UNIVERSITÄT
ZU KÖLN

Linguistics

VL Sprachliche Informationsverarbeitung

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INSTITUT FÜR
DIGITAL HUMANITIES
UNIVERSITÄT ZU KÖLN

Section 1

Language and Linguistics

Phonology and Phonetics

Phonetics

- How are language sounds produced and understood/processed?
- Focus: Practical, verbal and gestural use of language
- Links to biology, acoustics

Phonology

- Which function have certain phonemes within a language?
- Focus: Relation to other areas of linguistics and grammar
- Abstraction over concrete phonemes

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Relevant and irrelevant differences

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International Phonetic Alphabet (IPA)

https://www.internationalphoneticassociation.org

- Symbols defined via physiological properties of the pronounciation

Pronunciation mishaps

Reisebüro-Panne

Sächsische Kundin bucht Bordeaux statt Porto

Eine undeutliche Aussprache im Reisebüro kann teuer werden. Fast 300 Euro muss eine Kundin aus Sachsen für einen Flug zahlen, den sie nie angetreten hat - weil sie den gewünschten Zielort Porto dialektbedingt nicht klar artikulierte.

Pronunciation mishaps

Bordeaux vs. Porto

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Voice and Plosives

- Voice
  - Sounds with the use of the larynx (dt. Stimmlippen)
  - Example: Phase (voiceless: /f/) vs. Vase (voiced: /v/)
  - You can feel voice if you touch your throat

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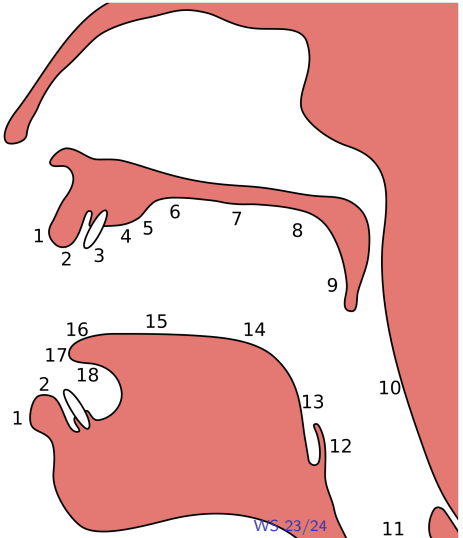
  - You can feel voice if you touch your throat
- Plosive
  - Air stream is blocked, but suddenly re-opened
  - Example: /bʊs/ (plosive) vs. /mʊs/ (nasal)

Producing Sounds

Important Locations for German Sounds (Consonants)

2. labial (Lippen): [b], [p]
3. dental (Zähne): [v], [f]
4. alveolar (Zahnfach): [d], [t], ...
5. postalveolar: [ʃ]
7. palatal: [ç]
8. velar: [g], [k], ...
11. glottal: [ʔ]
    - 'ein Echo': [aɪn ʔɛço]
    - 'Student:in': [ʃtuˈdɛntʔɪn]



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Consonants vs. Vowels

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  - labial/dental/... describes the position of the closure in the tract
- Vowel
  - Produced without closure of the vocal tract
  - Usually voiced
  - Shaped by tongue position and lip rounding
    - (this is a simplification)

Phonetics/Phonology

Written vs. spoken language

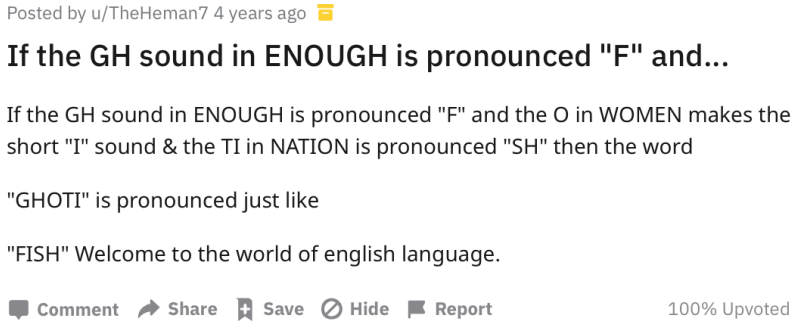

Figure: Reddit user TheHeman7

- Languages do not have a 1:1-mapping between written and spoken language
- German: 'ein Echo': [aɪn ʔɛço]

Subsection 2

Morphology

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- Ambiguity:
  - Order in which parts of words are assembled
- Morphological processes are language-dependent
  - German: Nominal composition very productive
    - Rindfleischetikettierungsüberwachungsaufgabenübertragungsgesetz

