THE MEASUREMENT MECHANISM:

THE ROLE OF SCALE STRUCTURE IN IMPLICATURE COMPUTATION

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SCALES IN SEMANTICS AND PRAGMATICS

Measurement scales (sets of totally ordered degrees, e.g. size) underly the meaning of gradable adjectives

(Bartsch & Venneman, 1973; Cresswell, 1977; Bierwisch, 1989; Kennedy & McNally, 2005; Kennedy, 2007; see Solt, 2015 for an overview)

Scalar expressions like *large* and *gigantic* form **entailment scales**, aka Horn scales

(Horn, 1972; Gazdar, 1979)

EXAMPLES AND RESEARCH QUESTIONS

What size is your apartment?

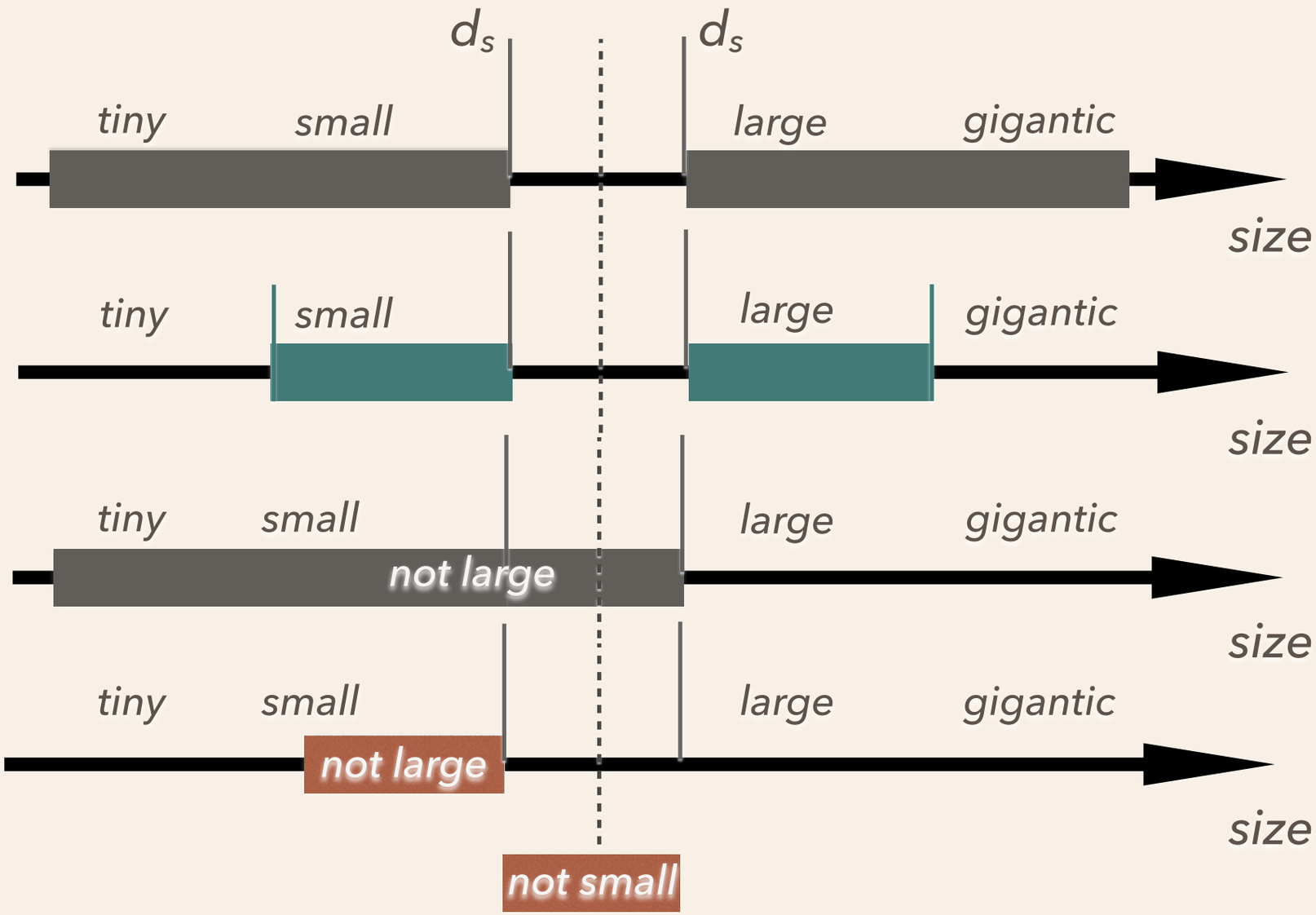
(1) It is large ⇝ large but not gigantic

(2) It is not large ⇝ small

(3) It is not small ⇝ medium-size

What mechanisms underlie the derivation of these inferences?
What role do scale structure and polarity play?

