



The Philosophy and Science of Language

Interdisciplinary Perspectives

Edited by
Ryan M. Nefdt · Carita Klippi
Bart Karstens

palgrave
macmillan

The Philosophy and Science of Language

Ryan M. Nefdt • Carita Klippi
Bart Karstens
Editors

The Philosophy and Science of Language

Interdisciplinary Perspectives

palgrave
macmillan

Editors

Ryan M. Nefdt
Philosophy Department
University of Cape Town
Cape Town, South Africa

Bart Karstens
Science and Technology Studies
Rathenau Institute
The Hague, The Netherlands

Carita Klippi
Tampere University
Tampere, Finland

Laboratoire d'Histoire des Théories
Linguistiques (CNRS, Université
de Paris, Université Sorbonne Nouvelle)
Paris, France

ISBN 978-3-030-55437-8

ISBN 978-3-030-55438-5 (eBook)

<https://doi.org/10.1007/978-3-030-55438-5>

© The Editor(s) (if applicable) and The Author(s), under exclusive licence to Springer Nature Switzerland AG 2020

This work is subject to copyright. All rights are solely and exclusively licensed by the Publisher, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, reuse of illustrations, recitation, broadcasting, reproduction on microfilms or in any other physical way, and transmission or information storage and retrieval, electronic adaptation, computer software, or by similar or dissimilar methodology now known or hereafter developed.

The use of general descriptive names, registered names, trademarks, service marks, etc. in this publication does not imply, even in the absence of a specific statement, that such names are exempt from the relevant protective laws and regulations and therefore free for general use.

The publisher, the authors and the editors are safe to assume that the advice and information in this book are believed to be true and accurate at the date of publication. Neither the publisher nor the authors or the editors give a warranty, expressed or implied, with respect to the material contained herein or for any errors or omissions that may have been made. The publisher remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

This Palgrave Macmillan imprint is published by the registered company Springer Nature Switzerland AG. The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

Preface

While perhaps *all* fields of study have at some point in the course of their existence interacted with other disciplines and exchanged such things as theories, concepts, metaphors, methods, instruments and measurement systems, the extent to which this so-called epistemic transfer has occurred with respect to linguistics appears to be exceptional. In many cases, epistemic and methodological transfer with both the sciences *and* the humanities have been documented but the underlying philosophical issues have not always been adequately addressed. The present volume hopes, that by bringing a diverse set of scholars in a range of fields connected to the study of language, the important philosophical and interdisciplinary questions can be approached and new avenues for research developed.

The aim of this volume, therefore, is to find out how linguistics interacts with neighboring disciplines such as philology, literary studies, philosophy, logic, mathematics, computer science and the cognitive sciences. Questions of the mathematical foundations of the subject, the cognitive implications, and the historical connections take center stage throughout the volume. A number of chapters overlap in their objectives but each offers unique insight into the central questions under discussion.

We have also aimed at showcasing the work of academics from not only different areas of expertise but also varying positions from emerging scholars to more established figures in their respective fields across three continents. The result is a book that aims above all to interest any

student or advanced scholar who is connected in any way to the study of language and more broadly general questions of diachronic and cross-disciplinary interaction.

Cape Town, South Africa
Tampere, Finland
The Hague, The Netherlands

Ryan M. Nefdt
Carita Klippi
Bart Karstens

Contents

1 Introduction	1
<i>Ryan M. Nefdt, Carita Klippi, and Bart Karstens</i>	
Part I Linguistics and the Formal Sciences	11
2 The Complexities of Syntax	13
<i>Jaroslav Peregrin</i>	
3 Negation in Dedekind Orderings and the Logic of Reciprocity	43
<i>D. Terence Langendoen</i>	
4 Variations on Abstract Semantic Spaces	71
<i>Katrin Erk</i>	
5 Mathematical Transfers in Linguistics: A Dynamic Between Ethos and Formalization as a Process of Scientific Legitimization	101
<i>Adrien Mathy</i>	

Part II	Linguistics and the Natural Sciences	141
6	Scientific Realism and Linguistics: Two Stories of Scientific Progress <i>Johannes Woschitz</i>	143
7	Linguistic Change and Biological Evolution <i>Unni Leino, Kaj Syrjänen, and Outi Vesakoski</i>	179
8	Three Models for Linguistics: Newtonian Mechanics, Darwinism, Axiomatics <i>Esa Itkonen</i>	195
Part III	Linguistics and the Cognitive Sciences	213
9	The Role of Language in the Cognitive Sciences <i>Ryan M. Nefdt</i>	215
10	Linguistics and Brain Science: (Dis-) connections in Nineteenth Century Aphasiology <i>Els Elffers</i>	239
11	Epistemic Transfer Between Linguistics and Neuroscience: Problems and Prospects <i>Giosuè Baggio</i>	275
Part IV	Linguistics and the Humanities	309
12	Linguistics Meets Hermeneutics: Reading Early Greek Epistemological Texts <i>Anna Novokhatko</i>	311
13	On the History of Models in American Linguistics <i>Jacqueline Léon</i>	349

14 Poetics and the <i>life of language</i>: Disciplinary Transfer in the Guise of Metaphor	375
<i>Carita Klippi</i>	
15 Linguistics and Philosophy: Break Up Song	409
<i>Kate Hazel Stanton</i>	
Index	437

Notes on Contributors

Giosuè Baggio, Professor of Psycholinguistics at the Norwegian University of Science and Technology. In addition to publishing in linguistics, psycholinguistics and cognitive neuroscience, he is also the author of *Meaning in the Brain* (MIT Press, 2018).

