Concepts, frames and cognition:

How knowledge-based terminologies can bridge the gap between definitions and the real world

Dr. François Massion
D.O.G. Dokumentation ohne Grenzen GmbH
(francois.massion@dog-gmbh.de)

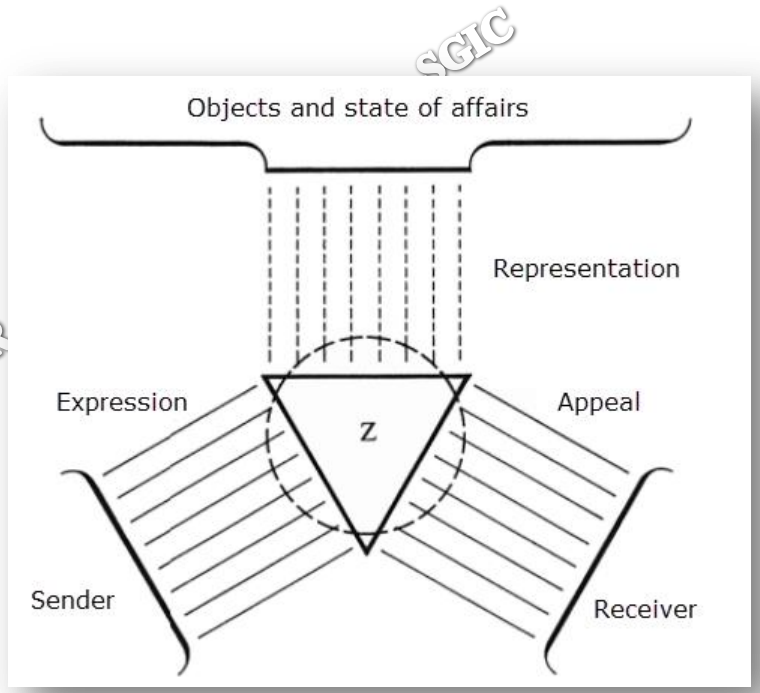
The dilemma of translation

- The translator aims to **transfer accurately a message** from language A to language B.
- But the parameters are not accurate:
  - The world is not the same everywhere.
  - Everyone does not understand ideas the same way.
  - Situations and perspectives are constantly changing.
- Our methods and tools have been designed to work in **generic** situations:

"English (word/sentence/statement)" = "Chinese 1" or "Chinese 2"

The Organon model according to Bühler

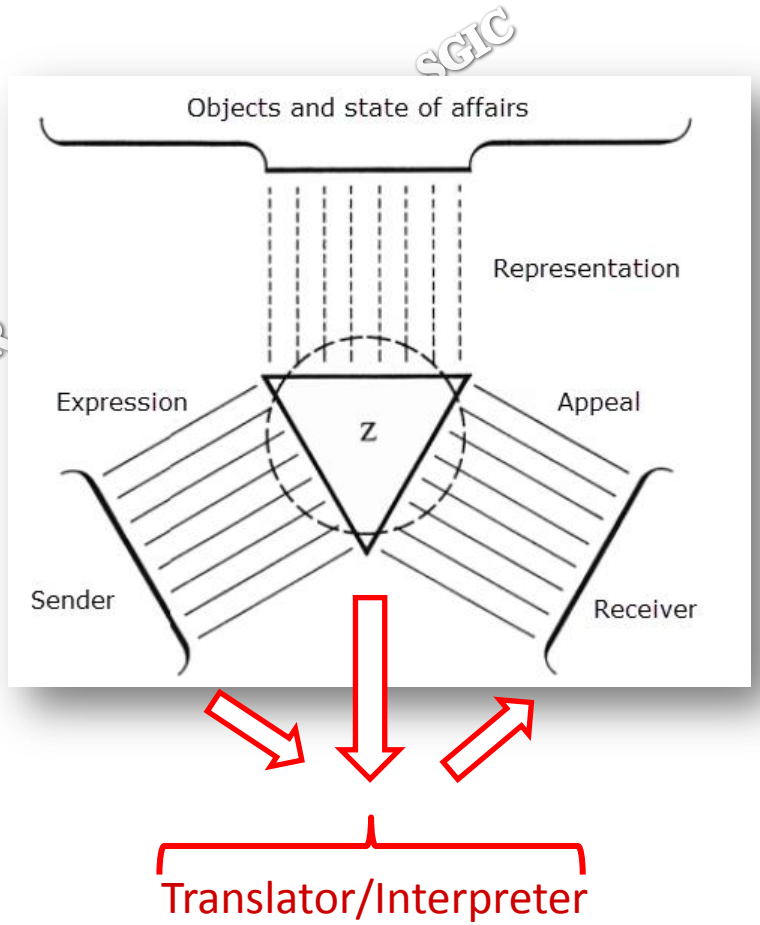
- It is a communication model
- Sign "Z“:
  - Utterance or written word
- A language sign has 3 functions:
  - It is an expression
  - It is an appeal, i.e. it has a communication function
  - It is a representation of an object/idea