SEMANTIC MEANING AND STRENGTHENED MEANING



Semantic meaning

Scalar implicature

Semantic meaning

Strengthened meaning

negative strengthening *middling*

cf. Horn (1989)

ENTAILMENTS OF DIFFERENT TYPES OF ADJECTIVES

Relative: contextual standard of comparison

(4) It is not large ⇏ it is small *middle ground*

Absolute: fixed standard (minimum or maximum degree)

(5) It is not clean ⟺ it is dirty *no middle ground*

(6) It is not very clean/spotless ⇏ it is dirty *middle ground*

Cruse (1986); Rotstein & Winter (2004); Kennedy & McNally (2005); Kennedy (2007)

SCALAR DIVERSITY

- **Challenge** for theoretical accounts: **variability** with which children and adults compute implicatures across different Horn scales

  (Papafragou & Musolino, 2003; Doran et al., 2012; van Tiel, et al., 2016; Gotzner et al., 2018a;b)

- **Properties of measurement scales** account for large portion of variability in the the domain of adjectives: <*large, gigantic*>, <*small, tiny*>, <*likely, certain*>,...

  (Gotzner et al., 2018a; b)

ACCOUNTS OF SCALAR DIVERSITY

1. Salience (Doran et al., 2009) or distinctness of alternatives (SI: van Tiel et al., 2016; Negation: Leffel, Cremers, Gotzner, Romoli, 2019)

2. Scale structure (Gotzner, Solt & Benz, 2018 a;b; Leffel et al., 2019)

For role of QuD see Sun & Breheny (2018) and Sun, Gotzner, Breheny (submitted)

FUTURE RESEARCH (EMMY NOETHER)

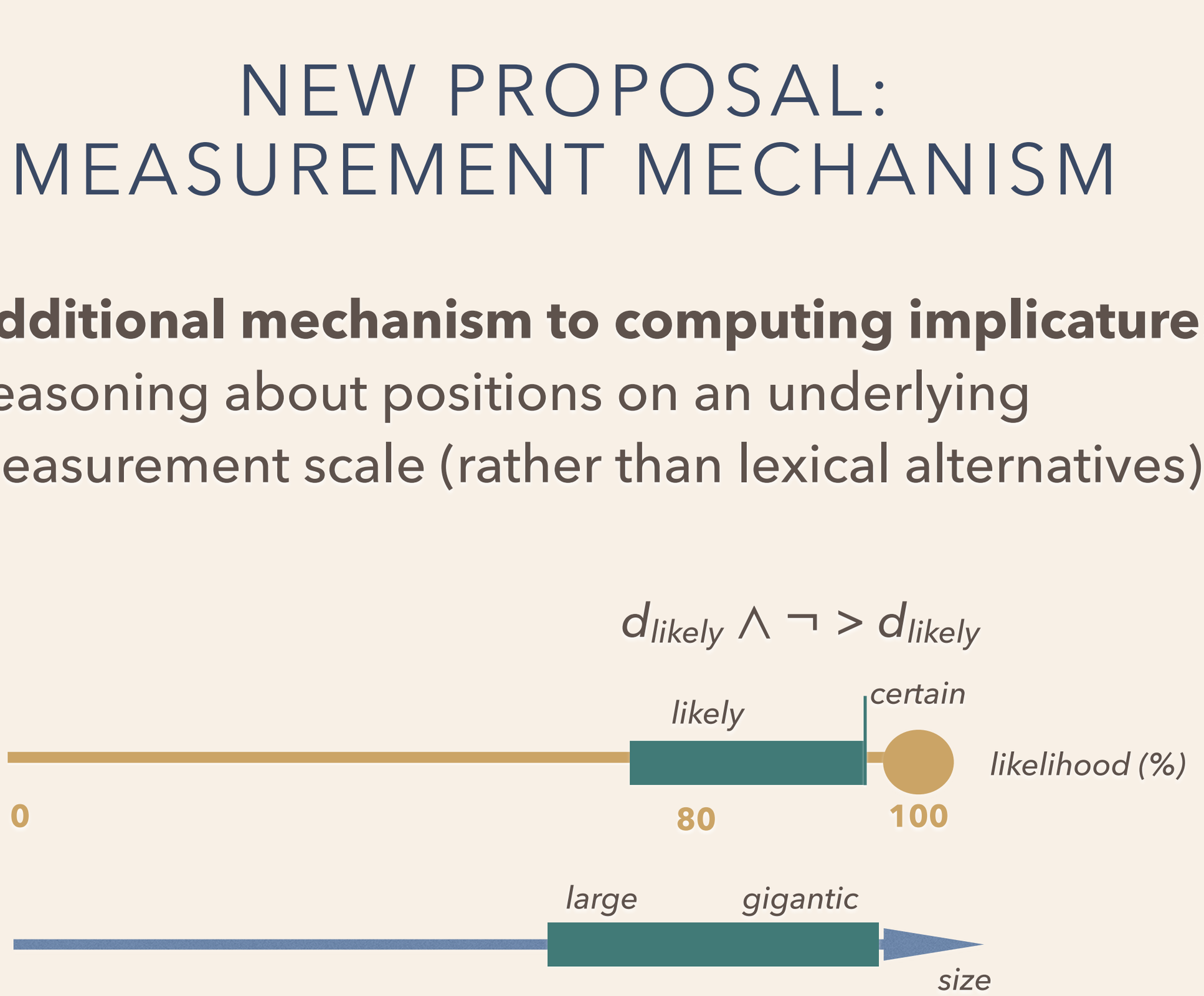
1. What alternatives constitute the basis for implicature computation? (cf. Lacina & Gotzner, this workshop)

