

Spatial-Temporal Modeling of Linguistic Regions and Processes with combined Indeterminate and Crisp Boundaries

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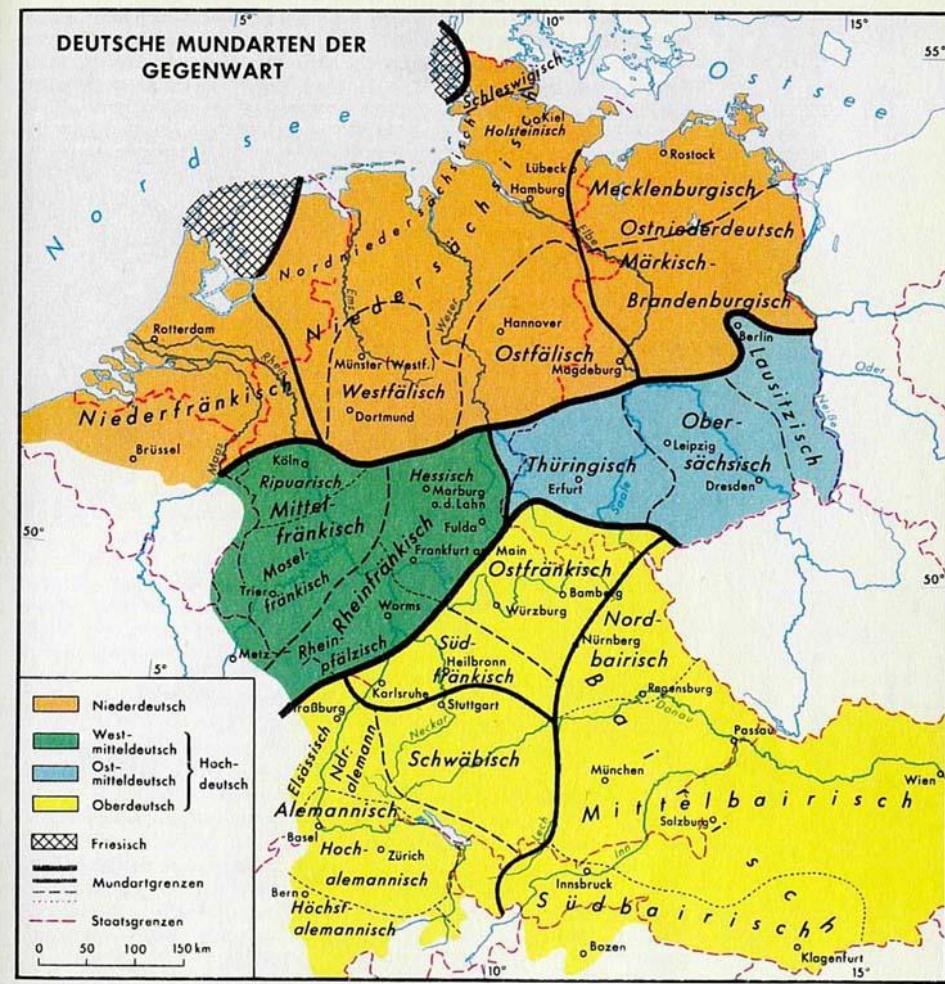
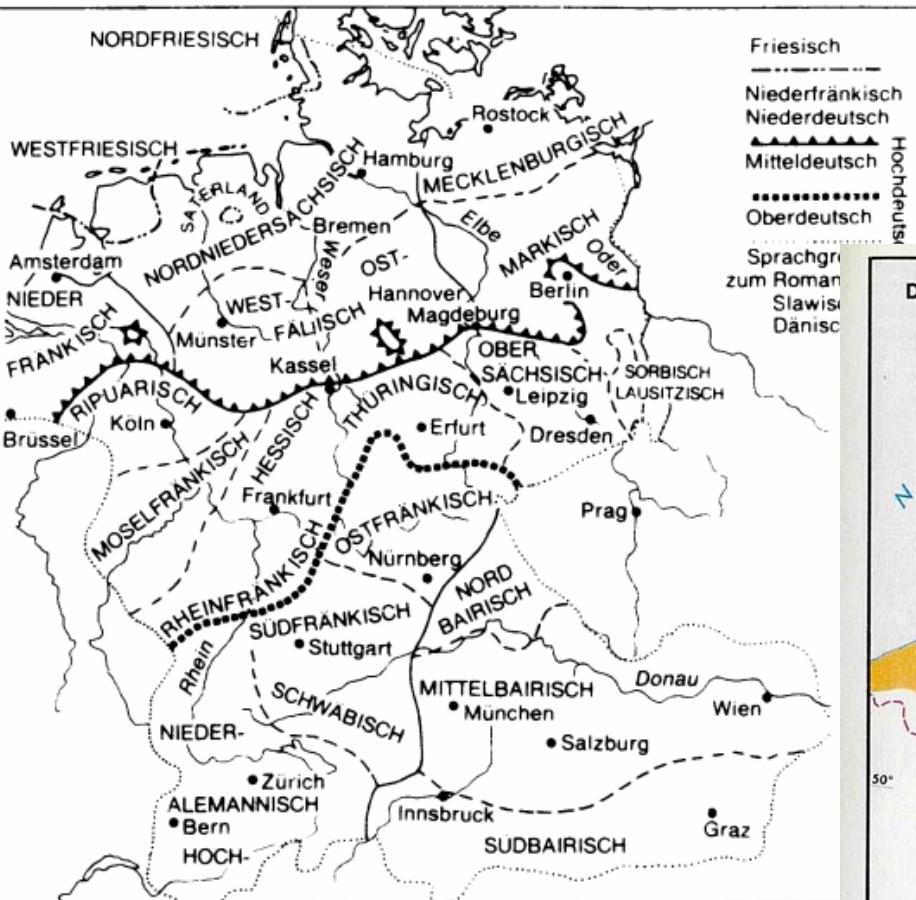
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- Fuzzy Theory for Boundaries and Frontiers
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Introduction and Motivation