Organon model (1934)

The Organon model according to Bühler

- It is a communication model
- Sign "Z":
  - Utterance or written word
- A language sign has 3 functions:
  - It is an expression
  - It is an appeal, i.e. it has a communication function
  - It is a representation of an object/idea



The sign

- The sign is the only tangible factor.
- All other aspects like object, intention, ideas are remote and blurry.
- Example:
  - Sign = bird
  - Defined concept = "*Birds (Aves) are a group of endothermic vertebrates, characterised by feathers, toothless beaked jaws, the laying of hard-shelled eggs, a high metabolic rate, a four-chambered heart, and a lightweight but strong skeleton*."
    (https://en.wikipedia.org/wiki/Bird, Wikipedia, access: 01.09.2016)

The object

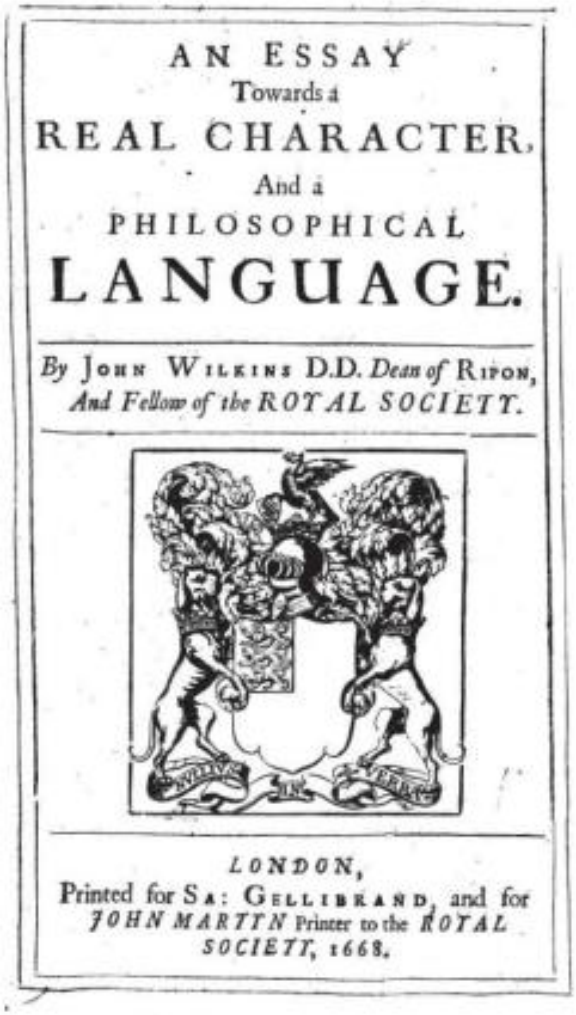
By Wilfried Wittkowsky - own work, CC by-sa 3.0, Https://commons.wikimedia.org/w/index.php?curid=746608

The idea of the conscious mind: Rationalism

- Descartes (1596 - 1650), rationalism. Human beings have a unique ability to **understand and explain the world rationally**.
- John Wilkins (1614 - 1672) *), "Notion" and "Expression"

  *"As men do generally agree in the same Principle of Reason, so do they likewise agree in the same Internal Notion or Apprehension of Things." (*1668)

*) one of the founders of the British Royal Society (Academy of Sciences)


AN ESSAY
Towards a
REAL CHARACTER,
And a
PHILOSOPHICAL
LANGUAGE.

