ability, and in 1939 Lhermitte **[27]** distinguished the traditional "anosognosia", such as denial of hemigplegia, from "anosodiaphoria", such as indifference to hemiplegia. There are multiple accounts of cases with lack of awareness of auditory or visual limitations **[28]**, while in some of these cases a parallel development of delusions and hallucinations is noted **[29]**. In 1985, Fredericks **[30]** differentiated "verbal anosognosia", in which the patient expresses a denial of symptoms during the medical examination and complementary questions, from "anosognosic behaviour disorder", where patients display unusual reactions regarding their suffering parts. Some patients may deny a pathology's existence, other's may indicate they were suffering in the past but not now, and others may even give a nickname for their body parts presenting a disorder. Other disorders may encompass "body schema disorders", which usually involve amputated body parts for which the patient complains of heat or burning, while another case is that of the "alien hand syndrome", whose description involves capacity of the hand to act on its own (e.g. touching the buttons of a shirt). Most syndromes that involve a deficit in awareness of a pathology are associated with damage in the right hemisphere. Deficits caused by *Anton Syndrome* are due to damage of the primary visual cortex**.** The "phantom limb" syndrome usually results from an amputation, more often in left amputated limbs, but also due parietal damage **[31]**.

A constellation of *redublicative phenomena,* characterized by confusion regarding the identity of bodily parts, have been given different terms with the passage of time, such as *misidentification symptoms, redublicative phenomena,* or *confabulation* and include delusional beliefs involving people, places or body parts **[32]**. A disorder characterized by delusional beliefs relating to place is known as *reduplicating paramnesia*, during which a delusional belief that a given place has moved to another place exists. In 1923, Capgras and Reboul-Lachaux **[33]** described a 53 year old woman who exhibited the delusional belief that her family and friends had been replaced by an identical impostor. Although a diagnosis of *Capgras Syndrome* today refers to psychiatric deficits, in approximately half of these cases some form of brain damage is discovered. Many of these disorders have been attributed to right thalamoparietal damage. Delusional beliefs may concern limbs, as in the case of *somatoparaphrenia,* an example of which is manifested in the delusion that someone's hand belongs to somebody else's who might be on the bed **[35]**. Delusions may also result from temporal epilepsy and hallucinations of faces or animals, along with *lilliputian hallucinations*, due to lesions in the secondary cortical zones **[36]**. Damage in the prefrontal cortex, both in the dorsolateral and orbitofrontal cortex, are known to cause a wide range of cognitive deficits, in which the patient may experience apathy and decreased awareness **[37]**.

Most neurological research supports the association of awareness syndromes with impairment in the right parietal lobe or/and its connectivity with the thalamus and frontal lobe. Many authors have described these syndromes as *disorders of an internal representation of the body,* and especially of these of *body image* or *body schema* **[38]**. It should be noted that disorders upsetting the awareness of primary visual and acoustic functions are more likely the consequence wide-spread brain damage. It has been suggested that damage in the right parietal lobe disrupts this representation in consciousness **[39]**, through a failed reception of sensory information regarding the opposite side of the body **[40],** or due to damage in the completion of the internal or external stimulation in the parietal lobe **[41]**. Damage in the right parietal cortex may disrupt an individual's ability to evaluate the importance of a stimulus or to notice changes in the internal or external environment. Deficits in attentional ability are more likely to derive from damage in the right hemisphere, as the right hemisphere includes a greater area of the association cortex **[42]**.

Insight and Psychosis

It is agreed that patients with schizophrenia often exhibit poor insight or lack of awareness of their pathology. David **[2]** supported that insight associated with schizophrenia involves three characteristics: the recognition that someone has a disorder, the compliance with therapy and the ability to acknowledge the unusual mental events as pathological. German neurologist Carl Wernicke distinguished disorders of awareness of stimuli generated from the body, which he termed *somatopsychosis*, from disorders involving awareness of externally generated stimuli, which he termed *allopsychosis*. Although patients with schizophrenia do not exhibit obvious neurological deficits, they exhibit many unusual symptoms in their motor movement that resemble the characteristics previously described *somatopsychosis.* Research also shows that individuals with schizophrenia do not display awareness of *tardive dyskinesia*, a syndrome appearing in 20% of individuals receiving antipsychotic medication, with symptoms such as involuntary chorioathetosis**,** tics, grimaces and dystonia. These patients rarely complain of their symptoms, and they seem to

have greater lack of awareness about dystonia in their mouth compared to other parts of their body, while the lack of awareness also seems to be more prevalent when cognitive deficits or negative symptomatology coexists **[43, 44]**. Patients with schizophrenia present multiple unusual bodily experiences and lose the sense of their body image **[45]**, while these bodily experiences may be influenced by "external agents", a symptom belonging to *Schneider›s first-rank symptoms* of schizophrenia. Body-image disturbances and somatic delusions are reported in 15-30% of psychotic patients, and involve disorders in the perception of body shape, size or position **[46]**. Patients with psychosis, compared to those without the disorder, present a greater occurrence of body-image distortion symptoms **[47]**. Delusions and hallucinations prevail in individuals with schizophrenia, while at least 90% report abnormal beliefs **[48]**. The inability to recognize the irrational nature of delusional beliefs is the key feature of the diagnosis of schizophrenia. However, similar to frontal lobe syndrome, patients with schizophrenia are able to recognize this irrational nature in others, even if they are unaware of it in themselves **[49]**. Most theoretical etiological perspectives refer to primary deficits in perception, attention or consciousness **[48]**. On the one hand, it is supported that delusions are the result of an expected and normal interpretation of an abnormal sensory experience **[50]**, while opposite views posit that an anomalous logic is used to interpret a normal perceptual experience **[51]**. The rather complex *Capgras Syndrome*, also observed in individuals suffering from Schizophrenia, often presents neurological changes and deficits. Multiple psychological mechanisms may co-exist, such as depersonalization, wish fulfillment, an inability to face ambivalent feelings, incestuous wishes and homoeroticism **[52]**. A typical characteristics of misidentification syndromes is that patients accept and maintain a double orientation to the "truth" of their delusions. A similar situation has also been described for recovering individuals with schizophrenia and has been termed *double awareness phase* **[53]**. Primary research has shown that hallucinations exist in at least 50% of patients with schizophrenia, and approximately one out of three report auditory hallucinations, while one out of five report visual hallucinations. In most cases these involve human voices talking in the third person **[48].** Furthermore, hallucinations seem to be more detailed and complex in patients with schizophrenia compared to those with neurological disorders. A research investigating the "source" of hallucinations, using a questionnaire directed at schizophrenic patients, found that 40% of patients failed to answer questions on this topic **[5]**.

