Chapter 1
General Introduction

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As witnessed by its title, the papers collected in this book aim to provide a renewed perspective on the relationships between dialogue, rationality, and formalism. More precisely, the goal of this volume is to shed light on the use of formalisms in psychological and philosophical explanations of the rationality of interactive agents. This book grew out of an interdisciplinary scientific project called DiaRaFor ("Dialogue, Rationality, Formalisms") and hosted by the MSH Lorraine (Lorraine Institute for Social Sciences and Humanities) from 2007 to 2011. The project was led by two Lorraine research teams, the *LHSP–Archives Henri Poincaré* (UMR 7117), and the *Laboratoire de Psychologie de l'Interaction et des Relations*

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Intersubjectives (InterPsy, EA 4432), in conjunction with several external researchers. Specific collaboration was implemented with a team of psychiatrists working at the *Centre Hospitalier Universitaire* (University Hospital) of Rouen.

The goal of the project was to compare recent accounts in the formalization of natural language (dynamic logics and formal semantics) with informal conceptions of interaction (dialogue, natural logic, and attribution of rationality) that had been developed in both psychology and epistemology. Like the project, the book is divided into four parts: historical and systematic studies; the formalization of context in epistemology; the formalization of reasoning in interactive contexts in psychology; the formalization of pathological conversations.

The book's chapters are partly direct products of the research conducted within the project, and partly written by international scholars working on issues adjacent to those of the DiaRaFor project. In the remainder of this introduction, we will briefly present the objectives of each part and the nature of the papers contained therein.

1.1   Part I: "Historical Context"

In the last century scientific philosophy has seen the birth of two epistemological currents, namely the better-known logical empiricism and, as a reaction against that, several continental European methodologies associated with the Erlangen School of Germany. Both have developed a logical analysis of scientific discourse and proposed to reconstruct theoretical terms on the basis of non-theoretical data. Both seek to distance themselves from German idealism and the German metaphysical tradition, and are famous for their seemingly draconian rejection of Heidegger (Lorenzen, Beth, Piaget). Recent studies on logical empiricism suggest, however, a more nuanced verdict concerning the influence of German metaphysics, and the same observation must be made with respect to the Erlangen School.

The topic of the first part of this book is motivated by the realization that the currents "around" the Erlangen School explicitly proposed a logical analysis of science—a logic of science—as well as an operational reconstruction of psychological concepts, while at the same time distinguishing themselves from their predecessors, who had been the target of Quine's celebrated 'Two Dogmas'.

The three papers in this part of the book provide insights into the difficulties of characterizing the very beginning of a conceptual reassessment of the project of rational reconstruction from a pragmatic point of view, including both the epistemological and psychological sides of the issue.

In "Phenomenology, "*Grundwissenschaft*" and "*Ideologiekritik*": Hermann Zeltner's Critique of the Erlangen School", **Christian Thiel** sheds light not only on a little-known German philosopher but, more importantly, on the intellectual circle that existed at the beginning of Kamlah and Lorenzen's collaboration in Erlangen. Following Carl Friedrich Gethmann's assertion that "constructive philosophy is phenomenology after the linguistic turn", one might conjecture that, as Kamlah

was influenced by Heidegger, so Zeltner was influenced by the supervisor of his *habilitation*, Moritz Geiger, who succeeded Husserl in Göttingen in 1932, such that both confirm Gethmann's thesis. Nevertheless, Thiel's carefully organized historic-systematic examination and testimony (Zeltner sat on the jury for his own *habilitation*) arrives at a different claim: (1) just as it is difficult to say "to what extent phenomenology was at the core of Geiger's philosophy", so it is difficult to say to what extent Zeltner "was a phenomenologist, regarding either the subjects of investigation or the methods employed"; (2) Zeltner's term "*Grundwissenschaft*" is directed as much against Plato's ontology as against Kant's epistemology. As far as geometry is concerned, it means that we must internalize (*mitvollziehen*) the meaning of geometrical norms as "prescriptions of actions in the physical world, in order to grasp the real meaning of mathematical propositions". This argument comes very near to Lorenzen's position, although his discussion of it was not in respect to a system of geometrical propositions. Nevertheless, although there were some common systematic (though non-phenomenological) features in common between the Erlangen School and its local philosophical counterparts, there was no significant discussion or exchange between the two. Thiel's paper is a precious argument against historical links hastily accepted. It is a masterpiece of "*Ideologiekritik*".

