

Subjective Probability and Generic Sentences

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What makes a generic true?

Generic sentences:

- | | | |
|-----|---|--------------|
| (1) | <i>Tolerate exceptions (to extreme degrees)</i> | |
| | a. Lions have a mane. | <i>True</i> |
| | b. Mosquitoes carry the West Nile virus. (< 1% do) | <i>True</i> |
| (2) | <i>Are irreducible to quantificational claims</i> | |
| | a. Ducks lay eggs. | <i>True</i> |
| | b. BUT: Ducks are female. | <i>False</i> |
| (3) | <i>Express stable, non-accidental generalizations</i> | |
| | a. Supreme court judges have a prime SSN. | <i>False</i> |
| | b. Children born in Rainbow lake are right-handed. | <i>False</i> |

How can these (and other) properties be accounted for?

Generics and probability

Cohen (1996, 1999, and later): Generics express probability judgments, interpreted as statements of hypothetical relative frequency

- ▶ $P(\psi|\phi)$ = the probability that an arbitrary member of ϕ satisfies ψ
- ▶ *Birds fly* is true at time t iff $P(\text{fly}|\text{birds})$ is >0.5 and remains \sim the same over long intervals in every admissible history continuing t
- ▶ The class of generics that are directly accounted for by this simple proposal are the ones which receive a straightforward analysis as strong quantificational claims

- (4)
- a. Ravens are black. (despite albinos)
 - b. Dogs have four legs. (despite maimed ones)

Extended truth-conditions: Homogeneity w.r.t salient partitions

- | | | |
|-----|-------------------------------------|--------------|
| (6) | a. Ducks are female. | <i>false</i> |
| | b. Israelis live on the coast. | <i>false</i> |
| | c. People are over three years old. | <i>false</i> |

- ▶ $P(\psi|\phi)$ must be the same in all salient partitions of ϕ (e.g. gender, space, age)
- ▶ The choice of predicate influences the availability of salient partitions
- ▶ This condition serves to eliminate a class of false generics

Extended truth-conditions: The relative–absolute contrast

- (7)
- | | |
|--|-------------|
| a. Frenchmen eat horsemeat. | <i>true</i> |
| b. Mosquitoes carry the West Nile virus. | <i>true</i> |
| c. Tigers eat people. | <i>true</i> |

- ▶ “ ϕ ‘are’ ψ ” is true as a relative generic iff $P(\psi|\phi)$ is $>$ $P(\psi|\phi')$ where $\phi' = \bigcup ALT(\phi)$
- ▶ A generic may be true on either the absolute or the relative reading
- ▶ This notion accounts for the truth of generics that do not correspond to strong quantificational relations

Goal

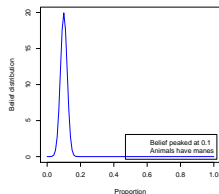
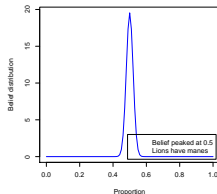
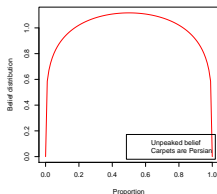
A unified account of bare plural generics whose truth/falsity is judged based on beliefs about proportions

Subjective probability

- ▶ The beliefs of an (individual or collective) agent underlie truth judgments and are represented by probability distributions over the parameters of interest (De Finetti 1989, Ramsey 1926)
- ▶ The agent's (un)certainty correlates with the shape of the belief distribution
 - ▶ Strong belief = Highly peaked graph
 - ▶ Weak belief = Unpeaked (spread-out) graph

Framework

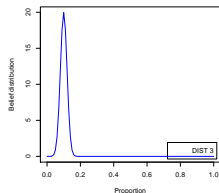
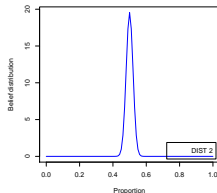
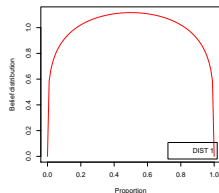
- ▶ $BEL : R \rightarrow \mathcal{P}([0, 1])$ represents an individual belief system, where R is a set of sentences and $\mathcal{P}([0, 1])$ is the set of probability distributions on $[0, 1]$
- ▶ For any generic “ ϕ ‘are’ ψ ”, $BEL(\phi \text{ are } \psi)$ is a probability distribution on $[0, 1]$ that describes an agent’s belief about the proportion of ϕ that are ψ



- ▶ For any set ϕ , ϕ_t represents its time-relativized version

Partial order on $\mathcal{P}([0, 1])$ for comparing beliefs

- ▶ **Comparability:** A pair of probability distributions on $[0,1]$ is comparable in the partial order \succ iff both are highly peaked and if these peaks are well separated
E.g.: DIST 2 \succ DIST 3
- ▶ **Incomparability:** A pair of probability distributions on $[0,1]$ is incomparable in \succ iff either or both are unpeaked, or if they are peaked at the same value
E.g.: DIST 1 $\not\succeq$ DIST 2, DIST 1 $\not\succeq$ DIST 3, DIST 2 $\not\succeq$ DIST 1



