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Editors
Benedikt Löwe
Deniz Sarikaya

Logic and foundations of the exact sciences at the University of Konstanz: people & projects 1966–2021

Bernd Buldt

Department of Mathematical Sciences, Purdue University Fort Wayne, 2101 E. Coliseum Blvd., Fort Wayne IN 46805-1499, United States of America

E-mail: buldtb@pfw.edu

Three remarks and a disclaimer

Some remarks, I think, are in order before we begin.

(1) I decided to write in English at the off-chance that someone from outside the German-speaking countries may look at and scour this report for information. But to give it some fluency, I translated language that is tied to peculiarities of the German system of higher education quite freely.

German universities have traditionally been set up and operating in ways that are very different from other countries (e.g., the American tenure-track system). Faculty positions in Germany are internally known, and in their ramifications well understood, according to salary ranges: W1, W2, and W3 since 2002 and C1, C2, C3, and C4 before.[1]

Painting with a broad brush, we can say a W3 or C4 position is known as a chair (*Lehrstuhl*), its tenured incumbent is known as an *Ordinarius* or *Ordinaria*; the chair has its own administrative staff position(s) and one or more positions for postdoctoral academic staff who are assisting the chairholder. These assistant positions are untenured and fixed-term and used to be called *wissenschaftlicher Assistent* in the C-salary scales (until 2002). They are roughly the German equivalent of a tenure-track assistant professorship, except that they do not usually come with a path towards tenure. Chairholders wield a fair amount of power: the denomination of the chair gives its occupant (not the department) control over the curriculum in that field, they (not the department) hire their assistants, and they (not the department) accept and train their own graduate students. A W2 or C3 position, by contrast, is a tenured full professorship that comes with fewer of the perks. One innovation of the W-salary scales is that the holder of a W1 position is no longer an assistant to the chair, but a *Juniorprofessor*. These are non-tenured, fixed-term departmental professorial positions hired by a committee. In this article, we refer to researchers on both W1 and C1 positions, i.e., *Juniorprofessoren* and *Wissenschaftliche Assistenten* as

[1] We can ignore the former, post-war H-salary scales.

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"assistant professors"; all other postdoctoral academic staff is called "post-doc".

While in the American system, faculty normally rise through the ranks of assistant, associate, and full professor at the same university by promotion, the German system does not know academic promotions; the default is that an external job offers are required to go from a W1 to a W2 position and then again from a W2 to a W3 position as chair.

In what follows I shall ignore these differences according to salary and endowment and simply refer to anyone on a W3, C4, W2, or C3 position as "professor" unless the context requires me to be more specific. The German system also knows tenured faculty on positions that are not of considered professorial rank (e.g., *wissenschaftlicher Mitarbeiter*, *Akademischer Rat*, *Akademischer Oberrat* etc.). I refer to those as "lecturer".

The qualification required to serve on a student's graduation committee is the *venia legendi*, which is normally obtained at the end of one's time as *wissenschaftlicher Assistent* by earning a second post-graduate degree, the *Habilitation*. Thus, while many faculty may participate in the education of masters and doctoral students, not all will have an official say in the matter.

Finally, we follow the German custom and identify a university with the city it is in. For example, when we say 'professor X moved to Bochum,' we mean she accepted a position at the Ruhr-Universität Bochum; writing this out every time feels clunky. Note that we write "Konstanz" instead of "Constance;" the reason is that even those who hail from English-speaking countries almost always use the city's German name, not the English one.

(2) The report needs a modicum of structure. Thus, while I freely admit that drawing lines is highly arbitrary, I organized the report mainly by "era" (i. e., the tenure of faculty who hold a chair). This sounds a bit too pompous, and it probably is, but it does the job. In each of the sections, we structure the text by these chronological eras: for each era, we list in separate subsections first **People: their stories & their projects**, then **Teaching, research, students**, after that **Notable projects, conferences, & guests**, and finally **Selected publications**. In the list of publications, we only mention works that originated while their authors were in Konstanz and do not list items we already mentioned in the text. We prefer collections and books over journal articles and try to represent everyone involved.

(3) The overall emphasis of my report will be on logic and work on the foundations of the exact sciences insofar the latter employs formal methods or reflects on them. The limitation to the formal aspects is advised since work that was done in Konstanz on the foundations of the exact sciences in general is simply too rich and too multifaceted to be included *in toto*. People who made substantial and often sustained contributions to the philosophy of

the exact sciences, such as Michael Esfeld, Paul Hoyningen-Huene, Martin Carrier, Gertrude Hirsch Hadorn, David Hyder, Peter Janich, Klaus Mainzer, Johanna Seibt, Marcel Weber, Gereon Wolters, to name just a few, all held rank-and-file positions at the university but won't find much mention below. This still leaves the question what counts as logic or formal. The program of any recent *Colloquium Logicum* is certainly more inclusive than they were when the DVMLG met at Oberwolfach for their annual April meeting and held its general membership meeting there. For this report, I take guidance from recent meetings and include what I believe would be considered an appropriate topic for presentation; I admit that this is fuzzy and subjective.

(4) Finally, the disclaimer. I left Konstanz more than 15 years ago and moved too far away for a quick road trip to visit the university archives. So this report is primarily based on anecdotal evidence with little support from historical records or documents I could peruse. I sent inquiries to various witnesses of the time, and almost everyone was kind enough to answer in writing or to make time for an online meeting or a telephone interview. You know who you are: Thank you!!! But I could not close all gaps, nor is, as we all know, personal memory always a reliable source. I did my best to be a faithful chronicler. I also tried to balance the various sections, so that equitable weight is given to all players, and made serious efforts to find an appropriate mix of storytelling and adducing facts. The limitations I faced, however, are obvious; and I want them to be understood.

1 Introduction

The *Universität Konstanz*, like many other universities that sprang up around the same time in many countries around the globe, is the result of post-war, baby-boomer economic needs and began its operation in 1966. But it was conceived by the *Gründungsausschuss* (founding committee) as something special, namely, as a "reform university" (*Reformuniversität Konstanz*). Various moving pieces contributed to the idea of a reform university: an explicit focus on cutting-edge research; a commitment to Humboldt's idea of research-informed teaching where intimate seminars take the place of big lecture halls; an institution meant to be small (with just thirteen departments and without any of the engineering programs and no medical school) but elite ("Little Harvard on Lake Constance" was its nickname); the implementation of architectural as well as administrative structures aimed at fostering cooperation and rewarding creativity and innovation: an open architecture with a common hub of services (library, canteen) along with close physical proximity on a single shared campus was meant to facilitate contact across disciplinary borders while limited professional development monies should incentivize faculty to seek external grants.

We mention these points since they actually shaped how logic and philosophy of science were done. When it comes to logic, there was a fair amount of cooperation among linguists, mathematicians, and philosophers on campus but also with institutions nearby (notably, Freiburg, Stuttgart, Tübingen, and Zürich); cooperation with computer science seems more recent—computer science moved out of mathematics and became a department of its own in the academic year 1999/2000—and not frequent. There was a higher than average number of externally funded projects (e.g., the number of philosophy faculty funded by grant money easily dwarfed the number of regular faculty at any given point in time, while for linguistics it even meant more faculty than students, at least early on), and Konstanz saw international cooperations and guests whose numbers were out of proportion for its age or size. In regards to the foundations of the exact sciences it should be mentioned that philosophy of science has been part of the university's master plan before it even started its operation. The plan for a new, reform university had, in its early stage, included a proposal for what was called the *Interfakultät*. The idea was to have a certain pool of faculty members not form traditional departments in their disciplines of training (e.g., mathematics or philosophy) but to distribute them over the three main schools for which they would primarily offer service courses and, in case of philosophy, engage in a critical reflection of the disciplines housed in that school. The plan was not implemented, but its spirit lingered as we can observe on multiple occasions below.

2 Logic in linguistics

It may seem strange, but linguists did serious work in logic before everyone else did in Konstanz. The study of languages was institutionalized in a very peculiar form in Konstanz. It was split into two divisions: One was called 'literary studies' (*Literaturwissenschaften*), the other division was called 'linguistics' (*Sprachwissenschaften*). This was (except for Bielefeld) in stark contrast to any other university at the time, when the discipline was organized according to individual philologies (German, English, French, etc.) or language families (Romance languages, East-Asian languages, etc.). This design did not go back to the *Gründungsausschuss*, as rumor has it, but originated in the so-called 'Rhedaer Memorandum' which, born out of the spirit of the student unrest at the time, was an initiative to free philologies, and in particular German studies, from the shackles of the (Nazi) past. For Konstanz this meant that the study of language was much less siloed than at most of the other places.

Era von Stechow (and Beyond): 1969–2008

In respect to logic, the most consequential hire among first-generation faculty was Peter Hartmann (1923–1984; in Konstanz: 1969–1984). Hartmann

came to Konstanz as an accomplished linguist but of a very traditional mold and with no track record of using formal methods; his dissertation was on Japanese grammar (1950) and his habilitation on nominal phrases in Sanskrit (1953), both with Alfred Schmitt in Münster whose successor he had become. At the time, however, linguistics at Münster was known to be among the more progressive departments, and so Hartmann brought along Klaus Brockhaus (1933–2011) as his assistant professor, who in turn had Arnim von Stechow (born 1941) in his tow as a post-doc. Beyond the brains, they came with a shiny new journal to publish their research in: *Linguistische Berichte*, founded by Hartmann and von Stechow in 1969. Brockhaus had majored in mathematics before he turned to formal linguistics; his doctoral work was on Carnap's *Aufbau*, with Hans Hermes in Münster (1963), and his habilitation was on automatic translations (1969). When Brockhaus left Konstanz already two years later, his former student von Stechow, who had done his doctoral work on finite-state machines with him (Münster, 1969), succeeded him as Hartmann's assistant and got a tenured position in 1972 which he held for the next 20 years (until he moved to nearby Tübingen in 1992).

People: their stories & their projects. When von Stechow and Brockhaus started their work, formal semantics did not yet exist as a discipline; worse, Brockhaus called von Stechow's ideas "interesting, but totally absurd." Their first approach was axiomatic (and hence more syntactic than model-theoretic) and oblivious of the work done elsewhere. Then, in 1971, Yehoshua Bar-Hillel spent his sabbatical in Konstanz. He applauded their early work in formal semantics but recommended Montague, or, in von Stechow's recollections: "he said he had studied the thing Brockhaus and I had written, and he said it was ingenious and it had gone almost so [sic!] far as Montague, and I should read that." Another seminal influence was a conference, organized by Edward Keenan in Cambridge (1973), with, among others, Hans Kamp, George Lackoff, David Lewis, and Barbara Partee in attendance and giving talks. Von Stechow switched gears, shifted more towards model-theoretic means, and assembled a research group that was destined to become a German, if not European, center for Montagovian formal semantics. A student of von Stechow, Peter (Eberhard) Pause—the first linguistics PhD in Konstanz (1972, on the logical complexity of transformation rules)—stayed on until his retirement (1974–2002), and in 1978 they were joined by Urs Egli (1941–2018; in Konstanz: 1978–2006) who, for lack of better opportunity, had written his dissertation on Stoic logic (Bern, 1967) but followed his early interests (Carnap, Chomsky, Montague) in his habilitation (Bern, 1973). There was hence a core group of three early-career faculty, supported by Hartmann, who worked on various aspects of semantics using mathematical and logical tools. And they were ably supported by

gifted students. Those of their students who made a name for themselves in formal semantics or computational linguistics include—all earned their PhD in Konstanz except for Heim-Rainer Bäuerle (Stuttgart), Markus Egg (HU Berlin), Klaus von Heusinger (Cologne), Irene Heim (MIT), Angelika Kratzer (UMass), Uwe Mönnich (Tübingen), Wolfgang Sternefeldt (Tübingen), and (Thomas) Ede Zimmermann (Frankfurt). The latter's doctoral thesis on intensional type theory might very well be the shortest in recent memory, but it was von Stechow, not the candidate, who deemed 13 pages published in the *Journal of Symbolic Logic* (on an erroneous assumption undergirding Montague's work) sufficient.

It was a lucky conincidence that the DFG (*Deutsche Forschungsgemeinschaft*, the German Federal Research Agency) had identified linguistics as a focus area for special funding (*DFG Schwerpunktprogramm "Theoriebildung und Methodenentwicklung für die Linguistik"*, 1969–1974). In its context linguists at Konstanz established and received funding for their own special research area (SFB, *Sonderforschungsbereich*) which they called, somewhat pretentious it its simplicity: "linguistics." Internally it was known by its number: SFB 99. It ran from 1977 to 1985, and Hartmann served as its first speaker. But not only faculty at the rank of full professor, like Hartmann, or regular contributors such as Christoph Schwarze (Romance philology) were eligible to receive funding for individual projects within the SFB but also von Stechow and Egli, who at the time were not yet of professorial rank but on lecturer positions. (Egli's initial hire was actually a condition for receiving the SFB grant.) The SFB 99 continued under the title *Grammatik und sprachliche Prozesse* and was followed by the DFG-funded research group *Forschungsgruppe Theorie des Lexikons* (1986–1995), which led to another *Sonderforschungsbereich*: *Variation und Entwicklung im Lexikon* (SFB 471, 1997–2008), which also included individual projects by Egli (diachronic lexical semantics) and Pause (semantics of verbal phrases). Ample grant money allowed semanticists to organize international conferences which fostered international exchange and enabled them to stay at the cutting edge of their discipline; guests included Renate Bartsch, Max Cresswell, Hans Kamp, David Lewis, Terry Parsons, Barbara Partee, and Helmut Schnelle; Angelika Kratzer returned to Konstanz for conferences and Irene Heim as a Senior Fellow at the *Zukunftskolleg* (for which see § 5).

Their objects of study were all the more difficult topics that many instructors hide or gloss over when they teach first-order logic as the last word (quantifier behavior; (in)definite articles; nominal, verbal, and adverbial phrases; context sensitivity and anaphora; etc., you name it) and the tools they used were the usual suspects: formalized languages, automata theory, intensional and non-classical logics, type theory and λ-abstraction, as well as model-theoretic semantics. But they also conducted a quite detai-

led study of whether the ι- or ε-operator of Russell and Hilbert, respectively, had promise for linguistics.

A project in the history of logic also came out of linguistics. Within the SFB 99, Egli had acquired funding for a project on the influence of Stoic dialectics (i. e., Stoic logic, philosophy of language, and epistemology) on the development of linguistics and employed Hülser to work on it.