2. Does scale structure provide a cue to implicature computation?

-> Model of implicature that accounts for scalar diversity (including negated cases)

NEW PROPOSAL: MEASUREMENT MECHANISM

Additional mechanism to computing implicature: Reasoning about positions on an underlying measurement scale (rather than lexical alternatives)

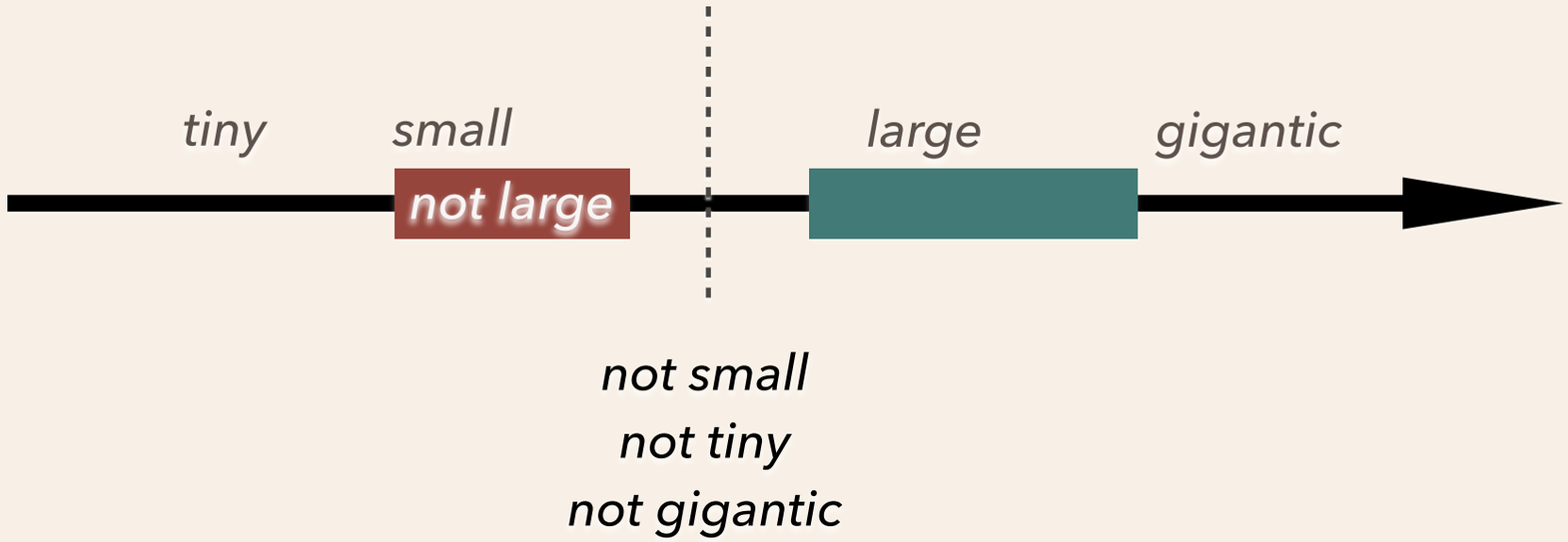


see Magri (2017) for a similar account of Hirschberg scales

INFERENCES OF RELATIVE AND ABSOLUTE ADJECTIVES

(GOTZNER & KIZILTAN, 2021; ALEXANDROPOULOU & GOTZNER, IN PREP.)

RESEARCH QUESTIONS



not small
not tiny
not gigantic

What specific ranges do bare and negated adjectives communicate relative to their stronger scale-mates and corresponding antonyms? How does scale structure affect inferences?

