Semantic processing and semantic experience in people with schizophrenia: a bridge between phenomenological psychopathology and neuroscience?

M. Ballerini

Mental Health Department, Azienda Sanitaria di Firenze, Florence, Italy

Summary

I describe and discuss two kinds of language anomalies in people with schizophrenia: impairments of Semantic Processing (SP), the neural activities underpinning the construction of meanings, and Semantic Experience (SE) the way one lives and manages meanings. The first level includes abnormal language lateralisation models and anomalies of Semantic Memory (SM). SM-based models shed light on three main domains: 1) heightened automatic spread of activation within the SM, 2) inability to build-up and to maintain a meaningful, coherent context of reference as a consequence of impairment of working memory and executive function, 3) impairment of the fine balance between SM-based and syntactically-driven combinatorial processing. Anomalies of SE include the tendency (or proneness) to override the extensional limits of semantic fields as imposed by socially shared constraints of meaning (semantic drift). Language looses its public validity and displays an over-reliance to transcendence, the possibility of every meaning to transcend its commonsense value. The ecological validity of SP models, role of neurocognition, segregation of SP and SE in specific psychopathological domains and diagnostic validity are discussed and contradictory findings underscored. In the final section, I speculate on common properties shared by SP and SE findings as two sides of the same coin, such that SP findings reflect a sub-personal (pre-phenomenal or neural) level (i.e. SM impairment), while SE findings reflect a personal (phenomenal or experiential) level (i.e. the hyper-trascendence of meanings).

Key words

Schizophrenia • Language • Semantic processing • Semantic experience • Neurocognition • Phenomenological psychopathology • Neurophenomenology

1. Introduction

During evolution humans developed the capacity to represent experience in *linguistic constructs* and the ability to operate a flexible manipulation of them [1]. Language is traditionally considered the emergent *behavioural side* of thought, as well as the medium of thinking. Although a "one-to-one" relationship between speech and thought is questionable (consider e.g. visual imagery or logic-mathematical thought) [2], it is nonetheless clear that we use linguistic constructs (*inner speech)* whatever activity we are engaged in, not only when we are in a *reflective stance*.

Since the early twentieth century, language impairments have been reported in people with schizophrenia [3 4] by assuming that they reflect an underlying *thought disorder*. Today, descriptive psychopathology relates language disorders to *Formal Thought Disorders (FTD)*, distinguishing *positive FTD* (loosing associations, neologism, tangentiality) from *negative FTD* (poverty of speech). A growing number of studies has been devoted to *speech production* while *speech comprehension* has been studied to a lesser extent [5]; a set of standardised assessment tools [6-8] have been developed to assess patients' speech production considering the behavioural side of thought disorder; on the contrary, single items of the BSABS (C.1.7) and the SPI-A (C-4) regard the phenomenon of comprehension [9 10] (Table I).

In language both production and comprehension reside on the same *linguistic constructs*, both involving the (internal) *representation of meaning* [11], that is – broadly defined – *semantics* [12]. The term *semantics* "has generally been used as an umbrella" [2] covering different levels of language organization: words, sentences (where the representation of meaning is integrated with syntactical structure) and discourse (where the boundary with *pragmatics* – the social contextualisation of language as communication device – is vaguely defined). *Semantic* and *syntactic* levels are thought to be processed in parallel – not sequential – "streams" provided with closely interacting processes [13-15].

In the next two sections, I will discuss the emergent findings from the field of neuroscience (*Semantic Processing*) and phenomenology (*Semantic Experience*). Each section includes an introduction aimed to delineate basic concepts concerning the neurobiology of semantic processing and the experience of representation of meaning under normal conditions and emerging findings in the area

Correspondence
M. Ballerini, Mental Health Department, Azienda Sanitaria di Firenze, Florence, Italy • E-mail: baller@virgilio.it

TABLE I.
Standardised tools to assess speech production in patients with schizophrenia. Only single items of the BSABS (C.1.7) and the SPI-A (C-4) regard the phenomenon of comprehension. In the CLANG scale, the factor *semantic disorder* intertwines semantic, syntactic and pragmatic features.

TLC	Scale for Assessment of Thought, Language and Communication	Andreasen [6]
CLANG	Clinical Language Disorder Rating Scale	Chen et al. [7]
TALD	Thought and Language Disorder	Kircher et al. [8]
BSABS	Bonner Skala fur die Beurteilung von Basissymptomen	Gross and Huber [9]
SPI-A	Schizophrenia Proneness Instrument, Adult Version	Schultze-Lutter et al. [10]

of schizophrenia. In the last section, I will tentatively look for *matching constructs* bridging phenomenological with neurobiological data. My final remarks will be *no more than tentative*, due to, on the one hand the paucity of studies, without large-scale investigations (phenomenology); on the other hand, *the working-through character* of the findings often charged by persistent *shadow-zones* or contradictory results (neuroscience).