Representation of information and insight in Psychosis

Most researchers support that similar to delusions, hallucinations result from the combination of a faulty perceptual process and faulty interpretive process. They also highlight their similarity with damage in the dorsolateral and orbitofrontal cortex, indicating that the level of the absence of awareness resembles the deficits in the process of error monitoring evident in patients with frontal disorders **[54]**. *Echolalia*, the automatic repetition of other's speech, and *echopraxia*, the automatic repetition of other's movements, are rate yet characteristic elements of both schizophrenic and frontal syndrome patients **[55]**. Consequently, from these findings it can be supported that at least some symptoms of unawareness in schizophrenic patients may be related with frontal lobe dysfunction **[56]**. It can also be suggested that the majority of awareness disorders in neurological patients are the result of right hemispheral damage, while findings regarding the lateralization of damage in schizophrenia suggest deficits in the left hemisphere. The initial hypothesis was related to the schizophreniform symptoms presented in patients with left temporal lobe epilepsy **[57]**. This finding was later reinforced both by postmortem studies **[58]** and neuroimaging research **[59]**. Nevertheless, in 1985 Cutting **[48]** suggested the presence of a right hemispheral anomaly, supporting the presence of a hemispheric imbalance in which the mechanisms of a malfunctioning right hemisphere lead to left hemisphere hyperfunction. This right hemispheral disorder is responsible for the deficits in body image perception we encounter in schizophrenic patients, but also in the difficulties of affect processing and expression. In the same year, Cummings **[60]** additionally postulated that posterior right injuries result in a disruption of the passage of information into the limbic system, which in turn leads to delusions and hallucinations. These two researchers hypothesized that symptom development follows the extent of brain damage. For instance, the perceptual symptoms of body image perception may reflect right posterior brain damage, while paranoid ideations and thought deficits may be linked to disordered mechanisms in the left hemisphere. Additionally, several neurobehavioral theories of awareness and body image disorders indicate the role of the right inferior parietal lobe in attentional impairment, despite the parietal lobe not being particularly considered accountable for schizophrenia **[41]**.

Multiple neuropsychological theories of awareness emphasize the role of an *error-monitoring system* **[54]**, which consists of three parts: (a) An internal representation of the desired outcome, (b) a feedback related to the outcome and (c) a comparison between the desired and final outcome. *Anosognosia* or the

overall *lack of insight* may result from fault in the mechanisms determining the desired outcome, or disturbances in the process of comparison. Similarly, in 1989 McGlynn & Schacter **[61]** suggested the presence of a *conscious awareness system* located in the inferio-parietal lobe, while in 1988 Shallice **[62]** presented the case of the *supervisory attentional system*. In 1992, Frith's **[63],** proposal of a *cybernetic model* put emphasis on *intention* and on the *monitoring system*. Frith supported that schizophrenia can be seen as *a disorder of meta-representation,* which plays an important role in awareness processes. This model involves (a) the awareness of one's goals, (b) the awareness of one's intentions, and (c) the awareness of the intentions of others. Frith hypothesized that the lack of awareness of one's goals leads to disorders of willed action characterized by negative symptoms, such as apathy. Lack of awareness of intentions leads to self-monitoring disorders and anomalies in the experience of action, such as motor movement deficits. In addition, limitations in social interaction leads to delusions of persecution and reference. Hallucinations are the result of a person's failure to recognize the self-generated nature of some actions or of inner speech, attributing it to an external source. Most positive symptoms can, according to Frith, be explained as a deficit in the capacity to distinguish between changes resulting from actions of the individual himself and those resulting from external events. Although these views emphasize *output mechanisms,* most neurobehavioral theories on delusions and hallucinations attribute them to deficits in perceptual *input mechanisms*. Input mechanisms are mostly associated with posterior brain areas, such as the parietal lobe, while output mechanisms are mostly associated with frontal areas, including the frontal cortex (Barr, 1998). Finally, Frith **[63]** suggested that brain areas involved in the disorders of willed action, such as the *dorsolateral prefrontal cortex*, the *supplementary motor area* and the *anterior cingulate gyrus* are responsible for the positive symptoms in schizophrenia, while the monitoring system seems to be primarily linked with the hippocampal system.

Disturbances of the self and insight in psychosis

The term *"self"* is defined as a constellation of characteristics, such as the body, emotions, thoughts and senses, which makes up an individual's *identity* and which differentiates him from others (Keefe, 1998, Keefe et al, 1995). Kraepelin, Bleuler, Schneider and numerous other researchers characterized schizophrenia as a *disorder of the self*. Patients appear to have a cognitive deficit in their capacity to maintain the distinction between the internal, mental phenomena generated within the boundaries of their nervous system and those occurring outside of their bodies, which are perceived through their senses. In 1993, Keefe **[64, 65]** termed these manifestations as *autonoetic agnosia,* referring to the "deficit in the ability to recognize self-generated mental phenomena". These involve delusions, hallucinations, ideas of thought broadcasting or thought insertion, etc. Hallucinations are considered the result of a misinterpretation of an internally generated mental phenomenon as something that has been generated in the externally perceived environment. All people may experience intense, and often quite lively visual or auditory memories or fantasies on an everyday basis, but they do not attribute them to some external agent. This type of misinterpretation has been found to take place in approximately 70% of patients with schizophrenia **[66]**. Moreover, many of the delusions of schizophrenic patients seem to involve a *misunderstanding of the self*. The most important delusional belief according to Schneider **[67]** is that of *thought insertion,* where external thoughts are inserted into these of the patient, *thought withdrawal,* where an external source withdraws thoughts from those of a patient, *thought broadcasting,* where thoughts are being shared to the environment and are thus available to others, and *delusional control*, where there is a sense that one's motor movements are determined by an external source. As previously mentioned, *insight* is defined as the ability of a person to view oneself, including his psychological functions, as if from the perspective of an external observer **[1].** Schizophrenic patients thus exhibit *autonoetic agnosia* **[64, 65],** since they do not only experience a limited capacity for insight in relation to their symptomatology, but they also have limited capacity for self-observation, resulting in a difficulty shifting between internal and external observation. This difficulty in the normal development of *the capacity to separate self and other* was a rather primary observation and was believed to originate from the early interaction between parent and child **[68, 69, 70].** These theories discussing the *schizophrenogenic parent* were rejected due to limited empirical evidence **[71]**, but views on the early establishment of a difficulty to separate an internal-external mental world remain, since it is evident that this discriminative ability is possible from infancy **[72]**. Still, individuals of normal development exhibiting hemiplegia often develop characteristics of *anosognosia*, followed by a denial regarding the obvious bodily deficits. Thus, a continuing question of the scientific community is the extent to which individuals with schizophrenia, who exhibit a profound inability to determine the source of their symptoms, are similar to individuals with anosognosia.

