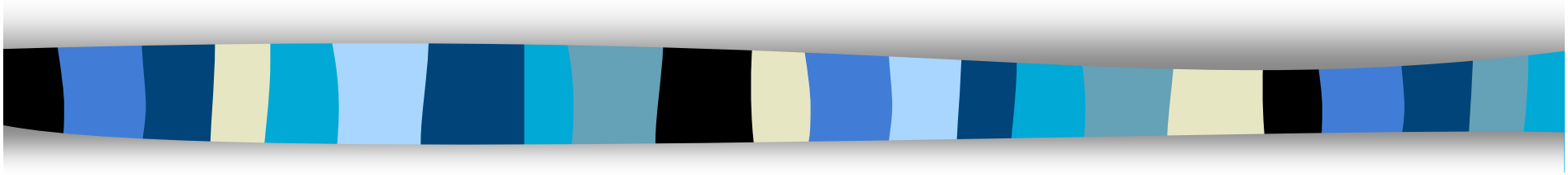
Generic Sentences and Predication



Jeff Pelletier

Characterizing Sentences

- Do not report specific or isolated facts, but express a kind of general property
  - a regularity summarizing groups of particular episodes or events or facts or states of affairs
- Much of our commonsense knowledge of the world is expressed by generic sentences

Characterizing sentences

- Potatoes contain vitamin C
- The lion has a mane
- Kepa has a beer after work

- Not only distinct from individual or particular predications, but also from explicit quantificational sentences
  - Each potato contains vitamin C
  - Most potatoes contain vitamin C
  - All potatoes from Alberta taste good
  - Xabier always drinks wine with dinner

Generic sentences can contain generic NPs

- As can be seen from many of the example sentences, the two types of genericity can occur together
  - The potato is highly digestible
  - Potatoes are served whole or mashed as a cooked vegetable
  - The lion has a mane
  - The Ivy-League Humanities professor wears a tweed jacket

Exceptions to Generic Sentences

- One of the notable features of generic sentences is that they are “exception-tolerating”
  - Xabier might omit wine from a few of his meals
  - Some lions do not have manes
  - Some potatoes are indigestible
- It is this feature that piques the interest of many logically-oriented linguists and philosophers

Exceptions: Two Bad Attitudes

- “generics are strictly speaking false, but are tolerated because they are ‘close enough for practical purposes’ ”
- “generics are *neither* true nor false; they are ‘rules to live by’, ‘ways to draw inferences’, etc.

Demur from the first attitude

- Most of our everyday, commonsense knowledge of the world is encoded in generic sentences
- So, it is pointless to say that they are merely acceptable and not really true
- Further, if correct, we would expect that “the fewer exceptions, the more acceptable”. But this is wrong.

Demur from the second attitude

- Denies that *Snow is white* is either true or false!!
- Denies that our information about the world is *knowledge*, but instead claims it to be “how to direct our actions and inferences”

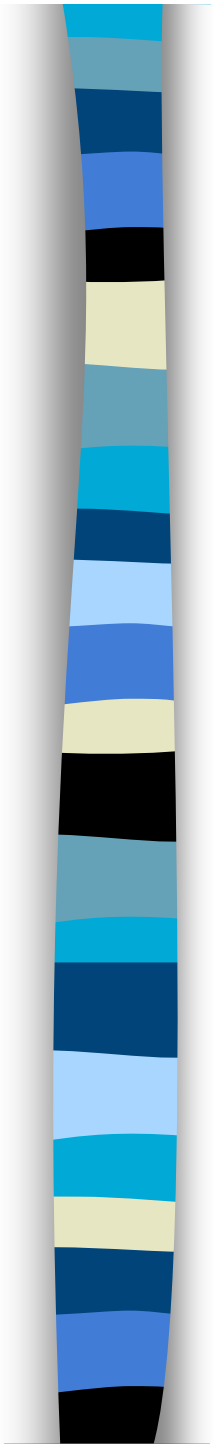
Second attitude, more problems

- Would deny generics can be embedded
  - Usually, if a person smokes after dinner, he also drinks brandy before bed
  - Countries that do not honor women's rights also do not honor general human rights
  - A cat is healthy if it chases an object when it is moved in front of its eyes
  - People who work late nights do not wake up early
  - People who do not like to eat out, do not like to eat out

(isn't this last one necessarily true? and hence true, and hence not "neither true nor false")

What are relevant “cases”?

