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Phantasy Therapy: A Novel Theoretic and Therapeutic Approach for the Special Treatment of Psychotic Patients in General Psychiatry

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Abstract

A new approach to group therapy for the special treatment of psychotic patients is introduced. This work begins with a clarifying **Introduction** motivated by the question: "What is psychosis?" This is followed by a short review of some recent literature on the «connectivity model» of psychosis. Within the spirit of the «connectivity model», an evidence-based neurobiological psychosis hypothesis is then formulated. The **Objective** is to put this hypothesis to work by laying the theoretical foundations of a corresponding psychosis therapy. This leads to the presentation of a practical **Method** called «Phantasy Therapy» for the group psychotherapy of psychotic patients in acute (stationary) and rehabilitation (ambulatory) phases. This depth-psychologically oriented therapy form has been practiced in our clinic since 1995. It represents a synthesis of over a decade of theoretical pondering, research work and hands-on clinical experience with people suffering from a psychotic disturbance. The clinical **Results** gathered include a quantitative pilot-study and preliminary results of a full investigation testing the method's effectiveness and quality assurance in both stationary and ambulatory settings. The work **Concludes** that the mental «binding problem» associated with psychosis may be

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effectively treated: first of all, by optimizing «therapeutic presence» so as to enhance the encounter between therapist and patient («pacing») and; subsequently, by playfully exposing patients to multifarious cognitive-emotional-sensorial-intuitive inputs while therapeutically channeling them under the empathic, participatory and vigilant guidance («leading») of the therapist. This approach enables the patient to rediscover our common objective reality within his or her unique subjective fantasy by „synergetically“ integrating multimedial elements from art-, movement/dance-, music- and psychotherapies. For reasons which will become clear from the arguments presented, it is fitting to call this new approach a «mind-body-social approach».

Introduction: A Mind-Body-Social Approach

This paper introduces a new approach to group therapy for the special treatment of psychotic patients. It is the synthesis of over a decade of theoretical pondering, research work and hands-on clinical experience with people suffering from a psychotic disturbance. This synthesis has, over the past ten years, led to the development of a special form of group psychotherapy which I call «Phantasy Therapy». For reasons which will become clear from the arguments below, it is fitting to call this new approach a «mind-body-social approach».

Since there are so many different ways to understand the phenomenon of psychosis, this paper begins with a clarifying discourse motivated by the question: "What is psychosis?"

What is Psychosis?

Psychosis can be defined most generally as «a weakened or distorted relationship to or attitude toward collective reality». Depending upon a clinician's field of specialization, clinic or research, he or she develops a particular understanding of the phenomenon psychosis.

«Phenomenological» Versus «Functional» Understanding of Psychosis

There are at least two major perspectives on psychosis: The «phenomenological» and the «functional» points of view. Each point of view represents a different domain of understanding psychosis.

The *phenomenological understanding of psychosis* stems from *clinical observation and description*. Someone is said to be «psychotic» if they suffer from a weakened or distorted relationship to or attitude toward collective reality while manifesting at least one of the following symptoms of an *overall psychosis syndrome: disorganized behaviour, hallucinations, delusions, or thought disturbances*. Here the psychosis syndrome is traditionally classified in a dichotomous fashion: exogenic versus endogenic. The «exogenic psychoses» have obvious external causes such as a traumatic experience, the ingestion of a psycholytic substance, or brain disturbance/damage, whereas the cause of the «endogenic psychoses» is not (yet) identifiable. The latter may be further

subclassified into affective and schizophrenic psychoses. The «affective psychoses» involve a loss of reality within the context of a depressive or manic disturbance. The «schizophrenic psychoses» involve a disturbance to the connection between sensory, feeling, thinking and intuitive functions. Finally, one can also speak of a mixed form lying between the affective and schizophrenic, endogenic psychoses, namely, the so-called schizoaffective psychoses. Depending upon one's theoretical and/or therapeutical inclination, one may take more of a «symptoms-of-the-mind» or more of a «symptoms-of-the-brain» approach to this understanding - see next section.

The *functional understanding of psychosis* stems from *empirical research and analysis*. Someone manifesting a weakened or distorted relationship to or attitude toward collective reality is found to be in *an unusual ("pathological") mind-brain state* involving state-specific neurological/biochemical pathways and modes of information processing or state-specific psychosocial attitudes toward reality. (A person in this state may or may not manifest one or another symptom of the above-mentioned psychosis syndrome.) Depending upon one's theoretical and/or therapeutical inclination, one may take more of a «state-of-mind» or more of a «state-of-brain» approach to this understanding - see next section.

These domains may only partially overlap: It is not yet clear if the allocation to either one of these domains, phenomenological (symptom-based) versus functional (state-based) psychosis, is necessary or sufficient for the allocation to the other domain. For example, the functional understanding allows for a diagnosis of psychosis solely on the basis of the neurological/biochemical pathways (brain-approach) and/or information processing (mind-approach) involved in the mind-brain state, even in the absence of any overt symptom belonging to the psychosis syndrome mentioned above. On the other hand, the functional mind-brain state of a person suffering from delusions may very well lie in the norm of nondisturbed information processing once the acute (functional) psychotic state has ameliorated. The independence of the phenomenological and functional understandings can also be exemplified with the substance-induced "model psychoses". These may not necessarily be the same as the schizophrenic psychoses in terms of the mechanisms and pathways involved during the respective information processing in the mind-brain, even though both kinds of psychosis may involve disorganized behaviour, or one or another delusion, hallucination or thought disturbance sufficient for a phenomenological definition of psychosis.

All ICD-10 diagnoses of psychosis rest upon a phenomenological understanding. Even the ICD-10 F06 and F1 diagnostic categories are based primarily upon the clinical psychosis syndrome, in these cases however, in clear correlation to evidence of organic damage or functional disturbance to the brain. The F06 and F1 categorizations do not, however, require details about the state of the neurological/biochemical pathways and information processing involved in the manifest syndrome.

Theoretic and Therapeutic Approaches to Each Understanding of Psychosis

Both domains of understanding can approach the concept of psychosis theoretically and therapeutically on any one of at least four different levels starting at the level of "pure" brain and ending at the level of "pure" mind:

- at the neurobiological level
(neurotransmitter therapy)
- at the perceptual-apperceptual / linguistic-symbolic level
(Phantasy Therapy / Progressive Mirror Drawing / hypnotherapy)
- at the cognitive-emotional-behavioural analytical level
(psychotherapy)
- at the spiritual level
(shamanism / spiritual healing)

Accordingly, from either a clinical or an empirical perspective, one is free to decide at what «level» one might attempt to *understand* and *treat* psychosis. For example,

- within the phenomenological (symptom-based) domain of understanding, the F06 and F1 ICD-10 psychotic disturbances require an evident neurobiological origin ("purely" «symptoms-of-the-brain»), whereas, at the cognitive-emotional-behavioural analytical level, the ICD-10 also allows for a purely hysterical psychotic reaction (F44: dissociative/conversion disturbances) in the absence of any recognizable organic defect ("purely" «symptoms-of-the-mind»).
- within the functional (state-based) domain of understanding, studies into the «neural correlates of consciousness» are based upon objective neuropsychological measurements such as EEG (=electroencephalogram) or PET (=positron emission tomography). Such measurements lead to conclusions about unusual ("pathological") «state-of-brain» specific neurological/biochemical pathways and modes of information processing. At the other extreme, cultural anthropological studies try to distinguish between opposing «states-of-mind» involving «mental illness», on the one hand, or «spiritual crisis», on the other: «Mental illness» is due to «states-of-mind», which are, within the given psychosocial context, collectively regarded to be disturbed; on the other hand, a «spiritual crisis» is due to «states-of-mind» which are, again within the given psychosocial context, regarded to result from a healthy, if critical, phase shift during a person's psychological individuation.

Main stream thinkers usually approach both theory and therapy of psychosis on one and the same level within a particular domain of understanding, usually the phenomenological domain: biological psychiatrists at the neurobiological level; art, movement and music therapists at the perceptual-apperceptual / linguistic-symbolic level; psychologists at the cognitive-emotional-behavioural analytical level; and adherents to alternative, complementary and religious/esoteric schools at the spiritual level. In contrast, this paper presents an unorthodox diversification, approaching theory at the neurobiological level while, at the same time, approaching therapy at the perceptual-apperceptual / linguistic-symbolic level. Both

approaches (to theory and to therapy) discussed in this work understand psychosis as a functional mind-brain disturbance. One evidence-based way to understand functional mind-brain disturbances has established itself in the recent literature under the name: «functional connectivity». But before discussing «functional connectivity», it is helpful to first take a look at what is meant by the overall concept of «connectivity».

What is «Connectivity»?

The general concept of «connectivity» is multifarious in meaning. Depending upon its particular context, connectivity may refer to the aggregation, bundling, clustering, cohesion, combination, commonality, communication, composition, gestalt, identity, integration, integrity, interactivity, jointness, linkage, mutual influence, networking, nonlinearity, oneness, orchestration, relatedness, synchronization, synergy, unity or wholeness etc. of a subset of elements within a given set.

On the one hand, connectivity may be manifest statically/structurally

1. in the geometrical or material continuity or nearness between and amongst the elements of a connected subset, or
2. in that these elements share one or another static attribute (gestalt) in common, like, for example, color or form.

On the other hand, connectivity may also be dynamically/functionally manifest

1. in the local causes and effects between and amongst the respective elements, or
2. in the correlations of their behaviour. Insofar as these causes and effects and/or correlations usually involve a complex pattern of reciprocal interactions (feedback loops), dynamical/functional connectivity is closely related to nonlinear information processing in the mind-brain. (See below.)

In general, one can say that connected elements must, by definition, share in common one or another (recognizable and perhaps also measurable) attribute. In the particular case of static/structural connectivity, this attribute can be, for example, nearness, color, form/gestalt/structure or substance. In the particular case of dynamic/functional connectivity, this attribute has to do with behaviour, for example, cause-and-effect, growth, transformation or motion.

The concept of connectivity is central to the understanding of how cognition results from operations of the brain. For example, the concept of connectivity is closely related, if not identical, to the concept of «binding» discussed in the literature to the science of consciousness (Revonsuo, 1999). Indeed, this concept raises several interesting questions regarding conscious awareness and brain function:

- Does one or another compact brain region or network of brain regions interact more strongly among itself than with the rest of the brain (for a given task or group of subjects)?
- Are mental operations localized to compact brain regions or are they represented by distributed networks of brain areas?
- Does the composition of a set of connected brain regions change depending upon which mental activity the subject is engaged in?
- Are certain brain regions always included or always excluded from such a set?
- Can such a set or can multiple sets of connected brain regions coexist in a normal subject?
- Are there pathological conditions such as psychosis that are reflected in abnormalities in the structural or functional connectivity within such a set?

These and related questions motivate present day research in the science of consciousness. In particular, the science of consciousness is interested in how the brain produces human mental functions. In the following, I will try to clarify some of the basic ideas underlying these questions.

Structural versus Functional «Connectivity»

Structural connectivity involves the qualitative commonality (for example, color or form), or the physical or geometrical – in medicine, the anatomical - continuity, amongst the elements of a subset. Structural connectivity implies that this commonality or continuity is more evident or recognizable than the commonality or continuity of this subset with respect to the rest of the system. Consider, for example, a snapshot of a large metropolitan area viewed from above. Actually, any accurate street plan would do the same to provide a good idea of the structural connectivity of human life in this city.

Functional connectivity involves the mutual/joint activity, behaviour, interaction, or motion amongst the elements of a subset regardless of whether or not the functional linkage is due to direct interactions or mediated by still other (possibly undefined) linkages. Functional connectivity implies that the gestalt/pattern of this mutual/joint activity, behaviour, interaction, or motion is stronger than that of this subset with the rest of the system. Functional connectivity can be assumed to go hand-in-hand with nonlinear information processing in the brain. Consider again as an example, a large metropolitan area filmed from above, this time at night, say, on the 21st of December, when the day is shortest (Northern hemisphere). The different patterns of lights going on and off in the houses and office buildings, along the streets and in the parking lots, moving as headlights with traffic etc. give a good idea of the functional connectivity of human life within this city.

Another example of both kinds of connectivity is that of a symphony orchestra. The structural connectivity is evidenced by the seating order of the musicians, the functional connectivity is determined by the musical score.

The relationship between structural and functional connectivity is a complex one. It is not as simple as the semantic discrimination may imply, and the above-mentioned examples are ideal cases:

On the one hand, behaviourally independent elements having no functional connectivity whatsoever may well be structurally connected geometrically or otherwise, e.g. by sharing the same static attribute, for example, substance, form or color etc.. On the other hand, spatially separated elements having no structural connectivity whatsoever may nevertheless be functionally connected, e.g. by sharing the same dynamic pattern.

«Connectivity» and the Norm: Psychological Perspective

Consciousness seems to be an aggregate phenomenon of the mind-brain. In other words, cognitive processes seem to result from the integration of spatially separated, functionally specialized areas. Indeed, there is evidence that, in the normal human brain, a single, coherent neural process is generated through ongoing re-entrant interactions among widely distributed brain areas (Edelman, 1989, p. 346ff), (Srinivasan, Russell, Edelman, & Tononi, 1999), (Tononi, Sporns, & Edelman, 1992). This means that normal mentation follows from conscious integration in association with the harmonious orchestration of the neural substrates underlying consciousness.

The set of such (widely separated) connected neural aggregates manifesting an integrated/orchestrated mental process is called a *functional cluster* (Tononi, McIntosh, Russell, & Edelman, 1998). A functional brain cluster can also be defined as a subset of neuronal regions that are more strongly interactive among themselves than with the rest of the brain, whether or not the underlying anatomical connectivity is continuous (Giulio Tononi et al., 1998). Only those signals exchanged within a functional boundary can be integrated (Tononi & Edelman, 2000). The particular set of brain regions defining a given functional cluster may differ considerably from subject to subject.