Karlheinz Hülser (born 1942) was uniquely qualified for the job: he had come to Konstanz to do his doctoral work with Friedrich Kambartel on Wittgenstein's *Tractatus* (1977) while he was simultaneously employed as a student worker in Greek Studies. He stayed in Konstanz for his entire career as a lecturer in philosophy. It soon became clear, however, that the project required much more reliable source materials than were available at the time. Hülser thus started work to amend the situation, work which became the monumental, 2,000-pages edition of all then-known fragments of Stoic logic: *Die Fragmente zur Dialektik der Stoiker* (1987–88; four volumes). As an external reviewer (G. Nuchelmans) stated it: "Mr. Hülser deserves ample admiration and gratitude for the perseverance and acumen with which he has brought a truly daunting enterprise to an end that will be an indispensable starting-point for any future worker in this thorny field."

This was the heyday of logic in linguistics (or, to be more specific, in formal semantics) where faculty and students lived the interdisciplinary dream envisioned by the *Gründungsausschuss*. They spent much time in the centrally located canteen and interrupted their discussions only for short visits to a nearby classroom to use one of the chalkboards. Students and faculty alike sat in on one another's classes whether it was linguistics, philosophy, or mathematical logic. Linguists Heim and Zimmermann, for example, got to know each other in a philosophy class taught by Gottfried Gabriel, while philosophers Gabriel and Pirmin Stekeler-Weithofer frequented not only events hosted by linguists (e.g., the SFB 99) but also by literary studies, in particular the *Forschergruppe Poetik and Hermeneutik*, a significant national research cooperation that Hans Robert Jauß had brought to Konstanz.[2] Linguists had their research colloquium, featuring both internal and external speakers, every Thursday from 4 to 6pm, and philosophers had theirs immediately afterwards from 6 to 8pm, so faculty went to both. (Mathematicians met for their colloquium Fridays at 5pm.) Faculty and students would mingle at private parties, go on annual department-wide hiking trips in the Alps (a custom followed by both Linguistics and Philosophy), face each other once a year for a soccer match ('don't foul Mittelstraß,' linguists cautioned one another, 'otherwise you might kill philosophy of science in Germany'), or rent an entire pub for a common graduation party. Angelika

[2]Some may argue it influenced how Gabriel and Stekeler-Weithofer thought and wrote about logic.

Kratzer recalls her formative years in Konstanz with the words: "it was pure Utopia—something that wasn't available anywhere else in Germany (or in the world)."

Internal cooperations. While the informal exchange was thick and frequent, the depth of formal cooperations differed. Gerhard Neubauer (1930–2003), who worked in functional analysis (operator theory in Banach spaces), was the first mathematician to join the new university, and he took an active interest in the education of students and curricular offerings. In the spirit of the original idea of the *Gründungsausschuss* to organize mathematics as part of the *Interfakultät*, he took it upon himself to teach the service course "Mathematics for Linguistics" when no one else volunteered. It was mostly automata theory. This changed, and it changed dramatically, when Ulf Friedrichsdorf got appointed to a permanent position as lecturer in the Department of Mathematics. He not only taught "Mathematical-logical foundations for linguists" on a regular basis during his entire time at the university, sometimes team-taught with Egli or another linguist, but would actively advise linguistics faculty on their projects and lend them his full support as a trained mathematician and logician. During the long time both held faculty positions, Friedrichsdorf and Egli team-taught classes on a wide variety of topics at the intersection of logic and linguistics, and they did it almost every semester, for a while joined by von Heusinger, and sometimes with other linguists. Topics included type theory, formal semantics, formal languages, and non-monotonic reasoning. For more than three decades Friedrichsdorf served as the logic hinge between linguistics and mathematics.

The same cannot be said for philosophy, at least not without further qualifications. People knew each other very well and talked to one another frequently, but they rarely committed to a formal cooperation. And if they did, then it did not require interdisciplinary work in the more narrow sense of two or more researchers with different disciplinary affiliations teaming up. (One could argue that this was not required since the project leads had the double competency needed to execute their projects without cross-disciplinary cooperation.) For example, philosophers had individual projects within a *Sonderforschungsbereich* run by linguists (e.g., Kambartel had one in SFB 99 and Wolfgang Spohn in SFB 471), but those do not look like integral parts of the bigger project. This began to change when the philosopher-linguists Kamp (who took over from Zimmermann) and Ulrike Haas-Spohn had individual projects in the *Forschungsgruppe* "Logic in Philosophy," and turned into a true collaboration with the *Forschungsgruppe* "What if," where Konstanz linguists Maribel Romero, Riccardo Nicolosi, and Maria Biezma not only each had their own project but also worked closely with their counterparts in philosophy. In closing we should mention that Egli and Hubert Schleichert (philosophy) co-authored a bibliography on erotetic logic for a volume edited by Nuel D. Belnap.

Selected publications.

Bäuerle, R., Egli, U., and von Stechow, A. (eds). *Semantics from Different Points of View* (= Springer Series in Language and Communication; 6), Berlin: Springer (1979).

Bäuerle, R., Schwarze, Ch., and von Stechow, A. (eds). *Meaning, Use and Interpretation of Language* (= Foundations of Communication and Cognition 6), Berlin: De Gruyter (1983).

Brockhaus, K. and von Stechow, A. "On formal semantics: a new approach," in: *Linguistische Berichte*, 11 (1971), pp. 7–36.

Brockhaus, K. and von Stechow, A. "Mathematische Verfahren in der Linguistik," in: *Grundriß der Literatur- und Sprachwissenschaft, Vol. II: Sprachwissenschaft*, ed. H. L. Arnold and V. Sinemus, Munich: dtv (1973), pp. 61–90.

Cresswell, M. and von Stechow, A. "De re belief generalized," in: *Linguistics and Philosophy*, 5 (1982), pp. 503–535.

Egli, U., Pause, P., Schwarze, Ch., von Stechow, A., and Wienold, G. (eds). *Lexical Knowledge in the Organisation of Language* (= Current Issues in Linguistic Theory; 114), Amsterdam: Benjamins (1995).

Kratzer, A., Pause, E., and von Stechow, A. *Einführung in Theorie und Anwendung der generativen Syntax*, Frankfurt: Athenäum (1974).

Schepping, M. and von Stechow, A. (eds). *Fortschritte in der Semantik. Ergebnisse aus dem Sonderforschungsbereich 99 „Grammatik und sprachliche Prozesse"der Universität Konstanz*, Weinheim: VCH (1988).

von Stechow, A., and Wunderlich, D. (eds). *Semantik. Ein internationales Handbuch zeitgenössischer Forschung*, Berlin: De Gruyter (1991).[3]

3 Logic in philosophy

It is not entirely clear how the *Gründungsausschuss* arrived at the decisions they made. Joachim Ritter (1903–1974), for example, then a philosopher at the University of Münster, was a representative of traditional German philosophy and advocated for its traditional place in a university, while people around the eminent sociologist Ralf Dahrendorf (1929–2009) envisioned "eine Nicht-Hegelische Universität ... in der die Philosophische Fakultät im Hintergrund steht, wenn es sie überhaupt gibt"[4] and instead championed the empirical sciences which included a critical reflection on their own methodology. No matter the differences, the founding committee considered

[3]Many papers can be found in the journal *Linguistische Berichte* or were published in the pre-print series *Arbeitsberichte der Fachgruppe Sprachwissenschaft*, partially available online at the university's institutional repository.

[4]Translation: "a non-Hegelian university in which the humanities play a minor role or no role at all".

the mathematician-turned-philosopher Paul Lorenzen to be their first choice for filling a faculty line in philosophy. But some were afraid he would not be up to the administrative challenges, so another mathematician-turned-philosopher, but twenty years younger, was offered the job: Friedrich Kambartel. He came to Konstanz in 1968. This made him founding professor (*Gründungsprofessor*) and gave him some sway over the final design of the various schools and programs as well as a say in the filling of other faculty lines. Kambartel thus had a voice in the hire of Jürgen Mittelstraß in 1970, a voice both had when Peter Janich was recruited in 1973. Three faculty lines of the first generation had thus been filled with people who affiliated themselves with the Erlangen school of philosophy.

On one hand, this was good news as far as logic was concerned. It meant that logic would play a prominent role in philosophy from day one. After all, the book by Kamlah and Lorenzen, *Logical Propaedeutics. A Rational Speech Primer* (*Logische Propädeutik. Vorschule des vernünftigen Redens*, 1967, ^{2}1972)—widely considered the manifesto of the Erlangen School—had made quite a splash at the time. On the other hand, it spelled doom for some, for it was not clear whether logic in Konstanz would be in the shackles of an opinionated and idiosyncratic philosophy. This concern was somewhat unfounded and turned out to be true only to a certain and dwindling extent; traditional (i. e., non-formal) philosophical logic actually flourished.

In respect to modern, formal logic, the only viable alternative to the Erlangen School at the time was the Munich school of Wolfgang Stegmüller who taught logic and the philosophy of science like analytic philosophers did elsewhere in the world. And slowly Munich took over Konstanz. The initial agent of change was Peter Schroeder-Heister. He facilitated the hiring of André Fuhrmann, a product of St Andrews and Australian National University, and of Hans Rott, a former doctoral student of Stegmüller in Munich, but who had been advised by Wolfgang Spohn. Three logicians, none of them an Erlangen faithful, were now working in the department. Six years after Rott, in 1996, Spohn joined faculty ranks at Konstanz. And while he was more than a logician, he was also that. His first slate of hires added four more: Bernd Buldt, Volker Halbach, Holger Sturm, and Max Urchs. Seven logicians working in the same department (Schroeder-Heister had moved to nearby Tübingen): that was unprecedented. And even when their number fluctuated and eventually dropped in subsequent years, philosophical logic, both formal and non-formal, thrived for the next 25 years. And the department built on that strength when they hired Leon Horsten, more a logician than anything else, as Spohn's successor.

One more remark. The denomination of the three chairs in philosophy was reminiscent of the original idea, discussed by members of the *Gründungsausschuss*, not to have a stand-alone philosophy department but

to make philosophy part of the *Interfakultät* and, consequently, to assign one chair to each of the three disciplinary clusters (i. e., natural sciences, social sciences, and humanities) and task their holders with the critical reflection of both methods and basic assumptions specific for the disciplines in that cluster. The denominations thus read "professor of philosophy, with special emphasis on the philosophy of the exact sciences," or "... the social sciences" and "... the humanities," respectively. These position were filled with Kambartel (in Konstanz: 1968–1993), Albrecht Wellmer (in Konstanz: 1974–1990), and Mittelstraß (in Konstanz: 1970–2005). Wellmer had habilitated with Jürgen Habermas in Frankfurt and was hence seen as a proponent of the Frankfurt School or Critical Theory. The Frankfurt School and the Erlangen School had a common target that united them at the time: an uncritical, affirmative positivism. To some extent, they were allies.[5] This gave philosophy in Konstanz, whose sole focus was on the philosophy of science, a coherence that was absent from any other philosophy department in Germany at the time where diversification, not concentration, was regarded paramount.

Era Kambartel & Mittelstraß: 1970–2009

People: their stories & their projects. Friedrich Kambartel (1935–2022) had earned a doctoral degree in mathematics (in complex analysis, *Funktionentheorie*, to be more specific) with Heinrich Behnke in Münster (1960) before he obtained his habilitation in philosophy (published in 1968 as *Erfahrung und Struktur*). He joined the University of Konstanz in 1968 but left for Frankfurt in 1993 (after Jürgen Habermas had convinced the state department of education to flout their own rules in order to make the job offer possible). In his work on topics like rationality or the foundations of modern science he emphasized the role of both practical reason and—possibly an influence of Ritter—culture: reason is not a free-floating entity but present only in its cultural manifestations.

Jürgen Mittelstraß (born 1935) completed both his doctoral work (1961, published 1962, *Die Rettung der Phänomene*) and his habilitation (1968, published 1970, *Neuzeit und Aufklärung*) in Erlangen, from where he came to Konstanz in 1970. He initiated, and became director of, the *Zentrum Philosophie und Wissenschaftstheorie* in 1990 and retired in 2005. Mittelstraß was stupendously productive and worked on many topics in the philosophy of science, broadly conceived (not to mention his extensive service as a government consultant), but one focal point that permeates his work is the Erlangen emphasis on *praxis*: science and its rationality is a certain way of

[5] Kambartel recalls not without a sense of pride that it was he and Mittelstraß who drafted and then promoted the 'Manifesto of the One-Hundred,' that is, the declaration against the Federal anti-radical decree (*Radikalenerlass*) signed by one hundred professors.

living (*Lebensform*), or doing things, which can then be used to argue for, defend, and justify it. But, going beyond Kamlah and Lorenzen, he pursued it in a post-Kuhnian way.

Peter Janich (1942–2016) obtained his doctoral degree with Paul Lorenzen (1969: *Protophysik der Zeit*). His research agenda was to continue his doctoral work and to provide all of the sciences with their respective protosciences; in other words, his goal was to identify a set of orthopractices—a collection of pre-scientific, artisan technical and measurement skills—that lend meaning to the basic vocabulary of the corresponding science and would thus define and justify in a non-circular way the fundamental concepts of that science. This made him the most hard-nosed representative of the Erlangen School in Konstanz when he started in 1973.

All three shared a normative orientation, which led to some tensions when they attempted to evangelize students and colleagues and preach the gospel of Erlangen constructivism. But Kambartel and Mittelstraß grew mild(er) over the years, and Janich left in 1980 which meant that, by and large, efforts to use formal methods left with him. So we skip the further development. But all three were strong supporters of logic, and Kambartel and Mittelstraß, who stayed on, fostered logic, each in their own but complementary ways, as we will show now.

Kambartel brought important editorial projects to Konstanz: Frege's posthumous works, Bolzano's *Collected Works* as well as the subject editorship for logic, philosophy of language, analytic philosophy, and the history and philosophy of science of the magistral "Historical Dictionary of Philosophy" (*Historisches Wörterbuch der Philosophie*, 1971–2007, in 12+1 volumes, on 8,736 pages or 17,144 columns). It is curious that it was Ritter in Münster who encouraged Kambartel to pick up the slack and continue work on Frege's *Nachlass*, which lay abandoned since Scholz's death in 1956. Kambartel *et al.* published Frege's 'Posthumous Writings' in 1969 (^{2}1983) and his 'Correspondence' in 1976. His long-term collaborator, Gabriel, would bring two of the historical projects to a good ending: more of Frege's posthumous works (diary, lecture notes) as well the Historical Dictionary.

Kambartel had brought along his student Gottfried Gabriel (born 1943) in order to receive his continued assistance with the edition of Frege's posthumous works. Gabriel earned his PhD (it was the third doctoral degree conferred in Philosophy) with an essay on definition in 1972 (published as *Definitionen und Interessen*), while his habilitation thesis in 1975 was on the semantics of fictional speech (*Fiktion und Wahrheit*, 1975, rev. ^{2}2019). It was an outcome of his broad interests that included not only Frege (cue: *ungerade Rede*) but also what was done next door where the program in literary studies was running the special interest group *Poetik und Hermeneutik*. Gabriel continued to be a voice in the history of logic; e.g., he edited

and re-issued Lotze's *Logik* and worked on early Analytic Philosophy. He stayed in Konstanz until 1992 and then went first to Bochum and three years later to Jena.

