Notes on Malink (2006)

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1   Overview of System $\mathcal{A}$

Malink (2006) develops an axiomatic term logic $\mathcal{A}$ to formalize Aristotle's modal syllogistic

- Three primitive types of predication relations between *terms*:

  > 1. Υab *Accidental$^+$ Predication*
  > 2. $\mathbf{E}ab$ *Substantial Essential Predication*
  > 3. $\tilde{\mathbf{E}}ab$ *Non-Substantial Essential Predication*

  - Intended interpretation of Υab: either a is the definition of b, or a is a genus or accident of b; by (ax_{1-2}) Υ is reflexive and transitive
    - ▷ Note that this makes Υab inclusive; it can be essential/necessary predication or genus/accidental predication
  - Intended interpretation of $\mathbf{E}ab$: a is part of the definition or the genus of b within the category of substance (M06:97-8) (*within?*)
  - Intended interpretation of $\tilde{\mathbf{E}}ab$: a is the definition or genus of b within a category other than substance (M06:97-8) (*within?*)

- Seven types of defined relations:

  > 1. Σa ***a** Belongs to the Category of Substance* (df_1)
  > 2. $\mathbf{K}ab$ *Incompatible Substances* (df_2)
  > 3. Πab *Two-Way Possible Predication* (df_3)
  > 4. $\overline{\Pi}ab$ *Two-Way Possible or Accidental$^+$ Predication* (df_4)
  > 5. $\hat{\mathbf{E}}ab$ *Essential Predication Within Some Category* (df_5)
  > 6. $\widehat{\Sigma}ab$ *Belongs to the Category of Substance or is Essentially Predicated of* (df_6)
  > 7. $\overline{\mathbf{E}}ab$ *Substantial Predication or **a** is a Substance and Accidentally Predicated* (df_7)

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  - (df_1): if a is the subject of substantial essential predication, then a must be a substance
  - (df_3):

- Four kinds of modal predication:

  > 1. $\mathbb{X}^{\mathbf{a/e/i/o}}ab$ *Assertoric*
  > 2. $\mathbb{N}^{\mathbf{a/e/i/o}}ab$ *Necessary*
  > 3. $\mathbb{M}^{\mathbf{a/e/i/o}}ab$ *One-Way Possible*
  > 4. $\mathbb{Q}^{\mathbf{a/e/i/o}}ab$ *Two-Way Possible*

  - Four combinations of quality and quantity:
    - ▷ **a**: universal affirmative, *All A are B*
    - ▷ **e**: universal negative, *All A are not B*
    - ▷ **i**: particular affirmative, *Some A are B*
    - ▷ **o**: particular negative, *Some A are not B*
  - Examples:
    - ▷ $\mathbb{X}^{\mathbf{a}}ab$: a applies to all b
    - ▷ $\mathbb{N}^{\mathbf{a}}ab$: a necessarily applies to all b
    - ▷ $\mathbb{M}^{\mathbf{a}}ab$: a may apply to all b
    - ▷ $\mathbb{Q}^{\mathbf{a}}ab$: a may or may not apply to all b

- The axioms induce an ordering on term-denotations that can be visualized with scheme described on p.104

2 Syllogisms of Interest

Barbara NAN (aaa-1-NXN)

A	N	all	B
B		all	C
A	N	all	C

$\rightsquigarrow$

$\mathbb{N}^{\mathbf{a}}ab$
$\mathbb{X}^{\mathbf{a}}bc$
$\mathbb{N}^{\mathbf{a}}ac$

$\Longleftrightarrow$

$\hat{\mathbf{E}}ab$
Υbc
$\hat{\mathbf{E}}ac$

$\overset{\text{(df}_5)}{\Longleftrightarrow}$

$\mathbf{E}ab \vee \tilde{\mathbf{E}}ab$
Υbc
$\mathbf{E}ac \vee \tilde{\mathbf{E}}ac$

- This syllogism is valid in $\mathcal{A}$; **Theorem 18** (M06:124)
  - **Proof** (By Cases): Suppose $\mathbf{E}ab$. Premise two gives us Υbc, so by (ax$_4$) $\mathbf{E}ac$ and thus $\hat{\mathbf{E}}ac$. Alternatively, suppose $\tilde{\mathbf{E}}ab$. Premise two gives us Υbc, so by (ax$_5$) $\tilde{\mathbf{E}}ac$ and thus $\hat{\mathbf{E}}ac$.

- What of the Theophrastian 'counterexample'?

Animal	*N*	*all*	*Man*
Man		*all*	*Moving*
Animal	*N*	*all*	*Moving*

$\rightsquigarrow$

$\mathbb{N}^{\mathbf{a}}am$
$\mathbb{X}^{\mathbf{a}}mv$
$\mathbb{N}^{\mathbf{a}}av$

$\overset{\text{(df}_5)}{\Longleftrightarrow}$

$\mathbf{E}am \vee \tilde{\mathbf{E}}am$
Υmv
$\mathbf{E}av \vee \tilde{\mathbf{E}}am$

  - Malink's (2006: 101-102) diagnosis:
    - ▷ The argument is valid but unsound (*my interpretation of Malink's remarks*)
      - ► *Animal* is part of the definition or genus of *Man* within the category of substance
      - ► Hence $\mathbf{E}am$ is true and $\tilde{\mathbf{E}}am$ false
      - ► By (df$_1$), Σm
      - ► Malink (2006: 101) shows that:
        $$\vdash_{\mathcal{A}} \Sigma a \wedge \Upsilon ab \supset \Sigma b$$
      - ► This, with our last result and the minor premise implies Σv
      - ► However, *Moving* is a non-substance term so on any adequate model of $\mathcal{A}$ this would be false
      - ► So both premises cannot be true simultaneously!
    - ▷ But wait, does this mean that Υmv is false whenever $\mathbb{N}^{\mathbf{a}}am$ is true?
      - ► *Yes!*, says Malink
      - ► But how could *Animal* necessarily applying to all *Man* imply that *Man* does not apply to all *Moving*?
      - ► Firstly, this does not amount to saying that the major premise implies that some moving thing is not human
      - ► Although it is a necessary condition of Υmv that each moving thing be human, it is not all there is to its truth for Aristotle
      - ► Substance terms can be universally affirmatively predicated only of their substantial subspecies

- ► Since *Moving* is not a substantial subspecies of *Man*, the *Man* cannot be universally affirmatively predicated of *Moving*, which is required for the truth of Υmv
- ► Malink calls predications of substance terms of non-substantial or non-subspecies terms **unnatural predications**
- ► He (M06:102) suggests that Aristotle only prohibits universal affirmative unnatural predications in his modal syllogistic, but not the other quality/quantity combos
  - Discuss Aristotle's motivations for prohibiting premises with unnatural predication

Barbara ANN (aaa-1-XNN)

A		all	B
B	N	all	C
A	N	all	C

$\rightsquigarrow$

$\mathbb{X}^{\mathbf{a}}ab$
$\mathbb{N}^{\mathbf{a}}bc$
$\mathbb{N}^{\mathbf{a}}ac$

$\Longleftrightarrow$

Υab
$\hat{\mathbf{E}}bc$
$\hat{\mathbf{E}}ac$

- This syllogism is invalid in $\mathcal{A}$; **Theorem 51** (M06:131)

References

MALINK, M. (2006). 'A Reconstruction of Aristotle's Modal Syllogistic'. *History and Philosophy of Logic*, **27**: 95–141.