Ariane Bazan/Filip Geerardyn/Veroniek Knockaert/David Van Bunder/
Gertrudis Van de Vijver

Language as the Source of Human Unconscious Processes

Abstract

A neuropsychoanalytic framework is proposed for the study of unconsciously determined human behavior as expressed in psychic symptoms and dreams. First, some clinical observations are operationalized in an analytical FREUDO–LACANIAN perspective. In particular the notion of the human unconscious as a linguistically structured dynamic system is presented. Second, these psychoanalytical notions are integrated with current neuroscientific insights on language.
This framework essentially conceives human language as the one object of two evolutionarily radically different neurological processing circuits, acting partially in parallel. The oldest pathway processes the "objective" or phonemic qualities of language input subcortically while the second and typically human pathway processes language neocortically on its semantic qualities. The affective processing of raw phonemic material therefore is thought to operate in relative autonomy from the semantic processing and thereby able to induce so-called "false connections". It is further proposed that (1) meaningful access to language is essentially a(n articulatory) motor event, (2) imagined speech also induces this motor activation and (3) unspoken phonemes give rise to "linguistic phantoms". In final, a structural hypothesis for the FREUDO–LACANIAN unconscious is proposed conceiving this system as a raster of latent phonemic phantoms, eventually functioning as "attractors" for the subject's affective attention.

Key words

Language, unconscious, phonemes, emotion, signifier,

Introduction

Major advances in the understanding of language dynamics have been achieved the last ten years and continue to come to us each day, originating from disciplines as diverse as medicine, neuroscience, evolutionary biology and phenomenological research in language development. The present contribution has no claim in the further elaboration of these domains, but proposes a more clinical or psychological approach to language dynamics. In clinical work, as in everyday psychopathology, the acute concern is not so much the exact neuronal trajectory of language, but far more the way a subject's emotional experience is influenced by or has influence on his or her particular language dynamics. The focus is therefore precisely this emotional language processing and the way it is proposed to be at the origin of the typically human unconscious mind.

Problem Presentation

Clinical observations

There has been, since FREUD (1960, 1975) and in particular with LACAN (1957), a particular interest and attention paid to the literal language patients use when talking about themselves or their problems in consultation. This is illustrated in Freud's clinical oeuvre from the start with, for example, his illustrative cases presented in the "Psychopathology of Everyday Life" (FREUD 1960). The forgetting of the name "Signorelli" for example seemed not to be motivated by some conflicting semantics connected with the painter "Signorelli", but, curiously, with the semantics of a phonological variant of the word "Signorelli", in this case *signor* or "master". In "The interpretation of dreams" FREUD (1975) introduced the concept that dreams are frequently to be taken literally and that these literal transcripts are subsequently to be

read as rebuses. That the same principle also pertains to symptoms, as FREUD proposes, is clearly illustrated in a letter to Fliess (FREUD 1897 **NOT IN REFS**, pp316–331) which is given here as a paradigmatic example:

"A little interpretation came my way… Mr. E. had an anxiety attack at the age of ten when he tried to catch a black beetle… The meaning of this attack had thus far remained obscure. Now, dwelling on the theme of "being unable to make up one's mind", he repeated a conversation between his grandmother and his aunt about the marriage of his mother… from which it emerged that she had not been able to make up her mind for quite some time; then he suddenly came up with the black beetle, which he had not mentioned for months, and from that to ladybug [Marienkäfer] (his mother's name was Marie); then he laughed out loud… Then we broke off and next time he told me that before the session the meaning of the beetle [Käfer] had occurred to him; namely: que faire? = being unable to make up one's mind… meschugge!

"You may know that here a woman may be referred to as a nice "beetle". His nurse and first love was a French woman; in fact, he learned to speak French before he learned to speak German".

As is made clear in the scheme on Figure 1, it seems that the literal forms of the words function as carrier of affects, more or less independently of their semantics.

