Seminar Natural Language Processing (NLP) — Part 1

Introduction to Computational Sociolinguistics

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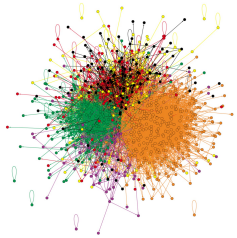
Natural Language Processing

Leibniz Universität Hannover

Outline

- **Motivation**



(Lietz et al., 2014)

- **Computational sociolinguistics (CSL)**

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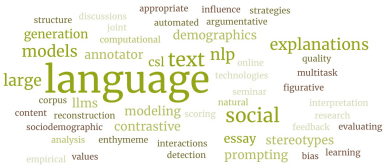
- **CSL research of the NLP Group**

- **CSL in this seminar**

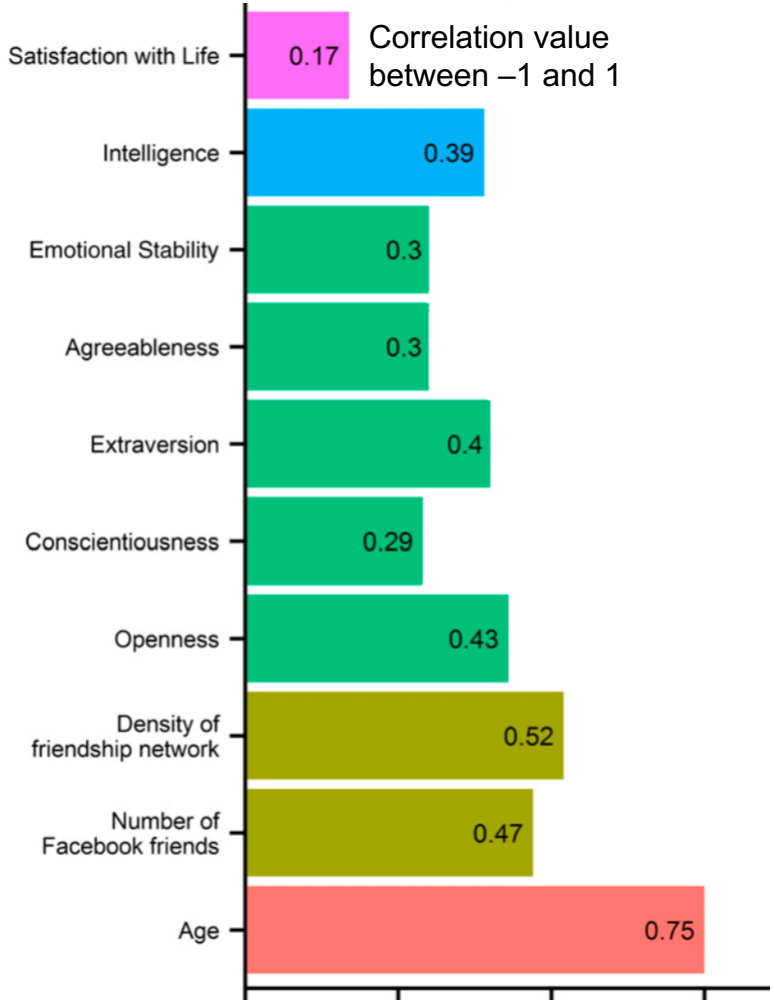


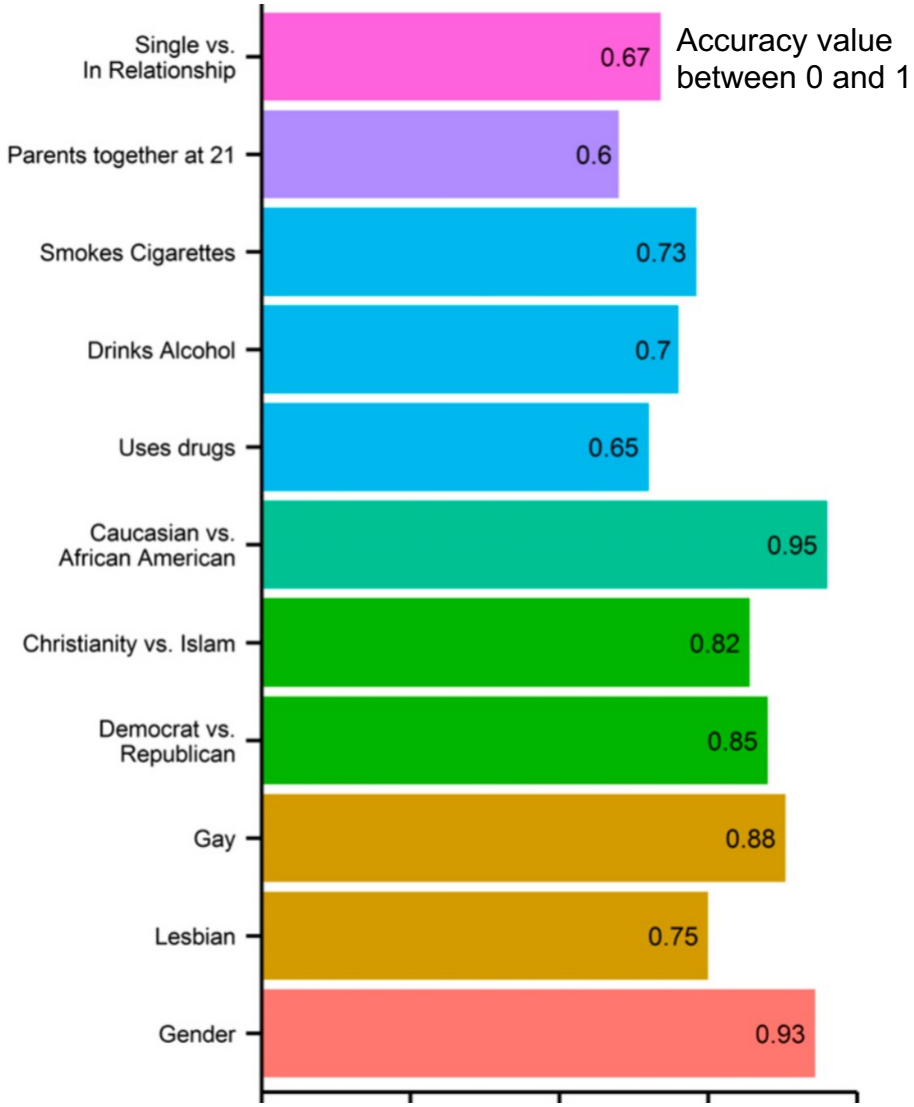
https://www.freewordcloudgenerator.com

Motivation

Example: Predictiveness of likes (Kosinski et al., 2013)