One of the most important brain functions is to recognize what element belongs to the self and what does not. In ba-

sic survival terms, we need to discriminate between elements belonging to our body and elements belonging to the external environment, since the latter may endanger our health through viruses, internal injuries etc. This requirement emerges in numerous everyday tasks, and our nervous system, as our immune system, expends large amounts of energy to maintain this distinction between internal and external. Imagine for example the problem that will occur if our nervous system fails to establish these boundaries of the self in periods of hunger. Furthermore, it is not enough to merely distinguish between internal and external events, but also between our own emotional reactions and other's emotional experiences **[64, 65]**. We are aware that individuals with brain damage or lesions present deficits in their mental imagery capacity, which are in line with deficits in perception, pointing to the presence of parallel neural pathways during imagery and visual perception **[73,74]**. In addition, brain areas encompassed in the realm of vision are also involved in visual mental imagery, while neural connections between the anterior inferior temporal lobe and the primary visual area of the occipital lobe indicate that visual images are shaped with the use of information stored in memory. Research employing PET scans has shown that the brain areas involved in visual mental imagery encompass, apart from the primary visual cortex in the occipital lobe, the superior parietal regions for the capacity to differentiate one image from another, the inferior parietal regions for the topographical coding of visual fragments during the assembly of an image, the temporal lobe for the recollection of material from our visual memory, and the prefrontal cortex, for the production of an image, extending it and potentially complementing it with older memory fragments. The question arising in relation to the case of *autonoetic agnosia* in schizophrenic patients concerns the point in this process where the internally generated image is confused with the externally perceived object. It is likely that *top-down processes* play an important role, since even the compartmentalized or fragmented visual information tends to be complemented by internal mechanisms of mental imagery **[73,74].**

Neuroanatomy of poor insight in psychosis

Some patients with temporal epilepsy develop symptoms similar to *Snaiderian* and symptoms of *autonoetic agnosia* **[75]**, while cases of malfunction of the temporal lobe or hippocaempal structures in patients with schizophrenia have also been reported **[76]**. The hippocampus is central for the comparison between sensory information and expected perceptual input, through an internally generated world constructed by memories. Schizophrenics clearly present with a weakness in maintaining an intact memory representation of the external world, something that deters the comparison between internal and externally generated phenomena. The temporal lobe has been considered the centre of auditory hallucinations. Electrical stimulation of the temporal lobe may generate auditory hallucinations, and the left temporal cortex is the most common brain area involved in epilepsy with auditory hallucinations **[77]**.

The anterior cingulate plays a key role in distinguishing between imagery and perception. Individuals with anterior cigulatomy have reported an automatic generation of imagery with perceptual content **[78].** The fact that increased activation of the anterior cingulate occurs in cases when a response to external events is required **[79]**, but not during the examination of internal spiritual or mental processes **[80]**, indicates that this structure supports the identification of external events as deriving from outside the self. Based on these findings, it was suggested that intentions are involved in the monitoring system from the prefrontal cortex, through the hippocampal-entorhinal cortex and the cingulate, and are completed in the basal ganglia and supplementary motor area **[81].** Decreased neural density in the anterior cingulate has been documented in psychotic patients, which indicates a developmental deficit in neural differentiation or migration. This may be encompassed in the etiology of schizophrenia symptoms: the abnormal connectivity of the anterior cingulate with the hippocampus may denote an abnormal myelination during late puberty, thus directing to the neurodevelopmental perspective on schizophrenia development **[82]**.

The functions of the *prefrontal cortex* are not fully understood, but we are aware that this brain area is involved in guiding behavior, including monitoring, action, decision making, planning and creativity, with the support of the working memory and through knowledge categorization **[83]**. The *supervisory attentional system* postulated by Shallice (1988) **[62]** incorporates the prefrontal cortex as a core structure. Indeed, the prefrontal cortex seems to play a role in this system in various ways. For example, both the visual perceptual process and visual mental imagery seem to stimulate similar neural networks, such as the primary visual cortex, the posterior parietal cortex, temporal areas and the dorsolateral prefrontal cortex. Yet, an important distinction arises in the fact that neural networks involved in imagery result to the triggering of top-down processes, whereas neural networks in perception are associated with bottom-up processes **[84]**.

Movement behavior begins with projections from the prefrontal cortex to the striatum, followed by the globus palidus and from there to the anteroventral and ventrolateral thalamic nuclei, which in turn project to the premotor area and the supplementary motor area and to the anterior cingulate **[80, 81]**. Malfunction in any of these areas may lead to disorders such as Parkinson's disease, while the positive symptoms of schizophrenia have also been associated with a failure in monitoring movements, accounted for by deficits between premotor areas and the striatum. This is supported by the symptom of a sense of movement, as if controlled by external forces, in patients with *Metachromatic Leukodystrophy*, where the white matter connectivity of several cortical areas, and in particular the frontal cortex is upset **[85]**.

The neuroanatomical *model of autonoetic agnosia* **[64, 65]** in schizophrenia suggests that the cognitive deficit in insight may be caused by a disrupted connectivity between specific brain areas. *Computer generated models* on information processing attempted to describe mechanisms through which the development of some symptoms takes place. The isolation of some computer parts led to several consequences, such as leading to conclusions irrelevant to the incoming data or the independent uncontrolled functioning of some parts. Applying these observations to cognitive contexts, the pioneers Hoffman & McGlashan **[86]** in 1993 hypothesized that if for instance some brain areas responsible for speech were isolated from the network of movement initiation, such as the supplementary motor area during the period of *cortical pruning,* the development of some form of subvocal speech would be possible perceived by the patient as independent of other intellectual processes and thus interpreted as a hallucination or as some thought deficit. A similar proposal was made by David in 1994 **[87],** who supported that the excessive neural activity between two brain areas, known as *dysmodularity,* provides a more accurate explanation for the pattern of cognitive deficits and neuroanatomical findings in patients with schizophrenia. This presupposes the burdening of the cognitive system and reduced brain hemispheric asymmetry, as suggested by Crow (1990) **[88]**, as well as reduced gray compared to white matter, which is associated with greater connectivity between brain areas **[89].**

