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# **Discourse coherence — From psychology to linguistics and back again**

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The present volume explores recent advances in modeling discourse processes, particularly new approaches aimed at understanding pathological language behavior specific to schizophrenia. In this work, we examine the modeling paradigm of formal semantics, which falls within the scope of both linguistics and logic while providing overlapping links with other fields such as philosophy of language and cognitive psychology.

This volume is based on results presented during the series of workshops on (In)Coherence and Discourse organized by SLAM (Schizophrenia and Language: Analysis and Modeling), a project developed to systemize the study of pathological language processing by taking an overarching interdisciplinary approach combining psychology, linguistics, computer science and philosophy. The principle focus is on conversations produced by people with psychiatric disorders (such as schizophrenia and autism). The series of (In)Coherence of Discourse workshops hosted by the Loria were held in Nancy, France in December 2013, December 2014, December 2015 and March 2017 and include 33 presentations by lead researchers, young researchers and invited speakers.

Our focus is on evaluating the heuristics of several formal approaches presented in the scientific literature aimed at explaining the incongruities and disturbances that characterize pathological discourse. We examine specifically the degree to which these formal approaches and experiments support traditional debates about discourse coherence and related cognitive processes. Based on a comprehensive evaluation of a range of works that have attempted to explain key disturbances such as disordered language and deficit in inferential skills, we show why some approaches are more relevant than others.

Discourse coherence has traditionally been explored through discipline-specific research. We propose that considerable potential lies in approaching the question through a wider lens by considering perspectives across a range of disciplines; notably linguistics, computer science, philosophy and psychology. This volume underscores the importance and value of exploring this particularly complex issue within an interdisciplinary framework.

In this introduction we begin by addressing the fundamental differences between current experimental and clinical approaches. By considering the underlying assumptions inherent in each, we show how both approaches fail to account for intentionality as an independent feature interaction dynamics. In the first section of this chapter, we show how modeling complex mental operations (including intentional states) through formal approaches to language can potentially compensate for this lack. In the second section, we describe several selected theories of linguistics and dedicate a section to those that have been applied to the study of schizophrenia. In the third and final section, we revisit the epistemological issues raised by the plurality of approaches to discourse coherence. We conclude with a more detailed presentation of the contributions in this volume.

## **1 Approaches to psychopathology**

Developing systematic analysis methodologies for evaluating verbal communication skills in patients with schizophrenia, the core focus of the SLAM project (Schizophrenia and Language: Analysis and Modeling), involves confronting the need for homogeneity in either corpus or experimental data.

The linguistic corpora are composed of data from neuropsychological tests, selected recordings using eye-tracking devices or electroencephalography (EEG), and transcriptions of audio recordings of conversations or clinical interviews involving a person with a psychotic disorder. These methods of data collection have regularly been used across a range of scientific studies but are particularly common in the field of cognitive psychopathology where the combined use of classical experimental methodologies has given rise to a markedly high number of publications (more than 1,000 articles per year since 2010, according to PubMed data). Both types of investigations are more or less guided by the paradigm of cognitive science which, drawing on aspects of psychology, linguistics, philosophy, and computer modeling, fundamentally seeks to understand the underlying mechanisms of information processing and cognitive functioning in the brain. Mental illnesses are also traditionally studied in the context of informal or intuitive clinical settings that take a person-centered approach and focus on the importance of the client's subjective worldview. These approaches were developed largely to respond to the needs of mental health care practitioners and developing more effective outpatient therapy and psychotherapeutic interventions. The knowledge they produce about the rationality of psychotic disorders is most often reinvested directly back into patient care. Both offer operational solutions in the immediate sense but do not necessarily meet the requirements of established scientific methods and are questioned for their validity and even viewed with suspicion by the scientific community. Any constructive debate or discussion between the two camps of quantitative and qualitative research representing two very different world views, would be an exercise in futility, even downright impossible, given the polar differences of their respective underlying theoretical, epistemological and methodological assumptions.