In the neuropsychoanalytic research unit at the University of Ghent a number of clinical observations of this kind were systematically recorded in collaboration with diverse clinicians. Three typical examples of this phenomenon are presented briefly: (1) a dream: a woman dreams that she is sitting in front of her therapist and that their feet are touching; the meaning of the dream becomes clear when she formulates its content as "we sat sole to sole"; (2) an anxiety: a woman gets an anxiety attack when her friend, promising her a hot time together, whispers to her: "Je te montrerai les sommets de la merveille" ("I will show you the top of the record"); upon analysis, it seems that the phonological carrier [læ mɛrvɛ:j] was for the young woman also referring to "la mère veille": i.e., mother is watching; (3) a dream: a pregnant woman dreams she is driving a big Mercedes down a spiral driveway; while she is driving the car, the driveway gets narrower and at one point her car gets stuck; upon analysis, it seems that the phonological carrier [læ mɛ:rsɛ:dɛs] was for the woman also referring to: "la mère cède" (i.e., "the mother fails"). The woman was at that moment preparing

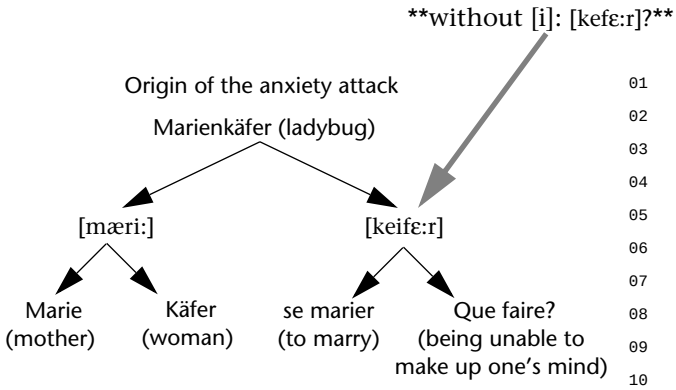

Figure 1. "The inability of mother to make up her mind concerning her marriage" = origin of the (current) anxiety.

for the presentation of her Ph.D. thesis and therefore experiencing some conflict between this energy consuming achievement and her imminent motherhood. Constant in these examples is that the origin of the symptom or dream is phonologically—and not semantically—related to the actual form in which the dream or symptom presents itself.

Psychoanalytical framework

In a FREUDO–LACANIAN framework the reference to a human unconscious refers to the idea of an unconscious that is structured like a language (LACAN 1972–1973; VAN BUNDER et al. 2002), and to the dynamic system thought to be at the origin of signifier mediated affective "mismatches" as illustrated in the aforementioned examples. For FREUD (1978), the word form or "word-representation" implicates an acoustic component, "the acoustic image" and a motor component or "speech movement representation", the kinesthetic incoming information of the articulatory system. This word-representation level has therefore a finite number of components and is as such to be distinguished from the "object-representation" level. This object-representation level has an infinite number of components, including e.g., visual, acoustic and tactile recordings of the object. The similarity of this model with the model of DAMASIO et al. (1996) and CARAMAZZA (1996) is remarkable. The word-representation level can be considered as corresponding to the lexical level, to be situated in the left basal temporal lobe, while the object-representation level obviously corresponds with the semantic level, to be situated distributed over the temporo-parieto-occipital areas of both hemispheres. For LACAN (1957), the word form or "signifier" is a phonemic carrier in the Saussurian sense, without any predetermined signification. The signi-

fier is an "empty" lexical position depending on the context for its conscious signifying. In his later seminars (LACAN 1972–1973; see also VAN DE VIJVER 2002), the signifier is not any longer this empty or neutral but is carrier of an unconscious sense through its phonemic articulation with the body.

Two Evolutionary Pathways for Language

The idea that language is also a carrier of sense *apart from its semantic sense* is implicit in these clinical examples above: it seems to be carrier of affect, in particular of anxiety or arousal, independently of its semantics, i.e., the phonemic carrier induces bodily changes on an affective level, apart from the access to semantics. Language therefore seems to be the carrier of two more or less independent levels of signification: a semantic one and an affective one.