- Language Geography (de Carvalho 1962):
 - Enhance the usability of digital language and dialect databases
 - Foster visual exploration of linguistic data
- Contemporary situation:
 - Linguistic Phenomena are mapped in a static manner
 - Linguistic Phenomena are regarded as being static
 - Maps having dialect regions and/or isoglosses
- Isogloss: geographic boundary of a linguistic feature



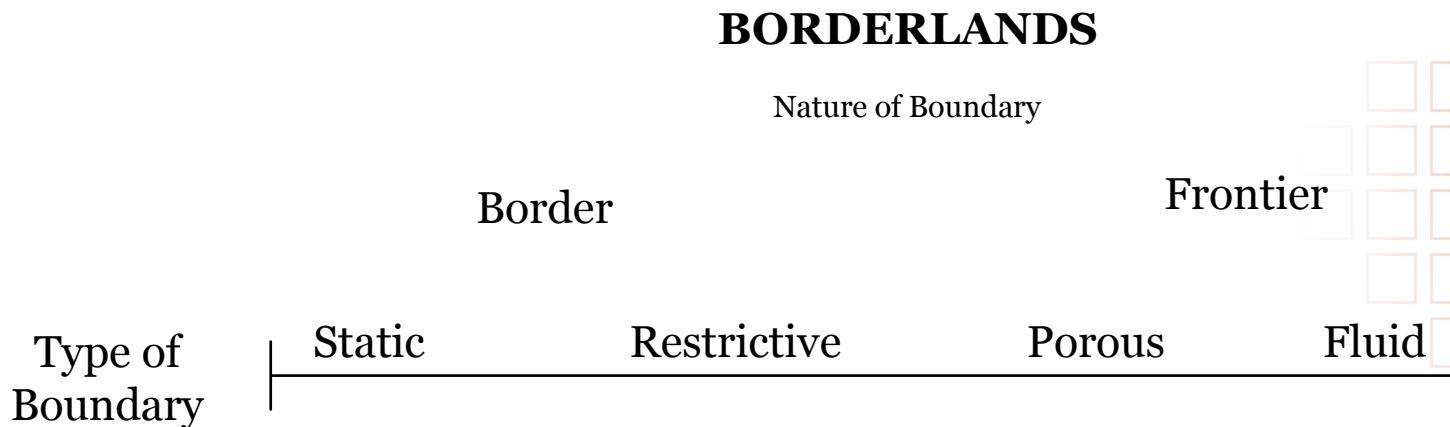
Introduction and Motivation



Introduction and Motivation

- Reality is different:
 - Language and dialect are dynamic phenomena
 - Why: media, mobility of people (globalization, urbanization),
- Language boundaries
 - May move over time >> fuzzy
 - But can also be crisp (i.e. due to natural or artificial barriers)
- Some more dynamics:
 - New language islands and regions emerge from scratch
 - Language and dialect regions disappear

- Boundary (Parker 2006; Kristof 1959): “**serves to indicate the bounds or limits of anything**”
- Kristof (1959) distinguishes frontiers and boundaries



Borderland continuum as defined by Parker (2006)

Borders and Frontiers

Political Boundaries
(Political, administrative, military)

Cultural Boundaries
(Linguistic, religious, material, cultural)

Demographic Boundaries
(Ethnic, population density, health, gender)

