How does pragmatics fit with the brain? New challenges from complex systems theories

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It is widely acknowledged that the pragmatic field of research is not homogeneous. In its broad sense, it covers a range of loosely related research programmes from formal studies of deictic expressions to sociological studies of ethnic verbal stereotypes. The diversity of approaches certainly mirrors the complexity of the field. However, when we come to investigate the connections of pragmatic research to research on the brain, not all the directions turn out to be equally capable of immediately translating into questions for which sensible answers can be sought. Indeed, if one of the most important steps in scientific research is formulating the *right* questions in order to get *relevant* answers, then some decisions have to be made as to the questions we would like to ask in order to gather data that have scientific relevance. In this paper I will give for granted that the data gathered within cognitive approaches to pragmatics are most relevant to neuropragmatics, and will further explore the possibility that a complex systems theory lens may help us look at them in new ways. Complex adaptive systems provide inspiring suggestions as to how we might capture this dimension of analysis of pragmatic facts, which appear to observation as complex dynamic units whose profiles are shaped in ever-changing manners by the interplay of the numerous variables at stake in interaction while at the same time preserving integrity and recognizability as unique and unrepeatable pieces of communicative behaviour.

Keywords: pragmatic facts, context, complex adaptive systems, neuropragmatics, literal/figurative distinction, inference

1. Introduction

"Pragmatics is no longer in its infancy": the opening statement of the newly born *International Review of Pragmatics* (Cap 2009) implicates many things: it implicates that the questions pragmatics has to face forty years after its breakthrough are both more numerous and more mature; that scholars working in the field have elaborated their theories to a fuller extent; that theories have spread over a number of linguistic and non-linguistic territories; that both micro- and macro-level phenomena have been finely analysed, and consequently, competing hypotheses have been put forward concerning their nature

 (Received January 2010)

and functional role in language use. We can therefore conclude that pragmatics is in the right position for tackling the question that is perhaps the hardest nut to crack in scientific enterprises concerning human communicative behaviour – namely, if and how the data accumulated so far fit with (what we know about) the brain.

The title of this paper presupposes that many of the notions and hypotheses that pragmatics has elaborated so far do fit with the brain and that there are several different manners in which they do. Yet, recent advances in neurocognitive sciences point to a new challenge for future research in cognition, the brain, and human verbal communication: the challenge is offered by complex systems paradigms, and it is my persuasion that neuropragmatics might become pivotal in this connection. In what follows I would like to explore the nature of this challenge, pointing out some issues that may arise in connection with data finding and interpretation in neuropragmatics as a scientific enterprise which might be called to seek an answer to the following conundrum: if language is a complex system, if cognition is a complex system, if the brain is a complex system, and if complex systems, interacting in complex modalities, are potentially chaotic systems, then how does it happen that (in non-pathological conditions) language use, which is the proper object of pragmatics, normally occurs in apparently smooth, non-chaotic manners?

2. Observation and explanation in pragmatics

The pragmatic field of research has never been homogeneous. In its broad sense, as Sperber and Wilson remark (Sperber & Wilson 2005), it covers a range of loosely related research programs, from formal studies of deictic expressions to sociological studies of ethnic verbal stereotypes. In between, some scholars view it as a subfield of linguistics which studies the ways in which context contributes to meaning, while others consider it a perspective on language focused on the aspects of meaning and use that are dependent on the speaker, the addressee and other features of the communicative situation. Still others describe it as the study of language use as opposed to the study of language structure. In a more focused, cognitively-oriented sense, pragmatics contrasts with semantics and is the study of how contextual factors interact with linguistic meaning in the production and interpretation of utterances.

The diversity of perspectives follows almost by necessity from the high number of variables and dimensions involved in the analysis of

verbal behaviour (see Verschueren 2009). However, when we come to investigate the connections of pragmatic research with research on the brain, not all the approaches turn out to be equally capable of immediately translating into questions for which sensible answers can be sought about the relation between brain structures and processes on one side, and language use in context on the other.

