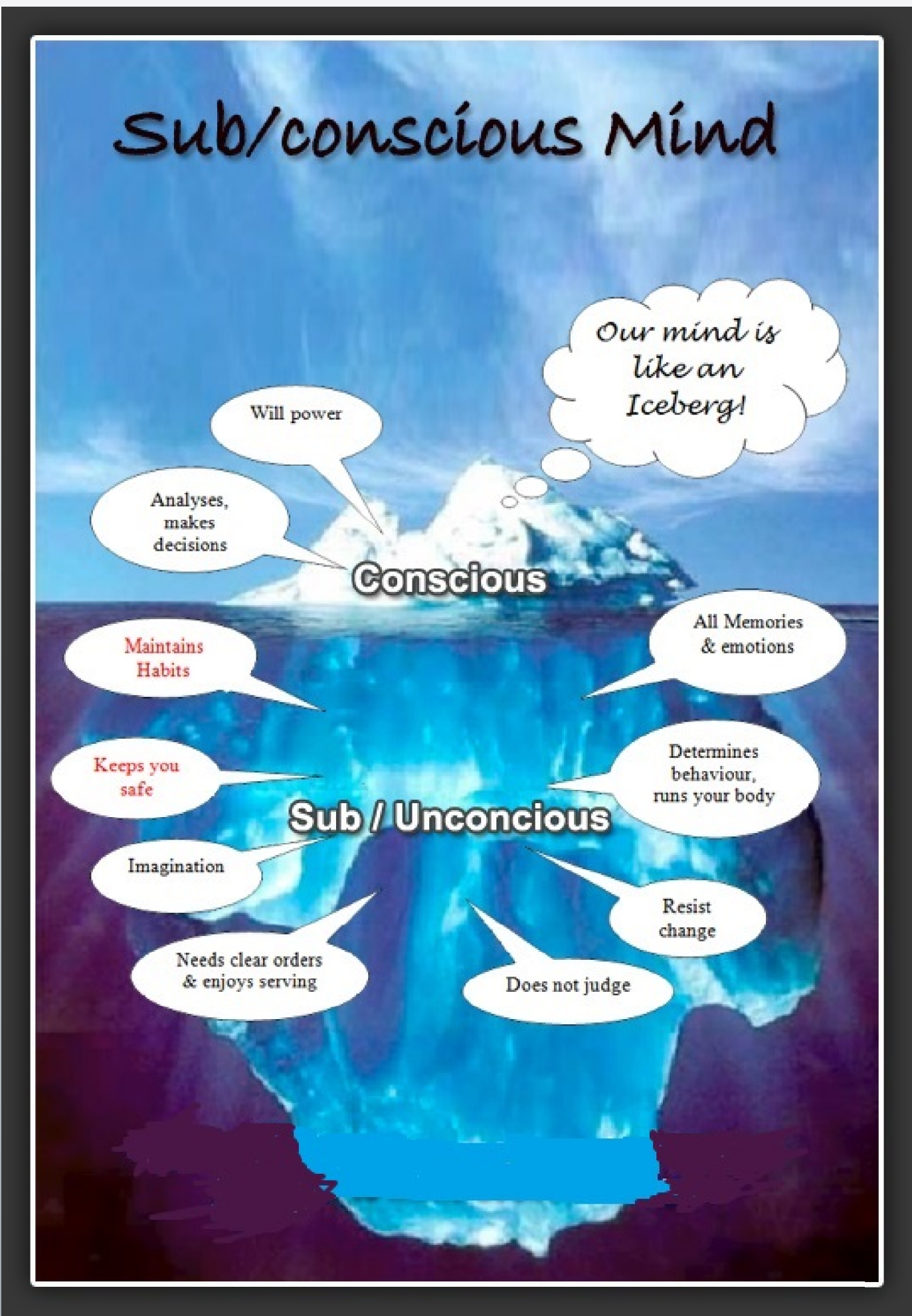