2. Neuroscience: semantic processing

Semantic processing (SP) is the large set of neural activities underpinning the construction of linguistic meanings [12 16 17]. In the last decades, an increasing number of studies employing several laboratory paradigms has produced a growing amount of findings that demonstrate, despite some inconsistencies, a substantial up-grading of language models, including their distortions in pathology. Anomalies of SP in people with schizophrenia have been attributed to impairment of *Semantic Memory* (SM) or, alternatively, to anomalous *Lateralization of Language Functions* (LLF). The emergent literature may appear, at least partially, obscure to non-experts since it relies on complex experimental laboratory variables and neurophysiological assumptions. In this section, I will discuss the theoretical models concerning the anomalies of SM and the disturbances of LLF; each section will be preceded by a brief summary of the basic concepts concerning the language functions herein considered.

2.1 What is SM?

SM is the large database containing all the knowledge about the world acquired throughout one's life. Its content is *long-term*, *formally generalised* (extracted from the experience that produced it) and *declarative* since it is expressible in propositional terms [18 19].
SM is absolutely indispensable to almost all our activities. The neural basis of SM has been investigated in fMRI studies (for a review, see [20]).

Neurobiology of SM

The neurological underpinnings of SM [18] include: a) *modality specific* (motor and sensory) cortical areas (demonstrating that SM is – at least partially – embodied); b) *supramodal convergence areas*, such as the temporal lobe and the inferior parietal regions (where representations become "more abstract" [18]); SM also involves the inferior, rostral and dorsomedial areas of the frontal cortex (*selection, combinatorial* and *retrieval* routines), as well as the posterior cingulate and precuneus cortex (where it may be integrated with *episodic memory* (hippocampus), providing the latter with *temporal organisation*) [18].
In SM, each representation constitutes a node or a hub within a network of associative connections with other hubs (related concepts) [21]. An incoming (meaningful) input (a word, or a concept) activates the corresponding node as well as the *related constructs* through associative links (e.g., *nurse-hospital-doctor*). The activation decreases as a function of reduced relatedness [11 12 18 21]. SM probably contains the same information in the two hemispheres but with very different arrangements [12]: in the left (dominant) hemisphere, semantic fields are tightly, finely and strictly connected; in the right hemisphere, semantic fields are wide, with remote associations. The two hemispheres display differences in the cytoarchitectonic structure of semantic regions (i.e. in the right – non dominant – hemisphere the pyramidal neurons display a wider number of dendritic branches and synaptic connections) [12].

How is SM studied?

SM has been extensively investigated in several laboratory paradigms [12 18-20], employing linguistic stimuli as single words, pairs of words (real words vs. meaningless strips of letters; related and unrelated pairs of words; conventional vs. novel metaphors, the latter taken from modern poetry), sentences, discourse (with congruous or incongruous arrangement of clauses). Other studies employ pictures or picture–word coupling (related or unrelated).
The responses measured in these studies include behaviour-

al indexes (recognition accuracy or time reaction), neuro-physiological markers and neuro-imaging data [12 18-20 22].
Among neuro-physiological markers, event related potentials (ERP) are perhaps the most studied. An ERP is widespread bio-electrical activity recorded from the scalp in response to specific stimuli (i.e. related or unrelated word pairs). In SM studies, the most relevant ERP component is the N400 (a negative waveform occurring 400 msec after the stimulus) indicating a *perceived semantic incongruity* between the two stimuli (e.g. *bread-tiger*) [19 23].
Some authors, as in a study on schizophrenia, prefer to rely on instrumental results such as ERP components, expression of automatic or "implicit" processes; behavioural responses, such as a semantic task, are considered to be more sensitive to controlled or "explicit" cognitive strategies; also, schizophrenia patients tend to be slow or inaccurate in behavioural tasks [24]. ERPs display good temporal resolution as they record neural activities online, but have poor spatial resolution, exactly the reverse pattern of fMRI results [24].

What is the priming effect?

The *priming effect* (PE) [25] is the recognition of a target word (e.g. *tiger*), which is facilitated if it is preceded by a related concept (i.e. *stripes*). PE is very useful to study the associative networks between diverse (related or unrelated) *semantic fields*; a major determinant in these studies is represented by the *time interval*, usually termed as SOA (Stimulus Onset Asymmetry) between the two stimuli. A short SOA (≤ 400 msec) activates *more automatic processing*, while longer SOAs (> 400 mSec) activate *more strategic, explicit, cognitively charged processing* [11 23 25].

2.2 SP in people with schizophrenia: SM-based models

The three [5 22] most influential models concerning SM impairment in schizophrenia are: a) *heightened automatic spread of activation within the* SM; b) inability to build-up and to maintain a meaningful, coherent *context of reference*; 3) impairment of the *fine balance between SM-based and syntactically-driven combinatorial processing*.