Due to the high complexity of a functional cluster, it can enter into a large number of differentiated states. Accordingly, it is reasonable to assume that functional mind-brain clusters may account for many of the fundamental properties of conscious (and unconscious?) experience. (See ADDENDUM: “Conscious-to-Unconscious Mind-Brain Activity”.) Indeed, conscious experience in the sense of awareness is associated with an increase in coherent firing within a functional cluster: On the one hand, with an increase in magnitude of neural response and, on the other hand, with an increase in integration of the neural response to a stimulus. Not unlike a process of ignition, conscious experience may then take place when the strength and efficacy of the re-entrant interactions among the areas comprising a functional cluster reach a sufficiently high level. (See my second remark to the second psychosis hypothesis presented below in the section “Theory: Evidence-based Psychosis Hypothesis” as well as my discussion in the ADDENDUM.) This would mean that rapid neural integration via re-entry (on the order of a few hundreds of milliseconds) is essential to give rise to a unified conscious, mind-brain state.

Phase Transitions in the Mind-Brain: The «Unfolding Dimension»

Mind-brain states of consciousness seem to be transient, globally coherent processes involving strong and rapid interactions among the participating, widely distributed neuronal aggregates. Such mind-brain states emerge at well-defined thresholds with the characteristics

of what is known in dynamical systems theory as a phase transition (Tononi & Edelman, 2000, p. 396). Upon emerging, such a state is considerably stable and capable of sustaining itself continuously while at the same time constantly changing its precise composition. Indeed, my colleague RUDOLF DÜNKI and I have been able to show that, even in the absence of external activation, information acquisition or controlled mental-task processing (such as counting backwards), that is, even at rest with eyes closed, dynamically different, functional mind-brain states correspond to the clinical states of acute psychosis as compared to remission in unmedicated patients (Dünki & Schmid, 1998).

A good example of aggregate function is provided by a city. (Recall above.) A city coordinates a recognizable coherence and structure from amongst a collection of different and otherwise independent elements (buildings). The identity of the city depends upon the spatial and temporal order coordinating the activity within and between the buildings as prescribed by the city's architectural arrangement (zoning laws) and by the set of laws governing opening and closing hours etc.. For any given city, the nature of its development lending expression and form to its spatiotemporal cultural unfolding is dictated (in part at least) by the mayor. By analogy, the mayor of a city would correspond to an „executive function,, of the brain that might control the unfolding of mentation.

Another example, already mentioned above, is that of a symphony orchestra. A symphony coordinates a recognizable coherence and structure from amongst a collection of different and otherwise independent elements (music instruments). The identity of the symphony depends upon the spatial and temporal order coordinating the activity within and between the instruments as prescribed by the seating arrangement and by the musical score. For any given symphony, the nature of its development lending expression and form to its spatiotemporal unfolding is dictated by the conductor standing in front. By analogy, the conductor of an orchestra would correspond to an „executive function,, of the brain that might control the unfolding of mentation.

It is important to point out, however, that, in spite of the insightfulness provided by the above examples, there seems to be no unique “neural mayor” or „neural conductor,, that is, no executive function, in the brain: the temporal and spatial unfolding of cognition results from the dynamic interactions among several aggregates of the brain and may be initiated from many different points (e.g. (Hebb, 1949)). Exactly how this works – probably a kind of self-organization – is still largely unknown.

An indirect measure of the unfolding of mentation is provided by what my colleague RUDOLF DÜNKI and I have called the «unfolding dimension» (Schmid & Dünki, 1996). Chaos theoretic analyses of the electroencephalograms (EEGs) of unmedicated patients suffering for the first time from a schizophrenic psychosis have shown that the so-called «correlation dimension», d_2 , “unfolds” in an abstract dynamical phase space at a statistically significantly faster rate during the phase of acute psychosis as compared to the subsequent state of remission, i.e. psychotic mind-brain states are “less nonlinear” (= “less functionally connected”) than nonpsychotic ones (Dünki & Schmid, 1998). This indirectly supports the «connectivity model» of psychosis discussed below.

«Connectivity» and the Norm: Neurophysiological Perspective

As already mentioned above, higher cognitive functions rely upon the fast exchange of information across several sensory and behavioural domains through feedback interactions among widely distributed brain regions. This is supported by the evidence from several empirical studies (Edelman, 1987), (Edelman, 1989), (Friston, 1997), (Heinze, Matzke, Dorfmüller, & Smid, 1997), (John, Easton, & Isenhardt, 1997), (Mesulam, 1990), (Mountcastle, 1979), (Tononi et al., 1992), (Tononi, Sporns, & Edelman, 1994). It is generally agreed by researchers in this field that the dynamical network operations made possible by connectivity maximizes flexibility of information representation and processing: A single change to the system can be conveyed to several parts of the brain virtually simultaneously whereby some of this information can be fed back into the initial site, meaning that, due to functional connectivity, mind-brain systems behave like physical fields.

The question still remains, however, as to the exact mechanisms by which this orchestration might take place: biochemical, bioelectrical or quantum physical (e.g. tunneling or teleportation), or a combination of all three.

Neural Context

The particular role of a given brain cell, a neural aggregate/ensemble or a set of aggregates/ensembles in mental function, e.g. in cognition (perception, attention, memory, language, reasoning etc.), is to a great extent determined by its neural context. The neural context defines how this brain cell etc. interacts with other regions of the brain. The functional relevance of a brain region thus depends upon how it operates in conjunction with other parts of the brain (McIntosh, 2000, p. 868).

The importance of neural context can be pictured by a city. Unto itself, the activity of any building or collection of buildings may not differ from state to state, but within a particular city, the same building or collection of buildings may display quite a different nature depending upon the context (business laws) in which it acts. The neural context is a direct result of the neural „city plan,, written in the architecture of the nervous system.

Neural context can also be explained with help of the symphony orchestra example. Played alone, the sound of any instrument or ensemble may not differ from one symphony to another, but within a particular orchestra, the same instrument or ensemble may have quite a different nature depending upon the context in which it is called into play. The neural context is a direct result of the neural „musical score,, written in the architecture of the nervous system.

Feature Maps and Qualia

A hypothesis consistent with neuroscientific evidence proposes that primitive features («qualia»), responsible for subjective experiences such as pleasure and pain, are processed in specialized modules called «feature maps» located in spatially segregated cortical areas specialized for processing such primitive features. (The existence of such «feature maps» allows one to speak of neural correlates of «qualia», perhaps even for such allusive subjective experiences as color recognition - different feature maps for different colors, for example, red

and green etc. - addressing, in part at least, the so-called "hard problem" in the science of consciousness (Shear, 1997).)

Transient Response

In the normal brain, the activity of only a subset of neuron ensembles correlates directly with conscious experience. Insofar as normal consciousness is a waxing and waning experience, one would expect that such subsets of brain regions may only transiently interact more strongly among themselves than with the rest of the brain. In other words, it seems central to cognition that information obtained from many different sensory sources be integrated within the brain in a rapid manner into a single functional entity (=mind-brain state) possessing only a transient dynamic stability (Edelman, 1987), (Tononi et al., 1992).

The importance of *transient response* is obvious in a city. Think, for example, of the transient bustling activity taking place in the cafés, diners and bars during a 24-hour period. Transient response can again be exemplified by the symphony orchestra metaphor. One symphony may emphasize one particular instrument or ensemble of instruments, whereas another symphony may give lead to another. In each case, a different „tone,, is set in the respective composition.

A given neuron, neuron ensemble or set of neuron ensembles may show rapid changes in response characteristics depending upon experience. For example, a correlation between the *conscious* perception of a visual stimulus and the *synchronous* activity of large populations of neurons was found in a binocular rivalry paradigm with the help of frequency-tagged neuromagnetic responses (Tononi, Srinivasan, Russell, & Edelman, 1998). Another example is the strong difference in effective neural connections developed during training in a differential sensory conditioning task (associative learning paradigm). This difference was found only for those subjects who were mentally/cognitively *aware* that only one of the two tones was a strong predictor of the presentation of a subsequent visual stimulus: If an auditory stimulus acquires some meaning, auditory cortex cells will respond more vigorously to the tone (Weinberger & Diamond, 1987). In other words, cerebral processes underlying awareness are mediated through coherent interactions amongst large-scale, distant neurocognitive systems and lead to learning-related changes (e.g. regional cerebral blood flow and functional connectivity) (McIntosh, Rajah, & Lobaugh, 1999), (Tononi & Edelman, 2000). This introduces us to another key concept of the mind-brain interface, namely, that of *transient response plasticity* (McIntosh, 2000).

Transient Response Plasticity

Empirical evidence attesting to the neural plasticity of the human brain - see, for example, (Spitzer, 1999) - shows that the human brain is in a constant flux of forming and reorganizing mind-brain gestalts. The concept «mind-brain gestalt» refers to nerve-fiber structures or networks within the cortex which are organized in so-called «cortical maps» according to certain nonlinear principles. One such principle says that cortical areas are bound together in such a way that any given areal receiving signals from a "lower" areal, also sends

signals back to it ("hand shaking"). It is this reciprocity or recursivity of signals which serves the choreography of mind-brain gestalts (cortical maps).

The Brain's Plasticity

The «plasticity» of the brain means that means that the brain is able to restructure its own neural architecture via signal recursivity. This kind of "correlation based learning" in the domain of higher mental representations - occurring even throughout adulthood! - may help explain how environmental, that is, psychosocial, influences can directly effect the functional architecture of the brain. Learning something new establishes new neural networks («cortical maps» - recall above). One of the most remarkable things about the brain is that, even as we grow older, it continues to develop, renew itself, set up new cortical maps, and remain active

Accordingly, human learning and development is not limited to certain critical periods, but takes place throughout a person's lifespan (Restak, 2002). When we are born, we have more neurons than we need and our brains lose neurons as we grow older. The crucial stages of brain development occur during infancy and childhood, when our burgeoning abilities to move, communicate and think are rapidly developing. This growth continues through adolescence, a chaotic period that gradually gives way to a stabilizing balance as the brain sets about shaping its connections for mature planning and judgment. Throughout adulthood, the brain plays a quiet but supportive role in the daily process of discovering who we are.

Of course, localization of function is also a genetic feature of brain organization and can extend to several high-level cognitive and perceptual functions such as semantics, phonology, syntax, and the perception of faces (Polk et al., 2002). Nevertheless, genetic mechanisms seem neither necessary nor sufficient to explain the localization of other, very important cognitive functions such as letter and number recognition. (See the «Pop-Out Effect» below.)
Summing up:

"Neural specialization in the human brain can extend to a category of stimuli that is culturally defined and that is acquired many years postnatally" (Polk et al., 2002, p. 145).

Returning to the example of a city: Just as the number and types of buildings, and their particular geographical organisation limits the cultural repertoire a city may have, so too does the anatomy of the brain impose limits upon its mental repertoire. However, and as opposed to the fixed response characteristics of each building involved in a city, the plasticity of the cell and hence of the ensemble means that brain aggregates have the potential to modify their response characteristics depending upon afferent information. Furthermore, since the ensemble response changes, so too will its efferent influence, thus transferring the plastic effects to other areas of the brain. This flexibility of function defines the basic response properties of both the central nervous system as well as that of human cognition in general (McIntosh, 2000).

Similarly for the example of a symphony orchestra: The number and types of music instruments, and their particular spatial organisation limits the musical repertoire an orchestra may have.

«Connectivity» and «Disconnectivity»

One particular consequence of «disconnectivity» is the so-called «pop-out effect» in visual experience. (See, for example, (Polk & Farah, 1994) and the references therein.) "A visual target is said to 'pop out' if it is detected quickly and without serial search" (Polk & Farah, 1994, p. 648). Sensations that differ from their perceptual surroundings by the presence of certain characteristic, primitive features (called «qualia»: in the case of visual perception, for example, color and orientation) pop out, whereas similar objects of attention that differ on other features do not.

The Pop-Out Effect

The occurrence of a «mental pop-out effect» indicates that the corresponding «feature maps» are more or less separated in the brain. The mental «hand shaking» mentioned above from a dynamical point of view can also be understood from a structural perspective: brain nerve ensembles are connected in such a way that a mentally "high-level" ensemble say, the recognition of letters or numbers, receiving signals from a neural correlate "lower" in the mental hierarchy, say, a particular kind of sensory impression like vision, also sends signals back to it. In other words, "lower" level ensembles not only provide input signals to "higher" level ensembles: They also receive information back from the "higher" levels (Mumford, 1992).

In the case of visual perception, for example, a pattern of impairments known as "pure alexia" involving disturbance of the ability to recognize visual words and letters may be due to disconnection between reading-specific neural modules and other modules governing the ability to recognize other visual objects, the ability to write, and to comprehend spoken language. The point here is that the existence of reading-specific neural modules implies the existence of experience-dependent neural specialization. Recent experiments indicate that response of this so-called "word-form area" is not based on simple perceptual familiarity but, rather, on some more abstract linguistic property such as orthographic regularity, i.e., conformity with the spelling rules of the language (Polk & Farah, 2002). Indeed, there seem to be at least three clinically relevant dimensions of language: «connectivity», modality, and complexity (Russell, 1998).

Evidence shows that the brains of skilled readers include a module specialized for letter recognition relative to digit recognition (Polk et al., 2002). In other words, the processing of arbitrary stimulus categories that are defined and distinguished solely by cultural conventions, such as letters versus numbers, can become spatially segregated in the cerebral cortex (Polk & Farah, 1995), (Polk & Farah, 1997), (Polk & Farah, 1998):

"Letter and digit recognition are not innate, so if the functional architecture of vision makes a distinction between letters and numbers, the environment must be helping to shape that architecture" (Polk & Farah, 1994, p. 648).