Els Elffers, Retired Lecturer in Dutch Linguistics at the University of Amsterdam. She is widely published in foundations and history of linguistics and the semantics and pragmatics of Dutch.

Katrin Erk, Professor in the Linguistics Department at the University of Texas at Austin. Her work is in computational semantics and computational lexical semantics.

Esa Itkonen, Emeritus Professor of General Linguistics at the University of Turku. He is a renowned philosopher of linguistics and has published countless articles and chapters on linguistic metatheory over the past decades. He has published a number of influential books including *Grammatical Theory and Metascience* (John Benjamins, 1978), *Causality in linguistic theory* (Indiana University Press, 1983), *Universal History of Linguistics. India, China, Arabia, Europe* (John Benjamins, 1991) and *Analogy as Structure and Process* (John Benjamins, 2015).

Bart Karstens, is a research fellow at the Rathenau Institute in The Hague. Previously he worked as a postdoc at the University of Amsterdam on a long term history of the concepts of structure and structuralism. Other subjects that interest him are discipline formation, interdisciplinarity, the history of linguistics and evaluations of past science.

Carita Klippi, Senior lecturer of French, Tampere University, Finland, and a member of the laboratory Histoire des théories linguistiques in Paris. Her research is focused on the disciplinary transfer between natural history and linguistic ideas, and on the conceptualization of linguistic space in the history of dialectology. She is the author of *La vie du langage. La linguistique dynamique en France de 1864 à 1916* (ENS Éditions, 2010). She has also published on lower class writing during the First World War and is involved in the digital project of *Grand Corpus des grammaires françaises, des remarques et des traités sur la langue (XIVe-XVIIIe s.)*.

Unni Leino, Associate Professor in Finnish at Tampere University and Principal Investigator at the BEDLAN (Biological Evolution and Diversification of Languages) research initiative in Finland. Her research interests include onomastics, cognitive linguistics, computational linguistics – especially as related to language variation – and heraldry.

Jacqueline Léon, Emeritus Senior Researcher at CNRS, Laboratoire d'Histoire des Théories Linguistiques, UMR7597 (CNRS, Université de Paris, Université Sorbonne Nouvelle). She has published numerous articles and books on the history of linguistics, epistemic transfer in the language sciences and the stochastic side of formal linguistics, including *Histoire de l'automatisation des sciences du langage* (ENS Éditions, 2017).

Adrien Mathy, Researcher in Linguistics at the University of Liège. He works on mathematization in linguistics, discourse analysis and sociology of science.

Ryan M. Nefdt, Senior Lecturer in Philosophy, University of Cape Town. He is a visiting fellow at the Pittsburgh Center for the Philosophy of Science and has published mostly in the philosophy of linguistics and language. He is also one of the co-authors of the upcoming updated *Stanford Encyclopedia of Philosophy* entry on the philosophy of linguistics.

Anna Novokhatko, Associate Professor of Classical Philology at the Aristotle University Thessaloniki. Besides cognitive approaches to metaphor in Ancient texts, her research focuses on Ancient Greek drama, digital humanities and Latin and Ancient Greek linguistics. In her habilitation, she studied the development of textual scholarship in Archaic and Classical Greece. She is the author of *The Invectives of Sallust and Cicero: Critical Edition with Introduction, Translation, and Commentary* (De Gruyter, 2009) and the co-editor of a number of volumes.

Jaroslav Peregrin, Research Professor at the Department of Logic of the Institute of Philosophy of the Czech Academy of Sciences and Professor at the Faculty of Philosophy of the University of Hradec Králové, Czechia. He is the author of *Doing Worlds with Words* (Kluwer, 1995), *Meaning and Structure* (Ashgate, 2001), *Inferentialism* (Palgrave, 2014), *Reflective Equilibrium and the Principles of Logical Analysis* (together with V. Svoboda; Routledge, 2017) and *Philosophy of Logical Systems* (Routledge, 2000). His current research focuses on logical and philosophical aspects of *inferentialism* and on more general questions of normativity.

Kate Hazel Stanton, Assistant Professor of Philosophy and Linguistics at the University of Pittsburgh and Resident Fellow in the Pittsburgh Center for Philosophy of Science. She works in formal semantics, and her research lies at the intersection of linguistics and philosophy of language. She also works in cognitive science and computer science.

