CEREBRUM
PRINCIPIA
DE MORBUS MENTIS

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C E R E B R U M

P R I N C I P I A

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Brain Principles of Mental Disorders

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Introduction

‘Cerebrum Prinicipia de Morbus Mentis’ means Brain Principles of Mental Disorders. The term ‘Principia’ comes to signify the importance of this document to psychiatry by comparing it to the importance of the ‘Philosophiae Naturalis Prinicipia Mathematica’ to calculus, as written by Issac Newton.

Full disclosure, this manuscript was edited with the help of Open-AI restricted to definitions and explanations, not to the basic ideas which are a product of 30 years of work including actual research and thought experiments (see PUBMED Peled A).

Brain-related Psychiatry is founded on three principles.

Principia I, Brain neural network connectivity, small world organization.
Principia II, Brain Hebbian dynamics of internal representations.
Principia III, Bayesian Brain Dynamics of global adaptations.

Each of these Principia are a chapter in this manuscript. Neuroanalytic Diagnosis and it’s Appendix conclude the manuscript with a proposed novel diagnostic conceptualization to be applied to the clinical assumptions and evaluations.

PRINCIPIA I

Brain neural network connectivity, small world organization

Brain connectivity refers to the complex web of connections between neurons in the brain. These connections, formed by long, slender fibers called axons and dendrites, allow neurons to communicate and share information. The specific patterns of these connections are crucial for brain function and underlie our ability to think, feel, and behave. The brain's emergent properties are those that arise from the interaction of its individual parts. In other words, the brain is much more than the sum of its individual neurons. The intricate network of connections between neurons allows the brain to perform complex functions that no single neuron could do on its own. Some examples of emergent properties of the brain include consciousness, memory, and emotion. Different brain regions are specialized for different tasks. For example, the visual cortex is responsible for processing visual information, while the motor cortex is responsible for controlling movement. Brain connectivity allows these different regions to communicate and share information with each other. This integration of information is essential for complex cognitive functions such as perception, decision-making, and planning. The brain is not a static organ. The connections between neurons are constantly changing throughout our lives. This plasticity allows the brain to learn and adapt to new experiences. It also plays an important role in recovery from brain injury. Brain activity is not random. Neurons in different brain regions often fire together in synchronized patterns. This synchronization is thought to be important for a variety of cognitive functions, including attention, memory, and consciousness.

Connectivity in the brain follows the Small world network organization. A small-world network is a kind of network that combines two seemingly contradictory properties: High clustering coefficient: This means that nodes (individual units in the network) tend to cluster together with many connections between each other. Imagine a social group where everyone knows everyone else in their friend group. Short path lengths: This means that you can travel from any one node to any other node in the network relatively quickly, despite the network not being fully connected. In social terms, this means that even though you might not know someone directly, you likely know someone who knows them, or someone who knows someone who knows them, and so on. The small-world phenomenon was first described by Duncan Watts and Steven Strogatz in their 1998 paper "Collective dynamics of 'small-world' networks." They showed that social networks, the power grid, and even the neural network of the worm C. elegans all exhibited small-world properties. Small-world networks are interesting because they allow for efficient information sharing and transmission. In a social network, for example, the fact that people tend to cluster with others who share their interests means that information can spread quickly within those groups. However, the fact that there are also shortcuts between different clusters means that information can also spread quickly between different parts of the network. Othe then the brain Small-world networks are found in many different natural and man-made systems, including: Social networks, The internet, The power grid, Transportation networks, biological pathways.

The brain organization also creates hierarchy dynamics. The brain utilizes two complementary processes to make sense of the world: top-down processing and bottom-up processing. These two approaches work together to create our perception of the environment.

Bottom-up Processing: Data-driven: Starts with sensory information from the external world. Building blocks: Our eyes, ears, nose, tongue, and skin receive raw sensory data (light, sound waves, etc.). Early processing: This data is processed in lower-level brain regions like the thalamus and brainstem. Feature extraction: These regions extract basic features like edges, lines, and colors (vision), or frequencies and rhythms (hearing).

Top-down Processing: Knowledge-driven: Works from the "top down," using existing knowledge, expectations, and memories. Interpretation: Higher-level brain regions like the frontal and temporal lobes interpret the processed information. Context and experience: Our knowledge and past experiences play a big role in shaping this interpretation. Expectation and prediction: The brain actively predicts what it might encounter based on context. Bottom-up processing provides the raw data, while top-down processing gives it meaning. This constant interplay allows for rich and accurate perception. Bottom-up processing alone wouldn't be enough: Without interpretation, the brain wouldn’t' t be able to make sense of the constant barrage of sensory information. Top-down processing alone can lead to errors: Our biases and expectations can sometimes lead us to misinterpret what we see. The brain's ability to use both approaches allows for flexible and accurate perception.

Error prediction is a crucial concept in understanding how the brain's hierarchical organization facilitates learning and adaptation. The brain constantly makes predictions about the world based on past experiences and sensory inputs. These predictions help us anticipate what's coming next and react efficiently. Different levels of the brain hierarchy are involved in making predictions and detecting errors. Lower levels process raw sensory data and generate initial predictions. Higher levels integrate information from lower levels and make more complex predictions. Detecting the Mismatch: When reality doesn't match the prediction, an error signal is generated. This error signal acts as a learning signal, highlighting the difference between what was expected and what actually happened. The specific brain regions involved in error prediction vary depending on the type of error: Midbrain: Plays a role in reward prediction errors, signaling the difference between expected and actual rewards. Basal Forebrain: May be involved in encoding the precision (reliability) of predictions about stimulus probabilities. Anterior Cingulate Cortex (ACC): Detects unexpected changes and motivates adjustments in behaviour. The error signal is then used to update the brain's internal models and predictions for the future. This allows us to learn from our experiences and adapt our behaviour accordingly. Error prediction is a powerful mechanism that allows the brain to: Refine sensory perception: When we see something unexpected, the error signal helps us refine our initial interpretation of the visual information. Optimize motor control: If a movement doesn't achieve the intended outcome, the error signal helps us adjust our motor commands for next time. Make better decisions: By learning from past mistakes (unexpected outcomes), we can make better choices in the future.

On top of the above brain organization dynamics the Global workspace organization is important to generate the emergent property of consciousness. The Global Workspace Theory (GWT), proposed by Bernard Baars and Stan Franklin, is a prominent theory that attempts to explain how consciousness arises from the brain's complex organization. GWT suggests that consciousness arises from the global integration of information across various specialized brain regions. The theory proposes a whole brain global workspace dynamic. This workspace acts as a kind of communication hub, receiving information from various specialized processing modules in the brain (e.g., visual cortex, auditory cortex, etc.) Information from these modules is then broadcast widely within the workspace, allowing for integration and unified access by different cognitive processes. This widespread access to integrated information is thought to be crucial for conscious experiences. It allows for: Unified perception: Combining information from different senses to create a coherent experience of the world (e.g., seeing a red apple and feeling its smooth skin). Attention and decision-making: Highlighting relevant information and guiding our actions based on a broader understanding of the situation. Working memory: Maintaining and manipulating information in the short term for conscious thought. Self-awareness: Potentially contributing to our sense of self by providing a central stage for integrating information about our thoughts, feelings, and actions.