NEGATIVE STRENGTHENING & NEGATED STRONG SCALARS

(7) a. She's not happy ⇝ she's sad

b. She's not sad ⇝̸ she's happy

c. She's not ecstatic ⇝̸ she's miserable

} *Polarity asymmetry*

(Israel, 2004: 10)

PREDICTIONS OF DIFFERENT INTERPRETATIONS UNDER NEGATION

Adjective type **Test sentence**		**Relative** *The door is not large /* *The door is not gigantic*	**Absolute** *The door is not clean /* *The door is not pristine*
Entailment	**Weak/** **Strong**	‘The door is less than large’/ ‘The door is less than gigantic’	‘The door is dirty’/ ‘The door is less than pristine’
Indirect scalar implicature	**Weak/** **Strong**	**??** / ‘The door is large’	**??** / ‘The door is clean’
Middling interpretation	**Weak/** **Strong**	‘The door is neither large nor small’/ ‘The door is neither large nor small’	**??** / **??**
Negative strengthening	**Weak/** **Strong**	‘The door is (rather) small’ / **??**	**??** / ‘The door is (rather) dirty’

?? : respective inferences are not predicted to be available

GRADING PARADIGM: METHODS

2 Experiments: 1 with relative and 1 with absolute adjectives (Gotzner & Kiziltan, 2021; Alexandropoulou & Gotzner, in prep.)

Methodology: Grading scenario with action-based task, fine granularity level (extension of Gotzner & Benz, 2018; Tessler and Franke, 2018)

-> When context makes distinctions between different terms relevant, less variability *within* adjective classes but still a difference *between* classes

Design: 2 Polarity (positive, negative) x 2 Scalar Strength (weak, strong) x 2 Negation (non-negated, negated)

Items: 7 relative adjective quadruplets (experiment 1), 8 absolute adjective quadruplets (experiment 2)

Participants: n=53 (experiment 1), n=48 (experiment 2)

EXAMPLE ITEM

Context:

The art class is receiving grades for a picture they drew for a final exam.

Please decide which grade each picture receives based on the teacher's statement.

1 = hideous; 5 = gorgeous

The teacher says:

Mary's picture is gorgeous.

○ 1 ○ 2 ○ 3 ○ 4 ○ 5

John's picture is pretty.

○ 1 ○ 2 ○ 3 ○ 4 ○ 5

Anne's picture is not gorgeous.

○ 1 ○ 2 ○ 3 ○ 4 ○ 5

Sue's picture is not pretty.

○ 1 ○ 2 ○ 3 ○ 4 ○ 5

Tom's picture is hideous.