In the purely scientific domain, the view of investigating mental illness is a different matter. Researchers are broadly divided into two schools and favor one of two approaches that are technically and methodologically complementary. The first is more classically used in the field of neuroscience and addresses mental illness in terms of dysfunctional or abnormal biological, psychopharmacological and neurocognitive processes. It examines the overlap between genetics of the human brain and what drives thought, or in a broader sense, the underlying mechanisms of cognition. Placed at this end of the spectrum are several investigative techniques that essentially focus on understanding executive function, memory, attention and, to some extent, deductive reasoning. This approach is, however, fairly distanced from the study of thought, language and communication disorders primarily because it relies on models more strongly rooted in biology and cognitive psychology, neither of which are structured to inform language development.

At this level the traditional framework of neuroscience intersects, at least for discussion purposes, with a second approach to investigating mental illness that falls under the aegis of cognitive psychopathology. It focuses mainly on identifying neurocognitive disorders (associated with deficits in attention, memory, language and executive function, and among others, two commonly measured by neuropsychological tests being short-term memory and mental flexibility) and understanding the mechanisms of social cognition, and specifically the processes underlying deficiencies in interpersonal relationships. As such, it includes examining cognitive processes that can be classified as intentional processes while also addressing language deficits and thought disorders.

Researchers in cognitive psychopathology, however, most often subscribe to a non-linguistic conception of social cognition. Currently, the most common reference (and basis for protocols) is a definition of social cognition proposed roughly 10 years ago at an NIMH (National Institute of Mental Health) Workshop on Social Cognition in Schizophrenia as: "the mental operations that underlie social interactions, including perceiving, interpreting, and generating responses to intentions, dispositions, and behaviors of others", (Green et al., 2008) In this context, four core domains of

research are considered to be related to social cognition. In a broad sense, these are: 1) emotional processing or the emotional component focused principally on the ability to recognize and differentiate basic and complex emotions; 2) social perception and social knowledge or decoding and interpreting social cues in others; 3) theory of mind/mental state attribution that encompasses processes of understanding, reasoning and attribution of mental states, regardless if they are emotional in nature; and 4) attributional style/bias as the way a person explains the causes, or makes sense, of social events or interactions.

The result is that conventional experimental designs tend to place the question of language and thought disorders in the background and shift the focus to variables that are most likely control linguistic components (phonological, lexical or syntactic) that ultimately outside the functioning of linguistic cognition itself, the very heart of what we call executive functions. Clearly, however, these experimental studies in psychopathology have proven effective, notably in their attempt to provide new knowledge about the basic operations involved in thought, those that may be strongly influenced by surrounding neurocognitive and neuropsychological conditions but are only indirectly related to processes involved in constructing the semantic representations formulated by the receiver or interlocutor about the mental state of the speaker.

If we accept the argument put forth by philosophers of language and cognitive pragmatics that the contextualization processes involved in determining communicative intentions, in discourse or communication, are on one hand based on the rationality of the cognitive inferential system (the cooperative principle, relevance theory, inference rules), and on the other (secondarily, in the chronology of the interpretive mechanism), on specific rules governing contextual access (i.e., pragmatics, semantic memory), we observe above all else that the experimental method in cognitive psychopathology has proven more effective in explaining access to context than in describing the dynamic and inferential constraints of the cognitive interpretive system. Describing the complex intentional processes involved in processing communication activity requires a methodology that is less static, one which takes into account the dynamic aspects of the context, which in this case is "discourse". The aim is to at once measure the process involved in gaining access to contextual information while investigating the dynamics of the inferential process. This experimental method has failed repeatedly when used to reveal specific cognitive constraints of the inferential tool, most likely due to the fact that it represents situations being analyzed in a fixed manner — whereas the distinguishing feature of the cognitive tool is that it is dynamic.

Conversely, despite the holistic nature of the contextual information rendered accessible through the inferential mechanism, formal methods long considered as reliable in linguistic analysis, have proved more effective in capturing the rationality of the inferential process itself. These methods have been shown to be more successful in not only representing the dynamic character of the communication action but in modeling variables and properties involved in an interaction that contribute to action planning. Ultimately, this makes it possible to isolate and identify selected features and compare the degree to which they activate or inhibit the inferential mechanism. Moreover, since the famous 'dynamic turn' in the 1990's, linguistic analysis and modeling in formal semantics have been based on dynamic discourse movements and not solely on fixed questions, which represents a remarkable step forward in the analysis of intentional processes. In this sense, this type of methodology effectively compensates for defects associated with the experimental method and facilitates investigating the dynamic properties of the inferential mechanism beyond the overly simplified explanation of reactive and automated processes.