By JOHN WILKINS D.D. *Dean of* RIPON,
And Fellow of the ROYAL SOCIETY.

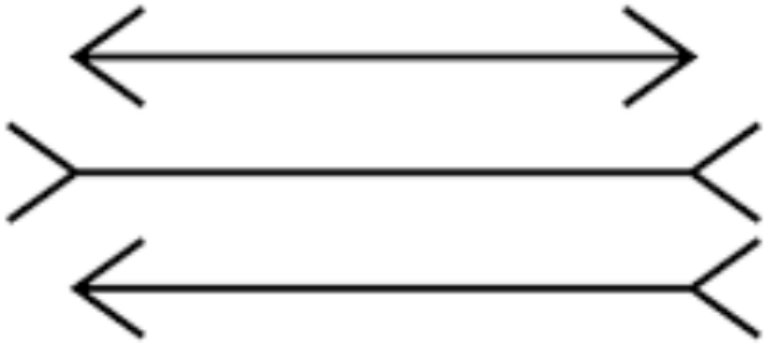
LONDON,
Printed for SA: GELLIBRAND, and for
JOHN MARTYN Printer to the ROYAL
SOCIETY, 1668.

The subconscious mind

- Cognitive linguistics shows that about 98% of the language acquisition and usage is far from being conscious and rationale.
- What we see, hear, feel, speak is filtered swiftly through many parallel processes in the brain by **predefined structures**.
- These structures are not the real world, but a reproduction of reality as perceived by our brain.

Reality and perceived reality

- Illusions are not just optical…..



- They are cognitive: „She holds a Master degree“ or „We speak about concepts and frames at the conference“?

Our brain

- We have about 86 billion neurons in our brain.
- Each neuron can form 1,000 to 10,000 connections.
- In the fetus, connections start to build up and become more sophisticated as we learn and gain experience.
- They shape our perception of the world.