Another project in the history of logic, while close to Kambartel, came out of linguistics and was mentioned already: Hülser's *Die Fragmente zur Dialektik der Stoiker*. While it soon became clear that there were obvious analogies between Stoic logic and Frege—Hülser recalls that he convinced Kambartel and Gabriel during hallway discussions in the winter semester 1981/82—it took three more decades to find the missing links and build a compelling case that some of Frege's views might indeed have been informed by Stoic ideas (see *History and Philosophy of Logic* 30:4 (2009), 369ff.).

What also deserves mention in the context of the history of logic is the *Philosophisches Archiv*. It started in 1978 as a modest effort by Gereon Wolters to collect historically important papers from Hugo Dingler's widow. The reason was that Dingler (1881–1954) was considered a forerunner of Erlangen ideas on proto-science. More acquisitions followed, skillfully negotiated by its now director, Wolters; and with institutional support by Mittelstraß, the *Dingler-Archiv* became the *Philosophisches Archiv* in 1985.

Gereon Wolters (born 1944) did his doctoral work on the axiomatic method in Johann Heinrich Lambert (1977) and his habilitation thesis on Ernst Mach (1985), both advised or promoted by Mittelstraß. Wolters became a tenured professor in Konstanz, working as a philosopher of science (particularly biology) and serving as the long-term director of the *Archiv* even beyond his retirement in 2009.

Facilitated by the personal relationships Mittelstraß had established with faculty at the Center for the Philosophy of Science in Pittsburgh (he had declined UPitt's offer in 1975) and his richly flowing grant money (among others, he was awarded the Leibniz Prize in 1989), a formal cooperation agreement was signed to the effect that the *Philosophisches Archiv* and the Archives for Scientific Philosophy in Pittsburgh share digital copies of their respective archival holdings. European researchers have thus gained access to the literary estates of eminent scholars like Oskar Becker, Rudolf Carnap, Bruno de Finetti, Kurt Gödel, Georg Kreisel, Paul Lorenzen, Frank P. Ramsey, or Ludwig Wittgenstein, among others.

Mittelstraß had been a student of Kamlah in Erlangen, not of Lorenzen, but the importance of logic was nevertheless part of his academic DNA. This shows clearly in the "Encyclopedia of Philosophy and Philosophy of Science" (*Enzyklopädie Philosophie und Wissenschaftstheorie*) which he shepherded through two editions (1980–1996, in four vols; 2nd edition, 2005–2018, in eight vols) and which covers logic to such an extent that it doubles as a comprehensive logic dictionary. And the fact that it includes person articles makes it even more useful, since logicians, from Aristotle to Zermelo, each have their own entry.

But Mittelstraß was also instrumental in bringing contemporary philosophical logic to Konstanz. In 1988 he launched, with ample funding by the state of Baden-Württemberg, the Center for Philosophy and Philosophy of Science (*Zentrum Philosophie und Wissenschaftstheorie*) as a campus-wide unit whose mission was to continue and revivify the idea of the *Gründungsausschuss*, namely, the idea of philosophy being integrated into the various sciences in its role of critically reflecting on their foundations and methodology. Peter Schroeder-Heister, first hired by Wolters to assist with the *Dingler-Archiv* and who in the meantime had become a close collaborator of Mittelstraß, recommended to include new or emerging fields such as computer science and artificial intelligence to the description of the Center's profile and advised him to open new faculty lines to applicants beyond the Erlangen school; Mittelstraß did both. This brought not only Martin Carrier to Konstanz, but also André Fuhrmann and Hans Rott; Schroeder-Heister thus doubled the number of formal logicians before he left.

Peter Schroeder-Heister (born 1953) had studied for a teaching degree (*Staatsexamen*) in mathematics and philosophy at the University of Bonn (1977) and was hired a year later by Wolters to work on the Dingler project. While in Konstanz, he was pursuing his doctoral work on proof theory, later accepted by Gisbert Hasenjäger in Bonn and—due to the most helpful intervention of Prestel—Dag Prawitz in Stockholm as external reader: *Untersuchungen zur regellogischen Deutung von Aussagenverknüpfungen* (1981). He worked in Konstanz on various logic-related topics, both historical and proof-theoretic, and obtained his habilitation in 1988, before he left for Tübingen in 1989 and became the face of proof-theoretic semantics.

Hans Rott (born 1959) earned his doctorate in Logic and Philosophy of Science in Munich, officially with Wolfgang Stegmüller but actually advised by Wolfgang Spohn: *Reduktion und Revision. Aspekte des nichtmonotonen Theorienwandels* (1989) and worked for a year with Kamp in Stuttgart, before Mittelstraß offered him a position in Konstanz (1990–1997). His habilitation thesis was *Making Up One's Mind. Foundations, Coherence, Nonmonotonicity* (1997). Soon after he joined the University of Amsterdam (1997–1999) but moved back to Germany and has been at the University of Regensburg since 1999. Formal theories of belief change was the topic he concerned himself with mostly during his Konstanz years.

André Fuhrmann (born 1958) had completed his MPhil at St. Andrews (1984) and his PhD at the Australian National University, *Relevant Logics, Modal Logics, and Theory Change* (1988), with Richard Sylvan (Routley), J. J. C. Smart, and Neil Tennant as his committee, before Schroeder-Heister brought him to Konstanz in 1989, where he obtained his habilitation with an *An Essay on Contraction* in 1995 and stayed on as lecturer and Heisen-

berg Fellow until 2002. He went to São Paulo (2002–2006) and has been in Frankfurt since 2006. During his time in Konstanz his research was mostly on non-classical logics and formal theories of belief change. He and Rott cooperated closely on the latter topic and were at the cutting edge of the field, recognized internationally for their contributions. They were joint recipients of the Heinz Maier-Leibnitz Prize in 1996.

Another cooperation came about by sheer serendipity. Luc Bovens had come to Konstanz on a Humboldt fellowship for the academic year 1998/99 with the plan to immerse himself in probability theory. During that year, he made some contact with Spohn and his group (see the section on the *Era Spohn*) but was assigned an office in the Mittelstraß area, namely, the office of his host, Fuhrmann, who was on sabbatical. This led to a chance encounter with his next door neighbor, Stephan Hartmann. Bovens inquired about Hartmann's interests and, upon learning about the other's background, he asked him for help to work through an introductory text on Bayesian networks. Hartmann, more interested in naturalized philosophy of science at the time, reluctantly agreed, and they ended up meeting regularly to study the theory of Bayesian networks and to further explore their potential. The real collaboration, however, got going only after Bovens had left Konstanz. It led to an avalanche of co-authored papers, a co-directed research group (PPM, see § 5.1), and catapulted the two to the forefront of contemporary Bayesianism.

Stephan Hartmann (born 1968) studied physics and philosophy in Giessen (MS Physics, 1991; PhD in Philosophy in 1995 with Bernulf Kanitscheider: *Metaphysics and Method*). Concurrently with his doctoral work in philosophy, he was pursuing a PhD in physics (with Jürgen Audretsch, Konstanz, and later with Axel Schenzle, Ludwig-Maximilians-Universität München, LMU) when Mittelstraß hired him as an assistant professor in 1998. He left Konstanz for a position at the London School of Economics (LSE) in 2004 and moved to Tilburg in 2007 (where he founded the Tilburg Center for Logic and Philosophy of Science, TiLPS)). Since 2012 he has been professor of philosophy of science at LMU and co-director of the Munich Center for Mathematical Philosophy (MCMP), which Hannes Leitgeb founded in 2010.

Finally, we should mention Pirmin Stekeler-Weithofer (born 1952), since 1992 professor in Leipzig. He was considered something like a whiz kid, moving freely and competently between mathematics, philosophy, and linguistics, and did his initial work on Erlangen home turf: logic and mathematics. This brought him into conflict with his teachers; Kambartel, whose protégé he was, called him a "doubtful case" (*unsicherer Kandidat*), and Janich actually tried to obstruct his habilitation. As doctoral work, Stekeler-Weithofer conducted a critical investigation into key components

of a formal logic (concepts, truth-functors, inference rules) whose results clashed with the game-theoretic Erlangen orthodoxy (1984, published 1986 as *Systeme der Logik. Eine Kritik der formalen Vernunft*), while in his habilitation thesis he developed his own take on a philosophy of mathematics (1987, published 2008 as *Formen der Anschauung. Eine Philosophie der Mathematik*), where he defended the primacy of geometry as a basis for mathematical thinking but severely criticized the proto-geometric program of the Erlangen School.

Teaching, research, students. Past schedules of classes do not seem to bear it out, but institutional memory has it that the logic education had been in the hands of Schleichert. Hubert Schleichert (1935–2020) had obtained both his doctoral degree (1957) and habilitation (1968) with Béla Juhos at the University of Vienna.[6] Schleichert became a professor in 1973 and was considered the logical positivist in the department.[7]

The course "Logical Propaedeutics," initially taught according to the eponymous book by Kamlah and Lorenzen, was mandatory for all majors and was followed by one or two courses called "Formal Logic." Typically, instructors would mention results like completeness but not prove them in class.[8] In addition to these introductory classes, Kambartel, Gabriel, and Hülser, quite regularly offered classes on Frege and other topics in history of logic, and occasionally other faculty (e.g., Mainzer) did as well. The Erlangen version of a game-theoretic justification of logical rules obviously played some role—e.g., Kambartel lectured on it—but it took a back seat as time went by. An exception was a brief teaching stint by Gerrit Haas who held a limited-term position after his MA with Lorenzen and before he started doctoral work with Christian Thiel in Aachen. He was excited about mathematical logic and metamathematics, presented full proofs in class, and was able to spread his enthusiasm; Stekeler-Weithofer recalls him as someone who inspired him.

Most research done by the people close to Mittelstraß and Kambartel was not related to logic, and to the extent it was, we briefly mentioned it in the preceding section as part of the thumbnail biographies.

Dissertations advised by the Kambartel-Mittelstraß circle which fall into the scope of the DVMLG include (here we list topics rather that titles and

[6] Juhos was a student of Schlick and, with Victor Kraft, what was left of the Vienna Circle in post-war Vienna. Juhos was also very briefly, from 1 April 1971 to his death on 27 May 1971, a member of the DVMLG; cf. B. Löwe, *Die Mitgliederentwicklung in der Frühzeit der DVMLG*, in this volume.

[7] This was not without irony since his position was for the history of philosophy; so he offered lecture courses on Nietzsche that drew big crowds from across campus but also taught Chinese Philosophy.

[8] This did not really change until Rott and Fuhrmann, and then Spohn's people, taught these (and other) classes.

do not repeat those we already mentioned above): Carlos Pereda (argumentation, 1974), Wolfgang Kemnitz (subjective probability, 1976), Karlheinz Hülser (early Wittgenstein, 1977), Peter Georgi (Greek mathematics, 1989), Alexander Rüger (quantum field theory, 1989), Fernando Augusto da Rocha Rodrigues (propositions and objects, 1990), Ursula Klein (emergence of chemistry, 1993), Edgar da Rocha Marques (Wittgenstein, 1995), Wolfgang Kienzler (late Wittgenstein, 1995), Mechthild Jäger (constructivism, 1997), Ulrich-Ekkehard Sauter (quantum mechanics, 1998), Veiko Palge (quantum mechanics, 2006). Wellmer served as primary advisor of Maeve Cooke (formal pragmatics, 1989), and two more dissertations in the philosophy of the exact sciences were advised by Paul Hoyningen-Huene: Marcel Weber (theory of evolution, 1996) and Insok Ko (thermodynamics, 1997).

Notable projects, conferences, & guests. We noted already major editorial projects—e.g., Frege's posthumous works or the *Enzyklopädie Philosophie und Wissenschaftstheorie*—as well as significant institutional projects: the *Philosophical Archive* or the *Zentrum Philosophie und Wissenschaftstheorie*. But the cooperation between Konstanz and Pittsburgh did not only bolster archival holdings at both institutions (see above) but also furthered the exchange among philosophers of science in the two countries via a series of conferences, the so-called "Pittsburgh–Konstanz Colloquium in the Philosophy of Science." The Conference met every two years, alternated between Konstanz and Pittsburgh, and the proceedings were published with the University of Pittsburgh Press; it fizzled out when those whose personal friendships had sustained it retired. Other international conferences were in the area of research by Fuhrmann and Rott: "The Logic of Theory Change" (October, 1989) organized by Fuhrmann and Michael Morreau (Tübingen, now Tromsø); "LogIn—Konstanz Colloquium in Logic and Information" (October, 1992), organized by Fuhrmann and Rott. Rott and Sven Ove Hansson (Uppsala, now Stockholm) coordinated a joint research project, funded by the DAAD, "Wissensrevision / Belief revision" (1993–1996), that involved 13 researchers from the universities of Konstanz, Leipzig, Lund, Saarbrücken, Umeå, and Uppsala.

Obviously, the Mittelstraß group saw many international guests and visitors; nearly everyone who had a name in analytic philosophy or the philosophy of science passed through Konstanz at least once to give a talk. A special role, however, was played by Fuhrmann. He capitalized on his education at international centers of logical research, groomed his professional network, and brought many scholars to Konstanz for an extended stay. This is how Luc Bovens, for example, came to Konstanz; Fuhrmann had met him at the annual Czech workshop *Logica*. Other names that may ring a bell among members of the DVMLG and who came for extended stays include George Boolos (MIT), Gabriella Crocco (Paris, now Marseille), Mic Det-

lefsen (Notre Dame), Michael Friedman (Indiana U, now Stanford), Kosta Došen (Belgrade), Andreas Herzig (Toulouse), Jean-Pierre Marquis (Montreal), Ingolf Max (Leipzig), David McCarty (Indiana U), Kazuyuki Nomoto (Tokyo), Francesco Paoli (Cagliari), Jaroslav Peregrin (Prague), Uwe Scheffler (Dresden), Tomasz Skura (Zielona Góra), Igor Urbas (Canberra, then Madrid), and Max Urchs (Leipzig). It seems the Mittelstraß group did what they could to help logicians from East Germany to weather the changes the German reunification had brought about.

Selected publications.

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Fuhrmann, A. "When hyperpropositions meet," in: *Journal of Philosophical Logic*, 28:6 (1999), pp. 559–574.

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Fuhrmann, A. and Rott, H. (eds). *Logic, Action, and Information. Essays on Logic in Philosophy and Artificial Intelligence*, Berlin: De Gruyter (1996).

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Gethmann-Siefert, A. and Mittelstraß, J. (eds). *Die Philosophie und die Wissenschaften. Zum Werk Oskar Beckers*, München: Fink (2002).