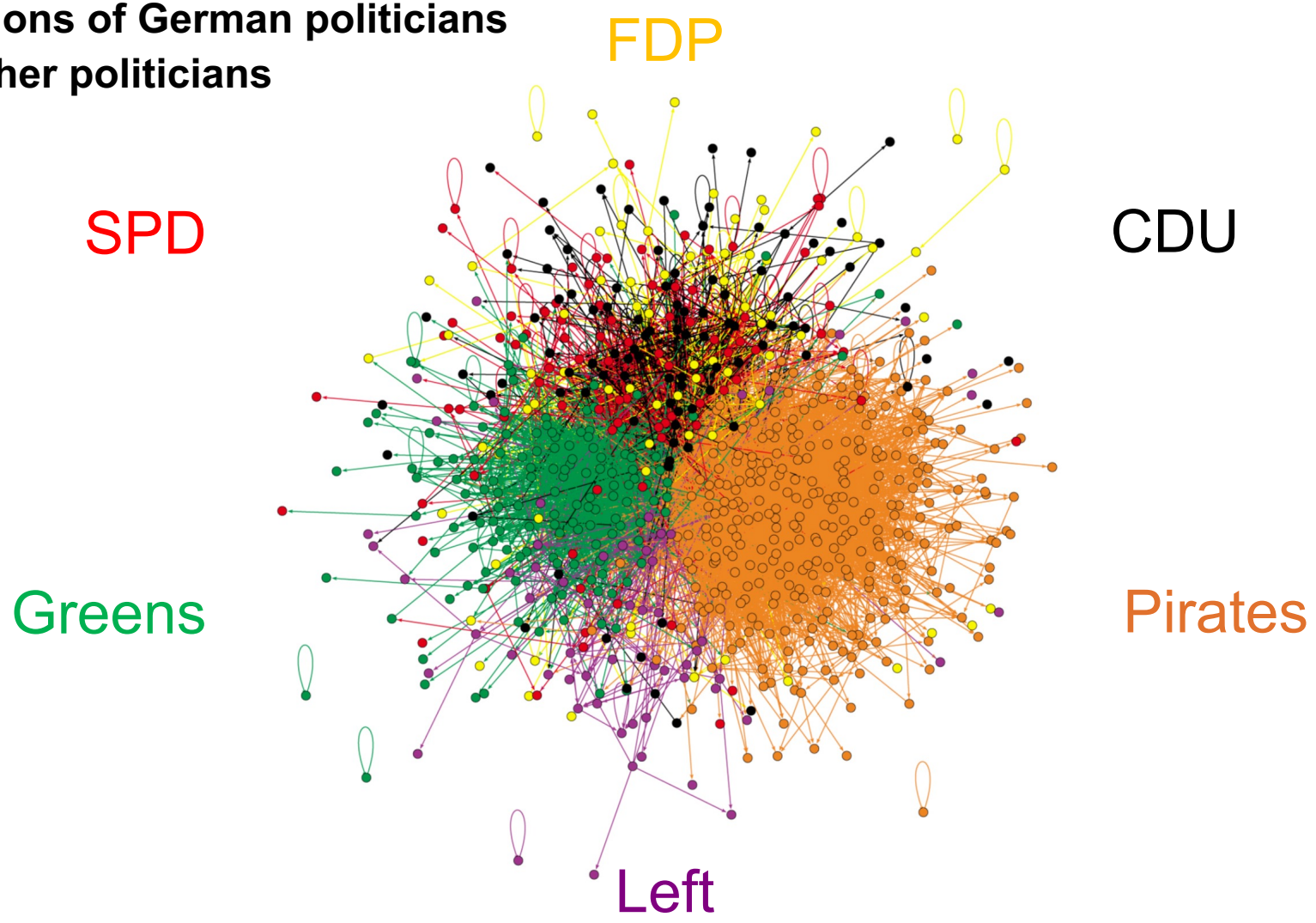
- **What social media likes reveal**





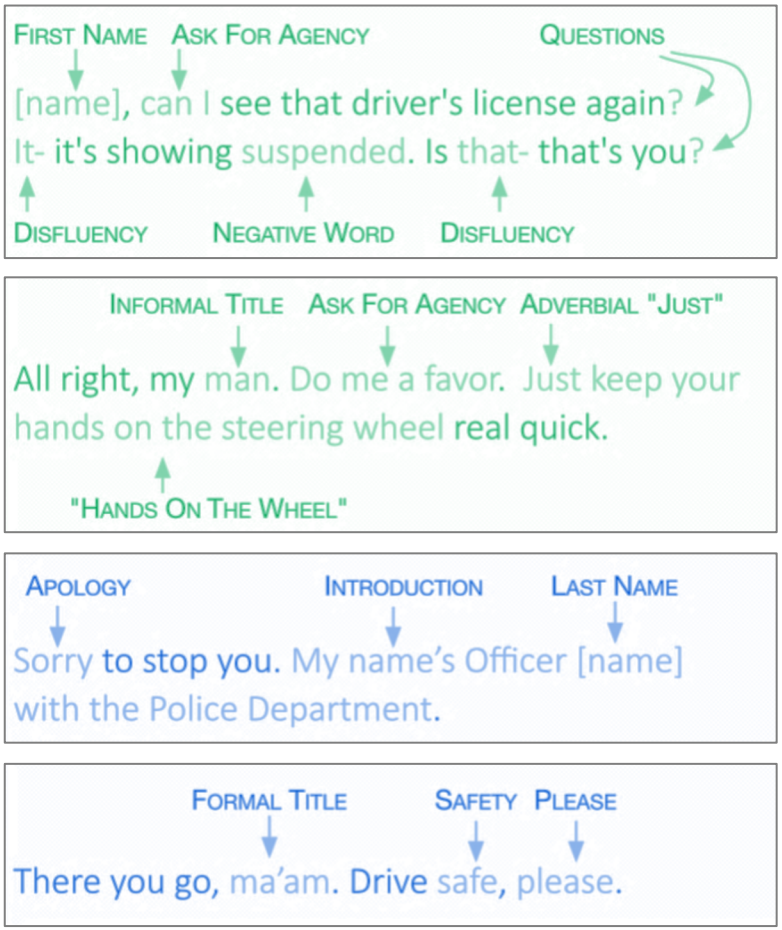
Example: Politicians‘ Twitter practices (Lietz et al., 2014)