The type of connectivity between brain areas in schizophrenic patients remains a central area of research in the field of neuroscience. Initial SPECT research had shown increased blood flow in the Broca's area in patients with auditory hallucinations **[90]**, a finding that denotes that auditory hallucinations are part of an inner speech which is not under the control of the self-monitoring system. However, other research using PET showed that in schizophrenic patients with auditory hallucinations there was reduced metabolism in the Broca and Wernicke's areas of the audiroty cortex, compared to patients without auditory hallucinations. Nevertheless, the hypothesis that the strongest connection in schizophrenia occurs between insight and the right frontal, parietal and temporal lobes, along with the striatum, remains, further reinforced by findings on patient's performance on the Wisconsin Card Test **[91]**. Neuroimaging findings suggest a relationship between poor insight and the global reduction of brain volume **[92]**, reduced volume of the frontal lobe **[93]**, and reduced volume of the cingulate gyrus and temporal lobe **[94]**, despite the existence of research supporting opposite findings **[95]**. Different method of imaging, analysis and measurement, but also the use of psychometric scales, are undoubtedly associated with the arising conflicting findings. Recent research has found an association between insight and the cortical thickness in patients during their first episode of psychosis **[96]**, the homogeneity of the white matter **[97]** and the cingulate gyurs of patients during their first episode of psychosis **[98]**. In addition, there seems to be an involvement of the cortical midline system, especially of the medial frontal (ventro-medial, BA 10, 11 and dorso-medial, BA 9) and of the cingulate gyrus. A meta-analysis by van der Meer et al (2010) emphasizes the involvement of the frontal segments in the activity of self-observation, compared to observation of others. Also, there was an activation of the right superior frontal gyrus (BA 9), close to the median line**,** when normal individuals were asked to replace themselves with a significant other figure, e.g. the prime minister Tony Blair **[99]**, whereas in schizophrenic patients no such activation occurred. The authors interpreted this finding as the patients' weakness to distinguish themselves during a meta-cognitive process. This finding is similar to the research by Holt et al **[100]**, in 2011, according to which patients with schizophrenia in a similar task displayed less activation in the medial prefrontal areas and slightly more in the medial posterior cingulate, which suggests «an anterior-to-posterior shift in medline cortical activity in schizophrenia». These findings are in line with those established in the long term studies by Michael Petrides **[101, 102, 103]** in humans and monkeys, according to which cortical lesions and damage in the medial part of the *mid-dorsolateral prefrontal cortex* (BA 46 & 9/46) lead to deficits in tasks of the monitoring of information in *working memory,* where the capacity for an *epoptic processing* of information is evaluated, while the

architectonic areas 46 & 9/46 of the prefrontal cortex appear to be linked with specific segments of the *inferior parietal lobe* through the *superior longitudinal fasciculus.* The inferior part of the posterior parietal cortex seems to be a crucial area for the updating of information in the working memory and the BA *46 & 9/46* encode it into an "abstract/symbolic form", in order to achieve the controlled monitoring in the active mnemonic process. According to Petrides **[103]** (2013), this system has the capacity to hold symbolically coded information in an active state, in order to supervise the between them relation and their relation with the intended programmed behavior . Adding to this topographical theory, Devinsky **[104]** (2009) mentioned characteristically: «Delusions result from right hemisphere lesions. But it is the left hemisphere that is deluded**».** It should also be noted that theories of self-monitoring and error-checking agree with the theory concerning the use of a salience network. According to Corlett et al (2010) **[105],** there are two *types of error prediction* associated with schizophrenia and the development of delusional beliefs, playing opposite roles: one that overweights the prediction versus one that underweights the prediction. The *over-weighting of the prediction* may be prioritized due to its pathogenetic nature, occurring first, and is followed by the *under-weighting of the prediction,* which bears as a result a state of fatigue and withdrawal. Neurobiologically, the hyperactivation of the salience network is likely followed by the hyper-activation of the default mode network (DMN) and subsequently by the suppression of the salience and attention network. This initial hyperactivation seems to be normalized by antipsychotics, since as stated by Kapur (2003) **[106],** "Antipsychotics dampen the salience of these abnormal experiences and by doing so permit the resolution of symptoms… they do not erase the symptoms but provide the platform for a process of psychological resolution… if treatment is stopped, the dysregulated neurochemistry returns, the dormant ideas and experiences become reinvested with aberrant salience, and a relapse occurs".

Insight and Metacognitive processes

The field of *metacognition* has enriched what is known as cognitive neuropsychiatry, an area promoting the research of cognitive processes that account for psychological and behavioral abnormalities. Saxe & Ofen **[107]**, in 2010, suggested the area of «attributive metacognition», which involves the capacity of a person to determine his beliefs and desires functioning as a part of his capacity for self-awareness, and the area of strategic metacognition, which refers to a person's capacity to monitor and control his mental acitivities. Their differences are found both in the objects of the thoughts (beliefs and desires vs mental activities and planning), and in the action that follows (attribution as interpretation vs strategy as control). The notion of *meta-memory* was created within this context, and its investigation through a psychometric questionnaire employed the question *"how many words does a person predict that he will remember from a given list of words".* David et al **[6],** in 2012, found that bipolar patients and patients with Alzheimer's disease, but not patients with schizophrenia, overestimated their memory capacity. The term *metacognitive thought* was initially introduced in the literature of education as the "capacity of thinking about thinking" during learning **[108]**, but throughout the years has gained a broad range of meanings which reflect the general ability of *thinking about thought* both in terms of content, but also in terms of its underlying processes. Therefore, while originally the term primarily described a person's ability to observe his own thought processes and to detect in them potential errors, it later included incorporated the ability of "awareness of cognitive distortions" **[109]**, as well as "thinking about emotions" **[110]**, while the importance of metacognitive thought in the triggering of reactions deriving from thoughts and emotions has been repeatedly highlighted. It should be noted that the use of the term "*metacognitive thought"* is often parallel to the use of other terms, such as *theory of mind* (TOM) and *mentalization*. The term theory of mind refers to «thinking about the thoughts of others during the process of relating to them" **[111]** and constitutes a major component of metacognitive thought as an element of a broader system that permits the capacity of *thinking about thinking*. The term *mentalization* refers predominantly to the understanding of internal states within the context of an attachment bond". Consequently, the term "metacognitive thought" can be conceptualized as *a range of activities, from thinking about specific psychological phenomena to compiling perceptions into complete and coherent representations of oneself and others* **[112, 113, 114]**. This constructive *metacognitive acitivity* involves: (1) the capacity for the construction of complex representation of internal states of the self and the ability to reflect upon these states, which is described with the term self-reflectivity (2) the capacity for the construction of complex mental representations of the internal states of others and the capacity for reflection upon them, which is referred to as the understanding of the mind of others, (3) the

ability to place these representations in a world where the self is not the center, which is labeled with the term *decentration*, (4) the ability to use knowledge to deal with and resolve psychological and social challenges, which is attributed as mastery [**115, 116**].

The theory of emotion regulation seems to hold an important place in the interpretation, but also in the consequences of lack of insight. Recently, Massons et al **[117]** (2017) studied 143 patients with psychosis using the Scale of Unawareness of Mental Disorder (SUMD), the Markova and Berrios Insight Scale and the 8th item of the Calgary Depression Scale for Schizophrenia (CDSS), and found that the awareness of the mental disorder was associated with higher scores on suicidality, especially in the following two items of awareness «disturbed thinking and loss of control over the situation» and «having a vague feeling that something is wrong». It is known that different emotions produce different behaviors, and that the same feeling under different circumstances may produce a different behavior. Emotions inform us on whether we are safe or not, without providing clear directions on the achievement of a goal. The theory of meta-emotion was developed within this context, exploring the relationship between affective reactions to primary emotions and the motivation for their change, along with the reactions directed at the "emotional self"; all of which formed the base for the development of the *Meta-Emotion Scale* (with items concerning anger, compassion, interest, embarrassment, cognitive control and thought suppression) **[118].** Thereof, we have arrived at a point where we are talking about the "cognition about emotion", but also about secondary emotions that attempt to determine the primary (emotions about emotions), based on which Dina Mendoca (2013) **[119]** suggested specific *metaemotional strategies* for the support of

psychotic patients, such as predictions about future emotions (anxiety for future anxiety), identification of current emotions, monitoring of changes in one's affective state, organization of a future plan of action, and regulation of future emotions that are diverted, as well as evaluation of the result.