Heinzmann, G. and Wolters, G. (eds). *Paul Lorenzen – Mathematician and Logician* (= Logic, Epistemology, and the Unity of Science; 51), Cham: Springer (2021).

Mittelstraß, J. (ed.). *Paul Lorenzen und die konstruktive Philosophie*, Münster: Mentis (2016).

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Rott, H. "Belief contraction in the context of the general theory of rational choice," in: *Journal of Symbolic Logic*, 58 (1993), pp. 1426–1450.

Rott, H. "Preferential belief change using generalized epistemic entrenchment," in: *Journal of Logic, Language and Information*, 1:1 (1992), pp. 45–78.

Rott, H. *Change, Choice and Inference: A Study of Belief Revision and Nonmonotonic Reasoning* (= Oxford Logic Guides; 41), Oxford: Oxford UP (2001).

Schroeder-Heister, P. "The completeness of intuitionistic logic with respect to a validity concept based on an inversion principle," in: *Journal of Philosophical Logic*, 12 (1983), pp. 359–377.

Schroeder-Heister, P. "Popper's theory of deductive inference and the concept of a logical constant," in: *History and Philosophy of Logic*, 5 (1984), pp. 79–110.

Schroeder-Heister, P. "A natural extension of natural deduction," in: *Journal of Symbolic Logic*, 49 (1984), pp. 1284-1300.

Era Spohn: 1996–2018

People: their stories & their projects. As far as logic is concerned, the hiring of Wolfgang Spohn was considered a game changer. This is curious for the following reason. Spohn hailed from Munich, where he did doctoral work on the conceptual foundations of decision theory (Munich 1976, published in 1978 as *Grundlagen der Entscheidungstheorie*) and developed a theory of causality in his habilitation (Munich, 1983), which already contained the foundations of a new, non-classical theory of probability (the theory of ranking functions), developed to better suit philosophical needs (e.g., when it comes to modeling the dynamics of belief change). Thus, when he joined the department, he came as a recognized expert in decision and probability theory and their ramifications for philosophy, and in particular the philosophy of science and formal epistemology, and few will have known that his unpublished master's thesis had been devoted to deontic logic, of which a single published paper bore witness compared to the roughly two dozen articles he had published in the former field before he came to Konstanz. But, being a student of Wolfgang Stegmüller and seen by many as his rightful heir, he was considered a logician. And he did not disappoint. While he continued research along his own lines, he promoted and supported logic in all its shapes and forms, whether historical, philosophical, or mathematical. Moreover, logical research now had a mentor who himself was very well-versed in its mathematics as well as in its philosophical aspects. Finally, he was able to direct research also in the cognate fields of formal linguistics, where he had a peer in his wife, Ulrike Haas-Spohn, who was a philosopher-linguist and had studied, among others, with von Stechow.

But this was not the only change Spohn's arrival in Konstanz ushered in. First, Kambartel and Mittelstraß framed rationality and logic as resulting from and being embedded in cultural practices, with language being one among other practices. Broad historical considerations therefore played a prominent role. For Spohn, however, the medium in which rationality expresses itself was just language; not the language spoken by warm bodies enmeshed in a specific culture, mind you, but the de-historized stripped-down—'sanitized,' if you will—language of formal linguists and analytic philosophers. Regardless of whether one embraces or rejects such a reduction in complexity, it is a prerequisite for bringing the tools of mathematics and formal logic to the task and thus helps explain the increase in formal studies during Spohn's tenure. Second, Konstanz–Erlangen philosophy of science was mostly a national discourse; parochial in its decision to publish the majority of its books and articles in German. Analytic philosophy represented by Spohn was international and spoke English. Last but not least, funding went to a lesser degree to individuals to bolster their institutional standing but rather to support teamwork and cooperation. All in all, it was a different style of doing philosophy.

From his previous position in Bielefeld, Spohn brought along Bernd Buldt (in Konstanz: 1996–2002 & 2004–2006)—who had done his doctoral work on Gödel (*Die Sätze von Gödel. Logische und philosophische Perspektiven*, Bochum, 1991, supervised by Gert König and with Jürgen von Kempski, one of the founding members of the DVMLG, in the wings) but shifted his attention to the philosophy of mathematics and the history of probabilistic reasoning during his years in Konstanz—and filled his second line with Volker Halbach (in Konstanz: 1997–2004) who, building on his dissertation (*Tarski-Hierarchien*, Munich 1994), established himself as a recognized authority on formal theories of truth during his time in Konstanz. They were soon joined by Sturm and Urchs. Holger Sturm (in Konstanz: 1997–1998 & 2003–2013), who had worked on infinitary polymodal logics for his PhD (*Modale Fragmente von* $\mathscr{L}_{\omega\omega}$ *und* $\mathscr{L}_{\omega_1\omega}$, Munich, 1997), moved from research in computer science logics via a study of properties to a general account of meaning, while Max Urchs (in Konstanz: 1998–2005)—whose concurrent job at the University of Szczecin (Poland) could not support a family—continued work on non-classical logics (Jaśkowski systems of deduction, temporal and causal logic), work he had begun in his PhD ("Systems with J-Implications Based on Multidimensional Modal Calculi," Copernicus University, Toruń, 1982) and his habilitation ("Causal Logic," Leipzig, 1987).

Spohn's initial slate of hires were thus all logicians. Other junior researchers Spohn put on faculty lines were not primarily logicians but reflect the wide spectrum of analytic philosophy that he stood for and whose work

still falls in the broad range of topics covered by the DVMLG: Ludwig Fahrbach (in Konstanz: 2001–2003) worked on Bayesianism, Wolfgang Freitag (in Konstanz: 2005–2012) on epistemology, Gordian Haas (in Konstanz: 2001–2003) on belief revision, Manfred Kupffer (in Konstanz: 1997–1998 & 2003–2004) on counterparts (i. e., Lewisian metaphysics), and Tobias Henschen (in Konstanz: 2013–2018) on causality (in economics). The exception to these later hires is Alexandra Zinke (in Konstanz: 2013–2017). She was not only the only woman but worked on logic more narrowly defined and wrote her dissertation on the concept of logical consequence, work she continued later.

Beyond faculty lines tied to Spohn's endowment as chair, there were also a number of affiliated positions and/or researchers funded by research grants. Those who stayed for an extended period of time include Olsson, Merin, and Raidl.

Erik J. Olsson (in Konstanz: 1997–2003), had done his doctoral work on belief change with Sven Ove Hansson in Uppsala (1997), was part of the research group "Logic in Philosophy" (see page 73), and worked mostly on coherence and belief revision. After very productive years in Konstanz, he returned to Sweden (Uppsala, 2001; Lund, 2007).

Arthur Merin (in Konstanz: 1999–2014), who had done his PhD in Cambridge and died prematurely in 2019, straddled the borders between logic, decision theory, and formal semantics in various projects over a 15-year period.

Eric Raidl (in Konstanz: 2012–2018) worked on two projects: first as a member of the French-German cooperation "Causality and Probability", then as part of the research group "What if?" (see pages 74). He wrote his dissertation supervised by Jacques Dubucs and Spohn at Paris I–Sorbonne, *Probabilité, Invariance et Objectivité* (2014). He completed his habilitation *Conditional(s)* in Konstanz (2021) and started working on epistemology and the logics of Machine Learning in Tübingen (2019).

Early career faculty with shorter employment include Christoph Fehige, Manfred Kupffer, Franz Huber, Michael Baumgartner, Luke Fenton-Glynn, and Niels Olsen; their projects are mentioned below. Frank Zenker (in Konstanz: 2015–2017) had written a dissertation on belief revision (with Ulrich Gähde in Hamburg, 2007, and Olsson as external reader) and worked on his own project: "Conceptual Spaces, Reasoning, and Argumentation," funded by the Volkswagen Foundation. In addition to Zenker, Spohn also served as a host for two fellows at the *Zukunftskolleg*: Huber and Antos (see §§ 5.2 & 5.5).

Many of those who were hired by Spohn or were in his orbit obtained permanent faculty positions later: Baumgartner (Bergen, 2017), Buldt (Purdue, 2006), Fehige (Saarbrücken, 2008), Fenton-Glynn (UCL, 2013), Freitag

(Freiburg, 2012, then Mannheim, 2018), Haas (Bayreuth, 2011), Halbach (Oxford, 2004), Huber (Toronto, 2013), Olsson (Uppsala, 2001, then Lund, 2007), Sturm (Saarbrücken, 2013), Urchs (EBS Business School, 2006), Zenker (Lund, 2014), and Zinke (Frankfurt, 2022).

Teaching, research, students. Spohn and his collaborators offered the usual slate of lecture classes and seminars in analytic philosophy and continued teaching courses that were already on the books: "Logical Propaedeutics" and "Formal Logic I+II." What they added were introductions to set theory, mathematical logic, recursion theory, proof theory, provability logic and other modal or non-classical logics, formal theories of truth, game theory, and probability theory, all of which, while pegged towards an audience of philosophers, were taught to more rigorous standards and with an emphasis on proof. Classes on more advanced topics such as Rosser sentences, admissible sets and structures, or paradoxes were offered for a mixed audience and team-taught with Friedrichsdorf. Over many semesters, Buldt, Halbach, and Friedrichsdorf ran a team-taught seminar on various topics at the intersection of logic and the philosophy of mathematics, while Sturm and Friedrichsdorf did the same later when they cooperated on a theory of properties.

Spohn was fluent in all of analytic philosophy, so there was little that was not represented by some graduate or post-graduate student affiliated with his chair. Areas of concentration that fall into the scope of the DVMLG were four clusters: (i) probability theory (Bayesianism, belief revision, ranking functions); (ii) philosophy of the exact sciences (causality, philosophy of mathematics, philosophy of physics); (iii) logic (modal and non-classical logics, theories of truth and meaning); (iv) philosophy of language (formal semantics, counterfactuals). It is fair to say (I hope) that Konstanz gained a national, if not international reputation, for research in all four areas during Spohn's tenure as chair. He was given the Lakatos Award in 2012 and awarded the Frege Prize in 2015 for a reason. We move a more detailed account of these four clusters to the section on notable projects.

Dissertation and habilitation theses that fall into the scope of the DVMLG include (we do not reproduce exact titles but list topics): Lucas Amiras (protogeometry, 1999), Manfred Kupffer (counterparts, 2000), Ludwig Fahrbach (Bayesianism, 2000), Marion Ledwig (Newcomb's problem, 2000), Jacob Rosenthal (probabilities as propensities, 2002), Radu Dudau (realism/antirealism, 2002), Gordian Haas (theory change, 2003), Wolfgang Freitag (formal philosophy, 2005), Stefano Bigliardi (ranking functions, 2008), Stefan Hohenadel (belief networks, 2012), Benjamin Bewersdorf (belief revision, 2012), Alexandra Zinke (logical consequence, 2013), Robert Michels (modality, Geneva, 2013), Niels Skorgaard-Olsen (ranking theory, 2014), Eric Raidl (probability, 2014), Anna-Maria Eder (rationality, 2018),

Ali Zolfagharian (suspending judgment, 2020), Arno Goebel (if-constructions, 2020); Christopher von Bülow (structuralism, tbd); habilitations include: Michael Esfeld (holism in quantum mechanics, 2000), Volker Halbach (deflationism, 2001), Bernd Buldt (19th century probability, 2003), Erik J. Olsson (coherence, 2003), Wolfgang Freitag (theory of knowledge, 2010), Holger Sturm (theories of meaning, 2010), Gordian Haas (verificationism, Bayreuth, 2011), Tobias Henschen (causality in macroeconomics, 2017), and Eric Raidl (conditionals, 2021).

Notable projects, conferences, & guests. The first in a series of major collaborative research efforts that characterized Spohn's time as chair was the *Forschungsgruppe* (research group) "Logic in Philosophy" (1997–2003). It was Schroeder-Heister in Tübingen who had first conceived of it and had made preliminary plans, but when Spohn came to nearby Konstanz, they joined forces; the philosopher-linguist Kamp entered from Stuttgart at halftime, taking over from Zimmermann. The research group was funded by the DFG, and it was the first of its kind in philosophy, blazing a trail for how to conduct philosophy in a cooperative style. It ran for a total of six years (1997–2003) with a third-year review when some projects were renewed, some were not, while a few new ones were added. The initial subdivision and their individual projects were as follows (we list the PI after the semicolon):

(1) Logic and Epistemology:

   (i) Believing as deciding (Konstanz: Fuhrmann, Olsson; Rott);

   (ii) Coherence theories of knowledge (Konstanz: Fahrbach, Halbach; Spohn);

   (iii) Logical form of belief ascription (Stuttgart-Tübingen: Robert van Rooij, later: Haas-Spohn; Zimmermann)

(2) Logic and Metaphysics:

   (i) Necessity, logic, individuation (Konstanz: Wolfgang Benkewitz; Spohn)

(3) Basic Logical Concepts:

   (i) Truth and reflection (Tübingen: Walter Hoering);

   (ii) Proof-theoretic semantics (Tübingen: Reinhard Kahle, Patrizio Contu; Schroeder-Heister).

The three projects that failed to attract funding (by Buldt, Friedrichsdorf–Fuhrmann, and Hoering) were too mathematical, it seems. Projects that were added at halftime were: (i) Cognitive and referential aspects of concepts (Stuttgart-Konstanz: Haas-Spohn; Kamp); (ii) The semantic conception of

the a priori (Stuttgart-Konstanz: Kupffer; Kamp, Spohn); (iii) a structural theory of properties (Konstanz: Sturm; Friedrichsdorf). The group produced 120 preprints, and about the same number of publications; moreover, group members organized about 15 workshops and conferences, twelve of which met in Konstanz.

Equaling in size, but, as members moved to other places, distributed over more locations than the first *Forschungsgruppe*, was the DFG-funded research group "What if?" (2012–2019). Its first phase was concerned with the epistemology and scientific relevance of counterfactual statements and thought experiments (2012–2015), while its second phase also included pragmatic, psychological, and cultural aspects of counterfactual thinking (2015–2019). It was mostly a collaboration among linguists (Maria Biezma, Riccardo Nicolosi (München), Maribel Romero) and philosophers (Bernhard Kleeberg (Erfurt), Thomas Müller, Tobias Rosefeldt (Berlin), Spohn, Marcel Weber (Geneva), Paul Ziche (Utrecht)) and one psychologist (Eva Rafetseder (Stirling)). It comprised the following individual projects that fall into DVMLG territory (we paraphrase some of the titles): (i) Conditionality, counterfactuality, and information transfer (Eric Raidl, Merin; Spohn); (ii) Semantics and pragmatics of counterfactuals (Eva Csipak, David Krassnig, Brian Leahy, Andreas Walker; Romero); (iii) Counterfactual knowledge and imagination (Daniel Dohr; Rosefeldt); (iv) Counterfactual thought experiments in the sciences (Julian Bauer; Kleeberg); (v) Alternatives for the future (Hadil Karawani, Antje Rumberg; Müller); (vi) Conditionals in discourse (Biezma); (vii) Instituting and contesting scientific openness (Ziche; Spohn); (viii) Simulation in neuroscience (Weber). The research group published close to 50 peer-reviewed articles and organized about 25 conferences and workshop, half of which met in Konstanz.