As a result of this «disconnectivity» in brain architecture, an arbitrary letter can be more easily found during a search exercise within a string of arbitrary digits than it can be found amongst a string of other, arbitrary letters. The same is true for an arbitrary digit amongst a string of arbitrary letters etc.. However, this kind of «pop-out effect» was greatly reduced in

experienced postal workers from Canada or England where all area codes are traditionally alphanumeric in nature. Since they spend several hours every working day sorting mail by reading area codes containing both letters and digits simultaneously, it is assumed that the corresponding cortical «feature maps» in their brains become intricately interconnected more or less homogeneously: This "learn effect" leads to more "interference effects" and, thus, to a diminished «pop-out effect». This kind of effect could have something to do with the observation that schizophrenic patients often tend to overestimate the importance of certain otherwise random events which apparently “pop out” to their attention, leading them to interpret these things symbolically in ways which don't seem to make sense to most nonpsychotic persons – see next section.

Cortical representations of acquired psychological capabilities like, for example, our ability to deal with numbers (=calculating) or letters (=reading), are located in separate cortical areas. These regions can, by motivated, interested and attentive learning, become connected. The resulting biological networking increases so-called interference effects influencing mental recognition. In the cited example, this decreases the so-called perceptual "pop-out effect" of isolated letters within a series of numbers or of isolated numbers amongst a string of letters (Spitzer, 1999). (This is rather surprising when we consider that, from a purely orthographical standpoint, there is hardly a difference between many letters and numbers, for example, between an A and a 4, or between a B and a 3.) Indeed, there is empirical evidence that a specialized brain region reacts differently depending upon the number of points presented to the visual field (1 to 5) (Nieder, Freedman, & Miller, 2002).

«Connectivity» and Psychosis

EUGEN BLEULER conceived the term ‚schizophrenia‘ to emphasize (1) the discrepancy between mental functions such as sensory processing, thinking, feeling, and intuition, in particular, or (2) the splitting/disintegration of consciousness, in general. The „psychic disintegration,, he was alluding to is evident in the formal thought disorders³ and in the cognitive deficits⁴ primary to schizophrenic psychosis. WERNICKE also had the original idea that psychosis, as well as dysphasia, may be a disorder of associative or integrative functions.

In BLEULER's time, there was no convincing, reliable evidence as to the origins of psychosis, neither psychological (from biographical cross sections) nor anatomical (from brain cross sections). Due to its cryptogenic nature, one simply labelled psychosis in a neutral fashion by calling it an „endogenic,, disorder – recall above. The pioneers of a so-called „biological psychopathology,, – ALZHEIMER, FREUD, KRAEPELIN, MEYNERT and WERNICKE amongst others – were limited in their arguments by the state-of-the-art capacity to image brain structure (spatial resolution) and to protocol cerebral haemodynamics (time resolution).

³ For example, in the loosening of association.

⁴ For example, disturbances to normal selective and expectant attention (vigilance), concentration, memory, audiovisual-motorics, reaction, planning and problem-solving ability including counting/calculating/logic (executive function), word/picture comprehension and speech etc.

It wasn't until the advent of computer tomography (CT) that reliable investigations could be made into the possible organic correlates of schizophrenia (Johnstone, Crow, Frith, Husband, & Kreel, 1976). As a result, psychosis could be differentially classified either as an organic or as a functional disorder. Indeed, it was medical orthodoxy that functional psychosis was not associated with organic or structural abnormalities of the brain. Nevertheless, CT scans did show significant (diffuse) enlargement of the ventricle system in people suffering from schizophrenia. Nosological dogma was saved by suggesting that structural brain changes in schizophrenia were secondary to the disorder, being a consequence of incidental factors such as medication or institutionalisation. Only recently have researchers resumed thinking of psychosis as a disconnection syndrome adversely affecting the structure or function of large-scale neurocognitive networks in the brain (Sigmundsson et al., 2001).

Structural factors, for example, may be responsible for the above-mentioned dissociation between, say, thinking and feeling noticed by BLEULER in association with schizophrenia. Indeed, in a recent article by FRANCINE M. BENES (Benes, 2003), she supposes an alteration in the amygdalar projection to the cingulate cortex in the brains of persons suffering from schizophrenia. Accordingly, it might be a good idea to try to demonstrate abnormalities (deterioration?) in the functional/structural connectivity between the amygdala (=the regulation of affect learning that takes place in relation to the emotional and behavioural responses to stressful conditions) and the anterior cingulate cortex (=the conscious processing of emotion and the regulation of selective attentional responses to stress).

A disruption of the local connectivity within a cortical area could lead to a disruption of integration because of its nonlinear effects on the overall level of coherency within the complex feedback loops forming the basis of brain functional architecture. This, in turn, could cause a mental „phase shift,, – recall above – from a normal to a psychotic mental state – see below. Indeed, it is still not at all clear whether the cognitive and psychotic disturbances associated with mental disorders like schizophrenia arise from alterations, deficits or defects in the otherwise normal neural circuitry of the brain (psychosis associated with a disturbance to normal *structural* connectivity – see e.g. (Harrison & Eastwood, 2001)) or in a mental phase shift occurring within one or another functional cluster (psychosis associated with a disturbance to normal *functional* connectivity).

If the harmonious orchestration of the neural substrates underlying consciousness is disturbed, perception can be altered. Visual perception is a particularly vivid example of the importance of structural and functional connectivity in the mind-brain: A good quarter of a second passes after a visual sensation arrives at the retina before it appears to the subject as a conscious perception. Within this short time-span, each and every individual element of the perceived picture – for example, color, form, position in room, movement etc. – is processed individually by different, specialized regions of the brain. These perceptual „mosaic,, or “picture puzzle” pieces must then be put together to comprise a conceptual whole which then, in turn, must be orchestrated to give a context-related meaning to the overall conscious perception. Only the end result achieves consciousness, the individual, intermediate steps not. I propose that, if things go wrong here, the person becomes psychotic.

These ideas allow us to formulate a simple metaphor for psychosis based on the «connectivity model»:

Mental awareness is composed of many different perceptive and apperceptive experiences or, figuratively speaking, of countless pieces of a picture puzzle comprising an overall mental impression. This work hypothesizes that mind-brain processes and the corresponding qualitative experiences of the individual are - figuratively speaking - also put together like the pieces of a mental puzzle. However, in the "psychosis picture puzzle", that is, for a person suffering from psychosis, each individual piece may sparkle and shine, but the overall composition of the picture makes little or no sense, it is weakened or distorted:

The puzzle pieces comprising the afflicted person's impressions may be individually experienced, separately, that is, not recognizably as belonging together as in the case of the nonpsychotic person. A person suffering from psychosis perceives only the details, like the individual pixels of a photograph, but doesn't get the overall context right. It leads to mental confusion which is difficult for others to comprehend: like looking at a garden hose and thinking it's a snake.

A study has shown, for example, that the mental „correction,, of visual data is apparently weakened in schizophrenic patients: Persons suffering from schizophrenia are less likely to invert the perception of normally implausible hollow objects into normal objects, e.g. a hollow (concave) mask into a normal (convex) mask, whereas by nonschizophrenic persons, cognitive factors generally „cancel,, perception by overriding the binocular disparity cues of stereopsis. This anomaly of mental comprehension during psychosis is a kind of pop-out effect – recall above - between the (weakly connected) picture-puzzle pieces of perception and apperception normally comprehended holistically in the nonpsychotic state: Hollow masks pop-out more evidently to persons suffering from schizophrenia as compared to controls, a phenomenon called „reduced binocular depth inversion,, in schizophrenic patients (Schneider et al., 2002).

Due to the role which functional clusters seem to play in conscious thinking and awareness, it is reasonable to consider the possibility that several symptoms of schizophrenia may derive not so much from a malfunctioning of a particular brain area but, rather, from a malfunctioning of the re-entrant (nonlinear) interactions that are responsible for the functional integration of the activities of distributed brain areas giving rise to conscious experience. Indeed, there is empirical evidence of intriguing differences between controls and schizophrenics in the strength and organization of the functional interactions among distributed brain areas (Tononi & Edelman, 2000).

Investigations support the idea that defective cortical interactions or the breakdown of cognitive integration, in particular, the disruption of reentrant interactions among distributed brain areas may underlie certain dysfunctions of conscious integration such as those seen in schizophrenia and dissociative disorders (Edelman, 1989), (Frith, Rees, & Friston, 1998), (Tononi & Edelman, 2000). Indeed, functional imaging evidence of abnormal frontotemporal activations on various tasks (Fletcher, McKenna, Friston, Frith, & Dolan, 1999), (Frith, 1995) lends support to the hypothesis that the core feature of schizophrenia is a disruption of frontotemporal functional integration (Friston & Frith, 1995).

Of course, structural factors may also be responsible for a dissociation between neural activity and interactivity in pathological mental conditions as seen, for example, in split brain patients (Giulio Tononi et al., 1998, p. 145). Thus it would be interesting to find out whether impaired functional connectivity in schizophrenia (Friston & Frith, 1995) is associated with

structural correlates, for example, as structural abnormalities in specific frontotemporal and frontoparietal white matter tracts, such as the uncinate and arcuate fasciculi and anterior cingulum (Dejerine, 1895), (Petrides & Pandya, 1988). Indeed there is evidence of reduced white matter tract integrity in the left uncinate fasciculus and left arcuate fasciculus suggestive of frontotemporal and frontoparietal structural disconnectivity in schizophrenia (Burns et al., 2003).

As a result of *transient response plasticity*, connected brain cells can show a rapid shift in response to afferent stimulation dependent upon the mental (psychological) *context* in which they fire. (Recall above.) This is not unlike what happens in the brain during the learning of a language. Accordingly, it has also been proposed that abnormal developmental/learning events may lead to an altered anatomical connectivity in the brain of persons suffering from schizophrenia. Over time – how long? -, that is, over a series of series of learning experiences, disruption of integrated performance could produce an altered set of connections within and among brain areas. A marked breakdown of interareal integration may result from slight modifications in connectivity patterns accruing during development and experience because of alterations in the modulatory action of diffuse ascending systems (Tononi & Edelman, 2000, p. 396).

«Connectivity» and Psychosis Therapy

The above considerations lead one to imagine psychosis as a kind of pathological „language,.. Psychosis therapy would then be a kind of „language school,, reorganizing a person's mentation via the neural plasticity of the brain.

This reorganization associated with neural plasticity

- has been observed in several parts of the brain, from single cells in isolated spinal cord preparations (Wolpaw & Lee, 1989), (Wolpaw, Carp, & Lee, 1989), (Wolpaw, Lee, & Carp, 1991) to primary sensory and motor structures (Donoghue & Sanes, 1994), (Sanes & Donoghue, 1997), (Sanes & Donoghue, 2000), (Recanzone, Schreiner, & Merzenich, 1992), and
- may be an ubiquitous property of the central nervous system (Wolpaw, 1997).

It is dependent upon the psychological context in which afferent stimulation takes place and can occur

- after prolonged training (Karni et al., 1995), (Karni et al., 1998)
- within a few stimulus presentations (Edeline & Weinberger, 1991), (Edeline & Weinberger, 1993), (Edeline, Pham, & Weinberger, 1993), (Molchan, Sunderland, McIntosh, Herscovitch, & Schreurs, 1994)

These empirical findings have two important implications to the phenomenon of psychosis:

1. Psychosis may imply a disturbance to the normal (nonpsychotic) (a) structural or (b) functional connectivity in the brain, or to the normal (nonpsychotic) (c) context-relatedness of *transient response plasticity* during mentation.
2. The „psychosis phase shift,, in the mind-brain state of dynamical information processing associated with this disturbance may be reversible.

Implications to Psychotherapy

These facts address, in part at least, the difficult nurture-versus-nature dispute about the origins of certain mental illnesses, like, say, schizophrenia, and the corresponding psychological-versus-biological dispute about their treatment. In addition, the above-mentioned evidence implies that psychological factors such as *empathy, participatory interest and expectant attention*⁵ are essential factors effecting the restructuring of cortical «feature maps».

In this regard, it is important to express a word of caution: *intention* involving "too much" emphasis upon willful mental exertion during cognitive training may actually be a stressor interfering with or diminishing such restructuring processes. Accordingly, it is important that persons suffering from mental disturbances be highly motivated and vigilant throughout treatment, while remaining unstressed.

This places two basic requirements upon psychotherapy, in general, and psychosis therapy, in particular:

1. Psychotherapy must be emotionally and cognitively appealing. This emphasizes the important role of humorous (Hirsch, 2002), playful and challenging elements, thus giving an edge in favour of atypical methods such as «Phantasy Therapy» (Schmid et al., 2000), (Schmid et al., 2002), (Schmid, 2005) in the treatment of psychosis.
2. Neuroleptic therapy must not interfere with processes supporting motivation and vigilance, thus, for example, giving an edge in favor of atypical neuroleptics in the treatment of psychosis (Spitzer, 1999).

Accordingly, one way of evoking and enhancing the reversal of psychosis would employ psychotherapeutic methods involving (a) patients' *experiences* simultaneously stimulating the connectivity of several, different sensory impressions and (b) patients' *expressions* stimulating the psychological context-relatedness of these (therapeutically channelled) impressions.

Phantasy Therapy

Our Phantasy Therapy has been specially designed to fulfill the latter two (necessary?) requirements for the psychotherapeutical treatment of psychosis. In particular, due to the ability of nerve cells to rapidly shift their response to afferent stimulation depending upon the context in which they fire (=transient response plasticity, (McIntosh, 2000, p. 862)) even

⁵ preferably without intention, since intention causes stress.

within a few stimulus presentations, Phantasy Therapy may have a subtle therapeutic effect after only a single session. This effect is expressed in what I have called an „!AYA!-Effect,, (Schmid et al., 2000), (Schmid et al., 2002).