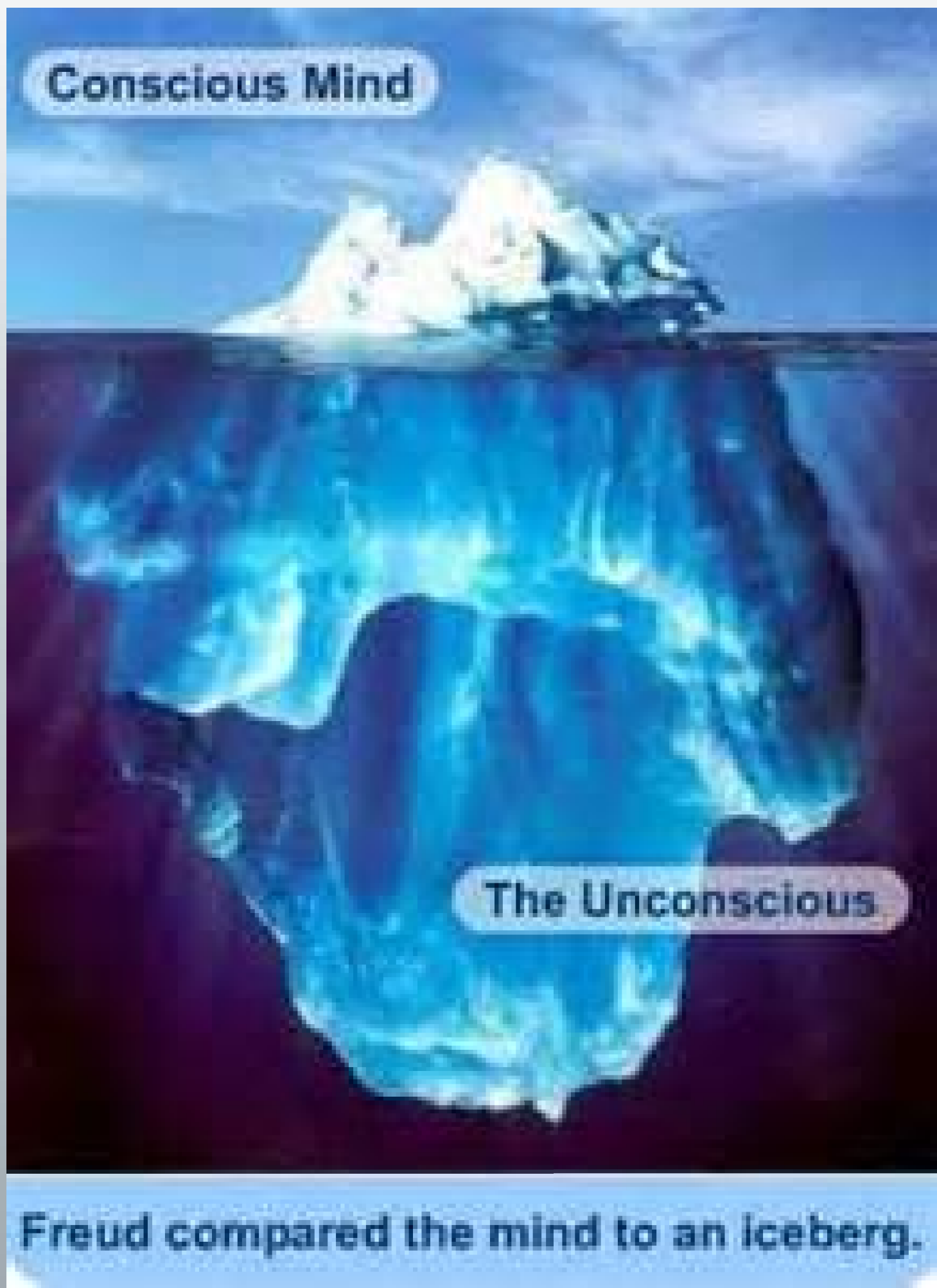


