Do extension gaps exist?

Guido Vanden Wyngaerd
(HUB–CRISSP/KU Leuven)

Contents

1 Introduction

(1) Extension gap (Kamp 1975, Klein 1980):
   a. the *positive extension* of predicate is the set of things of which it is true;
   b. the *negative extension* is the set of things of which the predicate is false;

c. the extension gap contains the individuals who fail to belong to either the positive or the negative extension of the predicate (also called the predicate's penumbra; Fine 1975).

(2) Fine (1975)

a. n is *nice* if $n > 15$
b. n is not *nice* if $n < 13$
c. Extension gap of *nice* = {13, 14, 15}.

(3) a. 14 is nice = ?
b. 14 is not nice = ?

(4) Truth Conditions for *nice*

a. $[\![N(n)]\!] = \text{T}$ if $n > 15$
b. $^*[\![N(n)]\!] = \text{F}$ otherwise

- Extension gaps challenge bivalence: a proposition is either true or false, and cannot have any other truth value.

- Bivalence = Law of the Excluded Middle (LEM)

(5) Law of the Exluded Middle (LEM)
$p \vee \neg p$

(6)

$N(n)$	$\neg N(n)$	$N(n) \vee \neg N(n)$
T	?	?
?	T	?

Question to be addressed in this talk: do extension gaps exist in natural language?

- Kennedy (2007): vague predicates are characterised by the existence of 'unclear cases' or 'borderline cases':

(7) a. Organic Kona: \$20/pound
b. Swell Start Blend: \$9.25/pound
c. Mud Blend: \$1.50/pound

(8) The Swell Start Blend is expensive.

(9) Is (8) true or false?
Kennedy (2007): "A natural response is 'I'm not sure'."

(10) a. Mary is tall.
b. Mary is tall or Mary is not tall.

- The example (10b) is a natural language LEM sentence. Given that, we expect (10b) to be necessarily true.
- To the extent that (10b) can be judged to be false by speakers, the example appears to challenge LEM.

Claims of this talk:

- Extension gaps exist.
- Extension gaps depend on opposition.
- Opposition comes in two guises: contradictory and contrary opposition.
- Contradictory opposition does not invalidate LEM, only contrary oppposition might.
- The type of opposition depends on (i) the type of adjective, and (ii) the type of negation.
- Logic only has one type of negation, which makes it unsuitable for expressing the distinction between contradictory and contrary opposition.

2 Contextual variability in truth conditions

- Sentence (11) may be true in Context 1, but false in Context 2.

(11) The coffee in Rome is expensive.

(12) a. Context 1: coffee in Naples, coffee in Milan, coffee in Bari, coffee in Venice, coffee in Palermo
b. Context 2: coffee in New York, coffee in Paris, coffee in Moscow, coffee in Tokyo, coffee in London

- These contexts define comparison classes, or a standard of comparison.

- With relative adjectives, truth is relative to the comparison class.
- The sentence in (13) on the face of it, it violates the *Law of Contradiction* (LC): $\neg(p\&\neg p)$. Yet it is not contradictory:

(13) The coffee in Rome is both expensive and not expensive.

- The reason for this is that the first occurrence of the predicate *expensive* in (13) is interpreted relative to a different standard than the second occurrence.

(14) $E(c)\&\neg E'(c))$

- Since the comparison class is left implicit, (13) appears to violate LC, but it does not.
- Implicit standards of comparison might also explain away at least some of the 'unclear/borderline cases': (10a) needs to be interpreted relative to a standard of comparison, but the standard is left implicit, whence Kennedy's answer 'I'm not sure'.
- What about (8)? Perhaps the comparison class for this sentence is not sufficiently clear, and we need to 'precisify' it (Pinkal 1995).

3 A logical solution: supervaluations

Supervaluationism (Van Fraassen 1966):

- give up bivalence
- preserves LEM.

(15) a. Mortimer is a man.
b. If Mortimer is a man, then Mortimer is mortal.
c. Mortimer is mortal.