The possibility of relative independence between the affective and "scenic" (or "declarative") content of the same input material is actually central to LEDOUX' theory on emotional processing (LEDOUX 1993, 1994). Central to his view is the wedge-like splitting of the neuronal trajectory of a single input train into two categorically different pathways, one subcortical or limbic and the other at the level of the neocortex. The limbic trajectory is both phylogenetically old and ontogenetically early: the systems are functional from birth on (and probably earlier) and immediately start establishing an emotional memory on the basis of conditioning of raw input material (LEDOUX 1993, 1994). The neocortical trajectory is both phylogenetically more recent and ontogenetically late: cortical maturation is not achieved until six to ten years after birth. Therefore, it is only with some delay that an articulate mature "cognitive" analysis of the input material can be fully achieved and stored in the semantic fields.

LEDOUX' scheme has some remarkable similarities with FREUD's idea of the "splitting of consciousness" as he formulates it in "The neuro-psychoses of defense" (FREUD 1961, p51–52): "If someone with a disposition [to neurosis] lacks the aptitude for conversion, but if, nevertheless, in order to fend off an incompatible idea, *he sets about separating it from its affect*, then that affect is obliged to remain in the psychical sphere. *The idea*, now weakened, is still left in consciousness, separated from all association. But *its affect*, which has become free, attaches itself to other ideas which are not in themselves incompatible; and thanks to this "false connection", those ideas turn into obsessional ideas".

The notion of the "splitting of consciousness" thus implies the splitting of an idea or experience in its content on the one hand and its affect or excitation sum on the other. The sum of excitation is invested in body innervations in conversion hysteria, or into other ideas in obsessional neurosis. The principle, however, remains the same: one and the same experience can psychologically be conceived as a "complex" of separable elements, with different dynamic characteristics, different fates and different output systems, which, without being completely independent from each other, nevertheless possess a relative autonomy.

It is therefore tempting to explain the above illustrated signifier mediated mismatches in a similar manner. Language is as appropriate an input stimulus as another (a non-language auditory or a visual stimulus) and is therefore also considered to be subject to "emotional conditioning". This emotional conditioning is relatively independent from semantics, which is considered an operation of the higher associative neocortical areas. At the level at which language is thought to be emotionally conditioned, clinical work teaches us that there is no difference between "soul" and "sole". Language is at that level not treated as a fundamentally ambiguous system that has to be contextually interpreted, but as any other object, i.e., unambiguously or objectively. Like other objects, the language object automatically activates a number of proper sensory and motor associations correlated with its particular phonemic form (and not with its semantic meaning) and the emotional activation is thought to be effective at the level of these, most probably, motor associations.

Incoming Phonemes Are Motor Programs

"Affective mismatch" operates at the phoneme level

Clinical work teaches us more than that. First, it seems clear that the substratum for emotional activation is not the raw acoustic material of language, but obviously its phonemic transcription. What is effective in eliciting an emotional activation does not seem to be necessarily endowed with some particular acoustic qualities; apparently, what does seems important, however, are the phonemic invariants of the message. Second, it appears that this emotional processing mechanism does not seem to respect word boundaries. In "*la merveille*" e.g., the relevant activating substratum ([la mer veij]) can ei-

ther be packed in one word or in a complete sentence.

These indications help us to speculate on the exact nature of the physiological language substratum responsible for the emotional activation. In a comprehensive model for the neural basis of auditory sentence processing FRIEDERICI (2002) situates the process of identification of phonemes as the second step, immediately after the primary acoustic analysis. In her scheme, this identification of phonemes involves a projection from the left temporal Brodmann area 42 (adjacent to HESCHL's gyrus or the primary auditory cortex) to the left prefrontal Brodmann area 44 or BROCA area and is completed within the first 100 ms of auditory processing. Immediately after this step, a number of lexical operations are then exerted on the phonemic material, implying between others the identification of word form and of word category. As neither word form, nor word category, nor, *a fortiori*, any semantic identification, is relevant in the described signifier-mediated affective mismatches, I speculate that emotional processing responsible for these mismatches takes place after phonemic processing but before lexical processing of language, i.e., during the first 100 ms after presentation.