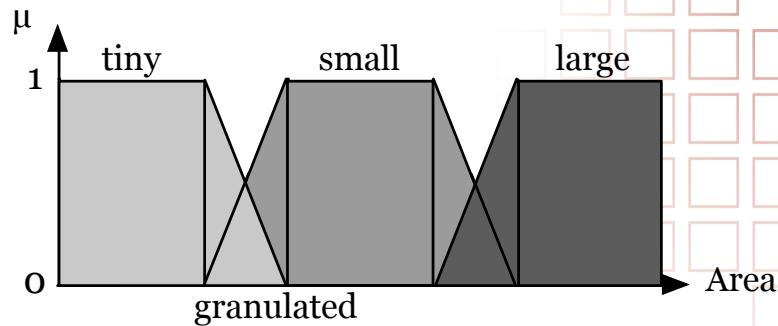
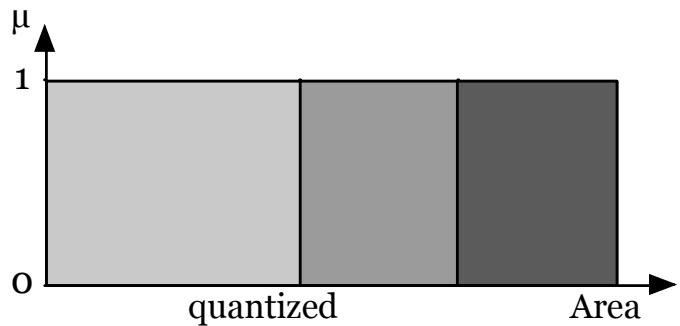
Economic Boundaries
(Extraction of raw materials, agricultural production)

Geographic Boundaries
(Topographic features, physical character, climate)

Boundary types defined by Parker (2006)

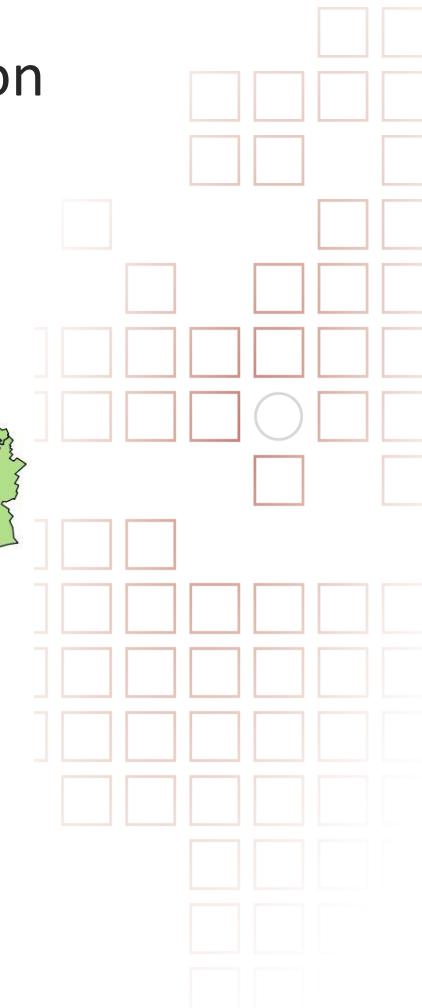
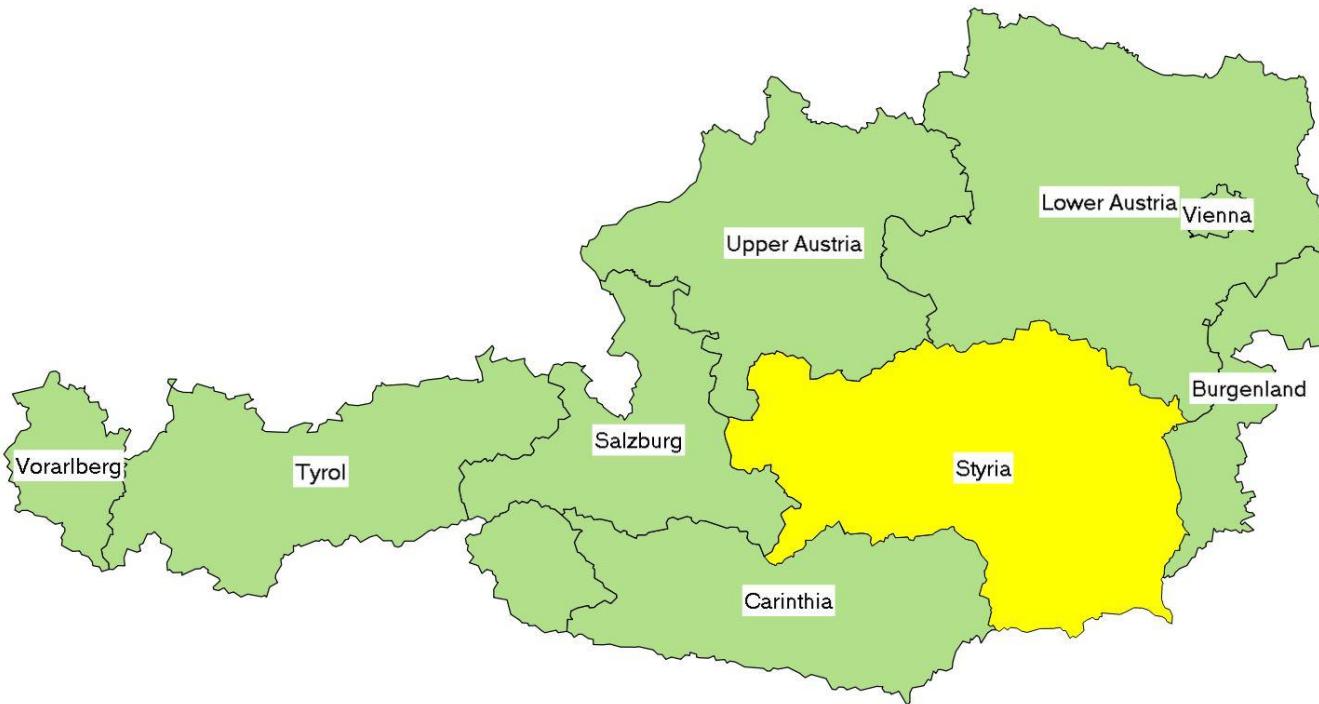
Fuzzy Theory for Boundaries