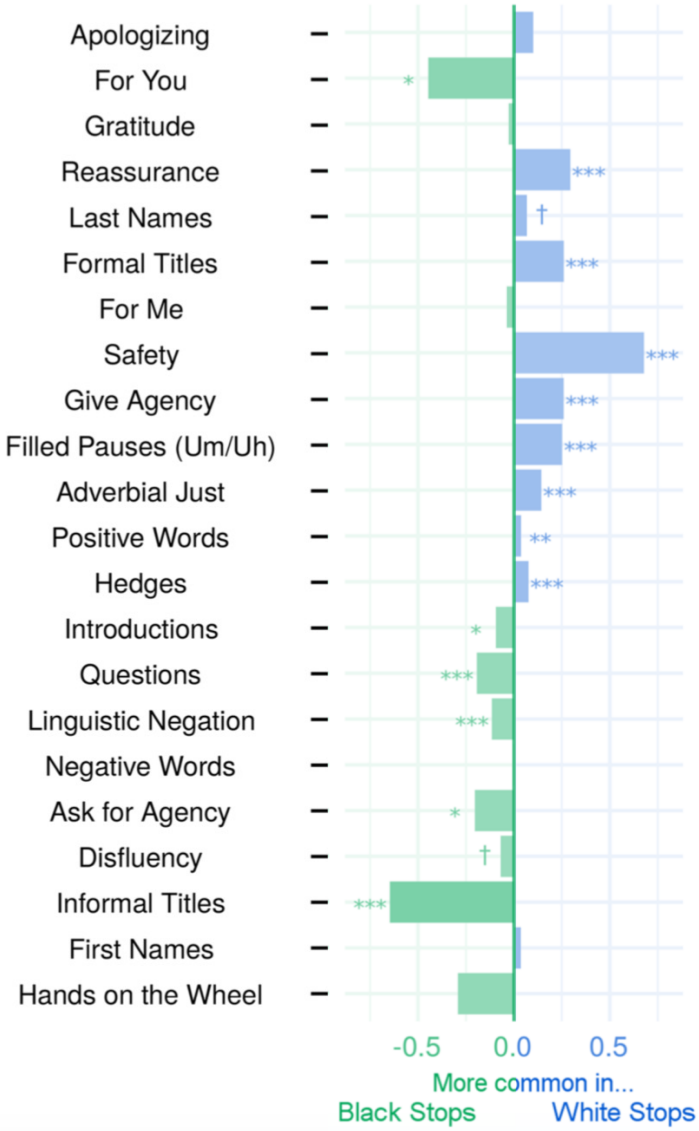
- **Mentions of German politicians by other politicians**



Example: Ethnicity-related police behavior (Voigt et al., 2017)

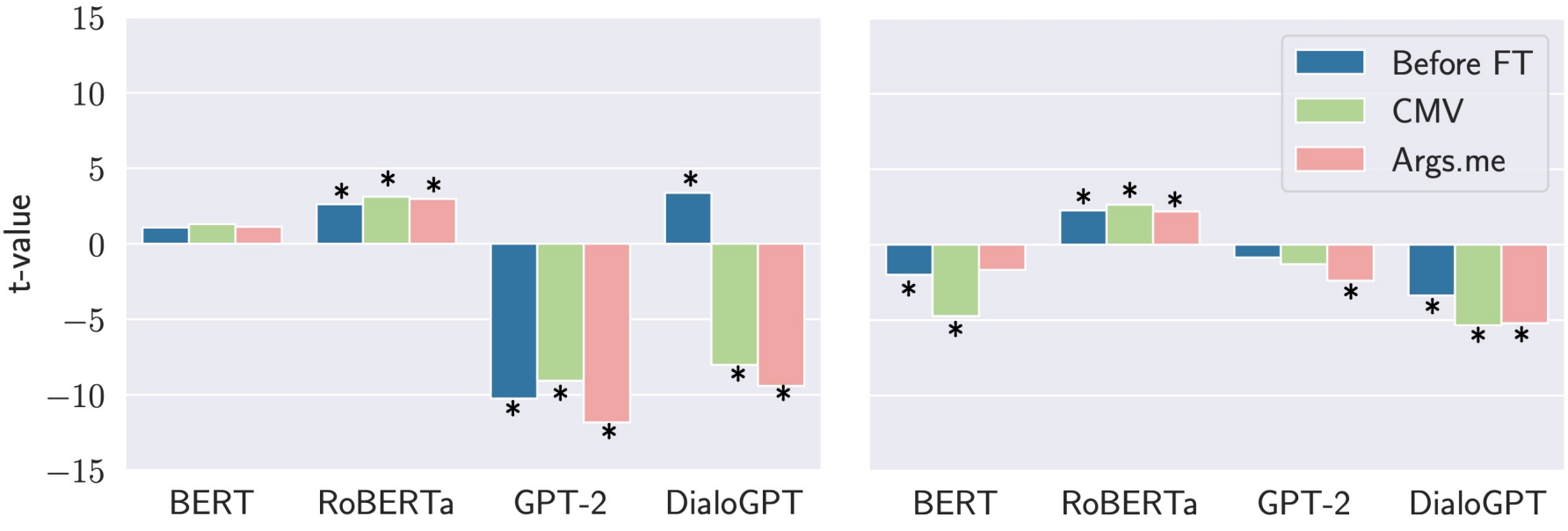
- **Language of US police officers towards black and white car drivers**