○ 1 ○ 2 ○ 3 ○ 4 ○ 5

RESULTS: RELATIVE

not hideous

not ugly

not gorgeous

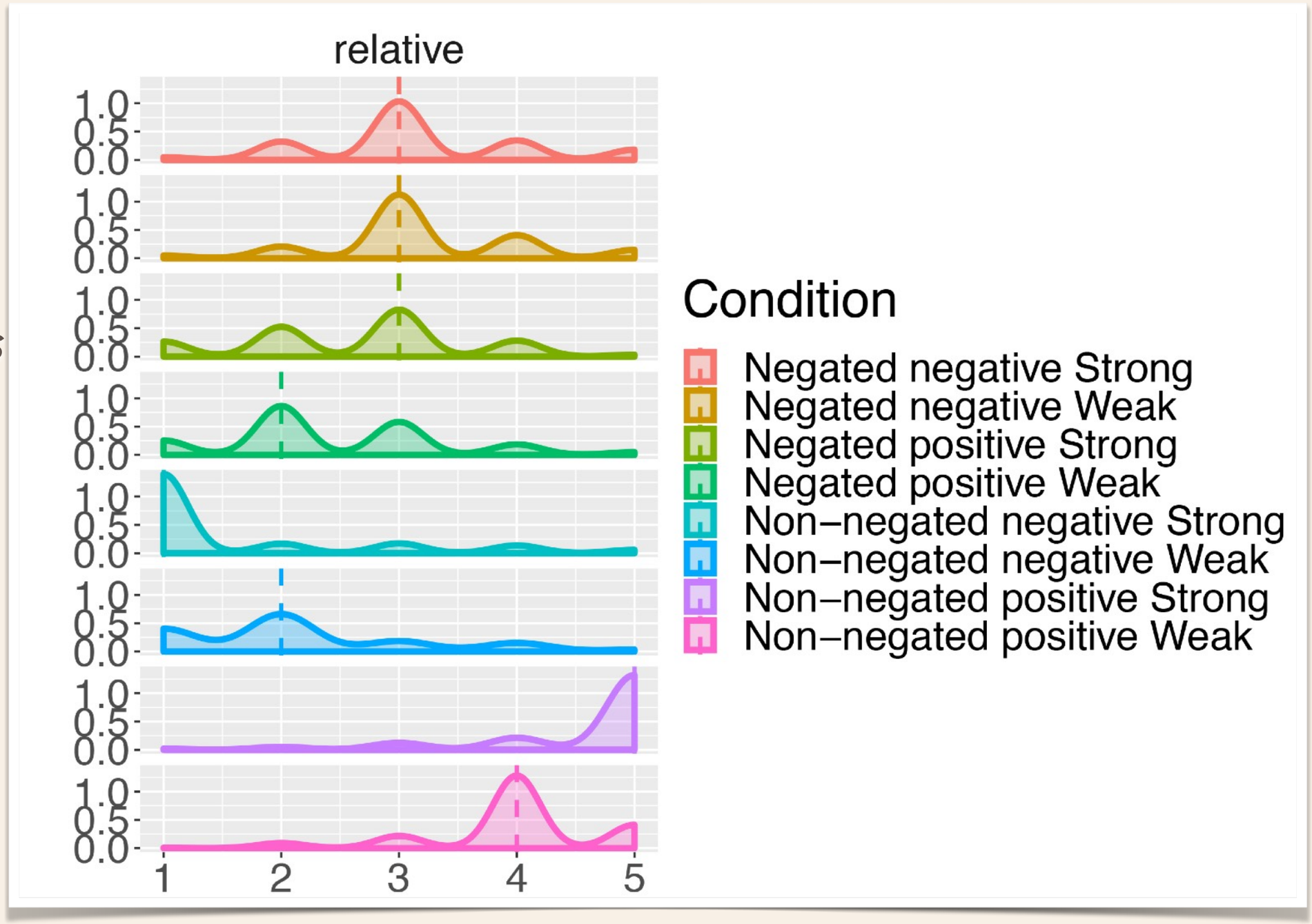
not pretty

hideous

ugly

gorgeous

pretty



*Clmm: scalar strength*polarity: z=−7.51, p<.0001, scalar strength*polarity*negation: z=−7.81, p<.0001, subset analyses: Non-negated: scalar strength*polarity: z=-8.29, p<.0001, Negated: scalar strength*polarity: z=-2.20, p<.05*