Language as a biological function

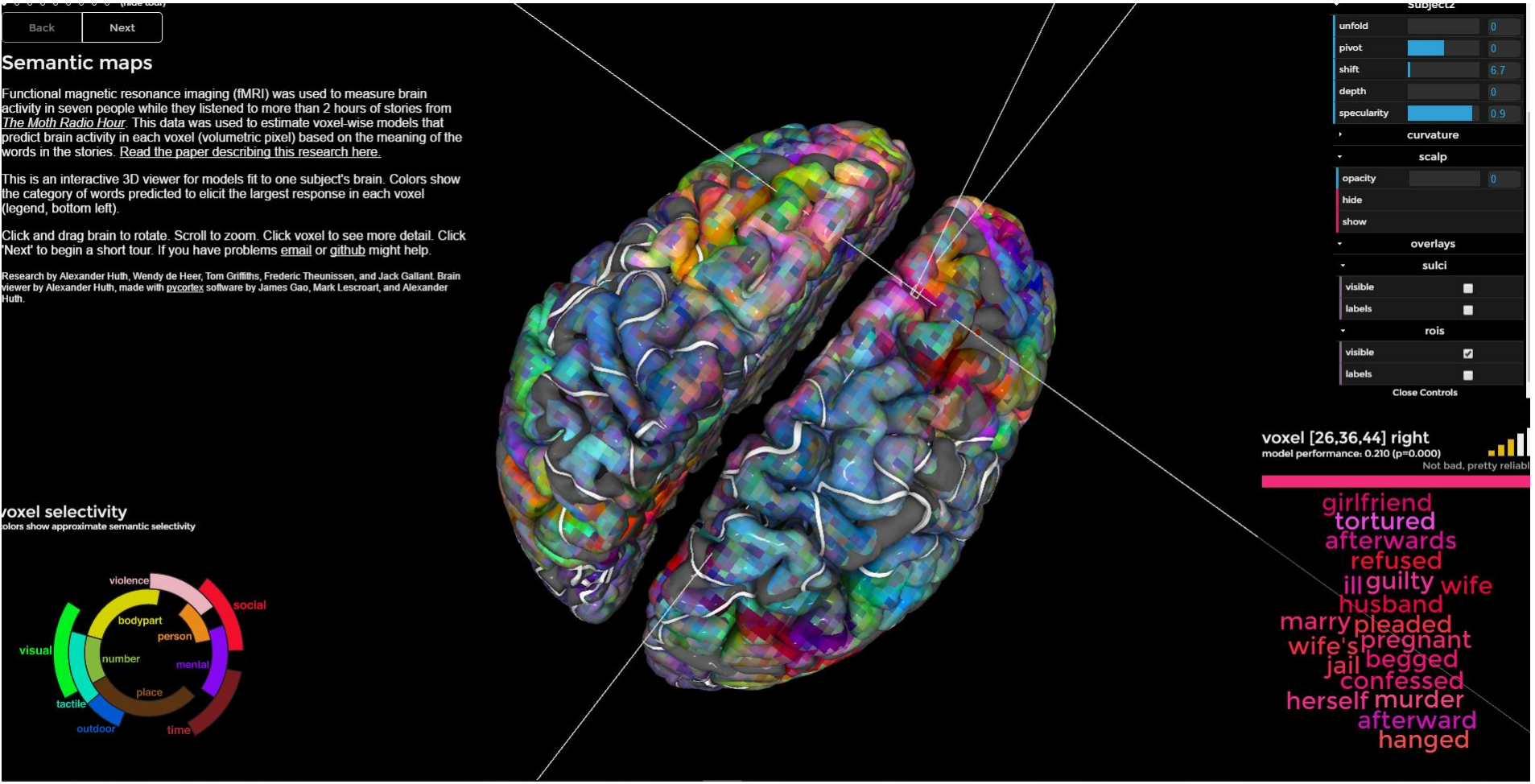
- Jerome A. Feldman (2006): From Molecule to Metaphor: A **Neural Theory of Language** (NTL)
- He studies **language** not as a sign system, but rather **as a biological function** of the brain (like the motor and senses functions).
- The brain constantly learns new information by strengthening connections between networks of neurons.

The brain atlas

- Team of scientists from the University of California*).
- Study with 7 subjects listening to recorded stories.
- Their brain activity in the cortex was recorded with fMRI (activated voxels).
- Active voxels were mapped to 12 semantic domains (e.g. visual, numeric, violent, abstract)

*) Huth, Alexander G.; de Heer, Wendy A.; Griffiths, Thomas L.; Theunissen, Frédéric E.; Gallant, Jack L. (2016). Natural speech reveals the semantic maps that tile human cerebral cortex.

Semantic map of the brain



http://gallantlab.org/huth2016/

Charles Fillmore and Frame semantics

- Research on semantic roles: "Frame semantics" (1982*)
- Each lemma of our language refers to a semantic frame.
- There are networks or hierarchies of frames.
- An individual frame contains frame element (FE) as e.g. event, agent, location, action.
- Frame elements have syntactic realizations.

• Fillmore, Charles J. (1982). Frame semantics. In: Linguistics in the Morning Calm. Seoul, Hanshin Publishing Co., 111-137.

George Lakoff‘s metaphors

- Metaphors not in the sense of a rhetorical figure, but as a cognitive metaphor, a cognitive association in everyday language.
- Two types of metaphor:
  - **Primary metaphors**: derived from physical experience
    ⇨ found in nearly all languages (“Warmth” = “Love”; “Up” = “More”)
  - **Complex metaphors**: combinations of primary metaphors
    ⇨ cultural (Theory = Building, Love = Journey)

) George Lakoff and Mark Johnson (1980). **Metaphors we live by. Chicago*

Language examples

- This is a **big** question.
- Time **is money**. (…) **Buy** more time. (…) **Spend** time. (…) **Give** me more time.
- This **leads to** better results.
- They try to **lose** weight.
- My foot **hurts**.
- That **sounds** like a new **Cold** War.