Kaj Syrjänen, Researcher in Finnish at Tampere University and member of the BEDLAN (Biological Evolution and Diversification of Languages) research initiative in Finland. His research areas are language change, computational linguistics, corpus linguistics, and linguistic datasets.

D. Terence Langendoen, Emeritus Professor of Linguistics at the University of Arizona and a former Program Director in Linguistics at the National Science Foundation. He was a faculty member in linguistics for over 40 years, teaching and doing research on a variety of problems in linguistic theory, phonology, morphology, syntax, semantics, pragmatics, psycholinguistics, and computational linguistics. He helped create the

General Ontology for Linguistic Description (GOLD) and is currently with the National Science Foundation as a part-time Expert in the Robust Intelligence program.

Outi Vesakoski, Researcher in Biology at the University of Turku and Principal Investigator at the BEDLAN (Biological Evolution and Diversification of Languages) research initiative in Finland. She works mainly within evolutionary biology, which includes a project about evolution of personality in marine isopods *Idotea balthica*, and especially sexual differences therein. She has published a number of articles and book chapters on or related to this work.

Johannes Woschitz, Researcher at the School of Philosophy, Psychology, and Language Sciences at the University of Edinburgh. He is currently involved in theoretical work related to the epistemic status of sociolinguistics. He addresses paradigm changes therein and questions of scientific progress by referring to principles of the philosophy of science, especially scientific realism. He has published various articles on the philosophy of science applied to generative and sociolinguistics.

List of Figures

Fig. 3.1	\succeq^f ordering of D_2^f	45
Fig. 3.2	\succeq^{b*} ordering of D_2^f	45
Fig. 3.3	Ordering of D_3 and D_3^b	49
Fig. 3.4	Ordering of Δ_3 and Δ_3^b	49
Fig. 3.5	Negation and d-negation in Δ_2 and Δ_2^b	52
Fig. 3.6	Ordering of $\neg\Delta_3$	53
Fig. 3.7	Ordering of $\neg\neg\Delta_3$	53
Fig. 3.8	Ordering of $\neg\neg\neg\Delta_3$	55
Fig. 3.9	Ordering of $\neg\neg\neg\neg\Delta_3$	55
Fig. 3.10	Ordering of $\Gamma_3^3 \cup \Gamma_3^1$ (lattice form)	56
Fig. 3.11	Ordering of $\Gamma_n^4 \cup \Gamma_n^2 \cup \Delta_n$ (lattice form)	58
Fig. 3.12	Ordering of the members of $\Gamma_n^5 \cup \Gamma_n^3 \cup \Gamma_n^1$ (lattice form)	59
Fig. 3.13	Ordering of $\Gamma_n^6 \cup \Gamma_n^4 \cup \Gamma_n^2 \cup \Delta_n$ (lattice form)	60
Fig. 3.14	$\Gamma_n \cup \Delta_z$ organized by left-edge growth of prefix μ ; length of prefix for given row is in leftmost column; number of distinct mappings for that row is in rightmost column	61
Fig. 3.15	Ordering of O_{3a}	62
Fig. 3.16	Ordering of O_{3c} and O_{3c}^b	64
Fig. 3.17	Ordering of O_{2a} and O_{2a}^b	65
Fig. 3.18	Ordering of O_{2b} and O_{2b}^b	66
Fig. 5.1	Scientific discourse	106
Fig. 5.2	Scientific discourse, mathematical formalization and writing	115
Fig. 5.3	The discourse duplication	132

Fig. 5.4	Produced ethos	135
Fig. 5.5	The dynamics of conceptual transfers in Culioli's work	136
Fig. 9.1	Gardner (1985) <i>The mind's new science</i>	228
Fig. 9.2	Intersectional approach	229
Fig. 14.1	Duck-rabbit (Jastrow 1899)	382
Fig. 14.2	Target is source	386
Fig. 14.3	Application of the causal theory of reference to the literal baptism of the life of language. (Klippi 2010, 45)	392