Conclusively, symptoms of schizophrenia could be explained as additional deficits in a sequence of developments, during the process of representation and interpretation of information (meta-representation process), but also during the cognitive enrichment and subsequent processing (meta-cognitive process). It should be noted that the lack of insight is not only documented in psychosis (in schizophrenia or affective disorders), but also in diagnoses of "neuroses", such as body dysmorphic disorder **[120],** hoarding disorder **[121]** and anorexia nervosa **[122]**. Surprisingly, the DSM 5 [**123]** mentions only about the lack of insight in three disorders, obsessive-compulsive disorder (OCD), body dysmorphic disorder and hoarding disorder, requiring the clinician to determine whether the patient has good insight, poor insight or the abstract term absent/delusional beliefs to account for lack of insight. Since the deficit in insight, at least in schizophrenic patients, appears to be less than an epiphenomenon of the disorder, the place, and potentially even the manner through which insight is developed may be a key element in the development of psychotic disorders. The mechanism that leads to the development of poor insight deserves to be further studied in the future, and not just as a pathogenetic mechanism of the development of psychosis, but also as an etiological component of multiple other psychological disorders **[124].** Also, the *lack of insight* may constitutes a *trans-diagnostic factor* underlying the human condition, independent of diagnosis, in a manner similar or parallel to the manner in which *psychotism* operates, as described by Van Os & Reinighaus (2016) **[125]**.

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References

1. Amador, X. F., Strauss, D. H., Yale, S. A., & Gorman, J. M. (1991). Awareness of illness in schizophrenia. *Schizophrenia Bulletin, 17,* 113-132.
2. David, A. S. (1990). Insight and psychosis. *British Journal of Psychiatry, 156,* 798-808.
3. Amador X & David A. Insight and psychosis, 1998, Oxford University Press, NY Oxford.
4. Wiffen, B. D. R., Rabinowitz, J., Lex, A. & David, A. S. 2010 Correlates, change and ‹state or trait› properties of insight in schizophrenia. *Schizophr. Res.* 122, 94-103.
5. Amador, X. F., Strauss, D. H., Yale, S. A., Gorman, J. M., & Endicott, J. (1993). The assessment of insight in psychosis. *American Journal of Psychiatry, 150,* 873-879.
6. David A, Bedford N, Wiffen B, Gilleen J. Failures of metacognition and lack of insight in neuropsychiatric disorder. Phil. Trans. R. Soc. B., 2012, 367, 1379-1390.
7. Michalakeas, A., Skoutas, C., Charalambous, A., Peristeris, A., Marinos, V., Keramari, E. & Theologou, A. 1994 Insight in schizophrenia and mood disorders and its relation to psychopathology. *Acta. Psychiat. Scand.* 90, 46-49.
8. Amador, X. F., Flaum, M., Andreasen, N. C., Strauss, D. H., Yale, S. A,, Clark, S. C. & Gorman, J. M. 1994 Awareness of illness in schizophrenia and schizoaffective and mood disorders. *Arch. Gen. Psychiat.* **51,** 826-836
9. Pini, S., Cassano, G. B., Dell›Osso, L. & Amador, X. F. 2001 Insight into illness in schizophrenia, schizoaffective disorder, and mood disorders with psychotic features. *Am. J. Psychiat.* **158,** 122-125.
10. Cuesta, M. J., Peralta, V. & Zarzuela, A. 2000 Reappraising insight in psychosis. Multi-scale longitudinal study. *Brit. J. Psychiat.* 177, 233-240

11 Clare, L. 2004 The construction of awareness in early- stage Alzheimer›s disease: a review of concepts and models. *Brit. J. Clin. Psychol.* **43,** 155-175.

12. Schwartz, R. C. 2001 Self-awareness in schizophrenia: its relationship to depressive symptomatology and broad psychiatric impairments. *J. Nerv. Ment. Dis.*

13. Mintz AR, Dobson KS, Romney DM. Insight in schizophrenia : a mata-analysis, Schizophrenia Research, 2002, 61, 75-88.

14. Owen, G. S., Richardson, G., David, A. S., Szmukler, G., Hayward, P. & Hotopf, M. 2009 Mental capacity, diagnosis, and insight in psychiatric inpatients: a cross-sectional study. *Psychol. Med.* **39,** 1389-1398.

15. David, A. S. 1999 ‹To see ourselves as others see us.› Aubrey Lewis›s Insight. *Brit. J. Psychiat.* 174, 210-216.

16. Keshavan MS, Rabinowitz J, DeSmedt G, Harvey PD, Schooler N. Correlates of insight in first episode psychosis. Schizophr Res. 2004, Oct 1;70(2-3):187-94.

17. Aleman, A., Agrawal, N., Morgan, K. D. & David, A. S. 2006, Insight in psychosis and neuropsychological function: meta-analysis. *Brit. J. Psychiat.* 189**,** 204-212.

18 Beck, A. T. & Warman, D. M. 2004 Cognitive insight: theory and assessment. In *Insight and psychosis: awareness of illness in schizophrenia and related disorders* (eds X. F. Amador & A. S. David), pp. 79-87, 2nd edn. New York, NY: Oxford University Press.

19. Beck, A. T„ Baruch, E„ Baiter, J. M„ Steer, R. A. & Warman, D. M. 2004 A new instrument for measuring insight: the Beck cognitive insight scale. *Schizophr. Res.* 68, 319-329.

20. Carpenter, W. T., Jr., Bartko, J. J., Carpenter, C. L., & Strauss, J. S. (1976). Another view of *schizophrenia subtypes.* Archives of General Psychiatry, 33, *508-516.*

21. Fingarette, H. (1969). *Self-deception.* London: Roufledge & Kegan Paul.

22. Sackeim, H. A. (1988). Self-deception: A synthesis. In J. S. Lockard, & D. L. Paulhus (Eds.), *Self-deception: An adaptive mechanism* (pp. 146-165). New Jersey: Prentice Hall.

23. Sackeim, H. A., & Gur, R. C. (1978). Self-deception, self-confrontation, and self-consciousness. In G. E. Schwartz, & D. Shapiro (Eds.), *Consciousness and self-regulation* (pp. 139-197). New York: Plenum Press.

24. Linden, W., Paulhus, D. L., & Dobson, K. S. (1986). The effects of response styles on the report of psychological and somatic distress. *Journal of Consulting and Clinical Psychology, 54,*309-313.

25. Sayer, N. A., & Sackeim, H. A., Moeller, J. R., Prudic, J., Devanand, D. P., Coleman, E., & Kiersky, J. E. (1993).The relations between observer-rating and self-report of depressive symptomatology. *Psychological Assessment,* 5, 350-360.