Wikipedia

Processes

- Inflection / Flexion / Beugung: adaptation of words to their context
  - Within a word class
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  - frei → Freiheit (adjective → noun)
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  - frei → Freiheit (adjective → noun)
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- Composition / Komposition: Creation of words by combining existing words
  - Sprache + Wissenschaft → Sprachwissenschaft
  - Geburt + Tag → Geburtstag
  - Fugen-s: Some compound nouns add an additional s
    - Historically genitive marker, but not always

Subsection 3

Syntax

Syntax

- Syntax: How are words used to form sentences?
  - Related to ‘grammar’
  - Two ways to look at syntax
    - Phrase structure
    - Dependency

Phrase Structure

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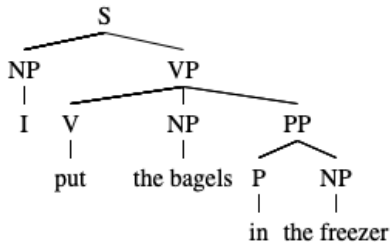
- Parts of speech (Wortarten) are not enough to explain sentences
- Constituents
  - Words that are grouped together as a unit
  - What can appear in diff. positions of a sentence is a constituent
    (1) I put the bagels in the freezer.
    (2) The bagels, I put in the freezer.
    (3) I put in the fridge the bagels (that John had given me).



Phrase Structure

Heads

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- Heads determine syntactic properties of the phrase
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Examples

(1) Der flauschige Hund bellt .
Nominal phrase
Head

(2) Die flauschigen Hunde bellen .
Nominal phrase
Head

Structural vs. Relational Descriptions

Example

Die Regierung besteht auf der neuen Startbahn.

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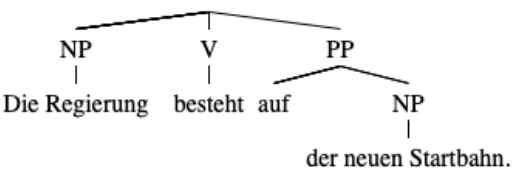
Nominal phrase in nominative case, verb, prepositional phrase with dative nominal phrase



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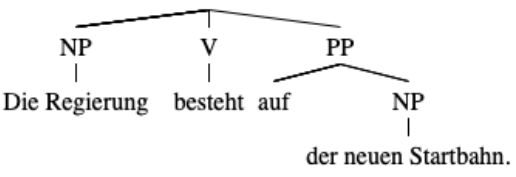

Syntactic Relations

Subject, predicate, prepositional object

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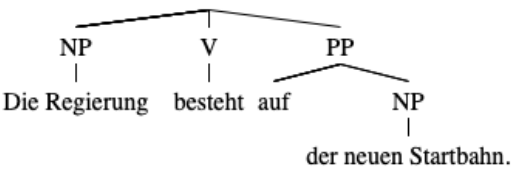

Related, but different views

Syntactic Relations

Subject, predicate, prepositional object

Syntactic Relations

- Subject, object, predicate, ...
- Relational terms
  - ‘die Regierung’ is subject of ‘besteht’
  - ‘auf der neuen Startbahn’ is prepositional object of ‘besteht’
  - ‘besteht’ is predicate of the entire sentence

Dependency Syntax

- Syntax is a relation between words (and not constituents)
- Each word is connected to its governor
  - I.e., the head of the phrase it is in
  - Arrows can go upwards or downwards, depending on taste ...
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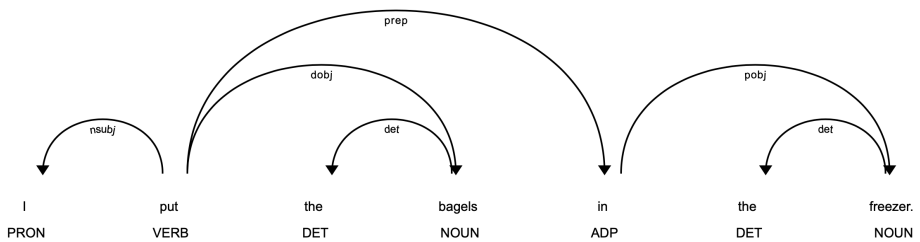

Dependency Syntax

- Often used in computational linguistics
- Much easier to process, because it's a relation between words
- Example for conceptual advancement through computational approaches

German Syntax

Peculiarities in German (every language has their share of oddities)

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  - 'Den Hund hat er gestreichelt.'
  - 'Er hat den Hund gestreichelt.'
- Separable verbs
  - aufstehen: 'Sie steht jeden Tag früh auf.'
    - *'Sie aufsteht jeden Tag früh'
  - bestehen: 'Sie besteht die Prüfung.'
    - *'Sie steht die Prüfung be.'
  - Mark Twain: 'The Germans have another kind of parenthesis, which they make by splitting a verb in two and putting half of it at the beginning of an exciting chapter and the other half at the end of it. Can any one conceive of anything more confusing than that?'

