13th-14th century theories of inference

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1 Their nature

In medieval logic, *consequence* refers to a relation between two parts of a hypothetical proposition, respectively called the *antecedent* and *consequent*, according to which what is stated in the consequent follows from what is stated in the antecedent, e.g. 'If Socrates is running, then he is moving'.

2 Why study consequence

Consequence is arguably the core notion studied in formal logic today, where it has stood since Alfred Tarski's groundbreaking work on the topic in the 1930s, and also plays a major role in adjacent fields including computing and the philosophy of science.

When compared to the intuitive notion of consequence that they aim to capture, however, the most widely-used theories of consequence suffer from several known deficiencies:

- Classical theories of consequence validate inference rules that are highly unintuitive. The best-known of these is *explosion*, which allows anything to be inferred from a contradiction.
- Natural language inference is *semantically closed*. making it possible for statements to refer, directly or indirectly, to themselves. The artificial languages studied in formal logic today, by contrast, tend to employ various devices to prevent semantic closure, leaving them less expressive than their natural counterparts.
- The inference schemata studied in modern logical systems tend, by design, to be indifferent to whatever content might be expressed in actual natural language inferences whose formalizations they capture. Particularly for novices, this can leave the use of these systems opaque.

2.1 Why study medieval consequences

Given these difficulties, the study of consequence at the height of its cultivation in the medieval period can be profitable in a number of ways.

2.1.1 To solve problems in modern logic

Work on inference in this period reaches a sophistication that it would not approach again until the beginning of the current tradition of work on the topic in the late 19th and early 20th century, and therefore provides a repository that can be drawn upon to improve modern theories of consequence. For example, where modern definitions of consequence are typically insensitive to tense and modality, medieval theories like that of John Buridan can vary their criterion for valid inference relative to the tense and modality of the parts of the inference under evaluation (Read 2015, p. 63).

2.1.2 To understand how we got here

In addition, several essential aspects of the theory of consequence as we understand it today first arose during this period: the earliest extant treatises directly devoted to consequence, translated in (Archambault 2017), were written at the turn of the 14th century, and the notion of *formal* consequence became a primary locus of attention shortly thereafter (Dutilh Novaes 2016). This period therefore provides the backdrop for understanding, prior to the more mathematical aspects provided at the turn of the 20th century, some of the more general aims of research on consequence as it continues to be carried out today.

3 Their origin

According to seminal research carried out in the late 70's and early 80's, theories of consequence appear to have arisen out of two groups of sources.

3.1 Topics

The first was the body of work devoted to the theory of topics the medievals inherited from Aristotle, Cicero, Themistius, and Boethius (Stump 1982), with the most conspicuous support for this being the placement of William of Ockham's treatise on consequences in his *Summa Logicae*, which sets out its subjects in an order corresponding to that of the books of Aristotle's logic, in the place normally reserved for topics (William of Ockham 1974). Traditional work on topics aimed to classify various properties or relations, e.g. between species and genera, parts and wholes, or causes and effects, which could ground the discovery of new conclusions about the entities to which those properties and relations applied. Early treatises on consequences, however, differed radically from their topical forebearers, grounding inferences not in a rich variety of arguably metaphysically robust relations, but rather almost entirely on extensional relations pertaining to the distribution of terms as outlined in medieval theories of supposition.

3.2 Sophismata

The second group, both more amorphous and influential, included treatises on *syncategoremata* (i.e. terms roughly similar to today's logical constants) fallacies, and other subjects not fully addressed in Aristotle's organon. (Green-Pedersen 1984; Spruyt 2018). 13th century authors working on consequence in this tradition include Nicholas of Paris, William of Sherwood, Lambert of Lagny and Peter of Spain.

4 Their Criteria

4.1 Impossible for the antecedent...

4.2 Containment

5 Their division

6 Their evolution

7 open questions

References

Archambault, Jacob (2017). "The development of the medieval Parisian account of formal consequence". PhD thesis. Fordham University.

Dutilh Novaes, Catarina (2016). "Medieval Theories of Consequence". In: *The Stanford Encyclopedia of Philosophy*. URL: `https://plato.stanford.edu/archives/fall2016/entries/consequence-medieval`.

Green-Pedersen, Niels Jørgen (1984). *The Tradition of the Topics in the Middle Ages. Commentaries on Aristotle's and Boethius' Topics*. Munich: Philosophia Verlag.

Read, Stephen (2015). "Introduction". In: John Buridan. *Treatise on Consequences*. Trans. by Stephen Read. Bronx, NY: Fordham University Press, pp. 1–52.

Spruyt, Joke (2018). "Consequence and 'Cause': Thirteenth-Century Reflections on the Nature of Consequences". In: *Vivarium* 56.3-4, pp. 320–339.

Stump, Eleonore (1982). "Topics: Their Development and Absorption into Consequences". In: *The Cambridge History of Later Medieval Philosophy*. Ed. by Norman Kretzmann, Anthony Kenny, and Jan Pinborg. Cambridge: Cambridge University Press, pp. 273–299.

William of Ockham (1974). *Summa Logicae*. In: *Opera Philosophica*. Ed. by Philotheus Boehner, Gedeon Gàl, and Stephen Brown. Vol. 1. St. Bonaventure, NY: Franciscan Institute.