Indeed, if one of the most important steps in scientific research is formulating the *right* questions in order to get *relevant* answers, then some preliminary decisions have to be made as to *what* is to be observed and scrutinized. And, if neuropragmatic research aims to unveil the underlying neural bases of pragmatic abilities (Bambini & Bara *forthcoming*), some subsequent decisions will have to be made concerning a) the *kind of questions* that can be asked and probed for answers in relation to the problem under investigation; b) *how* these questions are to be structured, and c) *how* the results of scientific investigations should be interpreted. The decisions we make in this regard will necessarily select some of the topics currently falling within the domain of pragmatics as more directly relevant, and will establish a point of view, a focus and a goal as further constraints on the theoretical models dealing with them.

Cognitive pragmatic models, and the phenomena therein analyzed (such as speech acts and intentionality in Bara's Cognitive Pragmatics, literal and non literal meanings in Sperber and Wilson's Relevance-theoretic model, reference resolution and reasoning in Experimental Pragmatics approaches; see Bara 2010; Sperber & Wilson 1986/1995; Noveck & Reboul 2008, respectively), clearly stand out as the best candidates for which the neurosciences may provide natural empirical test beds. Even in these models, however, a basic epistemological question concerns the *what* of observation and explanation, and that amounts, in my mind, to the identification and definition of the nature of *pragmatic facts*.

2.1. What is a pragmatic fact?

Pragmatics, broadly understood as the study of language use, is at least in principle strongly committed to the observation of actually recorded linguistic communicative behaviour as opposed to fabricated examples, hypothetical cases or intuitions. Unfortunately, however, as Noveck and Sperber claim, "these intuitions are educated guesses – and, no doubt, generally good ones – about hypothetical pragmatic facts, but are not themselves pragmatic facts and they may well end in error" (Noveck & Sperber 2007: 184-185).

Still, modern epistemology has long dictated that scientific investigation necessarily requires some degree of idealization; therefore, if only for the sake of replicability of the experiments and generalization of the results, some abstractions seem to be in order. Idealization in pragmatics, however, poses problems just as serious as in other scientific domains. Indeed, abstracting away in pragmatics may look like a sort of *contradictio in terminis*, since what is normally abstracted away in more formally oriented linguistic theories, namely the context, is partly the object of observation and investigation – that part upon which the type and quality of intuitions and judgments depend – and partly the goal of explanation – that part which researchers try to identify as responsible for what is communicated beyond what is linguistically said.

Participating in this double nature of *explanans* and e*xplanandum*, the context consequently represents a crucial problem in cognitive (as well as descriptive) pragmatic theories. The way we use language depends on internal (arousal, attention, memory, motivations, emotions etc.) as much as external (environmental) factors (situations, social membership, culture). The complexity of verbal communication is such that probably no component can be discarded a priori as irrelevant. As highlighted by Stemmer and Schönle, pragmatically appropriate behaviour involves "perceiving and filtering information, integrating incoming stimuli with current goals, planning, coordinating and monitoring complex behaviour, and providing feedback to internal and external stimuli" (Stemmer & Schönle 2000: 233).

This cannot but have consequences for scientific explanations, and the intricacies become more complicated when we pass from theoretical to experimental practices. Indeed, "the journey from experimental data to interpretation is seldom made without an occasional leap of faith" (Van Lacker Sidtis 2006: 276). The statement overemphasizes the well known but often neglected fact that the relationship between observation and theory is far from being straightforward and soundly founded: each step in scientific theorizing involves decisions that often rest on fragmentary data, rely on numerous implicit inferences and relate to several levels of interpretation.

When linguists attempt to ground the results of their analysis in neurobiology, the problems turn out differently, and are strongly biased, depending on the theoretical standpoint from which the model they investigate has been constructed. If the model assumes that such distinct levels as phonetics, phonology, morphology, syntax, semantics, and their units of analysis – phones, phonemes, morphemes, words, phrases, sentences and syntactic rules, meaning components – are the basic units of language structure, research

will partly aim to validate these assumptions and partly use these same assumptions as presupposed facts for the selection of phenomena to be observed. Consequently, in the specialized literature, these individual levels and units will be agreed upon as valid descriptors of neurological impairments and their processing sites will be sought.

But to what extent can we say that they are the basic units of analysis when the communicative dimension of language is taken into account? If we turn from theories of language structure that take the categories of grammar and their hierarchical relations as givens, to theories of verbal communication which view grammar as just one of the several components which enable verbal behaviour along with other crucial components, such as intentionality, situationality, rationality etc., then the facts to be observed turn out to be much more complicated entities, and within the latter the nature itself of grammar units may turn out to be partially different.