Subsection 4

Semantics

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- Semantics: Study of meaning (of language)
- What is the meaning of a sentence?

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Truth-conditional semantics

Davidson (1967)

- Meaning: Conditions that make a sentence true
  - (we're talking about full sentences now)
- Intuitively: If we know what makes a sentence true, we know something about its meaning

What makes a sentence true?

Example

Margaret Atwood is a writer.

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Sentence is true, iff the individual ‘Margaret Atwood’ belongs to a group of things that we call writer.

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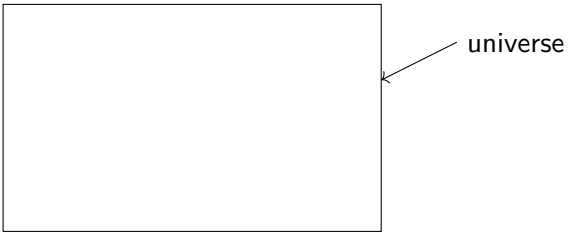

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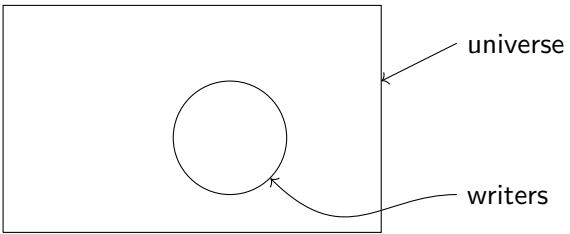

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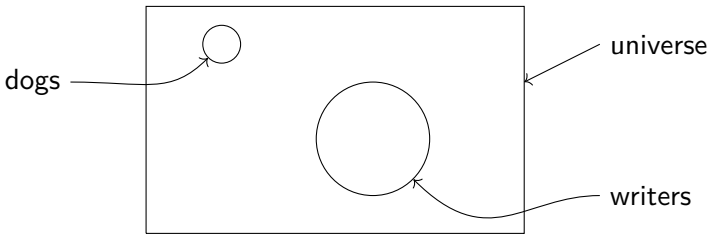

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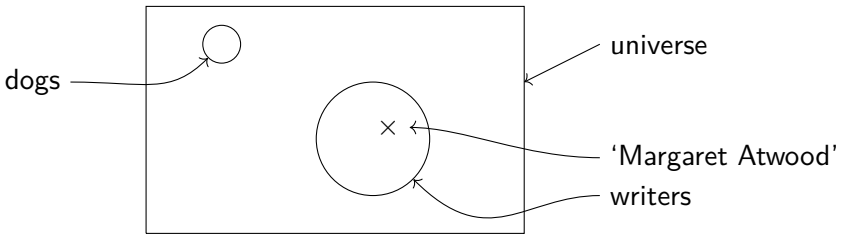

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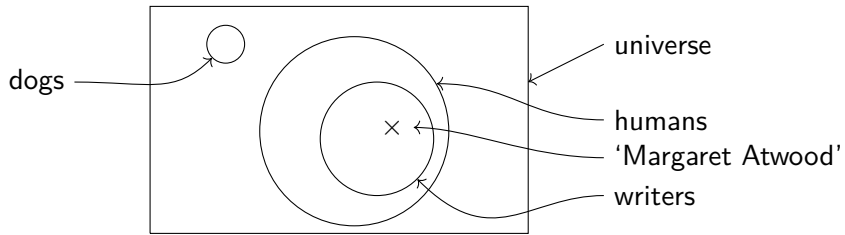

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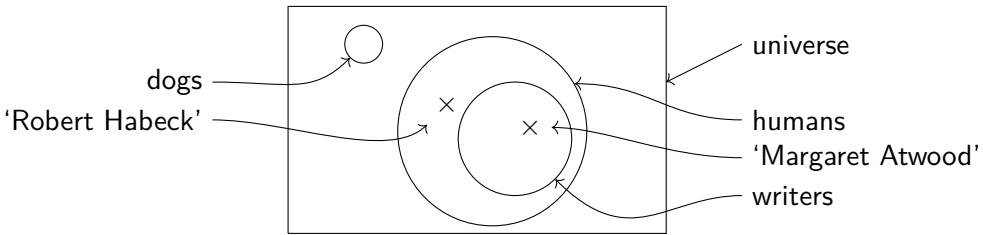

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Formal representation

First-order Logic

- $A(x)$, $B(y)$, $C(x, y)$ are statements about x and y
  - Statements can be true or false, with respect to a *universe*
  - $A(x)$ is true, iff $x \in A$

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- $\exists x : S(x)$ is true, iff there is a x, such that $S(x)$ is true (existential quantification)
- $\forall x : S(x)$ is true, iff for all x, $S(x)$ is true (universal quantification)

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- A hippo swims.
  - Indefinite article
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Every woman loves a man.