Language and frames

- Language = another filter for reality
- Study of Max Planck Institute Holland*)
- Two groups of Dutch language learners: French/English and Germans
- Eye-tracking when the Dutch word „***zetten***“ or „***leggen***“ (English: „put“) was pronounced.
- Germans looked at different objects (horizontal/vertical), English/French not.

Fig. 1. Example of a display.

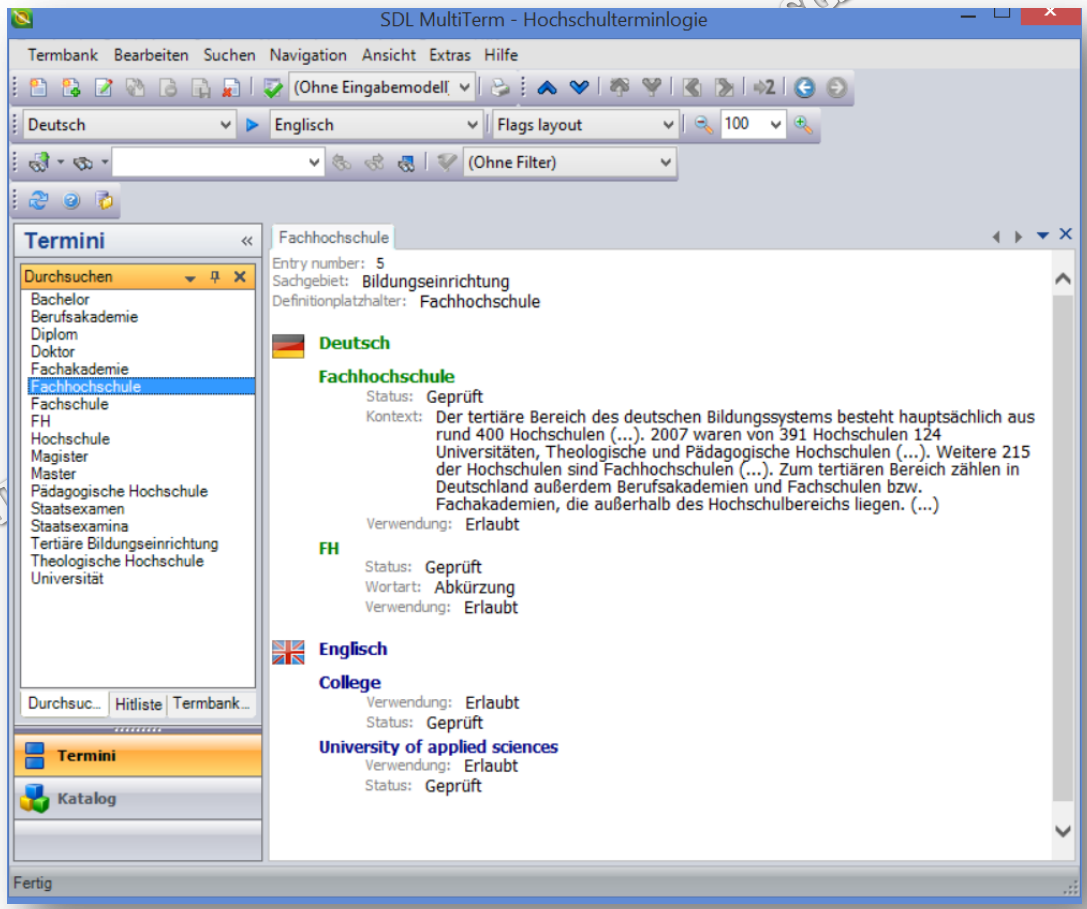
*) van Bergen, Geertje; Flecken, Monique (2016). Putting things in new places: Linguistic experience modulates the predictive power of placement verb semantics Max Planck Institute for Psycholinguistics, Wundtlaan 1, 6525 XD Nijmegen, The Netherlands

We think in terms of knowledge frames

- Different approaches lead to frames:
  - Cognitive (Lakoff)
  - Linguistic (Fillmore)
  - Neurolinguistic (Feldman)
- Our brain does not think in term of definitions.
- Concepts are **always understood in context**.
- **Typical contexts are frames**.
- Frames have certain elements, roles and rules.

