# Similarity Demonstratives

## Similarity in Cognitive Science

**Goodman 1972**

"Similarity, ever ready to solve philosophical problems and overcome obstacles, is a pretender, an impostor, a quack." (p. 437)
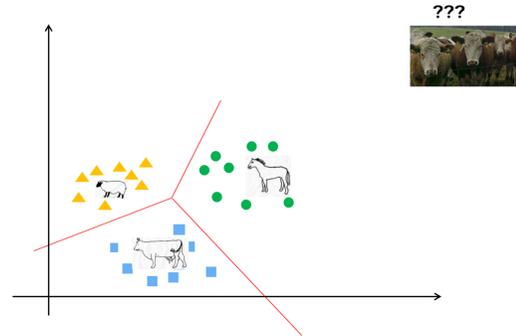
**Quine 1969**

"Similarity is fundamental for learning, knowledge and thought, for only our sense of similarity allows us to order things into kinds […]. " (p. 114)

**Tversky 1977**

"Similarity […] serves as an organizing principle by which individuals classify objects, form concepts, and make generalizations." ( p. 327)

similarity-based classification

???

**Characteristics of similarity**

**Asymmetry**

(a) North Korea is similar to Red China.
(b) Red China is similar to North Korea.

Similarity in (a) is rated higher than in (b)
(Tversky 77, but see also Gleitman et al. 96)

**Informativeness**

Quaggas are similar to zebras.
⇒ Quaggas have four legs
(Medin & Goldstone 95)

**Anomaly**

?? Robins are similar to birds
?? Robins are similar to questions.
(Medin & Goldstone 95)

Note that anomaly corresponds to the **constraints on coordination** — semantic difference and the existence of a superordinate concept – proposed in Lang (1984)

## The German demonstrative 'so'

**ad-adjectival**

*So groß ist Anna.*
'Anna is this tall.'

**ad-nominal**

*So ein Auto hat Anna.*
'Anna has a car like this.'

**ad-verbal**

*So hat Anna das Fahrrad repariert.*
'Anna fixed the bike like this.'

**The puzzle**

(i) what does the demonstrative **so refer** to?

(ii) how is it possible that a demonstrative acts as a **modifier**?

**Nunberg 2004**

The semantics of demonstratives involves

(a) a deictic component picking out a referent,

(b) an interpretation contributing to the proposition

(c) a relation between referent and interpretation which **need not be identity**.

**The solution**

(i) The **referent** of the demonstrative **so** is the individual **pointed to.**

(ii) The **relation** between the referent and the interpretation is **similarity**.

[[*So ein Auto hat Anna.*]] =

$\exists x.$ car(x) & **sim(x, ref, F)** & owns (Anna, x)

where

**sim**: : similarity relation

**ref**: the car the speaker points to

**x**: the discourse referent of the NP

**F**: a set of features of comparison (color, …)

## Multi-dimensional attribute spaces

**How to spell out similarity?**

**Measure function**

(Kennedy 1999)

$$f: U \rightarrow degrees$$

e.g. height (Anna) = 180cm

HEIGHT

**Generalized measure function**

(Gust, Umbach 2010)

$$F : U \rightarrow \text{points in multi-dimensional spaces}$$

e.g. F(Anna's car) = <color: blue,

equipment: radio,

weight: 900kg>

COLOR
EQUIPMENT
WEIGHT
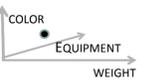
**Referential semantics + attribute spaces**

extension

positive examples

attribute space

domain

generalized measure function

classification function

domain    universe

{true, false}
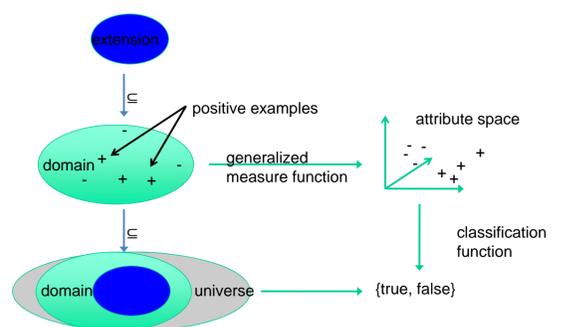
**Ways of implementing similarity**

- **Feature contrast** (Tversky 77)

  compare common/distinct weighted features

- **Conceptual spaces** (Gärdenfors 2000)

  quantitative similarity measure based on geometrical distance

- **Attribute spaces** (Gust, Umbach 2010)

  qualitative similarity measure based on undiscernability w.r.t. properties defined on dimensions

Gärdenfors , P. (2000( Conceptual Spaces. MIT Press
Goodman, Nelson (1972). Seven strictures on similarity. In Goodman, N., editor, Problems and Projects, pages 437–447. The Bobbs Merrill Company, Indianapolis and New York.
Gust, H. & C. Umbach (2010) Similarity-based classification in natural language. Paper presented at *the 10. Anual meeting of the Gesellschaft für Kognitionswissenschaft*, Potsdam.
Hahn, U., & Chater, N. (1998) Similarity and Rules: Distinct? Exhaustive? Empirically Distinguishable? Cognition, 65, 197-230.
Lang, E. (1984). The semantics of coordination. Studies in Language Companion Series 9. Benjamins, Amsterdam.
Medin, D. L. & Goldstone, R. L. (1995) The predicates of similarity. In Cacciari, C. (ed.) *Similarity inlanguage, thought and perception.* Brepolis. 83-110.
Nunberg, G. (2004) Indexical Descriptions and Descriptive Indexicals . In M. Reimer & A. Bezuidenhout (eds) *Descriptions and Beyond: An Interdisciplinary Collection of Essays on Definite and Indefinite Descriptions and Other Related Phenomena.* Oxford University Press, 261-279.
Quine W. V. (1969) *Ontological Relativity and Other Essays.* New York, Columbia, University Press.
Rosch, E. (1978) Principles of Categorization. In E. Rosch and B. Lloyd (eds.) Cognition and Categorization. Laurence Earlbaum Associates.
Tversky, A. (1977) Features of similarity. *Psychological Review* 84: 327-352.