# BAYESIAN UPDATING BASED ON HAUSDORFF OUTER MEASURES AND THE ROLE OF EMOTIONS DURING THE THERAPEUTIC PHASE OF ALLIANCE

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The phase of alliance is an interactive and collaborative relationship between patient and therapist, common to different psychotherapies, where both have an active role in achieving therapeutic goals.



The unconscious mind (or the unconscious) consists of the processes in the mind that occur automatically and are not available to introspection, and include thought processes, memory, affect, and motivation.

Sleep, sleepwalking, dreaming, delirium, and comas may signal the presence of unconscious processes, these processes are not the unconscious mind itself, but rather symptoms.

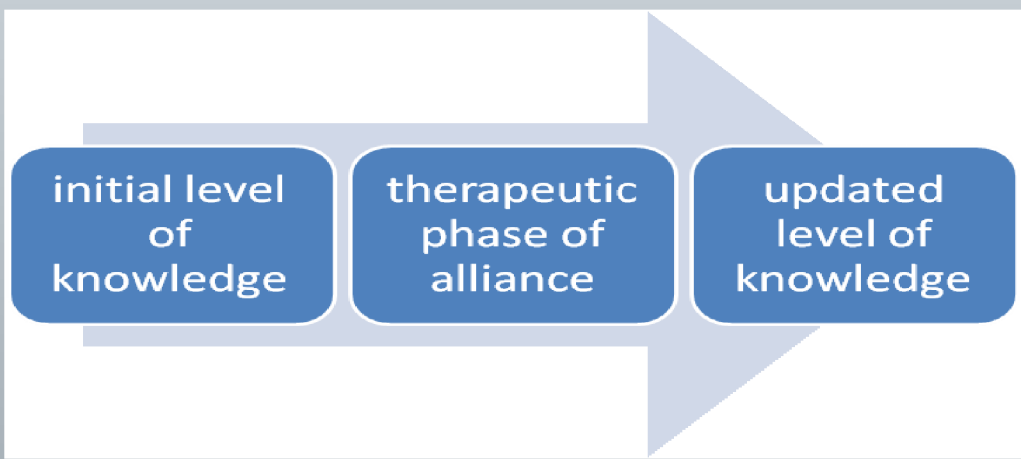
They condition the subject's level of knowledge and they should not be contradicted during the phase of the alliance.

For this reason the subject's level of knowledge is defined by a coherent conditional probability such that  $P(B|B)=1$ .