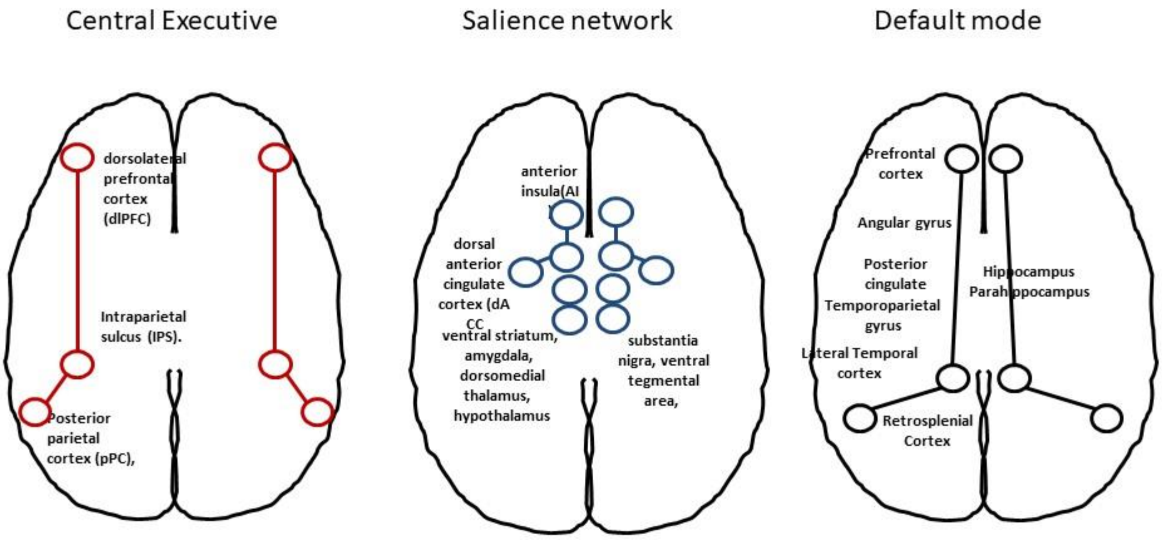
GWT can be seen as complementary to the idea of a hierarchical brain organization. Lower brain regions perform specialized processing, and the global workspace integrates this information in a higher-level region.

Marcel Mesulam in his work on unimodal, multimodal, and transmodal processing provides a framework for understanding how different brain regions handle information. Unimodal processing refers to how specialized brain regions handle information from a single sensory modality. For example: The visual cortex in the occipital lobe is primarily responsible for processing visual information like shapes, colors, and motion. The auditory cortex in the temporal lobe focuses on processing sound waves and interpreting them as meaningful sounds. The somatosensory cortex in the parietal lobe processes information about touch, pressure, and temperature.

Multimodal Processing: Multimodal processing involves integrating information from two or more sensory modalities to create a unified perception of the world. Different brain regions work together to combine this information: Seeing an apple (visual cortex) and feeling its smooth skin (somatosensory cortex) allows us to recognize it as a whole object, not just separate sensory experiences. Hearing someone speak (auditory cortex) while observing their facial expressions (visual cortex) helps us understand the emotional tone of their voice. Transmodal Processing: Transmodal processing goes beyond simple integration of sensory information. It involves using information from one modality to influence or guide another modality.

In sum Mesulam's work highlighted the importance of understanding not only how individual brain regions process information within a modality (unimodal) but also how they interact to create richer and more meaningful experiences (multimodal and transmodal).

The functions and brain dynamics described so far are most relevant to the Central Executive Brain Networks Figure 1



high level cognitive functions such as maintaining and using information in working memory, problem solving, and decision making executive control tasks IQ

detecting and filtering salient stimuli, variety of complex functions,, social behavior, self-awareness through the integration of sensory, emotional, and cognitive information

Integration of emotional and sensory stimuli, as well as in modulating the switch between the internally directed cognition of the default mode network and the externally directed cognition of the central executive network.[1]

wakeful rest internal focus daydreaming and mind-wandering. But it is also active when the individual is thinking about others, thinking about themselves, remembering the past, and planning for the future theory of mind Retrieval of social semantic and conceptual knowledge Autobiographical memory and future simulations

The Central Executive Network (CEN), also sometimes referred to as the Frontoparietal Network (FPN), is a network of brain regions crucial for various higher-order cognitive functions. It acts like a central command center, integrating information from other brain networks and directing our thoughts and actions. The CEN primarily consists of two major areas: Dorsolateral Prefrontal Cortex (DLPFC): Located behind the forehead, the DLPFC is involved in planning, decision-making, problem-solving, working memory, and attention control. Posterior Parietal Cortex (PPC): Situated at the back of the top of the head, the PPC is involved in spatial awareness, navigation, sensory integration (combining information from different senses), and attention shifting. The CEN is responsible for a variety of critical cognitive processes, including: Goal-Directed Behavior: The CEN helps us set goals, plan how to achieve them, and monitor our progress. Cognitive Flexibility: It allows us to adapt our thoughts and actions to new situations and switch between tasks effectively. Inhibition: The CEN helps us suppress irrelevant thoughts and distractions to focus on the current task. Working Memory: It plays a vital role in holding information in mind for short-term use, which is essential for reasoning and complex tasks. Decision-Making: The CEN integrates information from different brain regions to evaluate options and make choices. The CEN doesn't operate in isolation. It interacts with other brain networks to perform various functions: Default Mode Network (DMN): The CEN works with the DMN, which is active during daydreaming and introspection, to help us focus our attention and bring our internal thoughts to bear on the external world. Salient Network: The CEN collaborates with the Salience Network, which prioritizes important stimuli, to identify significant events and allocate attentional resources accordingly. Damage or dysfunction in the CEN can lead to a variety of cognitive impairments, including: Attention Deficit Hyperactivity Disorder (ADHD): Difficulties with focus, planning, and impulse control. Schizophrenia: Problems with working memory, decision-making, and social cognition. Dementia: Decline in cognitive abilities such as memory, planning, and reasoning. Overall, the Central Executive Network plays a central role in our ability to think, plan, and act purposefully. It's a complex network that interacts with other brain regions to orchestrate our higher-order cognitive functions. As already partially mentioned disturbances to the above structure and dynamics seem to play a critical role in the psychosis and schizophrenia spectrum phenomenology involving both positive and negative signs.

Positive symptoms represent an excess or distortion of normal thoughts or behaviors. They are often the most noticeable symptoms in the early stages of schizophrenia. Here are some common examples: Hallucinations: Perceiving things that aren't there. These can be auditory (hearing voices), visual (seeing things), tactile (feeling things), olfactory (smelling things), or gustatory (tasting things). Delusions: False fixed beliefs that are not based on reality. These can be persecutory (feeling like someone is trying to harm you), grandiose (believing you have special powers or abilities), or referential (believing that random events have personal significance). Disorganized Speech: Difficulty forming coherent or logical speech. This can manifest as rambling, illogical jumps in conversation, or making up words. Disorganized Behavior: Unusual or unpredictable behavior that may be difficult to understand. This could include agitation, repetitive movements, or inappropriate social behavior.

Negative symptoms represent a reduction or absence of normal thoughts or behaviors. They can be just as debilitating as positive symptoms, but they are often less noticeable to others. Here are some key negative symptoms: Blunt Affect: Reduced emotional expression. People with this symptom may appear withdrawn or emotionless, even in situations that would normally evoke a strong emotional response. Alogia: Speaking very little or showing a lack of interest in conversation.