- Different types of generic sentences call for different cases to be relevant
  - Tabby (usually) lands on her feet
  - Marvin (normally) beats Sandy at ping-pong
  - Bears with blue eyes are (normally) intelligent
  - A grade school student is (typically) a child
  - People who have a job are (usually) happy
  - People who live far from work (usually) drive



How many exceptions?

- Snakes are reptiles
- Telephone books are thick
- Guppies give live birth
- Lions have manes
- Italians are good skiers
- Frenchmen eat horsemeat
- Unicorns have one horn

Even a “vague” quantifier fails

- Consider Generally or In a significant number of cases. The following are false, yet would be true if quantified by such a quantifier
  - Leukemia patients are children
  - Seeds do not germinate
  - Books are paperbacks
  - Prime numbers are odd
  - Crocodiles die before they are two weeks old
  - Bees are female

Intensionality

- There is an “intensional” aspect to characterizing genericity:
  - This machine crushes oranges
  - Mail for Antarctica goes in this box
  - Members of this club help one another in emergencies
  - Children born in Rainbow Lake, Alberta, are left-handed
  - Pandas have three legs

Intensionality and Generics

- Shows complete implausibility of trying to capture genericity with an extensional quantifier, no matter how vague or probabilistically-determined
- Generic sentences are akin to scientific laws: “accidental generalizations” are not true characterizing generic sentences

Some Ambiguities

- John drinks beer
  - Beer is John's favorite alcoholic beverage (habitual)
  - John does not object to drinking beer (dispositional)
- Typhoons arise in this part of the Pacific
  - Typhoons in general have a common origin in this part of Pacific
  - There arise typhoons in this part of the Pacific
- A computer computes the daily weather forecast
  - Computers in general have the task of computing daily weather…
  - The daily weather forecast is generated by a computer
- A cat runs across my lawn every day
  - Cats in general run across my lawn every day
  - Every day, a cat runs across my lawn

Stress and ambiguity in generics

- Leopards usually attack monkeys in trees
- Leopards usually attack monkeys in trees
- Leopards usually attack monkeys in trees
- Leopards usually attack monkeys in trees

- Bullfighters are often injured

- We call the members of the implicit comparison class "restricting cases". They are the background against which the characterizing statement is made.

Some notation: the operator GEN

- Characterizing sentences have three parts, joined by an intensional operator GEN…a kind of unselective quantifier
  - a “matrix” (a main clause) which makes the main assertion of the sentence
  - a “restrictor clause” which states the restricting cases relevant to the matrix
  - a “variable list” that is governed by GEN

Examples

- Typhoons arise in this part of the Pacific
  - GEN[x](x are typhoons; ¸y[y is t-p-o-P & x arise in y])
  - GEN[x](x is t-p-o-P; ¸y[y are typhoons & y arise in x])
- John drinks beer
  - GEN[x,y,s](x=**John** & y is beer & y in s & x in s; x drinks y in s)
- John drinks beer
  - GEN[x,s](x=**John** & x in s; ¸y[y is beer & x drinks y in s)

The general form of generic sentences

$GEN[x_1 \ldots x_i; y_1 \ldots y_j](Restrictor[x_1 \ldots x_i];$

$Matrix[\{x_1\} \ldots \{x_i\}, y_1 \ldots y_j])$

unselective quantifier

variables bound by GEN

variables bound existentially, with scope just in matrix

means $x_1 \ldots x_i$ may or may not occur in matrix

What is the semantics of GEN?

- Relevant Quantification
  - Whales give birth to live young
  - Åx[whale(x) & **R**(x) ∞ g-b-t-l-y(x)]
  - Whales are sick
- Abstract Objects
  - subject terms refer to an “arbitrary object”
  - enforces a close link between two types of genericity
  - doesn’t cover whole range
    - Mary smokes when she is nervous
  - how to distinguish between accidental generalizations and real generics?