## **2. Approaches to language and the linguistic approach to schizophrenia**

Cognitive Psychotherapy treats verbal material more abstractly and independently of linguistic and discursive factors by using models and theories that do not account for context or the situational conditions in which the verbal material is collected (i.e., clinical interviews or conversations). It tends to reduce explanations of communication difficulties exhibited by patients with schizophrenia to executive dysfunction, and by association neuropsychological dysfunction. Linguistic elements involved, or language disorders, are at best assessed outside the context of discourse (and therefore, outside of the communication context) without reference to language theory. Added, the processes for analyzing communicative intentions, for example, are evaluated in a wider sense under social cognition without taking into account the specific inferential mechanism (inference rules) involved in recognizing communicative intentions (those that are implicit, for example). Difficulties in schizophrenia patients are attributed directly simple executive functions or, more broadly and even less precisely, to problems of semantic memory.

Nevertheless, the implicit conceptions of the relationship between language and thought that the experimental protocols used so widely in linguistic research are based on, remain close to the original concept of Eugen Bleuler (1911) that language is a direct expression of thought. Disturbances of thought or thought disorders have, thus, been a subject of high interest in psychiatry and psychoanalysis from the early 1900's. It was not until the 1970's that the field of linguistics would contribute to the question through the development of more formalized analytical methodologies (Chaïka, 1974; Fromkin, 1975). The debate shifted course at this point to the question of whether or not disturbances or language abnormalities exhibited by schizophrenia patients in interviews or in their general communication are more closely connected to deficits in language competence or to thought disorder.

These initial debates laid an important foundation for what we currently know about the diagnostic process, our understanding of specific disorders and advances in psychotherapeutic patient care, and yet they are today, around the world, only modestly addressed in professional training in psychology, and even less so in psychiatry. Additionally, psychologists and psychiatrists rarely receive training in language science which means that professionals and practitioners in both fields are equipped with a limited understanding of the importance of systematic data collection and corpus development. Data collection largely continues to take place on site in clinics or settings where patients receive care. While defining protocol guidelines for compiling corpus data is fairly straightforward, the quality of results can be highly variable; this is due in particular to the specificity of the subject under study, the nature of mental disorders that inherently render social interactions delicate and unstable, and to patients' difficulties adhering to restrictive or structured approaches these assessment strategies require.

As we previously mentioned, mental disorders are frequently studied through their manifestations as language abnormalities. Deepening our understanding of the mechanisms underlying disordered discourse should, naturally, be approached through linguistics. An obvious point of departure is studying and analyzing the singular aspect of language production during interactions with patients with schizophrenia (Kuperberg, 2010, a., and Kuperberg, 2010, b.) and conducting a comprehensive meta-analysis of the literature on linguistic approaches to these abnormalities in discourse production that highlights three types of characterization viewed through the lens of linguistics.

The first focuses on a frequency analysis of data on language and measuring predictability through using Cloze Analysis (Taylor, 1953) and variability of a specific word in its context with TTR (Type

Token Ratio). This type of analysis favors the notion that schizophrenia patients have reduced competence in mastering linguistic complexity (e.g., experience greater difficulty in predicting linguistic content) (Salzinger et al., 1970, Salzinger et al., 1979). Previous automatic analyses have shown that schizophrenics produce more associations between words (Maher et al., 2005), which would support the argument that shifts in themes occur with greater frequency. In addition, a study by Landauer & Dumais (1997) examined the lexical dives observed in transcribed interviews with schizophrenia patients and showed that these subjects produced much lower scores in semantic association, supporting the argument that they produce less coherent discourse.