Avolition: Reduced motivation or goal-directed behavior. People with avolition may have difficulty starting or completing tasks, or they may neglect personal hygiene or self-care. Anhedonia: Inability to experience pleasure or enjoyment. People with anhedonia may lose interest in activities they once enjoyed, such as hobbies or social interaction. Asociality: Withdrawing from social interactions and preferring isolation.

One already known disturbance to the brain organization in psychopathology is that of the disconnection syndrome. This theory proposes that schizophrenia may arise due to impaired communication between different brain regions. Similar to disconnection syndromes caused by

physical damage to connecting fibers, schizophrenia might involve dysfunction in these connections, even if the brain regions themselves are structurally intact. Disruptions in communication between brain regions could explain some of the core symptoms of schizophrenia, such as:
Hallucinations: Misinterpretation of internal signals due to a lack of proper integration between sensory processing and higher-order cognitive areas. Delusions: Difficulties in filtering information and integrating thoughts due to impaired communication between relevant brain regions.
Disorganized thinking: Inability to form coherent thoughts and speech due to a breakdown in communication between areas responsible for planning and language production.
Hyperconnectivity may also underly psychiatric phenomenology for example creating Local Minima dynamics in Brain Functions. Local Minima: In complex systems like the brain, a local minimum refers to a state where a function reaches a minimum value within a limited area, but it's not necessarily the global minimum (the absolute lowest value). Imagine a hilly landscape with valleys of varying depths. A local minimum would be a valley bottom, but there might be a deeper valley elsewhere (global minimum. In the context of the brain, some researchers propose that hyperconnectivity might lead to a brain getting "stuck" in local minima of thought patterns or behaviours. Increased connections could make it easier for the brain to fall into these patterns and have difficulty breaking out and exploring alternative states or solutions. For instance, in OCD (Obsessive-compulsive disorder), hyperconnectivity within certain circuits might make intrusive thoughts and compulsive behaviours more likely to occur and become entrenched. The brain gets stuck in a loop reinforced by these strong connections. Overall, the idea of hyperconnectivity and local minima offers an interesting perspective on how brain wiring might influence thought patterns and behaviour in some mental disorders.
Disruptions to hierarchical brain dynamics are also relevant to understand psychopathology from a brain organization perspective. For example Disruptions to hierarchical brain dynamics can impact error prediction: Deficient Lower-Level Processing: Damage or dysfunction in lower brain regions can lead to inaccurate initial predictions. For example, if the visual cortex struggles to process visual features correctly, it can't provide the higher levels with the necessary information to make accurate predictions about the environment. Disrupted Communication: If communication between different brain regions is impaired, the error signal might not reach the higher levels responsible for updating predictions. This can lead to persistent errors and difficulty adapting to changing situations. Higher-Level Dysfunction: Damage or dysfunction in higher brain regions can affect the ability to interpret error signals and make appropriate adjustments. This could manifest as difficulty learning from mistakes, inflexible thinking, or problems with decision-making.

Consequences of Impaired Error Prediction: Sensory Processing Issues: Difficulties interpreting sensory information due to inaccurate predictions about the environment (e.g., misinterpreting sounds or visual stimuli). Impaired Motor Learning: Difficulty learning and refining motor skills due to problems using error signals to adjust movements. Cognitive Deficits: Problems with attention, memory, and decision-making can arise if error prediction is disrupted. Mental Health Issues: Some theories suggest that impaired error prediction might be a contributing factor in certain mental health conditions like schizophrenia, where individuals struggle to distinguish between self-generated thoughts and external reality. There's a strong connection between error prediction and delusions, which are false beliefs firmly held despite evidence to the contrary. Our brains constantly predict what's coming next based on past experiences and sensory information. When reality deviates from these predictions, an error signal is generated. This error signal helps us update our beliefs and understanding of the world. Some theories propose that delusions may arise from dysfunction in the error prediction system.

PRINCIPIA II

Brain Hebbian dynamics of internal representations.

The way we see ourselves and others, our psychosocial awareness (personality traits) are related to internal representations achieved by the brain, they guide our behaviour and perception within psychosocial contexts. To learn how the brain creates internal representations we need to understand Hebbian dynamics. Hebbian dynamics named after Canadian psychologist Donald Hebb, is a fundamental concept in neuroscience that proposes a mechanism for learning and memory formation in the brain. Here's a breakdown of the core idea and its implications:

The Basic Principle: "Cells That Fire Together, Wire Together" Hebb theorized that when two neurons or groups of neurons are repeatedly activated at the same time, the connection (synapse) between them becomes stronger. This strengthening allows the neurons to communicate more efficiently in the future. When a presynaptic neuron fires and releases neurotransmitters, it can trigger an electrical impulse in a postsynaptic neuron if the connection between them is strong enough. According to Hebb, repeated co-activation of these neurons leads to increased release of neurotransmitters and changes in the structure of the synapse, making it easier for the presynaptic neuron to activate the postsynaptic neuron in the future.

Hebbian Learning and Long-Term Potentiation (LTP): Hebbian dynamics is closely linked to Long-Term Potentiation (LTP), a cellular process that strengthens synapses over time. LTP is believed to be a key mechanism for memory formation. Examples of Hebbian Learning: When a baby learns to recognize its mother's face, the neurons involved in processing visual features of the face are repeatedly activated together. Over time, these connections become stronger, making it easier for the baby to recognize the face in the future. Practicing a new skill, like playing a musical instrument, involves repeated activation of specific neural circuits. Hebbian learning can strengthen these connections, leading to improved performance. While the original theory has been refined, Hebbian learning remains a cornerstone of understanding how the brain learns and forms memories. Researchers are exploring how Hebbian principles can be applied to develop artificial neural networks that can learn and adapt like the brain. Overall, Hebbian dynamics provide a foundational framework for understanding how the brain learns and adapts.

Hebbian dynamics provide also a foundational explanation about Internal representations in the brain: Internal representations are the brain's way of encoding and storing information about the external world, our bodies, and even abstract concepts. They are not direct copies of reality but rather mental models that allow us to interact with the world, make decisions, and have thoughts and feelings. Types of Internal Representations are: Sensory Representations: These capture information from our senses like sight, sound, touch, taste, and smell. Specific brain regions process these signals and create internal maps of sensory data. For example, the visual cortex creates an internal representation of the visual scene in front of you. Motor Representations: These represent planned or imagined movements. They involve areas of the brain responsible for motor planning and control. When you imagine picking up a cup, your motor cortex creates an internal representation of the movement involved. Emotional Representations: Our brains also encode emotional states. These representations involve areas like the amygdala and hippocampus, which are linked to processing emotions and memories. Conceptual Representations: These are more abstract mental models of ideas, knowledge, and language. They are formed through experience and learning and involve higher-order brain regions like the prefrontal cortex. Sensory information from the external world is first processed by dedicated brain regions. These regions then interact with other brain areas involved in memory, learning, and past experiences. This interaction helps create a mental model or internal representation that captures the essence of the perceived information. Internal representations are constantly being updated and refined based on new experiences and sensory data. The Importance of Internal Representations are: They allow us to function in the world without constantly relying on direct sensory input. We can use internal representations to plan actions, anticipate future events, and make decisions. They are also crucial for memory, imagination, and even consciousness. The correlate concept for internal representations are Object Relationships The term "object relations" can refer to two different but related concepts: Psychoanalytic Object Relations Theory: This theory, developed by Sigmund Freud and later expanded by his followers, focuses on how our early relationships with caregivers shape our personality development and our capacity for future relationships. It emphasizes the internalization of these relationships, meaning we form mental representations of our caregivers (the objects) and how they interacted with us. Object Representation in the Brain: This is a more recent concept in neuroscience that explores the neural mechanisms underlying how the brain represents and categorizes objects in the environment. While these two concepts come from different fields, they share some interesting connections: Psychoanalytic Object Relations Theory and the Brain: The theory proposes that our early interactions with caregivers shape the development of specific brain circuits. For example, secure attachments with responsive caregivers might lead to stronger connections in brain regions involved in emotion regulation and social cognition. Conversely, insecure attachments or neglectful environments could lead to weaker connections or abnormal development in these brain regions.