List of Tables

Table 3.1	Members of Δ_3 and some of their identifying English expressions	50
Table 3.2	Negation and d-negation in Δ_3 and Δ_3^b	53
Table 3.3	Members of Γ_3^1 showing that $\neg\Delta_3 \geq^o \neg\Delta_3$	54
Table 3.4	Ordering of $\Gamma_3^2 \cup \Delta_3$	55
Table 3.5	Ordering of the members of $\Gamma_3^3 \cup \Gamma_3^1$ (tabular form)	56
Table 3.6	Ordering of $\Gamma_3^4 \cup \Gamma_3^2 \cup \Delta_3$ (tabular form)	57
Table 3.7	Ordering of $\Gamma_3^5 \cup \Gamma_3^3 \cup \Gamma_3^1$ (tabular form)	59
Table 3.8	Ordering of $\Gamma_3^6 \cup \Gamma_3^4 \cup \Gamma_3^2 \cup \Delta_3$ (tabular form)	60
Table 3.9	Ordering of $\Omega_{3a}^5 \cup \Omega_{3a}^3 \cup \Omega_{3a}^1$ (tabular form)	63
Table 3.10	Ordering of $\Omega_{3a}^6 \cup \Omega_{3a}^4 \cup \Omega_{3a}^2 \cup O_{3a}$ (tabular form)	63
Table 3.11	Ordering of Ω_{3c} (tabular form)	64
Table 3.12	Ordering of Ω_{2a} (tabular form)	65
Table 3.13	Ordering of $\Omega_{2b}^3 \cup O_{2b}$ and $\Omega_{2b}^3 \cup \Omega_{2b}^1$ (tabular form)	66
Table 4.1	Illustration of a count-based semantic space: a small corpus (top left), the resulting table of context word counts (bottom), and a sketch of vectors and vector similarity in a semantic space	75
Table 4.2	Ten nearest neighbors of <i>thrifty</i> , <i>stingy</i> , <i>thriftiness</i> and <i>stinginess</i> in to a GLoVe model trained on Wikipedia and Gigaword	88
Table 10.1	Scheme of content of Steinthal’s chapter on aphasia	264



1

Introduction

Ryan M. Nefdt, Carita Klippi, and Bart Karstens

The philosophy and science of language are emerging multidisciplinary fields of investigation (Scholz et al. 2016; Kempson et al. 2012; Nefdt 2019). Driven by both the advancements in other fields and *sui generis* results, some internal and others external, the study of language has at times been a conduit to the study of the mind, brain, a lens into societal structure, literature and human history. It is therefore only fitting that a

R. M. Nefdt (✉)

Philosophy Department, University of Cape Town, Cape Town, South Africa
e-mail: ryan.nefdt@uct.ac.za

C. Klippi

Tampere University, Tampere, Finland

Laboratoire d'Histoire des Théories Linguistiques (CNRS, Université de Paris, Université Sorbonne Nouvelle), Paris, France

e-mail: carita.klippi@tuni.fi

B. Karstens

Science and Technology Studies, Rathenau Institute, The Hague,
The Netherlands

e-mail: b.karstens@rathenau.nl

full length volume be devoted to the disciplinary connections between linguistics and those fields both past and present. This volume aims to bring together a diverse set of scholars from around the disciplinary landscape to delve into questions related to the history, philosophy, and theoretical interplay between the study of language and fields as distant as logic, physics, biology, classical philology, and cognitive neuroscience.

As stated in the preface, all academic disciplines have at some point exchanged theories, concepts, metaphors, methods, instruments, etc. with other (proto-) disciplines in the course of their existence, the extent to which this so-called epistemic transfer has occurred with respect to the study of language appears to be exceptional. This has of course not gone unnoticed in the historiography of linguistics, and many cases of epistemic transfer with both the sciences and the humanities have been documented. Yet, the vast majority of these studies remain 'isolated', in the sense that they are not compared to other case studies of epistemic transfer, nor are they linked to each other where this would actually be both appropriate and insightful. The goal of the volume is to find out why and how linguistics exhibited the extraordinary capacity to interact frequently, and in many different ways, with other disciplines across the academic spectrum.

This volume of essays is additionally aimed at bringing together scholars from theoretical linguistics, history, classical studies, philosophy, logic, computer science, evolutionary theory and cognitive science in order to approach the study of language across these disciplines and beyond. The theoretical approaches in philosophy include experts from both the analytic and continental traditions.

With each chapter a new avenue of insights and critique are brought forth. From the philosophical side, what sets this volume apart from some recent work on the philosophy of linguistics such as Ludlow (2011) or Tomalin (2006) is the expansion of the linguistic frameworks under discussion. Although generative linguistics features prominently in a number of chapters (Chaps. 2, 3, 6, 9, and 13), sociolinguistics (Chap. 6), structuralism (Chaps. 11 and 13), neurolinguistics (Chap. 11), cognitive linguistics (Chap. 9), and computational linguistics (Chaps. 4 and 13) all receive due philosophical and historical treatment. Additionally, on a broader level, diachronic or historical linguistics is considered in

Chap. 7, Chap. 8 discusses linguistic metatheory, Chap. 5 scientific discourse analysis and Chap. 14 incorporates metaphor studies.

The multiplicity of phenomena often leads scientists of any particular discipline to seek unifying principles for their object of study. The nature of language presents such a multiplicity. A search for such unification could lead to an eternal pursuit of a theory of everything, which would give the ultimate explanation of the linguistic universe. However, a true integral and total linguistics is unrealistic. Instead of tempting a unified theory to apprehend the slippery character of language, interdisciplinary exchanges have provided, one at a time, different solutions to translate the essential substance of language.

