

LBS 2016

13th Conference on Location-Based Services
Vienna, 14–16 November 2016



Cognitive Subdivisions in Outdoor Navigation

(An in-progress work ...)

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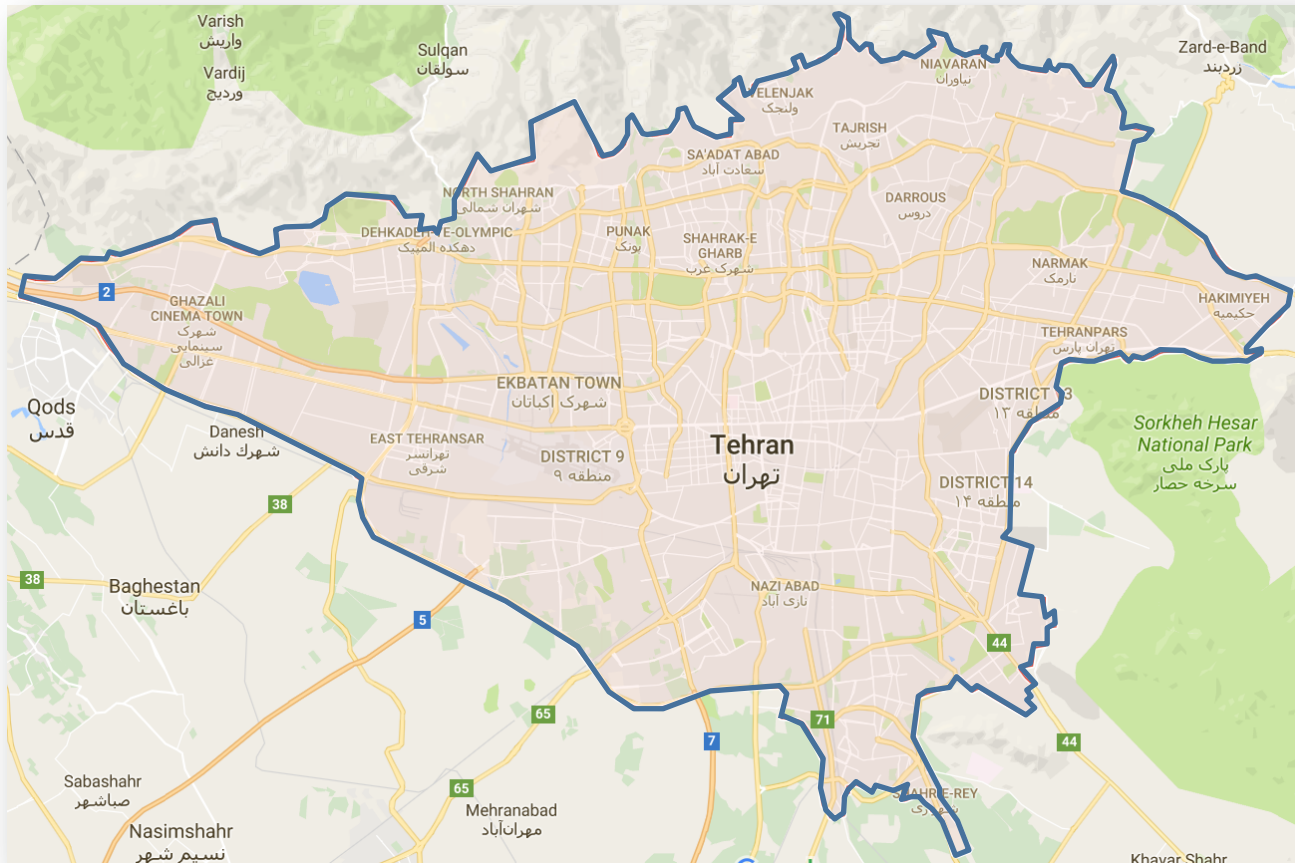
*School of Surveying and Geospatial Engineering, College of Engineering,
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