Heightened automatic spread of activation within the SM

A very influential model [26] depicts schizophrenia patients as suffering from a *heightened automatic spread of activation within the* SM. This is an abnormal proliferation of relationships between *semantic fields,* which leads to a sort of *hyper-activation* of connective links between weakly related or unrelated words and concepts.
Schizophrenia patients do not display enhanced SM: a meta-analysis documented [27] impairment in *semantic fluency tasks* where probands were asked to produce words belonging to specific categories. Also, patients do not suffer from a sort of *semantic dementia*: they were less accurate than controls in organising words according to semantic categories [28] and in recalling previously-stored lists of words, failing to use semantic strategies. The patients' performance improved if the time task was prolonged or external help was provided [29 30].
Patients *perceive remote or unrelated concepts as semantically related*. Their transcripts (with randomly omitted words) were judged to be more unpredictable than those produced by normal controls [31]. In *semantic fluency tasks*, patients produced bizarre semantic associations [32].
As documented by a meta-analysis [25], in semantic decision tasks (where the proband has to recognise the semantic relatedness between two words), patients with positive FTD exhibited hypersensitivity to PE. This finding was significant, with short SOAs indicating an impairment of automatic processing. Similarly, in ERP studies, patients with schizophrenia displayed a reduction of N400 component (semantic hyper-priming) when exposed to a pair of distant words (i.e. moderately or indirectly related words) [5 19 23]. This was more evident when short SOAs were used, activating more automatic associative processes; the ERP semantic hyper-priming is reduced with longer SOAs [23 24] or when patients are requested to make a behavioural decision (e.g. matching the semantic relatedness between two stimuli) [5 24 33].
On the contrary, other studies, employing behavioural responses (semantic decision tasks) and neuro-physiological data (N400), displayed reduced or negative PE both at short SOAs and at longer SOAs [34-36] suggesting the latter is an impairment of *semantic explicit strategies* (see next section).
All these findings were related to *SM disorganisation* with impairment of normal connections between related semantic fields [24 37]. These results have been regarded as the cause of *loosing associations* and *positive* FTD. Anomalies of semantic ERP were also occasionally described in patients with severe *Positive Symptoms* [35 38], or *Negative Symptoms* [39 40] (for discussion, see section 4).

Inability to build-up and maintain a meaningful, coherent context of reference

Anomalies of SP have been attributed to an inability to build-up and maintain a meaningful, coherent *context of reference* between word pairs or sentences [41]. Negative PE between word pairs has been considered the consequence of such a disturbance [37].
This inability has been referred to as an impairment in working memory (WM) and executive functioning (EF) [5 23 42 43]. The impairment of WM and EF may operate in several ways [23]: 1) inability to maintain "on line" the correct context of reference of meanings, especially in

the face of multiple sources of information; 2) inability to inhibit irrelevant words that do not match the context of reference. If these mechanisms do not work, the number of words that should be, and are not, inhibited overrides patients' reduced capacities [23].

Impairment of the fine balance between SM-based and syntactically-driven combinatorial processing

An integrative model has been recently purposed by Kuperberg and coworkers. The ability to correctly represent linguistic meaning *within the frame of discourse* is related to a fine integration of semantic-syntactic mechanisms necessary to obtain appropriate logical, causal, temporal connections, as well as consistent semantic matches [11 22 24]. Conventional models of *language processing* have established a *two step-sequential* mechanism: syntactic parsing plus semantic analysis, the latter performed when the syntactical structure has been already determined [22 24].

It is assumed that simple *blocks of semantic-syntactical associations* are stored in SM, ready-to-hand in many everyday transactions [13 15 24]. When one is faced with complex, ambiguous, or contradictory communication, a more sophisticated level of analysis is required, called the *combinatorial integrative* parsing of discourse [22 24].

Consider two examples [44 45] from laboratory paradigms, both without coherent meaning: "the guests played bridge because the river has many rocks"; "at breakfast the egg would eat …" (for review, see [24]). In the first case, the *homograph* (a word with two or more meanings) *bridge* has been used in its *subordinate meaning* (a card game), while the subsequent word *river* is connected to its *dominant meaning*. In the laboratory, when confronted with the term *river* normal people produced an N400 (perceived semantic incongruity). This is not the case with people with schizophrenia who seem to rely on *semantic association* between 'bridge' and 'river' irrespective of the context. In the second case, non-patients do not to produce a N400 (*transitory semantic illusion*) in response to the term *eat*, but they produce a late P600, reflecting a supervening need for *combinatorial-integrative parsing* (semantic-syntactic integration) of the sentence. People with schizophrenia do not produce this effect: they seem to rely on semantic associations between the words 'breakfast', 'egg' and 'eat' [44 45].

An fMRI study demonstrated that patients with schizophrenia have a reversed pattern of cortical activation: when responding to semantic-related stimuli, schizophrenia patients display hyper-activation of infero-frontal and temporal cortices; the inefficacy of lexico-semantic retrieval and selection (infero-frontal cortex) leads to hyperactivation of temporal structure [14].

Similarly, in another fMRI study the same research group indicated that schizophrenia patients experience a dissociation between frontal and temporal lexico-semantic integrative processes [46], which has been confirmed by other studies using a different semantic fMRI paradigm [47]. Another fMRI study, employing semantic indirect priming (two associated words predicting a target word), demonstrated hyperactivation of temporal regions in patients, suggesting enhanced activity in cortical semantic structures [48].