The second approach focuses on syntactic and lexical structures, along the same lines taken by Chaïka (1974) and Fromkin (1975). A number of previous studies have successfully shown that schizophrenia patients are less capable of dealing with syntactic complexity (Fraser et al., 1986) and tend to use incorrect grammar (Hoffman & Sledge, 1988), most commonly seen in their simplified sentence construction. This would suggest that these patients would also have difficulty understanding sentences with complex syntactic construction. What has emerged fairly clearly is that this lower syntactic complexity, both in terms of production and comprehension, is a telling characteristic of schizophrenia, while these same patients are able to produce and understand simple phrasal structures (Thomas et al., 1993). Importantly, patients with schizophrenia rarely display signs of syntactic impairment. Even the most incoherent statements or “word salad” are in fact composed of normal syntactic elements (Andreasen, 1979), suggesting that even markedly reduced language performance is not necessarily indicative of a concrete syntactic deficit. According to Covington et al. (2005), it is more likely that abnormalities in schizophrenic speech point to memory and information-processing deficits or cognitive disturbance (i.e., attention deficit) as constraints impacting communication rather than to a primary defect in linguistic competence (i.e., disrupted syntactic processing).

Finally, the third approach focuses on the linguistic interpretation of discourse. The objective here is to emphasize the skills involved in constructing normal interactions rather than analyzing the referential processes themselves (linking anaphors to their antecedents) (originally Rochester & Martin, 1979; Ditman & Kuperberg, 2010). Docherty et al. (1996) developed a comprehensive measure to capture a range of referential communication failures including vague, confused and missing references. This work essentially examines anomalies in speech production from a linguistics perspective by qualitatively measuring semantic relationships involved. As for the dynamics of controlling enunciation, or the distinctiveness of utterances, several studies have reported observing in some patients with schizophrenia impaired affective prosody; this refers to the neuropsychological function encompassing all non-verbal aspects of language necessary for both recognizing and conveying emotions in communication. According to Cutting (1985), the percentage of patients with schizophrenia who exhibit a deficit in either perceiving or expressing emotional prosody may be as high as 85%. It has also been shown that acoustic measures of vocal expression and production are attenuated in patients suffering from schizophrenia who also experience affective anesthesia, or a blocking of affective responses (one of the more negative symptoms associated with the condition) yet increase in patients with schizophrenia who do not experience psychological blocking off. The amplitude (volume) and frequency (pitch) of utterances by individuals suffering from both schizophrenia and affective disorders have been shown to be lower than they are in both normal subjects and individuals with schizophrenia without affective anesthesia (Alpert et al., 1989). Therefore, these authors posit, we would expect production of emotional prosody to be disrupted in patients with schizophrenia, while the level of linguistic content may be preserved.

In general terms, as Covington et al. (1985) and others have argued, the most pronounced disruption in schizophrenia occurs at the pragmatic level, essentially the point where language production and context processing meet. The most outward sign of dysfunction in schizophrenia often manifests in disordered speech or unexpected or unintelligible outbursts; an individual living with schizophrenia will say strange things that are contextually inappropriate. Other authors share this view, notably since Frith and Allen (1988) established that capacities in schizophrenia patients' syntactic and semantic processing can be unaffected while the same patients will have difficulty with more complex use of language, or what is known as pragmatics.

Interestingly, all of these approaches consider verbal expression in schizophrenia as an important vector for understanding thought disorder. This relatively strong assumption appears to be widely accepted and could considerably widen the scope of exploration, except that thought disorder itself has received only limited attention in the literature; thought disorder, or formal thought disorder, has historically been described somewhat broadly as the complex link between thought, language and speech. One obvious problematic is that addressing language output in schizophrenia necessarily requires considering the specificities of the patient concerned to gauge the level of disorder in their language and assign those abnormalities to levels defined by a Saussurian vision of language. A second difficulty associated with line of research, also pointed out by Kuperberg, is that patients suffering from schizophrenia are either under the influence of prescription antipsychotic medication, or they have stopped taking their medication and their symptoms consequently become more severe, which makes interaction even more difficult if not outright impossible. It is therefore extremely difficult to determine if language abnormalities are symptoms of the disease, or if they are related to the effects of the patient's medication. This may partially explain the fact that a number of previous works have reported syntactic impairment in schizophrenia, which our own more recent morphosyntactic analysis did not support (Amblard et al., 2015). What is undeniably clear is that schizophrenic discourse is structured very differently than normal discourse and necessarily requires approaches to address this singular difference. It is, however, important to note that unlike language abnormalities considered symptomatic of other disorders, such as aphasia, anomalies in schizophrenic speech selectively involve levels of linguistic structure which can vary from the lower semantic level to the more complex pragmatic level characterized by higher degrees of abstraction in terms of conceptual language modeling, which effectively are very difficult to identify.