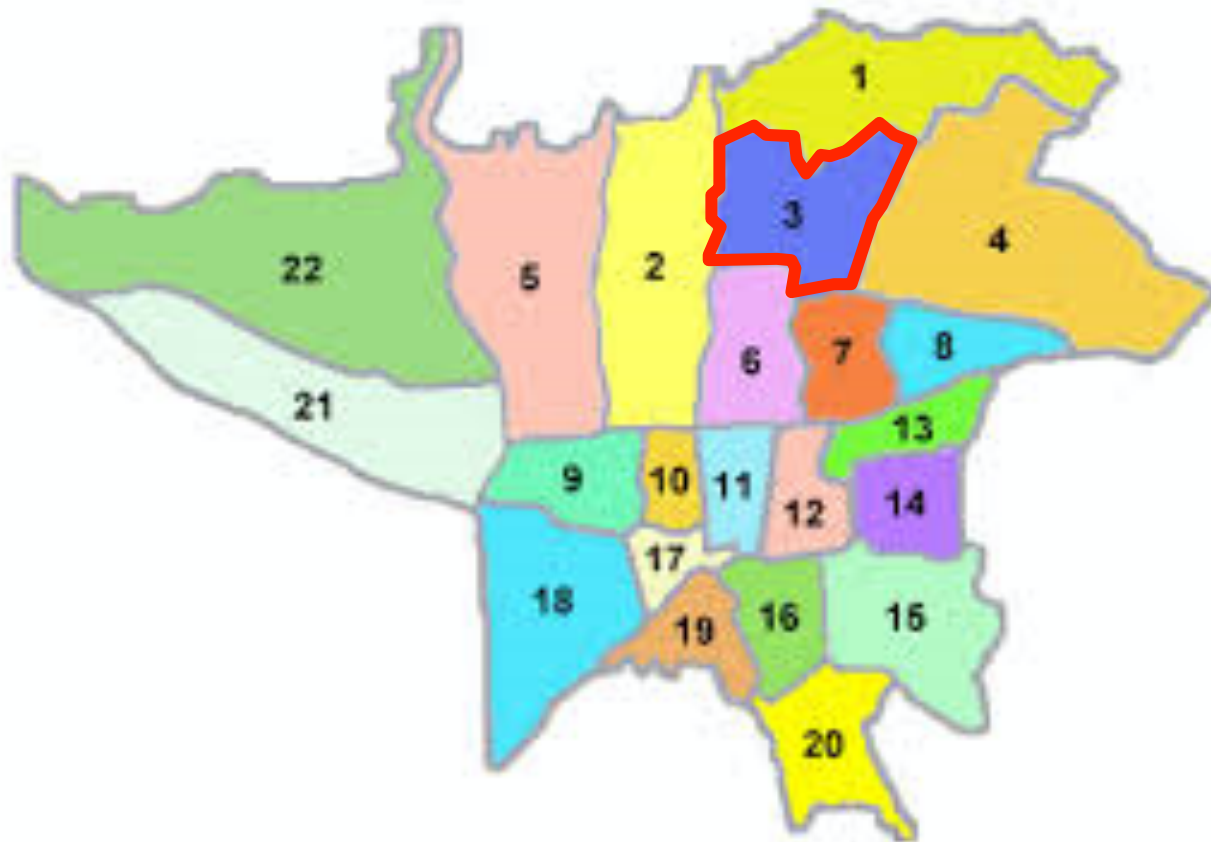
Assistant Professor

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University of Tehran, Iran*