Today's terminology management systems

- Static, unrelated
- Based on concepts
- Three levels:
  - Concept
  - Language
  - Term



Implementing brain compliant terminologies

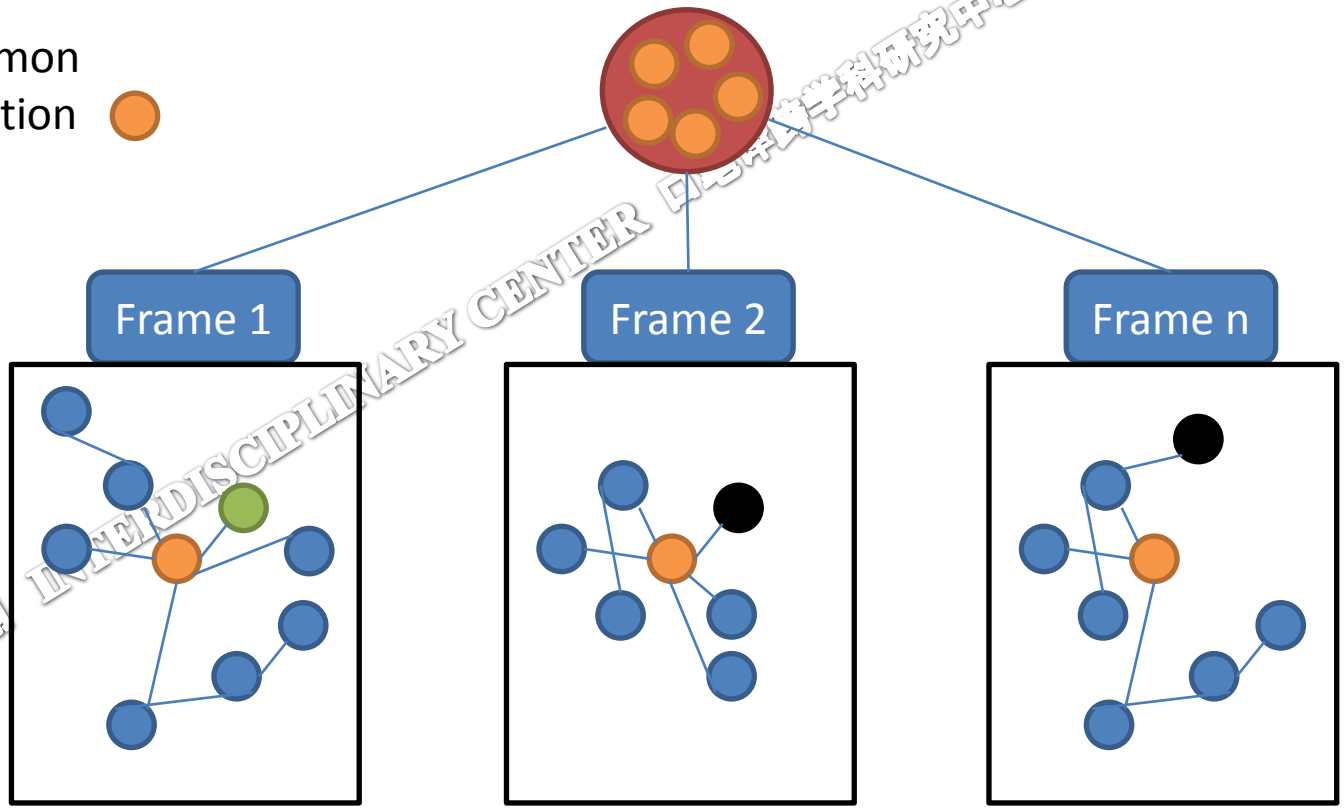
1. Select relevant definition properties for each language.
   - Properties and prototypes (Rosch, 1973)
   - Concept granularity and “concept imperialism”
2. Define the relations between the concepts.
3. Identify possible typical usage scenarios (with techniques from Natural Language Processing).
4. Enrich with metadata for intelligent queries.