Example: Social bias in language models (Holtermann et al., 2022)

- **Social bias in language models before and after fine-tuning (FT) on subjective language**



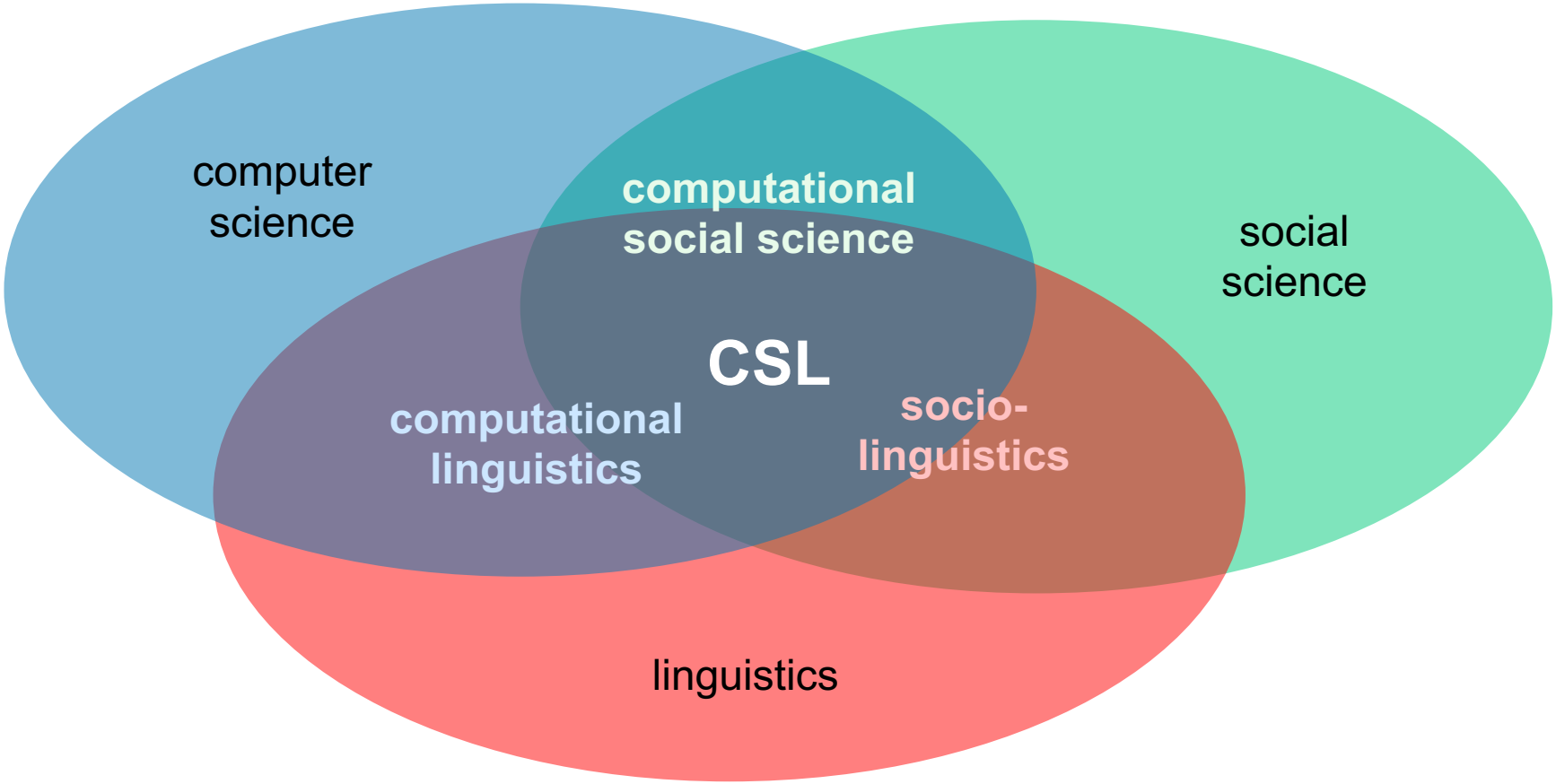
(a) LMB for Queerphobia

(b) LMB for Islamophobia

Computational Sociolinguistics (CSL)