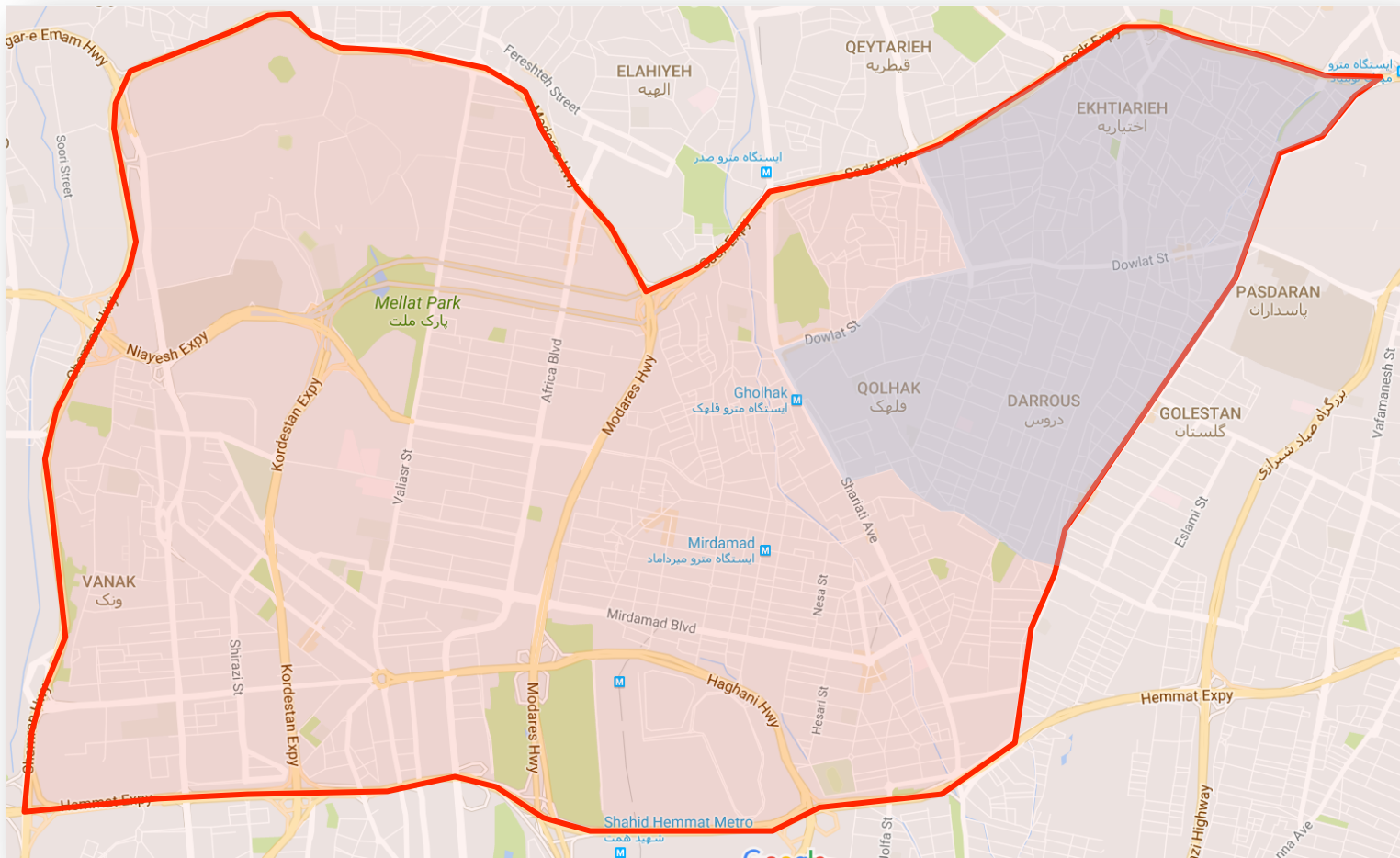
Varasteh St., No. 12, Tehran, Iran





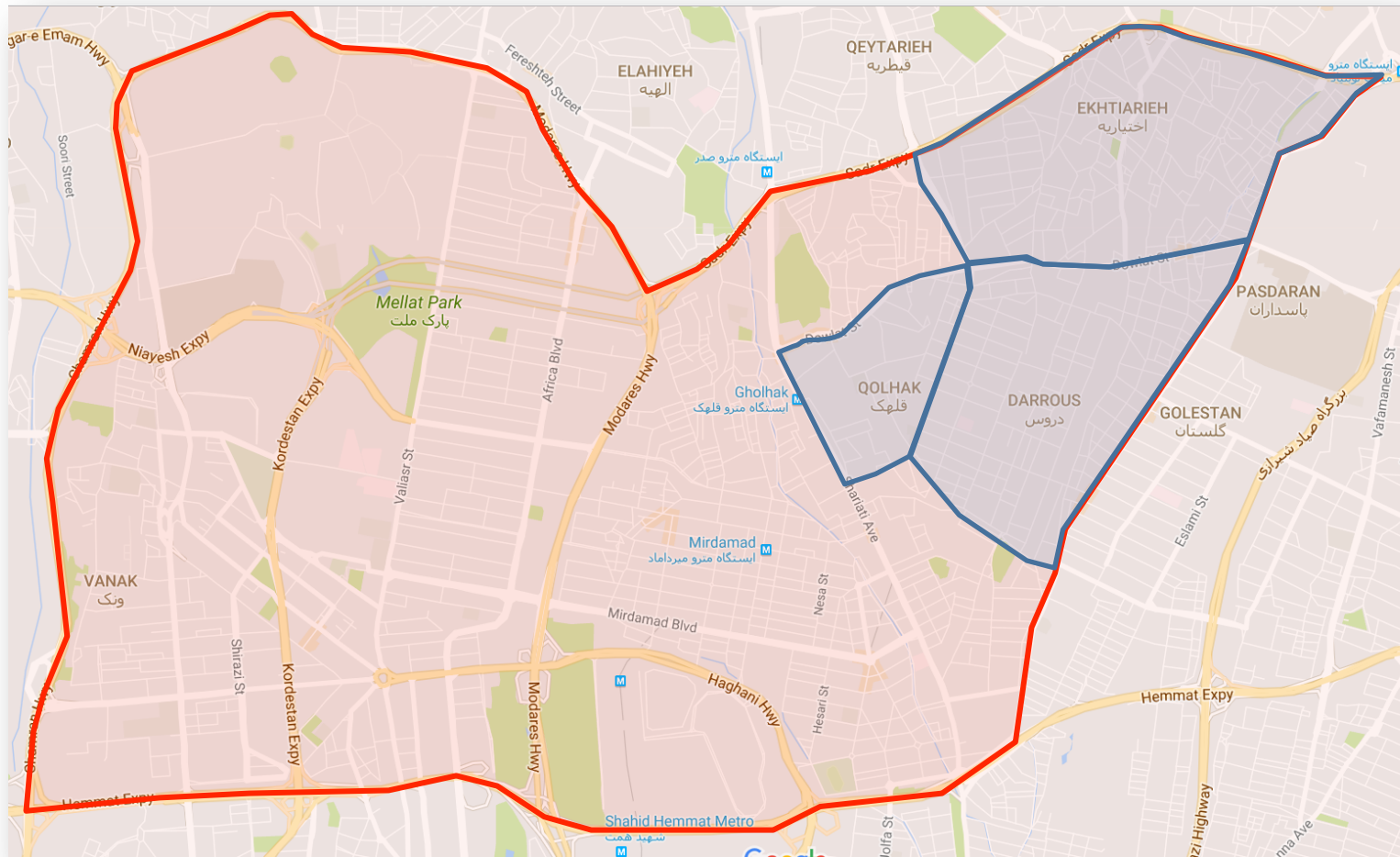
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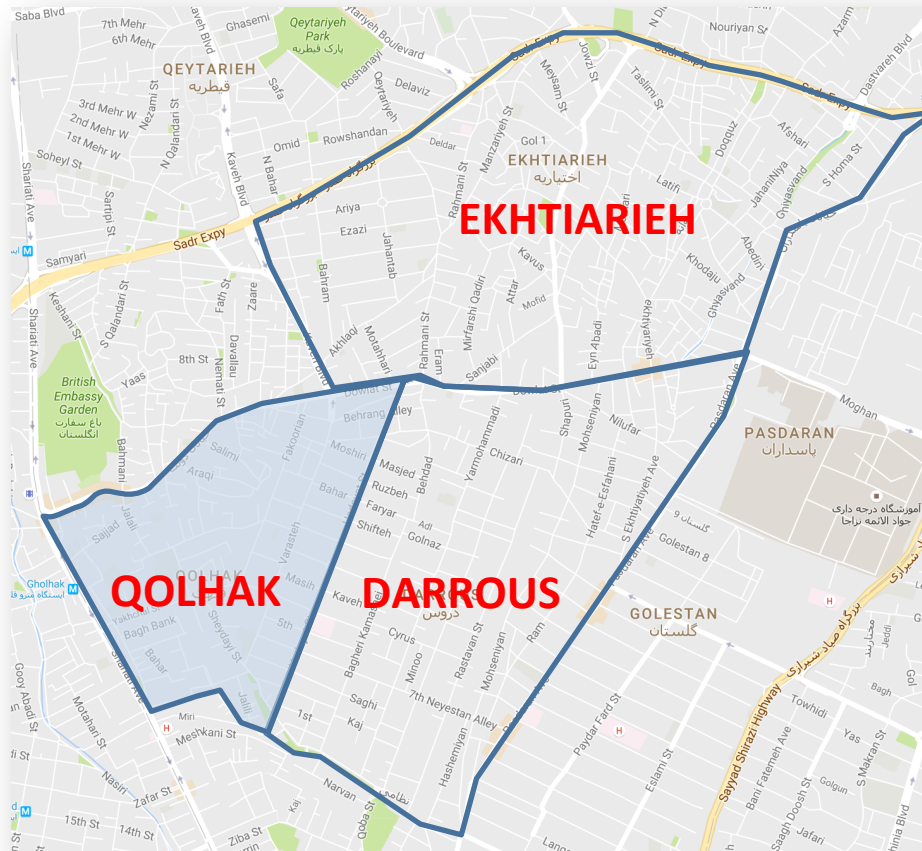