The focus on epistemic transfer shifts the center of attention to what unites academic disciplines instead of what divides them. This shift is in tune with a trend in present-day historiography of science to break down barriers between academic fields. The term ‘science’ is perhaps already inappropriate, if with science we would exclude the humanities. ‘History of knowledge’ is more in spirit of moving beyond disciplinary categories, although this prompts the question of the difference between ‘scientific’ knowledge and other forms of knowledge such as practical skills and knowledge by acquaintance.

In various places it has been argued recently that the persistent notion of a divide between the sciences and humanities has to be seriously qualified for at least two reasons (Graff 2015, von Dongen and Paul 2017). First, the line of division has in the past been drawn in different ways and for different reasons. If these demarcations are a local construct we cannot speak of a fundamental divide between the sciences and humanities. Second, it can be demonstrated that the sciences and humanities shared ideas or even have common origins. This volume is a further contribution to the growing body of literature that supports this claim.

Historians of science have developed a number of concepts that can help us to study interdisciplinary interaction. Well-known are Thomas Gieryn’s idea of ‘boundary work’ and Peter Galison’s notion of ‘trading zone’ (Galison 1997). For Gieryn boundaries between disciplines are not permanent but are instead continuously negotiated during “boundary work” (Gieryn 1999). He concludes that disciplinary boundaries are porous: that is, boundary work may involve boundary crossing. Galison

has tried to capture the constant redrawing of boundaries between the instrumental, experimental and theoretical subdisciplines of physics, with the trading zone concept. The trading zone is a place of interaction in which a hybrid community seeks ways to communicate, often through new forms of interlanguage. Trading zones can thus be the springboard for new institutional structures and new categories of knowledge. To zoom in closer on what is actually transferred during disciplinary interaction the concept of ‘cognitive goods’ has recently been proposed (Bod et al. 2019). ‘Cognitive goods’ is an umbrella term intended to refer to anything that can be exchanged by practitioners i.e. methods, concepts, models, metaphors, formalisms, principles, modes of representation, argumentative and demonstrative techniques, technical instruments, institutional arrangements, and intellectual, theoretical, and epistemic virtues. The cognitive goods concept is meant to serve as a springboard for systematic analysis of ‘flows’ between disciplines which have occurred throughout the history of science.

What follows is a brief summary of each chapter grouped around four general broad themes, linguistics and the formal sciences, linguistics and the natural sciences, linguistics and the cognitive sciences and finally linguistics and the humanities.

1 Contributions to This Volume

Jaroslav Peregrin’s chapter entitled “Syntax and Semantics in Linguistics and Logic” launches an investigation into the very notion of syntactic form within formal linguistics and formal logic respectively. He details the nature of formal properties as it is applied within linguistic and mathematical logic settings while touching on issues of syntax in semantics, cognitive science, and AI. He argues that the concept of syntax has played a crucial role in the development of modern logic and linguistics. Despite this its definition is not unequivocal, especially in cases where no clarification is given as to which of its various senses is being employed at a given time. Peregrin takes pains to distinguish these senses and shows that doing so provides philosophical fecundity in a number of settings, both theoretical and applied in both logic and linguistics.

While Peregrin's chapter offers a high-level theoretical exploration of the very concept of syntax, D. Terence Langendoen in his "Negation of entities and a reanalysis of the logic of reciprocity" showcases the connection between logic and linguistics directly by providing a mathematical linguistic analysis of the syntax of negation and reciprocity in natural language. This is a highly technical work linking advanced concepts in mathematics (Dedekind orderings) to natural language phenomena, e.g. the logic of multiple negation to reciprocity. Langendoen's chapter presents novel results toward a novel conclusion taking formal structures and applying them to linguistic phenomena.

Katrin Erk's chapter "Variations on abstract semantic spaces" moves to an overview of the connections between linguistics and computer science by surveying the vast and technical landscape of lexical semantics. She discusses the various computational means of representing semantic space. Semantic spaces represent the meanings of words and phrases as objects in space. Her chapter concerns abstract semantic spaces which are formalisms that, in one way or another, make use of the idea of meaning as a space. Although a complete account which allows for inference to sentence meaning is still unclear, Erk presents promising computational research possibilities for this eventual extension.

Finally, to close off the linguistics and formal sciences theme, Adrien Mathy mounts an argument that the formalization and the mathematization of linguistics was accompanied by adhering to a specific scientific ethos that linguists actively sought to exemplify. Thus non-epistemological factors played an important role in the acceptance of concepts from foreign fields. Additionally, in his chapter "Mathematical transfers in linguistics: A dynamic between *ethos* and formalization as a process of scientific legitimization", Mathy proposes a case study on the mathematization of linguistics through a publication of Antoine Culioli, *La formalisation en linguistique* (1968). The article aims at showing that disciplinary transfer does not concern only the conceptual apparatus as such, but also the belief system, the author has chosen to call "ethos" (in the footsteps of the French tradition in rhetoric and discourse analysis).

