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What is neuropragmatics? A brief note

(shortened version of a contribution to be submitted elsewhere for final publication)

We propose to adopt the term neuropragmatics to refer to the study of the neural basis of pragmatic abilities, i.e., the mental processes involved in linguistic and extra-linguistic communicative interaction. Drawing from notions and frameworks put forward by pragmaticians and psychologists of communication, neuropragmatics is an emerging interdisciplinary field encompassing research strands on both healthy and pathological subjects and applying different techniques – mainly neuropsychological observation and modern brain imaging approaches. Neuropragmatics deals with how communicative agents' brains represent and share intentions, beliefs situations and the various components of context in order to infer speaker's meaning and to engage in successful communication. Special test beds are communicative events where context plays a pivotal role in completing implicit and linguistically underspecified meanings, namely complex speech acts, figurative meanings and discourse phenomena. Nonetheless, the ultimate goal of neuropragmatics is to describe the neuro-functional architecture of pragmatics as a system underpinning the whole domain of appropriate communicative behavior in natural contexts of use.

Although the research field is still in its infancy, there exists a considerable and growing amount of data: in addition to a well-established tradition of lesion studies (the so-called "clinical pragmatics"), insights into the neural basis of pragmatics appear in specific contributions on specific topics (e.g., the brain basis of metaphor or coherence monitor) or fragmented in the literature under several rubrics such as social neuroscience, neuroscience of discourse, etc. It is now time to unify these approaches into a concerted enterprise converging on interaction-centered and context aware processes rather than artificially isolated ones (Bara & Tirassa 2000), strengthening the current experimental turn in pragmatics (Noveck & Reboul 2008) and adhering to the widely sought after ecological study of the language/brain relations (Small & Nusbaum 2004; Kutas 2006).

The first insights into the neural bases of pragmatics arose in the late 1970, when clinicians began to notice that, in contrast to patients with left hemisphere damages, patients with lesions to the right hemisphere demonstrated more subtle linguistics impairments that could not be classified as aphasic. A cornucopia of studies flourished in a large spectrum of phenomena mainly related to the comprehension of non-literal meanings (Winner & Gardner 1977; Brownell et al. 1983), the production of discourse and conversation (Joanette & Brownell 1990), and the understanding of the prosodic-emotional aspects of language (Ross & Mesulam 1979). By the end of the 1980s, these domains were grouped under the umbrella of pragmatics, and the hypothesis of the selective involvement of the right hemisphere for pragmatic processing imposed itself (Joanette et al. 1990; Tompkins 1995; Beeman & Chiarello 1998). In recent years, the field has benefited from refinements in the cognitive modeling of the pragmatic system (Sperber & Wilson 1986/95; Bara 2009) and has expanded to clinical populations other than right-hemisphere damaged patients, including neurodegenerative disorders and developmental syndromes (for overviews, see Paradis 1998; Stemmer 1999). All this, along with new findings from modern methodologies for the functional exploration of the brain, is currently leading to the revision of the right hemisphere hypothesis, towards more articulated proposals in terms of brain networks (Bambini 2005; 2007).

Across the clinical and experimental approaches, three are currently the pragmatic domains that especially attract the interest of researchers, which we sketch below along with some representative references.

1) Communicative intentions and speech acts

One of the main aspects contributing to the derivation of the intended meaning is the force of the speech act, through which the speaker can communicate more than what she is actually saying. Understanding speech acts relies on contextual cues to represent partner’s knowledge state and intentions, and the inferential load increases with the complexity of the representations involved (Bara 2009). Difficulties in processing complex speech acts (e.g., certain instances of irony and deceit) have been observed in developmental syndromes such as autism (Bara, Bucciarelli & Colle, 2001), acquired pathologies such as closed head injuries (Bara, Cutica & Tirassa, 2001) and dementia (Bara, Bucciarelli & Geminiani, 2000): the pragmatic disruptions at play here are generally linked to Theory of Mind mechanisms. Among the many brain imaging studies on the brain basis of socio-cognitive abilities in humans (Wang et al. 2006; Frith & Frith 2006; Gallese 2007), some of them specifically aim at unraveling the cerebral networks supporting the representation of different types of intentions in healthy and pathological subjects. Results describe a broad neural system extending bilaterally to the temporo-parietal junction, the precuneus and the medial prefrontal cortex, dynamically recruited according to the degree of sociality of the intention, from individual to communicative (Walter et al. 2004; Ciaramidaro et al. 2007; Walter et al. 2009).