The Neurobiology of Psychotherapy

These points have practical implications to psycho- and hypnotherapy: Any attractive, interesting and motivating psycho- and hypnotherapy can be expected to lead to significant changes to the gestalt-forming processes in the central nervous system, even after only a few stimulus presentations. These changes are either already now measurable or may be measurable in the not-too-distant future. «Therapeutic presence» in the sense of empathy, participatory interest and expectant attention (vigilance) of the therapist can be expected to improve mental health by influencing the mind-brain of the motivated, interested and attentive patient at one or several of the four levels mentioned above: neurobiological, perceptual-apperceptual / linguistic-symbolic, cognitive-emotional, and spiritual.

The Mind-Brain Biunity

Understanding psychotherapy as a determinant of cortical reorganization processes can help in the development and successful application of purely psychological intervention methods like hypnotherapy or our Phantasy Therapy. The main stream distinction between biological and psychological disturbances and, accordingly, between biological and psychological forms of therapy is out of date. Just as a coin represents a biunity of its two sides: “Heads” and “Tails”, the human organism can be thought of as a biunity of “mind” and “body” (Schmid, 1988, Chpt. 5).⁶

⁶ The Oxford English Dictionary defines «biunity» as:

"A unity or oneness of two members or parts."

Adapting this definition for purposes of consciousness research, I would like to add: "at once as two of one, such that any change suffered by the one member is accompanied by a corresponding change in the other".

Accordingly, I would like to define:

“A biunity is a unity or oneness of two members or parts, at once as two of one, such that any change suffered by the one member is necessarily accompanied by a corresponding change in the other.”

In the sense used here, biunity may be taken to express a proto-polarity or, conversely, polarity may be taken as the manifest expression of an intrinsic biunity. This is reasonable from a comparison of the above definition with the way in which the word «polarity» is used in the English language.

The Oxford English Dictionary defines «polarity» in the generalized sense as:

"The quality of exhibiting opposite or contrasted properties, or powers in opposite or contrasted directions; the possession of two points called poles having contrary qualities or tendencies."

Thus, according to the usage of these terms in the English language, we might say that:

The convergence of polarity is the oneness of biunity and the divergence of biunity is the twoness of polarity.

Notice that, actually, a set of three - and not only two - things is implicit to the concept of biunity: two entities plus the necessary relation between them. In other words, a biunity expresses

"a connecting principle that relates the two entities, bringing their separate qualities together to form a third entity, born, so to speak of their union."

This third entity is the biunity itself. In general, we can call any such relation (physical, logical, semantic, etc.), or pair of so-related concepts or entities, a «biunity», leading to yet another way to define this concept:

“A biunity is a relation between two entities such that the relation itself necessitates both interrelated entities just as either entity by itself necessitates both the other entity as well as the relation between them.”

Theory: Evidence-Based Psychosis Hypotheses

I have argued above in favor of a *theoretical approach* to psychosis therapy based upon the «connectivity model» of psychosis. (See, for example, (Harrison & Eastwood, 2001), (Klosterkotter, 1999) or (Spitzer, 1999). For related references see, for example, (McIntosh et al., 1999), (McIntosh, 2000)). This model understands psychosis as a «functional disturbance» at the *neurobiological level*.

I base my adherence to this model on two related, empirically-founded hypotheses stemming from the domains of chaos and quantum theory. In addition to the chaos dynamical «unfolding dimension» behaviour mentioned above, the process of psychosis can also be shown in general to manifest six fundamental features characteristic of deterministic chaos. I have already presented the details of these chaos-theoretical considerations elsewhere (Schmid, 1991), (Schmid, 1997a), (Schmid, 1997b), (Schmid, 1998). Details of the quantum-theoretical considerations are discussed below.

I prefer to speak in the case of psychosis of «linear information processing in the mind-brain», because the normal, nonlinear networking («connectivity») involving biochemical and bioelectrical feedback loops between certain regions of the brain or between certain neuronal ensembles are weaker during psychotic as compared to the remitted ("healthy/normal") states of mentation. In the science of consciousness, this is said to be a problem of «binding». In other words,

- ◆ *HYPOTHESIS I*: Psychosis is a consequence of disturbance to the (normal) nonlinear information processing („hand-shaking“ – recall above) between various cell ensembles in the mind-brain (Schmid, 1991), (Schmid & Dünki, 1996), (Dünki et al., 1996), (Schmid, 1997a), (Schmid, 1997b), (Schmid & Koukkou, 1997), (Schmid, 1998), (Dünki & Schmid, 1998), (Dünki, Schmid, & Stassen, 2000). This results in pathologies of associated coherence and synchronization also called «connectivity» or «binding» in the mind-brain: Afferent and efferent signals, in particular, those corresponding to the usual sensory and apperceptual channels become confusingly disorganized in psychosis.

This hypothesis can be augmented with a second hypothesis, namely, that the «psychosis binding problem» has formal parallels to certain nonlocal effects which have long been

In the Western languages, such a connecting principle is manifest grammatically in what are called «Correlative Terms»: “In many cases, two ideas which are completely opposed to each other, admit of an intermediate or neutral idea, equidistant from both; all these being expressible by corresponding definite terms” (Kirkpatrick, 1988, p. xxii). Just as Hume “had drawn important inferences with regard to the state of society among the ancient Romans, from certain deficiencies which he remarked in the Latin language” (Kirkpatrick, 1988, p. xxii, fn), we can just as well draw an important inference with regard to the state of psychiatric research from a certain deficiency in our Western languages, namely, the overemphasis upon concepts like «polarity» and «duality» and the negligence of the concept of «biunity» while addressing the mind-body problem in the science of consciousness.

proven to exist in atomic physics in connection with a phenomenon called «quantum communication»:

- ◆ *HYPOTHESIS II*: «Connectivity» or «binding» is sustained by quantum correlations playing an orchestrating role of instantaneous synchronization of brain processes over widely separated regions of the brain. In other words, a qualitative «mental state of ego-awareness» leading to an unambiguous ego-identity might be synonymous with the synchronization resulting from a quantitative «highly coherent, *local* quantum brain state». (This would justify the use of the dyadic concept «mind-brain».)

I would like to remind the reader about four issues discussed above which are particularly relevant to the first hypothesis.

First of all, about the neural and transient response plasticity of the brain.

Secondly, about the "pop-out" effect of mental comprehension during psychosis.

Thirdly, about the neurobiology of psychotherapy.

Fourthly, about the mind-brain biunity.

It is also interesting with regard to Hypothesis I to point out some evidence from trauma research indicative of a mental «binding» problem: In addition to disturbing the sensomotoric, the affective, and the cognitive development of traumatized children, psychological traumata can furthermore disturb a child's logical ability for narrative construction, that is, for differentiating between the beginning, the middle and the end of a story. Compare this now with the everyday, clinical observation that patients suffering from psychosis commonly manifest a similar disturbance to the narrative construction of their own, ongoing, real-life stories (Schmid, 2005).

I would also like to make four remarks concerning the second hypothesis.

First of all, biochemical and bioelectrical signals seem to be too slow to guarantee an optimally functioning «connectivity»: It has long been generally accepted that the usual biochemical and bioelectrical feedbacks are much too lethargic to enable the speed of cognitive synchronization (faster than ca. 100 ms) presumed necessary for survival (Blumenthal, 1977).

Secondly, biochemical and bioelectrical processes seem to be too complex to be adequately orchestrated solely by the classical anatomical channeling of mind-brain information: *Only about 0.01% of the brain's overall activity is experienced consciously!* More exactly, *the data rate processed by the human brain is an astronomical 320 Gbytes/s of which only about 32 Mbytes/s is conscious!* (As I demonstrate in the ADDENDUM, this can be estimated from at least three independent arguments based on memory ability, neuronal activity, and neuroanatomical comparisons.) In other words, it is as if roughly 10'000 cinema films are actually going on in the brain all at once, while we are only consciously aware of one of them, indeed, a very particular one transmitted through the sensory

channels (sight, smell, sound, taste, touch and balance)! Accordingly, one could argue that *the birth of human consciousness is a kind of „ignition problem“ occurring only if a system is capable of processing, like the human brain, at least 320 Gbytes/s (or more) of information.* (Because of the wide range of estimates for the numbers used here, the exact order of magnitude cannot be taken too critically. In any case, however, there's a lot of information processing going on in the brain, most of which we are not at all conscious of!) Summing up: Quantum communication mechanisms may, in addition to the usual biochemical and bioelectrical processes and anatomical pathways, be necessary to help coordinate the tremendous amount of information processing going on both consciously and unconsciously in the mind-brain.

Thirdly, quantum theory allows for a simple model of psychosis: Psychosis may result from a "phase shift" into a pathological state of weakened «connectivity» or «binding» in the mind-brain – recall the section “Phase Transitions in the Mind-Brain: The «Unfolding Dimension»” above. Such a phase shift may be caused, e.g., by an overactivity of electrical firing across synapses, or by a temporary (mentally or physiologically triggered) decoupling of certain, critical neural ensembles from their usual thermodynamic environment in the brain. Indeed, patients often report a kind of "mental big bang" upon becoming psychotic for the very first time. Unfortunately, there seems to be a problem with quantum nonlocality after this "psychosis phase shift": During psychosis, the individual's mind-brain processes may be dictated by a temporarily "expanded" (=weakly coherent) quantum state which all too much encompasses the social environment in its field of reception. Indeed, persons suffering from psychosis often report psychopathological experiences consistent with this idea of distant mentation.

Finally, quantum theory allows for a simple model of the Self: The synchronisation resulting from a «highly coherent, *nonlocal* quantum brain state» with correlations between individual and extra-individual mind-brain states may be responsible for unified self-awareness, for the feeling of coherence, "oneness", and “belonging” in the healthy individual.

Putting Theory into Practice: Corresponding Psychosis Therapy

According to these hypotheses, a form of psychosis (and perhaps also trauma) therapy is needed which

1. neuro-psychologically induces and supports the orchestration of different sensory-awareness channels by simultaneously stimulating several sensory inputs and by synergetically bundling them together («connectivity» or «binding») into meaningful somataesthetic⁷ images («gestalts», «qualia»);

⁷ «Aesthetic» means "characterized by a love of beauty" and "beauty" is "the quality present in a thing or person that gives intense pleasure or deep satisfaction to the mind, whether arising from sensory manifestations (as shape, color, sound, etc.), a meaningful design or pattern, or something else (as a personality in which high spiritual

2. depth-psychologically increases the patient's feeling of experiencing and expressing themselves and of being experienced by and expressive to others («!AYA!-Experience» see (Schmid et al., 2002), (Schmid et al., 2000)) via the therapist's empathic-identificatory communication and progressive synaesthetic⁸ positivation of the often distorted and destructive images expressed from within the patient's mythopoetical world of imagination.

Thus, an effective psychosis therapy should be a somataesthetic therapy of neural synchrony and coherence, on the one hand, and, on the other hand, a synaesthetic therapy involving empathic identification with and progressive positivation of the patient's inner mythology. This helps the individual suffering from psychosis to gradually relearn a collective, context-related understanding of his or her sensory inputs and apperceptions by practical experience and self-expression in the therapeutic setting. He or she is enabled to gradually build up his or her own symbol of Self and, consequently, to balance the otherwise ambivalent, uncontrolled psychological switching between symbiosis and separation from the outer world so characteristic of psychosis (cf. (Benedetti, 1994)).

Thus, and in contrast to analytical therapies, this form of therapy is not goal- or learning-oriented but, rather, experiential and expressive („!AYA!“) in nature.

Psychosis- vs. Neurosis-Therapy

For psychotherapeutic work with neurotic patients, analysis, interpretation and explanation are of central importance. However, in psychotherapeutic work with psychotic patients, such efforts are of only secondary significance. To help clarify this point, I would like to offer a simple metaphor.

A person suffering from psychosis experiences his surroundings as you might experience them were you to be suddenly and unexpectedly "teleported" to a planet inhabited by alien beings (=psychosis as an epistemological disturbance). You would hardly be able to understand anyone, and everything around you, including the behaviour of the others, would have almost no discernable context within which you could comprehend the world. From an epistemological point of view, you might well seem to others to be psychotic! Of course, this analogy has its weak points: You would not have the above-mentioned functional information-processing disturbance characteristic of a person suffering from psychosis, that is, you would not experience and comprehend the world and your own person unto themselves as piecewise and dissociated (=psychosis as an ontological disturbance). Nevertheless, the metaphor has certain didactic advantages as we continue on with it. For example, your psychosis therapist could be accused of malpractice were he or she to encourage you to repress or deny the world where you presently believe to find

qualities are manifest)". Accordingly and for the purposes of this work, I take "aesthetic" to mean "empathic, integrative/holistic and coherent/meaningful". This enables me to coin the term «somataesthetic» to mean "empathic, integrative and coherent with virtually all sensory input channels".

⁸ that is, "empathic, holistic and meaningful in terms of virtually all apperceptive qualities."

yourself, or the world where you believe yourself to have come from. On the other hand, your therapist shouldn't go to the other extreme and move in with you or advise you to buy an apartment on this alien planet! Indeed, your therapist should try, along with you, to learn the local language so that he or she can better accompany you. Your therapist should furthermore help you get around in your new world and, ultimately, guide you to the "spaceport" returning you back down to "earth" (collective reality)

The best psychosis therapist is one who is empathically, participatively, interestedly, and attentively present, meeting their patient emotionally, cognitively, intuitively and with all their senses (called «pacing» in hypnotherapy), there, where the patient is now, in his or her fantasy and, only afterwards, gradually bringing their patient back (called «leading» in hypnotherapy) to the common reality from which both therapist and patient have come.