More semantics for GEN

- Prototypes
  - Cats have tails , The prototypical cat has a tail , Åx(PROTO(Cat)(x)∞¸y(y is a tail & x has y))
  - a prototype is supposed to be a “realistic object”; so a prototypical human will have hair, and hence will have hair of some particular color. If there is no one prototypical color, then there will be many different prototypical humans, one for each color.
  - many researchers (Smith & Osherson) think that PROTO is not a compositional operator.
  - Consider also:
    - Ducks have colorful feathers
    - Ducks lay whitish eggs

Yet more semantics for GEN

- Stereotypes (not features of the world, but rather of our perception of it)
  - A lion has a mane [true]
  - A lion is male [false even though this is a superset of the ones with manes]
- Isn't it false that
  - Snakes are slimy

  even though that is the stereotype for snakes?

Still more semantics for GEN

- (Modal) Conditionals
  - Birds fly
  - if x is a bird, then x flies
  - in any of the most normal possible worlds, every bird flies
- Seems relevant for intensionality, for law-likeness, dispositionals, etc.

Problems for modal conditionals?

- Is there any "the most normal possible worlds"? -- isn't ours the most normal, by definition?
- Is it really more normal to have all birds fly?
- Is it more normal to have penguins, kiwis, ostriches, emu,… fly??
- Or broken-winged birds? Or fledglings?
- If most normal world had only bright-colored-winged ducks, then no females…and no males either.

Situation Semantics

- Characterizing sentences report a constraint on situations…i.e., report a relation between types of situations.
- Situations have maybe an advantage over possible world approaches in being able to consider “smaller” domains.
- Seems to be able to deal with the “conflicting defaults” [the ducks]

Default reasoning approaches

- Birds are feathered
  - if *x is a bird* is true, and if the fact *x is feathered* can be consistently assumed, then conclude that *x is feathered* is true [Default Logic: Reiter]
  - if *x* is a bird and it is not known that *x* is not feathered, then *x* is feathered [Autoepistemic Logic: McDermott&Doyle,Moore]
  - if *x* is a bird, and *x* is not abnormal for a bird (with respect to being feathered), then *x* is feathered [Circumscription: McCarthy]
  - if *x* is a bird, and the probability of *x*'s being feathered conditional on its being a bird is å, then the probability that *x* is feathered is å [Bacchus & Halpern, Pearl]

Things to watch for in default reasoning systems

- Want generic statements to be true or false…not “directions for inferences”
- Want to allow embedded generics
- Want to allow for (the possibility of) necessary truths
- Generics must be embeddable in propositional attitudes and counterfactuals
  - John believes that cassowaries fly
  - John knows that Mary loves kissing him, and he would be unhappy if she were to like it less

watch out for...

is consistent with all of my beliefs

- Birds fly , Åx[Bird(x)&◊Fly(x)∞Fly(x)]
  - does not capture nomic relationship between antecedent and consequent
  - makes the following true
    - Squares are round
    - Tigers are vegetables
    - Numbers are animals
  - makes truth of generics depend on epistemic states of people…but the following are true even if no agents
    - Birds fly
    - Tigers are quadrupeds

watch out for

- Is it really right to say
  - In the most normal world, penguins fly
  - In the most normal world, there are no penguins
- Although do not require biologically impossible worlds for (a) because it is analyzed as (b)

  a. Ducks lay whitish eggs

  b. If x is a duck and we have no information to the contrary (e.g., that x is male), then x lays whitish eggs

  don't we <u>always</u> have information to the contrary?

some non-monotonic inferences

I. Dogs are normally hairy
Dogs normally have four legs
Fido is a three-legged dog
So, Fido is hairy

II. Birds fly
Dogs bark
Tweety is a non-flying bird
Fido is a dog
So, Fido barks

Various of the systems do not validate one or the other of these. In particular, the "rational" nonmonotonic systems do not validate II, nor does Pearl's probabilistic semantics for conditionals.

Asher's Commonsense Entailment

- Adopts a modal conditional analysis of generics
  - These are therefore true/false
  - Locates the nomic force and intensionality in that
- Does not postulate "absolutely normal" worlds, nor does it locate nonmonotonicity in such a realm
- Adopts situation-semantic strategy of using "minimal amount of information" in premises of argument…and says that nonmonotonic conclusion-withdrawl occurs when we have additional information
  - Note that the generic premises continue to be true
- CE allows a nice set of nonmonotonic inferences

But we can't talk about all that here….

- More details in

  F.J. Pelletier & N. Asher (1995) "Generics and Defaults" in J. van Benthem & A. ter Meulen (eds.) *Handbook of Logic and Language* (Amsterdam: Elsevier)