Phoneme identification involves motor activation

Even if in the literature there might be some confusion about the exact extent of implication and about the exact brain locus of interest (for a review, see BURTON 2001), there seems to be large agreement that phonemic identification does involve motor areas situated either prefrontally in the BROCA area (HICKOK/POEPPEL 2000) or subcortically, i.e., implicating basal ganglia and/or cerebellar pathways (IVRY/JUSTUS 2001). This observation therefore gives weight to LIBERMAN's motor theory of speech perception" (LIBERMAN et al. 1967; LIBERMAN/MATTINGLY 1985). This theory, based on phonological research, holds that the basis of speech perception is not the actual sound of speech, but rather the "articulatory gestures" made by the speaker. It argues that listeners identify spoken words through using that information to access their speech motor system. This is supported by the fact that the speech phones, the smallest units we can hear in words, link to articulatory and not auditory-related invariants. Phoneticians classify and characterize phones nearly entirely in terms of how they are articulated and not in terms of how they sound. The theory thereby accounts for our ability to perceive the invariant articulatory events that form the speech stream, in spite of the great variability in the acoustic signal.

There has been a more recent neural instantiation of this motor theory by RIZZOLATTI/ARBIB (1998). These researchers report that in monkeys a part of the premotor cortex (F5) contains neurons that discharge both when the monkey grasps or manipulates objects and when it observes the experimenter making similar actions. Recent studies suggest that a similar system exists in humans. FADIGA et al. (1995) reported evidence for motor activation when human subjects merely observed an action, and the muscles activated were those that would have been used had they performed the action themselves. RIZZOLATTI/ARBIB (1998) also show that there are neurons in F5 in the monkey's brain that respond both when the animal makes lipsmacking movements and when it observes them in others. Of particular importance is the fact that these authors note that area F5 in the monkey is the probable homologue of BROCA's area in humans. ZATORRE et al. (1992, 1996) have indeed argued that the mapping of the incoming speech stream onto the linguistically relevant units, which are thought to be the corresponding articulatory gestures, activates BROCA's area. There is some parallel argumentation, especially coming from CORBALLIS (1999), that the origins of human language might be situated in manual gesture rather than in vocalization. Recently, CALLAN et al. (2002) have shown that the presence of such mirror neurons in speech motor areas of the brain may explain why lip-reading enhances the intelligibility of what a person is saying. This finding adds strength to the argument that human speech evolved from a primitive gestural system of communication, rather than from simple vocalizations. For all these reasons, RIZZOLATTI/ARBIB (1998) propose that the development of the human speech circuit is a consequence of the fact that the precursor of BROCA's area was endowed, before speech appearance, with a mechanism for recognizing actions made by others.

This idea of perception–action linking already stood central in FREUD's "Project for a scientific psychology" (FREUD 1995, pp333–334): "While one is perceiving the perception, one copies the movement oneself—that is, one innervates so strongly the motor image of one's own which is aroused towards coinciding [with the perception], that the movement is carried out. Hence one can speak of a perception having an *imitation-value*. (…) Thus judging, which is later a means for the *cognition* of an object that may

possibly be of practical importance, is originally an associative process between cathexes coming from outside and arising from one's own body—an *identification of information or cathexes from [the perception] and from within*". More generally, this suggests that external stimulation only makes sense for the brain if reprocessed into something self-initiated (GEERARDYN 2002). In his study on aphasia, FREUD (1978, pp91–92) then suggested that in language this movement might be thought of as articulation: "Understanding of spoken words is probably not to be regarded as simple transmission from the acoustic elements to the object association; it rather seems that in listening to speech for understanding, the function of verbal association is stimulated from the acoustic elements at the same time, so that *we more or less repeat ourselves the words heard*, thus supporting *our understanding with the help of kinaesthetic impressions*. A higher measure of attention in listening will entail a higher degree of transmission of speech heard on to the tract serving the motor execution of language".

A comprehensive framework for the mechanism of "affective mismatches"

In summary, I suggest that in the signifier-mediated affective mismatches as illustrated above, the phonemic transformation of the incoming linguistic material is the effective substratum and that this phonemic transformation involves language motor pathways, and therefore that the significant "affective mismatch" is to be situated at the motor–limbic interface. The full mechanism of these affective mismatches is understood as follows. Any time affectively colored phonemes are actualized in the ongoing discourse, be it not in the right original semantic context, affect is nevertheless aroused and may be falsely connected to the actual semantics (e.g., the anxiety aroused by the beetle is falsely attributed to the appearance of the beetle). The selection process for the pertinent semantic interpretation can be conceived as an active inhibitory process, which "represses" contextually non-valid semantic alternatives (cf. SIMPSON/KANG 1994; FAUST/GERNSBACHER 1996; GORFEIN/BERGER/BUBKA 2000). Since, however, affective activation is thought not to be subject to this cortical inhibition process (cf. the automaticity of affect, DE HOUWER/EELEN 1998; FAZIO 2001), it may be the case that this irrepressible affect is experienced in the "wrong" semantic context and therefore gives rise to falsely connected symptoms in psychopathology.