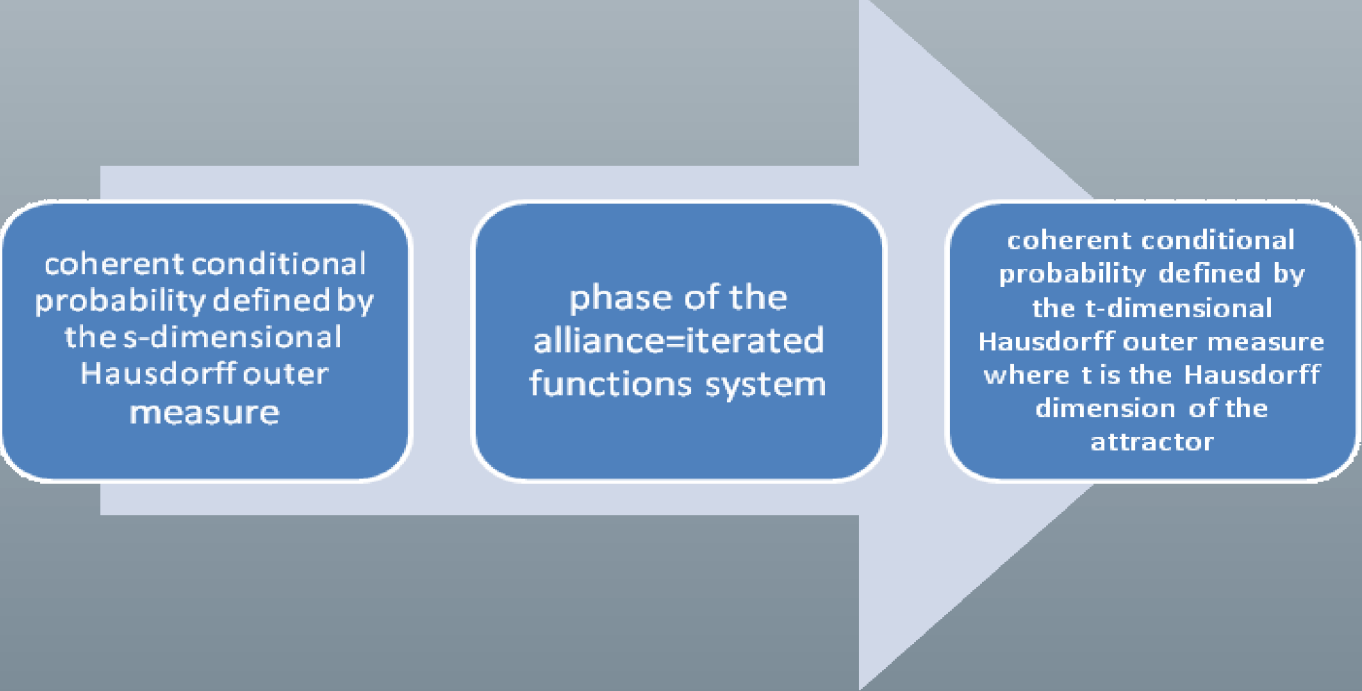
According to Matte Blanco, the conscious and unconscious are two different modes of being respect to the psychophysics unity of the Man, asymmetric and in becoming the first, symmetric and static the second: this terminology is due to the fact that the latter is regulated by the symmetric principle, contrarily to the first.

Blanco also discussed the notion of infinite set in Mathematics, analogically compared with the symmetric mode of being of the unconscious, precisely with its property of indistinguishability between the part and the whole, in the sense that they both have the same cardinality

Formulating diagnosis is a complex process, related to the clinician's ability to represent the patient's discomfort, to use error due to the incompleteness of the information available, to make predictions about well-being. We interpret the therapist-patient system as a complex system, whose evolution, representing the phase of alliance, is described by a finite family of contractions that, starting from certain initial conditions, evolve the system into the attractor; this set, characterized by its own complexity, measured in terms of the Hausdorff dimension, represents the state in which the therapist and patient find themselves after the phase of alliance.



A probabilistic approach of the diagnostic process is proposed in which the subject's degree of knowledge is represented with coherent upper conditional probabilities defined by Hausdorff outer measures. Using this model, the diagnosis is assumed to be positive when it produces a change, that is when the subject's level of knowledge is defined by an a posteriori Hausdorff outer measure different from the initial Hausdorff outer measure.