- To model the fuzziness of frontiers the theory of Fuzzy Sets is appropriate (Zadeh 1965, 2008)
- Boundaries can be crisp and fuzzy
 - Fuzzy sets support both concepts

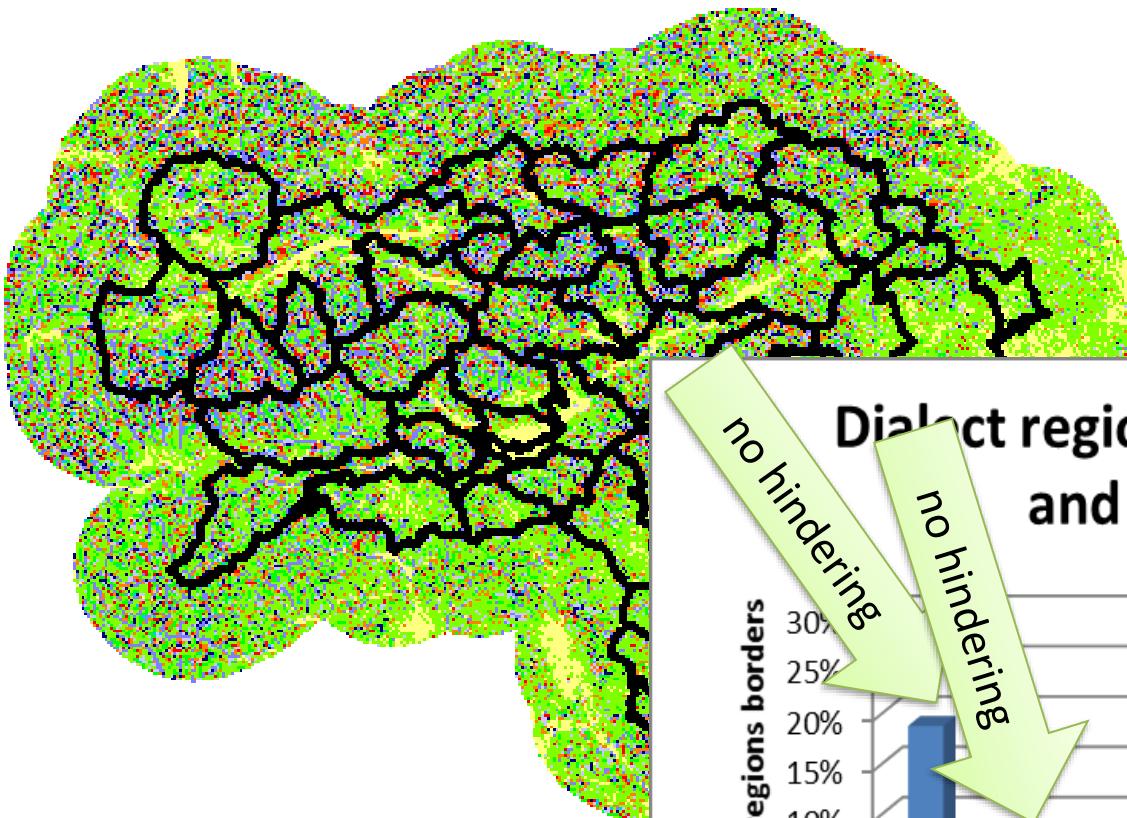


Fuzzy Theory for Boundaries

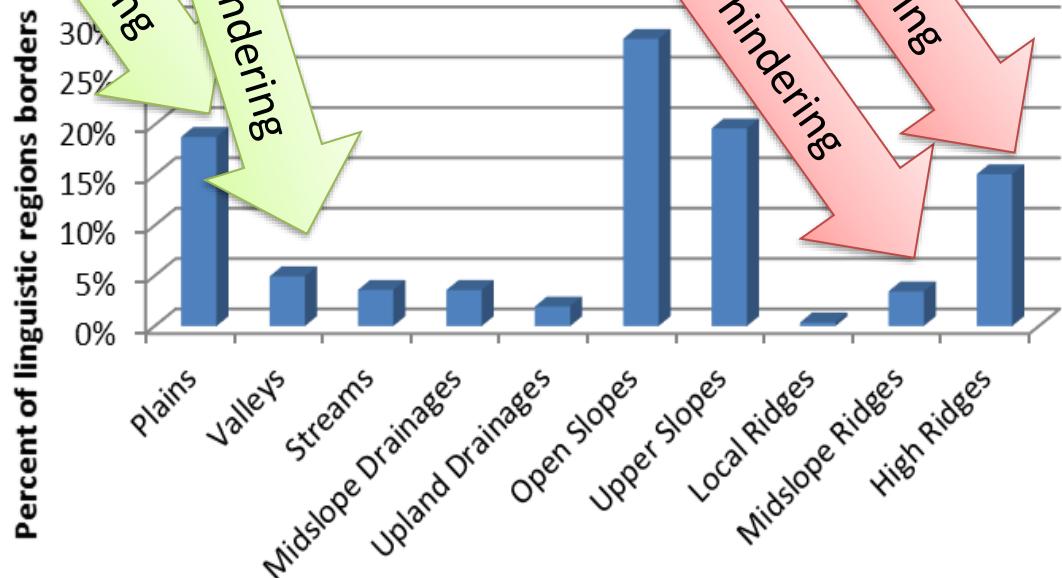
- Exist natural barriers in language and dialect region boundaries?