RESULTS: ABSOLUTE

not filthy

not dirty

not pristine

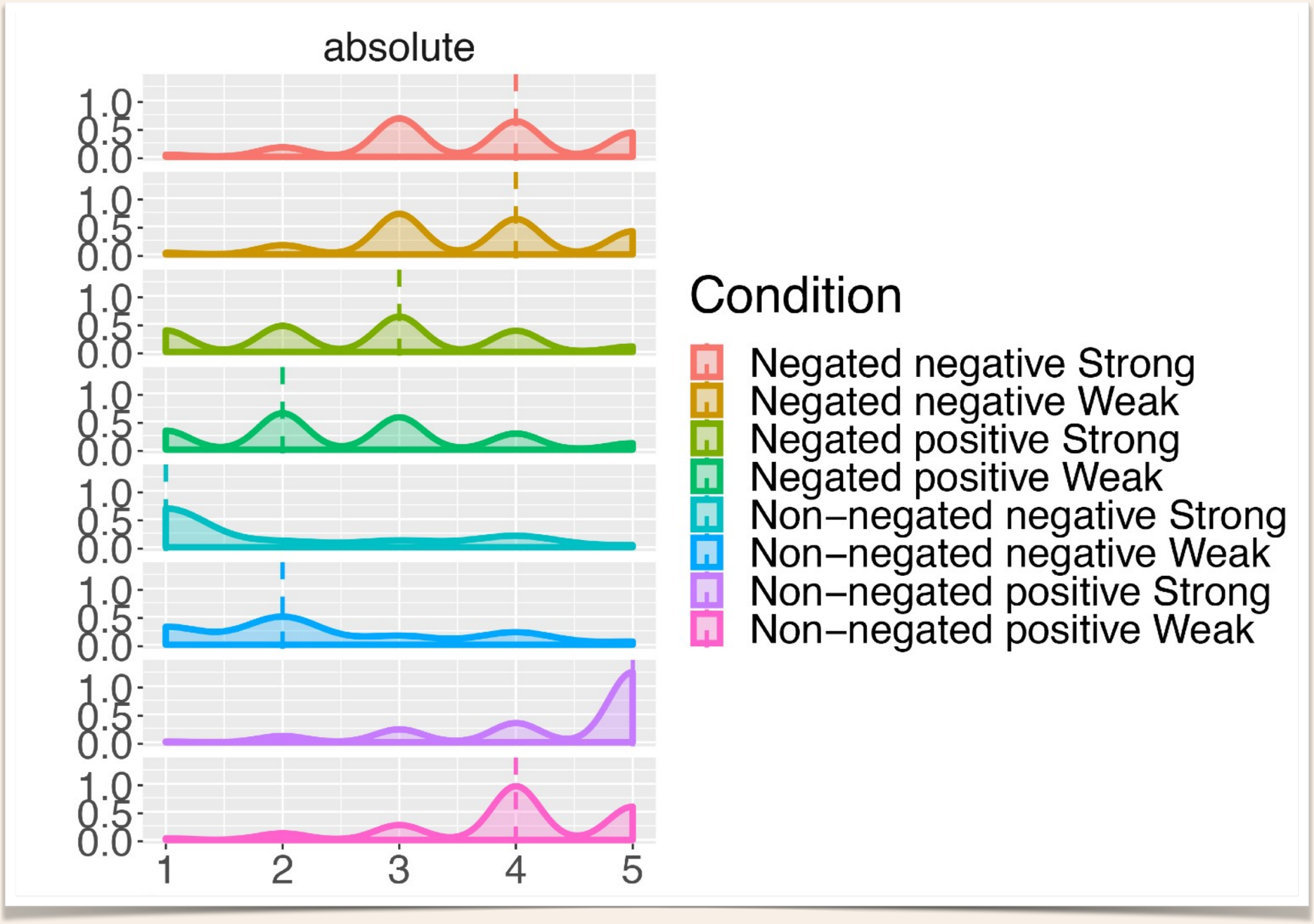
not clean

filthy

dirty

pristine

clean



*Clmm: scalar strength*polarity: z= −5.31, p<.0001, scalar strength*polarity*negation: z=−5.07, p<.0001, subset analysis: Non-negated: scalar strength*polarity: z=-6.17, p<.0001*

DISCUSSION

- SI in non-negated environments for absolute and relative adjectives
- Within adjective classes, fewer distinctions under negation
- Polarity asymmetry due to negative strengthening and middling interpretation of relative adjectives; to a lesser extent with absolute adjectives
- Weak absolute adjectives are interpreted semantically, while granularity is responsible for additional interpretations of absolute adjectives

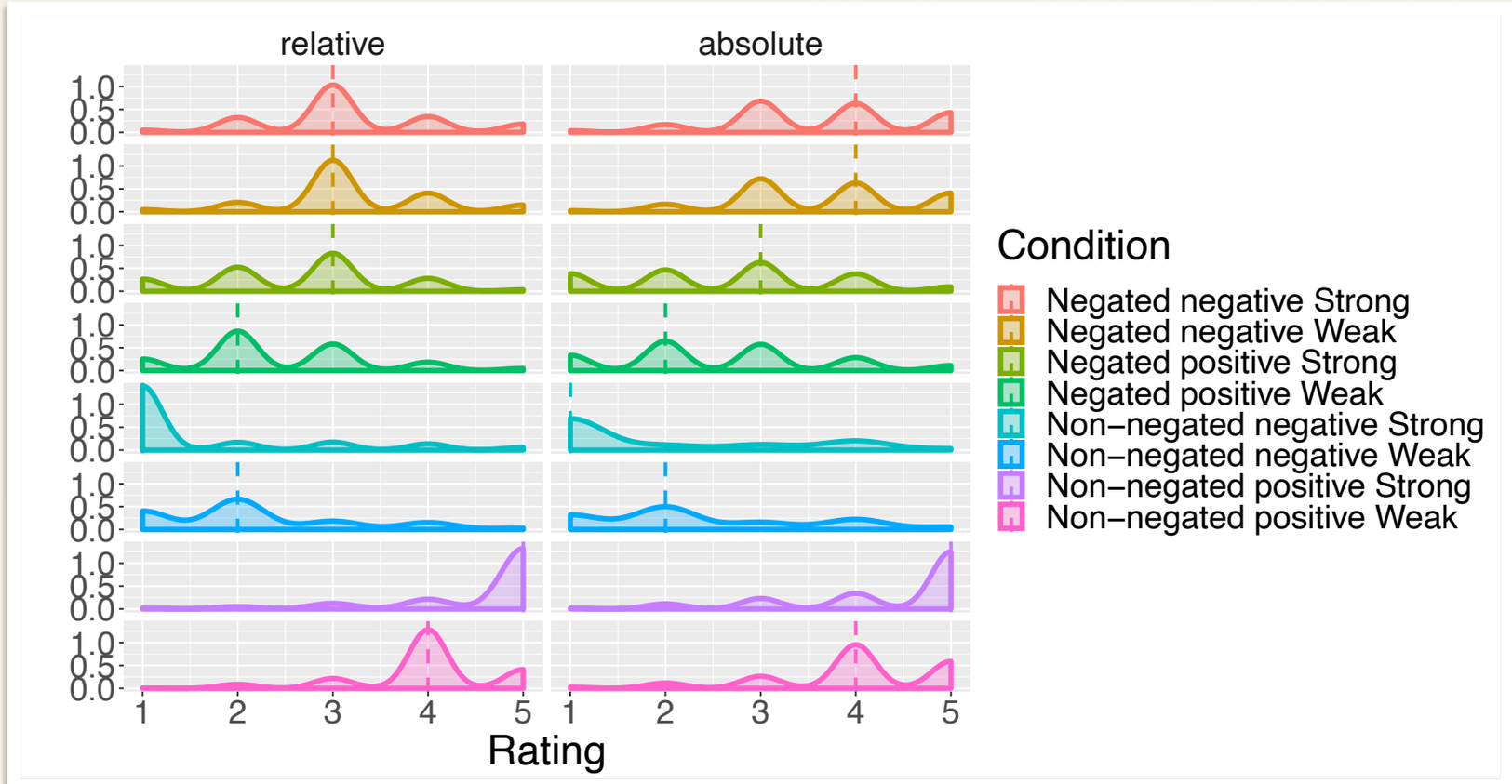
OVERALL CONCLUSIONS

- Negated expressions are less informative and thus distinguish fewer pragmatic functions compared to non-negated ones (Givón, 1975; Israel, 2004)
- Between adjective classes, scale structure, polarity, and granularity affect the derivation of different inferences