The activity of internal representations and object relationships has been attributed to the Default Mode Network organization of the brain.

The default mode network (DMN) is a collection of brain regions that exhibit increased activity when your mind is wandering or not focused on a specific external task. It's like the brain's resting state network, where it engages in internal processes like: Daydreaming: Letting your mind wander freely and come up with new ideas. Self-referential processing: Thinking about yourself, your memories, and your plans for the future. Theory of mind: Attributing mental states (thoughts and feelings) to yourself and others. Empathy: Understanding and sharing the feelings of others.

The DMN consists of several interconnected brain regions, including: Medial prefrontal cortex (mPFC): Located behind the forehead, the mPFC is involved in self-reflection, social cognition, and thinking about the future. Posterior cingulate cortex (PCC): Situated at the back of the top of the head, the PCC is involved in memory retrieval, spatial navigation, and integrating information from different senses. Precuneus: This region near the PCC is involved in self-awareness, episodic memory (memory of personal experiences), and mental imagery. Angular gyrus: Located in the parietal lobe, the angular gyrus is involved in processing language, attention, and integrating different types of information. (Figure 1). The DMN is most active when you're not engaged in a demanding external task. For example when resting with your eyes closed: Even though your brain isn't processing external stimuli, the DMN is busy with internal processing. Daydreaming while waiting in line: Your mind might wander to unrelated thoughts and ideas. Thinking about a past experience: The DMN helps you retrieve memories and relive them in your mind. Considering your future goals: The DMN allows you to imagine future scenarios and plan your actions. The DMN's activity can decrease when you shift your attention to a specific external task. This allows other brain networks responsible for focused attention and processing sensory information to take over.

While sometimes seen as the brain's "idling" network, the DMN plays a crucial role in several important mental functions. It allows us to process information internally, make sense of our experiences, and plan for the future. It also contributes to our sense of self, empathy for others, and creativity.

The default mode network and internal representations are closely linked concepts in understanding how the brain functions at rest and during introspection. Here's how they interact: The DMN provides a stage for the brain to build and manipulate internal representations. When you're not focused on external tasks, the DMN allows different brain regions to work together to create mental models of: Memories: Retrieving and reliving past experiences through memory representations. Future planning: Simulating potential future scenarios and formulating plans based on internal representations of goals and past experiences. Self-referential processing: Internal representations of ourselves, our thoughts, emotions, and beliefs come into play during self-reflection. Theory of mind: The DMN is involved in attributing mental states to others, which relies on internal representations of our own emotions and thought processes. The DMN doesn't just passively display internal representations; it actively shapes them. By integrating information from various brain regions, the DMN can: Fill in the gaps: Internal representations can be incomplete based on fragmented memories or limited information. The DMN helps fill in these gaps using inferences and past experiences. Create narratives: The DMN can connect different internal representations to form a coherent narrative, such as a story about a past event or a plan for the future. Emotional colouring: The DMN can influence the emotional tone associated with internal representations. For example, a memory might be recalled with a positive or negative emotional charge depending on the DMN's activity. Internal Representations and the Modulation of the DMN: Internal representations don't passively wait to be processed by the DMN. They can also influence the network's activity.Vivid or emotionally charged internal representations can activate the DMN more strongly, leading to deeper introspection or daydreaming.

How do internal configurations of the DMN arias? This is connected to the idea of Experience-dependent plasticity. Experience-dependent plasticity, also known as experience-based plasticity, is a well-researched concept in neuroscience. It refers to the brain's ability to modify its structure and function based on our experiences throughout life. Here's a breakdown of the key points:

The Core Idea: Our brains are not static organs. They are constantly shaped by the sights, sounds, emotions, and interactions we encounter. Through experience-dependent plasticity, the brain strengthens existing neural connections (synapses) that are used frequently, and weakens or prunes those that are not. When we learn a new skill, have a new experience, or form a new memory, the brain strengthens the connections between neurons involved in that process. This can involve Increased growth of dendritic spines (tiny protrusions on neurons that receive signals)More neurotransmitters (chemical messengers) being released at synapses Conversely, if a neural pathway isn't used much, the connections weaken or are eliminated. There is growing evidence that psychotherapy can work by promoting experience-dependent plasticity in the brain. For example, studies have shown that psychotherapy can lead to changes in the size and function of brain regions that are involved in emotion regulation, memory, and self-awareness. New neural connections: Psychotherapy can help to create new neural connections between brain cells. These new connections can help people to develop new coping mechanisms and to learn new ways of thinking about themselves and the world around them. Strengthening existing connections: Psychotherapy can also help to strengthen existing neural connections that are helpful. For example, therapy can help to strengthen the connections between the prefrontal cortex (which is involved in planning and decision-making) and the amygdala (which is involved in emotion processing). This can help people to better regulate their emotions. Weakening unhelpful connections: In some cases, psychotherapy may also help to weaken unhelpful neural connections. For example, therapy can help to weaken the connections between the amygdala and the hippocampus (which is involved in memory). This can help people to reduce their fear response to trauma-related memories.

It is proposed here that Personality disorders are related to the activity of the default mode network. Personality disorders are a group of mental disorders characterized by inflexible and maladaptive patterns of thinking, functioning, and behaving. These patterns deviate from cultural norms and expectations, and cause significant distress or impairment in social, occupational, or other areas of life. As mentioned, It is assumed that personality disorders are related to the dynamics of internal representations in the brain. As mentioned above internal representations are mental models of ourselves and others that form based on our early experiences, particularly with our caregivers. These models act like filters, influencing how we perceive and interact with the world around us. In healthy development, these representations become integrated and nuanced. However, in personality disorders, these internal representations can be rigid, distorted, or fragmented.

Here's how internal representations can be linked to personality disorders. Fragmented representations: People with borderline personality disorder (BPD) may struggle with unstable representations of themselves and others, leading to intense and shifting emotions and difficulty maintaining stable relationships. Negative representations: People with avoidant personality disorder may have internal representations of themselves as inadequate or unlovable, leading to social withdrawal and isolation. Grandiose representations: People with narcissistic personality disorder may have inflated internal representations of themselves, leading to a sense of entitlement and a lack of empathy for others. Therapists can help people with personality disorders identify and challenge their unhelpful internal representations and develop more adaptive ways of thinking about themselves and others.

PRINCIPIA III

Bayesian Brain Dynamics of global adaptations.