Frames complement the definitions

Concept with common Properties = Definition

Modelized typical use cases

Concepts and relations in the frames



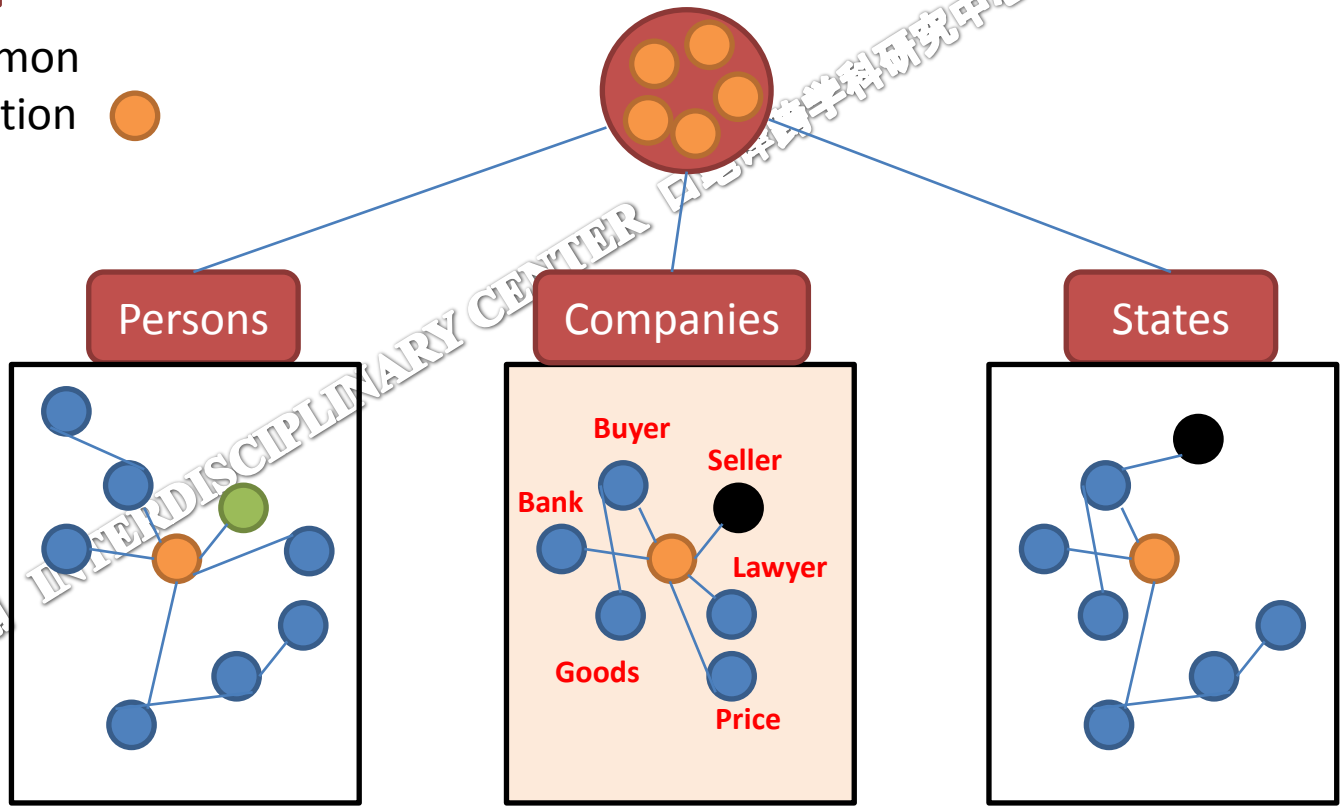
Frames complement the definitions

„AGREEMENT“

Concept with common Properties = Definition

Modelized typical use cases

Concepts and relations in the frames

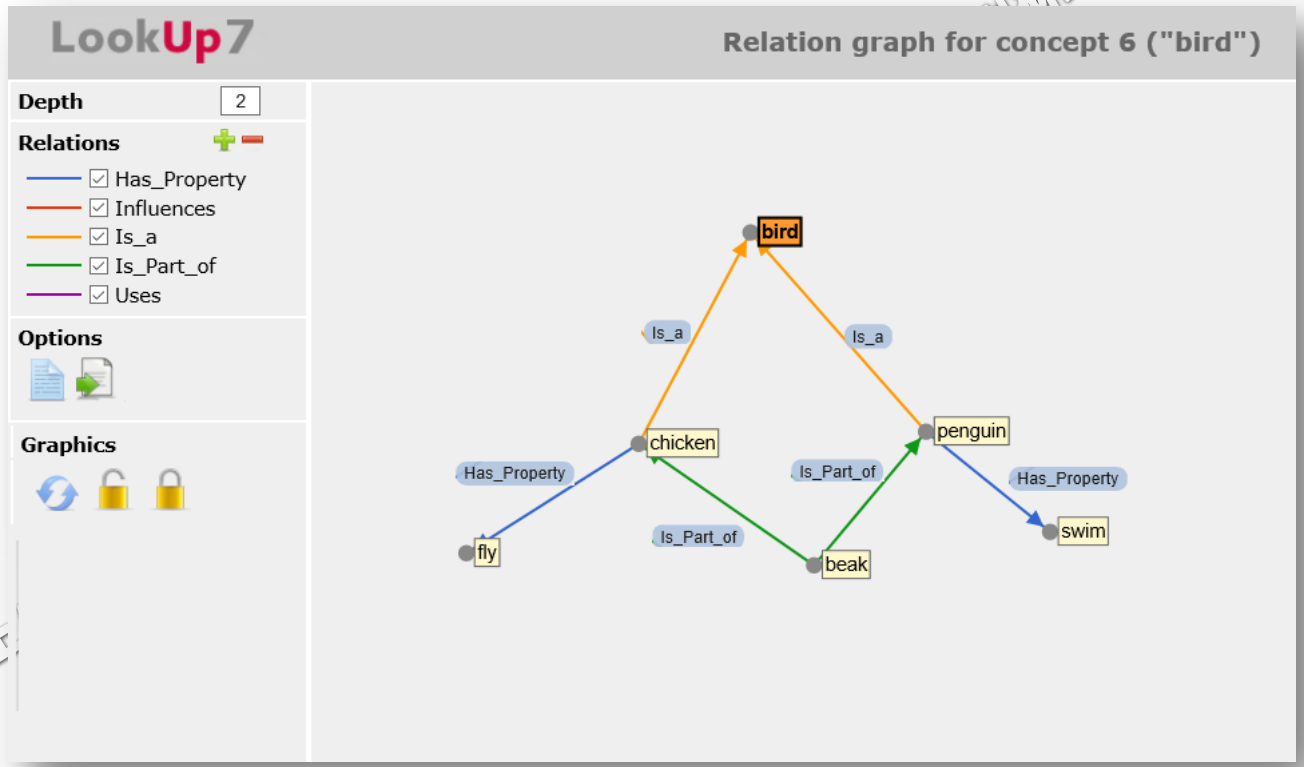


Technical aspects

- **Terminologies** and **ontologies** combine their strengths
  ⇨ Knowledge-rich terminologies (a.k.a. „Ontoterminologies“)
- Concepts are the core elements, they are multilingual, include synonyms (instead of classes and instances in ontologies)
- Relations between concepts
- Attributes of concepts and terms
- Data format to be defined. Based on XML with elements of TBX, RDF, OWL

Knowledge-based terminology

- Supports the translation activity



Contact:

Dr. F. Massion
D.O.G. Dokumentation ohne Grenzen GmbH
Neue Ramtelstr. 12
71229 Leonberg, Germany
francois.massion@dog-gmbh.de