

A linear logic account of social meaning as enthymematic inference

Bill Noble, Vladislav Maraev, Ellen Breitholtz, & Christine Howes

SKY Symposium, 2025

Thursday, October 2

Preliminaries

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Preliminaries

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Social meaning

Three waves of sociolinguistics:¹

- first** correlations between **linguistic variables** and primary social categories (e.g., socioeconomic class, race, gender)
- second** ethnographic study fine-grained social categories; *linguistic style*
- third** variation as a resource for *constructing* **social meaning**, rather than a reflection of the speaker's social status

¹Penelope Eckert (Jan. 2005). "Variation, Convention, and Social Meaning". In: *Annual Meeting of the Linguistic Society of America*. Oakland, CA, p. 33.

Persona-based social meaning

- ▶ A *persona* is a commonly recognised fine-grained social category; a *type of person* like *jock* or *burnout*²
- ▶ Speakers **project** personae through the use of social signals
 - ▶ Phonological articulation, lexical choice, clothing, ...
- ▶ Personae exist in a complex **indexical field**³ that includes linguistic and personal style, ideological commitments, and association with social groups
- ▶ Speakers construct contextualized style through a process of **bricolage**⁴ in which personae are resources to disassemble and reuse

²Penelope Eckert (June 1988). “Adolescent Social Structure and the Spread of Linguistic Change”. In: *Language in Society* 17.2, pp. 183–207.

³Penelope Eckert (Sept. 2008). “Variation and the Indexical Field”. In: *Journal of Sociolinguistics* 12.4, pp. 453–476.

⁴Dick Hebdige (2008). *Subculture: The Meaning of Style*. New Accents. London New York: Routledge.

Enthymemes and topoi in dialogue

- ▶ Arguments in dialogue tend to be *enthymematic* — relying on what is **in the mind** of the interlocutor/audience
- ▶ In order to be accepted, enthymemes must be underpinned by acceptable principles of reasoning
 - ▶ facts (or beliefs) and principles of reasoning that warrant the acceptability (and applicability) of the argument
 - ▶ these warrants are sometimes referred to as **topoi**
- ▶ Topoi are ubiquitous even in superficially non-argumentative dialogical contexts⁵
- ▶ Topoi can be viewed as **rhetorical resources** that support linguistic interaction by **licensing** certain inferences⁶

⁵Oswald Ducrot (1980). *Les Échelles Argumentatives*.

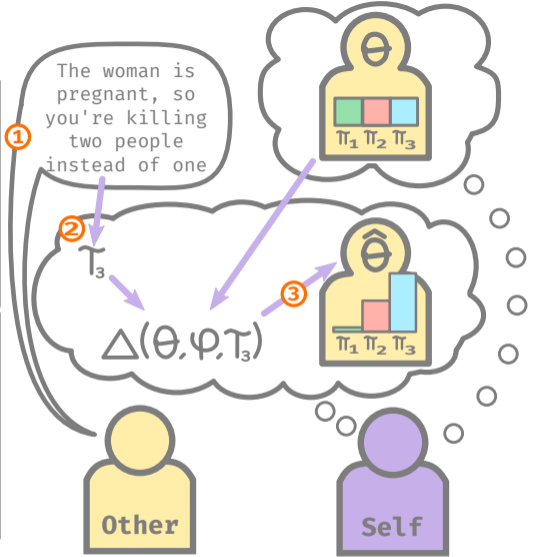
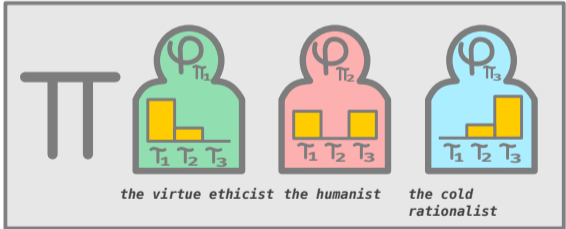
⁶Ellen Breitholtz (Nov. 2020). *Enthymemes and Topoi in Dialogue: The Use of Common Sense Reasoning in Conversation*. Brill.

Topoi as sociolinguistic variables

- ▶ An enthymematic utterance can **evoke** on or more topoi
- ▶ Topoi can be indexically related to certain personae
- ▶ Listener uncertainty about the persona of the speaker can result in uncertainty about the topoi they are likely to evoke and lead to uncertainty about the content of their utterances
 - ▶ This situation creates a *joint inference problem* (see also: Beltrama and Schwarz 2021)
- ▶ Previous work developed a Bayesian probabilistic model for inferring topoi and speaker personae⁷
 - ▶ This model is only minimally integrated into a formal account of dialogue

⁷Bill Noble, Ellen Breitholtz, and Robin Cooper (June 2020). “Personae under Uncertainty: The Case of Topoi”. In: *Proceedings of the Probability and Meaning Conference (PaM 2020)*. Gothenburg: Association for Computational Linguistics, pp. 8–16.