In language comprehension, the two "streams" of processing, that is, the *semantic memory-based* and the *combinatorial-integrative syntax driven*, need to be *fine-balanced* [11 22 24]. People with schizophrenia seem to rely excessively on semantic associations. These patients are able to match the incoming linguistic stimuli with the stored constructs [37], but when confronted with more complex or ambiguous parses of language they are unable to inhibit their over-reliance on semantic associations. The authors concluded that the *fine balance between semantic memory-based and syntactically-driven combinatorial processing is disrupted in schizophrenia, and that such a disruption can lead to errors in the build-up of higher-order meaning under some circumstances* [24].

2.3 What is the LLF?

Lateralisation of brain functions (and conversely, asymmetries in neuro-anatomy) are widespread in many species. They represent an evolution-driven advantage in performing many tasks. Human language has been considered for many decades strictly lateralised in the left (dominant) hemisphere. Today, the classical nineteenth century model (the Wernicke–Broca model) is considered no more valid. Language processing involves both hemispheres and possibly sub-cortical structures [16 17]. Nonetheless, the two hemispheres do not need to be considered functionally (and anatomically) equivalent: there is growing evidence for hemispheric specialisation, that is, the segregation of specific language functions in the right or left hemisphere [12 49].

The Four Quadrants model

In the model proposed by Crow [49-51], the brain torque is subdivided by two axes (antero-posterior and latero-lateralis) in *four linguistic chambers*: left dorso-lateral pre-frontal cortex (speech production), left hetero-modal associative occipito-temporo-parietal cortex (phonemic comprehension), right hetero-modal associative occipito-temporo-parietal cortex (meanings representation) and right dorso-lateral pre-frontal cortex (planning concepts and intensions); while the left – dominant – hemisphere is prevalently dedicated to motor and sensory phonological features of language, the right is devoted to more conceptual features. While the left (dominant) hemisphere contains a set of primary lexico-semantic modules neces-

sary to speech production and comprehension, the right hemisphere is considered a "secondary lexicon or lexico-semantic store" where the "separation of a motor from a sensory component gives rise to distinction between meanings on the one hand and thoughts and intentions on the other" [50]. In the left (dominant) hemisphere, the connections between linguistic neural representations or "engrams" are restricted to linear or serial forms of processing, while in the right hemisphere they are wider and provided with "in parallel" associative links, consenting more complex or "alternative" elaboration of meanings [51]. The four chambers are connected by one-way pathways: the direction is biased toward the right at the posterior level (representation of meanings) and biased toward the left at the anterior level (speech production, where thoughts and intentions – at least partially elaborated in the right hemisphere – become speech) [50]. The correct functioning of the entire system requires absolute hemispheric segregation of *linguistic routines*: if not, the road is open to overt pathology [49-51].

Bilateral activation integration and selection model

Another very influential theory of SP is the BAIS model (Bilateral Activation Integration and Selection) [12]. The model has been developed via fMRI and neurophysiological studies. In laboratory paradigms, it is possible to rely on only one hemisphere by addressing semantic stimuli in one visual hemi-field.
SP occurs in both hemispheres in *parallel streams*, distinct but complementary and highly interactive: in the left (dominant) hemisphere, *semantic fields* are tightly, finely and strictly connected, while in the right hemisphere they are widely connected, with remote associations; the left hemisphere is activated by strong categorical information (dominant meanings, literal associations, contextually-relevant information), effective for quick comprehension and speech production; the right hemisphere seems to be engaged by distant, non-conventional categorisation (subordinate meanings, unusual or distant semantic associations, apparently irrelevant information, abstract concepts), displaying an advantage in detecting context inconsistencies, deriving themes, drawing inferences, repairing grammatical errors, producing figurative language and comprehending novel metaphors and jokes [12]. When faced with a semantic stimulus (a word, or discourse), the semantic networks are activated. The diverse semantic fields are then computed and integrated by their overlapping zones. Finally, the best-matching semantic field is chosen, while all others are inhibited. The brain regions involved in these sequential processing are, respectively, the posterior temporal cortex, anterior temporal and frontal infero-lateral cortex [12]. SP may be viewed as the product of this "hemispheric negotiation" [52]. It is still unclear what regions operate as the *selector,* able both to address the "stream" in one direction and to switch off processing. The right hemisphere may be activated when left hemisphere processing is inconclusive [12]. Some authors have suggested that the left (dominant) hemisphere plays "a gate-keeper role" by preventing unconventional semantic processing from becoming excessive [53].

2.4 SP in people with schizophrenia: lateralization-based models

In a seminal paper [49], Crow argued that schizophrenia is the price *Homo Sapiens* pays for the acquisition of verbal language. While the model is still under debate, there is still a growing amount of evidence concerning anomalous LLF in people with schizophrenia.