2) Non-literal meanings

Since the lexical-semantic system is in constant balance between the stability of form-meaning connections in context and the instability of the connections themselves out of context (Bertuccelli Papi 2003), communicators make sense of words by supplementing linguistic decoding by contextually driven inferences, operating upon the conceptual dimension and integrating ingredients from co-text, situation, and beliefs about the world (for different accounts, Carston 2002; Coulson & Oakley 2005). Context-based processes become eminent when the intended meaning seems not to actually feature in the coded material, as in the case of non-literal expressions (novel metaphors, idioms, humor, ironic statements and different kinds of implicatures), which have been reported to be vulnerable to several neurological conditions. The clinical literature on metaphor –for instance– ranges from focal lesions to Alzheimer's disease and autistic and schizotypal disorders (Gagnon et al. 2003; Rinaldi et al. 2004; Papagno 2001, Amanzio et al. 2008; Norbury 2005; Iakimova et al. 2006). A similar scenario suggests that figurative meaning resolution capitalizes upon the interplay of different systems, which can be differently damaged across pathologies (Martin & MacDonald 2003; Perkins 2005). Brain mapping findings are providing insights into this delicate neural circuitry: fronto-temporo-parietal networks implicated in memory, attention, Theory of Mind and visual imagery stand out in particular, with modulations according to the specific contextual coordinates of the non-literal expression (Eviatar & Just 2006; Giora 2007; Bambini et al. submitted).

3) Discourse phenomena

Communication runs in units larger than isolated sentences, unfolding in stories, dialogues, texts, where part of the intended meaning emerges from both local and global properties (Brown & Yule 1983). The dimension of discourse has been the issue of a number of brain imaging studies, taking into account different abilities, from deriving the moral of a story to mastering cohesive devices (reviewed in Bookheimer 2002; Gernsbacher & Kaschak 2003). Recent comparative analyses show that the extraction of intended meaning from connected discourse – as it happens for the extraction of intended meaning from figurative expressions – relies upon a set of distinguishable high-order abilities, mainly implemented in inferior frontal and temporal cortex bilaterally (Mason & Just 2006; Ferstl et al. 2008). As expected, a wide variety of clinical populations exhibits poor control over discourse, delivering verbose, non-informative, unconnected, tangential, repetitive speech.

A promising research line addresses the temporal signature of pragmatic processing: traditional behavioral measures are now supported by electrophysiological techniques, which can track cognitive operations as rapidly as they unfold and contribute to solving the long-standing debate over the priority of literal meaning (Giora 2003). EEG studies on the resolution of figurative expressions and discourse-based phenomena show that context starts to influence processing very early, and support the idea of the brain as a highly context-sensitive machine, designed to integrate context, structure and meaning in an incremental fashion (Coulson 2004; Van Berkum 2009).

From the succinct survey above, the domain of neuropragmatics emerges as extremely vast: the areas of investigation range from irony detection to anaphora resolution, and there are many unexplored territories, as pragmatic processes permeate all the structural levels of the communicative event. Yet the focus of neuropragmatics is quite clear-cut: the neural machinery behind the construction of contextually based meanings. Research is showing that pragmatic processes are not haphazard: there are regularities in the way of integrating structures (linguistic and extra-linguistic) and context, i.e. regularities in interfacing different cognitive systems for communicative purposes under certain environmental constraints, probably stored in specific knowledge formats ("pragmatic/communicative competence"), subject to specific developmental path and possibly decay and damage. We can expect that major future contributions will come from the combination of theoretical refinements and sound experimental designs, in order to achieve a better characterization of crucial notions such as sharedness, intentionality and, above all, context. Researchers are pioneering this issue in at least two ways: on the one hand, by disentangling context in its sub-components (spatio-temporal coordinates, previous discourse, etc. up to speaker's identity and personal values) in order to single out specific cognitive imports and neural patterns (Bosco et al. 2004; Van Berkum et al. 2008); on the other hand, by developing protocols that preserve the richness of context and closely match ecological scenarios, in order to describe the complete networks of regions recruited in (multi)modal situated communication (Barsalou 2008; Hasson et al. 2008; Wilson et al. 2008). The direction seems to be toward grounding each interaction within participant's body and brain.

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