The second paper starts out by highlighting geometry as the area of mathematics which was first axiomatized successfully, by today's standards of mathematical rigor, namely, in Hilbert's ground-breaking "Grundlagen der Geometrie". In a number of sections, the author then outlines the various steps in geometry which led to this culmination: Hippasos of Metapont (around 425 B.C.) first proved that the ratio of the diagonal over the side of a square is irrational, leading to an early "foundational crisis" of what geometry is all about and whether the objects it is considering "have reality". Euclid (around 300 B.C.) summarized the achievements of Greek geometry in his "Elements", starting his proofs from axioms (or, rather, postulates, as opposed to the "self-evident" axioms), including his famous Parallel Postulate. There was then a long hiatus until the sixteenth and seventeenth century, when Descartes, Pascal, and Hobbes began considering geometry again from a more philosophical point of view, trying to "define" the objects of geometry, whereas Tschirnhaus and Wolff tried to combine the definitions of the objects of geometry with the axiomatic method of deductive reasoning. The author then jumps directly to the late 1890's, when Hilbert completed what Felgner calls "cutting the umbilical cord of geometry from (physical) reality" and formulated a system of axioms which describe geometric objects as idealized rather than physical objects. The rest of the paper describes Hilbert's method and way of thinking in fair detail, in particular the so-called "Completeness Axiom", which ensures that each line in space is order-isomorphic to the real line, and comments further on Hilbert's "structuralist" point of view, according to which the objects of geometry (points, lines, etc.) can only be described but not defined.

In summary, the two papers make for a captivating read on how two fundamental topics in mathematics were viewed over the course of more than two millennia, with many direct quotes from thinkers along the way, part of which accounts for the linguistic challenge in reading the two papers.

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Nicholas J. J. Smith. *Logic: The laws of truth*. Princeton University Press, Princeton NJ, 2012, xiv + 528 pp.

Nicholas J. J. Smith's stated aim in this book is to provide students of logic with both "the how and the why of logic" (p. xi). The result is an introductory text notable for both its breadth and its depth.

The book is divided into three parts. Parts I and II provide clear and comprehensive introductions to Propositional and Predicate Logic respectively, using trees. Part III contains extension material not typically found in introductory texts, including a chapter introducing the main alternatives to trees: axiomatic proofs; natural deduction and sequent calculus. Although comparatively brief, the presentations of these systems give students some familiarity with their methods, and some appreciation of the relationships between systems. There is also a well-paced chapter on the metatheory of the systems introduced in Parts I and II, and a chapter on set theory, which provides a general introduction to essential material in the area, as well as functioning as an appendix to further elucidate topics introduced earlier in the text. Exercises are provided throughout the chapters to allow for the scaffolding of skills, with solutions available through an associated website.

The book is written in a way that balances an accessible and readable style with formal precision. Important discussions are relatively slow-paced to avoid common confusions (I would note, for example, the pace of the introduction of the languages of Monadic and General Predicate Logic, which students often find difficult), but at the same time Smith avoids glossing over difficult issues, and uses model-theoretic and set-theoretic terminology and concepts in a way that most introductory texts do not, providing invaluable preparation for students continuing with logic beyond the introductory level. Endnotes provide a more

extended treatment of some of the philosophical issues arising in connection with the formal material, and introduce some alternate presentations and interpretations.

This breadth of coverage will leave readers with a more comprehensive than usual understanding of the "how" of logic, but another distinctive feature of the book is Smith's attention to the question of "why". Teaching students how to apply the methods of formal logic can be easier than motivating those methods, especially if, as is typical in introductions to the subject, logic is presented as being the study or science of good reasoning. For the increasing number of students who have already been exposed to critical thinking courses, in particular, it may not be obvious why we would use the methods of formal logic to study reasoning, or how those methods contribute to that study. Smith presents logic in Fregean terms, as the study of the laws of truth, arguing that while an understanding of logic can help promote better reasoning, reasoning is not itself the subject matter of logic. This construal of logic establishes a much better foundation for an answer to the question of why formal logic is the way it is.

The characterisation of logic as concerned with the laws of truth underlies the presentation of logic throughout the text, making sense of aspects of logic that can otherwise cause confusion for students. One example of this is the discussion of translation in Chapter 6, where Smith explores problems relating to apparent failures of translation between English and the language of Propositional Logic. Smith introduces quite a detailed discussion of Gricean conversational maxims, contrasting truth and assertability conditions for a range of purported problem cases. Students are often (not unreasonably) unwilling to accept that "but" is really just the same as "and", and "unless" is really just the same as "or", but coming to translation with the understanding of logic as being concerned with the laws of truth gives a clearer sense of why it is the truth conditions of an utterance, rather than its implicatures or other considerations about its meaning, that are relevant to its logical content.

While this is primarily a text aimed at beginning logic students, it also contains material that will be of interest to professional philosophers and logicians. In Chapter 11, for example, Smith presents a thorough and careful analysis of the concept of a proposition, drawing on different ways that uninterpreted formulas of propositional logic can be given content, through translation and valuation. He endorses a pluralistic understanding of the concept of a proposition, distinguishing and relating various formal analogues of the intuitive notion of a proposition, and examining the relationship between these conceptions and other central logical concepts. The discussion of propositions is of independent interest, and is also used to illuminate and clarify some important distinctions made elsewhere in the text, such as the distinction between validity and necessary truth preservation, and between logical and necessary truth. This chapter makes a useful contribution to the understanding of the concept of a proposition, which is central to philosophy of logic and language.

A possible reservation one might have about this text is that its sheer scope and comprehensiveness does mean that a single-semester introductory unit will inevitably leave much of its content untouched. In his Preface, Smith distinguishes between the book's core and extension material, noting parts of the book that could be covered in a basic introductory course, but it may still be that a briefer introduction to the formal mechanics of logic may be sufficient, and more appropriate, for some purposes. Smith's book does, however, provide an excellent, thorough foundation in logic, of particular benefit to those who wish to go on with the subject, either in subsequent logic units or independently.

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