The second paper, "Geometry as a Measurement-Theoretical A Priori: Lorenzen's Defense of Relativity Against the Ontology of Its Proponents", by **Oliver Schlaudt**, describes and motivates Lorenzen's normative approach to geometrical space as an object constituted by spatial measuring operations and highlights the consequences of this approach for the interpretation of the theory of relativity. What is often conceived of as "fact" is, in the tradition of Poincaré's conventionalism, the outcome of a process of interpretation that also depends on a priori elements. In Lorenzen, "*a priori*" simply denotes the consequences of linguistic and technical methods established by convention within the reconstruction of scientific theories. In this carefully argued article, the author shows convincingly how Lorenzen transcends the customary realism/anti-realism quarrel: his pragmatic approach reflects both Helmholtz and Mach on the one hand and the neo-Kantian thinkers Kries and Cassirer on the other. His arguments thus leverage two opposing currents, a critical one and a constructive one, which respectively inherit empiricist and rationalist positions. He replaces the circles used by these modes of thought with the so-called theory of forms, i.e. the objects of a purely "basic geometry", with an operationally defined plane surface as the most fundamental form, ranging from topology to geometry strictly speaking. The originality of Lorenzen's approach is finally clarified by a confrontation with the earlier positions of Helmholtz, Russell, and especially Couturat.

The correspondence between Beth and Piaget, edited and annotated by **Gerhard Heinzmann**, **Alain Trognon**, and **Frédérick Tremblay**, was kindly made available to us by the Beth Foundation in Amsterdam. It constitutes a very exceptional document that fits perfectly into a book about the DiaRaFor project. It is, in fact, a dialogue, more precisely an epistolary dialogue, but at the same time it has all the properties of a critical discussion conducted within the framework of an

interdisciplinary scientific project. It focuses on the relationship between "natural mind" and "formal thinking", a long-standing issue in epistemology and one of the main points discussed by the members of Lorenzen's Erlangen School. The dialogue concludes with "Psychology and Epistemology of Mathematics" and a basic declaration of the separateness of research on the "laws of thought" and research on logic. The missing link that would have allowed a closer intellectual agreement between Piaget and Beth was to come much later, with the "pragmatic turn" of logic. The semantic tableaus presented by Beth during the Geneva seminar on Genetic Epistemology and then within his discussion with Lorenzen[1] hold the key to his pragmatic insights.

1.2   Part II: "Epistemology, Context, Formalism"

The second part of the book is devoted to formal epistemology. Since Hintikka's seminal 1962 work *Knowledge and Belief,* the considerable development of epistemic and doxastic logics—mainly in such areas as computer science, economy, and game theory—has led them quite far from their original core area, namely a priori conceptual reasoning (a.k.a. philosophy). Epistemology, on the other hand, has remained relatively isolated from such technical developments. Since the early 2000s, however, a strong renewed interest in philosophical issues has been expressed by a number of prominent epistemic logicians (see Benthem 2006; Hendricks 2006). All the while, dynamic epistemic logic (DEL) has incorporated (modeled) concrete features of agent actions into the abstract framework of epistemic and doxastic logic. The overall picture of formal epistemology is now that of a lively discipline attempting eagerly to account for a more realistic, cognitively plausible conception of knowledge.

The papers in Part II show the distance that has been covered by contemporary epistemology since the original formulation of doxastic and epistemic logics half a century ago. Dynamics is concerned not only with epistemic and general actions but also with changes in context, especially conversational context. In addition to formulating his own specific conception, Lewis's contextualist perspective on knowledge corroborated a view reminiscent of what cognitive scientists had already begun stressing at the time: that knowledge was no longer to be apprehended from God's perspective but rather in relation to contexts of ascription, thereby bringing epistemology back down to a more worldly arena.

Whence the direct connection between Part II and this book's overall purpose. At the frontier between epistemology and pragmatics, different agents' roles in dialogue must be taken into account in order to provide finer-grained descriptions of real-life attitude ascriptions. A number of classical puzzles can be revisited in light

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[1]This correspondence will be published in a forthcoming volume.

of this new insight. The four papers collected here all reflect this new dynamic and more "concrete" trend in epistemology.