- (15) seems a valid argument, despite the fact that (15a) is neither true nor false, due to presupposition failure (the name *Mortimer* does not refer).

(16) A supervaluation over a model is a function that assigns T (F) exactly to those statements assigned T (F) by all the classical valuations over that model.

(17) Assume a predicate F, such that
   a. $[\![F(a)]\!] = 1$
   b. $[\![F(b)]\!] = undefined$

To make a supervaluation, we need to compute all classical valuations:

- for $F(b)$ there are two classical valuations (T and F)
- for $F(b) \vee \neg F(b)$ (LEM), there are correspondingly two classical valuation functions: v_1 and v_2

(18)

	v_1	v_2	s
$F(a)$	T	T	T
$\neg F(a)$	F	F	F
$F(b)$	T	F	—
$\neg F(b)$	F	T	—
$F(b) \vee \neg F(b)$	T	T	T

The supervaluation function s assigns

- T to $F(a)$, because all classical valuations assign T to it.
- undefined to $F(b)$ (i.e. bivalence does not hold)
- T to $F(b) \vee \neg F(b)$ (i.e. LEM)

(19) a. ⟦ Mary is tall ⟧ = ?
   b. ⟦ Mary is tall or Mary is not tall ⟧ = T

- The truth of (19a) has to be determined relative to a context or comparison class. Since the comparison class is not made explicit, we might be dealing with an 'unclear case'.
- In (19b), however we ultimately choose the comparison class, (19b) will come out true, i.e. regardless of where we draw the dividing line between *tall* and *not tall*.

(20) a. This book is red or pink. (Fine 1975)
b. This book is red, and that book is not red. (Pinkal 1995)

- Context for (20a): the book in is a borderline case between red and pink.
- Context for (20b): both books are borderline cases but with exactly the same colour (Law of Contradiction $\neg(p\&\neg p)$ holds).

4 Opposition in natural language

4.1 Contrary opposition

Contrary opposition: neutral middle ground

(21) *wide-narrow, happy-sad, tall-short, full-empty*

(22) Andrea is neither happy nor sad.

Contrary statements cannot both be true at the same time either, but they can both be false:

(23) a. Andrea is happy.
b. Andrea is sad.

Contrary opposition poses a potential challenge to LEM:

(24) a. Andrea is happy or sad. → can be false
b. Andrea is happy or unhappy. → can be false
c. Andrea is happy or not happy. → necessarily true?

(25) a. $H(a) \vee S(a)$
b. $H(a) \vee H'(a)$
c. $H(a) \vee \neg H(a)$

4.2 Contradictory opposition

Contradictory opposition: no neutral middle ground

(26) *dead-alive*, *present-absent*, *right-wrong*, *bound-free*, *odd-even*.

(27) *The chairman was neither present nor absent.

Contradictory statements cannot be true at the same time, nor false at the same time (see (28)).

(28) a. 7 is odd.
b. 7 is even.

Contradictory opposition poses no challenge to LEM:

(29) a. 7 is odd or even. → necessarily true
b. 7 is odd or not odd. → necessarily true

(30) a. $O(7) \vee E(7)$
b. $O(7) \vee \neg O(7)$

Conclusion: Logical negation only comes in one flavour, opposition in natural language comes in at least two flavours.

5 Negative operators in natural language

5.1 How to make a sentence negative

(31) Law of the Exluded Middle (LEM)
$p \vee \neg p$

(32) The coffee in Rome is expensive.

(33) *Ways of making a sentence negative in natural language*
a. The sentence 'The coffee in Rome is expensive' is false.
b. It is not the case that The coffee in Rome is expensive.
c. The coffee in Rome is not expensive
d. The coffee in Rome is inexpensive.
e. The coffee in Rome is cheap.

- Contradictory opposition: (32) and (33a)/(33b)
- Contrary opposition: (32) and (33d)/(33e)
- Claim: (32) and (33c) are a pair of contradictories.

(34) *Truth condition for vague predicates*
$[\![P(x)]\!]$ true if x is clearly P in the comparison class, false otherwise.