Fuzzy Theory for Boundaries

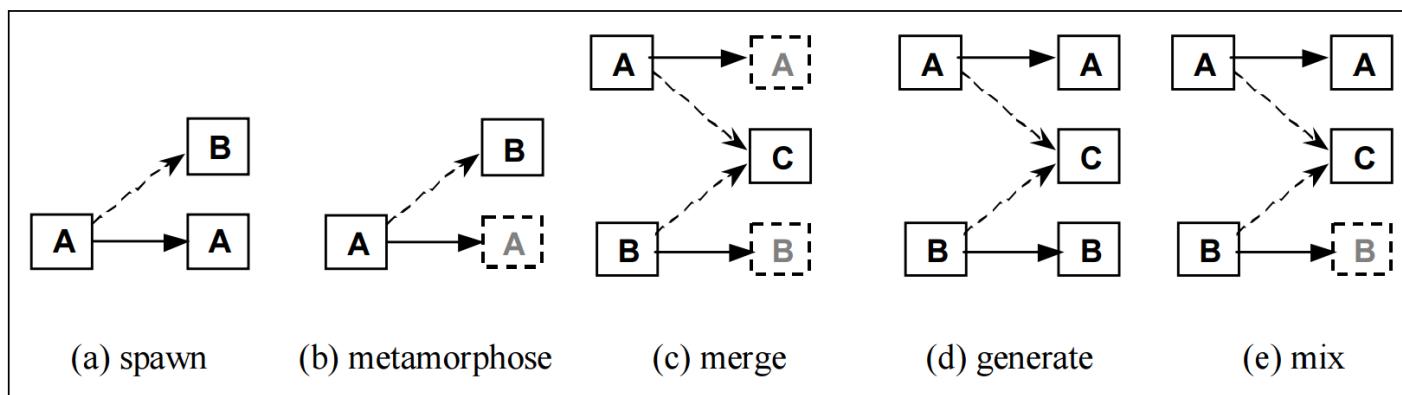


Dialect region boundaries in Styria
and their landform



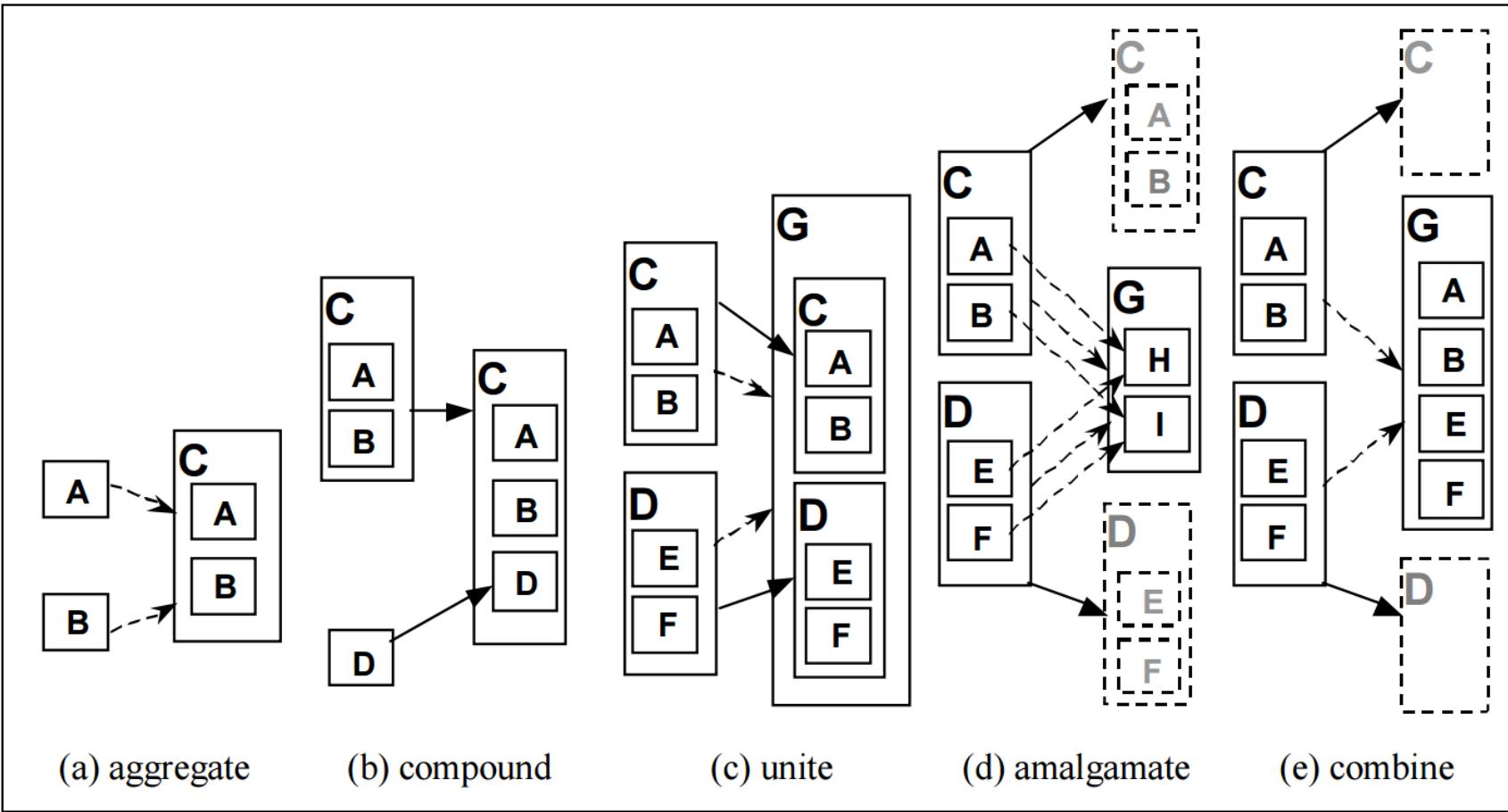
Spatial-Temporal Representation of Linguistic Phenomena

- To model changes of spatial entities over their lifespan we relate to Medak (1999) and Hornsby and Egenhofer (1997, 2000)
- Object identity operations represent snapshots of spatial-temporal processes



Object identity operations on simple objects (Hornsby & Egenhofer 1997)