The theme shifts to the connections with the natural sciences in Johannes Woschitz' chapter "Scientific realism and linguistics: Two stories of scientific progress". Here he draws on the scientific realism debate

in the philosophy of science to assess progress in two linguistic subdisciplines, namely Chomskyan syntax and the Labovian study of phonological change. He analyses the historical developments of Universal Grammar (UG) and Labov's internal factors as case studies. He then claims that the history shows continuity and similarity in development between these two disciplines, as in both cases epistemologically 'expensive' concepts have been challenged and re-theorized. Woschitz makes use of contemporary work on scientific models, realism, theory comparison and the Kuhnian sociology of science to put forward his picture of scientific continuity.

The next chapter by Unni Leino, Kaj Syrjänen and Outi Vesakoski "Linguistic change and biological evolution" explores the interaction between linguistics and biology, with specific focus on the analogy between linguistic change and biological evolution. They argue that general evolutionary meta-theories give support for finding and using similarities between biology and linguistics. But they caution that such general theories are often too general for the task of adapting specific tools from one field to another which requires detailed analysis of both fields. Nevertheless, they are optimistic that there exists between biology and linguistics, a network of functional similarities which extends from evolutionary biology and historical linguistics to population biology and dialectology/sociolinguistics.

Lastly, under this umbrella theme is Esa Itkonen's chapter "Three models for linguistics: Newtonian Mechanics, Darwinism, Axiomatics". In characteristic style, Itkonen discusses the history of three major influences on linguistics but goes further to ask the value-laden questions of whether or not these three particular influences, classical mechanics, Darwinism evolutionary theory and axiomatic logic have been beneficial, harmful, or irrelevant to its development. He suggests that axiomatics provided a better model for two specific desiderata of linguistic theory, systematization and causal explanation respectively, but outlines its weaknesses with relation to applied settings as well as provides a convincing case for why the other two major influences fail in terms of the aforementioned desiderata.

The next overarching theme concerns the relationship between linguistics and the cognitive sciences. The first chapter by Ryan M. Nefdt "The

Role of Language in the Cognitive Sciences” aims to present a case for why language and linguistics should retain a central role in the emerging Second Generation Cognitive Science. He provides a historical overview of the initial cognitive revolution in the late 1950s and the philosophical as well as historical reasons language occupied a leading position in the nascent interdisciplinary project before using architectural considerations to suggest that language still has much to offer the scientific study of the mind in the twenty-first century.

Els Elffers shifts the timeline back further to the relation between aphasiology and linguistics in the nineteenth century in her “Linguistics and brain science: (dis-) connections in 19th century aphasiology”. In her chapter, she presents a nuanced picture of nineteenth century interaction between linguistics and aphasiology. Unlike many of the other chapters in the volume which highlight interdisciplinary cross-pollination, Elffers asks why there was only minimal contact between these two disciplines at a time when there was scientific developments at their intersection. She pays special attention to Steinthal’s contribution to aphasiology. His chapter on language disorders has been referred to as a unique and promising example of interdisciplinary neurolinguistics-avant-la-lettre. She argues that although this is an overstatement, Steinthal’s text bears witness of psychological sophistication, but is not a programmatic plea for a new linguistically-informed approach to aphasiology. Her narrative is intriguing and aims to provide clues to historical interdisciplinary mysteries at the core of language studies and brain science in the nineteenth century.

Finally, Giosuè Baggio takes us back to trends of epistemic transfer in contemporary neurolinguistics with his chapter entitled “Epistemic transfer between linguistics and neuroscience: Problems and prospects”. This chapter focuses on cases of successful, partial, and failed unidirectional epistemic transfer between theoretical linguistics and neuroscience. He distinguishes between three types of transfer, depending on the nature of the linguistic knowledge involved: type-A knowledge, about language as such, essentially invariant across theories or formalisms; type-B knowledge, about alternative formal analyses of basic structures and operations in language; type-C knowledge, about the application of various computational methods to analyzing or modeling behavioral or neural data. He

argues that successful epistemic transfer may be achieved, under certain conditions, with type-A and type-C knowledge, but suggests that Type-B transfer has not led so far to new knowledge of the neural correlates and mechanisms of linguistic computation. He concludes that greater theoretical emphasis on algorithmic-level analyses, via a revised notion of linguistic competence and a new model of epistemic transfer, can bring formal linguistics and neuroscience closer together. He also discusses the possible role of a computationalist psycholinguistics as a ‘bridge science’, that could serve the aim of linking linguistics and neuroscience.