The term "Bayesian Brain" refers to a theory that suggests our brain's function using principles from Bayesian statistics. Here's a breakdown of the key points. The brain treats information probabilistically. It doesn't just accept sensory input as absolute truth, but considers it as evidence within a larger context. We have existing beliefs and expectations about the world (prior probabilities). When we encounter new sensory information (evidence), the brain updates these beliefs (posterior probabilities) as follows:

1. Prediction: The brain constantly makes predictions about the world based on prior experiences and knowledge.
2. Sensory Input: We take in information through our senses (sight, sound, touch, etc.).
3. Error Detection: The brain compares the prediction to the actual sensory input. If there's a mismatch (prediction error), it signifies a need to update our beliefs.
4. Belief Update: The brain adjusts its beliefs based on the size of the prediction error. A larger error suggests a more significant update is needed.

Benefits of a Bayesian Brain include Efficient learning: We can learn and adapt quickly to new situations without needing overwhelming amounts of data. Dealing with uncertainty: The brain can make reasonable decisions even in situations with incomplete information. Integrating information: It allows us to combine prior knowledge with new sensory input to form a more complete picture of the world.

The critical mechanism underlying adaptability and Bayesian dynamics is plasticity. This refers to the brain's ability to adapt and change throughout life. It involves the formation of new neural connections, strengthening existing ones, and even the creation of new brain cells (neurogenesis). Research suggests that depression disrupts neuroplasticity. Chronic stress, a common factor in depression, can lead to shrinkage in certain brain regions like the hippocampus (important for memory) and the prefrontal cortex (involved in mood regulation). Additionally, depression can decrease the production of brain-derived neurotrophic factor (BDNF), a molecule crucial for neurogenesis.

The good news is that the relationship between plasticity and depression is a two-way street. Antidepressant medications and therapeutic interventions like cognitive behavioral therapy (CBT) are believed to work, in part, by promoting neuroplasticity. These treatments can help stimulate neurogenesis, strengthen neural connections, and improve the function of brain regions impacted by depression

The brain constantly optimizes its internal representations to be efficient and effective in processing information and guiding behaviour. The brain strives for sparse representations, meaning it uses as few neurons as possible to encode information. This helps to conserve energy and processing power. Pruning of unused connections and strengthening of frequently used ones allows for efficient information flow. The brain optimizes representations to capture the essential features of information, discarding irrelevant details. This allows for faster recognition and categorization of objects, situations, and experiences. Abstraction allows the brain to form generalizable representations that can be applied to new experiences. The brain combines information from different sensory modalities (sight, sound, touch) to create a richer and more complete internal representation. This allows for a more accurate understanding of the environment. Cross-modal integration helps connect related information from different brain regions, leading to a unified understanding. As already mentioned The brain constantly updates its internal representations based on new experiences. This allows for adaptation to changing environments and the formation of new memories. Error correction mechanisms adjust representations to minimize errors in prediction and perception.

The optimization process is not perfect, Biases can arise due to past experiences, leading to misinterpretations of new information. Overfitting to specific details can make it difficult to generalize to new situations. Depression can create a negative feedback loop with regards to plasticity. Depressive symptoms like negative thoughts and social withdrawal can further decrease stimulation and weaken neural connections. This reinforces negative thinking patterns and makes it difficult to engage in activities that could promote positive change. The brain retains its plasticity even in depression. This means that therapeutic interventions can promote positive changes in the brain.

Adaptation dynamics in the brain seems to relate to the Salience Network The salience network acts as the brain's prominence detection system. It includes regions like the anterior cingulate cortex and insula. The salience network is a critical player in mood disorders, particularly depression and anxiety. The salience network acts as the brain's prominence detection system. It includes regions like the anterior cingulate cortex and insula. Its role is to identify significant stimuli, be it emotional (threat, reward), unexpected events, or situations requiring a shift in attention. The salience network then directs information flow to other brain networks for further processing and guiding appropriate responses.

Research suggests that dysfunction in the salience network is linked to mood disorders like depression and anxiety. This dysfunction can manifest in several ways, Hyperactivity: The network might become overly sensitive, misinterpreting neutral cues as threats, leading to excessive worry and anxiety. Hypoactivity: Conversely, the network might under-respond to important stimuli, leading to a lack of motivation or an inability to experience pleasure (anhedonia) in depression. Impaired Connectivity: Disrupted communication between the salience network and other brain networks involved in emotional processing and goal-directed behaviour can contribute to mood dysregulation. A hyperactive salience network can lead to an overestimation of threats and negative experiences, fuelling anxiety and rumination (dwelling on negative thoughts). A hypoactive salience network can make it difficult to experience positive emotions and engage in rewarding activities, worsening depression symptoms. Disrupted communication can lead to difficulty regulating emotions, shifting attention, and making decisions, all of which contribute to mood instability. While research is ongoing, understanding the salience network's role in mood disorders holds promise for future treatments. Techniques like mindfulness meditation and cognitive-behavioural therapy (CBT) might target regulating activity within the salience network. Future treatments could potentially involve neurostimulation techniques to modulate the salience network's activity and improve communication with other brain regions. Overall, the salience network plays a crucial role in our emotional well-being. By understanding how its dysfunction contributes to mood disorders, researchers are paving the way for developing more targeted and effective treatments.

NEUROANALYTIC BRAIN PROFILING DIAGNOSIS

Brain profiling aims to identify the underlying dysfunction in brain circuits that contribute to mental health symptoms. This approach might involve using various tools like Neuroimaging: Techniques like MRI or fMRI to examine brain structure and function. Electrophysiology: Measuring electrical activity in the brain using EEG (electroencephalography).

Proponents of brain profiling believe it could lead to more accurate diagnoses: By pinpointing the specific brain dysfunction, clinicians could provide more targeted treatments. Earlier intervention: Identifying underlying brain issues early on could allow for earlier intervention and potentially better outcomes. Development of new treatments: A deeper understanding of the brain mechanisms involved in mental disorders could pave the way for new treatment approaches.

Brain profiling is still a developing concept, and it aims at the daunting task of revolutionizing psychiatry by introducing etiology concepts into its diagnostic framework.

Overall, brain profiling holds promise as a potential future tool for diagnosing mental disorders. However, more research is needed to validate its effectiveness and determine its appropriate role in clinical practice.

Here is a concise summery of the ideas of Neuroanalytic Brain Profiling: Psychosis is the result of disconnection dynamics in the brain, meaning that different neuronal networks which normally function in synchronization and optimized harmony are disintegrated disconnected and act statistically independent from each other. As seen when the global workspace of transmodal organization fragments conscious experience is likewise fragmented. This causes experience to fragment and patient to become disorganized. Speech is fragmented as different semantic associations become disjointed. Logic collapse and erroneous activations form delusional conceptions. Hallucinations happen when entire brain processors such as speech language processors become disconnected from the global brain organization and from environmental external inputs. With disconnection brain hierarchal organization is altered and Top-Down shift may overrun normal error correction fixating top-down erroneous configurations thus fixating and increasing delusional contents. All this happens in the neuronal networks of the Central Executive Networks responsible for the integrative conscious experience. As thoughts and perceptions are millisecond-range phenomena then the disturbances of connectivity and hierarchy are also millisecond range time-scale disturbances. Optimal brain dynamic connectivity organization is that of Small World Network (Basset Bulmore 2016) organization thus it is expected that the disconnection syndrome of psychosis is a disturbance to Small World Network organization for example the Cluster Coefficient of nearby connections compared to far away connections. The implications on state-space global workspace and dynamic core are all a result of disconnection and fragmentation dynamics.