This dynamic has been as much a subject of interest in linguistics as it has in computational linguistics. These two fields combined have produced a significant number of recent advances in both language production theories and language processing tools for studying speech patterns in schizophrenia, but they approach the question from two distinctive angles.

The first looks to computational linguistics for developing language processing tools and computerized models adapted to analyze speech production data collected from schizophrenia patients. Researchers at IBM (Bedi et al., 2015) achieved this by combining automated speech analysis and a machine learning algorithm as a classifier to evaluate a corpus of transcripts for semantic and syntactic complexity. The results of this study are impressive in that they show how computerized methods can be used to characterize complex behavior such as speech and ultimately can identify and predict schizophrenia. The downside is that this study only included 5 patients with schizophrenia, which underlines an important point — as much as these types of approaches open novel avenues of study, the reasoning of moving towards strictly implementing them as protocols has been questioned simply because sufficient quantities of relevant data are highly difficult to obtain.

The other approach or interest in combining linguistics and computational linguistics places focus on the models themselves. Ultimately, the aim is to produce soundly defined formal representations that are both cognitively motivated and justified in the linguistic framework. This calls to mind Montague semantics (Montague, 1974), a theory of natural language semantics and of the relationship with syntax, as well as those approaches that integrate the dynamic aspects of discourse interpretation (Kamp and Ryle, 1993) or extensions of Segmented DRT (Asher and Lascarides, 2003). These models, among others, are generally the basis for implementing natural language processing. Thus, studying how accurately they reflect atypical speech patterns can by extension provide valuable information about what can or cannot be automatically identified. This implies the need to consider normative context when determining or envisaging possible implications of these models.

Indeed, a legitimate line of questioning is whether, or to what degree, these models can accurately represent a language in the absence of constraints. This language would necessarily become the place where cognitive processes take place. Therefore, models that are capable in principle of differentiating between standard and unconventional use of language would ideally simulate these processes. This in turn would validate the reality represented by the language recognized by these models and would support the cognitive validity of the models themselves. This should still be true without specifying or defining processes involved in language acquisition. Cognitive reality in the context of computational modeling, however, is difficult to define. Considering these incongruities allows us to compare these models through complex phenomena present in the language providing more concrete validation.

As we alluded to earlier, incongruities that emerge when communicating with schizophrenia patients occur at a highly abstract level situated between semantics and pragmatics. The fact that only limited empirical evidence has been reported in the literature on deficits in abstraction, in our view, makes it critically important to direct more attention to this defining aspect of language dysfunction in schizophrenia, and underlines the importance of integrating 'abstraction' as a criterion in formal language models. Lastly, given the highly specific nature of language in schizophrenia, more emphasis should be given to developing accurate representations of dialogue analyzed by processing models, than evaluating the validity of the models themselves.

### **3. Contributions of Pluralism**

Coherence and incoherence are normative concepts. Identifying inconsistencies in discourse, however, does not necessarily call for a high-level metalinguistic assessment. Most speakers are generally able to grasp when things are not going well or when a conversation begins to veer off course. They can sense a change in register, or style of language, to signal humor, poetry or "madness". This sensitivity is acquired with linguistic competence: ensuring that we are understood in verbal interactions involves not only accommodating contributions made by others, but integrating intentions and content communicated as common ground or shared reference and making the necessary adjustments when the speaker makes a mistake.