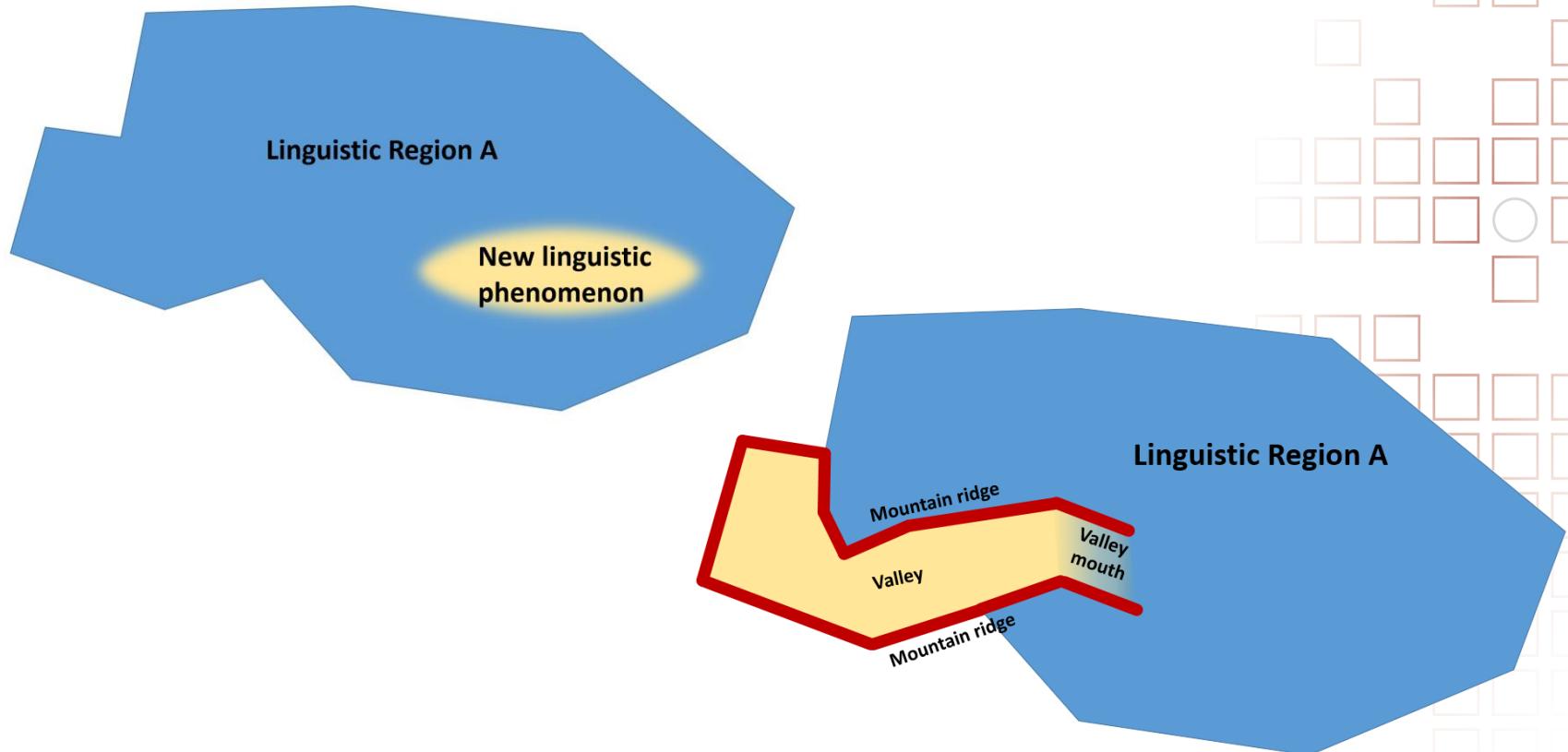
Spatial-Temporal Representation of Linguistic Phenomena



Object identity operations on composite