Research cooperations at a smaller scale or with less DVMLG-related topics include the following. The *Sonderforschungsbereich Entwicklung und Variation im Lexikon* (1997–2008), was another one that came out of linguistics, this time with Aditi Lahiri as speaker (Frans Plank took over when she left for Oxford in 2007), and with 41 individual projects it was a massive undertaking. Spohn participated with a project to bring decision-theoretic semantics to bear on questions of conceptual content (Benkewitz, Merin; Spohn). It was a continuation of a project, funded by the Thyssen Foundation, on the relevance theory of meaning (1999–2001, Merin; Spohn). The French-German cooperation "Causality and Probability" (2009–2012), cosponsored by the ANR and DFG, was co-led by Jacques Dubucs (Paris). Participating researchers were Anouk Barberousse, Isabelle Drouet, Philippe Huneman, and Max Kistler in Paris as well as Michael Baumgartner, Lorenzo Casini, Luke Glynn, and Eric Raidl in Konstanz. Topics of investigation were (i) actual causation, (ii) counterfactual accounts of causation,

(iii) multi-level causation, and (iv) the objective reality of causation. The cooperation produced close to 40 peer-reviewed publications and organized five conferences or workshops, two of which met at Konstanz. The two projects "Reflexive Rationality: A Theory of Dynamic Choice," and "Reason Relations, Argumentation, and Conditionals: Applying Ranking Theory to Psychology of Reasoning" (2014–2017) were part of the first and second phases, respectively, of the national *DFG Schwerpunktprogramm* "New Frameworks of Rationality" (2011–2019), whose speaker was Markus Knauff (Gießen). Niels Skovgaard-Olsen collaborated with Spohn on both projects. A late outcome of this national cooperation was the *Handbook of Rationality* (2021), edited by Knauff and Spohn, which attempts to be, with 65 chapters in 15 sections on almost 1,000 pages, alarmingly comprehensive. Still ongoing is "Reflexive Decision and Game Theory" (2020–2025), a DFG-funded Koselleck Project. Its goal is to re-evaluate and hopefully transform the very basis on which contemporary game and decision theory have been erected, especially in respect to their normative role (what is rational behavior?). Current post-docs are Gerard Rothfus (PhD, Irvine, 2020) and Mantas Radzvilas (PhD, LSE, 2016), while İrem Portakal (TU Munich) and Bernd Sturmfels (MPI Leipzig) serve as associate members.

Projects and conferences from within Spohn's group but without his direct involvement include "Truth, Necessity and Provability" (1999), an international workshop in Leuven organized by Leon Horsten and Halbach; "Philosophy of Mathematics: Sociological Aspects and Mathematical Practice" (2006-2010), a DFG-funded international research network, initiated by Benedikt Löwe and Thomas Müller, with Buldt as a founding member; "Rudolf Carnap" (2006) an international workshop at GAP.6, organized by Steve Awodey and Buldt; "Towards a New Epistemology of Mathematics" (2006), an international workshop at GAP.6, organized by Buldt, Löwe, and Müller.

The Spohn group saw many international guests at their conferences, but not so many stayed for an extended period of time; those who did include Steve Awodey (Carnegie Mellon University), André Carus (Chicago, now Munich), and David McCarty (Indiana U).

Selected publications.

Baumgartner, M. and Glynn, L. (eds). *Actual causation*, Suppl. 1 to *Erkenntnis*, 78 (2013).

Buldt, B., Halbach, V., and Kahle, R. (eds). *Reflections on Frege and Hilbert*, special issue of *Synthese*, 147:1 (2005).

Buldt, B., Löwe, B., and Müller, Th. (eds). *Towards a New Epistemology of Mathematics*, special issue of *Erkenntnis*, 68:3 (2008).

Esfeld, M., Ledwig, M., and Spohn, W. (eds). *Current Issues in Causation*, Paderborn: Mentis (2001).

Freitag, W., Rott, H., Sturm, H., and Zinke, A. (eds). *Von Rang und Namen. Philosophical Essays in Honour of Wolfgang Spohn*, Paderborn: Mentis (2016).

Freitag, W. and Zinke, A. "The theory of form logic," in: *Logic and Logical Philosophy*, 21 (2012), pp. 363–389.

Fuhrmann, A. and Olsson, E. (eds). *Pragmatisch denken*, Frankfurt: Ontos (2004).

Haas-Spohn, U. (ed.). *Intentionalität zwischen Subjektivität und Weltbezug*, Paderborn: Mentis (2003).

Halbach, V. (ed). *Methods for Investigating Self-Referential Truth*, special issue of *Studia Logica*, 68:1 (2001).

Halbach, V. and Olsson, E. (eds). *Coherence and Dynamics of Belief*, special issue of *Erkenntnis*, 50 (1999).

Halbach, V. and Horsten, L. (eds). *Principles of Truth*, Frankfurt; Hänsel-Hohenhausen (2002); Frankfurt: Ontos (^{2}2004).

Hinzen, W. and Rott, H. (eds). *Belief and Meaning – Essays at the Interface*, Frankfurt: Hänsel-Hohenhausen (2002).

Horák, V. and Rott, H. (eds). *Possibility and Reality – Metaphysics and Logic*, Frankfurt: Ontos (2003).

Kahle, R. and Schroeder-Heister, P. (eds). *Proof-Theoretic Semantics*, special issue of *Synthese*, 148:3 (2006).

Kahle, R., Stärk R., and Schroeder-Heister, P. (eds). *Proof Theory in Computer Science* (= Lecture Notes in Computer Science; 2183), Berlin: Springer (2001).

Olsson, E. J. (ed.). *The Epistemology of Keith Lehrer*, Dordrecht: Kluwer (2003).

Olsson, E. J. (ed.). *Belief Revision*, special issue of *Studia Logica*, 73:2 (2003).

Olsson, E. (ed.). *Knowledge and Inquiry: Essays on the Pragmatism of Isaac Levi* (= Cambridge Studies in Probability, Induction and Decision Theory), Cambridge: Cambridge UP (2006).

Olsson, E. J., Schroeder-Heister, P., and Spohn, W. (eds). *Logik in der Philosophie*, Heidelberg: Synchron (2005).

Raidl, E. "Completeness for counter-doxa conditionals—using ranking semantics," in: *Review of Symbolic Logic*, 12:4 (2019), pp. 861–891.

Raidl, E. "Open-minded orthodox Bayesianism by epsilon-conditionalisation," in *British Journal for the Philosophy of Science*, 71:1 (2020), pp. 139–176.

Rott, H. *Change, Choice and Inference: A Study of Belief Revision and Nonmonotonic Reasoning* (= Oxford Logic Guides; 42), Oxford: Oxford UP (2001).

Rott, H., and Williams, M.-A. (eds). *Frontiers in Belief Revision* Dordrecht: Kluwer (2001).

Spohn, W. *Causation, Coherence, and Concepts. A Collection of Essays*, Dordrecht: Springer (2009).

Spohn, W. *The Laws of Belief. Ranking Theory and its Philosophical Applications*, Oxford: Oxford UP (2012); received the Lakatos Award 2012.

Urchs, M. "Complementary Explanations," *Synthese*, 120 (1999), pp. 137–149.

Zinke, A. "A BULLET for invariance: Another argument against the invariance criterion for logical terms," in: *The Journal of Philosophy*, 115:7 (2018), pp. 382–388.

Zinke, A. *The Metaphysics of Logic*, Frankfurt: Klostermann (2018).

Era Horsten: since 2019

On the one hand, it is obviously way too early to engage in a retrospective and summarize Leon Horsten's time at the university. One the other hand, we cannot *not* mention him and his team; so we do, albeit briefly.

Leon Horsten (born 1966) was born in the Netherlands, completed his MA in Minnesota (1989), and obtained his PhD from the KU Leuven (1993), where he also held his first faculty appointment. It was during his time in Leuven that he first came into contact with Konstanz due to his cooperation (continuing to the present day) with Halbach. From Leuven he moved to Bristol (2008–2019) from where he came to Konstanz, fearing that the Brexit might put an end to his productive years in England.

Before Horsten came, however, the department had abandoned his former concentration on the philosophy of science as its primary mission, and the denomination of Horsten's chair was changed to read "professor of theoretic philosophy with special emphasis on metaphysics, epistemology, and logic." What the department did not change was the expectation that topics in the three areas listed should be addressed by an analytic philosopher which made Horsten, who came as a highly accomplished scholar and an internationally recognized expert for bringing formal tools to bear on philosophical problems, a great fit. He had written, among others, a book in metaphysics: *The Metaphysics and Mathematics of Arbitrary Objects* (2019), had edited a book in (the) epistemology (of mathematics): *Gödel's Disjunction: The Scope and Limits of Mathematical Knowledge* (2016, with Philip Welch), and about twenty of his research papers were published in journals of the ASL. Better-known names among his collaborators (beyond Halbach)

are Igor Douven, Graham E. Leigh, Hannes Leitgeb, Øystein Linnebo, Richard Pettigrew, and Philip Welch.

Horsten's initial hires (to fill the two faculty lines associated with his chair) were Mount and Roberts.

Beau Mount did his DPhil in the philosophy of mathematics (*The kinds of mathematical objects*, 2017), supervised by Halbach and Timothy Williamson, and was a junior research fellow at New College (2018–2020) before he came to Konstanz.

Sam Roberts completed his PhD requirements with the thesis *Potentialism and reflection principles* (Birbeck College, 2016, part of Linnebo's project "Plurals, Predicates, and Paradox"), from where he moved to work at ConceptLab (Oslo, 2017–2020), one of whose co-directors is Linnebo.

The total number of articles all three have published in logic journals suggests that their future research will be closer to core areas of mathematical logic than that of any group before. This orientation can also be found in the doctoral colloquium they run jointly with Carolin Antos (see § 5.5) since 2020.

More logic & foundations in philosophy: Rosenthal

Jacob Rosenthal (born 1969) earned an MA in mathematics (Würzburg, 1995) before he came to Konstanz to work on the propensity interpretation of probability, supervised by Spohn (2002, published as *Wahrscheinlichkeiten als Tendenzen. Eine Untersuchung objektiver Wahrscheinlichkeitsbegriffe*, 2004). He had competing interests in action theory and ethics, so he left for Bonn and completed a habilitation on action theory (2012, sponsored by Andreas Bartels), published 2017 as *Entscheidung, Rationalität und Determinismus*). In 2013 he came back to Konstanz on a visiting position, and while he holds the chair for practical philosophy since 2016, he has never really stopped thinking about probability.

Selected publications.

Rosenthal, J. "Probabilities as Ratios of Ranges in Initial-State Spaces," in: *Journal of Logic, Language and Information*, 21:2 (2012), pp. 217–236.

Rosenthal, J. "Johannes von Kries's Range Conception, the Method of Arbitrary Functions, and Related Modern Approaches to Probability," in: *Journal for General Philosophy of Science*, 47:1 (2016), pp. 151–170.

More logic & foundations in philosophy: Müller

Thomas Müller (born 1969) earned an MSc in physics, a PhD in philosophy (both Freiburg, 1997 and 2001) and completed his habilitation in Bonn (2008). His dissertation was on tense logic (*Arthur Priors Zeitlogik. Eine problemorientierte Darstellung*, published 2002) and his habilitation thesis was on moral aspects of promising (*Versprechen. Zur Struktur einer moralischen Praxis*). During his time as assistant professor in Bonn he was not,

however, affiliated with the the Department of Philosophy itself but with its *Lehr- und Forschungsbereich III*, formerly known as the Hasenjaeger-Institut, the *Seminar für Logik und Grundlagenforschung*, whose director at the time was Rainer Stuhlmann-Laeisz.[9] Müller first moved to Utrecht (2007–2013), before he accepted the offer for the position as "professor of philosophy with a special emphasis on theoretical philosophy." His job description (i. e., theoretical philosophy) is currently all that is left of what was once the hallmark of philosophy in Konstanz, namely, the philosophy of science; it has been stricken from all chair denominations since. (I was told the department has meanwhile decided to add "philosophy of science" to the denomination for a future replacement.)

Before Müller came to Konstanz, he had distinguished himself by contributions to temporal logic and its metaphysics as well as by spearheading a philosophy of mathematical practice. Most of his more recent research expands on the former and not only develops new improved formalisms for branching time but also teases out the consequences they have for loaded issues such as (in)determinism, free will and agency, open future, and the metaphysics of possibility and time in general. While the metaphysics does not seem to fall on DVMLG territory, the formalisms involved surely do.

Notable projects, conferences, & guests. Müller brought two projects from Utrecht to Konstanz: "What is really possible? Philosophical explorations in branching-history-based real modality," funded by the NWO, the Dutch Research Council, and its sister project, funded by the ERC, the European Research Council, "Indeterminism Ltd. An intervention on the free will debate." The first project employed Marius Backmann, Antje Rumberg, and Rosja Mastop, while the second saw Michael De, Verena Wagner, Niels van Miltenburg, Antje Rumberg, Jesse Mulder, and Daan Evers as post-docs or graduate students. Those who contributed to the logic were Rumberg and De.

Antje Rumberg, who wrote her MA thesis on Bolzano under direction of Schroeder-Heister, received her PhD from Utrecht University (*Transitions toward a semantics for real possibility*, 2016), supervised by Albert Visser and Müller. She worked with Müller in Konstanz (2013–18) before she moved on, first to Stockholm, then Aarhus.

Michael De, who hails from Canada and did his MA at Simon Fraser, earned his PhD, supervised by Stephen Read and Peter Milne, at St Andrews (*Negation in context*, 2011). He worked with Müller in Utrecht (2011–2013) and Konstanz (2013–2015 & 2016–2017 as an adjunct), before me moved via Miami and Bern to Utrecht.

[9] This unit, specifically created for Hasenjaeger in 1962, was terminated when Stuhlmann-Laeisz retired in 2008. Cf. E. Brendel & R. Stuhlmann-Laeisz, *Geschichte des Lehrstuhls für Logik und Grundlagenforschung an der Rheinischen Friedrich-Wilhelms-Universität Bonn*, in this volume.