Indeed, pragmatic facts appear to observation as complex dynamic units whose profiles are shaped in ever-changing manners by the interplay of the numerous variables at stake in interaction, and the striking feature is that all this does not happen in a chaotic fashion: it happens, instead, in modalities that globally preserve their integrity and recognizability as pieces of unique, unrepeatable communicative behaviour.

Complex adaptive systems provide inspiring suggestions as to how we might capture this dimension of analysis of pragmatic facts. They view human verbal behaviour as a dynamic form of interaction resulting from multiple convergencies and competing influences on a cognitively-based adaptive system which reaches stable configurations over time via local and global processes triggered by specific contexts. Within this perspective, pragmatic facts would become the data of a research that posits the complexity of verbal communication in all its richness as the final *explanandum*. This is not without consequence for research in neuropragmatics either, since it would invite a shift from strict localizationist to more dynamical localizationist models: in other terms, if looked at from this perspective, neuropragmatics would not be confined to the search for specific brain sites for individual phenomena, nor should it try to reduce the complexity of pragmatic facts abstracting some components away in more or less arbitrary ways in order to pin down the factors which by hypothesis can most directly be tracked to some areas. Instead, neuropragmatic research should naturally incline to disentangle the complexity of verbal behaviour by identifying the neuro-cognitive principles, patterns,

networks, paths and circuits which dynamically govern it via their interplay. As recently described by Beckner et al. 2009:

> Cognition, consciousness, experience, embodiment, brain, self, human interaction, society, culture, and history are all inextricably intertwined in rich, complex and dynamical ways in language. Everything is connected. Yet, despite this complexity, despite its lack of overt government, instead of anarchy and chaos, there are patterns everywhere. Linguistic patterns are not preordained by God, genes, school curriculum, or other human policy. Instead, they are emergent – synchronic patterns of linguistic organization at numerous levels (phonology, lexis, syntax, semantics, pragmatics, discourse, genre, etc.), dynamical patterns of usage, diachronic patterns of language change (linguistic cycles of grammaticalization, pidginization, creolization, etc.), ontogenetic developmental patterns of language growth and decline, dominance and loss, and so forth. We cannot understand these phenomena unless we understand their interplay (Beckner et al. 2009: 18).

3. Complex adaptive systems

It is not my purpose here to review the literature on complex systems theories, nor do I intend to endorse one or another specific version of them. However, a brief outline of the major features shared by the various versions of complex systems theories may help clarify my point, namely that many of the ideas put forward and developed in the most outstanding approaches to cognitive pragmatics are compatible with a complexity view of language and the brain.

Complex systems are systems whose behaviour is determined by a high number of interrelating factors and dimensions. Complexity is, therefore, a function of the quantity of the variables the system handles. On the other hand, the complexity resulting from multiple interacting elements is contrasted by the level of organization of the system itself. Living systems, cognitive systems and social systems exhibit sophisticated forms of organised complexity, which represents the essential precondition for their behaviour.

Let me briefly summarize the main features of organized complex dynamic systems typically shared by living, cognitive and social entities:

1. *Dynamicity* – the system evolves through time, i.e., it has a history.

2. *High number of dimensions* – the system can be described only in terms of a high number of different states resulting from a high

number of integrated dimensions. Complexity is in turn connected to two other properties:

3. *Non-linearity* – small-scale dynamics and interactions among the systems components can determine large-scale systemic changes; in complex systems, small quantitative differences in certain parameters often lead to phase transitions (i.e., qualitative differences), and even when there is no parametric change, the behaviour of a complex dynamical system can change dramatically at some point going through a phase transition.

4. *Nestedness* – the system can in turn be composed by other smaller sub-systems that may be complex as well. Changes in the systems are typically local: complexity arises via incremental changes based on locally available resources, rather than being predetermined or top-down.

5. *Identifiability and predictability of behavioural patterns* – the system shows advanced forms of organizations, in terms of schemes, regular patterns, etc. that constrain their dynamics and determine the system's integrity. Moreover, particular types of organized complex systems show the key ability of developing forms of *self-organization*, i.e., new forms of organization *emerge* out of the interactions with the environment. as well as among the systems component. Crucially, self-organization is the hallmark of adaptive systems and *adaptivity* is indeed another property which defines complex systems.