In Negative Signs schizophrenia-like conditions over-connectivity dynamics takes over the activity of the Central Executive Networks. Connections are strengthened and fixated causing increase of mutual constraints among networks. Consequently, the space state of the brain is reduced (poverty of thought) the brain dynamics tends to limit and fixate in “Local Minima” i.e., preservations Alogia. Higher-level transmodal optimization is hampered and the emergent property of Volition is damaged and even eliminated

Personality disorders are related to experience dependent plasticity thus a lifetime-scale developmental process that generates internal representations from experiences and memories. The representations are formed by Hebbian dynamics and shape the way we interpret others and ourselves. The experience of other and ourselves determine our feeling and behaviour within psychosocial settings thus defining our personality traits.

Experience dependent internal representations have been described as “Organismic maps” by Carl rogers (see above) and as “Object Relationships” by Object Relationships psychologists

The Default Mode Network, resting network is active during self-contemplation and is presumed to represent the construct determining our personality traits.

Personality disorders are emergent property from immature and / or biased development of the Default mode Network.

Anxiety is an emergent property from a globally spread perturbation of brain neuronal networks. The hubs of such network are the Salient Network subcortical Basal Ganglia with their connections to both the Central Executive as well as to Default Mode Networks. As the brain faces cognitive computations and external interactions it is perturbed because the multiple constraint satisfaction dynamics is challenged by the everchanging cognitive computational demand on brain networks. The perturbation of multiple constraint satisfaction generates Anxiety. This can be continuing for perturbations that result from constant stress. Perturbing events can be also in the timescale of minutes as is typical for panic attacks.

In Depression plasticity is reduced. The changeability and adaptability of the brain is reduced. This hampers Bayesian brain dynamics i.e., the ability of the brain to predict and adapt to new everchanging constellations. Matching complexity is reduced. Error prediction is hampered and Free Energy (Sikora 2022) Delta, increases. This triggers a deoptimization (see above) dynamics at whole-brain level of organization. The deoptimization dynamics of the brain generates the emergence of

depressed mood. External occurrences (computed by the Central Executive Network) matched to internal representations (computed by the Default Mode Network) define the optimization and de-optimization dynamics thus is intermediated by the Salient Network. The adaptability and reduction of free energy depend on plasticity inducing processes that take weeks to months' timescale.
To conclude, depression emerges from deoptimization dynamics related both to external occurrences and internal representations within the framework of the Bayesian Brain with it's "free Energy" dynamics. All, related to the activity of the Salient Network within week to months timescale. Deoptimization and depression are the opposite of what transpires in Mania.
Mania emerges from hyper-optimization dynamics related both to external occurrences and internal representations within the framework of the Bayesian Brain with it's "free Energy" dynamics. Free energy reduction triggers antidepressant and manic emergent properties.
Also, here all is related to the activity of the Salient Network within week to months' timescale.
When corrective balance effects trigger contradicting deoptimization and hyper optimization oscillatory dynamics bipolar phenomenology emerges.

Table 1 summarizes the Neuroanalytic formulations.

DSM NM DIAGNOSIS

DSM	NM
Psychosis Delusions Hallucinations Loosening of associations	Millisecond range disturbances Disconnection dynamics disintegration of conscious experience reduced clustering coefficient of Small World Network organization Top-down imbalance with constraining distortion of higher-level transmodal schemata (ideations) upon bottom-up evidence. A disturbance to error-correction millisecond range Bayesian dynamics. Location Central Executive Network Frontal parietal hubs. Hierarchical transmodal organization
Negative Symptoms Dementia precox Poverty of thought	Over-connection dynamics Increase clustering coefficient of Small World Network organization. Constraint state-space dynamics Hierarchical collapse with insufficient transmodal optimization Location Central Executive Network Frontal parietal hubs. Hierarchical transmodal organization
Anxiety	Perturbation to Multiple Constraint Satisfaction Dynamics over distributed whole-brain networks. Consequence of computational brain dynamics. The dynamics of perturbation to Multiple Constraint Satisfaction takes place in the timescale of minutes as is evident from anxiety-related manifestations. Location Salient network with subcortical basal ganglia hubs acting upon massively distributed general cortical whole-brain networks.
Depression	Distributed hypoplasticity governed by Salient Network hubs resulting in reduced Bayesian brain dynamics, with deoptimization dynamics of internal representations, with overall increase of free energy. The dynamics of deoptimization takes place in the weeks to months' timescale as is evident from antidepressant plasticity-dependent processes Location Salient network with subcortical basal ganglia hubs acting upon massively distributed general cortical whole-brain networks.
Mania Bipolar	Distributed hyper plasticity governed by Salient Network hubs resulting in increased Bayesian brain dynamics, with hyper optimization dynamics of internal representations, with overall decrease of free energy. Hyper plasticity and hyper optimization can trigger balancing effect that can result in oscillating hyper-hypo dynamics which will induce a bipolar phenomenology. The dynamics of hyper optimization takes place in the weeks to months' time-scale as is evident from stabilization of plasticity-dependent processes Location Salient network with subcortical basal ganglia hubs acting upon massively distributed general cortical whole-brain networks.

Personality disorders	Default-Mode Resting-State Network develops within a lifetime scale from birth to adulthood and beyond. It is configured by Hebbian dynamics as an "Experience – Dependent Plasticity" process where experience activates representative neuronal networks creating memories, internal representations via strengthening experience dependent connections. Experience continually moulds and reshape the brain network organization, while optimizing and deoptimizing the internal configurations thus relating our experiences to mood.

Clinician Rating input

1) Scrolls input based on guide for Clinical Rating based on conventional scales input of Module 1

Phenomenology Item	Non =o	Mild =1	Moderate =2	Marked =3
Positive signs loosening Hallucinations		Thinking is circumstantial, tangential, or para-logical. There is some difficulty in directing thoughts toward a goal and some loosening of associations may be evidenced under pressure. Tends to be slightly agitated, hypervigilant, or mildly over aroused. Slight awkwardness in movements. One or two clearly formed but infrequent hallucinations, or else a number of vague abnormal perceptions which do not result in distortions of thinking or behavior. presents a guarded or even openly distrustful attitude, but thoughts, interactions, and behavior are minimally affected. *PANSS P2 Conceptual disorganization 2,3,* *PANSS P4 Excitement 2,3,*	Generally has difficulty in organizing thoughts, as evidenced by frequent irrelevances, disconnectedness. or loosening of associations even when not under pressure Agitation or over arousal is clearly evident episodic outbursts occur sporadically, Movements are notably awkward or disjointed. Hallucinations occur frequently but not continuously. These may involve more than one sensory modality, and tend to distort thinking and/or disrupt behavior *PANSS P2 Conceptual disorganization 4,5,* *PANSS P4 Excitement 4,5,* *PANSS G5 mannerism posturing 4,5,* *PANSS P3 Hallucinatory behavior 4,5,*	Thoughts are disrupted to the point where the patier is incoherent. There is marked loosening of associations, marked excitement delimits attention, and affects personal functions such as eating and sleeping Frequent repetition of bizarre rituals, mannerism or stereotyped movement Hallucinations are present almost continuously, causing major disruption o thinking and behavior. Patient treats these as rea perceptions, and functioni is impeded by frequent emotional and verbal responses to them. *PANSS P2 Conceptual disorganization 6,7,* *PANSS P4 Excitement 6,7,* *PANSS G5 mannerism posturing 6,7,* *PANSS P3 Hallucinatory behavior 4,5,*