The last activities that deserve mention are ongoing and not yet completed. There is, first, the DFG-funded project "Different kinds of conditionals: Coin tosses and kangaroos in the forest of alternative possibilities," which is a follow-up to the project already mentioned: "Alternatives for the future" (see page 74). It is executed by Hadil Karawani, a trained linguist, who wrote her PhD thesis on counterfactuals with Frank Veltman (*The real, the fake, and the fake fake*, Amsterdam, 2014). The goal is to achieve a unified analysis "based on a (modal) forest of (temporally tree-like ordered) alternative possibilities." Second, there are the twin projects "Suspending Belief" (*Sich doxastisch enthalten*, 2020–2022), along with the participation in the international effort "Thinking About Suspension" (2021–2024). The latter is coordinated not by Müller but by Wagner (Konstanz) and Zinke (see page 71).

Verena Wagner, who did her doctoral work with Rott (*Free and coerced agency: A new approach to classical compatibilism*, Regensburg, 2013,) cooperated with Müller already on the earlier project "Indeterminism Ltd." She plans to turn her research in the context of the two projects into a habilitation.

In the past, the analysis of counterfactuals and the modeling of doxastic states required some formal machinery at the intersection of formal semantics and logic; whether this applies to the three projects just mentioned is in at least one of their possible futures.

Selected publications.

Belnap, N., and Müller, Th. "CIFOL: Case-Intensional First Order Logic (I): Toward a Theory of Sorts," in: *Journal of Philosophical Logic*, 43:2–3 (2014), pp. 393–437.

Belnap, N., and Müller, Th. "BH-CIFOL: Case-Intensional First Order Logic (II): Branching Histories," in: *Journal of Philosophical Logic*, 43:5 (2014), pp. 835–866.

Belnap, N., Müller, Th., and Placek, T. *Branching Space-Times. Theory and Applications*, Oxford: Oxford UP (2022).

De, M. "Intrinsicality and counterpart theory," in: *Synthese*, 193:8 (2016), pp. 2353–2365.

De, M. and Omori, H. "Classical Negation and Expansions of Belnap–Dunn Logic," in: *Studia Logica*, 103:4 (2015), pp. 825–851.

Müller, Th. "Time and Determinism," in: *Journal of Philosophical Logic*, 44:6 (2015), pp. 729–740.

Müller, Th., Rumberg, A., and Wagner, V. (eds). *Real possibilities, indeterminism, and free will: Three contingencies of the debate*, special issue of *Synthese*, 196:1 (2019).

Rumberg, A. "Transition Semantics for Branching Time," in: *Journal of Logic, Language and Information*, 25:1 (2016), pp. 77–108.

4 Logic in mathematics

Era Prestel: 1975–2008

People: their stories & their projects. Alexander Prestel (born 1941) did his doctoral work in number theory with Karl-Bernhard Gundlach in Münster (*Die elliptischen Fixpunkte der Hilbertschen Modulgruppen*, 1966) and his habilitation, promoted by Gisbert Hasenjaeger, in Bonn (*Untersuchungen über Pasch-freie Geometrien und semi-geordnete Körper*, 1972), where he and Ronald Jensen were assistant professors and Prestel became the successor to Wolfram Schwabhäuser. The official denomination of his position in Konstanz was algebra, but (according to one contemporary witness) the intent of the search committee was to hire a logician, and they believed Prestel to be an expert in higher set theory. In the spirit of the original idea that mathematics should be part of the university's service-teaching unit (the *Interfakultät*), physicists urged that new hires in mathematics should be for applied mathematics; they were appeased with the argument that mathematical logic is applied mathematics: mathematics applied to logic.

The other permanent member of Prestel's group was Ulf Friedrichsdorf whom he got to know as a student during his time as an assistant professor in Bonn. Friedrichsdorf had left Bonn for Kiel on a doctoral fellowship to work with Klaus Potthoff and became the latter's only doctoral student (*Existentiell abgeschlossene und generische Zahlstrukturen*, 1973). But the position as assistant professor in Kiel he had hoped for was sacked, so when Prestel inquired whether he would like to come to Konstanz, Friedrichsdorf moved south. His hire proved critical for the reason mentioned already in previous sections: having secured himself a permanent lecturer position early on, Friedrichsdorf could devote himself to an academic life that embodied the inter- and transdisciplinary spirit which people on the *Gründungsausschuss* meant to be a hallmark of the university. While Prestel devoted his time and energy exclusively to mathematics, Friedrichsdorf taught or team-taught many interdisciplinary logic classes and was the face of logic to people outside the department. And while all graduate students were strictly speaking students of Prestel (Friedrichsdorf lacked the credentials (habilitation) to officially supervise graduate students), a really nice masters thesis, written by Christopher von Bülow on Rosser sentences (and later published as a book), was written under Friedrichsdorf's supervision and forced none less than Bob Solovay to admit a slip and to correct a proof.

Among the longer-term assistants were Koenigsmann, Schmid, and Schweighofer.

Jochen Koenigsmann came with a BA in mathematics and philosophy from Oxford in order to do his PhD in Konstanz under Prestel's supervision. His research was centered around model theory and arithmetic of fields where he also co-supervised numerous master theses in real algebraic geo-

metry, in valuation theory, and on Hilbert's 10th Problem. A break through during his time at Konstanz (1985–2001) was his Galois characterization of p-adically closed fields (1995) which had been an open problem ever since, in 1965, Ax-Kochen and, independently, Ershov had provided the p-adic analogue of Tarski's results on the model theory of real closed fields. From Konstanz he moved back to Oxford, where, inspired by his teaching around Hilbert's 10th Problem in Konstanz, he gave a diophantine definition, not for $\mathbb{Z}$ in $\mathbb{Q}$ (which would prove Hilbert's 10th Problem for $\mathbb{Q}$ to be unsolvable), but for the complement of $\mathbb{Z}$ in $\mathbb{Q}$ (see *Annals of Mathematics*, 183:1, 2016, pp. 73ff.). Koenigsmann was an invited speaker at the ICM 2018 in the section on "Logic and Foundations."

Jürgen Schmid (born 1959) completed his PhD in 1991 (*Existentiell abgeschlossene Integritätsbereiche mit reellen Radikalrelationen*), work which resulted in co-authored publications with Prestel. He wrote his habilitation thesis in Dortmund (1999) and obtained the *venia legendi* in Konstanz (1999). While he started to teach as *Gymnasiallehrer* in 2000, he has been teaching as an adjunct professor since 2004. His teaching and research interests are, besides topics in mathematical logic proper, quadratic forms and associative rings.

Markus Schweighofer (born 1974) did his doctoral work on *Iterated rings of bounded elements and generalizations of Schmüdgen's theorem* (2002) and wrote a cumulative habilitation thesis entitled *Positive polynomials, sums of squares and optimization* (2007). Two years later he obtained a tenured position as professor in Konstanz. He and his doctoral students (six former, three current) keep working on various aspects of polynomial optimization and organize conferences and workshops in the area. The most recent cooperation is the European POEMA project (2019–22), and recent work showed, for the first time by applying techniques from logic and real closed fields to a Lasserre's hierarchy, that many systems of real polynomial inequalities can be converted to slightly generalized linear programs.

Teaching, research, students. *Teaching.* Prestel and Friedrichsdorf taught the usual slate of introductions to or upper-level classes on logic and set theory and offered courses for graduating seniors and seminars for doctoral students. On a semi-regular basis Prestel taught a cycle of three classes: mathematical logic, model theory, and recursion theory, but left it mostly to Friedrichsdorf to supplement it with a class on set theory which was offered outside that cycle and hence more often. These classes followed the usual pattern of two hours of lecture each week combined with either a two-hour tutorial (*Übungen*) for introductory-level classes or a two-hour seminar for upper-level classes. Prestel made a name for himself as a good and effective lecturer, known for his famous 'two-sponge method' (cleaning the chalk board with two wet sponges simultaneously to shave off more lecture

time). And although the logic classes were advertised as a good stepping stone towards a masters thesis ("*zusammen mit anderen Vorlesungen und Seminaren aus meinem Zyklus kann sie auf dem Gebiet der Modelltheorie zu einer Staats- und Diplomarbeit führen*"), most graduate work was done in algebra. Beyond logic, Prestel lectured on algebra (abstract, linear, real), algebraic curves, algebraic geometry, function fields, and number theory. (For Friedrichsdorf, see the remarks in previous sections.) From the mid-1980's to the mid-1990's Prestel und Friedrichsdorf took their students (as Ziegler did from Freiburg) to the famous Läuchli–Specker Seminar in Zürich. (It was started by Bernays and Gonseth in 1936; Läuchli died unepectedly in 1997 but Specker continued until 2002.) Since this required an overnight stay in Zürich, it was as much a social event as it was an academic experience.

Research. Prestel's research was in model theory, or more specifically, in the model theory of fields (including developments that stemmed from Hilbert's 10th and 17th problems) to whose toolkit he added more algebraic methods, e.g., valuation theory or infinite Galois theory from the arithmetic of fields. Although he attended the workshop in Oberwolfach on Shelah's work when it first hit (1972; then again in 1980), Prestel did not concern himself with 'pure' model theory such as stability theory or the resulting classifications efforts. To the contrary, his own focus and the research direction his students took gravitated more and more towards algebra, a development that is also reflected in how his research group was named and in his book titles (see below). Initially, and for many years, Prestel called his group simply "Logic and Algebra." Later this was spelled out further by listing real algebraic geometry, Galois theory, valuation theory, and model theory. Eventually, in 2006, it became simple again: "Real Geometry and Algebra." Colleagues report that his lecture notes on formally real fields and formally p-adic fields (with Roquette) have triggered quite some research interest in the community and think that the joint paper with Schmid from 1990, which continued earlier work on preordered fields from 1982, is an exceptionally nice piece of work, in which the authors axiomatize and prove the decidability of the theory of the ring of algebraic integers. Prestel seemed to have shared the sentiment: he made it the topic of one out of the two talks he ever gave at Oberwolfach (the other was on positive polynomials in 1997).

Students. Among Prestel's 17 doctoral students—Wilfried Meißner (1979), Margarita Delso (1987), Camilla Grob (1988), Joachim Schmid (1991), Maria Pia Solèr (1993), Thomas Jacobi (1999), Maria Eugênia Canto Cabral (2005), Holger Merkel (2009), Sven Wagner (2009), Sabine Burgdorf (2011), and Samuel Volkweis Leite (2013)—at least six continued beyond their doctoral work and obtained faculty positions: Bernhard Heinemann (1982; Hagen, Germany), Cydara Ripoll (1991; Universidade Federal do Rio

Grande do Sul, Brazil), Jochen Koenigsmann (1993; Oxford), Mihai Prunescu (1998; IMAR, Bucharest), Markus Schweighofer (2002; Konstanz), and Tim Netzer (2008; Innsbruck, Austria). If we use the MSC classification as a guideline, then most dissertations fell into abstract algebra (primary classification 12–16, with clusters at 12 (field theory and polynomials) and 13 (commutative algebra)), while three have a traditional logic flair: Grob (decidability in certain closed fields), Meißner (model theory of quadratic forms), and Prunescu (diophantine definability and Matiyasevich's theorem); two more, Cabral and Wagner, worked on effective decision procedures (whether certain quadratic modules are Archimedean). Some of Prestel's students added work in logic or computer science logic (MSC classification 03 and 68, respectively) later in their career: Heinemann (03, 68), Koenigsmann (03), Prunescu (03, 68), and Schmid (03, 68).

Notable projects, conferences, & guests. Major research projects with Prestel as PI were"Arithmetic of fields" (internally funded), "Representation of positive polynomials" (2000–2006, DFG-funded), and a project on approximating nonnegative polynomials (*Selbstkonkordante Barrieren für Kegel nichtnegativer Polynome*, 2005–2008); the latter funded research conducted by Markus Schweighofer and later by Tim Netzer. Prestel joined the research training group "Mathematical logic and its application" (2002–2008), co-founded by his former student Jochen Koenigsmann and done in cooperation with nearby Freiburg (its chair was Jörg Flum), whose focus was on finite model theory and its applications for computer science (*Graduiertenkolleg #806*, which is some kind of fixed-term graduate school funded by the DFG). Later Prestel became a member of the European research network "Real Algebraic and Analytic Geometry" (RAAG, 2002–2006), among whose main objectives was "the training of young researchers through active participation in research of the highest quality." This last cooperation had a lasting impact on the direction of his research group.

Prestel quite regularly attended the annual logic meetings at Oberwolfach from 1970 to 1983. But around the time their focus shifted more towards proof theory and constructive mathematics, he started to organize workshops on model theory that met every other year: 1982 (mit W. Baur and A. Macintyre), 1984 (with L. van den Dries and U. Felgner), 1986 (with G. Cherlin), 1988 (with W. Hodges and M. Ziegler), 1990 (with L. van den Dries and P. Roquette), 1992 (with D. Lascar and M. Ziegler), 1994 (with U. Felgner and M. Ziegler), 1998 (with Y. Ershov and M. Ziegler), and 2000 (with D. Lascar and M. Ziegler). In addition he participated in the Oberwolfach meetings on the Arithmetic of Fields (1990, 1993, 2002, 2006, 2009, 2013), Real Algebraic Geometry (1984, 1993, 1997), Quadratic Forms (1978, 1985, 1995), and Valued Fields (2010).

Prestel's co-organizers, the organizers of other workshops he attended, and recurring participants at both indicate the research cooperations he maintained. Members of his network include, among others, Peter Roquette (Heidelberg), Martin Ziegler (Freiburg), Eberhard Becker (Dortmund), Wulf-Dieter Geyer (Erlangen), and Manfred Knebusch (Regensburg) within Germany; outside Germany there were Antonio Engler (Campinas, Brazil), Yuri Ershov (Paris, then Novosibirsk), Moshe Jarden with his students Dan Haran and Ido Efrat (Tel Aviv), Max Dickmann, Françoise Delon and Zoé Chatzidakis (Paris), Angus Macintyre and Alex Wilkie (Oxford), Gregory Cherlin (Rutgers), Lou van den Dries (Utrecht, then Urbana), and Charles Delzell (Stanford, then Louisiana). All visited Konstanz, some for a year or longer (e.g., Delzell, Efrat, Engler, Ershov, Haran, van den Dries).

Selected publications.

Berr, R., Delon, F., and Schmid, J. "Ordered fields and the ultrafilter theorem," in: *Fundamenta Mathematica*, 159:3 (1999), pp. 231–241.

Friedrichsdorf, U. *Einführung in die klassische und intensionale Logik*, Braunschweig: Vieweg (1992).

Friedrichsdorf, U., and Prestel, A. *Mengenlehre für den Mathematiker* (= Grundkurs Mathematik), Braunschweig: Vieweg (1985).

Klep, I. and Schweighofer, M. "Connes' embedding conjecture and sums of Hermitian squares.," in: *Advances in Mathematics*, 217:4, pp. 1816–1837; addendum *ibid.* 252 (2014), pp. 805–811.

Kriel, T. L. and Schweighofer, M. "On the exactness of Lasserre relaxations and pure states over real closed fields," in: *Foundations of Computational Mathematics*, 19:6 (2019), pp. 1223–1263.