6. *Stochasticity* – the high degree of complexity of the system results in the system dynamics being modelled only in probabilistic terms.

The fact that living and social realities actually behave like organized complex systems is nowadays mostly undisputed. There is also a strong persuasion that neural networks (either natural or artificial) form complex systems with a high degree of interactions and interrelations among the system parts. We can assume that the particular topology of the network is the result of some form of stipulation, e.g., by its human designer or as an effect of genetic endowment. On the other hand, an essential property of neural networks is their ability to find stable states of organization resulting from the microdynamics among the neurons in interaction with external stimuli received by the network. Therefore, the particular behaviour learnt by the network is said to represent an emergent property of the system resulting from its self-organization ability.

Whether language can be characterized in the same terms is a more controversial issue, but research in this direction is rapidly

progressing in various domains (de Bot et al. 2007; Ellis & Cadierno 2009; Larssen-Freeman & Cameron 2008; Schoeneman 2009; Smith 2005). While most of the above listed properties can be easily recognized as defining features of language systems, it is an open research question in cognitive sciences and in linguistics the extent to which human linguistic abilities can be interpreted as *emerging properties* deriving from complex interactions between general biological, cognitive, social and environmental constraints, rather than being stipulated as part of the genetic endowment (Elman 2005; MacWhinney 2002; Thelen & Bates 2003. For a different perspective on the issue of emergent properties cf. also Wilson & Carston 2006).

Clearly, a discussion of these issues goes far beyond the purposes of this paper, but I would like to point out that to the extent that language use can be viewed as a dynamic and adaptive extension of numerous domain-general cognitive capacities, such as inferencing, shared attention, imitation, sequential learning, chunking, categorization, etc., and if language structure can be seen as essentially and dynamically moulded by cognitive abilities, processing capacities and limitations, and general and specific circuitry of the human brain, these perspectives cannot but have consequences for future research in neuropragmatics once all these features are anchored to a significant notion of context.

In other words, it seems to me that a complex systems-based perspective on neuropragmatics might provide the coordinates for an analysis of pragmatic facts as complex *situated* language events, where by *situated* I mean something strongly inspired by the notion of situatedness in Barsalou 2009 – that is, produced by a human being endowed with a body, a brain and a mind, interacting with other human beings similarly equipped, in a social environment out of which a *context* is dynamically selected in order for mutual comprehension to take place. If a speaker's communicative behaviour is the result of competing factors from a wide range of environmental affordances and constraints (cf. Blythe & Croft 2009), context is the platform that enables it. Context, therefore, becomes a primary object of investigation which perspectivizes all explanations of all language communication phenomena. The context that we need, however, is not a generic context, roughly coinciding with the environment in which the interaction takes place. It is, as Sperber and Wilson have long pointed out (Sperber & Wilson 1986/1995), a cognitive construct selected out of the total information available in the environment and organized in such a way as to comply with the cognitive requirements of the task at hand. Spelling out the neurobiological nature of the factors that trigger and guide the processes of context selection and com-

position allowing reciprocal understanding will consequently be one of the primary tasks of neuropragmatic research.

Assuming the role of the cognitive context as a pivotal notion that may guide research in a complex-systems oriented view of neuropragmatics, some phenomena that presently stand out as maximally relevant might actually be seen in a new light. In what follows I will concentrate on two of them – literality and inferentiality.

4. Literal and non literal meanings

One of the basic problems which is legitimately proposed as a primary candidate for neuropragmatic research is the nature and neuro-cognitive representation of literal meaning.

Albeit very simple as a commonsense concept, theoretically the notion has been extensively and intensively investigated from several perspectives which have cast light on its multifarious nature. Truth-conditionality, full-compositionality, context-invariance, codedness, explicitness, and non-figurativeness have been either individually or jointly identified as the crucial properties which distinguish literal meaning, as defined exclusively by linguistic units and grammatical rules, from its counterpart and putative complement, namely non-literal meaning, viewed as essentially pragmatic in nature, and, for the most part though not universally, as non-compositional, context-dependent, indirect, inferred, figurative and non conventional.