Hypothesis: The Unconscious is Affect Aroused by Phonemic "Phantoms"

Imagined speech is motor activation.

Speech motor areas are not only activated in case of speech production or active speech perception, but in a number of other conditions where speech is imagined but not effectively produced, including inner speech (MCGUIRE et al. 1996), auditory verbal imagery (MCGUIRE et al. 1996) and hallucinations in schizophrenia (LIDDLE et al. 1992; CLEGHORN et al. 1992; MCGUIRE/SHAH/MURRAY 1993). As imagining movements leads to increased cerebral blood flow in motor areas concerned with their execution (DECETY et al. 1994; STEPHAN et al. 1995), the activity in regions which control speech motor systems may be due to imagined speech in these conditions.

DECETY/GRÈZES (1999) define motor imagery as a dynamic state during which the representation of a given motor act is internally rehearsed within working memory without any overt motor output. It has been proposed that such a simulation process corresponds to the conscious counterpart of many situations experienced in everyday life, such as watching somebody's action with the desire to imitate it, anticipating the effects of an action, preparing or intending to move, refraining from moving, and remembering an action (JEANNEROD/DECETY 1995; DECETY 1996).

All of these tasks involve motor representations that recruit neural mechanisms specific to action planning. GEORGIEFF/JEANNEROD (1998) and DECETY/GRÈZES (1999) remark that comparison of brain activation during several modalities of action representation (including observation and imagining) reveals a common network to which the inferior parietal lobule (area 40), part of the supplementary motor area (SMA), the ventral premotor area, the cingulate gyrus and the cerebellum contribute. The ventral premotor area corresponds to a crossroads between the ventral part of area 6 and areas 44 and 45 (BROCA's area), a cortical zone which bears some homology with the monkey ventral area 6 where mirror neurons are recorded (RIZZOLATTI et al. 1996). For all these reasons, it is expected that, similar to what is proposed for the signifier mediated affective mismatches, the substratum for speech imagery also involves the phonemic motor pathways.

Imagined motor activation induces phantoms

The phantom limb syndrome refers to the strong perception that a missing limb is still there, to the sense of being able to move it and to reported feelings arising from it such as intense pain. RAMACHANDRAN (1994) suggests that the relevant signaling maintaining the phantom are the sensations arising from reafference signals derived from the motor commands sent to the muscles of the phantom. Pain could especially be linked to the missing of the corresponding sensory feedback that would confirm the movement execution. The concepts of "efference copy", as introduced by HELMHOLTZ (1995) suggests that a copy of one's *intended* movement is used every time a voluntary action is planned, such that the sensory consequences of the action can be anticipated and eventually cancelled (BLAKEMORE et al. 1998). Most contemporary accounts of efference copy have claimed that it is unconscious, or acts to cancel percepts rather than generate them. Nevertheless, some clinical and experimental observations suggest that this information, in particular the state of the motor system, can influence subjective perception of the body. In deafferentiation, people still gesticulate while talking, even when the sight of these gestures is blinded to them and their interlocutor (COLE/PAILLARD 1996). It is suggested that, in agreement with MERLEAU-PONTY (1945) and IVERSON/GOLDIN-MEADOW (1998), the gesticulation when talking is for the subject's own linguistic-thought processes and not just for communicative purposes and that the informative signals here are not the (absent) somatosensory signals but, remarkably, the efference copies of the hand muscles. MCGONIGLE et al. (2002) recently report the case of E. P., a right-handed female stroke patient with a right frontomesial lesion who sporadically experiences a supernumerary "ghost" left arm. Their results suggest that areas traditionally classified as part of the motor system can influence the conscious perception of the body and they propose that, as a consequence of her injury, E.P. is aware of the position of the phantom limb in its "action space" on the basis of the efference (motor) copies while also continuing to be aware of the true position of her real limb on the basis of afferent somatosensory information. Focusing on the desired goal of an action, JEANNEROD (1994, p201) suggests that neurons encoding the "final configuration" of the body would continue firing "until the goal has been reached". If the goal were not reached, "the sustained discharge would be interpreted centrally as a pure representational activity and give rise to mental imagery" (JEANNEROD 1994, p201). In the case of E.P. sustained activity in a traditionally motor area of the brain (the SMA) correlates with her perception of a phantom arm (MCGONIGLE et al. 2002). All these observations suggest that phantoms arise when motor commands are consistently given, and that phantom pain could especially be linked to the missing of confirmatory sensory feedback.