26. Babinski, M. J. (1914). Contibution a l'etude des troubles menaux dans l'hemiplegie organique cerebrale (Anosognosie). *Revue Neurologique, 12,* 845-848.

27. Lhermitte, J. (1939). *L'image de notre corps.* Paris. Nouvelle Revue Critique.

28. David. A. S., Owen, A. M., & Forstl, H. (1993). An annotated summary and translation of «On the self-awareness of focal brain diseases by the patient in cortical blindness and cortical deafness» by Gabriel Anton (1899). *Cognitive Neuropsychology, 10,* 263-272.

29. Brockman, N. W., & von Hagen, K. O. (1946). Denial of blindness (Anton›s syndrome). *Bulletin of the Los Angeles Neurological Society, 11,* 178-180.

30. Frederiks, J. A. M. (1985). Disorders of the body schema. In J. A. M. Frederiks (Ed.), *Handbook of clinical neurology: 1 (45): Clinical neuropsychology,* pp. 373-393. Amsterdam: Elsevier.

31. Hecaen, H., Penfield, W., Bertrand, C., & Malmo, R. (1956). The syndrome of apractognosia due to lesions of the minor cerebral hemisphere. *Archives of Neurological Psychiatry, 75,* 400-434.

32. Forstl, H., Almeida, O. P., Owen, A. M., Burns, A. & Howard, R. (1991). Psychiatric, neurological and medical aspects of misidentification syndromes: A review of 260 cases. *Psychological Medicine, 21,* 905-910.

33. Capgras, J., & Reboul-Lachaux, J. (1923). L'illusion des «sosies» dans un delire systematise chronique. *Bulletin de la Societe Clinique de Medecine Mentale, 11,* 6-16.

34. Kapur, N., Turner, A., & King, C. (1988). Reduplicative paramnesia: Possible anatomical and neuropsychological mechanisms. *Journal of Neurology, Neurosurgery, and Psychiatry,* 51, 579-581.

35. Gerstmann, J. (1942). Problem of imperception of disease and of impaired body territories with organic lesions : Relation to body scheme and its disorders. Archive of Neurology and Psychiatry, 48, 890-913.

36. Penfield, W., & Rasmussen, T. (1950). *The cerebral cortex of man.* New York: MacMillan.

37. Luria, A. R. (1980). *Higher cortical functions in man* (2nd ed.). New York: Basic Books.

38. Fisher, S. (1970). *Body experience in fantasy and behavior.* New York: Appleton-Century-Crofts.

39. Schilder, P. (1935). *The image and appearance of the human body.* London: Kegan Paul, Trench, Trubner.

40. Denny-Brown, D., & Chambers, R. A. (1958). The parietal lobe and behavior. *Research Publications—Association for Research in Nervous and Mental Disease, 36,* 35-117.

41. Mesulam, M. (1985). Patterns in behavioral neuroanatomy: Association areas, the limbic system, and hemispheric specialization. In M. Mesulam (Ed.), *Principles of behavioral neurology,* Philadelphia: F.A. Davis.

42. Goldberg, E., & Costa, L. D. (1981). Hemisphere differences in the acquisition and use of descriptive systems. *Brain and Language, 14,* 144-173.

43. Alexopoulos, G. (1979). Lack of complaints in schizophrenics with tardive dyskinesia. *Journal of Nervous and Mental Disease, 167,* 125-127.

44. MacPherson, R.. & Collis, R. (1992). Tardive dyskinesia: Patients› lack of awareness of movement disorder. *British Journal of Psychiatry, 160,* 110-112

45. Bleuler, E. **(**1950**)** Dementia Praecox or the Group of Schizophrenias, 1911 *(English translation: J. Zinkin). New York: International Universities Press.*

46. Cutting, J. (1980). Physical illness and psychosis. *British Journal of Psychiatry, 136,* 109-119.

47. Reitman, E. E., & Cleveland, S. E. (1964). Changes in body image following sensory deprivation in schizophrenia and control groups. *Journal of Abnormal Social Psychology, 68,* 168-176.

48. Cutting, J. (1985). *The psychology of schizophrenia.* Edinburgh: Churchill Livingstone.

49. Brown, R. (1973). Schizophrenia, language, and reality. *American Psychologist, 28,* 395-403.

50. Maher, B. (1974). Delusional thinking and perceptual disorder. *Journal of Individual Psychology,* 30,98-113.

51. Arieti. S. (1974). *Interpretation of schizophrenia* (2nd ed.). New York: Basic Books.

52. Berson, R. J. (1983). Capgras syndrom *e. American Journal of Psychiatry, 140,* 969-978.

53. Sacks, M. H., Carpenter, W. T., & Strauss, J. S. (1974). Recovery from delusions:

Three phases documented by patients› interpretation of research procedures. *Archives of General Psychiatry, 30,* 117-120.

54. Goldberg, E., & Barr, W. B. (1991). Three possible mechanisms of unawareness of deficit. In G. P. Prigatano & D. L. Schacter (Eds.), *Awareness of deficit after brain injury: Clinical and theoretical issues* (pp. 152-175). New York: Oxford University Press.

55. Andreasen, N. C. (1982b). The relationship between schizophrenic language and the aphasias. In F. A. Henn & H. A. Nasrallah (Eds.), *Schizophrenia as a brain disease.* New York: Oxford University Press.

56. Young, D. A., Davila, R., & Scher, H. (1993). Unawareness of illness and neuropsychological performance in chronic schizophrenia. *Schizophrenia Research, 10,* 117-124.

57. Flor-Henry, P., Koles, Z. J., Howarth, B. G., & Burton, L. (1979). Neurophysiological studies of schizophrenia, mania and depression. In J. Gruzelier & P. Flor-Henry (Eds.), *Hemisphere asymmetries of function in psychopathology,* pp. 189-222. New York: Elsevier.

58. Crow, T. J., Ball, J., Bloom, S. R., Brown, R., Bruton, C. J., Colter, N., Frith, C. D., Johnstone, C., Owens, D. G. C., & Roberts, G. W. (1989). Schizophrenia as an anomaly of development of cerebral asymmetry. *Archives of General Psychiatry, 46,* 1145-1150.

59. Bogerts, B., Ashtari, M., Degreef, G., Alvir, J. M., Bilder, R. M., & Lieberman, J. (1990). Reduced temporal limbic structure volumes on magnetic resonance images in first episode schizophrenia. *Psychiatry Research: Neuroimaging, 35,* 1-13.

60. Cummings, J. L. (1985). Organic delusions: Phenomenology, Anatomical Correlations, and Review. *British Journal of Psychiatry, 146,* 184-197.

61. McGlynn, S. M., & Schacter, D. L. (1989). Unawareness of deficits in neuropsychological syndromes. *Journal of Clinical Experimental Neuropsychology, 11,* 143-205.