(35) a. The Organic Kona is expensive. → T
b. The Swell Start Blend is expensive. → F
c. The Mud Blend is expensive. → F

(36) a. The Organic Kona is cheap. → F
b. The Swell Start Blend is cheap. → F
c. The Mud Blend is cheap. → T

(37) a. The Swell Start Blend is expensive or not expensive. → necessarily T
b. The Swell Start Blend is cheap or not cheap. → necessarily T
c. The Swell Start Blend is expensive or cheap. → F

- *Not* marks contradictory negation, which poses no challenge to LEM.
- Affixal negation (*expensive-inexpensive*) or lexical opposition (*expensive-cheap*) involve contrary opposition.
- To the extent that one restricts logical negation to contradictory negation, there is no apparent problem for logic.
- however, affixal negation clearly involves a negative morpheme, so what is this if not some Boolean negative operator?
- Lexical opposition presumably involves some sort of (subliminal) negation as well.

5.2 A problem and its solution

(38) The Swell Start Blend is not expensive.

- We tend to interpret 'not expensive' in (38) as 'cheap'.
- Horn (1989:330ff): 'contraries in contradictory clothing': formally contradictory negation (as in (33c)) often shows a tendency to strengthen to a semantic contrary as in (33e).

(39) a. A: How do you rate John's chances for passing his exams?
b. B: I'm not optimistic.
c. B: I'm pessimistic.

- Short-circuited (relevance-based) implicature (SCI): "for most contemporary speakers the politeness associated with examples like [(39b)] is often felt as conventional or pro forma only and not really heartfelt" (Horn 1989:351).

(40) I'm not pessimistic.

6 Natural language LEM sentences

Is (42) necessarily true?

(41) Mary is tall.

(42) Mary is tall or Mary is not tall.

- Supervaluationist intuition: although speakers may disagree on the truth of (41), they will agree on the truth of (42) because it is true regardless of the decision we take on the truth of *tall*.

- Since the example (42) is uninformative, so speakers might interpret it is a metalinguistic statement: a sentence must be true or false.

- Could we ask native speakers?

- Alxatib and Pelletier (2011) showed subjects a police line-up of five individuals of different height, and asked them to evaluate the truth of (43a) and (43b).

(43) a. Mary is neither tall nor not tall.
b. Mary is both tall and not tall.

- For the individuals of intermediate height, 53.9% of speakers judge a statement like (43a) true (indicating an extension gap).

- 44.7% do so for a statement of the form (43b) (indicating an extension overlap).

- 53.7% of the subjects who judged (43a) true also judged (43b) true, i.e. about a quarter of all informants judge both (43a) and (43b) true.

7 Conclusion

- Vague predicates exist.
- Extension gaps exist.
- LEM is not invalidated by contradictory negation; LEM is potentially invalidated by contrary opposition only.
- On the other hand, contrary opposition is not innocent, as it is unclear how it is to be distinguished from contradictory opposition at all in classical logic.
- The status of natural language LEM sentences remains unclear.

References

Alxatib, Sam, and Jeffry Pelletier. 2011. The psychology of vagueness: Borderline cases and contradictions. *Mind and Language* 26:287–326.

Fine, Kit. 1975. Vagueness, truth and logic. *Synthese* 30:265–300.

van Fraassen, Bas. 1966. Singular terms, truth value gaps, and free logics. *Journal of Philosophy* 63:481–495.

Horn, Laurence. 1989. *A natural history of negation*. Chicago: The University of Chicago Press.

Kamp, Hans. 1975. Two theories about adjectives. In *Formal semantics of natural language*, ed. Edward Keenan, 123–155. Cambridge: Cambridge University Press.

Kennedy, Christopher. 2007. Vagueness and grammar: the semantics of relative and absolute gradable adjectives. *Linguistics and Philosophy* 30:1–45.

Klein, Ewan. 1980. A semantics for positive and comparative adjectives. *Linguistics and Philosophy* 4:1–45.

Pinkal, Manfred. 1995. *Logic and lexicon*. Dordrecht: Kluwer.