Judging generics: Our proposal

“ ϕ ‘are’ ψ ” is true iff we (sharply) believe that the proportion of ϕ that are ψ is greater than the proportion of ϕ' that are ψ and if our belief in the proportion of ϕ that are ψ is stable across time

“ ϕ ‘are’ ψ ” is judged true iff $BEL(\phi_t \text{ ‘are’ } \psi_t)$ is **salient** for each time t and $BEL(\phi \text{ ‘are’ } \psi)$ is **stationary**

(8) **Salience:** $BEL(\phi_t \text{ ‘are’ } \psi_t)$ is salient iff there exists a **well-defined** ϕ' s.t. $BEL(\phi_t \text{ ‘are’ } \psi_t) \succ BEL(\phi'_t \text{ ‘are’ } \psi_t)$.

ϕ' is **well-defined** w.r.t. “ ϕ ‘are’ ψ ” iff

a. $[[\phi']] \supset [[\phi]]$

b. $\forall x[\phi'(x) \rightarrow [[\psi(x)]] \in \{0, 1\}]$

(9) **Stationarity:** $BEL(\phi \text{ ‘are’ } \psi)$ is stationary iff $BEL(\phi_t \text{ ‘are’ } \psi_t)$ does not vary with time t

Sources of falsity for generics

Generic sentences will be judged false if either:

1. $BEL(\phi \text{ 'are' } \psi)$ is not stationary

- (10) a. Supreme court judges have a prime SSN. *False*
 b. Children born in Rainbow lake are right-handed. *False*

2. $BEL(\phi'_t \text{ 'are' } \psi_t) \succ BEL(\phi_t \text{ 'are' } \psi_t)$ for any time t

- (11) a. Americans have a small ecological footprint. *False*
 b. Girls in Saudi Arabia dress skimpily. *False*

3. $BEL(\phi_t \text{ 'are' } \psi_t)$ and $BEL(\phi'_t \text{ 'are' } \psi_t)$ are incomparable in the partial order [see next display]

Incomparability as a falsifier

$BEL(\phi_t \text{ 'are' } \psi_t)$ and $BEL(\phi'_t \text{ 'are' } \psi_t)$ are incomparable in the partial order if either:

- ▶ there is no well-defined ϕ' relative to ϕ are ψ

- (12) a. Books are paperbacks. *paperback undefined beyond books*
b. Humans are autistic. *autism undefined beyond humans*

- ▶ there is a well-defined ϕ' but

$$BEL(\phi_t \text{ 'are' } \psi_t) = BEL(\phi'_t \text{ 'are' } \psi_t)$$

- (13) a. Ducks are female. *$\phi' = \text{birds, animals, \#living things}$*
b. Peacocks are male. *$\phi' = \text{birds, animals, \#living things}$*

- ▶ there is a well-defined ϕ' but either $BEL(\phi'_t \text{ 'are' } \psi_t)$ or $BEL(\phi_t \text{ 'are' } \psi_t)$ has a spread-out (unpeaked) distribution, rendering the pair incomparable

- (14) a. Carpets are Persian.
b. People are over three years old.

Comparison with the frequentist view

Advantages of our proposal:

- ▶ While we introduce the notion of beliefs, we do away with some idealized abstractions implicit in Cohen:
 1. admissible histories continuing into the future
 2. limiting proportions as size goes to infinity
- ▶ Truth/falsity uniformly determined by salience and stationarity, eliminating the need for:
 1. predicate-induced alternatives
 2. checking homogeneity w.r.t. salient partitions
 3. relative-absolute contrast
- ▶ All generics are relative in our account
- ▶ Generics depend on agent's beliefs

Comparison with the frequentist view (contd.)

<i>Class of generic</i>	Source of falsity	
	Frequentist analysis	Subjective analysis
<i>SCJ have a prime SSN</i>	non-homogeneous histories	fail stationarity
<i>Ducks are female</i>	non-homo. salient partition	fail salience
<i>Books are paperbacks</i>	non-homo. salient partition	fail salience
<i>Humans are autistic</i>	no explanation	fail salience

<i>Class of generic</i>	Source of truth	
	Frequentist analysis	Subjective analysis
<i>Ravens are black</i>	absolute generic	salience+stationarity
<i>Lions have manes</i>	predicate-induced ALT	salience+stationarity
<i>Frenchmen eat horsemeat</i>	relative generic	salience+stationarity
<i>Tigers eat people</i>	relative generic	salience+stationarity

Extending the account

- ▶ Satisfaction of salience dependent on contextually provided supercategory:
 - (15) a. Indians speak English.
b. Cats make good pets.
- ▶ Existential generics:
 - (16) a. Hindus eat beef.
b. Mammals lay eggs.
- ▶ Predictions for divergent judgments about:
 - (17) a. Muslims are terrorists.
b. Black people are criminals.

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