The philosophers Quine and Davidson insisted that understanding, interpreting and responding to the arguments of others relies heavily on the principle of charity: interpretation of the beliefs and utterances of others that maximizes the truth or rationality of what others think and say, without which communication is impossible. Underlying this strategy, to use Wittgenstein's own terminology, is essentially a "language game" rooted in shared conceptual parameters that takes place in a cultural environment both parties understand, a common "form of life". This fundamentally describes



how sharing the same form of life and the same language game can lead us to implicitly assume that we share the same rational norms with our interlocutor and, effortlessly, we are able to understand the meaning of our linguistic exchanges.

The immediacy of understanding can be at risk when others violate the rules expected of us in communication. In the absence of a shared “common ground” of syntax when communicating with a person who does not master the language being used, or when the lexicon and semantics diverge, understanding is rendered more difficult or even impossible. The presence of madness in verbal exchange is one of the more prominent sources of conflict. Some consider, along the same lines as Jaspers, that psychosis is characterized by that which is incomprehensible, which effectively distinguishes it from simple neurosis. Understanding is fundamentally impossible in psychosis due to the lack or failure of empathy (Einführung): I cannot see myself in this person suffering from psychosis, so therefore I cannot understand him or her.

Importantly, the fact that we stop understanding does not prevent us from trying to explain, which leads us back to the classic distinction drawn by Dilthey between the science of the mind and the natural sciences. While Freud notoriously contested this position by arguing that interpretation could effectively replace empathy when attempting to understand a person exhibiting psychosis, the more widely held approach to madness reduces its apprehension to naturalism. However, whether it comes down to a question of favoring neurobiological, neurochemical or even genetic causes, or all of the above combined with multifactorial explanations, the naturalist paradigm is limited to a third person approach in that it eliminates the subject’s perspective altogether. The reasons, motives and rationality of the psychotic subject are simply not considered relevant. This position, however, is problematic for not only the person suffering from psychosis essentially withdrawn from the equation, but for the scope of the analysis.

Indeed, incoherent and disordered speech characterized by frequent derailments are, at the linguistic level, among the most frequently observed symptoms of schizophrenia. Assessments of disordered speech or contradictory statements necessarily requires relying on rational norms rather than natural laws. Similarly, the occurrence of delusions, hallucinations, or general denial of reality commonly associated with schizophrenia, can only effectively be detected by evaluating semantic coherence of thought contents. The naturalistic approach offers no way of analyzing the rational and semantic dimensions of schizophrenic thinking. Understanding the rationality of a person with schizophrenia is possible, however, through linguistic interaction by means of normative modeling, or in other words by using theoretical tools developed by the fields of logic and formal linguistics.

The plurality of theoretical approaches to studying disordered discourse thus requires going beyond the mere integration of naturalistic explanations. It becomes not only a question of combining different structural levels of mental illness and cognitive processes, but of accepting models that cannot be definitively integrated because they involve other levels. A pluralism that stops at recognizing the diverse nature of biological, neurochemical and neuropsychological factors would not be sufficient. In psycholinguistics, we must instead assume a conceptual pluralism based on the essential difference between factors that can be described in naturalistic terms, and linguistic and rational factors that can be analyzed by normative approaches.

Studies on discourse incoherence commonly use corpora involving patients diagnosed with mental disorders and generally rely on a distribution of interlocutors described as either patients or normal controls, a division that is simply not factual. This distribution presupposes a positioning of the boundary between normal and pathological which cannot be defined in biological terms, as evidenced by debates surrounding the classification system proposed by successive editions of the DSM. The criteria that separate what is considered normal from pathological in terms of mental

suffering are socially constructed, and subsequently, this means that that they are far from arbitrary categories.

The scientific identification of discourse inconsistencies thus implies a crossover of several normative systems: those that define the boundaries of the normal and the pathological (neurobiological or psycho-cognitive) and those that constitute the grammar of coherent verbal communication (lexicon, syntax, semantics, pragmatics). Pluralism ultimately appears to represent the reverse of another aspect of scientific knowledge, first theorized by Duhem and later by Quine, being holism. Faced with the inherent problematic of inconsistencies in discourse, virtually no discipline works with isolated data, whereas theoretical models regularly do due to an essential mutual interdependence in normative delimitations. This holism suggests that striving for greater balance between disciplines in terms of scientific procedure would allow each to rely on the results of others as hypotheses to be tested.