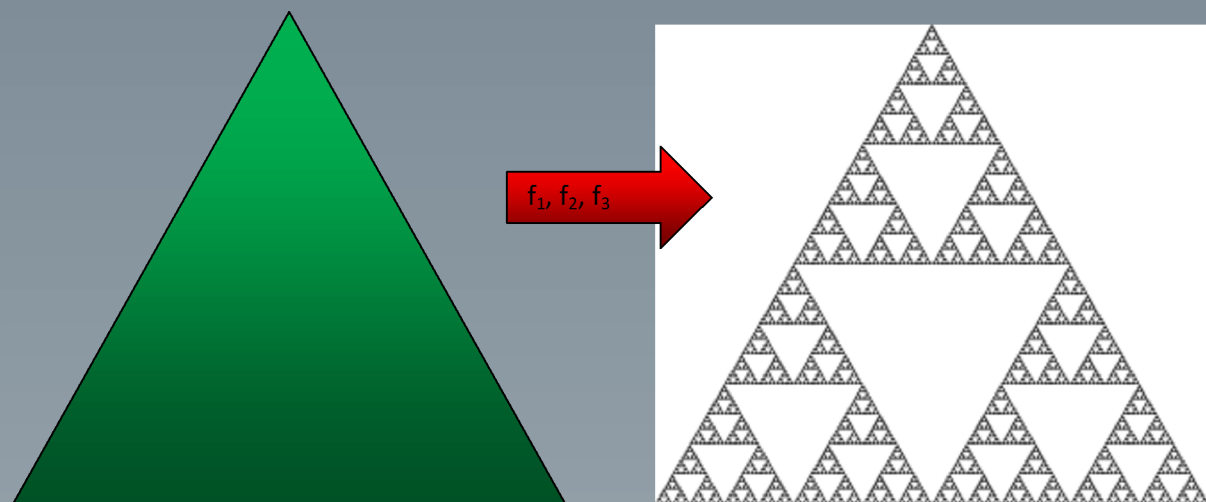


We believe that one of the roles of the therapist in the phase of the alliance is to shorten the distance between him and the patient so that he can update the level of cognitive and emotional understanding of the problem the patient asks for his help for. The first step that the therapist must take is to realize that he him is a complex system and small perturbations to the initial state, i.e. the encounter with the patient, can bring to totally unpredictable states, from which he has to assess the probability of success of the diagnosis. The phase of the therapist-patient alliance can be interpreted as the phase in which the complexity is likely to increase.

In the mathematical model, the role of the therapist is represented by choosing a particular system of contractions, the similarities, that keep unchanged some geometric properties. These invariance of geometric properties aims to describe the fact that some features of the therapist are repeated at different scales, influencing the diagnostic attitude. By iterating these contractions, the patient-therapist system reaches a state represented by a self-similar set, called the attractor of the system; if the attractor has zero probability with respect to the Hausdorff measure that defines the initial level of knowledge of the patient then another measure needs to be used to represent the subject's level of knowledge conditioned to the attractor. The goal of the phase of the alliance is therefore to have the patient to confront with an unpredictable state, represented by a set having initial probability of zero value.

The Sierpinsky Triangle is the attractor of the following set of similitudes

$$f_1 = \begin{cases} X = \frac{1}{2}x \\ Y = \frac{1}{2}y \end{cases} \quad f_2 = \begin{cases} X = \frac{1}{2}x + 1 \\ Y = \frac{1}{2}y \end{cases} \quad f_3 = \begin{cases} X = \frac{1}{2}x + \frac{1}{4} \\ Y = \frac{1}{2}y + \frac{\sqrt{3}}{4} \end{cases}$$



The attractor of the system represents the unconscious of the system therapist-patient and according to the theory developed in Matte Blanco it is characterized by symmetry and self-similarity.

In particular, according to Freud, the usual ordinary logic rules of conscious thought are no valid for the unconscious since it operates according to another logic system. The former is ruled by a classical, assertoric (not modal) logic founded on the material implication and having, as fundamental laws, the identity principle, the non-contradiction principle, the bivalent principle, the principle of sufficient reason and the principle of the excluded third (tertium non datur). Instead, according to the studies on schizophrenia made by Matte Blanco, the fundamental principles of the unconscious are the **generalization principle** and the **symmetric principle**.

According to the **generalization principle** the unconscious treats any single thing (individual, object, concept, etc) as it were a member, or an element, of a class which contains other members or elements; in turn, this class is considered as a subclass of another more general class, and so on.

According to the **symmetric principle** in the realm of unconscious, every relation is symmetric (just in the mathematical sense of this term).

Ignacio Matte Blanco (1908-1995) has been a notable psychiatrist and psychoanalyst who have devoted many years of his work in studying the mathematical thought starting from his many-years experience with schizophrenic patients. His definitive results were published in the celebrated work entitled Unconscious as Infinite Sets: An Essay on Bilogic (1975).