Hypothesis: A linguistic unconscious

As a hypothesis, it is therefore proposed that recurrent unspoken phonemes, the motor circuitry of which is regularly activated, either by directed speech perception, by linguistic imagery or by refraining from speaking them ("repression"), could similarly create "phantom" phonemes in a linguistic "action space". These "phantom phonemes" which would be often or lastingly internally rehearsed in the phonological loop of working memory, would, if not spoken (enough), be interpreted centrally as representational activity, giving rise to mental imagery. This mental imagery then is not to be conceived as primarily semantically structured, but would rather have a primarily phonemic structure.

It is difficult to further speculate on the nature of such a phonemic mental imagery, but as phonemes were proposed to be affect-carrying substrates, it makes sense to conceive that although executing the motor plan is subject to inhibition, the associated affective activation is not. In this perspective, it is interesting to note that motor imagery activates heart and respiration control mechanisms in proportion to the actual effort that would be required for the real action (DECETY et al. 1991; DECETY et al. 1993; WANG/MORGAN 1992). Such an autonomic response in a situation where no muscular work is produced can only be attributed to a central influence similar to that observed during motor preparation. As the autonomic system is by definition independent of voluntary control and cannot be held under inhibition, central influences on this system become recordable at the periphery (JEANNEROD 1994).

Author's address

Ariane Bazan, Psychiatric Center, Sint-Amandus, Beernem, Belgium, and Research Unit in Neuro-Psychoanalysis at the Department for Psychoanalysis and Clinical Consulting, University of Ghent, Belgium.
Email: ariane.bazan@rug.ac.be

In conclusion, I propose the following structural hypothesis regarding the FREUDO–LACANIAN unconscious: phonemes of particular importance in one's personal history (e.g., the proper name) need not to be actualized per se in the ongoing discourse but have formed throughout the individual's particular history a raster of phonemic "phantoms", that are continuously functioning as "attractors" for the subject's affective attention.

References

Blakemore, S. J./Wolpert, D. M./Frith, C. D. (1998) Central cancellation of self-produced tickle sensation. Nature Neurosciences 1:635–640.

Burton, M. W. (2001) The role of inferior frontal cortex in phonological processing. Cognitive Science 25:695–709.

Callan, D./Jones, J./Munhall, K./Kroos, C./Callan, A./Vatikiotis-Bateson E. (2002) Mirror neuron system activity and audiovisual speech perception. Presented at the 8th International Conference on Functional Mapping of the Human Brain, June 2–6, 2002, Sendai, Japan. Available on CD-Rom in NeuroImage 16(2).

Caramazza, A. (1996) The brain's dictionary. Nature 380:485–486.

Cleghorn, J. M./Franco, S./Szetchtman, B./Kaplan, R. D./ Szetchtman, H./Brown, G. M./Nahmias, C./Garnett, E. S. (1992) Towards a brain map of auditory hallucinations. American Journal of Psychiatry 149:1062–1069.

Cole, J. D./Paillard, J. (1996) Living without touch and peripheral information about body position and movement: Studies upon deafferented subjects. In: Bermudez, A. M./ Eilan, N. (eds.) The body and the self. MIT/Bradford Press: Cambridge, MA, pp. 245–266.

Corballis, M. C. (1999) The gestural origins of language. American Scientist 87:138–145.