Every man loves a woman.

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- Ambiguous: Is it the same man/woman?
- Ambiguity can be represented by different scopes of the quantors

What makes a sentence true?

Formal representation

Examples

Every woman loves a man. Every man loves a woman.

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- Ambiguity can be represented by different scopes of the quantors
- $\forall w : \text{woman}(w) \Rightarrow \exists m : \text{man}(m) \wedge \text{love}(\text{w},\text{m})$
- $\exists m : \forall w : \text{woman}(w) \Rightarrow \text{man}(m) \wedge \text{love}(\text{w},\text{m})$

Subsection 5

Pragmatics

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  - 'pragmatic wastebasket' Bar-Hillel (1971)
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  - Presupposition
  - Speech acts
    - 'I hereby christen this ship the H.M.S. Flounder.' Austin (1962)
    - Change of the state of the world
  - Conversational structure

Presupposition

Implicit assumptions about the world

Example

(1) John managed to stop in time.

(2) John stopped in time.

(3) John tried to stop in time.

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From (1), we can infer (2) and (3).

Example

(4) John didn't manage to stop in time.

From (4), we cannot infer (2), but (3).

Presupposition

- Entailments are cancelled under negation
- Presuppositions remain stable

Presupposition

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- Presuppositions remain stable
- Where does the presupposition come from?
  - The word 'manage' – let's replace it by 'try'

Example

(5) John tried to stop in time.

(6) John didn't try to stop in time.

(5) is not presupposed by (6).

Presupposition triggers

- Some words trigger presuppositions
- Trigger words have been collected and categorized

Presupposition triggers

- Definite descriptions
  - John saw/didn't see the man with two heads

  $\rightarrow$ there exists a man with two heads

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- Comparisons and contrasts
  - Marianne called Adolph a male chauvinist, and then HE insulted HER

  → For Marianne to call Adolph a male chauvinist would be to insult him
- ...

Presupposition properties

- So far: Presuppositions
  - are implicit assumptions about the world
  - survive under negation
- Now:
  - Defeasibility

Presupposition

Defeasibility

- Presuppositions can be cancelled/prevented/defeated

Presupposition

Defeasibility

- Presuppositions can be cancelled/prevented/defeated
- By background knowledge (that John didn't to a PhD)

(1) John regrets that he did a PhD
$\rightarrow$ John did a PhD

(2) At least John won't have to regret that he did a PhD.
$\not\rightarrow$ John did a PhD

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- By the meaning of the sentence
  (3) Sue cried before she finished her thesis.
  $\rightarrow$ Sue finished her thesis
  - 'before' triggers a presupposition

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  $\not\rightarrow$ John did a PhD
- By the meaning of the sentence
  (3) Sue cried before she finished her thesis.
  $\rightarrow$ Sue finished her thesis
  - 'before' triggers a presupposition
  (4) Sue died before she finished her thesis.
  $\not\rightarrow$ Sue finished her thesis

Presupposition

Defeasibility

- By more context

  (1) He isn't aware that Serge is on the KGB payroll
  $\rightarrow$ Serge is on the KGB payroll

Presupposition

Defeasibility

- By more context
  - (1) He isn't aware that Serge is on the KGB payroll
  - $\rightarrow$ Serge is on the KGB payroll
  - (2) A: Well we've simply got to find out if Serge is a KGB infiltrator
    B: Who if anyone would know?
    C: The only person who would know for sure is Alexis; I've talked to him and he isn't aware that Serge is on the KGB payroll. So I think Serge can be trusted
  - $\not\rightarrow$ Serge is on the KGB payroll
- A specific discourse context can override a presuppositional inference

Section 2

Summary

Summary

- Linguistics: Scientific study of language(s)
- Syntax, semantics, pragmatics, ...: Different levels of abstraction over the text/speech
- Pipeline idea: Output of one level used as input for the next
  - Error-prone and complex systems
  - "End-to-End-systems" are now popular
- Ambiguity on every level