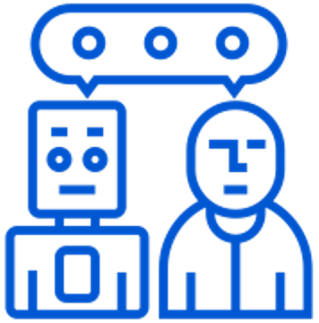
An interdisciplinary research area

- **Two views of computational sociolinguistics (CSL)**
  - The intersection of computational linguistics and sociolinguistics
  - Computational social science on language data

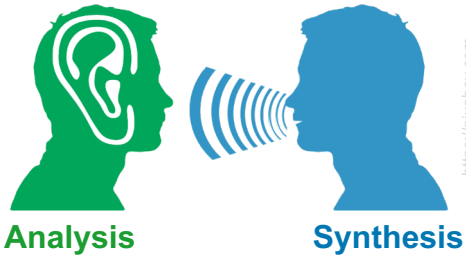


Computational linguistics based on Tsujii, (2011)

- **Computational linguistics (CL)**
  - Studies the intersection of computer science and linguistics
  - Models for linguistic phenomena, based on knowledge and statistics (machine learning)
  - Technologies for natural language processing tasks



- **Natural language processing (NLP)**
  - Methods for understanding and generating speech and human-readable text
  - Various syntactic, semantic, and pragmatic tasks
  - From language to structured information, or vice versa



- **Goals of research**
  - Creativity. Novelty of developed models and methods
  - Accuracy. Effectiveness in tackling tasks
  - Empirical research is often seen as stronger than theory

Sociolinguistics based on Nguyen et al. (2016)

- **Sociolinguistics (SL)**
  - Studies the mutual interaction of society and language
  - Relations between social variables and language use
  - Language variation across social groups, social contexts, and communicative situations

https://thenounproject.com

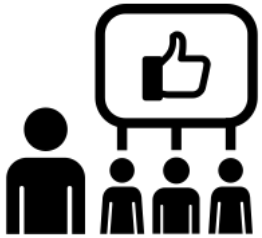
- **Language as a social phenomenon**
  - Social identity of speakers and listeners (gender, age, …) are inherently connected to language use
  - People can choose how to use language to achieve their goals
  - Analyzing language often requires to consider the people

- **Goals of research**
  - Validity. Extent to which research design isolates an issue to be studied
  - Reliability. Reproducibility of a result
  - Empirical research is seen as a means to support theory

Computational social science

- **Computational social science (CSS)**
  - Studies questions from the social science through empirical data analysis
  - Insights into social phenomena and dynamics (primary)
  - Technologies to support social context (secondary)

- **Data** (among others)
  - Sociocultural key indicators
  - Social network structures
  - Online activities
  - News and social media texts



- **Analyses** (among others)
  - Statistical correlation analyses
  - Data mining
  - Natural language processing

All figures on this slide from https://thenounproject.com

Computational sociolinguistics based on Nguyen et al. (2016)

- **Computational sociolinguistics (CSL)**
  - Studies relations between language and society computationally based on data
  - Questions emerging from theory in sociolinguistics
  - Methods from computational linguistics