objects (Hornsby & Egenhofer 1997)

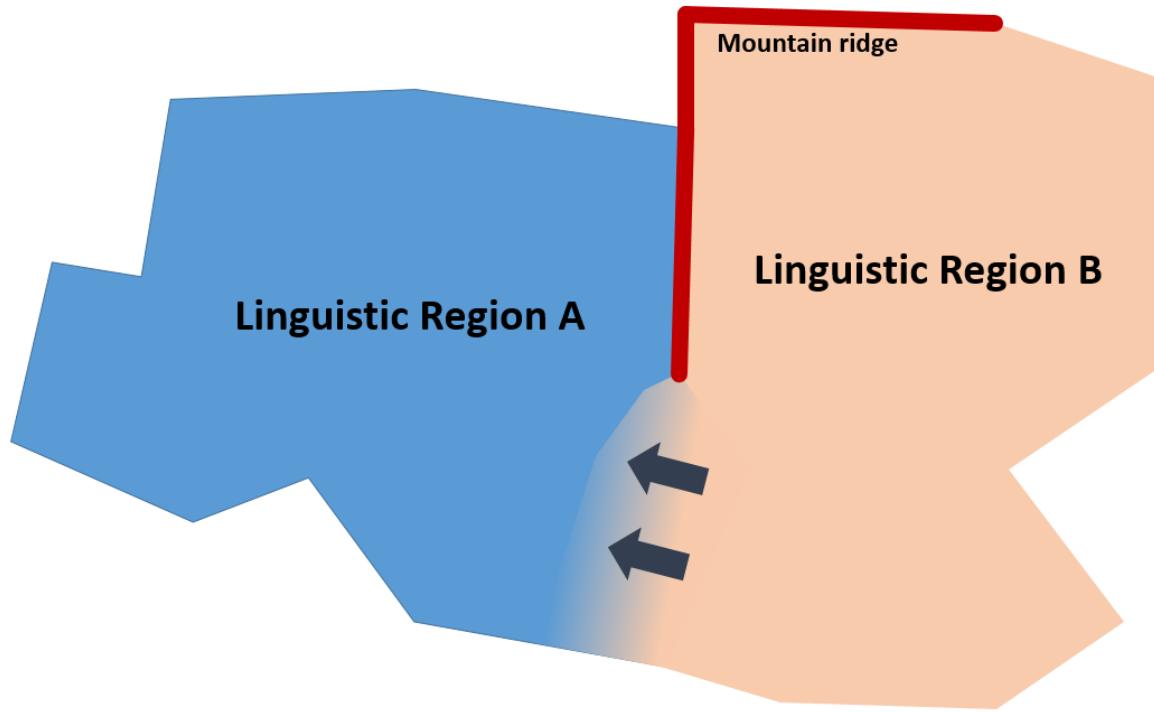
Spatial-Temporal Representation of Linguistic Phenomena