Crow's model

Crow has proposed that anomalous lateralisation impedes the normal hemispheric segregation of diverse language functions. He suggests that psychotic symptoms are the result of this anomalous lateralisation, as well as a possible reversal in the direction that these pathways typically flow. For example, auditory verbal hallucinations are viewed as products of reversed direction in the posterior pathway [50 51] – inner speech becomes objectified in perceptive-like (auditory) phenomena. In Crow's model, anomalies of language account for all classic psychotic (first-rank) symptoms [49-51] and possibly for incoherent speech phenomena [50].

Experimental evidence concerning anomalous LLF in schizophrenia

Several studies have demonstrated anomalous LLF in people with schizophrenia, ranging from neuro-anatomical [54] to functional levels, as documented by fMRI investigations [55 56]; despite some inconsistencies [57], a correlation between the severity of psychotic symptoms and defective lateralisation has been found [56 58 59]. A meta-analysis confirmed a correlation between defective language lateralisation and auditory hallucinations, although with small effect-size [60]. Anomalies of language lateralisation have been documented in patients with relevant negative symptoms [61], first episode patients [59], un-medicated patients during acute episode [58] and in relatives [62 63], suggesting that they may represent a vulnerability marker for schizophrenia.

BAIS based evidence

Two studies [52 64] have challenged the BAIS model in people with schizophrenia. In one study [64], schizophrenia patients exhibited a reverse pattern of brain activation during a semantic task (conventional vs. unconventional

metaphors). In another study [52], the ERP magneto-EEG was recorded during a semantic task test (literal related or meaningless word pairs, conventional or unconventional metaphors). Patients were more able than controls to identify novel metaphors, but performed worse on all other tasks. Also, patients did not display the M350 waveform (similar to N400 reflecting perceived semantic incongruity) for either unrelated words pairs or unconventional metaphors. In conclusion, patients with schizophrenia (with positive FTD) seemed to rely on automatic – *coarse* – (right hemisphere-based) SP independent of the type of semantic stimuli [52 64]. Given the small number of patients, the results are preliminary.

3. Phenomenology: *semantic experience*

From a phenomenological perspective, *semantic experience* (SE) may be considered the way we live and manage *meanings*, the building blocks of all knowledge. In other words, SE is the subjective, first-person experience *of meaning*. In this section, after recalling the notions of 'meaning' as developed by social phenomenology, I will briefly summarise the (few) psychopathological studies regarding SE in people with schizophrenia.

3.1 Meanings and language

Man is an *animal symbolicum* [65] and his core property is the ability to *conceptualise* reality. Facts, events and objects are typified through *meaningful constructs* (MC). Every kind of knowledge is grounded on MC, including *common sense* (CS) – *knowledge,* taken-for-granted and shared intuitively by all the individuals of a given socio-cultural context, as well as the most sophisticated forms of *scientific knowledge* – whose evolved symbolism is shared only by experts and adepts [65].
Language is the principal means through which we *typify* experiences. It is the way we give sense to our actual experience, the way we retrieve past experiences and build up predictions. In learning our *native language*, we acquire a large stock of knowledge [66]. We use this knowledge to take account of our experiences and to communicate with others [67].

Meanings and the (socially-shared) interpretative procedures

The social world is articulated in the *everyday life-world* (the world which we all first and foremost inhabit) and in specific *districts of meaning* (e.g., the world of art, science, work, specific disciplines, or groups of adepts etc.). These are essentially *interpretative orders* – an incredible *database of meanings, categorisations, standards, rules, principles, causalities* etc. – that the individuals of a given social context share intuitively and spontaneously [65 66].
CS (including the standards of specific disciplines, activities and restricted groups of people) is not only the database of knowledge at everyone's disposal; it is also the set of *interpretative procedures* (IP) or *account practices* [68] that allow us to experience different phenomena in the world as solid realities whose meaning is taken for granted. Garfinkel [68] introduced the term *indicality* to point out a fundamental property of socially-shared IP: every meaning is contextually grounded but the context (the frame of reference of each meaning) is nothing more than a sum of MC ("accounts") assembled according their semantic values or properties. In our engagement with the world, we intuitively use *already-assembled* or ready-to-hand *frames of reference* (assembled contexts) to represent meaning [68]. The socially-shared IP represent a facet of the more complex CS experience; other facets include the *system of values*, *social attunement, self-experience* and, finally, *lived space* [69 70]. CS is the grounding element and the condition of possibility of social life. Normally transparent, it is the root of our sense of reality. The boundaries of our perception of reality are traced by the *interpretative order* provided by CS [71]: each deviance brings bewilderment, disapproval, embarrassment, or fear [68].