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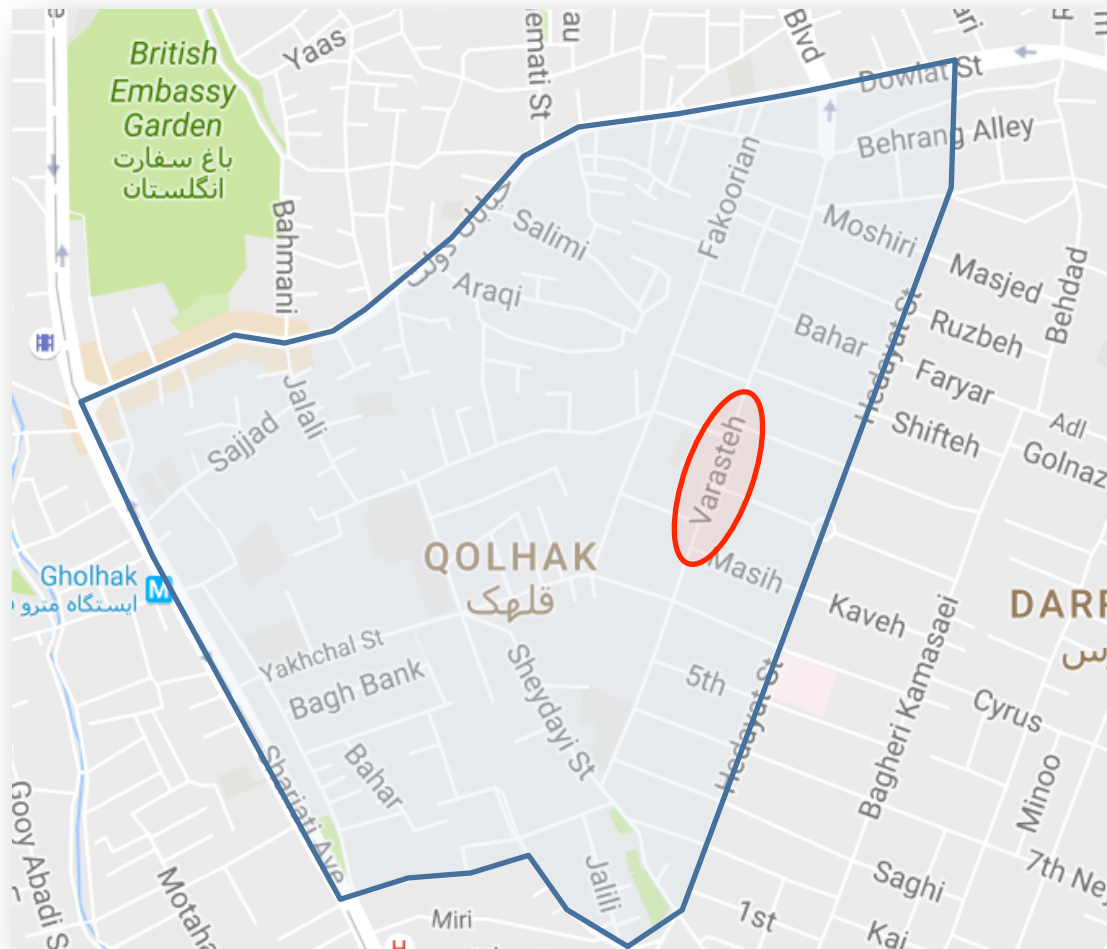
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Qolhak, Varasteh