Main Points: Psychosis- vs- Neurosis-Therapy

Psychosis therapy is basically *identificatory and antiregressive*.⁹ This is opposite to analytical therapeutic work with neurotic patients which is basically anti-identificatory and regressive in nature.

Psychosis therapy empathically finds the person in the magical, mythopoetical depths of the collective unconscious and leads them back into the here-and-now world of collective reality. Neurosis therapy guides the patient from the here-and-now world of collective reality into the magical mythopoetical world of their own subjective unconscious.

Psychosis therapy focuses upon the patient's *self-experience* and *self-expression* (ontological approach) whereas neurosis therapy focuses upon the *self-understanding* (epistemological approach) of the patient.

Elements of Psychosis Therapy

The therapeutically most effective way to encounter a person suffering from psychosis is to meet him or her empathically there, where they find themselves, in their fantasy («pacing»), so as to be able to gradually guide them back again to our collective reality («leading»). To do this, we must not only be present intellectually, but also emotionally, intuitively, and with all our senses. Accordingly, I would like to define what I have chosen to call «therapeutic presence».

⁹ It is important to mention that a certain amount of regression is often necessary in the psychotherapy of psychotic patients in order to meet up with them on common grounds at the very basis/origin of their disturbance in the „moonscape“ of their unconscious. Antiregressive is the work ultimately „leading them back“ to collective reality.

«Therapeutic Presence»

«Therapeutic presence» is a balance of empathy with, participatory interest in, and intentionless expectant attention (= "vigilance" or "mindfulness") to the situation and conditions of the patient, here and now.

«Therapeutic Presence» is an Instrument

1. to enhance the optimism of the patient while accompanying him or her through their crisis,
2. to help the patient realize what and how to do those things sufficient to help themselves out of their crisis and, finally,
3. to help the therapist reconstruct, together with their patient, that individual «healing myth» necessary for the patient to find personal meaning in their past psychotic experiences and insights and, accordingly, to bridge the gap between their subjective and our collective realities.

In short, «therapeutic presence» encourages (1) hopefulness, (2) constructive action, and (3) the search for meaning (cf. (Taylor, Kemeny, Reed, Bower, & Gruenewald, 2000)).

«Countertransference»

The best way to establish and maintain this «therapeutic presence» is by utilizing the inner world of the patient as this is mirrored subjectively in the mind of the therapist. Depth psychologists speak here of «countertransference». «Countertransference» is the best innate instrument for the clinician to more accurately and precisely establish a therapeutic rapport with their patient. In a certain sense, it can be said to be the “psychotherapist’s stethoscope”.

Psychosis Therapy and Hypnotherapy

Psychosis therapy, like many other forms of depth-psychologically oriented psychotherapy, has an especially close relationship to modern *hypnotherapy*. Indeed, hypnotherapy offers one of the best methods for utilizing countertransference to establish a therapeutic rapport («therapeutic presence») via the well-established techniques of «pacing» and «leading». If one regards psychosis as a kind of pathological (dissociative) trance state, then one possible approach to psychosis therapy amounts to the therapist going into a (nonpathological, associative) self-hypnotic state in order to join their afflicted partner there, in their altered state of consciousness and, gradually, “de-hypnotize” him or her back to collective reality. This is where the concept of «counter-trance» has gotten its name: The patient is brought out of their dissociative pathological trance (=psychosis) to the extent by which the therapist themselves goes into an associative therapeutic trance (Vas, 1993), (Zindel, 1997), (Schmid, 2001).

Both psychosis therapy and hypnotherapy allow a metaphoric comparison to the ancient tradition of *shamanism*:

The „healer“, that is, the therapist, puts him- or herself into an „ecstatic healing trance“ («counter-trance»). This enables the healer/therapist to „travel directly into“, i.e., to identificatorily empathize with the „fantastic and supernatural“. In the present context, the "fantastic and supernatural" refers to the subjective world of the patient. The purpose here is to meet up («pacing») with the patient's "soul" («mind set») and, ultimately, to „bring it back“ («leading») to collective reality. Bringing the patient's "soul"/«mind set» back means antiregressively positivizing it into the „healthy“, that is, into the coherently, cognitive-emotionally balanced realm of collective reality.

Another modern, scientific transformation of this shamanistic tradition within the context of psychoanalytical reflection is GAETANO BENEDETTI's multistep therapeutic process of visio-motor graphic drawing involving symbolic creation, symmetrisation, imaginative forming, progressive positivation, and symbolic reconstitution (Benedetti, 1994). This process has been further developed by his colleague MAURIZIO PECICCIA into their method of *Progressive Mirror Drawing* (Peciccia & Benedetti, 1992) which is closely related to our Phantasy Therapy (Schmid, 2001).

PRACTICE: PHANTASY THERAPY: Rediscovering Reality in Fantasy

The *therapeutic approach* favored in this work utilizes first-person experience and expression at the *perceptual-apperceptual / linguistic-symbolic level*. (Recall above.) I call our mind-body-social version of this approach «Phantasy Therapy» (Schmid, 2001), (Schmid et al., 2000), (Schmid, 2005). According to our approach, self, sensory, and social awareness should be progressively positivized, expanded and orchestrated:

- Mind perception
e.g. cognition, affect, magical-mythopoetical intuition etc.
- Body perception
e.g. sensory, psychomotoric, kinetic transformation of verbal content etc.
- Social perception
e.g. nearness/distance, symbiosis/separation etc.

The reasons for this emphasis upon the progressively positivized expansion and orchestration of self, sensory, and social awareness at the perceptual-apperceptual / linguistic-symbolic level stem from the functional understanding of psychosis discussed in the previous sections onhand the connectivity model.

Since I have already discussed our Phantasy Therapy in detail in several other publications (Schmid, Eisenhut, Dämpfle, Frei, & Ito, 1997), (Schmid et al., 2000), (Schmid, 2001), (Schmid, 2005), I restrict myself here to only the most important aspects.

I would also like to mention here in passing that, in addition to treating psychotic patients (and, by the way, depressive and borderline patients as well), the methods of Phantasy Therapy can also help psychosis therapists themselves to develop and refine their own countertransference abilities. In fact, the therapist's own active participation in Phantasy

Therapy helps him or her to let loose of their usual adult logic and to take a certain relaxed distance to it, thus enabling them to approach their own childlike fantasy and body feeling without shyness. This helps the therapist come closer to their patients, to be better able to feel into the regressive emotional and body world of their patients, and to give their patients the experience of being empathically encountered by their therapist and not only intellectually understood by him or her. In this spirit, my colleagues, REBECCA EISENHUT (movement and dance therapist), STEPHAN DÄMPFLE (art therapist), KAE ITO (Ph.D.-level clinical psychologist) and I have been offering therapists and clinicians Phantasy Therapy Workshops in Europe and Japan since 1998.

The Role of Human Language in Phantasy Therapy

Phantasy therapy takes explicit advantage of several forms of verbal and nonverbal *linguistic symbolization*. (See, for example, (Schmid, 2005).) Linguistic symbolization enables the individual to represent and understand themselves, and to express the many aspects of their inner life:

- ◆ word (⇒ spoken language)
- ◆ object (⇒ manual body language)
- ◆ movement (⇒ mimic, gesture and motion-oriented body language)
- ◆ color and form (⇒ semiotic/symbolic language)
- ◆ rhythm and melody (⇒ musical language)

Phantasy Therapy understands psychosis in accordance with the connectivity model as a functional mind-brain information processing disturbance leading to a mental state in which the individual "picture puzzle pieces" of reality (elements of awareness and expression) may, prosaically speaking, sparkle and shine while the overall picture of the world no longer makes sense.

The underlying concept of Phantasy Therapy is to optimize patients' orchestration («connectivity», «binding») of their isolated perceptive and apperceptive experiences. This orchestration should occur in such a way that patients are able to express and communicate themselves within an overall

- ◆ meaningful, cognitive-emotional / sensory-intuitive gestalt.

Human communication in its many facets: speech, manipulation, mimic, gesture, movement, sign/symbol and music etc. is the "red line" giving this gestalt expression. A fairytale representative of the weekly theme is the "heart" of our approach.

Main Points

- ◆ Phantasy Therapy is a form of group psychotherapy for psychotic patients
- ◆ Phantasy Therapy is interdisciplinary

- Psycho- and Hypnotherapy
- Movement and Dance Therapy
- Art Therapy
- Music Therapy
- ◆ Phantasy Therapy is *integrative*
 - A single theme-object-fairytale triad provides one, unified context for 2 to 3 sessions during a whole week (therapeutic "mosaic" approach – see Table 1)
 - Language (spoken, body: mimic/gesture/manual/movement, semiotic/symbolic, musical) provides the "glue" holding the various therapeutic "mosaic pieces" together
- ◆ Phantasy Therapy principally represents more an experience-/expression- and less a solution-oriented approach («!AYA!-Effect») to psychosis therapy
- ◆ Phantasy Therapy enables the estimation and treatment of *cognitive deficits*
- ◆ Phantasy Therapy enables general *diagnostic estimations* via observation of patients' reactions
- ◆ Phantasy Therapy fulfills certain basic requirements of *quality control*
- ◆ Phantasy Therapy breaks certain classical *therapeutic prejudices and taboos*
 - Group therapy with acute psychotic patients
 - Large groups with acute psychotic patients
 - Imaginative work with acute psychotic patients including the reading of fairytales
 - Taboo themes involving high-expressed emotions, e.g., as found in fairytales
 - Multichannel experience- and expression-work with acute psychotic patients
 - Closeness and touching during therapy with acute psychotic patients
 - Effectiveness after only one session

These points will be touched upon in somewhat more detail in the discussion to follow. A summary of the two sequential sessions is provided in Table 1.

Table 1: Summary of the Two Sequential Sessions

t min.	DAY 1	DAY 2
20	<ul style="list-style-type: none"> - A new Theme is introduced by the Psychotherapist and <i>cognitive-emotionally discussed</i> in the group. - A corresponding Object, concrete-operationally representative of the theme, is presented by the Psychotherapist and passed around in the group allowing the P. firsthand <i>tactile-audio-visual and sensory-motor confrontation</i> with the theme. 	<ul style="list-style-type: none"> - The course of the 1. day is summarized by the Psychotherapist. The experiences of the Ps. relevant to the Theme are <i>cognitive-emotionally discussed</i>. - The Fairytale is read by the Ps. in tandem providing them with a <i>coherent auditive-cognitive experience</i> under supervision of the

		Psychotherapist. The Ps. are asked to volunteer and share their <i>thoughts and feelings about the fairytale pictures and symbols.</i>
50	- The theme is <i>kinaesthetically transformed</i> with Music under supervision of the Movement/Dance therapist into corresponding Movement exercises at <i>three sequential levels of experience</i> : The experience of myself (in the circle of others), of you in the partner exercises and of us in the group exercises.	- The fairytale scenes are represented by <i>pictures and symbols (gestalts)</i> thereby <i>synaesthetically transforming</i> the theme into Color and Form. The gestalts are then progressively positivized under supervision of the Art therapist.
20	- A Fairytale, symbolically related to the theme and object, is read to the group as a <i>coherent auditive-cognitive experience</i> by the Psychotherapist. The Ps. thereupon volunteer and share their impressions as to which pictures and Symbols have made the strongest <i>emotional impression</i> upon them and their comments are <i>progressively positivized in discussion.</i>	Spontaneously arising discussions with and between Ps. are encouraged by both therapists with focus upon the <i>coherent progressive positivization</i> of the Self-symbolic content. In principle, however, the Ps.' graphic creations are not psychologically interpreted with individual Ps..
<i>Important Points</i>		
Suggested time order in the presentation of 7 therapeutic elements on two sequential days:		
Day 1 » Theme > Object > Music > Movement > Fairytale (read to the group by the therapist).		
Day 2 » Theme > Fairytale (read in tandem by the Ps. themselves) > Color and Form > Symbol.		
Phantasy Therapy has a fixed structure with a ritualized course of presentation:		
◆ The direction of the group in a circle during the introduction of Theme, Object, Movement, Fairytale, Artwork and Symbol has proven to be important for support of the group-ego		
◆ The following „I-You-We“ temporal order has also proven effective and has become standard in the course of therapy:		
(1) Encounter with myself in movement within the circle of others (I-experience)		
(2) Encounter with my partner in synchronized partner exercises (You-experience)		
(3) Concluding collective-movement exercises in our group (We-experience).		

Realization of the Method

- *Three professionals* are generally involved in the realisation of Fantasy Therapy: Day 1 is lead by a psychotherapist together with a movement/dance therapist. Day 2 is lead by a psychotherapist together with an art therapist. Usually, one therapist-in-training also serves in background on both days.
- A different *theme-object-fairytale triad* is chosen each week from a clinically-proven sequence of themes leading to a cycle which repeats itself every 4 months or

so. Whereas remitting, ambulatory patients are more receptive of concrete themes, patient compliance is enhanced with acute, stationary patients by the use of respective abstract themes:

Energy	⇒ Chaos	⇒ Labyrinth ⇒
Opening/Closing	⇒ Nearness/Distance	⇒ Opposites ⇒
Polarity	⇒ Mirroring	⇒ Twisting/Rolling ⇒
Transformation	⇒ Balancing	⇒ Walking ⇒
Dialogue	⇒ Harmony	⇒ Music ⇒
Sensing	⇒ Active Imagination	⇒ Passive Activity ⇒
⇒ Energy	⇒ Chaos ⇒ Labyrinth	⇒ etc

- The examples can be easily extended.
- Special goals and aspects of three (arbitrarily) selected triads:

Energy:

- Catharthis of pent-up anger
- Constructive treatment of aggression
- Treatment of cognitive deficits

Mirroring:

- Reality-testing
- Constructive "anchoring" of self- and body-image
- Treatment of cognitive deficits

Transformation:

- Heightened awareness of metamorphosis / healing processes
- Constructive treatment of ambivalence
- Treatment of cognitive deficits

- Depth-psychological problems brought to light during fantasy therapy sessions are subsequently dealt with in individual psychotherapy / analysis sessions.

