

Summary

- The Japanese modal particle *darou* is **responsive**, i.e., it can combine with both declaratives and interrogative clauses [1, 2].
- However, it is **not reductive**. This is problematic for theories which assume that responsive modal operators always apply to **propositions**.
- Further, the meaning/felicity of *darou* is modulated by intonation [1, 2].
- Our analysis captures **non-reducibility** and the effects of **intonation**.
- Crucially, we assume that declarative and interrogative clauses have the same semantic type and that modal operators apply uniformly to them.

Basic data and challenges

Darou is responsive, but not reductive

- (1) a. Taro-wa utau-**darou**↓.
Taro-TOP sing-DAROU
'I believe Taro will sing.'
- b. Taro-wa utau-**darou**-ka↓.
Taro-TOP sing-DAROU-Q
'I wonder if Taro will sing.'
- c. Dare-ga utau-**darou**-ka↓.
who-NOM sing-DAROU-Q
'I wonder who will sing.'

- *ka* in (1-b)-(1-c) is a question particle.
- However, (1-b)-(1-c) do not behave as questions; e.g., one cannot respond to (1-b)-(1-c) with 'Why are you asking *me* that question?'
- *ka* with a fall can also function as an exclamative marker, but (1-b)-(1-c) do not express exclamation about the speaker's beliefs.
- Hara & Davis (2013); Hara (2015): *ka* does not apply to the matrix clause in such constructions, but is part of the prejacent of *darou*.
⇒ *darou* is a *responsive modal particle*: it can take both declarative and interrogative prejacentes.
- **Crucial observation**: the interrogative-embedding use of *darou* cannot be reduced to its declarative-embedding use: 'I wonder Q' does not mean that for some answer A to Q, 'I believe A'. This is problematic for standard reductive theories of responsive operators, e.g., Karttunen (1977).

Effects of intonation (Hara 2015)

- (2) a. Taro-wa utau-**darou**↑.
'Taro will sing, won't he?'
- b. *Taro-wa utau-**darou**-ka↑.
- c. *Dare-ga utau-**darou**-ka↑.

- How does intonation interact compositionally with *darou* and *ka*?

Background (Inquisitive Epistemic Logic; IEL)

Intuitive characterization of IEL

In inquisitive semantics, declarative and interrogative clauses are taken to have the same kind of semantic value, i.e., a set of propositions. IEL treats modals as operators applying to such unified semantic values. This enables us to account for 'non-reducible' responsive modal particles like *darou*.

IEL Model

An IEL model for a set \mathcal{P} of atomic sentences and a set \mathcal{A} of agents is a triple $M = \langle \mathcal{W}, V, \Sigma_{\mathcal{A}} \rangle$, where:

- \mathcal{W} is a set of POSSIBLE WORLDS,
- $V : \mathcal{W} \mapsto \wp(\mathcal{P})$ is a VALUATION MAP, and
- $\Sigma_{\mathcal{A}} = \{ \Sigma_a \mid a \in \mathcal{A} \}$ is a set of INQUISITIVE STATE MAPS, one for each agent $a \in \mathcal{A}$, mapping every world $w \in \mathcal{W}$ to a downward-closed set of information states $\Sigma_a(w)$, namely those information states that settle the issues that a entertains in w .
- $\Sigma_a(w)$ is called the INQUISITIVE STATE of a in w , and its union, $\cup \Sigma_a(w)$, represents the current information state of a in w .

IEL Semantics

- The semantic value of a sentence φ in IEL, $\llbracket \varphi \rrbracket$, is a downward-closed set of propositions, namely those propositions that support the information conveyed by φ (if any) and resolve the issue expressed by φ (if any).
- Truth-conditions of φ are derivable from $\llbracket \varphi \rrbracket$: φ is true in w iff $\{w\} \in \llbracket \varphi \rrbracket$.
- The informative content of φ , $\text{info}(\varphi)$, is the set of all worlds where φ is true, $\cup \llbracket \varphi \rrbracket$.

- (3) a. $\llbracket \alpha \rrbracket := \{p \mid \forall w \in p : \alpha \in V(w)\}$
 b. $\llbracket \neg \varphi \rrbracket := \{p \mid \forall p' \in \llbracket \varphi \rrbracket : p \cap p' = \emptyset\}$
 c. $\llbracket \varphi \wedge \psi \rrbracket := \llbracket \varphi \rrbracket \cap \llbracket \psi \rrbracket$
 d. $\llbracket B_a \varphi \rrbracket := \{p \mid \forall w \in p : \sigma_a(w) \in \llbracket \varphi \rrbracket\}$
 e. $\llbracket E_a \varphi \rrbracket := \{p \mid \forall w \in p : \Sigma_a(w) \subseteq \llbracket \varphi \rrbracket\}$
 f. $\llbracket !\varphi \rrbracket := \{p \mid p \subseteq \text{info}(\varphi)\}$
 g. $\llbracket ?\varphi \rrbracket := \llbracket \varphi \rrbracket \cup \llbracket \neg \varphi \rrbracket$

- The 'believe' modality B and the 'entertain' modality E are equivalent if their prejacent is non-inquisitive. That is, when $\llbracket \varphi \rrbracket$ contains only one maximal proposition, then we have that $\llbracket E_a \varphi \rrbracket = \llbracket B_a \varphi \rrbracket$.