Koenigsmann, J. "From p-rigid elements to valuations (with a Galois characterization of p-adic fields)," in: *Journal für die reine und angewandte Mathematik*, 465 (1995), pp. 165–182.

Prestel, A. "Pseudo real closed fields," in: *Set Theory and Model Theory* (= Lecture Notes in Mathematics; 872), ed. R. B. Jensen and A. Prestel, Berlin: Springer (1981), pp. 127–156.

Prestel, A. *Einführung in die Mathematische Logik und Modelltheorie* (= Grundkurs Mathematik), Braunschweig: Vieweg (1986); rev. engl. tr. Delzell, C. N.: *Mathematical Logic and Model Theory. A Brief Introduction* (= Universitext), London: Springer (2011).

Prestel, A. and Delzell, C. N. *Positive Polynomials: From Hilbert's 17th Problem to Real Algebra* (= Springer Monographs in Mathematics), Berlin: Springer (2001).

Prestel, A. and Roquette, P. *Formally p-adic Fields* (= Lecture Notes in Mathematics; 1050), Berlin: Springer (1984).

Prestel, A. and Schmid, J. "Existentially closed domains with radical relations. An axiomatization of the ring of algebraic integers," in: *Journal für die reine and angewandte Mathematik*, 407 (1990), 178–201.

Prestel, A. and Schmid, J. "Decidability of the rings of real algebraic and p-adic algebraic integers," in: *Journal für die reine and angewandte Mathematik*, 414 (1991), 141–148.

Prestel, A. and Ziegler, M. "Modeltheoretic methods in the theory of topological fields," in: *Journal für die reine and angewandte Mathematik*, 299/300 (1978), 318–341.

Schmid, J. "Regularly T-closed fields," in: *Hilbert's Tenth Problem: Relations With Arithmetic and Algebraic Geometry* (= Contemporary Mathematics; 270), ed. J. Denef et al., Providence: AMS (2000), pp. 187–212.

Schweighofer, M. "Iterated rings of bounded elements and generalizations of Schmüdgen's Positivstellensatz," in: *Journal für die reine and angewandte Mathematik*, 554 (2003), pp. 19–45.

Era Kuhlmann: since 2009

People: their stories & their projects. Salma Kuhlmann (born 1958) completed her college education at McGill University in Montréal, did her PhD work with Daniel Lascar at the Université Paris Diderot–Paris VII (1991, *Quelques propriétés des espaces vectoriels values en théorie des modèles*), and obtained the habilitation with her work on *Ordered Exponential Fields* at the University of Heidelberg in 1999. Before she joined faculty ranks in Konstanz—from a tenured position at the University of Saskatchewan, where she remains to hold an adjunct position—she had visiting positions at Punjab University, Chandigarh (1995), and the Fields Institute, Toronto (1996–1997). She describes her research interests as to falling into five areas: (i) model-theoretic algebra: o-minimal structures, saturated and recursively saturated o-minimal expansions; (ii) model theory of valued fields: ordered fields, fields of power series, dependent fields, exponential fields, Hardy fields, exponential-logarithmic power series fields, transexponential fields; (iii) ordered algebraic structures: lexicographic orderings, ordered vector spaces, Hahn groups; (iv) models of arithmetic: integer parts; and (v) real algebraic geometry: *Positivstellensätze*, moment problems, symmetric positive polynomials.

The first two post-docs who stayed on for some time were Carl and Infusino.

Merlin Carl obtained his PhD with Peter Koepke in Bonn (*Alternative finestructural and computational approaches to constructibility*, 2011), after which he came to Konstanz for six years (2011–2017) before he moved on to Flensburg. He worked, among others, on infinite-time computation, diophantine polynomials encoding proofs, exponential real closed fields, and

taught introductory courses to mathematical logic but also branched out into philosophy (Husserl, Gödel, Lakatos). The legacy, however, he created for himself was the interdisciplinary (computer science, law, linguistics, mathematics, and philosophy) logic colloquium "Logic in Konstanz" that he initiated, at the beginning co-sponsored by Spohn. Kuhlmann and Antos (see § 5.5) took over when Carl left.

Maria Infusino hailed from Italy, where she had worked, under supervision of Aljosa Volčič in Calabria, on her dissertation *Uniform distribution of sequences of points and partitions* (2011). She spent three years in Reading (2011–2014) before she joined Kuhlmann's group (2014–2020). Her interests lie at the intersection of analysis and real algebraic geometry as well as their application to mathematical physics. She was awarded her habilitation degree in 2020 and returned to Calabria for a tenure-track position shortly thereafter.

Currently, three more post-docs seek additional academic qualification, be it their habilitation or otherwise; two are 'home-grown', Krapp and Serre, while Brickhill came from Bristol.

Hazel Brickhill did her PhD, advised by Philip Welch, in set theory (*Generalising the notions of closed unbounded and stationary sets*, 2017), for which she received a Faculty of Science Commendation, and continues research along those lines; in a side job she has teamed up with Horsten (§ 3), whom she knows from her time as a graduate student, to explore a theory of non-standard infinitesimal probabilities via ultrafilter constructions.

Lothar Sebastian Krapp, who came to Konstanz after completing his MMath with Jonathan Pila in Oxford, wrote his dissertation on *Algebraic and model-theoretic properties of o-minimal exponential fields* (2019), did joint work with Carl on exponential fields, and intends to further investigate ordered algebraic structures for his habilitation.[10]

Michele Serra came with a combined masters degree in mathematics from Leiden and Padova (by courtesy of the Erasmus Mundus Joint Masters program) and completed his doctoral work on *Automorphism groups of Hahn groups and Hahn fields* in 2021. His research interests include, more broadly, commutative algebra, valuation theory, and ordered structures.

In addition to these five assistant professors in her group, she won two fellows for the *Zukunftskolleg*: Margaret Thomas (2010–2019) and Pantelis Eleftheriou (2013–2021); cf. §§ 5.3 & 5.4.

[10]He was selected as one of the speakers at the PhD Colloquium at *Colloquium Logicum 2022* in Konstanz. The PhD Colloquium is the DVMLG's celebration of the most talented PhD students in logic: the members can nominate candidates for the PhD Colloquium talks among those who graduated after the last *Colloquium Logicum* and before the next. The Programme Committee of the *Colloquium Logicum* then selects the speakers. An invitation to speak at the PhD Colloquium can be seen as the German "best dissertation in logic" award.

A few junior people did not stay for long.

Annalisa Conversano (2009–2011) had written her doctoral thesis in Siena, supervised by Alessandro Berarducci in Pisa: *On the connections between definable groups in o-minimal structures and real Lie groups: the non-compact case* (2009), and left after two years to assume duties as Senior Lecturer in Auckland. While in Konstanz, her closest cooperation was with Anand Pillay.

Itay Kaplan (2010–2011) is a student of Saharon Shelah (*Topics in dependent theories*, 2009) and returned to Jerusalem after one year in Konstanz.

Mickaël Matusinski, a frequent co-author of Kuhlmann, passed through for a brief stay (2009–2010). He had done his doctoral work in Dijon with Jean-Philippe Rolin, *Ordinary differential equations with coefficients in a field of generalized power series* (2007), and had worked with Kuhlmann before in Saskatchewan (2008). He is now in Bordeaux.

Teaching, research, students. *Teaching.* Kuhlmann's team members continue the Prestel-Friedrichsdorf tradition and offer the full gamut of introductory logic classes (set theory, model theory, and recursion theory) but, also as before, treat proof theory as the red-haired step child. Clearly, they continued to offer the algebra courses (linear and abstract) mandatory for majors. What Kuhlmann seems to do differently is that she offers lecture classes that teach knowledge prerequisite for a meaningful participation in research seminars (e.g., introduction to real algebraic geometry) on a more regular basis and supported by her own lecture notes. Members of her team have likewise enriched the existing curriculum. Infusino, for instance, quite regularly taught graduate classes on topological vector spaces and topological algebras along with one-offs such as positive polynomials and moment problems.

Research. In the preceding section we briefly indicated the research interests that members of Kuhlmann's group pursue and note that as the research group became more international and more mixed, so did the range of topics being studied. As we saw above, towards the end of his career, Prestel considered himself an algebraist who had delegated logic to Friedrichsdorf. This trend away from logic was reversed by Kuhlmann. While Prestel's *Oberseminar reelle Geometrie und Algebra* was maintained—the German *Oberseminar* is a weekly meeting for graduate and post-graduate students to discuss new literature and their own ongoing research—within a year it saw a companion-*Oberseminar Modelltheorie* (2010) to include Frehm (see below) and Thomas, which, as more new members joined the team, first morphed into *Mathematische Logik, Mengenlehre und Modelltheorie* (2018) when Brickhill joined, and then into "Complexity Theory, Model Theory, Set Theory" (2020) after Mateusz Michałek joined the department as professor

(chair) of real algebraic geometry. Contemporary research in mathematical logic, it seems, is represented more broadly these days.

Michałek joined the group, but being a chair himself, he is independent of it. The same was true for Fehm. – Arno Fehm completed his PhD in Tel Aviv in 2010 (*Decidability of large fields of algebraic numbers*) under supervision of Moshe Jarden (as part of the European Research and Training Network "Galois Theory and Explicit Methods"). While working on his doctoral thesis, he was in frequent contact with Ziegler, Koenigsmann, and Prestel. So he joined the faculty in Konstanz as a *Juniorprofessor* (2010–2016), after which he went to Manchester for a year before he returned to TU Dresden on a tenured position. He did mostly his own thing while in Konstanz, but participated in Kuhlmann's *Oberseminar* and organized, with Pierre Dèbes (Lille) and Lior Bary-Soroker (Tel Aviv) the French-German summer school "Galois Theory and Number Theory." With Prestel, who at the time still attended the *Oberseminar* as an emeritus, he co-authored a joint paper; it was received August 29, 2014, and is the last paper Prestel submitted.

Students. Since Kuhlmann came in 2009, a number of students completed their PhD under her supervision. Besides Krapp and Serra, mentioned above, the other doctoral students were Charu Goel: *Extension of Hilbert's 1888 theorem to even symmetric forms* (2014); Katharina Dupont: *Definable valuations on NIP fields* (2015); Simon Müller: *Quasi-ordered rings: A uniform study of orderings and valuations* (2020). The dissertation by Gabriel Lehericy: *Quasi-ordres, C-groupes, et rang différentiel d'un corps différentiel valué* (2018), was co-directed with Françoise Point (Sorbonne), and co-directed with Infusino was Patrick Michalski: *A systematic approach to infinite-dimensional moment problems* (2012). The MSC classification 03, it seems, is back prominently.

When it comes to fostering student success, we should mention that Infusino, as a member of the association "European Women in Mathematics" and with Kuhlmann's support, founded a local chapter "Konstanz Women in Mathematics" (KWIM) and ran events from 2013 through 2019. When Infusino left, she passed the baton to Kuhlmann.

Conferences. Kuhlmann is no stranger to the MFO (*Mathematisches Forschungszentrum Oberwolfach*—she has been invited to meetings on model theory since 1998 and organized meetings at the MFO herself (2014, 2017, 2020)—but it is just one venue in addition to events at the university, which are open to everyone. She, members of her team (e.g., Antos, Eleftheriou, Goel, Infusino, Thomas), and external partners: Paolo D'Aquino (Naples), Alessandro Berarducci (Pisa), Philip Ehrlich (Ohio), Didier Henrion (Toulouse), Tobias Kuna (Reading), Jonathan Pila (Oxford), and Victor Vinnikov (Ben Gurion), have been organizing about two meetings a year, many not at Konstanz. Kuhlmann and Thomas (see § 5.3) have founded

the annual regional (Basel, Freiburg, Konstanz, Passau) workshop on model theory, called *Donau-Rhein Modelltheorie und Anwendungen*, which has met every year since its inauguration in 2017.

Selected publications.

Carl, M. "Optimal results on recognizability for infinite time register machines," in: *Journal of Symbolic Logic*, 80:4 (2015), pp. 1116–1130.

Carl, M. and Krapp, L. S. "Models of true arithmetic are integer parts of models of real exponentiation," in: *Journal of Logic & Analysis*, 13:3 (2021) pp. 1–21.

Chernikov, A. and Kaplan, I. "Forking and dividing in NTP_2 theories," in: *Journal of Symbolic Logic*, 77:1 (2012), pp. 1–20.

Conversano, A. and Pillay, A. "Connected components of definable groups and o-minimality I," *Advances in Mathematics*, 231:2 (2012), pp. 605–623.

D'Aquino, P., Knight, J., Kuhlmann, S., and Lange, K. "Real closed exponential fields," in: *Fundamenta Mathematicae*, 219 (2012), pp. 163–190.

Dupont, K., Hasson, A., and Kuhlmann, S. "Definable valuations induced by multiplicative subgroups and NIP fields," in: *Archive for Mathematical Logic*, 58:7–8 (2019), pp. 819–839.

Fehm, A. and Prestel, A. "Uniform definability of Henselian valuation rings in the Macintyre language," in: *Bulletin of the London Mathematical Society*, 47:4 (2015), pp. 693–703.

Ghasemi, M., Infusino, M., Kuhlmann, S., and Marshall, M. "Moment problem for symmetric algebras of locally convex spaces," in: *Integral Equations and Operator Theory*, 90:3 (2018), art. 29 (19 pp.).

Goel, C., Kuhlmann, S., and Reznick, B. "The analogue of Hilbert's 1888 theorem for even symmetric forms," in: *Journal of Pure and Applied Algebra*, 221:6 (2017), pp. 1438–1448.

Infusino, M. "Quasi-analyticity and determinacy of the full moment problem from finite to infinite dimensions," in: *Stochastic and Infinite Dimensional Analysis* (= Trends in Mathematics), ed. C. C. Bernido et al., Basel: Birkhäuser (2016), pp. 161–194 (= ch. 9).

Infusino, M. and Kuhlmann, S. "Infinite dimensional moment problem: Open questions and applications," in: *Ordered Algebraic Structures and Related Topics* (= Contemporary Mathematics; 697), ed. F. Broglia et al., Providence: AMS (2017), pp. 187–201.

Krapp, L. S., Kuhlmann, S., and Serra, M. "On Rayner structures," in: *Communications in Algebra*, 50:3 (2022), pp. 940–948.

Kuhlmann, S. and Matusinski, M. "Hardy-type derivations in generalized series fields," in: *Journal of Algebra*, 351 (2012), pp. 185–203.

Lehéricy, G. “On the structure of groups endowed with a compatible C-relation,” in: *Journal of Symbolic Logic*, 83:3 (2018), pp. 939–966.

