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

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Extended Abstract

The intention of Language Geography – a branch of classical Human Geography (Carvalho 1962) – is to enhance the usability of digital language and dialect databases and foster visual exploration of linguistic data. Currently, linguistic phenomena are commonly mapped in a static manner, which results in maps with dialect regions or isoglosses. Isoglosses define the geographic boundary of a linguistic feature, such as the pronunciation of a vowel, the meaning of a word, or the use of some syntactic feature.

Due to the fact that language and dialect are dynamic phenomena per se, a digital representation can serve as solid basis to model this fact. Hence, we apply the theory of fuzzy sets (Zadeh 1965) and indeterminate boundaries to Language Geography. Given the fact that language regions and isoglosses may move and/or change their shape over time, boundaries between adjacent regions are not always crisp – but they can be crisp if, e.g., a natural barrier hinders the movement of people and thus the exchange of language. This is true for, e.g., mountain chains or oceans, which constrain the movement of people. The same can be said about barriers having been introduced in the late 19th and in the 20th century, when language became a major identifier for each country and there were more and more efforts to use political boundaries also for outlining cultural (and especially linguistic) domains.

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In addition, language islands and regions may arise from scratch as well as existing language regions or islands may disappear over time – which has to be modeled accordingly. Globalization and urbanization fosters this creational process of new language islands and regions within existing language regions. Hence, these regions have no crisp border, but share a certain part of space with fuzzy memberships of the involved linguistic regions (Burrough 1996, Worboys 1998).

The article at hand covers spatial-temporal modeling of language phenomena based on fuzzy sets, indeterminate boundaries, and spatial-temporal change of spatial entities (see Medak 1999, Hornsby and Egenhofer 1997, Hornsby and Egenhofer 2000). Hence, linguistic processes are analyzed regarding the implications on space and time, i.e. the change of linguistic regions over time with respect to their shape and attributes in space and time, i.e. the change of linguistic regions over time. The paper highlights the representation of linguistic regions with combined indeterminate and crisp boundaries – i.e. frontiers and borders. Both boundary types are necessary in order to model the spatial-temporal dynamics of language phenomena. The article analyzes further the emerging, ending, moving, and merging of linguistic regions and phenomena with respect to space and time as well as boundary types. In order to represent frontiers or indeterminate boundaries, fuzzy logic is employed.

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