Preview of the semantics of *darou* φ -*darou*

- has the question 'whether φ ' as its at-issue meaning, and
- conveys that the 'speaker entertains φ ' as its non-at-issue meaning.

Proposal

Formal treatment of *darou*, *ka* and sentence-final fall/rise

- (4) a. $\llbracket \varphi \text{ darou} \rrbracket = \llbracket ?!\varphi \rrbracket$
 b. $\llbracket \varphi \text{ darou} \rrbracket^\bullet = \llbracket E_{\odot} \varphi \rrbracket \cap \llbracket \varphi \rrbracket^\bullet$
- (5) a. $\llbracket \varphi \downarrow \rrbracket = \llbracket !\varphi \rrbracket$
 b. $\llbracket \varphi \downarrow \rrbracket^\bullet = \llbracket \varphi \rrbracket^\bullet$
- (6) a. $\llbracket \varphi \text{ ka} \rrbracket = \llbracket \varphi \uparrow \rrbracket = \llbracket ?\varphi \rrbracket$
 b. $\llbracket \varphi \text{ ka} \rrbracket^\bullet = \llbracket \varphi \uparrow \rrbracket^\bullet = \llbracket \varphi \rrbracket^\bullet$

- $\llbracket \varphi \rrbracket$: the at-issue meaning of φ .
- $\llbracket \varphi \rrbracket^\bullet$: the non-at-issue meaning of φ .
- \odot : the contextually determined deictic center (Hara and Davis, 2013)
- **Markedness assumption**: \uparrow is more marked than \downarrow , and is blocked in case it does not have any semantic effect.

Predictions

- Below we use the fact that if α is non-inquisitive, then $\llbracket !\alpha \rrbracket = \llbracket \alpha \rrbracket$.

- (7) a. $\llbracket \alpha \text{ darou} \downarrow \rrbracket = \llbracket !?\alpha \rrbracket$ (tautologous)
 b. $\llbracket \alpha \text{ darou} \downarrow \rrbracket^\bullet = \llbracket E_{\odot} \alpha \rrbracket = \llbracket B_{\odot} \alpha \rrbracket$
- (8) a. $\llbracket \alpha \text{ darou-ka} \downarrow \rrbracket = \llbracket !?!?\alpha \rrbracket$ (tautologous)
 b. $\llbracket \alpha \text{ darou-ka} \downarrow \rrbracket^\bullet = \llbracket E_{\odot} ?\alpha \rrbracket$
- (9) a. $\llbracket \alpha \text{ darou} \uparrow \rrbracket = \llbracket ??\alpha \rrbracket = \llbracket ?\alpha \rrbracket$
 b. $\llbracket \alpha \text{ darou} \uparrow \rrbracket^\bullet = \llbracket E_{\odot} \alpha \rrbracket = \llbracket B_{\odot} \alpha \rrbracket$
- (10) a. $\llbracket \alpha \text{ darou-ka} \uparrow \rrbracket = \llbracket ??!?\alpha \rrbracket$ (tautologous)
 b. $\llbracket \alpha \text{ darou-ka} \uparrow \rrbracket^\bullet = \llbracket E_{\odot} ?\alpha \rrbracket$

- $\llbracket \alpha \text{ darou} \downarrow \rrbracket^\bullet$ conveys that the speaker believes α .
- $\llbracket \alpha \text{ darou-ka} \downarrow \rrbracket^\bullet$ conveys that *the speaker entertains the issue whether α* . Although this is semantically compatible with the speaker believing either α or $\neg \alpha$, it implicates that the speaker is ignorant due to the presence of stronger and formally simpler alternatives: $\llbracket \alpha \text{ darou} \downarrow \rrbracket$ and $\llbracket \neg \alpha \text{ darou} \downarrow \rrbracket$
- $\llbracket \alpha \text{ darou} \uparrow \rrbracket$ is the meaning of a polar question, *whether α* , while $\llbracket \alpha \text{ darou} \uparrow \rrbracket^\bullet$ conveys a strong speaker bias toward α .
- (8) and (10) are equivalent in both at-issue and non-at-issue meaning. Since \uparrow is more marked than \downarrow , (8) *blocks* (10).

References

- [1] Yurie Hara and Chris Davis. *Darou* as a deictic context shifter. In Kazuko Yatsushiro and Uli Sauerland, editors, *Formal Approaches to Japanese Linguistics 6*, pages 41–56. MITWPL, 2013.
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- [4] Ivano Ciardelli and Floris Roelofsen. Inquisitive dynamic epistemic logic. *Synthese*, 192(6):1643–1687, 2015.