-> Need for model of scalar meaning that integrates multiple semantic and pragmatic factors

APPENDIX

COMPARISON UNDER NEGATION



- **Relative adjectives:** Clear distinction between negative strengthening in weak positive terms and middling in strong positive terms

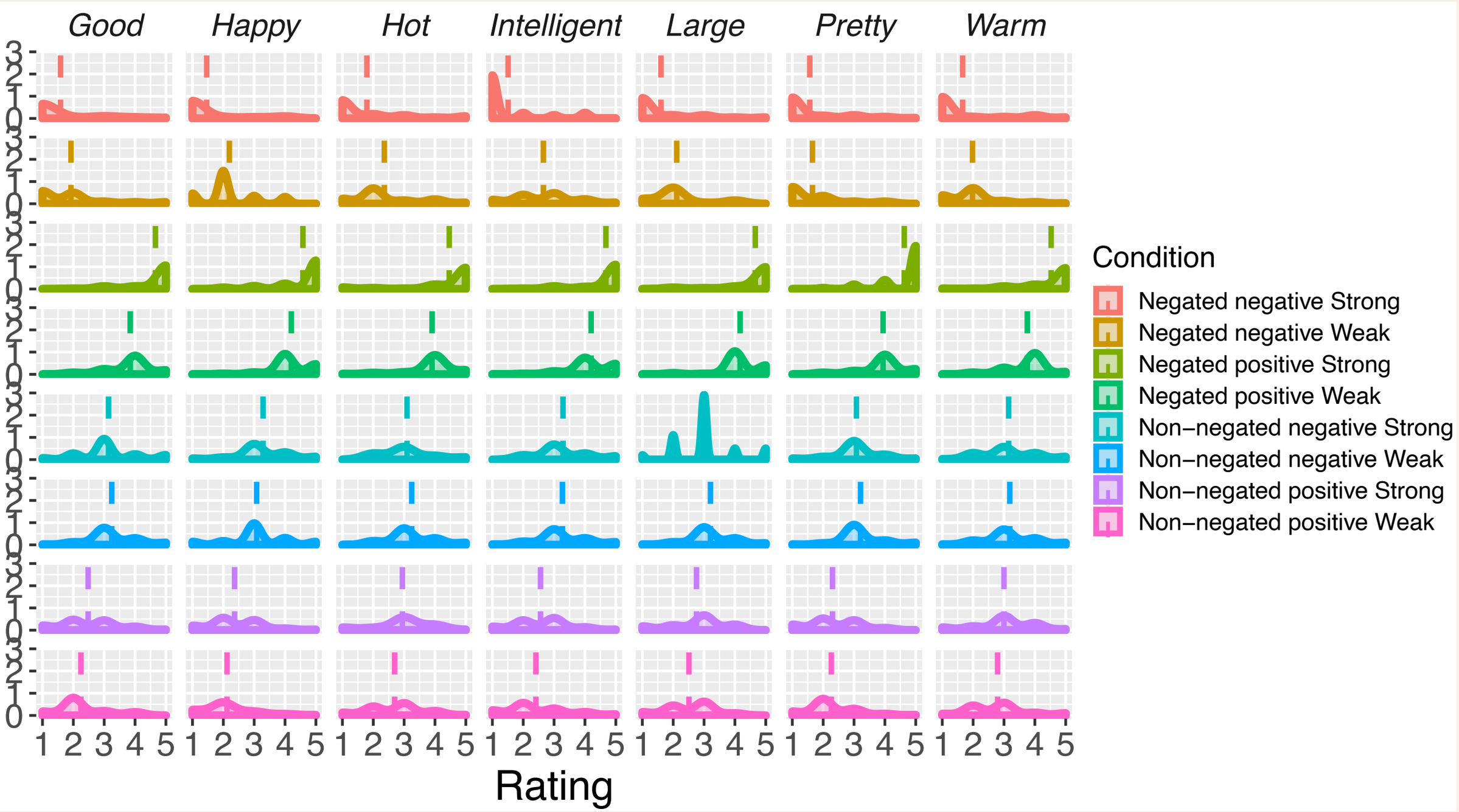
  Absolute adjectives: No clear distinction between middling & entailment to the antonym in weak positive terms, and middling & inference to the antonym due to negative strengthening in strong positive terms