The first chapter, "Principles of Knowledge, Belief and Conditional Belief", by **Guillaume Aucher**, offers a sharp review of different axiomatic systems for knowledge and belief which have been proposed in the epistemic logic literature. The author thereby isolates and addresses a number of nagging problems that have helped shape the modern history of the logic of knowledge. The paper also investigates the conditions for the formal interdefinability of the two notions of belief and knowledge, and establishes that certain important and intricate principles for reasoning about knowledge can be derived from a set of intuitively simple interaction axioms relating knowledge and conditional belief.

In "Procedural Information and the Dynamics of Belief", **Eric Pacuit** offers an overview of recent advances in DEL and introduces the key ideas and definitions of the operations that dynamically alter agents' beliefs during social interaction. The paper focuses on *procedural information,* that is, information about the protocol specifying which of a number of options are feasible and permissible for the agents at any given moment. It also discusses the role played by this kind of information in situations of interaction and learning.

In "Reasoning About Knowledge in Context", **Franck Lihoreau** and **Manuel Rebuschi** propose a new semantics, based on the notion of *contextual models,* that makes it possible to express and compare—within a unique formal framework— different views on the roles of various notions of context in knowledge ascriptions. Skeptical and moderate invariantism, contextualism, and subject-sensitive invariantism are thus examined. A dynamic formalism is also proposed that offers new insights into a classical skeptical puzzle.

Finally, **Tomoyuki Yamada**'s chapter, "The Epistemic Closure Principle and the Assessment Sensitivity of Knowledge Attributions", addresses the debate between relativism and contextualism over the vexed issue of the semantics of knowledge ascriptions. The interest in relativism on this issue has recently been renewed by authors who defend the idea, championed by Macfarlane, of the assessment sensitivity of epistemic attributions, i.e., that their truth is somehow relative to the context of a "judge" or assessor rather than to the attributor's context. Yamada's paper challenges this notion with an argument grounded in new, alternative formulations of the principle of epistemic closure.

1.3 Part III: Reasoning in Interactive Context

Pure logic has been built up against the psycho-sociology of thought; Frege theorized its advent at the beginning of the twentieth century. In the present volume, the Beth-Piaget correspondence (pp. 45–93) bears witness to the solidity of that construction in the 1950s.

At the beginning of the twenty-first century however, the so-called "Wall of Frege", to use Van Benthem's evocative metaphor (Benthem 2008), was poised to

fall. A loyal cooperation without second thoughts could now replace the "armed peace" that had prevailed between logic as a "discipline of foundations" on the one hand and the human and social sciences as the study of empirical thought on the other. This collaboration was set to perfect a reconciliation that had begun around 1980. We recently re-examined this reconciliation (Trognon and Batt 2011) by following two special editions of the journal *Synthese*. A "mild" psychologism reconciling pure logic with the human and social sciences through the concept of "rational agency", with social psychology as an interface, may take the place of what has remained the rule until recently, namely antipsychologism, as driven by Hintikka for instance. Van Benthem asserts that "logic is of course not experimental, or even theoretical, psychology and it approaches human reasoning with purposes of its own. And a logical theory is not useless if people do not quite behave according to it. But the boundary is delicate. And I think the following should be obvious: if logical theory were *totally disjoint* from actual reasoning, it would be no use at all, for whatever purpose!" (Benthem 2008, p. 69). He goes on to say that " 'human behaviour' as brought to light by psychology is not just a set of protocol sentences in simple-minded experiments, but a hierarchy of description levels, ranging from plain observable facts to sophisticated higher-order description. Viewed that way, the fit with logical theory becomes much more plausible, in both directions" (Benthem 2008, p. 80).

The third part of our volume is meant as a step in the direction in which van Benthem and other logicians want to take their colleagues: the meeting point between logic and the human and social sciences.

Martine Batt and **Alain Trognon** portray the microgenesis of the solution to an arithmetic division problem by showing two children dialoguing in order to solve it. In their chapter "From Dialogue to Calculation", they employ the method of "interlocutory logic", which involves leveraging logical knowledge "controlled" by the progression of the dialogue. This allows them to precisely locate the turning point in the children's work and illustrate the representation of the division they accomplish in their dialogue, thus bringing to light an interlocutory model of representation achieved through experimental developmental psychology.