5 Zukunftskolleg

The *Zukunftskolleg* started operation in 2001, initially as a three-year pilot scheme called “Center for Junior Research Fellows” (the ZWN, *Forschungszentrum für den wissenschaftlichen Nachwuchs*), and was instituted in its current form in 2007 as an Institute for Advanced Study for early-career researchers. Its mission has remained the same, namely, to counteract the incrusted structures at German universities that can leave junior faculty at a considerable disadvantage. The basic idea is straightforward: if a post-doc can find the grant money, the university will provide the support structure. Since 2007, the first time Konstanz was recognized as one of the Top 10 in Germany (Excellence Initiative), the *Zukunftskolleg* disposes of enough federal grant money to award its own fellowships.

5.1 Luc Bovens & probability (2002–2005)

Among the first to take advantage of the *Zukunftskolleg* was Bovens. He returned to Konstanz on a Sofja Kovalevskaja Award (DFG) to form a research group, co-directed with Hartmann, so that they could continue their cooperation on all things Bayesian. The group was named “Philosophy, Probability, and Modeling” (2002–2005), and their range of topics was staggering: from “Bayesian networks in philosophy” to “Models of terrorism prevention.” Topics were arranged into four groups: (i) Evidence and Confirmation, (ii) Rational and Social Choice, (iii) Probabilistic Causation, and (iv) Uncertain Reasoning. Project leads were—they were all post-docs—Claus Beisbart, Franz Dietrich, Armond Duwell, Ludwig Fahrbach, Natalie Gold, Amit Hagar, Franz Huber, Luca Moretti, Veiko Palge, Gabriella Pigozzi, Robert Bishop, Rolf Haenni, Iain Martel, Christoph Schmidt-Petri, and Paul Thorn; almost all of them obtained permanent faculty positions later. Group members organized 20 conferences, workshops, and summer schools, 13 of them met in Konstanz, and produced about 30 working papers. Prominent visitors over the summer included James Hawthorne, Christian List, Miklós Rédei, and Teddy Seidenfeld.

Selected publications.

Beisbart, C., Bovens, L., and Hartmann, S. “A utilitarian assessment of alternative decision rules in the council of ministers,” in: *European Union Politics*, 6:4 (2005), pp. 395–418.

Bovens, L. and Hartmann, S. *Bayesian Epistemology*, Oxford: Oxford UP (2003).

Dietrich, F. "How to reach legitimate decisions if the procedure is controversial," in: *Social Choice and Welfare*, 24 (2005), pp. 363–393.

Dietrich, F. and List, Ch. "The impossibility of unbiased judgment aggregation," in: *Theory and Decision*, 68 (2010), 281–299.

Dietrich, F. and Moretti, L. "On coherent sets and the transmission of confirmation," in: *Philosophy of Science*, 72:3 (2005), pp. 403–424.

Fahrbach, L. and Hartmann, S. "Normativität und Bayesianismus," in: *Deskriptive oder normative Wissenschaftstheorie*, ed. B. Gesang, Frankfurt: Ontos (2005), pp. 177–204.

Gold, N. and List, Ch. "Framing as path dependence," in: *Economics & Philosophy*, 20:2 (2004), pp. 253–277.

Haenni, R. and Hartmann, S. "Modeling partially reliable information sources: A general approach based on Dempster–Shafer theory," in: *Information Fusion*, 7 (2006), pp. 361–379.

Hartmann, S. and Pigozzi, G. "Judgment Aggregation and the Problem of Truth-Tracking," in: *Proceedings of the 11th Conference on Theoretical Aspects of Rationality and Knowledge (TARK XI)*, New York: ACM (2007), pp. 248–252.

Huber, F. "Assessing theories, Bayes style," in: *Synthese*, 161:1 (2008), pp. 89–118.

Huber, F. "The logic of theory assessment," in: *Journal of Philosophical Logic*, 36:5 (2007), pp. 511–538.

5.2 Franz Huber & formal epistemology (2008–2013)

Franz Huber (born 1977) did his MA in logic with Paul Weingartner and Johannes Czermak (Salzburg, 2000) and his PhD with Gerhard Schurz in Erfurt (2004, *Assessing theories. The problem of a quantitative theory of confirmation*). He was a member of the Bovens–Hartmann group at Konstanz (2002–2005), worked at CalTech (2005–2007), before he returned to Konstanz to head the research group "Formal Epistemology" (2008–2013). It was located at the *Zukunftskolleg* and funded by an Emmy Noether fellowship (DFG). And while it may look as though Huber simply continued the work done earlier in Konstanz by Fuhrmann, Olsson, Rott, and Spohn, this was not the case, at least not initially, when Schurz and Bovens had a greater influence. It was only over time that Huber moved closer to Spohn's ideas.

Members of the group worked on the following projects: (i) Knowledge and justification (Peter Brössel, PhD *Rethinking Bayesian Confirmation Theory*, 2012); (ii) Belief and its revision (Benjamin Bewersdorf; PhD, same

title, 2012); (iii) Degrees of belief and belief (Zinke,[11] Huber); (iv) Theories of degrees of belief (Huber); (v) Degrees of rational acceptability (Anna-Maria Eder, PhD *A study on the foundations of theories of epistemic rationality*, 2016); (vi) Belief revision in dynamic epistemic logic and ranking theory (Peter Fritz; he left after his BA to continue in Amsterdam, then Oxford); (vii) Understanding normality (Corina Strößner). As indicated by the theses that were completed, the research group did double-duty as a graduate program affiliated with the department of philosophy. Strößner was the only post-doc (PhD *Logic and semantics of normality statements*, supervised by Niko Strobach, Saarbrücken, 2012), while Katharina Felka (not linked to any one project), obtained her MA and then went to Hamburg for her PhD.

The group hosted "Monthly Monday Meetings," often with guest speakers from abroad, and (co-)organized six international conferences in formal epistemology (four of them lovingly called 'Formal Epistemology Festival'); external co-organizers included Ray Briggs, Igor Douven, Kenny Easwaran, Branden Fitelson, Eric Swanson, and Jonathan Weisberg.

Selected publications.

Brössel, P. and Eder, A.-M. "How to resolve doxastic disagreement," in: *Synthese* 191:11 (2014), pp. 2359–2381.

Brössel, P., Eder, A.-M., and Huber, F. "Evidential support and instrumental rationality," in: *Philosophy and Phenomenological Research*, 87:2 (2013), pp. 279–300.

Huber, F. "Structural equations and beyond," in: *Review of Symbolic Logic*, 6:4 (2013), pp. 709–732.

Huber, F. "New foundations for counterfactuals," in: *Synthese*, 191:10 (2014), 2167–2193.

Huber, F. "What should I believe about what would have been the case?," in: *Journal of Philosophical Logic*, 44:1 (2015), pp. 81–110.

Huber, F., Swanson, E., and Weisberg, J. (eds). *Conditionals*, special issue of *Erkenntnis*, 70:2 (2009).

5.3 Margaret Thomas & o-minimal structures (2010–2019)

Margaret Thomas (in Konstanz: 2010–2017) obtained her PhD, supervised by Alex Wilkie in Oxford, with a thesis on *Convergence and parameterization in o-minimal structures* (2009). She stayed in Konstanz for nine years, before she landed a tenure-track position first at McMaster (2018), then at Purdue (2020). During her time in Kostanz she supported herself primarily through a DFG grant "Parameterization and Algebraic Points in O-Minimal Structures" (2012–2017). While in Konstanz, beyond polishing her docto-

[11] See page 71; this was her MA thesis.

ral work (jointly with Wilkie), she extended and branched out from it; a frequent research collaborator was Gareth O. Jones, once a fellow graduate student in Oxford. She did some teaching and participated in Kuhlmann's *Oberseminar*, but otherwise cooperation was limited to the organization of workshops: with Kuhlmann she organized the annual *Donau-Rhein Modelltheorie und Anwendungen*, with Eleftheriou and Kuhlmann the "Summer School in Tame Geometry" (2016), and with Antos "European Women in Mathematics" (Graz, 2018). Thomas was the sole organizer of the international workshop "O-Minimality and Applications" (2015). She advised one PhD thesis: Derya Çıray: *Mild parameterization in o-minimal structures* (2019).

Selected publications.

Andújar Guerrero, P., Thomas, M., and Walsberg, E. "Directed sets and topological spaces definable in o-minimal structures," in: *Journal of the London Mathematical Society* (2), 104 (2021), pp. 989–1010.

Chernikov, A., Starchenko, S., and Thomas, M. "Ramsey growth in some NIP structures," in: *Journal of the Institute of Mathematics of Jussieu*, 20:1 (2021), pp. 1–29.

Jones, G. O. and Thomas, M. "Effective Pila-Wilkie bounds for surfaces implicitly defined from Pfaffian functions," in: *Mathematische Annalen*, 381 (2021), pp. 729–767.

Jones, G. O., Thomas, M., and Wilkie, A. "Integer-valued definable functions," in: *Bulletin of the London Mathematical Society*, 44 (2012), pp. 1285–1291.

5.4 Pantelis Eleftheriou & recovering structures (2013–2021)

Pantelis Eleftheriou got his PhD from Notre Dame under the supervision of Sergei Starchenko (*Groups definable in linear o-minimal structures*, 2007) and came to Konstanz in 2013 after post-docs in Barcelona (2007–2008), Lisbon (2008–2011), and Waterloo (2011–2013); first on a two-year fellowship, followed by a five-year one, both at the *Zukunftskolleg*. He obtained the post-doctoral degree of habilitation with the thesis *Structure theorems and applications in semi-bounded and tame pairs* in 2019. In 2021 he moved to Leeds for a tenure-track position. His research interest is "to recover concrete mathematical structure from given logical data, such as Lie groups from definable groups, algebraic curves from definable sets with many rational points, algebraically closed fields from strongly minimal structures, and algebraic topology (homotopy/homology) from semi-linear data." While in Konstanz, he cooperated repeatedly with Ayhan Günaydin (Istanbul), Assaf Hasson (Ben Gurion), Philipp Hieronymi (Urbana), and Ya'acov Peterzil (Haifa); he supervised one doctoral student (Alex Savatovsky, *Structure theorems for d-minimal expansions of the real additive ordered group*

and some consequences, 2020) and mentored two visiting post-docs: Eliana Barriga and Erick García Ramírez. He participated in Kuhlmann's *Oberseminar* and assisted with nine conferences, two of them local for which he secured the funding: "Summer School in Tame Geometry" (2016) and "Tame Expansions of o-Minimal Structures" (2018).

Selected publications.

Eleftheriou, P. "Semi-linear stars are contractible," in: *Fundamenta Mathematicae*, 241 (2018), pp. 291–312.

Eleftheriou, P., Günaydin, A., and Hieronymi, P. "Structure theorems in tame expansions of o-minimal structures by a dense set," in: *Israel Journal of Mathematics*, 239 (2020), pp. 435–500.

Eleftheriou, P., Hasson, A., and Keren, G. "On definable Skolem functions in weakly o-minimal non-valuational structures," in: *Journal of Symbolic Logic*, 82 (2017), pp. 1482–1495.

Eleftheriou, P., Hasson, A., and Peterzil, Y. "Strongly minimal groups in o-minimal structures," in: *Journal of the European Mathematical Society*, 23 (2021), pp. 3351–3418.

5.5 Carolin Antos & set theory (2016–2023)

Carolin Antos (in Konstanz: from 2016) did her MA and PhD in Vienna at the Kurt Gödel Research Center for Mathematical Logic (formerly, the *Institut für Logistik*) with Sy Friedman (*Foundations of Higher-Order Forcing*, 2016). In 2016 she came to the *Zukunftskolleg* on two successive grants and has her own research group since 2018 "Forcing: Conceptual Change in the Foundations of Mathematics" (2018–2023), generously founded by a Freigeist Fellowship of the Volkswagen Foundation. The overarching goal of the project on forcing is twofold: first, to track how the technique of forcing has transformed set theory as a discipline, and second, to analyze the ramifications this has for mathematics, its foundations and its philosophy. Members of her group are Neil Barton, Deborah Kant, and Daniel Kuby. Barton did doctoral work, advised by Ian Rumfitt, on set theory at Birkbeck College (*Executing Gödel's programme in set theory*, 2016), from where he went to Vienna (2016), to Konstanz (2019), to Oslo (2022). He and Antos know each other from their time as graduate students (he used her results at critical junctures in his dissertation) and seem to form the hub of the group. Kant, well-known among those who have an interest in the philosophy of mathematical practice, works on questions of independence and naturalness in set theory, while Kuby, who did doctoral work on Paul Feyerabend (*Studies on Paul Feyerabend's philosophy: from logical empiricism to the historical turn in philosophy of science*, 2017) supervised by Elisabeth Nemeth in Vienna, pursues a satellite project in which he frames the universe-multiverse debate in set theory as a philosophy-of-science question about intertheoretic

inconsistency. Associated members are Regula Krapf (Bonn), who did her doctoral work on class forcing (Bonn, 2017),[12] and Nick de Hoog (graduate student, co-supervised with Hamburg). Thus far, group members have organized four major conferences.

But Antos is doing more than directing a research group. She became an assistant professor (with special emphasis on the philosophy of mathematics) at the Department of Philosophy. As such, she teaches introductory logic classes mandatory for philosophy majors but also team-teaches graduate classes with members of the Kuhlmann group. Moreover, after Carl had left, she joined in the organization of the interdepartmental logic group "Logic in Konstanz," which hosts semi-regular meetings with internal and external speakers. She and her activities align perfectly with what the *Gründungsausschuss* once envisioned for all of Konstanz: truly interdisciplinary research.

Selected publications.

Antos, C., Barton, N., and Friedman, S. "Universism and extensions of V," in: *The Review of Symbolic Logic*, 14:1 (2021), pp. 112–154.

Antos, C., Barton, N., Friedman, S., Ternullo, C., and Wigglesworth, J. (eds). *Foundations of Mathematics*, special issue of *Synthese*, 197:2 (2020).

Barton, N. "Forcing and the universe of sets: Must we lose insight?" in: *Journal of Philosophical Logic*, 49:4 (2020), pp. 575–612.

Barton, N., Müller, M., and Prunescu, M. "On representations of intended structures in foundational theories," in: *Journal of Philosophical Logic*, online first (September, 2021).

Barton, N., Ternullo, C., and Venturi, G. "On forms of justification in set theory," in: *The Australasian Journal of Logic*, 17:4 (2020), pp. 158–200.

Centrone, St., Kant, D., and Sarikaya, D. (eds). *Reflections on the Foundations of Mathematics. Univalent Foundations, Set Theory and General Thoughts* (= Synthese Library; 407), Cham: Springer (2019).

Kant, D. and Sarikaya, D. "Mathematizing as a virtuous practice: Different narratives and their consequences for mathematics education and society," in: *Synthese*, 199:1–2 (2021), pp. 3405–3429.

[12] Krapf was a speaker at the PhD Colloquium at the *Colloquium Logicum 2018* in Bayreuth; cf. Footnote 10.