The final theme puts the connections between the human sciences and linguistic under the lens. Anna Novokhatko in her “Linguistics meets hermeneutics: reading early Greek epistemological texts” argues that the interaction between linguistics and philology is reciprocal and benefits both fields tremendously. She cautions that this connection can all too often be forgotten by formal/mathematical approaches, but her analysis of pre-classical Ancient Greek epistemological texts shows that there is hope for synthesis. Much like Langendoen’s chapter which provides both logical and linguistic analysis of particular constructions, Novokhatko analyzes the texts of Pindar, Theognis, Archilochus, Heraclitus, Xenophanes and many others. She advocates the position that analysis of formal structure may crucially hinge on content analysis (and vice versa).

Maintaining the historical textual analysis, Jacqueline Léon in her chapter “On the history of models in American linguistics” tracks the emergence of the term “model” through various epochs of modern formal linguistics. She argues that the use of the term stabilized with the Chomskyan paradigm but not before various detours and appropriations from formal logic, model theory, proof theory, and stochastic approaches such as Markov models. Her analysis shows more than a terminological issue in that it provides a glimpse into the evolution of the mathematical concept within linguistic practice.

Carita Klippi argues that metaphors can be understood as interdisciplinary vehicles, but also that they form an integral part of theory formation within scientific disciplines. She focuses on the metaphor of ‘life of language’ in the second half of nineteenth century linguistics and shows how this metaphor induced historicist and organicist theoretical linguistic conceptions, given rise to *diverging* notions of what kind of science linguistics actually is. Modes of validation of knowledge are not just

discipline specific, they may differ within the same discipline depending on diverging interpretations of the same metaphor.

Finally, Kate Hazel Stanton's chapter "Linguistics and Philosophy: Breakup Song" ends the book with a critical look at the future of the interaction between linguistics and philosophy. She reviews past successes and suggests that it was the undeveloped nature of linguistics at the time that accounted for most of them. She argues that despite rhetorical flourish and reflection on erstwhile interactions, there is now a growing methodological chasm between the disciplines. One that will ultimately hinder continued interdisciplinary interchange. Nonetheless, she concludes by considering some promising avenues for fruitful collaboration between the fields in the future.

References

- Bod, Rens, Jeroen Van Dongen, Bart Karstens, Sjang Ten Hagen, and Emma Mojet. 2019. The flow of cognitive goods: A historiographical framework for the study of epistemic transfer. *Isis* 110 (3): 483–496.
- Galison, Peter. 1997. *Image and logic: A material culture of microphysics*. Chicago: University of Chicago Press.
- Gieryn, Thomas. 1999. *Cultural boundaries of science: Credibility on the line*. Chicago: University of Chicago Press.
- Graff, Harvey. 2015. *Undisciplining knowledge: Interdisciplinarity in the twentieth century*. Baltimore: Johns Hopkins University Press.
- Kempson, Ruth, Timothy Fernando, and Nicholas Asher. 2012. *Philosophy of linguistics*. Oxford: North Holland/Elsevier B.V.
- Ludlow, Peter. 2011. *The philosophy of generative linguistics*. Oxford: Oxford University Press.
- Nefdt, Ryan. 2019. The philosophy of linguistics: Scientific underpinnings and methodological disputes. *Philosophy Compass* 14 (12): e12636.
- Scholz, Barbara C., Geoffrey K. Pullum, and Francis Jeffrey Pelletier. 2016. Philosophy of linguistics. In *The Stanford encyclopedia of philosophy*. <https://plato.stanford.edu/entries/linguistics>
- Tomalin, Marcus. 2006. *Linguistics and the formal sciences*. Cambridge: Cambridge University Press.
- van Dongen, Jeroen, and Herman Paul. 2017. *Epistemic virtues in the sciences and the humanities*. Cham: Springer Press.

Part I

Linguistics and the Formal Sciences



2

The Complexities of *Syntax*

Jaroslav Peregrin

1 What Is *Syntax*?

What is *syntax*? The primary sense of the word is usually explained as “the way in which linguistic elements (as words) are put together to form constituents (as phrases or clauses)” and “the part of grammar dealing with this” (this particular wording is taken from the Merriam-Webster Dictionary). This, of course, can be generalized to not necessarily linguistic systems, so that it becomes something as *the way in which elements of a constructional system are put together to form constituents*, where a *constructional system* is anything where some wholes are assembled out of some parts. (Merriam-Webster reflects this, I think not very successfully, by listing a second case of “a connected or orderly system: harmonious arrangement of parts or elements <the *syntax* of classical architecture>”).

Work on this paper was supported by the grant No. 20-18675S of the Czech Science Foundation.

J. Peregrin (✉)

Institute of Philosophy, Czech Academy of Sciences, Prague, Czech Republic

e-mail: peregrin@flu.cas.cz

© The Author(s) 2020

R. M. Nefdt et al. (eds.), *The Philosophy and Science of Language*,

https://doi.org/10.1007/978-3-030-55438-5_2

The term *syntax* comes from the Greek *syntaxis* (σύνταξις—“putting together, order or arrange”), which is a combination of the prefix *syn-* (σύν—“together”) with *taxis* (τάξις—“arrangement”). Note that *syntax* in this sense is always a matter of a *system* of items: it is about how items of the system are constructed from other items of the system (e.g. how expressions of a language are constructed from other expressions). It is obvious that an item may count as simple w.r.t. a system (like a word w.r.t. the system of expressions of English), while counting as complex with respect to another system (like the same word w.r.t. the system of all compounds of English letters).