63. Shallice, T. (1988). *From neuropsychology to mental structure.* Cambridge: Cambridge University Press

63. Frith, C. D. (1992). The cognitive neuropsychology of schizophrenia. Hove, England: Erlbaum.

64. Keefe, R. S. E., Blum, C., Roitman, S. L., Harvey, P. D., Davidson, M., Mohs, R. C., & Davis, ^ K. L. (1993). *Cognitive dysfunction in Kraepelinian schizophrenics.* Presented at the American College of Neuropsychopharmacology Annual Meeting.

65. Keefe, R. S. E., Roitman, S. L., Harvey, P. D., Blum, C., DuPre, R. L., Prieto, D. M., Davidson, M., Davis, K. L. (1995). A pen-and-paper human-analogue of a monkey prefrontal cortex activation task: Spatial working memory in patients with schizophrenia. *Schizophrenia Research, 17,* 25-33.

66. Bentall, R. P. (1990). The illusion of reality: A review and integration of psychological research on hallucination. *Psychological Bulletin, 107,* 82-95.

67. Schneider, K. (1959). *Klinische Psychopathologie* (5th ed.). New York: Grune & Stratton.

68. Freud, S. (1915/1963). The unconscious: In P. Rieff (Ed.), *General Psychological Theory.* New York: Collier.

69. Freud, S. (1924/1963). Neurosis and Psychosis. In P. Rieff (Ed.) *General Psychological Theory.* New York: Collier.

70. Fenichel, O. (1945). *The psychoanalytic theory of neurosis.* New York: Norton.

71. Ricks, D. F., & Berry, J. C. (1970). Family and symptom patterns that precede schizophrenia. In M. Roff & D. F. Ricks (Eds.), *Life history research in schizophrenia.* Minneapolis, MN: University of Minnesota Press.

72. Stern, D. N. (1985). *Interpersonal world of the infant.* New York: Basic Books.

73. Kosslyn, S. M., & Koenig, O. (1992). *Wet mind: The new cognitive neuroscience.* New York: Free Press.

74. Kosslyn, S. M., Alpert, N. M., Thompson, W. L., Maljkovic, V., Weise, S. B., Chabris, C. F., Hamilton, S. E., Rauch, S. L., & Buonanno, F. S. (1993). Visual mental imagery activates topographically organized visual cortex. *Journal of Cognitive Neuroscience, 5,* 263-287.

75. Perez, M. M., Trimble, M. R., Murray, N. M. F., & Reider, I. (1985). Epileptic psychosis: An evaluation ofPSE profiles. *British Journal of Psychiatry, 146,* 155-163.

76. Lieberman, J. A., Alvir, J. M. J., Woerner, M., Degreef, G., Bilder, R. M., Ashtari, M., Bogerts, B., Mayerhoff, D. I., Geisler, S. H., Loebel, A., Levy, D. L., Hinrichsen, G., Szymanski, S., Chakos, M., Koreen, A., Borenstein, M., & Kane, J. M. (1992). Prospective study of psy- chobiology in first-episode schizophrenia at Hillside Hospital. *Schizophrenia Bulletin, 18,* 351-371.

77. Roberts, G. W., Done, D. J., Bruton, C., & Crow, T. J. (1990). A ‹mock-up› of schizophrenia: Temporal lobe epilepsy and schizophrenia-like psychosis. *Biological Psychiatry, 28,* 127-143.

78. J ohnson, M. K. (1991). Reality monitoring: Evidence from confabulation in organic brain disease patients. In G. P. Prigatano & D. L. Schacter (Eds.), *Awareness of deficit after brain injury: Clinical and theoretical issues* (pp. 176-197). New York: Oxford University Press.

79. Pardo, V., Pardo, P. J., Janer, K. W., & Raichle, M. E. (1990). The anterior cingulate cortex mediates processing selection in the Stroop attentional conflict paradigm. *Proceedings of the National Academy of Science, 87,* 256-259.

80. Frith, C. D., Friston, K., Liddle, P. F., & Frackowiak, R. S. J. (1991). Willed action and the prefrontal cortex in man: A study with PET. *Proceedings of the Royal Society of London, 244,* 241-246.

81. Frith, C. D. (1987). The positive and negative symptoms of schizophrenia reflect impairments in the perception and initiation of action. *Psychological Medicine, 17,* 631-648.

82. Benes, F. M. (1993). Neurobiological investigations in cingulate cortex of schizophrenic brain. *Schizophrenia Bulletin, 19,* 537-549.

83. Damasio, A. R. (1991). Concluding comments. In H. S. Levin, H. M. Eisenberg, & A. L. Benton (Eds.), *Frontal lobe function and dysfwwtion* (pp. 401-408). New York: Oxford University Press.

84. Kosslyn, S. M., Flynn, R. A., Amsterdam, J. B., & Wang, G. (1990). Components of high-level vision: A cognitive neuroscience analysis and accounts of neurological syndromes. *Cognition, 34,* 203-277.

85. Hyde, T. M., Ziegler, J. C., & Weinberger, D. R. (1992). Psychiatric disturbances in metachromatic leukodystrophy: Insight into the neurobiology of psychosis. *Archives of Neurology, 49,* 401-406.

86. Hoffman, R. E., & McGlashan, T. H. (1993). Parallel distributed processing and tire emergence of schizophrenic symptoms. *Schizophrenia Bulletin, 19,* 119-140.

87. David, A. S. (1994). Dysmodularity: A neurocognitive model for schizophrenia. *Schizophrenia Bulletin, 20,* 249-255.

88. Crow, T. J. (1990). Temporal lobe asymmetries as the key to the etiology of schizophrenia. *Schizophrenia Bulletin, 16,* 433-443.

89. Jernigan, T. L., Zisook, S., Heaton, R. K., Moranville, J. ‹[., Hesselink, }. R., & Braff, D. L. (1991). Magnetic resonance imaging abnormalities in lenticular nuclei and cerebral cortex in schizophrenia. *Archives of General Psychiatry, 48,* 881-890.

90. McGuire, P. K., Shah, G. M. S., & Murray, R. M. (1993). Increased blood flow in Broca›s area during auditory hallucinations in schizophrenia. *Lancet, 342,* 703-706.

91. Young, D. A., Davila, R., & Scher, H. (1993). Unawareness of illness and neuropsychological performance in chronic schizophrenia. *Schizophrenia Research, 10,* 117-124.

92. McEvoy, J. P., Johnson, J., Perkins, D., Lieberman, J. A., Hamer, R. M., Keefe, R. S., Tohen, M., Glick, I. D. & Sharma, T. 2006 Insight in first-episode psychosis. *Psy-*

chol. Med. **36,** 1385-1393.

93. Sapara, A. *et al.* 2007 Prefrontal cortex and insight in schizophrenia: a volumetric MRI study. *Schizophr. Res.* 89, 22-34.

94. Cooke, M.A., Fannon, D., Kuipers, E., Peters, E., Williams, S.C. & Kumari, V. 2008 Neurological basis of poor insight in psychosis: a voxel-based MRI study. *Schizophr. Res.* **103,** 40-51.