Phantasy Therapy in the Day Clinic

I have also successfully implemented Phantasy Therapy in our day clinic. Insofar as ambulatory patients have greater cognitive-emotional abilities than stationary patients, I have been able to somewhat intensify the basis program:

- ◆ less abstract, more concrete, weekly themes (e.g. "aggression" instead of "energy")
- ◆ more complex treatment of objects (e.g. juggling)
- ◆ longer, more intense discussions of theme (1/2 to 3/4 hour instead of 15 min.)
- ◆ more difficult movement exercises
- ◆ longer, more complicated texts (parables, literary anecdotes, essays etc.)

- ◆ longer, more intense discussions of the symbolic content of the texts with more emphasis upon personal emotional commitment

To date and as will be shown in a following section (“Preliminary Results”), the practicality, economy, effectiveness and robustness of Phantasy Therapy is similar in both ambulatory and stationary settings.

Clinical Indications and Contraindications

Phantasy Therapy is especially suitable for agitated patients with acute psychotic disturbances. Furthermore, our experience has shown that even the energetic behaviour and high expressed emotions of manic patients can be bundled and focused during a Phantasy Therapy session, thus enabling these patients to return to the ward with a more relaxed, collected attitude. In addition, patients suffering from depression benefit from Phantasy Therapy through general activation and through the specific treatment of cognitive deficits also characteristic of depressive disturbances. Borderline patients learn to deal with physical and emotional closeness and boundaries.

To date I have found no clinical contraindications. It has turned out, however, that patients suffering from substance abuse tend to find this playful form of therapy too „childish“, that is, they generally have a strong unconscious resistance to partake of the group identity.

Therapeutically Effective Factors

This work argues that the most important *neuropsychological* therapeutic effect of any psychosis therapy lies in the repeated simultaneously and coherently channeled (empathic, interested, attentive) activation of different and separate areas of the (motivated, interested, attentive) mind-brain. This activation induces the context-related orchestration («connectivity», «binding») of the many different subjective and gestalt-forming sensory impressions («qualia») neurologically correlated to these areas. Such orchestration during Phantasy Therapy provides the patient with an overall «somataesthetic» experience. (Recall the definition of «somataesthetic» in the footnote above.)

I argue furthermore that an integratively channeled imagination within the context of guided, positivising, subjective gestalt-forming is essential to the *depth-psychological* therapeutic effect of any psychosis therapy. This imagination is stimulated, supported and focused by respective therapeutic exercises. Such exercises during Phantasy Therapy encourage and enable the patient to express themselves «synaesthetically». (Recall the definition of «synaesthetic» in the footnote above.)

In nonpsychotic individuals, the processes of imagination and action are in continuous, cyclic interaction with one another.

An accomplished artist, for example, commonly begins his or her painting process by imagining something. The further development of this idea/image depends, amongst other things, upon the results gradually taking form on the mental canvas in his or her mind during the actual physical process of painting on the canvas in front of them. These results are continuously being fed back into the results of the previous steps («feedback looping»): Via the nonlinear recursivity of this process (cf. (Schmid, 1997b)) of planning and doing, the nonpsychotic artist is both doer and observer at the same time. His or her product is well composed. From an aesthetic point of view, nothing "pops-out".

In psychotic individuals, the continuous, cyclic interaction between the processes of imagination and action typical of the nonpsychotic person is cut through.

In marked contrast to the above-mentioned accomplished artist, plan and action seem to be more or less isolated during the linear painting process of the schizophrenic artist: Imagining and doing hardly seem to recursively interact, that is, to feed back, one upon the other. This could explain the strong reduction and painstaking reproduction of figures, forms and symbols which the works of schizophrenic painters are usually crammed full of and which commonly mark the artistic style of such so-called «Art-Brut» artists. The composition is difficult if not impossible to recognize from a third-person standpoint. Many elements of the product seem to "pop out" in a fashion disagreeable to the mind's eye of the observer.

Treatment of Cognitive Deficits

The practical realization of Phantasy Therapy activates, via the above-mentioned therapeutic effects, those mental attributes generally known to be considerably disturbed by psychosis and depression (called «cognitive deficits»; cf. (Goldberg & Gold, 1995), (Heinrichs & Zakzanis, 1998)):

- ◆ motor coordination and speed of performance
- ◆ attention and expectant attention (vigilance)
- ◆ concentration
- ◆ working memory which enables the simultaneous processing of information from different sensory channels
- ◆ planning- and problem-solving ability (executive function)
- ◆ speech.

I have already discussed elsewhere (Schmid, 1997b) the extent to which these cognitive deficits could be consequences of linear information processing (weakened «connectivity» or «binding») in the mind-brain.

Preliminary Empirical Results

To date we have completed a pilot study (Hänni, 2003) testing the *hypothesis*:

“With just a single session, Phantasy Therapy is more effective for the treatment of cognitive deficits than either a comparable group psychosis therapy or a placebo group.”

This same hypothesis is also being tested in a full study. Preliminary results are presented in the next subsection.

Pilot Study with Remitting, Ambulatory Patients

The empirical population is described in Table 2. It comprised 9 adult patients from our day clinic located in the city of Winterthur, Switzerland (3 males and 6 females = 33.3% m and 66.7% f, respectively).

Phantasy Therapy (N=5) was compared to a sport therapy group (N=4) of similar diagnostic indication, symptom severity, stage of illness, time between admittance and first exposure to therapy, group size and duration of session. The same certified movement and dance therapist lead both groups. The author was coleader for the Phantasy Therapy group.

Both Phantasy Therapy and sport therapy were compared to a placebo group (N=5) consisting of the weekly information session. Here too, we had a group of similar diagnostic indication, symptom severity, stage of illness, time between admittance and first exposure to therapy, group size and duration of session.

Due to both clinical and ethical reasons for carrying out the study under the condition of “treatment as usual” (TAU), the three comparison groups only partly overlapped: Only 3 of the 9 patients took part in all three groups, 2 patients took part in Phantasy Therapy and in the placebo group (but not in sport therapy), 3 patients took part solely in Phantasy Therapy, and 1 patient, solely in sport therapy. No patient took part solely in the placebo group.

In all three groups, Phantasy Therapy, sport therapy and placebo group, the therapists took active part together with the patients.

The therapeutic effect was estimated in each group by comparing the respective patients’ pre- and posttherapy results on three different test instruments:

1. Self-estimate of momentary state of (a) general well-being, (b) relaxation/tension, (c) sadness/happiness, (d) wakefulness/tiredness.
2. Connect-the-numbers test of cognitive agility.
3. Third-person estimate of disturbance in the somatic, the psychological, and the social-communicative dimension.

The self-estimate used the parallel scales Bf-S and Bf-S’ from VON ZERSSSEN and KOELLER (Zerssen & Köller, 1976). The ZVT of OSWALD and ROTH (Oswald & Roth, 1987) was used in 12 different parallel versions for the connect-the-numbers test before and after each of the three above-mentioned groups. The BSS of SCHEPANK (Schepank, 1995)

was used to estimate the level of disturbance in the three dimensions: body, mind, and social communication.

Results were judged in terms of the effect strengths derived at by the chosen measures with a correction for the pretest differences between the respective experimental (E) and control (C) groups (Klauer, 1993). This (corrected) effect strength normalizes the difference between pretherapy and posttherapy averages of the experimental group by dividing this difference by the so-called “pooled” standard deviation s_{pooled} of both the experimental and control groups¹⁰. In the present study, the variable scales were so defined that the larger the (positive) value of the effect strength is, the better is the outcome for the respective experimental group. The effect strengths of all three pilot-study groups are compared in Table 3.

Table 2. Empirical population of pilot study in the day clinic

Age (years)	Frequency	Percent
Unter 20	1	11.1
20 – 29	3	33.3
30 – 39	3	33.3
40 – 49	2	22.2
Total	9	100.0
Highest Formal Schooling	Frequency	Percent
Completion of Mandatory Schooling	2	22.2
High School Diploma	1	11.1
Profession with Diploma	5	55.6
University Degree	1	11.1
Total	9	100.0
Diagnosis (ICD-10)	Frequency	Percent
Schizophrenia F20	5	55.5
Psychotic Disturbance F23	2	22.2
Schizoaffective Disturbance F25	2	22.2
Total	9	100.0
Begin/Duration of Disturbance	Frequency	Percent
First Hospitalization	3	33.3

¹⁰ $s_{\text{pooled}} = \text{SQRT}(((N_E - 1)s_E^2 + (N_C - 1)s_C^2) / (N_E + N_C - 2))$. The corrected effect strength $d = (\langle X_{\text{post}}^E \rangle - \langle X_{\text{pre}}^E \rangle) / s_{\text{pooled}}$ can be calculated online with a module created 22.10.1999 by Bernhard Jacobs on the website www.phil.uni-sb.de/~jakobs/seminar/vpl/bedeutung/eskorrr.htm.

Disturbance since one year	2	22.2
Disturbance since more than two years	4	44.4
Total	9	100.0
Time Point of Investigation	Frequency	Percent
On the day of admittance	1	11.1
On the day following admittance	3	33.3
On 8. day after admittance	4	44.4
On 15. day after admittance	1	11.1
Total	9	100.0

Table 3. Effect strengths of all three day-clinic pilot-study groups in comparison. The effect strength is the difference between pretherapy and posttherapy averages divided by the “pooled” standard deviation – see text. For each pair of groups, the larger the (positive) value is, the more the effect strength speaks in favor of the group printed in bold text as opposed to the comparison group.

Test Results		Pretherapy Test			Posttherapy Test			d Effect Strength
		AVG.	S	N	AVG.	S	N	
Cognitive Test (Interval scale: Time in secs. to completion, smaller values are better results)	Phantasy	1.81	.50	8	1.61	.51	8	0.73
	Placebo	1.29	.25	5	1.39	.41	5	
	Phantasy	1.81	.50	8	1.61	.51	8	0.49
	Sport	1.21	.37	4	1.23	.36	4	
	Sport	1.21	.37	4	1.23	.36	4	0.11
	Placebo	1.29	.25	5	1.39	.41	5	
Third-Person Rating (Rank scale: the larger the value, the worse the patient is doing)	Phantasy	6.13	1.25	8	2.87	1.25	8	1.85
	Placebo	5.60	2.19	5	5.20	1.92	5	
	Phantasy	6.13	1.25	8	2.87	1.25	8	2.57
	Sport	3.75	.96	4	3.50	1.00	4	
	Sport	3.75	.96	4	3.50	1.00	4	0.02
	Placebo	5.60	2.19	5	5.20	1.92	5	
Self-Rating (Rank scale: the larger the value, the worse)	Phantasy	24.50	13.07	8	19.37	15.26	8	-0.08
	Placebo	18.80	10.13	5	12.40	5.77	5	
	Phantasy	24.50	13.07	8	19.37	15.26	8	0.37

the patient is doing)	Sport	11.50	7.14	4	9.50	6.25	4	-0.33
	Sport	11.50	7.14	4	9.50	6.25	4	
	Placebo	18.80	10.13	5	12.40	5.77	5	

In general and roughly speaking, the value of an effect strength can be judged as follows (Bortz & Döring, 1995):

$0.20 \leq d < 0.50$	small effect
$0.50 \leq d < 0.80$	moderate effect
$0.80 \leq d$	large effect

The results clearly support the above-mentioned hypothesis that, “with just a single session, Phantasy Therapy is more effective for the treatment of cognitive deficits than either a comparable group psychosis therapy or a placebo group.” The results also indicate that, with just a single session, Phantasy Therapy is more effective for the amelioration of certain somatic, psychological, and social-communicative disturbances than either a comparable group psychosis therapy or a placebo group. With regard to the self-rating of the momentary state of (a) general well-being, (b) relaxation/tension, (c) sadness/happiness, (d) wakefulness/tiredness, sport therapy tended to overtax patients the most, and, as also might be expected, Phantasy Therapy tended to overtax patients slightly more than the placebo group.

Full Study with Acute, Stationary Patients: Preliminary Results

The preliminary empirical population is described in Table 4. It comprised 119 adult patients from the stationary open and closed wards of our clinic located in a small village in the countryside about 20 km outside the city of Winterthur (54 males and 65 females = 45.4% m and 54.6% f, respectively).

Table 4. Empirical population of preliminary study in the stationary wards

	Phantasy Therapy		Art Therapy		Placebo Group		All Groups	
	Freq	C-%	Freq	C-%	Freq	C-%	Freq	C-%
Sex								
Males	19	41.3	33	41.3	25	46.3	54	45.4
Females	27	100	47	100	29	100	65	100
Total	46		80		54		119	
Age (years)								
Under 20	3	6.5	5	6.3	3	5.6	7	5.9
20 – 29	13	34.8	22	33.8	18	38.9	32	32.8
30 – 39	11	58.7	20	58.8	16	68.5	34	61.3
40 – 49	12	84.8	17	80.0	8	83.3	23	80.7
Over 49	7	100	16	100	9	100	23	100

Total	46		80		54		119	
Diagnosis (ICD-10)	Freq	C-%	Freq	C-%	Freq	C-%	Freq	C-%
Schizophrenia F20	21	47.7	25	31.6	10	18.5	34	29.1
Delusional Disturbance F22	2	52.3	1	32.9	1	20.4	3	31.6
Psychotic Disturbance F23	4	61.4	3	36.7	3	25.9	6	36.8
Schizoaffective Disturbance F25	7	77.3	10	49.4	6	37	13	47.9
Depressive Disturbance F30	4	86.4	9	60.8	10	55.6	18	63.2
Neurotic Disturbance F40	3	93.2	5	67.1	2	59.3	7	69.2
Personality Disturbance / Borderline F60	1	95.5	6	74.7	3	64.8	6	74.4
Substance Abuse F10	1	97.7	18	97.5	16	94.4	26	96.6
Other Disturbances	1	100	2	100	3	100	4	100
Missing	2		0		0		2	
Total			80		54		119	

Legend: Freq = frequency; C-% = cumulative percent of nonmissing data

The group psychosis therapy tested here is an art therapy¹¹ group of comparable stage of illness, time between admittance and first exposure to therapy, group size and duration of session. However, as opposed to the sport therapy group of the Pilot Study, the art therapy group did not compare well with the Phantasy Therapy population with regard to diagnostic indication and symptom severity. (See Table 4.) The art therapy group was lead by a certified art therapist. A certified movement and dance therapist lead the Phantasy Therapy group together with the author as coleader.