The ambiguity of meanings

Commenting on the Schutz's notion of MC (typifications), Natanson [72] observed three main properties that may be extended to the notion of *interpretative procedures*. These include: (1) *abstraction*, since each MC is not confined to the experience that produces it; (2) *anonymity* since each MC is at everyone's disposal; (3) *transcendence*, since each MC may go *further*, may be manipulated, updated, acquiring new meaning [71]; every meaning also displays an *intrinsic ambiguity* – it is an "open horizon" in the fact that it permits the possibility of *natural evolution* (new significations) or personal manipulation [65 73].
Meanings are *never forever*: they are signs of time, as they evolve continuously.
Man is also *a set of solitude and sociality* [74]: each of us is permeated by an immediate feeling of individuality [73], rooted in his personal life-history and in his unique arrangement of habits, interests, values, cognitive and affective styles. Nonetheless, each *personal world* is situated within the *extensional constraints* established by CS [68].
The construction of meaning also involves a *dialectal tension* between the *social matrix* and the subjective pole of interpretation. Each of us assembles the *frames of reference* (context) of meanings in a personal way. Every meaning displays a socially-driven *central core* and a personal *peripheral fringe* [64]: we are anchored to the social matrix of meanings, but we also commonly reside in the peripheral fringe.

As far is possible to penetrate in the peripheral fringe of meanings?

There is a continuum between *ordinariness* (the center), *originality* (close to the boundaries) and *bizarreness* (beyond the boundaries). The socially-shared IP, that is, the cognitive style of everyday life-world also called *natural attitude,* and *the cognitive styles of specific disciplines* draw the limits within the sense of reality (objectivity) is preserved. Beyond these limits, *meanings* are immediately felt as original, strange, uncanny, bizarre. IP circumscribe the *semantic fields* and act as a constraint [68]. Everything that goes beyond these boundaries is felt as a *derailment*. Beyond these *extensional limits* we find only peculiar, odd, uncanny and, at the extreme of this continuum, bizarre assemblages of meanings and semantic attitudes.

3.2 SE in people with schizophrenia

There is a paucity of psychopathological studies regarding SE in people with schizophrenia. Most rely on only a few patient samples or even single cases.

Pioneering contributions

The Italian psychiatrist Sergio Piro was a forerunner in this field, documenting in patients the tendency to endorse the *semantic halo* of linguistic constructs instead of the usual *dominant meanings* [75]. Lacan, in a psychoanalytic context, evidenced a subversion of the symbolic register of meanings [76]. Schwartz, Wiggins and Spitzer described in schizophrenia an apparently automatic expansion of the *horizon of meanings*, where people are absorbed in semantic associations departing from commonly shared categorisation procedures [77]. During the prodromal stage of schizophrenia, words may appear void, meaningless, unfamiliar, lacking their usual references; patients collapse into an abyss of doubt, reality does not match the way is commonly represented. Patients, losing the strength of CS experience, suffer the collapse of their sense of reality [78].

The semantic drift

In more recent years, Stanghellini and I depicted the anomalies of SE in people with schizophrenia as a *semantic drift:* patients appear to be detached from the (socially-shared) *frame of reference of meanings* as a consequence of the impairment of CS experience [69].

Some patients seem to be engaged in the search for a private (idiosyncratic) language and for *new meanings* [79]. They sometimes look for the right words to conceptualise their ineffable experiences [80-82]. Other times, patients' hyper-reflective stance may be reflected in their attitude toward language and words [82] resulting in obsessive-like ruminations about the semantic potentials of specific words. Sass and Pienkos [82] recalled that de-contextualisation of language may occur *within* the referential frame of language itself: patients may be captivated by some anomalous salience of certain words, sometimes residing in the phonemic properties. Other times, they may attribute odd, uncanny, strange powers or properties to words, as in the magicians' world. Patients may be interested in the graphic features of the words (Stanghellini, this issue), often in *exotic* languages, using diverse typefaces (e.g., Hebrew, Veda). They manipulate words and types transcending their linguistic value but investing in them peculiar properties. Words are decontextualised from their *significant reference*: words may become semi-independent objects, losing their inter-subjective value [83].

Finally, in a recent contribution [70] I outlined patients' narratives (reflective of their *semantic attitude*), as lacking both *internal coherence* [84] (i.e. consistency and logical connections), and *external coherence* [85], since they overwhelm any pattern of social shared knowledge, symbolism, standards, values, or frames of action.

In schizophrenia patients, the *referential frames* of meaning tend to vanish; m*eanings* become *de-contextualised* from the socially shared network of signs and symbols and from their common sense *semantic fields*. Italian anthropologist and psychopathologist De Martino argued that psychosis is characterised by a dramatic detachment from the inter-subjectively valid *cultural background* that is shared by all individuals of a given socio-cultural context [86].

De-contextualisation of meanings is a *central value* in patients with schizophrenia. They may feel unable to take for granted the objective character of reality. They may deliberately (and sometimes disdainfully) refuse CS assumptions, including the (implicit) rules, standards and causalities, intuitively shared by all the people of a given socio-cultural context. The shared constructs and symbols are felt by patients as threats to their individuality ['antagonomia', [69 70 83 87-90]]. In 'idionomia' [69 70 88 90 91], there is the absolute exaltation of one's personal rules, principles and world-view, which are all detached from the CS world. Patients may be engaged in personal studies and endless reading, ruminating philosophical, religious or sociological assumptions, but subverting the established tenets and the methodology of these disciplines.