Through its theme and contributions, the present work should therefore be read as an illustration of how conceptual holism and pluralism play an essential role in relationships developed between the fields of logic, linguistics, psycholinguistics and cognitive psychology as each of these disciplines confront the challenge of understanding a unique form of the abnormal.

## **4. Presentation of the volume**

### **Part 1**

Part One of this volume opens with a chapter entitled "Linguistic Recursion and Discourse Particles: Language in Children with Autism Spectrum Disorder", by Patrick Blackburn, Torben Braüner and Irina Raheemah. In this chapter, the authors describe their research on second-order false beliefs (SOFB) in children with autism syndrome. This interdisciplinary work, in the truest sense, associates experimental methodology taken from psycholinguistics and psychology with linguistic models, which these authors developed further by integrating concepts borrowed from artificial intelligence and epistemic logic. The scientific literature, they point out, has to date largely focused on first-order false beliefs, which this work attempts to address: they offer an updated perspective and discussion about the relationship between the level of control of SOFP and the control of language functioning in autistic children. By using modal particles in Danish based on the JDV test and the Recursive Embedding Tool, they show that good control of recursive embedding increases a person's ability to recognize false beliefs. They analyze the reasoning processes underlying the two tests and highlight the common elements related to reasoning identified at the level particle control in Danish (JDV) as this facilitates recognizing false beliefs. They extend their analysis and reflections to consider neurotypical children and their stages of their ontogenetic development, and more generally, the question of acquiring beliefs.

In their chapter entitled "Reasoning in multiparty dialogue involving patients with schizophrenia", Ellen Breitholtz, Robin Cooper, Christine Howes and Mary Lavelle present their work on the formalization of reasoning, and focus specifically on developing formal models of arguments that appear in conversations involving individuals with schizophrenia. Particular attention is given to their report of an excerpt from a conversation sourced from the DRiPS corpus, a body of transcripts of discussions between three people (including one person diagnosed with schizophrenia) who discuss the moral dilemma of the balloon: passengers in a hot air balloon realize that one person will need to leave if any of them are to survive, but how do they decide who? This situation requires the participants to not only share information, but their own reasoning processes. The authors rely principally on the concepts of topoi and enthymemes as representing general principles of

reasoning and their instantiation through verbal exchanges. These interactions are managed through a dialogue gameboard within the framework of the Type Theory with Records and the principles of game theory. This methodological tool, these authors posit, helps explain differences in reasoning supported by non-logical inferences leading to misunderstandings that require new accommodations to become understandable.

The research presented by Maria Borichev and Maxime Amblard in the chapter “Picturing Questions and Answers — A Formal Approach to SLAM” concerns the compositional treatment of assertions, questions and responses in dialogue. These authors describe using formal methods in their analysis configured to model dialogue in a dynamic framework, with the specific focus being assessing recursive and sequential properties of conversation, in normal or pathological contexts. In their analysis of empirical data from the SLAM corpus (mentioned above) they base formal constructions largely on frame semantics, which allowed for a contextual update of linguistic expressions specific to negotiation in dialogic interactions. They were able to develop a frame semantic taxonomy of questions and a frame semantic description of negation, and propose a description of dynamic operators involved in calculating the information being negotiated and integrated at the level of conversational patterns pairing, for example ‘assertion-assertion’, ‘assertion-question’ and ‘question-answer’. In addition, they explain how the different formal models presented in their work show high potential for adequately explaining abnormalities in schizophrenia at the discourse level, and finally, describe conditions that would facilitate developing a future formal model with the capacity to recognize conversation ruptures in normal conversation.

The last chapter of Part One features a work entitled “Incoherences in Dialogues and their Formalization — Focus on Dialogues with Schizophrenic Individuals” by Christophe Fouqueré, Jean-Jacques Pinto and Myriam Quatrini who describe their use of a relatively recent extension of logic. First developed by Jean-Yves Girard around 2000, Ludics is logical framework wherein interaction is a central concept and takes place between two designs as a step-by-step travel through two dual paths, with one path in each design being a set of potential paths where interaction may take place. The same way the concepts of logic relate naturally to philosophy and language, this novel approach lends itself to the nature of dialogue and linguistic representations. In Ludics applied to the dynamics of dialogue, playfulness as a level of linguistic expressiveness produces two parallel representations, which in the context of conversation correspond to the person speaking and the person listening (the receiver). In this work, the authors show how the two viewpoints of the conversation can veer in different directions yet remain rational within the model. It is these divergences that lead to misunderstandings, which they seldom do as this would violate the rules of logic. Logical coherence, therefore, can be understood in terms of cohesion. These authors illustrate these ruptures of cohesion through excerpts taken from conversations involving patients with schizophrenia.