As in the pilot study, the placebo group consisted of a weekly information session. Once again, we had a group of comparable stage of illness, time between admittance and first exposure to therapy, group size and duration of session, but not of comparable diagnostic indication and symptom severity. (Recall Table 4.)

Due to both clinical and ethical reasons for carrying out the study under the condition of “treatment as usual” (TAU), the three comparison groups only partly overlapped: Only 9 of the 119 patients took part in all three groups, 2 patients took part in Phantasy Therapy and in the placebo group (but not in art therapy), 24 patients took part in Phantasy Therapy and in art Therapy (but not in the placebo group), 17 patients took part in art therapy and the placebo group (but not in Phantasy Therapy), 11 patients took part solely in Phantasy Therapy, 30 patients solely in art therapy, and 26 patients solely in the placebo group.

In all three groups, Phantasy Therapy, sport therapy and placebo group, the therapists took active part together with the patients.

The therapeutic effect was estimated by comparing the patients’ pre- and posttherapy results on three different test instruments:

¹¹ Art therapy is the only other group therapy in our clinic, aside from Phantasy Therapy, which can also contain several, *severely* acute psychotic patients together in the same session. (Movement & Dance Therapy groups hardly ever contain more than one severely acute patient together with others.)

1. Self-estimate of momentary state of (a) general well-being, (b) relaxation/tension, (c) sadness/happiness, (d) wakefulness/tiredness.
2. Connect-the-numbers test of cognitive agility.
3. Third-person estimate of disturbance in the somatic, the psychological, and the social-communicative dimension.

The self-estimate used a simple in-house scale with 5 levels in each of the 4 dimensions of momentary state. As in the pilot study, the ZVT of OSWALD and ROTH was used in 6 different parallel versions for the connect-the-numbers test before and after each of the three above-mentioned groups. Another simple, in-house scale with 6 levels was used to estimate the degree of disturbance in the two dimensions: body and mind/social communication.

Results were again judged in terms of the same measure of effect strength already used in the Pilot Study. Also as in the Pilot Study, the variable scales were so defined that the larger the (positive) value of the effect strength is, the better is the outcome for the respective experimental group. The effect strengths of all three preliminary-study groups are compared in Table 5 by taking into account only those patients from each group having an ICD-10 F2 diagnosis (schizophrenia, schizotypal and delusional disturbances).

These preliminary results clearly do not reject the above-mentioned hypothesis that, “with just a single session, Phantasy Therapy is more effective for the treatment of cognitive deficits than either a comparable group psychosis therapy or a placebo group.” The fact that the effectiveness in the treatment of cognitive deficits in Phantasy Therapy is of the same magnitude as that of art therapy, but not, as expected, better, probably lies in three unavoidable methodological “blemishes” in this study:

- ◆ as opposed to Phantasy Therapy and the placebo group which both take place in the afternoon, when patients are well awake and long after the initial effects of the daily medication have worn off, art therapy begins
 - a. early in the morning
 - b. immediately after patients were given their first daily dose of medication.

This fact tends to positively bias the effect strength of art therapy (artificially low pretest results compared to “normal” posttherapy test results 1.5 hours later after wake-up and metabolism of initial medication). This is evidenced by the fact that the average test result of the pretherapy test in art therapy is considerably smaller than both that in Phantasy Therapy as well as that in the placebo group (Table 5)

- ◆ as opposed to Phantasy Therapy and the placebo group which both forbid smoking during the session and also have no break during which patients can smoke, patients may leave the art therapy room at any time to smoke a cigarette. Insofar as nicotine has been shown to help compensate cognitive deficits due to neuroleptics (Levin, 1992), (Levin, Wilson, JE, & McEvoy, 1996), (Sandyk, 1993), (Taiminen et al., 1998), to help overcome negative symptoms associated with schizophrenia (Erdmann, 1995), (Erdmann, 1995), and to reduce the biological halftime of high-potency neuroleptics

(Erdmann, 1995), smoking may help somewhat enhance the difference between the pre- and posttherapy test averages of the art therapy group.

The final analysis will have to correct for these biases.

As in the Pilot Study, the results also indicate that, with just a single session, Phantasy Therapy is more effective for the amelioration of certain somatic, psychological, and social-communicative disturbances than either a comparable group psychosis therapy or a placebo group. With regard to the self-rating of the momentary state of (a) general well-being, (b) relaxation/tension, (c) sadness/happiness, (d) wakefulness/tiredness, Phantasy Therapy tends to overtax patients more than art therapy and the placebo group.

Table 5. Effect strengths of all three stationary-patient preliminary-study groups in comparison (schizophrenic patients only: ICD-10 F2)
For each pair of groups, the larger the (positive) value is, the more the effect strength speaks in favor of the group printed in bold text as opposed to the comparison group

Test Results		Pretherapy Test			Posttherapy Test			d Effect Strength
		AVG.	S	N	AVG.	S	N	
Cognitive Test (Interval scale: Numbers correctly connected in 60 secs., larger values are better results)	Phantasy	46.38	19.28	33	51.51	17.14	33	0.3
	Placebo	45.02	24.98	20	44.98	25.93	19	
	Phantasy	46.38	19.28	33	51.51	17.14	33	-0.1
	Art	39.56	23.03	35	46.52	22.34	35	
	Art	39.56	23.03	35	46.52	22.34	35	0.3
Third-Person Rating (Rank scale: The larger the value, the worse the patient is doing)	Phantasy	2.99	0.84	34	2.65	1.00	34	0.3
	Placebo	2.80	1.21	20	2.75	0.88	18	
	Phantasy	2.99	0.84	34	2.65	1.00	34	0.3
	Art	2.92	0.94	38	2.87	0.99	39	
	Art	2.92	0.94	38	2.87	0.99	39	0.0
Self-Rating (Rank scale: The larger the value, the worse the patient is doing)	Phantasy	10.11	3.49	33	9.34	3.95	33	-0.2
	Placebo	10.62	3.69	18	10.69	4.31	18	
	Phantasy	10.11	3.49	33	9.34	3.95	33	-0.2
	Art	10.02	3.63	30	10.14	4.16	31	
	Art	10.02	3.63	30	10.14	4.16	31	0.0
	Placebo	10.62	3.69	18	10.69	4.31	18	

Requirements and Goals

An empirical, descriptive statistical evaluation of 226 patients during 63 treatment sessions (Day 1 only) over a period of 66 weeks between 14. March 1995 and 30. June 1996 demonstrated that our therapeutic concept fulfills several practical requirements:

0. Suitable to the majority of patients under the difficult conditions of a public psychiatric clinic, namely,
 - (a) roughly 50% forced admissions
 - (b) short inpatient hospitalizations (on the average of 3 weeks)
 - (c) wide range of ages (ca. 14 - 82) for both sexes.
1. Suitable for a broad spectrum of disturbances, in particular, acute psychosis.
2. Suitable for patients in very „bad“ states (autistic/mutistic, excited, strongly medicated or otherwise „difficult“).
3. Motivation of negativistic patients via psychosocial activation through the „group-ego“.
4. Control of highly excited, disorganized patients via the ritualized, structured support of the „group-ego“.
5. Treatment of large groups (up to ca. 18, max. 22 patients with 3 therapists).¹²
6. Therapy time of only 2x 90 minutes.
7. Effectiveness already possible with only one session (activation of cognitive resources via the «!AYA!-Effect» with simultaneous reduction of disorganization and aggression).
8. Openness to patient visitors and other interested members of a multidisciplinary team (e.g. medical doctors, nurses, therapists or therapists in training, or also for patients as visitors who initially don't want to participate.)

Our experience since the end of July 1996 with the 2-day program (Table 1) shows that acceptance of Day 2 tends to be even slightly higher than that of Day 1.

Quality Assurance

Phantasy Therapy is

◆ *practical:*

Suitable for all diagnostic groups with patients of both sexes and all ages, in particular, for negativistic, aggressive or psychotic patients under the difficult

¹²One could argue that any group larger than ca. 10 persons can no longer be regarded to fulfill the clinical requirements of a *therapy*, or at least that the term "therapy" is questionable under such conditions. Nevertheless, our experience has shown that, given a sufficiently large therapy room, such large groups can be quite successful.

conditions of a public psychiatric clinic (Pts. 0, 1, 2, 3 and 4). We have even been able to successfully treat patients in wheelchairs or brought into therapy in their bed (!).

- ◆ *economical:*
18 patients-1.5 hours/3 therapists = 9 patient-hours per therapist (Pts. 5 and 6).
- ◆ *therapeutically effective:*
Activation of cognitive resources via the «!AYA!-Effect» with simultaneous reduction of disorganization and aggression possible in only one or two 90-minute sessions (Pt. 7).

Accordingly, Phantasy Therapy fulfills the 3 major quality-assurance criteria of the Swiss National Health Office (Schweizer Bundesamt für Gesundheitwesen): It is *practical*, *economical* and *effective*.

In addition, the 8th requirement (openness for visitors, whether patient or therapist, and treatment of short-term, skeptical patients) shows that our therapy form is *robust*.

Outlook / New Developments

Phantasy Therapy has been planned to cover three days in a special psychosis ward of our clinic. The first two days are carried out as explained in Table 1 with a psychotherapist, movement and dance therapist, and an art therapist, whereas Day 3 is an extension additionally involving a music therapist:

- ◆ Day 1 = introduction of new theme and object + transformation of theme into mimic, gesture, and movement + closure with theme-based fairytale (theme embodiment).
- ◆ Day 2 = repetition of theme-based fairytale of Day 1 + transformation of symbolic content into form and color + closure with gestalt positivation (positivation of embodied theme).
- ◆ Day 3 motivates the musical transformation of the graphical symbolic work of Day 2 into rhythm and melody with emphasis upon positivation of the overall theme, object, and fairytale symbolism (vivification of positivized, embodied theme).

Summary and Conclusion

In Theory

Psychosis is «a weakened or distorted relationship to or attitude toward collective reality».

Our theoretical approach understands psychosis as a functional mind-brain disturbance at the quantum neurobiological level, namely, as a problem of mind-brain «connectivity» or «binding». The «connectivity» or «binding» problem refers to a weakening or distortion of the normal, nonlinear networking involving quantum physical, biochemical, bioelectrical, and

anatomical feedback loops between certain regions of the brain or between certain neuronal ensembles.

Mind-brain processes and the corresponding qualitative experiences of the individual are, figuratively speaking, put together like the pieces of a mental picture puzzle. However, in the "psychosis picture puzzle", each individual piece may sparkle and shine (= «pop-out effect»), but the overall composition makes no sense, it is distorted: The picture puzzle pieces comprising the afflicted person's impressions are individually experienced, separately, that is, not recognizably as belonging together as in the case of the nonpsychotic person.

In Practice

Phantasy Therapy is a depth psychologically oriented group approach. This approach is designed to optimize «therapeutic presence», a combination of (1) empathy for, (2) participatory interest in, and (3) intentionless expectant attention to the patient. «Therapeutic presence» enhances the cognitive-emotional-sensorial-intuitive encounter between therapist and patient («pacing»). The established rapport enables the (motivated, interested and attentive) patient to put together the picture puzzle pieces of his or her disorganized inner and outer experiences into one meaningful, collective context. As a result, the patient can rediscover our common objective reality within respect for his or her own fantasy under the empathic, vigilant guidance («leading») of his or her therapist.

Our clinical approach understands therapy as a somataesthetic experience- and synaesthetic expression-oriented encounter with the patient.¹³ This encounter occurs via the therapist's empathic imaginative identification with the patient¹⁴ onhand a progressively positivising, cognitive-emotional thematic rapport. This rapport can be enhanced by specialized therapeutic elements (for example, the seven therapeutic elements of our Phantasy Therapy) and offers the patient creative freedom in a humorous and playful way within a certain therapeutic security and guardianship (Amae-Principle - cf. (Doi, 1982), (Ito, 1994), (Ito & Takei, 2001)).

Human understanding for the person suffering from psychosis is, in this method and within a somatosynaesthetic setting, as important as the explanation and even the analysis of the disorder or of its psychogenesis. Indeed, the empathic-identificatory and progressively positivising rapport with the psychotic person - «therapeutic presence» - is already therapy.

¹³ Recall our definitions above: «Aesthetic» means "characterized by a love of beauty". Accordingly, I coin the term «somataesthetic» to mean "empathic, integrative and coherent with virtually all sensory input channels", and the term «synaesthetic» to mean "empathic, holistic and meaningful in terms of virtually all apperceptive qualities".

¹⁴ as opposed to psychopathology which is more characterized by explaining the patient's behaviour through observation.