In "Dialogue of Rationalities: A Case Study" **Marcelo Dascal** demonstrates that human rationality is not reducible to "mathematical" rationality (or "hard" rationality). Rather, it coexists peacefully with soft rationality. These two rationalities complete each other due to the very features that distinguishes them in a dialogue of rationalities. Dascal discovers this theorization in the "Preliminary Discourse on the Conformity of Faith and Reason", which opens the *Essais de Theodicée* of Leibniz, whom he calls "perhaps *the* rationalist par excellence".

Finally, **Denis Vernant**'s proposal of a "logic of veridicality" will probably be very useful in research on inter-discourse and cooperative multi-agent dialogues. This logic now allows us to examine "the combining of different agents' veridictional actions in relation to the same proposal". Its principles are presented in the chapter entitled "Pragmatics of Veridicity".

1.4 Part IV: "Conversation, Pathology, Formalization"

The fourth part of the book focuses on research at the intersection between linguistics and psychology. For cognitive psychologists, studying subjects' effective reasoning through thought patterns in conversation (non-directed dialogue) is a natural way to pinpoint possible disorders. This is particularly the case in psychopathology, where surface deviances can reflect more or less profound dysfunction. Indeed, conversations are complex human activities involving a wide array of competences. Disorders can occur at any level, from phonetic recognition or syntactic competence to social interaction and logical capability.

Some linguists, on their end, have tried to account for the pragmatic features of dialogue using formal semantic tools. Among the main developments of the past few decades, after Lewis and Montague's attempts in the 1970s at formalizing (fragments of) natural language, there have been key achievements yielded by Hans Kamp's DRT (Discourse Representation Theory) (see Kamp and Reyle 1993). This formal framework, shaped to fit the dynamic aspects of discourse, was eventually subjected to several extensions in order to account for phenomena such as underspecification or presupposition as well as rhetorical links in monologue and dialogue. This is dealt with especially closely by Nicholas Asher and Alex Lascarides's (2003) SDRT (Segmented DRT), which opens up new prospects in both pragmatics and psycholinguistics.

Two of the papers in this part focus on linguistic issues, while the other two are concerned with the use of language analysis in psychopathology.

In the first chapter, "Modeling the Dynamic Effects of Discourse: Principles and Frameworks", **Maxime Amblard** and **Sylvain Pogodalla** offer an overview of various accounts of dynamic phenomena in linguistics, more particularly in formal natural language semantics. The authors introduce several phenomena, such as presupposition, anaphora and modal subordination, that challenge traditional truth-theoretical semantics. They then present several formalisms capable of handling these phenomena: DRT and SDRT as well as dynamic predicate logic and continuation semantics.

Jean Caelen and **Anne Xuereb**'s chapter, entitled "Dialogue Analysis: Pragmatic and Rhetorical Aspects", explores the pragmatic and rhetorical aspects of dialogue and dialogue interpretation. After a conceptual survey of the issue, they offer their analysis of a real-life conversation between a doctor and a patient. According to the authors, such analyses support their conception of dialogues as strategic games, i.e., as constituting a special kind of action-oriented practice grounded in a more general praxeology.

In "Investigating Discourse Specificities in Schizophrenic Disorders", **Michel Musiol** and **Frédéric Verhaegen** present a pragmatic and psychological framework used to account for schizophrenic discourse. They offer a rational background for this, from psychological and psychiatric viewpoints to more formal studies such

as that presented in the following paper. In their approach, the authors distinguish between several types of discontinuities occurring in conversations between a psychologist and a schizophrenic patient.

In the final chapter, "Using SDRT to Analyze Pathological Conversations", **Manuel Rebuschi**, **Maxime Amblard**, and **Michel Musiol** present ongoing research into the formalization of conversations between schizophrenic individuals and ordinary speakers. This work is based on the collection and transcription of empirical data and on informal pragmatic analyses performed by psychologists. Because significant irregularities are identified, the authors propose using SDRT to analyze and discuss the specific features of the extraordinary rationality exhibited by schizophrenic speakers, from the interpreter's point of view.

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