Buridan's and Avicenna's Aristotelian Diagrams for Combined Operators

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In this talk I will look at various medieval Aristotelian diagrams (such as the well-known square of oppositions, but also larger ones) for propositions involving multiple logical operators (which can be quantifiers, modalities, temporal adverbs, etc.). It is relatively well-known that John Buridan had several Aristotelian octagons for such propositions; for example, he studied propositions such as "it is necessary that every man is mortal", which contains the modality "necessary" and the quantifier "every". It will be shown that Buridan's octagon can be "decomposed" into two squares (Square1 for the modalities and Square2 for the quantifiers). After briefly mentioning that Buridan's octagon can essentially already be found in Al-Farabi, I will propose a way to measure the "logical complexity" of this diagram in terms of its Boolean closure. A systematic way of extending Buridan's and Al-Farabi's octagon consists in looking at the Boolean closure not of the octagon itself (which would be unreasonably large), but rather of one of the two squares in which it can be decomposed, i.e. Square1 and Square2. In this way two natural 12-formula diagrams are obtained, and I will argue that both of them can be found in Avicenna. Interestingly, one of these two extensions is logically no more complex than Buridan/Al-Farabi's original octagon, but the other one is exponentially more complex. To conclude, I will address a very natural question, viz. what happens if we take the Boolean closure of Square1 and Square2 simultaneously?

(This talk is based on joint work with Saloua Chatti, Hans Smessaert and Fabien Schang.)