- Emergence and end of linguistic phenomena



Spatial-Temporal Representation of Linguistic Phenomena

- Moving linguistic entities



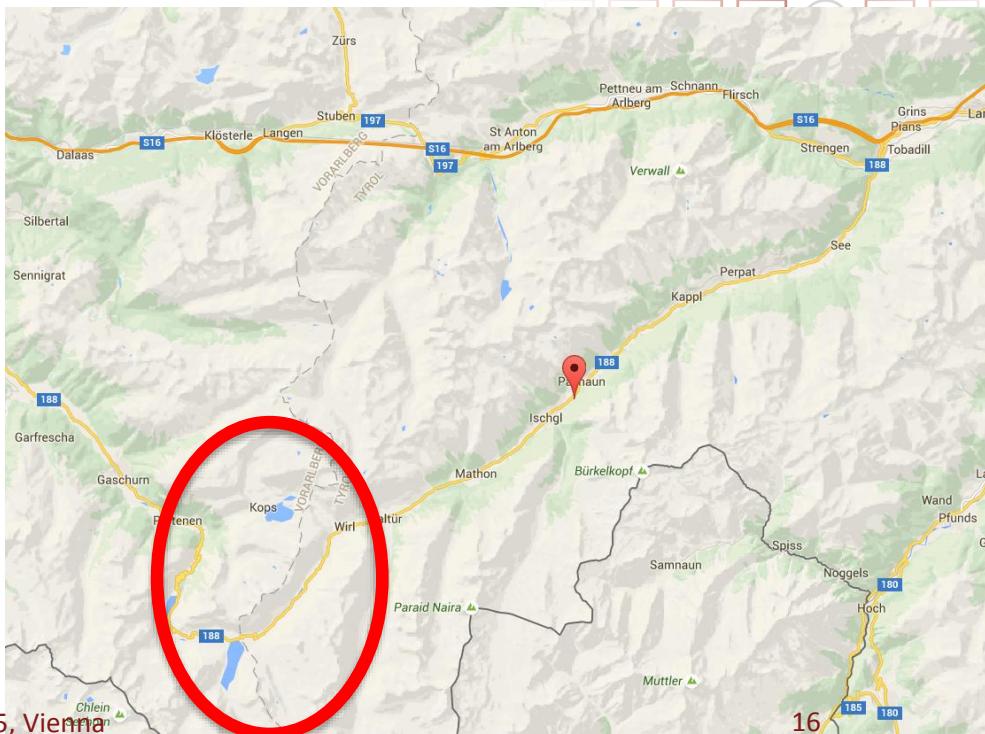
Real-World Example

- Paznaun Valley (Wandl-Vogt 1997; Birlinger 1890)



Real-World Example

- **Paznaun Valley (Wandl-Vogt 1997; Birlinger 1890)**
 - Bielerhöhe (2026 m) connects Vorarlberg and Tyrol
 - 100-1350 roman shepherds settled temporarily in Paznaun >> roman remains in the local dialect
 - 1350-1850 the Walser moved in from the west which moved the Alemannic-Bavarian language boundary to the east
 - 1850 – 1900 people orient their trade eastwards >> Alemannic-Bavarian language boundary was moved back to Arlberg main ridge and is considered as stable



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Conclusions

- Analysis of spatial-temporal behavior of linguistic/dialect regions and phenomena
- Boundaries are analyzed in terms of their nature: crisp vs. fuzzy boundaries which leads to the definition of borders and frontiers
- Application of Fuzzy Theory to model crisp and fuzzy boundaries accordingly
 - Analysis of Styrian language regions > linguistic phenomena may have both fuzzy and crisp boundaries
- Spatial-temporal representation of processes of language phenomena with combined crisp and fuzzy boundaries

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