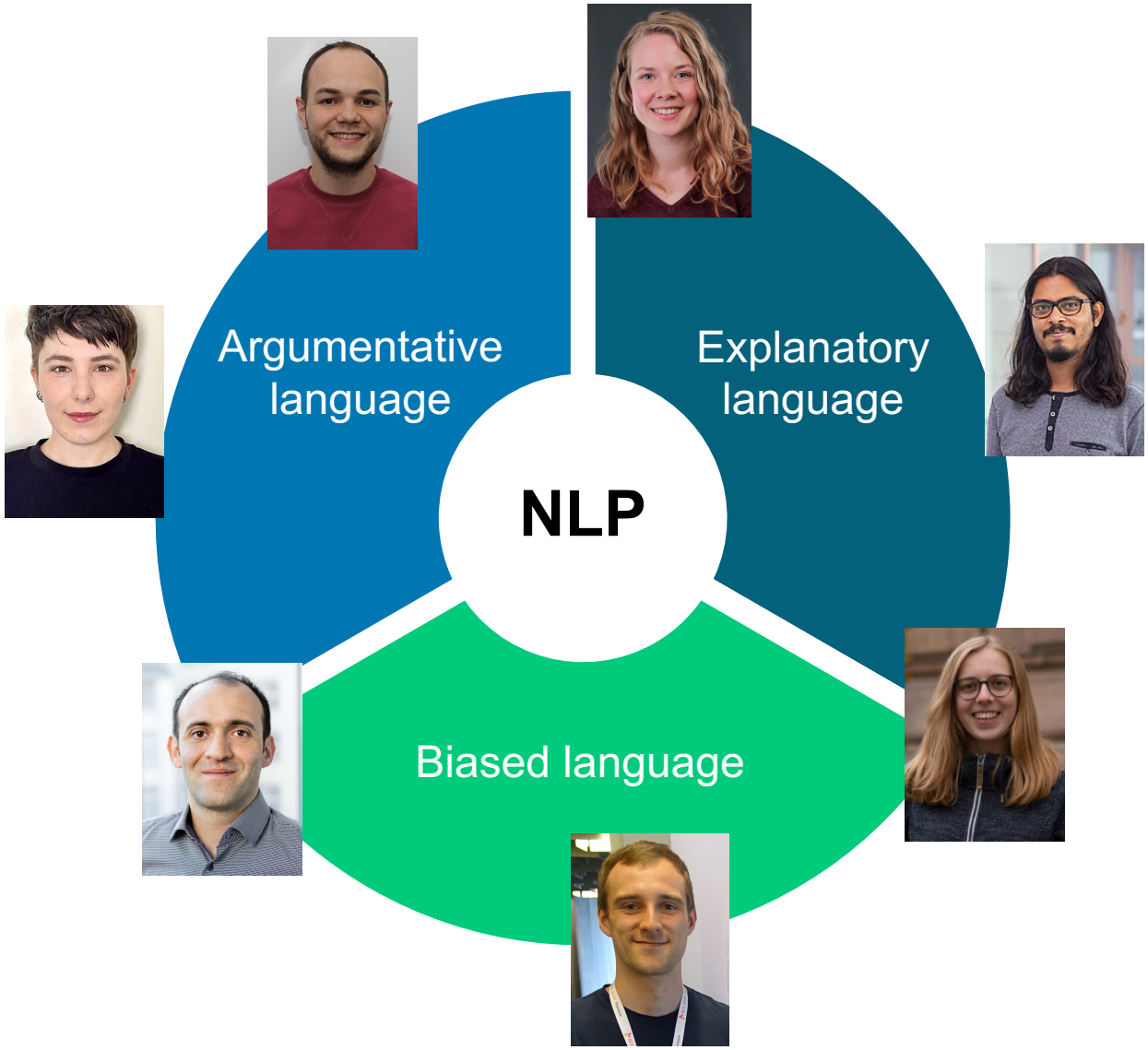
https://thenounproject.com

- **NLP in the context of CSL**
  - Data. Natural language texts, along with sociocultural meta-information
    Texts often come from news or from discussions and posts on social media.
  - Methods. Primarily analysis (classification, regression, clustering, …), but also text generation may be involved
  - Applications. Tools with social dimensions (chatbots, writing support, …)

- **Mutual impact of involved fields**
  - SL → CL. Build more robust and well-grounded computational methods
  - CL → SL. Refine theoretical models, better understand social dynamics

CSL research of the NLP Group

CSL in the NLP Group



CSL research on argumentative language

- **Argumentative language**
  - Online discussions on controversial issues
  - Claims and arguments that express viewpoints
  - Persuasive essays written by learners

- **Analysis**
  - Modeling of the structure and style of the argumentative texts
  - Computational assessment of the quality of the texts
  - Automatic identification of toxicity in the texts

- **Generation**
  - Computational reconstruction of implicit argument parts
  - Computational generation of counterarguments
  - Computational generation of feedback to learner texts

CSL research on biased language

- **Biased language**
  - Language reflecting positive/negative views of social groups
  - Language reflecting stereotypes about the groups
  - Values and political views expressed through language

- **Analysis**
  - Empirical evaluation of social biases in language models
  - Computational analysis of priming effects on language models
  - Assessment of the quality of language model outputs

- **Generation**
  - Automatic generation of counterfactuals for bias mitigation
  - Prompting strategies for bias detection and mitigation
  - Influence of sociodemographic factors on generated text

CSL research on explanatory language

- **Explanatory language**
  - Explanations given to describe or justify phenomena
  - Linguistic devices used in explanations
  - Explanatory dialogues between two or more people

- **Analysis**
  - Modeling of structural patterns in explanatory texts and dialogues
  - Computational understanding of the functioning of explanations
  - Human and machine evaluation of explanation quality

- **Generation**
  - Computational generation of explanations
  - Computational adjustment of explanations to user language
  - Explaining machines that lead dialogues with users