Linguistics has strived to pin down the essentials of literal meanings as a means, among other things, to keep semantics and pragmatics distinct. In a survey of the literature, Ariel (2002) found it impossible to identify one agreed upon criterion for 'literal meaning' as a theoretical construct. Indeed, it seems that there are arguments against the necessity of each of the properties mentioned above, and pragmatics on one side, cognitive semantics on the other side, have done much to demonstrate that a) there is much non literality in presumed literal meanings and b) non-literal meanings share many of the properties which are generally attributed to literal meanings.

As to the first point, it is definitely one of the most remarkable contributions of Relevance theory scholars that recovering what is said by an utterance implies as much inferential work as recovering what is implicated. Carston's elaboration of the notion of explicature has started a debate on the processes of conceptual adjustment, such as narrowing and broadening, reformulated by other scholars as expansion and completion, enrichment, and saturation, which has

brought to the foreground the pregnancy of the issue (cf. Carston 1988; Bach 1994; Recanati 1989; Carston 2007).

As to the second point, Lakoff (1986) noted that if we take literal meaning to be: (i) objectively true or false; (ii) non-metaphorical; (iii) directly meaningful; (iv) conventional; and (v) fully compositional, and assume that all these properties may pattern together or come apart, so that any one of them might be taken as a diagnostic of literal meaning, then we can get unexpected results: metaphorical expressions may be directly meaningful, conventional, and capable of being true or false (e.g., *we are out of time*); conventional expressions may have non-compositional semantics (e.g., *he flew off the handle*); metaphorically-structured constructions (e.g., *grasp* = 'understand') may combine compositionally with other constructions (e.g., *grasp the idea*); and things which are non-compositional, metaphorical or both might still be perfectly direct (e.g., *take a hike* or *buzz off* as used in a direct request to be left alone). The point of course is not that 'literal meaning' is somehow defective or incoherent: rather, the common-sense category denoted by *literal* seems not to fit into a unique set of necessary and sufficient conditions.

A wide range of phenomena have been collected in recent years as proofs of the difficulty in finding a divide between literality and non literality. The existence of literal meanings seems however to be intuitively, that is pre-theoretically, somehow necessary. Without some notion of literal meaning it is unclear what it would mean for anyone to mean what they say, or how anyone else could ever understand them. Literal meanings seem to fulfil an anchorage function for language – literally, words would be anchored to an (inner or outer) reality which guarantees their truth, or at least their capability of being accessed equally by all speakers. This has obvious consequences for neuropsychological theories. If literal meanings are basic and cannot be dispensed, while non-literal meanings are inferentially derived, then literal meanings should be accessed first and quickly, while non-literal ones should take longer to access and possibly rely on different paths of access. In order to prove this, we would have to look for the sites in the brain where literal meanings are processed and for the type of processes underlying their identification as opposed to the specialized ones subserving identification of non-literal meanings.

Unfortunately, the hypothesis has been repeatedly disconfirmed by experiments showing that (at least) response times to literal vs. figurative statements do not always vary significantly (Giora 1997; 2003). Alternative theoretical models have been explored as sources for testable hypotheses which on the one side refine the notion of

non-literal/figurative meanings by pointing out important differences between types of non-literal phenomena, such as for example metaphor and irony (cf. Sperber & Wilson 1986/1995), and on the other side throw a different light onto the search for the cortical areas involved in the processing of non literal phenomena.

Two major empirical questions under investigation have thus become: a) if the mechanism for processing literal and non literal meaning is the same, and no preliminary computation of literal meaning is required, does the processing result in the activation of the same brain areas? b) if metaphor and irony are two different types of figurative language, how is the difference reflected in terms of neural processes and patterns of activation? As to the former, the classical hypothesis that the right hemisphere is the sole responsible for the efficient processing of metaphors and ironies has been revised: no clear-cut consistent specialization of the right hemisphere has been found in studies on patients (Klepousniotou & Baum 2005). Instead, neuropsychological and behavioural studies with healthy participants and a growing number of functional imaging studies of language processing suggest that both hemispheres participate in the processing of figurative language (Bookheimer 2002 for a review; Bambini et al. *submitted*). As to the second question, the results of functional imaging studies seem to converge in supporting the view of functional networks of brain regions that work together bilaterally with extra activation required by the type of complexity (metaphor or irony) affecting the location of brain regions that are added to the network (Eviatar & Just 2006).