Damasio, H./Grabowski, T. J./Tranel, D./Hichwa, R. D./Damasio, A. R. (1996) A neural basis for lexical retrieval. Nature 380:499–505.

Decety, J. (1996) Neural representations for action. Reviews in Neurosciences 7:285–297.

Decety, J./Grèzes, J. (1999) Neural mechanisms subserving the perception of human actions. Trends in Cognitive Sciences 5:172–178.

Decety, J./Jeannerod, M./Durozard, D./Baverel, G. (1993) Central activation of autonomic effectors during mental simulation of motor actions in man. Journal of Physiology 461:549–563.

Decety, J./Jeannerod, M./Germain, M./Pastene, J. (1991) Vegetative response during imagined movement is proportional to mental effort. Behavioral Brain Research 42:1–5.

Decety, J./Perani, D./Jeannerod, M./Bettinardi, V./Tadary, B./Woods, R./Mazziotta, J. C./ Fazio, F. (1994) Mapping motor representations with positron emission tomography. Nature 371:600–602.

Declerq, F. (1995) De paranoïde logica van de betekenis: Psychoanalyse en communicatie. Psychoanalytische Perspektieven 27:87–101. **NOT IN TEXT**

De Houwer, J./Eelen, P. (1998) An affective variant of the Simon paradigm. Cognition and Emotion 12:45–61.

Fadiga, L./Fogassi, L./Pavesi, G./Rizzolatti, G. (1995) Motor facilitation during action observation: A magnetic stimulation study. Journal of Neurophysiology 73:2608–2611.

Faust, M. E./Gernsbacher, M. A. (1996) Cerebral mechanisms for suppression of inappropriate information during sentence comprehension. Brain and Language 53:234–259.

Fazio, R. H. (2001) On the automatic activiation of associated evaluations: An overview. Cognition and Emotion 15:115–141.

Friederici, A. D. (2002) Towards a neural basis of auditory sentence processing. Trends in Cognitive Sciences 6:78–84.

Freud, S. (1960) The psychopathology of everyday life. In: Tyson, A. (ed) The Standard Edition of the Complete Works of Sigmund Freud, Volume 6. The Hogarth Press, London, pp. **PAGES**. Originally published in 1901.

Freud, S. (1961) The neuro-psychoses of defence. In: Strachey, J. et al. (ed) The Standard Edition of the Complete Works of Sigmund Freud, Volume 3. The Hogarth Press, London, pp. **PAGES**. Originally published in 1894.

Freud, S. (1975) The Interpretation of Dreams (J. Stratchey, translator). In Standard Edition IV-V. The Hogarth Press, London, pp. **PAGES**. Originally published in 1900.

Freud, S. (1978) On aphasia: A critical study (Translated by E. Stengel). International Universities Press: New York. Originally published in 1891.

Freud, S. (1986) Briefe an Wilhelm Fließ 1887–1904 (Ungekürzte Ausgabe). Fischer Verlag: Frankfurt am Main. **NOT IN TEXT**

Freud, S. (1995) A Project for a Scientific Psychology In: Strachey, J. (ed) The Standard Edition of the Complete Works of Sigmund Freud, Volume 1. Hogart Press: London, pp. **PAGES**. Originally published in 1895.

Geerardyn, F./Van de Vijver, G./Knockaert, V./Bazan, A./Van Bunder, D. (2002) "How do I know what I think till I hear what I say": On the emergence of consciousness between the biological and the social. This issue.

Georgieff, N./Jeannerod, M. (1998) Beyond consciousness of external reality. A "Who" sytem for consciousness of action and self-consciousness. Conscious Cognition 7(3):465–77.

Gorfein, D. S./Berger, S./Bubka, A. (2000) The selection of homograph meaning: Word association when context changes. Memory and Cognition 28:766–773.

Helmholtz, H. (1995) Science and culture: Popular and philosophical essays (Edited and translated by D. Chahan). University of Chicago Press: Chicago.

Hickok, G./Poeppel, D. (2000) Towards a functional neuroanatomy of speech perception. Trends in Cognitive Sciences 4:131–138.

Iverson, J. M./Goldin-Meadow, S. (1998) Why people gesture when they speak. Nature 396:228.