		PANSS G5 mannerism posturing 2,3, *PANSS P3 Hallucinatory behavior 2,3,*		
Positive signs Delusions		Presence of one or two delusions which are vague, un-crystallized delusions that do not interfere with thinking, social relations, or behavior. Thought content is somewhat peculiar or idiosyncratic, or familiar ideas are framed in an odd context. *PANSS P1 Delusions 2,3,* *PANSS G9 Unusual thought content 2,3,* *PANSS P6 persecution 2,3,*	Presence of numerous well-formed delusions that are tenaciously held and occasionally interfere with thinking, social relations, or behavior. Distrustfulness is clearly evident, Patient shows marked distrust, there are clear-cut persecutory delusions that have limited impact on interpersonal relations and behavior Ideas are frequently distorted and occasionally seem quite bizarre. *PANSS P1 Delusions 4,5,* *PANSS G9 Unusual thought content 4,5,* *PANSS P6 persecution 4,5,*	Presence of a stable set of delusions which are crystallized, possibly systematized, tenaciously held, and clearly interfere with thinking, social relations, and behavior. These frequently result in inappropriate and irresponsible action, which may even jeopardize the safety of the patient or others. Clear-cut pervasive delusions of persecution which may be systematize and significantly interfere interpersonal relations. Patient expresses many illogical or absurd ideas or some which have a distinc bizarre quality *PANSS P1 Delusions 6,7,* *PANSS G9 Unusual though content 6,7,* *PANSS P6 persecution 6,7,*
Negative signs Alogia		Some rigidity shown in attitudes or beliefs. Tends to give literal or personalized interpretations to the more difficult proverbs and may have some problems with concepts that are fairly abstract or remotely related Conversation shows little initiative. Patient's answers tend to be brief and unembellished.	Thinking is rigid and repetitious thus conversation is limited to only two or three dominating topics Deals primarily in a concrete mode, exhibiting difficulty with most proverbs and many categories. Conversation lacks free flow and appears uneven or halting. marked lack of spontaneity and openness, replying to	Thinking, behavior, and conversation are dominate by constant repetition of fixed ideas or limited phrases, leading to gross rigidity, inappropriateness and restrictiveness of patient's communication. Can use only concrete modes of thinking. Shows comprehension of proverb common metaphors or similes, and simple categories. Patient's responses are limited mainly to a few

		There is evidence of some indecisiveness in conversation and thinking, which may impede verbal and cognitive processes to a minor extent. Changes in facial expression and communicative gestures seem to be stilted, forced, artificial, or lacking in modulation. Conversation is characterized by a stilted strained or artificial tone. It may lack *PANSS N5 Abstract thought 2,3,* *PANSS N6 flow conversation 2,3,* *Stereotyped N7 2,3,* *PANSS N1 Blunted affect 2,3,*	questions with only one or two brief sentences. Affect is generally ~flat-, with only occasional changes in facial expression and a paucity of communicative gestures. *PANSS N5 Abstract thought 4,5,* *PANSS N6 flow conversation 4,5,* *Stereotyped N7 4,5,* *PANSS G13 Dist' Volition 4,5,* *PANSS N1 Blunted affect 4,5,* *PANSS N2 Emotional withdrawal 4,5,* *PANSS N3 Poor Rapport 4,5,* *PANSS N4 Apathetic withdrawal 4,5,*	words or short phrases intended to avoid or curta communication. Conversation is seriously impaired as a result. Marked flatness and deficiency of emotions exhibited most of the time Patient seems constantly t show a barren or "wooden expression. Patient is highly indifferent with marked interpersonal distance. Eye and face contact are frequently avoided. *PANSS N5 Abstract though* *6,7,* *PANSS N6 flow conversatio* *6,7,* *Stereotyped N7 6,7,* *PANSS G13 Dist' Volition 6* *PANSS N1 Blunted affect 6* *PANSS N2 Emotional withdrawal 6,7,* *PANSS N3 Poor Rapport 6,* *PANSS N4 Apathetic withdrawal 6,7,*
Negative signs Avolition		Usually lacks initiative and occasionally may show deficient interest in surrounding events. Emotional depth or tend to remain on an impersonal, intellectual plane. Shows occasional interest in social activities but poor initiative *PANSS G13 Dist' Volition 2,3,*	Disturbance of volition interferes in thinking as well as behavior. Patient shows pronounced indecision that impedes the initiation and continuation of social and motor activities, and which also may be evidenced in halting speech. Patient is clearly detached emotionally from persons and events in the milieu, resisting all efforts at engagement. Patient	Disturbance of volition interferes in the execution of simple, automatic moto functions such as dressing and grooming, and marke affects speech. Failure of volition is manifested by gross inhibition of movement and speech, resulting in immobility and/or mutism Patient is almost totally withdrawn, uncommunicative, and neglectful of personal nee

		PANSS N2 Emotional withdrawal 2,3, *PANSS N3 Poor Rapport 2,3,* *PANSS N4 Apathetic withdrawal 2,3,*	appears distant, docile, and purposeless Patient typically is aloof, act bored, or express disinterest. Dis-involvement is obvious and clearly impedes the productivity of the interview. Patient may tend to avoid eye or face contact. Passively participates in only a minority of activities and shows virtually no interest or initiative *PANSS G13 Dist' Volition 4,5,* *PANSS N1 Blunted affect 4,5,* *PANSS N2 Emotional withdrawal 4,5,* *PANSS N3 Poor Rapport 4,5,* *PANSS N4 Apathetic withdrawal*	as a result of profound lac of interest and emotional commitment. Apathetic and isolated, participating very rarely in social activities and occasionally neglecting personal needs. *PANSS G13 Dist' Volition 4* *PANSS N1 Blunted affect 4* *PANSS N2 Emotional withdrawal 4,5,* *PANSS N3 Poor Rapport 4,* *PANSS N4 Apathetic withdrawal*
Generalized Anxiety		Expresses some worry, over concern, or subjective restlessness, but no somatic and behavioral consequences are reported or evidenced. Mild Worries, anticipation of the worst, fearful anticipation, irritability. Feelings of tension, fatigue, startle response, moved to tears easily, trembling, feelings of restlessness, inability to relax. Mild fears of dark, of strangers, of being left alone, of animals, of traffic, of crowds. Mild difficulty in falling asleep, broken sleep, unsatisfying sleep and fatigue on waking, dreams, nightmares,	Serious problems of anxiety which have significant physical and behavioral consequences, such as marked tension, poor concentration, palpitations, or impaired sleep. Moderate worries, anticipation of the worst, fearful anticipation, irritability. Feelings of tension, fatigability, startle response, moved to tears easily, trembling, feelings of restlessness, inability to relax. Moderate fears of dark, of strangers, of being left alone, of animals, of traffic, of crowds. Moderate difficulty in falling asleep, broken sleep, unsatisfying sleep and fatigue on	Subjective state of almost constant fear associated with phobias, marked restlessness, or numerous somatic manifestations. At times reaches panic proportions or is manifest in actual panic attacks. Marked worries, anticipation of the worst, fearful anticipation, irritability. Feelings of tension, fatigue, startle response, moved to tears easily, trembling, feelings restlessness, inability to relax. Marked fears of dar of strangers, of being left alone, of animals, of traffi of Crowds. Marked difficul in falling asleep, broken sleep, unsatisfying sleep a fatigue on waking, dreams nightmares, night terrors.