Again, these data seem to point towards a complex systems perspective as capable of offering alternative analyses of the problem, based on dynamicity and functionally-motivated variability rather than on the identification of boundaries. Under the complex systems lens, literal meanings might appear as epiphenomena resulting from repeated configurations of inferential patterns acting on the relationships between subsets of conceptual variables and subsets of contextual information: this would turn the problem of whether they exist or not into the problems of why they are psychologically perceived as existing, why they need not always be computed first, when and how (under what contextual conditions) some specific clues trigger some specific inferential tracks.

The view of a lexical pragmatics I have put forward in Bertuccelli Papi (2003) and Bertuccelli Papi & Lenci (2007), hinging on the view of words as complex micro-systems embedded within the lexicon as a complex macro-system, puts forward a perspective of analysis which

points in the same direction. Words need not be represented in a dual (either literal – or non literal) modality. Words may be represented in various modal systems in different formats (Barsalou 2008), exhibiting something similar to some intuitive notion of literal meaning (most plausibly a statistical one) to various degrees, and reacting to it in various ways (i.e., recruiting information from variable sites in the brain) depending on the task they are called to perform. Some metaphors are frozen or highly conventionalized and may not need to be preliminarily processed in terms of literal meaning, whereas others are primed by the context and again may be accessed directly; still others are newly coined or contextually unexpected and may need some cognitive effort to interpret; some forms of irony may be grasped intuitively bypassing conscious processing; others are more quickly processed if situated in a context which enhances their recognition; still others may need to recruit information from different brain areas in order to be recognized and interpreted. In other words:

> [...] words act at the same time as cues of mental representations, triggers or organizers of ad hoc conceptual constructions, and anchors which hinder meanings from verging on the border of chaos: more specifically, we view words are cues, pointers to conceptual structures out of which meanings are dynamically construed in context-sensitive modalities, following a non-linear logic, but emerging in recurrent configurations with some degree of statistically relevant stability, which is the way the lexical macrosystem of a language self-organizes in order to prevent communicative chaos (Bertuccelli Papi & Lenci 2007: 21).

5. Inferentiality and the explicit / implicit issue

Strictly connected to the literalist debate is the explicit/implicit communication issue. A neuropragmatics program of research cannot avoid facing the problem of inferential reasoning and most notably of pragmatic inferences. To my knowledge, the nature of the inferential apparatus, broadly understood as the set of both logical and non-demonstrative mental processes involved in comprehension, has seldom been systematically investigated from a neurobiological point of view (but cf. Noveck 2009; Bonnefond & Van der Henst 2009). However, the functioning of the mind crucially relies on inferences. According to Levinson (2000), this is due to that sort of "design flaw" which is represented by the articulatory bottleneck that slows down the speed of thoughts inducing a contraction of information in the production process that naturally calls for expansion and compensation in

the interpretation process: "The only way around this essential asymmetry between speaking and thinking is that the cognitive design envisages a compensatory, powerful inferential machinery: inference is cheap, articulation is expensive, and thus the design requirements are for a system that maximizes inference" (Levinson 2000: 28).

Levinson's argument from design strengthens the view that inferences, intertwined as they are with the neurophysiology of communication, are definitely crucial in a neuropragmatic account of mutual understanding. Indeed, Relevance theorists' claim that the speaker's meaning is always inferred, even when it consists in a literal interpretation of the linguistic expressions used, points to the necessity of a deeper understanding of the nature and the role of inferences in human brain activities.

The current debate on the nature of the inferential processes involved in the derivation of explicatures and implicatures provides further arguments in this direction. A major development of the Gricean distinction between what is said and what is implicated is the recognition that linguistically encoded information, even when enriched with pragmatically determined values for referring expressions and mechanisms of disambiguation, falls short of representing the proposition explicitly communicated by a speaker (with some differences, "what is said" in Recanati's understanding of the Gricean term, "explicature" in Relevance theory, "impliciture" in Bach's terminology). Context acts beyond reference assignment and disambiguation to saturate incomplete logical forms (variously called semantic skeletons or scaffolding, blueprints, assumption schemas) as in *Coming!* or *Yes, I will*. But in a wide range of cases, even after disambiguation, saturation of indexicals, and completion to full-fledged propositional status, utterances may turn out to need free enrichments of various sorts in order to explicitly correspond to what the speaker wants to communicate and to function as premises in the derivation of implicatures. Typical examples include:

(1) I have *nothing* to wear. ('nothing appropriate')
(2) *Something* has happened. ('something important')
(3) It is raining. ('in Pisa')

As Carston (2002) has pointed out, the problems at stake for a cognitively oriented view of pragmatics are manifold. First, how are the processes of reference assignment and disambiguation actually effected? What guides or drives them? Do the speaker's communicative intentions play a role? Are the processes of enrichment of the same nature as the processes for implicature derivation? Do

they involve similar or distinct kinds of mechanisms or architectural units? Attempts to provide answers to these questions essentially cluster around three positions:

1. The various different pragmatic tasks are performed by processes that comprise a single system, which takes decoded linguistic meaning as its input and delivers the propositions communicated (explicatures and implicatures).
2. There is a crucial split between the processes involved in deriving explicit utterance content, on the one hand, and the processes of implicature derivation, on the other, with the two sets of processes each belonging to a distinct cognitive system, the output of the first (explicature or "what is said") being the input to the second.
3. There are distinct processes for at least some of the (conceptually) distinct pragmatic tasks (disambiguation, indexical reference assignment, recovery of unarticulated constituents, speech act assignment, etc.) and each of these distinct processes is performed by a distinct cognitive system (Carston 2002).

The unitary position (1) is the one taken by Relevance theorists: recovery of both explicatures and implicatures proceeds in parallel and is performed via a process of mutual adjustment which may involve inferences from explicatures to implicatures but also from implicatures to explicatures. The binary position (2), instead, is the standard one and has been developed by Recanati (2004) in terms of a distinction between primary and secondary processes: primary pragmatic processes, whether required as saturation or optional ones as free enrichments, are responsible for the identification of what is said. Secondary pragmatic processes enable the derivation of implicatures. In Recanati's view, the two processes differ in substantial ways: the former are local, associative (not properly inferential), unconscious, guided by a criterion of accessibility (depending on the degree of activation in a conceptual network), and do not require initial attribution of mental states to the speaker. Secondary pragmatic processes are assumed to be properly inferential (global, prepositional explicit), accessible to consciousness, guided by norms of rational behaviour, such as the gricean maxims, and do require attribution to the speaker of mental states throughout the reasoning process. Recanati endorses Grice's claim that "the presence of an implicature must be capable of being worked out" (Grice 1989: 31), and defends an interpretation of the claim as referred to the participants in the talk exchange, not simply to theorists: "it is the speaker and the hearer who must be capable of working out the implicatures" (Recanati 2004: 245).

This commitment to the capacity of speakers and hearers to consciously perform the inferential steps suggested by Grice as a line of reasoning clearly calls for experimental verification, even though not in terms of times of derivation, since Recanati has explicitly denied that the ordering between interpretation of what is said and derivation of what is implicated is chronologically sequential. Experiments should and could however be focused on the availability to consciousness of the step-by-step derivation. In fact, different views have been put forward concerning the psychological reality of the line of reasoning suggested by Grice.

Bach (2006) points out that it would be misleading, and probably even harmful under some respects, to think that the rational reasoning described for the derivation of implicatures actually mirrors what happens in the brain in real communicative processes. Grice provided a rational reconstruction, by enumerating the ingredients involved in recognizing an implicature and how these ingredients are logically organized, which is different from a psychological theory or even a cognitive model (Bach 2006: 23).

Indeed, the rational derivation of implicatures has been strongly suspected to be not only cognitively inadequate to represent what happens in the human mind, but also formally inapplicable to computational systems aiming to simulate what happens in the mind. Computationalists, who represent Carston's third position, have pointed out that the maxims are too vague and too general to be directly implemented in natural language processing systems, and the cooperation principle is far too broad to produce useful inferences since it is unable to exclude the undesired ones. A fine analysis of what happens on specific occasions of pragmatic interpretations that are claimed to fulfil one or more of the maxims has been claimed to show that much more specific mechanisms apply to much more specific, context-bound phenomena, and only bear a very tenuous connection with the maxims. Should that be proved to be the case even in non-simulated tasks, then the rational patterns of derivation indicated by Grice would need to be further elaborated to translate into the neuropsychological terms of the actual operations needed for computing implicated meanings in actual discourse