## **Part 2**

Felicity Deamer and Sam Wilkinson focus on the causal mechanism of delirium in psychosis. Their work “Metaphorical Thinking and Delusions in Psychosis” examines the hypothesis that the experience of inner speech resonates with the rationality of the metaphorical thought process, which contributes at once to the emergence of delirium and to the development of its content. Thus, it is the literal meaning of a metaphorical expression that can be extracted from the proposal with metaphorical meaning, and which would, despite its context of enunciation, relate directly to the occurrence of delusional, bizarre or colorful assertions (Finbarr delusions). The authors ascribe this singular mechanism for understanding spoken sentences to cognitive failure, commonly found in delusional schizophrenic patients, which in this context often presents as a difficulty in inhibiting the

literal meaning despite the context of enunciation. Interestingly, they also explore the experience of delirium from the patient's perspective and advance the hypothesis that while patients with schizophrenia may experience inner speech as assertive and sincere, the content of their thoughts ultimately remains separate from reality and has no real consequences.

In his article "The Myth of Irrationality: A Wittgensteinian Approach to Delusions and to the Principle of Charity", Mathieu Frerejoun discusses the merits and limits of relying on the principle of charity to recognize the irrational. Can this principle be applied to delusional speech, and if not, how can we understand the latter? The philosophy of psychiatry tends to oscillate between the systematic postulate that the applying the principle of charity influences the rationality of the delusional subject, and the symmetrical rejection that rationality can be recast by this principle. The author proposes that understanding rationality needs to be considered from a wider angle than one based purely on logic, notably by incorporating the rules governing a course of action that essentially represent Wittgenstein's basic or 'hinge' certainties. And as such, rather than interpreting specific delusions or irrationality itself by attempting to understand the illusory nature of each, we might consider how each aligns to our norms of what is rational and, therefore, meaningless.

Fabrice Louis' article "(In)coherences in the Discourse of the Schizophrenic: An Anthropological Approach to the Mind" also alludes to Wittgenstein but turns instead to his thinking on the concepts of language game and life form. Here, the author underlines the value of adjusting our beliefs and taking a more pragmatist, which ultimately led him to attribute incoherent utterances in schizophrenic speech as manifestations of problems related more closely to interaction than to semantics. Unlike the previous work that considers delusional discourse as meaningless, Louis suggests that it can be assigned meaning interpreted in the context of another form of a language game specific to the individual with schizophrenia. Utterances in a more ordinary language game that may count as an assertion or expression of beliefs may, in another, signify an expression of emotion. This shift in the nature of the game between interlocutors produces conversational disturbance, and ultimately isolates the schizophrenic speaker, even without considering semantic inconsistencies.

Part Two closes with a chapter by Valérie Aucouturier, "Conversations with Madness — Meaning, Context and Incoherence". This author focuses here on Wittgenstein's concept of shared 'form of life' — being the common humanity in language — between normal speakers and individuals with schizophrenia. Conversational ruptures that arise against this common backdrop are not, the author argues, necessarily due to a breakdown of rationality on the part of the schizophrenic speaker but instead stem from a gap between the two interlocutors' reference contexts. The construct of the schizophrenic speaker's perspective relies less on the principle of charity as a projection of rationality perceived in the other's speech but is more reflective of their ability to understand the interlocutor's context references, their beliefs, and as a result, the meaning being conveyed. This chapter thus concludes on the optimistic note being that inter-comprehension in conversation in the presence of madness is achievable if we look beyond the linguistic, semantic and pragmatic aspects towards focusing on understanding and modeling the broader context of the exchange.

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