Patients may be fascinated or absorbed by the inexplicable complexity of the nature of existence: they may be moved by *what is beyond*, including the mere appearance (what is taken-for-granted or the *natural attitude toward the world),* the standards of specific disciplines, the *ordinary semantic fields*, the frames of reference (assembled contexts) of meaning and any socially-shared interpretative procedures. It is notable that patients seem to be engaged in a sort of continuous, moment-by-moment idiosyncratic re-assemblage of referential contexts, with the effect of producing a peculiar proliferation of meanings devoid of any accomplished arrangement.

Schizophrenia and the hyper-transcendence of meanings

The *semantic attitude* of people with schizophrenia displays a tendency (or a proneness) *to override the extensional limits* of *semantic fields* as imposed by CS *constraints of meaning*. Patients lose themselves beyond the peripheral fringe of *meanings* without being able to come back, to limit their enlarged perspective, or to bring back *this enlargement* to the correct (semantic-syntactic) frames of *meaning*. Meanings, and conversely language, lose their *anonymity*, their *public validity,* that is their intersubjective value. Meanings may appear sententious, philosophical or abstract, but they represent a grotesque distortion of *abstraction* since they rely dramatically on the (abnormal) experience that produced them. Finally, patients display an *over-reliance on the transcendence of meanings*: *hyper-transcendence* involves the assembled contexts, the IP and, consequently, the resulting meanings. Lacking the grounding effect of CS, patients may contribute to an uncontrolled solipsistic polysemy of the world. Abnormal semantic attitude in people with schizophrenia is a consequence of the impairment of CS experience [69 70]. Patients' *semantic attitude*, intertwined with the peculiar arrangement of values, may substantiate the typical feature of bizarreness that characterises schizophrenia [69 70 88]. Patients' statements may appear assumptions of reality when they are concrete, "distorted metaphors" [83 92] constitutive of a strange, *solipsistic private world* erected upon new meanings and causalities, completely divergent from social shared symbolism [69 83 88].

4. Concluding *critical* remarks

In this section, I will discuss some critical issues regarding anomalies of SP and SE in people with schizophrenia.

Do contradictory findings undermine theoretical models?

Contradictory findings can be found in studies regarding both physiology as pathology pathology of brain linguistic functionality, e.g. the right-hemisphere advantage for novel metaphors, the neural localisation of *supra-modal areas* within the SM and the precise staging of SP, including its anatomy [93-95]. The significance of the hyper/hypo priming effect, the role of cognitive processes, clinical correlates and the diagnostic validity of the above reported models have also been challenged (see below). Laboratory models are *working-through models*, which are necessary to structure available findings and to direct future research. Yet we need extensive investigations, large samples of patients (in most laboratory studies the samples are very small) and standardised methodology to obtain comparable results.

Are laboratory findings ecologically valid?

The ecological validity of laboratory findings is obviously questionable, but at the moment technology does not permit *on-line (real-world)* studies. Laboratory paradigms aim to isolate *objective* sub-personal variables while available phenomenological studies aim to investigate the experiential first-personal level. Laboratory models need to be integrated with phenomenological data. Also, they may serve as "points of reference" or "constraints" to *refine* the phenomenological theoretical models.

Are the above-mentioned SP anomalies limited to patients with positive FTD, or do they characterise schizophrenia as a whole?

SM anomalies are well-documented in patients with positive FTD [5 11 25 27]. There are few reports regarding their presence in patients with relevant positive symptoms [35 38] and negative symptomatology [39 40]. One study in first-episode patients found correlations between negative symptoms, on one hand, and semantic retrieval disturbances and cortical (parietal) anomalies, on the other [40]. Alternatively, it has been hypothesised that [24]: a) different stages of SP may be altered in patients with diverse symptomatology, i.e. the *activation stage* in patients with positive FTD and the *selection stage* in patients with positive symptomatology; b) the impairment may be of a different intensity with a diverse arrangement of symptoms. Anomalous language lateralisation seems to characterise schizophrenia as a whole and particularly patients with prominent positive symptoms [49-51 54-56 58-60].
SM and lateralisation models may not be mutually exclusive, since abnormalities in these functions may contribute independently to overt symptomatology and possibly to diverse psychopathological domains. It is important to recall that BAIS-based models [52 64] seem to integrate disorders of SM with abnormal lateralisation.

Is SP independent from basic neurocognition?

Anomalies of SP are more evident in patients with positive FTD where neurocognitive impairment is more severe [96]. Impairments in sustained attention, WM and EF have been invoked as major determinants of SP impairment [43]. It is still under debate whether there are components of WM specifically dedicated to SP [5 50]. It has been debated whether SM impairment involves the *storage* or the *retrieval stage* [27]. In every case patients displayed disorganised and not degraded SM [2 36].
One study using a semantic paradigm (related, weakly related or unrelated sentences), documented semantic

ERP anomalies, but no difference with respect to normal controls in response accuracy in patients: the authors hypothesised a late cognitive repairing mechanism [97]. On the contrary, other studies [44 45] using incongruent sentences as stimuli (see above, section 2.2c) showed bioelectric (ERP) anomalies associated with poor response accuracy: patients were judged to be unable to maintain meaning coherence within the frame of discourse. Also, studies with explicit semantic tasks, seen in patients with reduced or negative PE [33-36] suggests impairments of cognitive semantic strategies (for review see [24]). In patients with schizophrenia, the relationship between SP and cognition has to be more precisely ascertained.