		night terrors. Mild combined somatic symptoms *PANSS G2 Anxiety 2,3,* *PANSS G4 Tension 2,3,* *HAM-A Anxious mood 1,* *HAM-A Tension 1,* *HAM-A Fear 1,* *HAM-A Early insomnia 1,* *HAM-A somatic (combined) 1,*	waking, dreams, nightmares, night terrors. Moderate combined somatic symptoms *PANSS G2 Anxiety 4,5,* *PANSS G4 Tension 4,5,* *HAM-A Anxious mood 2,* *HAM-A Tension 2,* *HAM-A Fear 2,* *HAM-A Early insomnia 2,* *HAM-A somatic (combined) 2,*	Marked combined somatic symptoms *PANSS G2 Anxiety 6,7,* *PANSS G4 Tension 6,7,* *HAM-A Anxious mood 3, 4,* *HAM-A Tension 3, 4,* *HAM-A Fear 3, 4,* *HAM-A Early insomnia 3, 4* *HAM-A somatic (combined* *3, 4,*
Depression		Expresses some sadness or discouragement only on questioning. but there is no evidence of depression in general attitude or demeanor. Questioning elicits a vague sense of guilt or self-blame for a minor incident, but the patient clearly is not overly concerned Slight but noticeable diminution in rate of movements and speech Patient may be somewhat underproductive in conversation and gestures. *PANSS G6 Depression 2,3,* *PANSS G3 Guilt feeling 2,3,* *PANSS G7 motor retardation 2,3,* *HAM-D depressed mood 1,* *HAM-D Guilt 1,* *HAM-D Suicide 1,* *HAM-D late insomnia 1,* *HAM-D Work and activity 1,* *HAM-D retardation 1,*	Distinctly depressed mood is associated with obvious sadness, pessimism, loss of social interest psychomotor retardation, and some interference in appetite and sleep. The patient cannot be easily cheered up. Patient expresses a strong sense of guilt associated with self- deprecation or the belief that he deserves punishment. The guilt feelings may have a delusional basis, may be volunteered spontaneously, may be a source of preoccupation and/or depressed mood, and cannot be allayed readily by the interviewer. Patient is clearly slow in movements, and speech may be characterized by poor productivity, including long response latency, extended pauses, or slow pace. *PANSS G6 Depression 4,5,* *PANSS G3 Guilt feeling 4,5,*	Depressive feelings seriou interfere m most major functions. The manifestations include frequent crying, pronounc somatic symptoms, impaired concentration, psychomotor retardation, social disinterest, self-neglect, possible depressiv or nihilistic delusions, and/or possible suicidal thoughts or action. Strong ideas of guilt take o a delusional quality and le to an attitude of hopelessness or worthlessness The patient believes he should receive harsh sanctions for the misdeeds and may even regard his current life situation as such punishment. Movements are extremely slow, resulting in a minimum of activity and speech. Essentially the day is spent sitting idly or lying down. *PANSS G6 Depression 6,7,* *PANSS G3 Guilt feeling 6,7,* *PANSS G7 motor retardati 6,7,* *HAM-D depressed mood 4,*

		HAM-D loss of weight mild	*PANSS G7 motor retardation 4,5,* *HAM-D depressed mood 2,3,* *HAM-D Guilt 2,3,* *HAM-D Suicide 2,3,* *HAM-D late insomnia 2, 3,* *HAM-D Work and activity 2,3,* *HAM-D retardation 2,3,* *HAM-D loss of weight moderate*	*HAM-D Guilt 4,* *HAM-D Suicide 4,* *HAM-D Late insomnia 4* *HAM-D Work and activity* *HAM-D retardation 4,* *HAM-D loss of weight marked*
Mania		Hypomania Increased rate or amount of speech at times, verbose at times, content Special project(s); hyper-religious Some expansiveness or boastfulness is evident, but without clear-cut grandiose delusions. Definite subjective elevation; optimistic, self-confident; cheerful; appropriate to content, Motor animated; gestures increased Definite subjective increase of sexual interest Irritable at times episodes of anger or annoyance Sleeping less than normal by more than one hour *PANSS P5 Grandiosity 2,3, YMRS Elevated mood 1,* *YMRS motor energy 1,* *YMRS sexual interest 1,* *YMRS Sleep 2,* *YMRS irritability 1,* *YMRS Speech rate amount 1,* *YMRS Content grandiose 1,*	Mania Consistently increased rate and amount of speech, difficult to interrupt Content Grandiose or paranoid ideas; ideas of reference Feels distinctly and unrealistically superior to others. Some poorly formed delusions about special status or abilities may be present but are not acted upon. Elevated; inappropriate to content; humorous Excessive energy; hyperactive at times; restless Elaborates on sexual matters; hypersexual Decreased need for sleep *PANSS P5 Grandiosity 4,5,* *YMRS Elevated mood 2,* *YMRS motor energy 2,* *YMRS sexual interest 2,* *YMRS Sleep 3,* *YMRS irritability 2,* *YMRS Speech rate amount 2,* *YMRS Content grandiose 2,*	Mania psychosis Pressured, uninterruptible continuous speech. Conter marked Delusions, parano grandiose. Clear-cut delusions of remarkable superiority. Thinking, interactions, and behavior are dominated by multiple delusions of amazing abilit wealth knowledge, fame, power, and/or moral stature. Euphoric; inappropriate laughter; singing Motor excitement; continuous hyperactivity (cannot be calmed) Sexual interest involves overt sexual acts. Hostile, uncooperative; interview impossible Denies need for sleep *PANSS P5 Grandiosity 6,7,* *YMRS Elevated mood 3, 4,* *YMRS motor energy 3, 4,* *YMRS sexual interest 3, 4,* *YMRS Sleep 4,* *YMRS irritability 3, 4,* *YMRS Speech rate amount 4,* *YMRS Content grandiose 3 4,*

higher personality organization		Rigid predictable restricted behaviors attitudes and traits Indirect or restrained communication of anger such as sarcasm, disrespect, hostile expressions, and occasional irritability. Patient tends to be easily angered and frustrated when facing stress or denied gratification but rarely acts on impulse. *PANSS G14 poor impulse control 2,3,* *PANSS P7 Hostility 2,3,* *PANSS G14 poor impulse control 2,3,* *PANSS P7 Hostility 2,3,*	Rigid predictable restricted behaviors attitudes childish immature personality egocentricity dependency are marked Special sensitivity to criticism, need for attention low impulsive threshold Presents an overtly hostile attitude, showing frequent irritability and direct expression of anger or resentment. Patient exhibits repeated impulsive episodes involving verbal abuse, destruction of property, or physical threats. *PANSS G14 poor impulse control 4,5,* *PANSS P7 Hostility 4,5,* *PANSS G14 poor impulse control 4,5,* *PANSS P7 Hostility 4,5,*	Dominant restricted behaviors attitudes Dependent immature personality dependency is marked to extent that hampers any functional challenge Unstable, impulsive, inabil to regulate or control emotions.Tends to split (al or-none-all good all bad attitude) when under stres becomes paranoid (brief psychotic episodes) Uncooperativeness and verbal abuse or threats are typical and seriously impac upon social relations. Patient may be violent anc destructive and is physical assaultive toward others. Patient frequently is impulsive aggressive, threatening, demanding, and destructive, without a apparent consideration of consequences. Shows assaultive behavior and m also be sexually offensive *PANSS G14 poor impulse control 6,7,* *PANSS P7 Hostility 6,7,* *PANSS G14 poor impulse control 6,7,* *PANSS P7 Hostility 6,7,*