- **In overlapping negative conditions**, more middling interpretations for relative than for absolute adjectives; inferences to the antonym for absolute adjectives: entailment for weak terms & granularity effect for strong terms

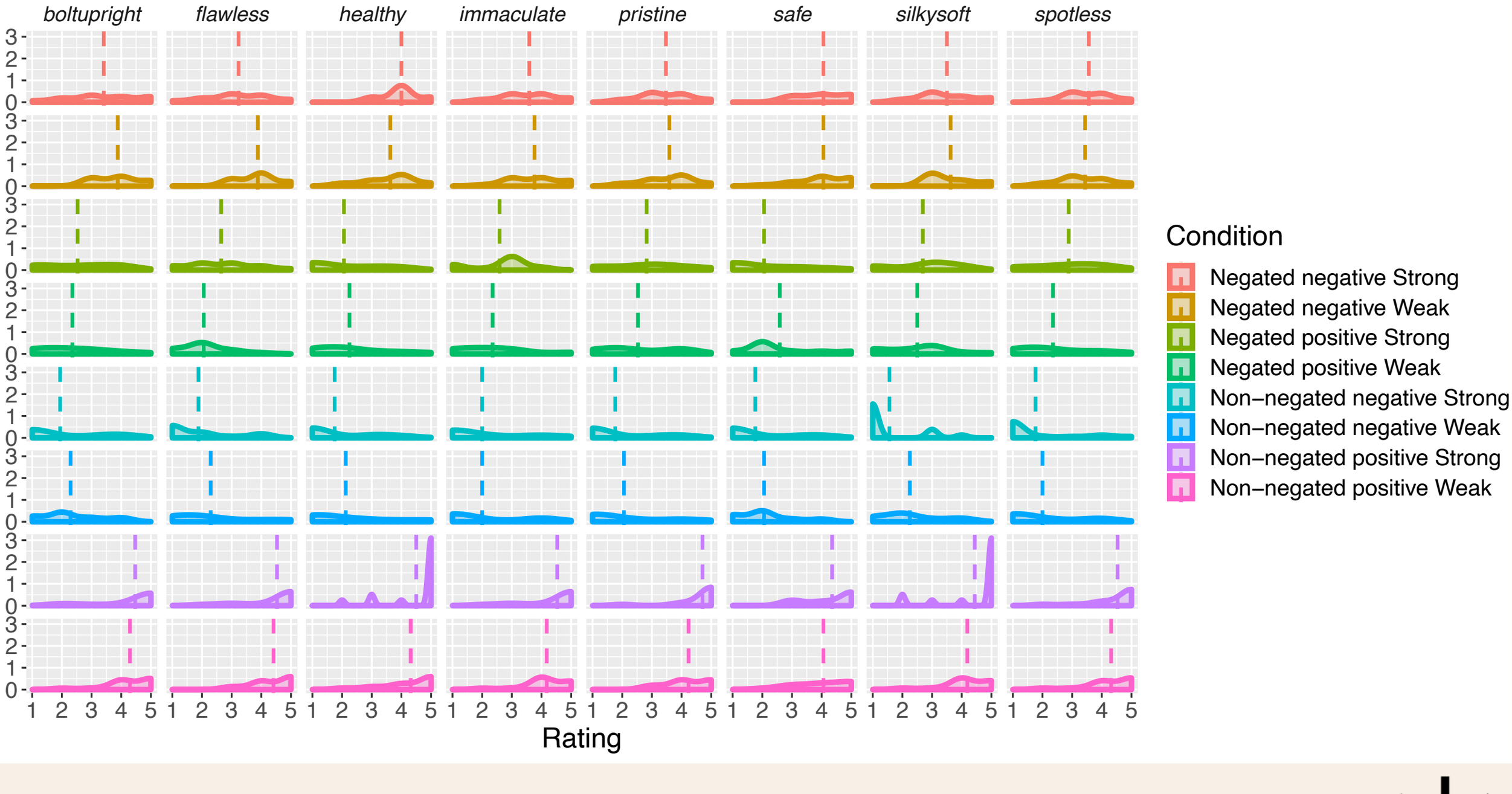
Model with strength nested under adjective type and polarity:

- *Weak vs Strong significant for positive relative items ($z=-3.45$, $p<.001$), but not for positive absolute ($p=.2$), negative absolute ($p=.91$) or negative relative items ($p=.27$)*
- *Negative conditions got significantly higher ratings in absolute items than in relative items (Polaritynegative:Type interaction: $z=5.04$, $p<.0001$)*

ITEM VARIABILITY (RELATIVE)



ITEM VARIABILITY (ABSOLUTE)



GRANULARITY: ABSOLUTE ADJECTIVES