Again, what can be observed in actual communicative events and in text understanding, is a complex (and currently not well understood) interplay of mutually feeding local and global derivations that involve multiple variables along multiple dimensions (cf. Virtue & van den Broek 2006, among others). Some inferences are automatic and may be drawn on the fly, whereas others are strate-

gic, time-consuming, and may lurk in standby till triggered by some perceptual input. Still, others are nothing more than background hypotheses to be further confirmed or disconfirmed as discourse goes on. Many inferences are pragmatic in that they depend on the uttering of certain expressions in specific contexts, but not all pragmatic inferences are Gricean implicatures. The communicative intention the speaker wants to convey, the conditions for making the utterance felicitous, and other bits of inferable information that are not necessarily intentionally communicated by the speaker, but come along with what he is saying (such as emotional attitudes), should be kept distinct and might be tracked differently at a neural level. The information needed for their performance may come from different internal and external sources, and the paths they follow may take different directions, triggering different mental and neural circuits. And this need not necessarily results in different processing times: "an enriched interpretation may be primed by the context and, as a result, may be easier to infer than a literal interpretation" (Noveck & Sperber 2007).

The point seems to be: what is it that permits this apparently infinite variation within the finite space of a human brain? A possible suggestion from complex systems views might be related to the existence of 'attractors' or 'fields of attractors', fractal in shape, which enable the selection of information in continuously changeable but recognizable manners, identifying the most natural, unmarked states the system may assume in order to produce relevant interpretations – be they literal or non-literal. These attractors could at least in part be related to the situated conceptualisations theorized by Barsalou. He suggests that concepts are not typically processed in isolation: instead, they are situated, i.e., represented as multi-modal simulations of multi-component situations, with each modal component simulated in the respective neural system. When a situation is experienced repeatedly, components of the conceptualisation become entrenched in memory such that minimal cueing activates it when relevant (Barsalou 2009: 1284). Evidence which implicates pattern completion inference on situated conceptualisation as basic computational mechanisms in the brain is provided by Barsalou (2003), Yeh & Barsalou (2006), Robbins & Aydede (2008).

It seems to me that, from a neuropragmatic perspective, this would call for investigation of the ways the perceptual, cognitive, emotional variables involved in actual (i.e., environment-bound) interactions (cf. Bertuccelli Papi 2009) are first selected and then related, individually and/or in variable clusters, to different neural patterns

of activation setting up the contexts for the activation of the relevant inferential paths. This would not be in contrast with the Relevance theorists' proposal of the existence of general principles (relevance) and cognitive processes of concept adjustment (narrowing, broadening) triggered by specific cognitive contexts for the computation of what is said and of what is implicated.

It would however make it plausible that the rational pattern of inference derivation may actually be the external, observable outcome of the dynamical interplay of numerous neural microprocesses operating on ad hoc conceptual representations under the attractions of different domains. These microprocesses might actually operate in non linear manners, the results surfacing in rationally analyzable global patterns because of the system pressure to self-organization in terms that make them comprehensible and thus socially shareable. In the same vein, "the brain can be viewed as a coordinated system that generates a continuous stream of multi-modal predictions during situated action and social interaction" (Barsalou 2009: 1287).

6. Conclusions

In this paper I have tried to suggest that while several interesting answers to the question posed by the title can be provided by several topics currently dealt with in cognitive pragmatics models, new questions may be posed and new answers might be offered by a complex systems view of verbal behaviour based on the observation of actual pragmatic facts. Pragmatic facts appear to observation as complex dynamic entities which are shaped in continuously changing configurations by the contexts they occur in. This makes it possible to explore the hypothesis that a complex-systems based neuropragmatics might cast new light on the relationship between language use and the brain, pointing to the investigation of the dynamic working of principles and processes capable of governing the complexity of the language and brain systems more than to the search for specific sites for specific units.

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Finito di stampare nel mese di Settembre 2010
presso le Industrie Grafiche della Pacini Editore S.p.A.
Via A. Gherardesca • 56121 Ospedaletto • Pisa
Telefono 050 313011 • Telefax 050 3130300
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