A FORMAL APPROACH TO PSYCHOANALYTIC THEORY: A PRE-LOGICAL SETTING FROM A QUANTUM MODEL

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Bases and results

- We build on abstract views proposed in the development of psychoanalytic theory, on the basis of the original Freudian *Theory of Representation*. One main source is Ignacio Matte Blanco's approach to the logic of the Unconscious via *Bi-Logic*, that enables the reading of the features of the structural Unconscious in a formal logical setting. Another source is derivable from the approach to psychoanalysis proposed by Wilfred Bion, in particular in his epistemic trilogy, in turn originated in the *Theory of Object Relations* by Melanie Klein.

- Our reference is the quantum world, as the physical model where undefiniteness plays the central role. We have set our work on a logical representation of quantum states in predicate logic. It leads to the idea of *Infinite Singleton* suited to Matte Blanco's Symmetric Mode and its Primary Process. Then, the quantum spin model described by the *Bloch Sphere* can support a logical description of the exit from the Primary Process, explained in terms of the Bionian theory.

- We introduce a pre-logical setting, via modal operators associated to the Bloch Sphere of the spin states. The operators are defined via equations, a method introduced in basic logic, namely a platform for a modular study of logics.

The quantum model

Given a quantum particle $\mathcal{A}$ measured by fixed observable, one obtains the set of outcomes of the measurement V, and the state of the particle can be described by the formula $(\forall x \in V)A(x)$. One can prove that V is an infinite singleton.

The spin state of particle $\mathcal{A}$, prepared along the direction z and measured in a given direction d (observable σ_d), is a dot on the surface of the *Bloch Sphere*:
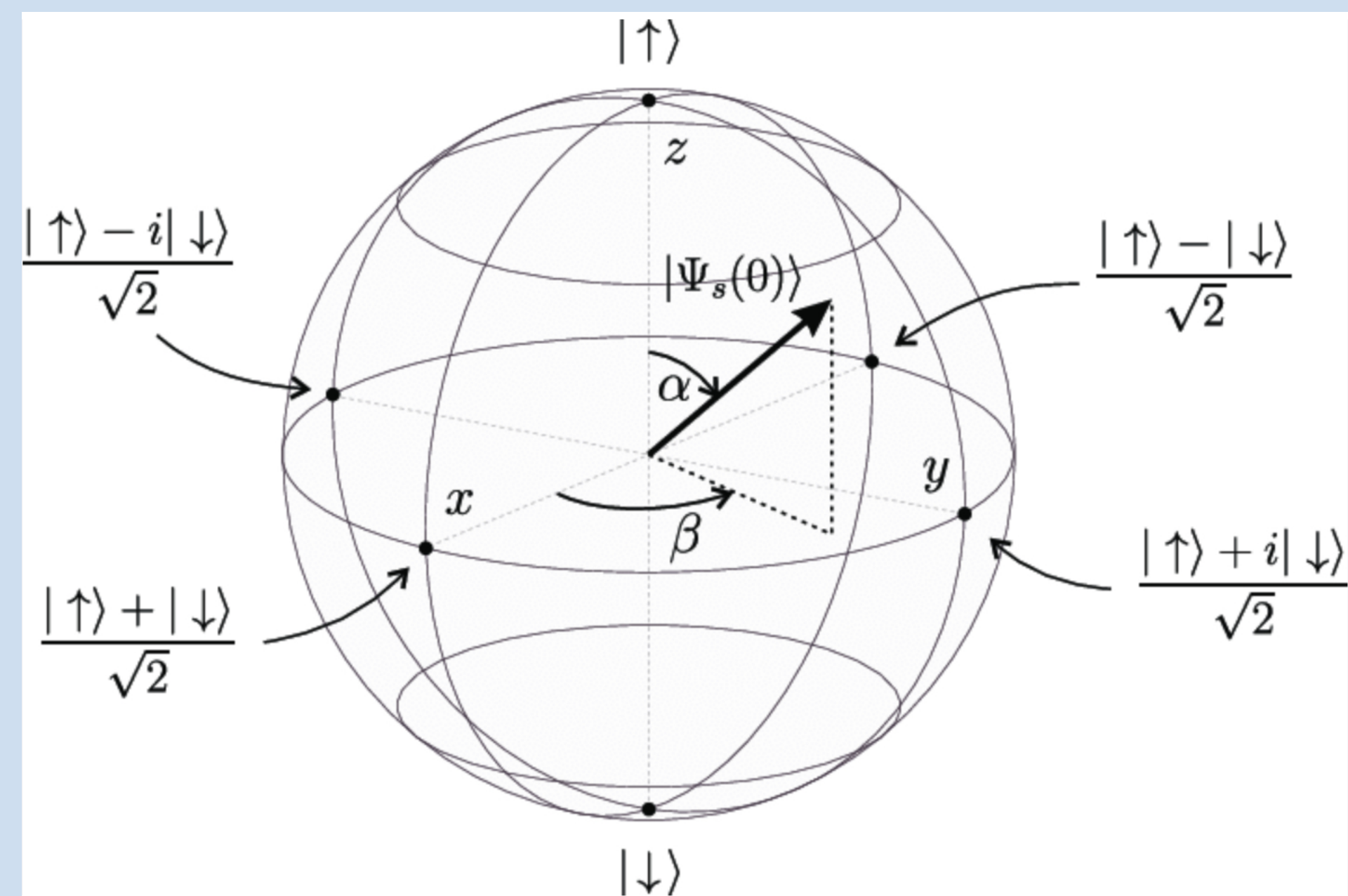
Any σ_d can be decomposed as:

$$\sigma_d = \alpha I + \beta_x \sigma_x + \beta_y \sigma_y + \beta_z \sigma_z$$

- The component σ_z is associated to the z direction, the two eigenstates are $|\uparrow>$ and $|\downarrow>$. It is the real positive component: the measurement asserts the preparation. It corresponds to an *abstract projector*.

- The component σ_x is the real negative component. As a unitary matrix, it can switch the eigenvectors of σ_z. It can be obtained as the real combination of the two antiprojectors. It corresponds to an *abstract antiprojector*.

- The component σ_y is a negative irreal component. As a unitary matrix, it can also switch the eigenvectors of σ_z. It is a combination of the two antiprojectors, but with imaginary coefficients.

- The component I is infinite. It has infinite many eigenvectors, then no direction is associated in particular.

Then the pure infinite component I is not observable as a specific point, namely a spin state $\psi_s(0)$. An analysis shows that no temporal parameter can be assumed in such a case.

Infinite Singletons at the core of the Primary Process

Sets are usually described by their elements: $V = \{u_1, u_2, \ldots u_n, \ldots\}$. In particular singletons are described by their unique element, denoted by a closed term, namely a word u: then, the membership relation $z \in V$ is identified with the equality $z = u$ and we conceive the (finite) singleton $V = \{u\}$.

According to the Freudian Theory of Representation

In the mind, objects are first represented as things, without words.

In formal terms: the mind, that needs to represent a certain object $\mathcal{A}$ (in a process that eventually would give rise to a closed formula $A(u)$), considers a variable ranging on a domain V, rather than a closed term. Then closure is obtained by quantification, getting the formula $(\forall x \in V)A(x)$. In order to preserve the unitarity of the object so represented, the universal and existential quantification coincide on V:

$$(\forall x \in V)A(x) \text{ is equivalent to } (\exists x \in V)A(x)$$

for every formula A.

Such a position makes any V a singleton. Without further assumptions, V is infinite: for, one can prove that, if the object(s) of a set are not distinguishable by words, the counting process is not possible.

Infinite Singletons meet both the requirements of Matte Blanco's Symmetric Mode: infinite objects equipped with symmetric relations only (relations are all symmetric only in singletons).

Condensation and displacement naturally occur with Infinite Singletons.

Characterizing abstract infinite and finite components

In logic, dropping the specific domain of quantification, one gets an abstract form of the quantifier, that coincides with the necessity modal operator $\square$. Then the infinite possibility and three basic finite possibilities are obtained:

- $\square A$ is interpreted as $(\forall x \in T)A(x)$ where T is "the abstract infinite singleton" that *contains* the elements attributed to the object $\mathcal{A}$. In the Bloch Sphere, it means to consider the whole surface, namely any direction d, and no one in particular. T can be interpreted as the Bionian *Container* that makes the *Symbiotic Link* possible.

- $\square A$ is interpreted as $A(p)$, where p is an abstract positive witness associated to the Bionian *Convivial Link*. It enables to convert thing presentations into word presentations, and hence to assert facts from reality (direction z in the Bloch Sphere).

- One gets a negative modal operator $\square_n A = A(n)$, where n is an abstract negative witness associated to the negation of the reality one has previously represented, namely its repression: it is the Freudian *Verneinung* (direction x in the Bloch Sphere).

- One gets a different negative modal operator $\square_e A = A(e)$, where e is an abstract negative irreal witness associated to the denial of reality, that is the rejection of its representation: it is the Freudian *Verleugnung*, and corresponds to the Bionian *Parasitic Link* (direction y in the Bloch Sphere).

The above interpretation can analyse the role of the infinite vs finite elements for the mind beyond Matte Blanco. The symbiotic link, associated to the infinite interpretation of $\square$ unfolds into the finite positive and negative components $\square, \square_n, \square_e$ due to the emergence of the temporal parameter.

Then one can see that the collapse from the Primary Process to the Secondary Process occurs when time, negation and contradiction are conceived, as proposed by Freud in the Interpretation of Dreams.