95. Bassitt, D. P., Neto, M. R. L., de Castro, C. C. & Busatto, G. F. 2007 Insight and regional brain volumes in schizophrenia. *Eur. Arch. Psychiat. Clin. Neurosci.* 257, 58-62.

96. Buchy, L., Ad-Dab›bagh, Y., Malla, A., Lepage, C., Bodnar, M., Joober, R., Sergerie, K., Evans, A. & Lepage, M. 2010 Cortical thickness is associated with poor insight in first-episode psychosis. *J. Psychiat. Res.* 45, 781-787.

97. Antonius, D., Prudent, V., Rebani, Y., D›Angelo, D., Ardekani, B.A., Malaspina, D. & Hoptman, M.J. 2011 White matter integrity and lack of insight in schizophrenia and schizoaffective disorder. *Schizophr. Res.* 128, 76-82.

98. Morgan, K. D. *et al.* 2010 Insight, grey matter and cognitive function in first-onset psychosis. *Brit. J. Psychiat.* 197, 141-148.

99. David, A. S., Bedford, N., Gilleen, J., Greenwood, K., Morgan, K. & Wiffen, B. 2001 The etiology of lack of insight in schizophrenia. *Schizophr. Bull.* **37** (suppl 1), 14.

100. Holt, D. J., Cassidy, B. S., Andrews-Hanna, J. R., Lee, S. M., Coombs, G., Goff, D. C., Gabrieli, J. D. & Moran, J. M. 2011 An anterior-to-posterior shift in midline cortical activity in schizophrenia during self- reflection. *Biol. Psychiat.* **69,** 415-423.

101. Petrides, M. (2000). Dissociable roles of mid-dorsolateral prefrontal and anterior inferotemporal cortex in visual working memory. Journal of Neuroscience, 20, 7496-7503.

102. Petrides, M. (2005). Lateral prefrontal cortex: Architectonic and functional organization. Philosophical Transactions of the Royal Society, Series B, 360, 781-795.

103. Petrides, M. (2013). The mid-dorsolateral prefronto-parietal network and the epoptic process. In D.T. Stuss & R.T. Knight (eds), Principles of Frontal Lobe Function, Chapter 7. New York: Oxford University Press, 79-89.

104. Devinsky **O**, Delusional misidentifications and duplications: Right brain lesions, left brain delusions, Neurology, 2009, 72(1):80-7.

105. Corlett PR, Taylor J, Wang X, et al. Toward a neurobiology of delusions. Prog Neurobiol. 2010; 92:345-69.

106. Kapur S. Psychosis as a state of aberrant salience : a framework linking biology, phenomenology, and pharmacology in schizophrenia. Am J Psychiatry, 2003, 160(1): 13-23.

107. Saxe, R. & Often, S. 2010 Seeing ourselves: what vision j can teach us about metacognition. In *Metacognition and severe adult mental disorders* (eds G. Dimaggio & P. H. I, Lysaker), pp. 13-30. Hove, East Sussex: Routledge.

108. Flavell JH. Metacognition and cognitive monitoring: a new area of cognitive developmental inquiry. Am Psychol 1979; 34(10): 906- . 911.

109. Moritz S, Woodward T. Metacognitive training for schizophrenia patients (MCT): a pilot study on feasibility, treatment adherence and subjective efficacy. German J of Psychiatry 2007; 10: 69-78. 4

110. Wells A. Metacognitive Therapy for Anxiety and Depression. New York: The Guilford Press; 2009.

111. Brune M. Theory of mind in schizophrenia: a review of the literature. Schizophr Bull 2005; 31: 21-42.

112. Semerari A, Carcione A, Dimaggio G, Falcone M, Nicolo G, Procacci M, Alleva G. How to evaluate metacognitive functioning in psychotherapy? The metacognition assessment scale and its applications. Clin Psychol Psychother 2003; 10(4): 238-261

113. Lysaker PH, Bob P, Ondrej P, Hamm J, Kukla M, Vohs J, Popolo R, Salvatore G, Dimaggio G. Synthetic metacognition as a link between brain and behaviour in schizophrenia. Transl Neurosci 2013; 4(3): 368-377.

114. Lysaker PH, Carcione A, Dimaggio G, Joharmesen JK, Nicolo G, Procacci M, Semerari A. Metacognition amidst narratives of self and illness in schizophrenia: associations with insight, neurocognition, symptom and function. Acta Psychiatr Scand 2005; 112: 64-71.

115. Lysaker PH, Erickson M, Ringer J, Buck KD, Semerari A, Carcione A, Dimaggio G. Metacognition in schizophrenia: the relationship of mastery to coping, insight, self esteem, social anxiety and various facets of neurocognition. Br J CI Psychol 2011; 50(4): . 412-424.

116. Lysaker PH, McCormick BP, Snethen G, Buck KD, Hamm JA, Grant M, Nicolo G, Dimaggio G. Metacognition and social function in schizophrenia: associations of mastery with functional skills competence. Schizophr Res 2011; 131: 214-218.

117. Massons C, Lopez-Morinigo JD, Pousa E, Ruiz A, Ochoa S, Usall J, Nieto L, Cobo J, David AS, Dutta R. Insight and suicidality in psychosis: A cross-sectional study. Psychiatry Res. 2017 Feb 27;252:147-153.

118. Mitmansgruber, H., Beck, T.N., et al. (2009). When you don't like what you feel: Experiential avoidance, mindfulness and meta-emotion in emotion regulation. *Personality and Individual Differences*, *46*(4), 448-453.

119. Mendonça D. Emotions about emotions. Emotion Review. 2013, 4: 390-396.

120. Hartmann, A.S., Thomas, J.J., Wilson, A.C., Wilhelm, S., 2013. Insight impairment in body image disorders: delusionality and overvalued ideas in anorexia nervosa versus body dysmorphic disorder. Psychiatry Research 210, 1129–1135.

121. Dimauro, J., Tolin, D.F., Frost, R.O., Steketee, G., 2013. Do people with hoarding disorder under-report their symptoms? Journal of Obsessive_Compulsive and Related Disorders 2, 130–136.

122. Konstantakopoulos, G., Varsou, E., Dikeos, D., Ioannidi, N., Gonidakis, F., Papadimitriou, G., Oulis, P., 2012. Delusionality of body image beliefs in eating disorders. Psychiatry Research 200, 482–488.

123. American Psychiatric Association Diagnostic and Statistical Manual of Mental Disorders, DSM-5 , 2013.

124. Oulis P, Konstantakopoulos G, Lykouras L, Michalopoulou PG. Differential diagnosis of obsessive-compulsive symptoms from delusions in schizophrenia: A phenomenological approach, World J Psychiatr. Sep 22, 2013; 3(3): 50-56

125. Van Os & Reinighaus, Psychosis as a transdiagnostic and extended phenotype in the general population Positive symptoms, *World Psychiatry, 2016*