Do anomalies of SM possess diagnostic validity?

There are some encouraging results concerning the diagnostic specificity of N400 in people with schizophrenia compared with affective disorder patients [98 99]; nonetheless, a recent study [100] documented N400 disturbances in a sample of psychotic patients without respect to nosographical diagnosis. Anomalies normalise in remitted patients [100]. The relatives of schizophrenia patients do not display these anomalies [101], hence SM neuro-physiological anomalies may be a biomarker of full-blown illness, but not an endophenotype or a marker of schizophrenia vulnerability.

Is decreased language lateralisation a specific characteristic of schizophrenia?

Crow's model suggests that anomalous language lateralization may be the root of psychotic symptoms in schizophrenia [49-51]. Yet psychotic symptoms are not characteristic of schizophrenia [102]. Abnormal language lateralisation has been documented in relatives and high risk population resulting a candidate trait marker and an endophenotype [61 62]. Nevertheless, diagnostic specificity is lacking: disturbances have been documented in non-schizophrenia psychotic patients, suggesting a *psychosis liability marker* [103 104]. Language lateralisation has been assessed with diverse fMRI techniques; in neuroimaging, results are dramatically prone to technical variables. We need to ascertain if different patterns of anomalies are at play in different psychotic diseases.

Do phenomenological results possess diagnostic specificity?

Schizophrenia patients display anomalies of SE, a kind of *semantic drift*, intertwined with their peculiar arrangement of values and other features of so-called 'bizarreness' [69 70 88]. These anomalies of SE in people with schizophrenia seem to be absolutely divergent from the language anomalies described in bipolar patients [83 105], as patients with bipolar disorder are *intolerant of semantic ambiguity* and over-reliant on commonsense assumptions. Extensive studies assessing SE among comparative populations are lacking.

5. Is it possible to bridge the gap between phenomenology and neuroscience?

The heightened automatic spread of activation within the SM or, alternatively, the dependence on coarse (right hemisphere based) SP in people with schizophrenia could be matched with their peculiar SE, that is, their tendency (or proneness) to override the extensional limits of semantic fields imposed by CS constraints of meaning (i.e., over-reliance on transcendence of meaning). We may hypothesise that SM anomalies and SE disorganisation represent two sides of the same coin, the former reflecting the sub-personal level (pre-phenomenal or neural) and the latter reflecting the personal (phenomenal or experiential) level.

Some authors have speculated on the experiential consequence of SM disorganisation. Patients may be over-reliant on apparently irrelevant environmental stimuli that may be felt as meaningful [35], opening the door to *abnormal salience*. Moreover, patients may "jump too quickly to remote conclusions, with limited control over the meanings they form" [52]. Patients are captivated by the *ambiguity* of language; they are *hyper-tolerant* of the *intrinsic ambiguity of meanings* [83]. They may perceive remote or unrelated concepts as significantly semantically related. They lose themselves beyond the peripheral fringe of semantic fields unrelated to the socially shared constraints of meaning. As a result, patients appear to display a *proneness to override the extensional limits* of *semantic fields* imposed by social shared *constraints of meaning*. As suggested by one patient, 'I open too many windows to be able to adequately manage with all of them'. Persons with schizophrenia may be unable to 'close' these 'windows' once they are open.

Alternatively, we may also hypothesise that abnormal lateralisation impedes the ability to switch off the activation of *coarse (right hemisphere-based) SP*. Sass and Parnas have suggested that *diminished self-affection* (the impairment of basic-self, the pre-reflective fundament of subjectivity) may be the root of thought disorder by depriving patients of the "lived point of orientation" [80] and inducing a "proliferation of meta-perspectives" that patients are unable to manage. As a consequence, thinking looses coherence and pragmatic efficacy. Patient narratives may lack both internal (lexico-syntactic) and external (socio-cultural grounded) coherency. These anomalies may be regarded as the experiential consequences of the imbalance of fine syntactic-semantic integrative processes. Language is no longer able to conceptualise actual experience according to culturally-shared standards, hence it looses its pragmat-

ic value [106]. Language loses its *anonymity* and appears to be distorted in a grotesque taint of *abstraction*.
The phenomenon of 'hyper-transcendence' may emphasise words as such, transforming them into semi-independent objects [82]. They become decontextualised and de-situated not only with respect to ordinary semantic fields (including the biographical arrangement of memories), but also to the intrinsic character of symbols. They *materialise* into something real and concrete (Stanghellini, this issue), opening the door of hallucinatory experience [83]. Can this be linked to the abnormal segregation of language functions as described in Crow's model? This may be another intriguing hypothesis. In all of these cases, language is no longer a means of sharing a world [83], becoming the basis of a new *solipsistic* world.

Conflict of interests
None.

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