The basic idea behind Phantasy Therapy can be summed up as follows:

- Phantasy Therapy utilises «therapeutic presence» in a structured, aesthetic way to create a suggestive “you-space” for each patient which may help him or her to playfully put the picture-puzzle pieces of his or her subjective “I-world” within one or another objective context of the group’s “we-reality”.

In fact, any attractive, participatory, interesting and motivating psychotherapy can lead to significant changes to the gestalt-forming processes in the central nervous system. These are either already now measurable or will be measurable in the not-too-distant future.

ADDENDUM: Conscious-to-Unconscious Mind-Brain Activity

Information Processing in the Central Nervous System: "Pure Mind" to "Pure Brain"

There are at least three different ways to estimate the rate of information processing going on in the human mind-brain. The first approach offers an estimate based entirely upon mental capabilities. The third approach is based solely upon biological properties of the brain. The second approach lies somewhere inbetween, calling upon arguments based on the mind as well as the brain.

All three methods allow a rough estimate of the ratio of conscious to unconscious information processing, and lead to the same conclusion:

*The ratio of conscious to unconscious information processing in the mind-brain
≈ 1 to 10⁴.*

Other approaches and estimates are certainly possible. Nevertheless, even if the arguments used here are in error by as much as an order of magnitude (=factor of 10), the conclusion remains astonishing.

Conscious-Memory-Efficiency Approach

This approach relies upon an estimation of the efficiency of conscious thought. It requires two independent approximations:

- The length of one consciously experienced moment

- The maximum number of conscious moments recalled per year

The first approximation is acquired from estimates based upon the conscious experience of time. The second approximation is derived from rough estimates of memory efficiency.

Conscious Experience of Time

Without delving into philosophical discussions about the nature of observation in quantum theory, it is reasonable to accept that, for everyday purposes, the spatial world around us is an internal (subjective) construct of our visual, auditory etc. perception of an external (objective) reality. Indeed, it seems only natural, that is, we take it for granted, that there is no distortion of reality along the way from sensory impression to mind-brain comprehension of space: We automatically assume that the geometry we „see in our heads“ is the same geometry that „really exists out there“. Indeed, it seems hard for us to accept the possibility that the spatial world we mentally assume to exist around us might result from a subjective distortion of objective spacial reality. Maybe, for this reason, it is just as difficult for us to accept the possibility that the temporal world around us may also result from a subjective distortion of an objective temporal reality.

Following W. STERN, there is the concept of «the psychological present», namely, the longest time span experienced to be the immediate present or, the maximum time interval between two sensory signals which still allows us to continuously and consciously experience them as a single event without resort to memory. This maximum time span may extend up to ca. 12 sec. (Dorsch, 1982, p. 502), (Rohracher, 1988, p. 144).

At the other end of human time experience, we have the shortest time span which can occur between two sensory signals in order for us to still be able to differentiate them as separate events. This is roughly 1/18 sec. = 55,555... ms. In other words, we can scarcely hear 18 air pressure oscillations per second as a succession of beats or just barely see 18 pictures per second as a jiggling: More single-frequency beats per second are heard as a single, continuous and deep tone¹⁵; more pictures per second are seen as a single, continuous motion. Thus, time intervals shorter than about 1/18 sec and longer than ca. 12 sec. elude our conscious expectant attention. *In other words, we seem to experience the world around us in conscious «expectant attention windows» of maximum 12 sec. length separated by unconscious intervals of at least 1/18 sec..* I will slightly modify the breadth of this «expectant attention window» below.

A more careful physiological analysis shows that simultaneity is a relative concept depending upon the particular sensory channel receiving two signals: Roughly speaking, the more information accompanying a signal, the more time that is necessary between signals in order for the mind-brain to be able to consciously process them distinctly. Thus two successive sounds can already be distinguished consciously if they are separated by only 4-5 ms; two touches by 10 ms, whereas two pictures require a duration of at least 20-30 ms between them (Müller, 1986, „Zeiterleben“, p. 738), (Pöppel, 1985). Conversely, sound beats

¹⁵ It is interesting to mention that while listening to human speech, we are able to distinguish up to as many as roughly 50 multi-frequency tone impulses per second.

with a frequency higher than roughly 200 – 250 Hz, skin vibrations with a frequency of more than ca. 100 per second and films with a picture rate of more than about 25 pictures per second will be consciously experienced as a single continuous sensation (tone, pressure or motion) even though they comprise a succession of sensory impressions. Furthermore, and independent of the particular sensory channel involved, a time interval of approximately 30-40 ms between sensations is necessary in order for a person to be conscious of the rank order - which signal came first? - between signals. This brings me back to the estimated 1/18 sec interval between conscious sensations mentioned above.

Finally, I return to the idea of the necessary duration of a sensation in order to experience it continuously in the present sense of „now“: Sensations shorter than 3 sec. in duration are generally overestimated to be somewhat longer, whereas a sensation lasting longer than 3 sec is generally underestimated to be somewhat shorter (Müller, 1986, „Zeiterleben“, p. 739). Successive sensory impulses following each other within this 3 sec time window can be comprehended as belonging to the same time-gestalt, whereas this is less possible (to being altogether impossible) for series of sensations occurring within time spans of shorter or longer duration than roughly 3 sec.. From this I slightly modify my above estimate and conclude that we seem to experience the world in «attention time windows» of around 3 sec. length separated by intervals of approximately 1/18 sec. Thus, I arrive at the following conclusion:

One consciously experienced moment takes up on the average of 3 sec + 1/18 sec = 3.0555... sec of lifetime.

It is interesting in this regard to note that shamanistic drumming and rattling aimed at inducing a trance state is typically carried out at a frequency of roughly 3 Hz, i.e. 1/3 sec between beats, namely, at a frequency lying very well within the range of conscious attentive experience.

Memory

Based on the above considerations, over the time of one year a person experiences an average of about $(2/3) \times 365.25 \times 24 \times 3600 / 3.0555... = 6 \times 10^6$ conscious moments (having excluded 1/3 of the year for sleep). Accordingly, if a person could remember every single living moment over this same entire time span, he or she would have to be able to store roughly 6 million conscious remembrances every year. But it has already been demonstrated that even a person with an exceptionally gifted memory is only capable of recalling one or more remembrances of occurrences by date for roughly 100 days per year (for example, 4 events on their birthday, 3 at Christmas etc.), long after this year has passed (Wieck, 1955, p. 51). Thus, assuming for the sake of argument that a most gifted person could recall an average of 600 remembrances by date per year (= roughly 1 ½ events on the average per day by date), I find an efficiency of only 0.01% ($= 6 \times 10^2 / 6 \times 10^6$). Interestingly enough, this same ratio will turn up from my data-processing and anatomical considerations of the mind-brain below. This apparent inefficiency of the conscious mind-brain can just as well be understood as an attest to the predominance and efficiency of unconscious information processing in the mind-brain.

Information Theory Approach

Another possible way to grasp consciousness in scientific terms is via information processing in the mind-brain. The data handling activity $A_{\text{consciousness}}$ of the nervous system necessary for the processing of conscious experience can be estimated by the channel capacity or bandwidth necessary to carry the information for a modern multimedia system designed to fill a movie theater audience with the experience of realism:

One single full picture in PAL-resolution of 768x576 pixels (1 pixel = 1 byte = 8 bits) corresponds to 442'368/1024 kilobytes (kb) = 432 kb of information. At a standard rate of 25 pictures per second, this gives a data rate of 10'800 kb/s for a black and white silent film. For color pictures we must multiply this result by 3 resulting in 32'400 kb/s or 32'400/1024 Mb/s = 31.6 Mb/s for a color film without sound. Including audio information from 16 bit stereo sound at a standard CD rate of 44 kHz (88 kb/s = 88/1024 Mb/s = 0.0859 Mb/s), hardly changes this estimate. Rounding up, I find an overall data rate of roughly 32 Megabytes/s for a full blown cinema:

$$A_{\text{consciousness}} = 32 \text{ Megabytes/s, that is, on the order of } 10 \text{ Megabytes/s.}$$

An estimate of the overall activity A_{Total} of the waking brain is not so simple. On the one hand, actual values for the number N of neural synapses in the brain have been obtained either by examining brain sections from sites throughout the brain or by sampling counts made on homogenized brain material. Such estimates give ca. $N=2 \times 10^{13}$ (Walker, 199? p. 104) to ca. $N=2 \times 10^{15}$ (King, 1996, p. 203) corresponding to an average of 200 to 20'000 synapses, respectively, for each of the ca. 10^{11} neurons in the brain (cf. e.g. (Penrose, 1995, p. 43)). For the purposes of this analysis, I assume the logarithmic average, namely, $\langle N \rangle = 2 \times 10^{14}$ *neural synapses in the central nervous system*.

Now if the neural system optimally encoded information, the amount of information \mathbf{I} transferred across each synapse would be 1 bit every time a synapse decided to fire or not to fire, i.e., every time an action potential arrived at the synapse and the activation time $t=0.3$ ms ran out. There is, however, a lot of redundancy in the handling of data in the brain which most likely serves to reduce the information-loss inherent to thermal disturbance of the quantum firing process. The corresponding value of \mathbf{I} is therefore smaller than 1 bit and has been accordingly estimated to be, on the average, on the order of $\langle \mathbf{I} \rangle = 0.03$ *bits of information per activation event* (Walker, 1979). (See also (Walker, 199? p. 105).) Finally, I need an estimate of the average activation frequency per synapse $\langle f \rangle$ at any given time in the brain during the waking state: $\langle f \rangle = 0.3$ *activations/synapse-s*. Then, a (very) rough, „back-of-the-envelope“ estimate of the overall information data rate or activity A_{Total} of the waking brain is given by

$$A_{\text{total}} = \text{average number of neural synapses in the brain} \times \text{average activation frequency per synapse} \times$$

$$\begin{aligned}
 & \text{avg. amount of information with each activation (firing decision)} \\
 A_{\text{total}} &= \langle N \rangle \times \langle f \rangle \times \langle I \rangle \\
 A_{\text{total}} &= 10^{14} \text{ synapses} \times 0.3 \text{ activations/synapse-s} \times 0.03 \text{ bits/activation} \\
 &= 0.009 \times 10^{14} \text{ bits/s} \\
 &= 9 \times 10^5 \text{ Mbits/s} \\
 &= 10^5 \text{ Mbytes/s}
 \end{aligned}$$

The result is roughly

$$A_{\text{total}} = 10^4 A_{\text{Consciousness}}$$

Once again - recall my discussion of memory above -, *only about 0.01% of all the brain's activity is experienced consciously* (cf., e.g., (Walker, 199? p. 105)). In other words, it is as if roughly 10'000 cinema films are actually going on in the brain all at once, while we are only consciously aware of one of them, indeed, a very particular one transmitted through the sensory channels¹⁶ (sight, smell, sound, taste, touch and balance)!

Altogether then, the data rate processed by the brain is an astronomical 320 Gigabytes/s! Accordingly, one could argue that the birth of human consciousness is a kind of „ignition problem“ occurring only if a system is capable of processing, like the human brain, at least 320 Gb/s (or more) of information. Because of the wide range of estimates for the numbers used here, the exact order of magnitude cannot be taken too critically. In any case, however, there's a lot of information processing going on in the brain, most of which we are not at all conscious of!

Anatomical Approach

This estimation is based upon approximations of the neural distribution within the central nervous system.

¹⁶ Other "back-of-the-envelope" estimates are also possible. For example, taking only those signals (=action potentials) into account which reach the cortex via the nerve fibers transporting information to the brain from the sensory organs and assuming (1) that each fiber transports roughly 300 action potentials per second and, (2) that there are roughly 3 million such fibers, one gets an estimate of the cortical-sensory mind-brain information flow rate on the order of 1 Gigabits/s (Spitzer, 1999), most of which can be assumed to be incoming unconsciously. After (basically unconsciously) processing this tremendous amount of information, the cortical mind-brain output flows over ca. 2 million nerve fibers which (again, primarily unconsciously) steer human behaviour. Accordingly, the entirety of in- and outgoing cortical-motory-sensory information flow involves roughly 5 million nerve fibers, or an order of magnitude of 10^7 (=5x10⁶) external nerve fiber connections. The number of internal nerve fiber connections is much higher: 10^{10} cortical neurons x 10^4 connections internally to other cortical neurons = 10^{14} internal nerve fiber connections. This means that there are roughly 10 million (=10¹⁴/10⁷) internal cortical nerve-fiber connections for each nerve filament sending signals to or from the cortex! If we assume that an average cortical map encompasses ca. 1000 internal nerve-fiber connections, then we again find a measure of the ratio for internal-to-external information processing on the order of 10^4 (=10⁷/10³) to 1.

Neural Distribution within the Central Nervous System

It is encouraging to note that my estimate of 0.01% conscious brain activity is the same as what we would expect from a simple neuroanatomical comparison of classical conscious and unconscious parts of the central nervous system (=brain + spinal cord). In other words, the interstitial nerve complex lying between the (more or less conscious) sensoric and motoric parts of the central nervous system is generally assumed to comprise the components of a supposedly unconscious „calculating neural network“ and is estimated to contain circa 99.98% of all the nerve cells of the central nervous system (Nauta & Feirtag, 1988, p. 90.) Accordingly, this (very quantitative argument) would also imply that only about 0.01% of all the brain's activity could be experienced consciously.

A certain proportion of this conscious processing may occur interstitially by classical neurophysiological means. Nevertheless, the biochemical calcium hypothesis (Kelly, Deutsch, Carlson, & Wagner, 1979) has long been shown to be severely limited in explaining this (Kelly et al., 1979). More refined, standard quantum physical considerations explaining the processes providing the interconnection among the nerve synapses in the brain, namely, tunneling at the synaptic clefts, are indeed capable of predicting the above-mentioned consciousness data rate (Walker, 199?). But what about the other 99.99% of unconscious data processing in the brain? New ideas are still in need!

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