The first treatise devoted to syntax as a linguistic discipline is almost as old as the term itself; it was written by the Greek scholar Apollonius Dyscolus under the telling title *Peri syntáxeos*. However, a systematic study of syntax is not older than some two centuries (Graffi 2001). In his path-breaking *Syntactic Structures* (1957), Chomsky writes:

Syntax is the study of the principles and processes by which sentences are constructed in particular languages. Syntactic investigation of a given language has as its goal the construction of a grammar; that can be viewed as a device of some sort for producing the sentences of the language under analysis.

In the context of modern linguistics, syntax is one part of linguistics, its other parts being semantics, morphology, phonetics etc. However, outside of the context of linguistics we can often encounter the simplified opposition syntax × semantics.

Probably the widest leakage of this mostly technical concept outside of the narrowly scientific circles is due to the philosopher John Searle: he used it to back up his claim that computers can never think, because, as Searle (1980) puts it, “the computer ... has a syntax but no semantics” (p. 423). This has been, since then, broadly accepted as a revelatory statement; and even many of those who did not quite agree with Searle, took this as an illuminating way of framing the discussion; and the framework is still widely accepted. However, independently of whether we agree with Searle or not, is the concept of syntax as he employs it the same—or similar—to that used by Chomsky and other linguists?

In the 1930's, the concept of syntax also moved to the center of discussions in logic, especially in connection with the path-breaking results of Gödel (1930, 1931). The logician who became famous by his painstaking analyses of the concept is Rudolf Carnap. What he was after was putting the concept of syntax, along with the concept of semantics, on firmer conceptual foundations, for he became aware that without this, it would be impossible to secure firm conceptual foundations for modern logic. In his *Introduction to Semantics* (Carnap 1942),¹ he famously divides the general theory of language, which he calls *semiotics*, into *syntax*, *semantics* and *pragmatics* as follows:

In an application of language, we may distinguish three chief factors, the speaker, the expression uttered, and the designatum of the expression, i. e. that to which the speaker intends to refer by the expression. In semiotics, the general theory of signs and languages, three fields are distinguished. An investigation of a language belongs to pragmatics if explicit reference to a speaker is made, it belongs to semantics, if designata but not speakers are referred to, it belongs to syntax, if neither speakers nor designata but only expressions are dealt with. (p. 8)

Again, it is not quite clear whether this explication of the concept is compatible with the ways it is handled by either Chomsky or Searle.

2 Syntactic Versus Formal Properties

While syntax, we saw, concentrates on “the way elements are put together to form constituents”, the opposition between syntax and semantics may lead to a broader construal of *syntax*, such that it encompasses all properties an expression has “by itself”, independently of what it may mean or designate, all its “internal” properties. (Semantic properties are then “external” ones, such that we have conferred on it to let it mean or designate something.) According to Carnap, syntax is a theory of *formal rules*

¹ Similar ideas can be found already in his earlier writings—viz., e.g., Carnap (1939). It is not without interest that, as was pointed out to me by A. Klev, Carnap (1932) uses the term *semantics* as a synonym for *logical syntax*. See Tuboly (2017) for a thorough discussion.

governing linguistic forms. In *The Logical Syntax of Language* (Carnap 1934), he explains the term *formal* as follows:

A theory, a rule, a definition, or the like is to be called *formal* when no reference is made in it either to the meaning of the symbols (for example, the words) or to the sense of the expressions (e.g. the sentences), but simply and solely to the kinds and order of the symbols from which the expressions are constructed. (p. 1)

Hence the concept of *formal* property is much broader than that of *syntactic* property as we have conceived of it up to now. The fact, however, is that the terms “syntactic” is often used, even by Carnap, in the sense of *formal*. Hence an important disambiguation—we must distinguish between the two possible senses of *syntactic* so that we keep using the term *syntactic* in the narrower sense and we engage the term *formal* for the broader sense.

Consider, for the sake of illustration, a “language” constituted by the following list of names:

Ann

Bob

Cynthia

John

Jill

Juliet

Rachel

In the terminology we have introduced, they do not have any (non-trivial²) *syntactic* properties (none of the names consists of other names on the list), but they have a lot of *formal* properties. They have, for example, various phonetic properties: some of them are, for instance, mono-syllabic. Or they consist of different numbers of letters.³ On the

²Of course, they all have the trivial property «to be simple, not to be composed of anything».

³Remember that the classification of a property as syntactic depends on what we take the system in question to be. If, for example, we took the list as a part of a more exclusive system containing also all the letters of the English alphabet, then the items would have a lot of properties that would be syntactic.