CSL in this seminar

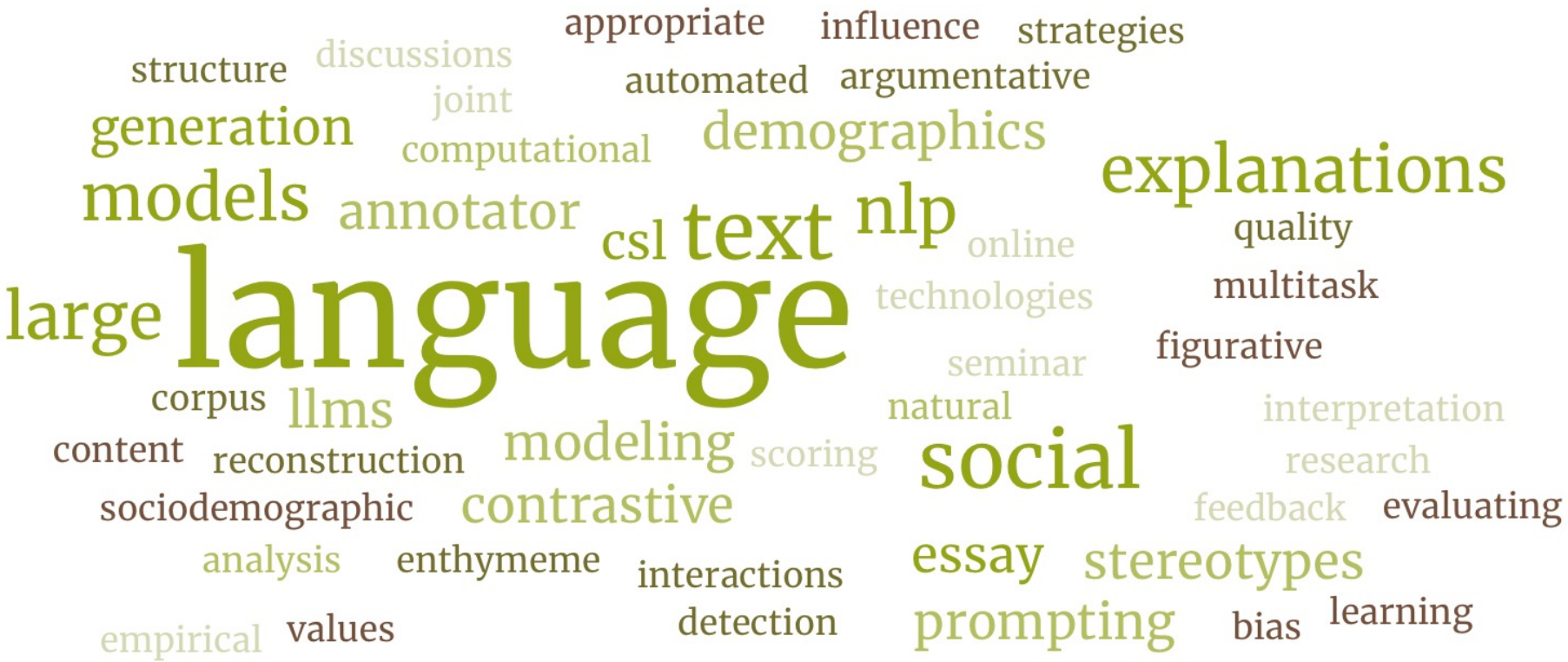
This seminar

- **Frame of this seminar**
  - Basics of NLP for computational sociolinguistics
  - State-of-the-art NLP research in this area
  - Connections to research at Institute of Artificial Intelligence

- **Covered topics**
  - Assessment and generation of argumentative language
  - Analysis and evaluation of biased language
  - Identification and understanding of explanatory language

- **Notice**
  - We take a broad view on CSL in this seminar
  - Topics are selected according to our research interests
  - Required basics of NLP to be acquired rather than taught

Concrete seminar topics: Next week



Conclusion

- **Computational sociolinguistics (CSL)**
  - Studies relations between language and society computationally
  - Intersection of computational linguistics and sociolinguistics
  - Analysis and synthesis of texts from social contexts

- **This seminar**
  - State-of-the-art NLP research on computational sociolinguistics
  - Learner, explanatory, subjective, and language model language
  - Close connection to research in the NLP Group

- **Next up**
  - Overview of concrete seminar topics with literature pointers
  - Topic preference choice and topic assignment
  - Basics of scientific presentation

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- **Holtermann et al. (2022).** Carolin Holtermann, Anne Lauscher, and Simone Ponzetto. Fair and Argumentative Language Modeling for Computational Argumentation. In Proceedings of the 60th Annual Meeting of the Association for Computational Linguistics (Volume 1: Long Papers), pages 7841–7861, 2022.
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