Ψ
 τ_1 *x is a child → don't sacrifice x*
 τ_2 *x may achieve great things → don't sacrifice x*
 τ_3 *given a choice between n people and n+1 people → sacrifice n people*



Information State Update

- ▶ In dialogue, participants actively build up **common ground** — a collection of facts and resources that are mutually understood and can be relied on to further the aims of the dialogue
- ▶ An Information State Update (ISU) account of dialogue explicitly models the common ground as a structured *information state*⁸
 - ▶ A contribution by a particular speaker is modeled as an update to the information state
 - ▶ The effect of a given contribution can depend on various aspects of the previous state
- ▶ Typical components of an ISU model include recent *contributions*, the current *question under discussion*, *speaker commitments*, and established *facts*.

⁸Staffan Larsson (2002). “Issue-Based Dialogue Management”. PhD thesis. Gothenburg, Sweden: University of Gothenburg; Jonathan Ginzburg (2012). *The Interactive Stance*. Oxford University Press.

Linear Logic⁹

Propositional logic is not suitable for reasoning about actions and resources. Consider:

A	John has a dollar.
$A \rightarrow B$	If John has a dollar he can buy a candybar.
$\Rightarrow B$	John can buy a candybar

We want a notion of “using up” certain premises.

⁹Jean-Yves Girard (Jan. 1987). “Linear Logic”. In: *Theoretical Computer Science* 50.1, pp. 1–101.

Resource and action in Linear Logic

Propositional logic:

$$A, A \rightarrow B$$
$$\vdash A, A \rightarrow B, B$$

Linear logic:

$$A, A \multimap B$$
$$\vdash A \multimap B, B$$

A Linear Dialogue Manager (LDM)¹⁰

- ▶ Resource-sensitivity allows linear logic to model *dialogue state*
- ▶ Maraev, Bernardy, and Ginzburg 2020 implement a linear logic-based dialogue manager
 - ▶ proof search to identify possible next actions
 - ▶ metavariables for underspecification and unification for question resolution
 - ▶ extensible domain-independent framework

¹⁰Vladislav Maraev, Jean-Philippe Bernardy, and Jonathan Ginzburg (2020). “Dialogue Management with Linear Logic: The Role of Metavariables in Questions and Clarifications”. In: *Traitement Automatique des Langues* 61.3. Ed. by Liesbeth Degand and Philippe Muller, pp. 43–67.

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Implementation

Dual goals of implementation

1. **Machines:** Prototype a dialogue system that interprets enthymematic utterances as (possibly) socially meaningful
2. **Humans:** Validate and refine a theoretical account of the role of topoi and personae in dialogue

Adding personae and topoi to LDM

- ▶ A persona is associated with a *topoplex* (collection of topoi)
 - ▶ At start of dialogue: Load topoplex associated with the *default persona*
- ▶ Add *Enthymeme Under Discussion* (EUD) to the information state
- ▶ Raising an EUD triggers a search for a *private topos* that validates the enthymeme
- ▶ Underspecified enthymemes are represented with meta-variables
- ▶ Topoi can be confirmed or cancelled by explicitly communicated *facts*

Example: ... *because I hated metal*

1. **P:** Metal was actually the reason I started doing hip hop
2. **P:** ... because I hated metal
3. **J:** Oh, I thought you were going to say something completely different!

Demo

Future work

- ▶ Accounting for other examples of social meaning (e.g., Burnett and Paris-Diderot 2019)
- ▶ Unpacking personae
 - ▶ Salient personae emerge from a particular social context
 - ▶ genre, level of granularity,...
 - ▶ Dynamic collection of available personae
 - ▶ Concept of *default persona*
- ▶ Similar issues with topoi:
 - ▶ there is no fixed lexicon of topoi
 - ▶ sources of topoi? Common knowledge, cultural assumptions, conversational genre, ...
- ▶ How does the concept of *topoplex* relate to indexical field? What is the role of speaker ideology with respect to persona?

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Thank you!

References

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-  Beltrama, Andrea and Florian Schwarz (Dec. 2021). “Imprecision, Personae, and Pragmatic Reasoning”. In: *Semantics and Linguistic Theory* 31.0, pp. 122–144.
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-  Noble, Bill, Ellen Breitholtz, and Robin Cooper (June 2020). “Personae under Uncertainty: The Case of Topoi”. In: *Proceedings of the Probability and Meaning Conference (PaM 2020)*. Gothenburg: Association for Computational Linguistics, pp. 8–16.