Ivry, R. B./Justus, T. C. (2001) A neural instantiation of the motor theory of speech perception. Trends in Neurosciences 24:513–515.

Jeannerod, M. (1994) The representing brain: Neural correlates of motor intention and imagery. Behavioral and Brain Sciences 17:187–245.

Jeannerod, M./Decety, J. (1995) Mental motor imagery: A

window into the representational stages of action. Current Opinion in Neurobiology 5:727–732.

Lacan, J. (1975) Le séminaire, livre XX. Encore (1972–1973) **??**. Seuil: Paris.

Lacan, J. (1999) L'instance de la lettre dans l'inconscient ou la raison depuis Freud (1957)??** In: Ecrits I (2ième ed. de poche). Seuil: Paris, pp. 490–526.

LeDoux, J. E. (1993) Emotional memory systems in the brain. Behavioural Brain Research 58:69–79.

LeDoux, J. E. (1994) Emotion, memory and the brain. Scientific American 6:32–39.

Liberman, A. M./Cooper, F. S./Shankweiler, D. P./Studdert-Kennedy, M. (1967) Perception of the speech code. Psychological Review 74:431–461.

Liberman, A. M./Mattingly, I. G. (1985) The motor theory of speech perception revised. Cognition 21:1–36.

Liddle, P. F./Friston, K. J./Frith, C. D./Hirsch, S. R./Jones, T./Frackowiak, R. S. J. (1992) Patterns of cerebral blood flow in schizophrenia. Britisch Journal of Psychiatry 160:179–186.

McGonigle, D. J./Hänninen, R./Salenius, S./Hari, R./Frackowiak, R. S. J./Frith, C. D. (2002) Whose arm is it anyway? An fMRI case study of supernumerary phantom limb. Brain 125:1265–1274.

McGuire, P. K./Shah, G. M. S./Murray, R. M. (1993) Increased blood flow in Broca's area during auditory hallucinations in schizophrenia. Lancet 342:703–706.

McGuire, P. K./Silbersweig, D. A./Murray, R. M./David, A. S./Frackowiak, R. S. J./Frith, C. D. (1996) Functional anatomy of inner speech and auditory verbal imagery. Psychological Medicine 26:29–38.

Merleau-Ponty, M. (1945) Phenomenologie de la perception. Gallimard, Paris.

Ramachandran, V. S. (1994) Phantom limbs, neglect syndromes, repressed memories, and Freudian psychology. International Review of Neurobiology 37:291–333.

Rizzolatti, G./Arbib, M. A. (1998) Language within our grasp. Trends in Neuroscience 21:188–194.

Rizzolatti, G./Fadiga, L./Gallese, V./Fogassi, L. (1996) Premotor cortex and the recognition of motor actions. Cognitive Brain Research 3:131–141.

Simpson, G. B./Kang, H. (1994) Inhibitory processes in the recognition of homograph meanings. In: Dagenbach, D./Carr, T. H. (eds) Inhibitory processes in attention, memory, and language. Academic Press: San Diego CA, pp359–381.

Stephan, K. M./Fink, G. R./Passingham, R. E./Frith, C. D./Frackowiak, R. S. J. (1995) Functional anatomy of the mental representation of hand movements in healthy subjects. Journal of Neurophysiology 73:373–386.

Van Bunder, D./Knockaert, V./Van de Vijver, G./Geerardyn, F./Bazan, A. (2002) The return of the repressed. Anticipation and the logic of the signifier. International Journal of Computing Anticipatory Systems. Forthcoming.

Van de Vijver, G./Van Bunder, D./Knockaert, D./Bazan, A./Geerardyn, F. (2002) The role of closure in a dynamic structuralist viewpoint of psychic systems. This issue.

Wang, Y./Morgan, W. P. (1992) The effects of imagery perspectives on the physiological responses to imagined exercise. Behavioural Brain Research 52:167–174.

Zatorre, R./Evans, A./Meyer, E./Gjedde, A. (1992) Lateralization of phonetic and pitch discrimination in speech processing. Science 256:846–849.

Zatorre, R./Meyer, E./Gjedde, A./Evans, A. (1996) PET studies of phonetic processing of speech: review, replication and reanalysis. Cerebral Cortex 6:21–30.