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Contextual Adaptability of Navigational Spatial Descriptions: A Pragmatic Comparison

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Map Semiotics

Syntactics: Structure Semantics: Fixed meaning Pragmatics: Contextual meaning





MacEachren (1993), "How Maps Work: Representation, Visualization, and Design"

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Semiotics

Syntactics: Structure Semantics: Fixed meaning Pragmatics: Contextual meaning



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Raubal et al. (2012), "Cognitive and Linguistic Aspects of Geographic Spaces: New Perspectives on Geographic Information Research"

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Semiotics

Syntactics: Structure Semantics: Fixed meaning Pragmatics: Contextual meaning

Weiser (2014), "A Pragmatic Communication Model for Way-finding Instructions"

 Route communication between two humans with an at least partially shared knowledge of an environment

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Semiotics

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Tomko (2007), "Destination Descriptions in Urban Environments"

The way people with a shared knowledge of an environment communicate a destination through its relations to the surrounding features

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Problem Definition



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Syntactics: Structure Semantics: Fixed meaning Pragmatics: Contextual meaning



Frank (2003), "Pragmatic Information Content—How to Measure the Information in a Route Description"

- Relation between information content of a route description and its users
- A route description may be interpreted differently by two users

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Syntactics: Structure Semantics: Fixed meaning Pragmatics: Contextual meaning



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Dale et al. (2005), "Using Natural Language Generation in Automatic Route Description"

Comparison of route descriptions generated by automated systems and humans
People omit obvious or unimportant instructions in their spatial descriptions

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Syntactics: Structure Semantics: Fixed meaning Pragmatics: Contextual meaning



Richter (2007), "Context-Specific Route Directions: Generation of Cognitively Motivated Wayfinding Instructions"

An approach to generalize route descriptions based on the structural properties of the environment

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Syntactics: Structure Semantics: Fixed meaning Pragmatics: Contextual meaning



Karimipour et al. (2015), "Generalizing Route Descriptions Based on the User's Spatial Knowledge"

Considering the User's Spatial Cognitive Information in Communicating Route Instructions

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This Paper ...

 How different types of navigational spatial descriptions allow handling pragmatic aspects as well as prior knowledge and the structure of the environment in order to provide the adequate level of detail (LoD) of the information for a specific user in a certain environment.

Gusshausstrasse 28, 1040 Vienna

... Turn right onto Schwarzenbergplatz; walk for 56*m*; turn left onto Gusshausstrasse, walk for 500*m*; destination will be on your right.

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Navigational Spatial Descriptions

 Expressions that uniquely refer to a destination or to a route toward a location

Address

Route description

Gusshausstrasse 28, 1040 Vienna

... Turn right onto Schwarzenbergplatz; walk for 56*m*; turn left onto Gusshausstrasse, walk for 500*m*; destination will be on your right.

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Computers vs. Human Generated Spatial Description

Computers

- Provide spatial descriptions as a combination of map features (e.g. street name and district number) in a predefined way
- Offer no way to adapt to different users and environments



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Computers vs. Human Generated Spatial Description

- Humans
 - Provide more flexible navigational descriptions
 - Describing a travel destination to a taxi driver by referring to features of the environment
 - Generalizing a route description by considering prior shared knowledge of the environment and its structure
 - Not only depend on the user (i.e. interpretant), but also on the environment and situation

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Address

 A specification that refers to a unique location on Earth



• A combination of certain components with addressing value and their relations

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Address

Structured addressing

- The components and their order are predefined
- Easily comprehended by computes



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Address

Descriptive addressing

- Expressed freely in their natural language based on people's spatial mental representations
- Several concepts with addressing values may be used.



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Route Description

 Verbal instructions about how to go from one place to another

Computer-generated:

- Turn-by-turn instructions that include street names as well as distance and time information
- In contrast to how humans generate route descriptions



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Route Description

- Human-generated:
 - Expressed in natural language by describing the relations of landmarks and visible features to the environment
 - Generalize by omitting obvious or unimportant steps, which depends on the individual and the situation
 - A spatial discourse between parties who may not have the same prior knowledge of the environment

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Destination Description

- A referring expression uniquely describing a place, consisting of a hierarchically ordered set of references to prominent spatial features of various types that are known to the addressee
- A route description focusing on the *where* of the destination instead of the *how* to reach it

Example: In the city center, next to the opera house, off Kartnerstrasse

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Pragmatics

 The relation between description and description-using agents or interpreters



The study of the use of language from a viewpoint of its usage properties

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Pragmatics

- <u>Redundant</u> information may be intentionally added to communication to make sure that the message is correctly transferred.
- Communication may contain terms that are only <u>relevant</u> for the communication parties.
- <u>Cohesion</u> corresponds to the terms that are only understandable for a group of people.
- People shape their utterance in a way that it is <u>coherent</u> based on a shared knowledge between the communication parties.
- <u>Speech act</u> refers to the fact that speech may carry the intentions of the speaker to affect the act of the hearer.

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Redundancy

 That part of the description which is not necessary in the decision-making process but will enable better understanding

 Redundant information may be intentionally added to communication to make sure that the message is correctly transferred.

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Redundancy

- Structured formal addresses Machine-generated route descriptions
- Contain some levels of redundancy
 - 1040 in "Gusshausstrasse 28, 1040 Vienna"
 - Keep going straight
- Providing redundant information is not flexible

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Redundancy

Descriptive addresses

Human-generated route descriptions

- Redundant information could be flexibly employed and adapted based on the <u>users</u> and <u>environmental</u> contexts
 - 968 Lewes Road, Moulsecoomb area
 - 968 Lewes Road
 - number 968

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Relevancy

 A spatial description is relevant if it connects with contextual assumptions to provide a better understanding of it.

 Many elements of varying relevance may be mentioned in a description, but humans select the most relevant ones in the given context.

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Relevancy

- Structured formal addresses
- **Machine-generated route descriptions**
- No relevancy adaption due to their predefined structure and format.

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Relevancy

Descriptive addresses

Human-generated route descriptions

- Flexibly allow relevancy adaption on both sides
 - The speaker can select the most relevant referents to be included in the description
 - The addressee can interpret the description in a manner most relevant to him
 - They can even start a negotiation to improve the selection of referents based on the context.

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Cohesion

- The effect of a group of people/things as a whole
- Public belief is not always precise enough, but frequently used in the language
- Cognitive errors pervade human spatial descriptions

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Cohesion

 Referring to a direction as *north* while it is not really representing north



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Context

- All the factors (either from the user or environment) that form the setting of a description and are necessary for it to be fully understood.
- In spatial descriptions
 - <u>User factors</u>: age, gender, carrier, culture, and background geographical knowledge
 - <u>Environmental factors</u>: topology, slope, distance, landmarks, direction

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Context

Structured formal addresses Machine-generated route descriptions

- Less flexible in assimilating contexts
- Efforts to incorporate contextual parameters in automated route descriptions

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Context

Descriptive addresses

Human-generated route descriptions

- Highly depend on user and environmental contexts
 - Referent selection
 - Deciding on the optimum LoD

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Conclusion

- Spatial descriptions that are expressed in natural language and made based on human spatial thinking are global among human beings.
- The basic formations are the same everywhere around the world:
 - Selection of *good* elements (semantically and pragmatically)

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Conclusion

- Addresses are among the most commonly used spatial descriptions
- Their structure, and consequently their semantic and pragmatic considerations, show geographical differences.
- Different addressing systems around the world fundamentally differ even on the syntactic level.

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Thank you for your attention!



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