St., No. 12, Tehran, Iran





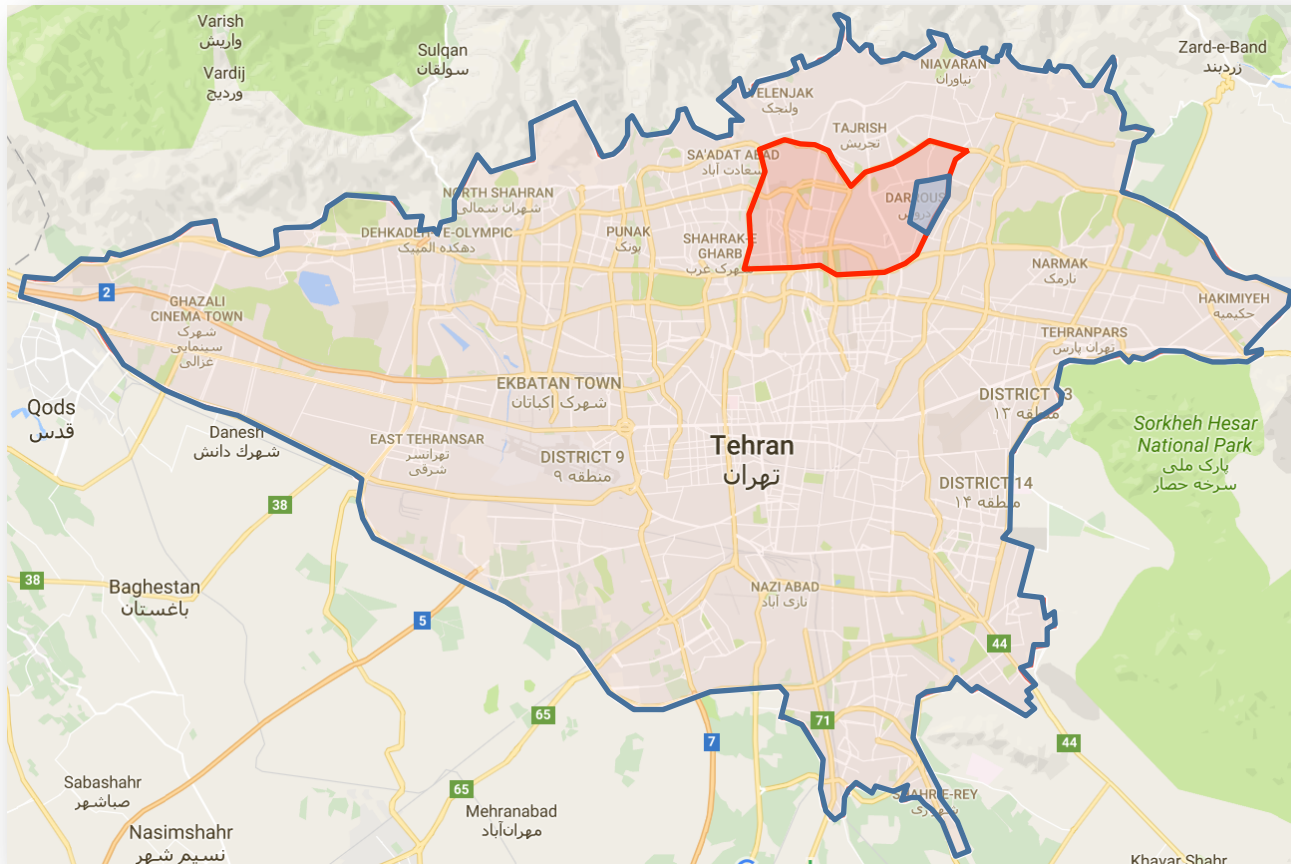
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Qolhak, Varasteh St., No. 12, Tehran, Iran



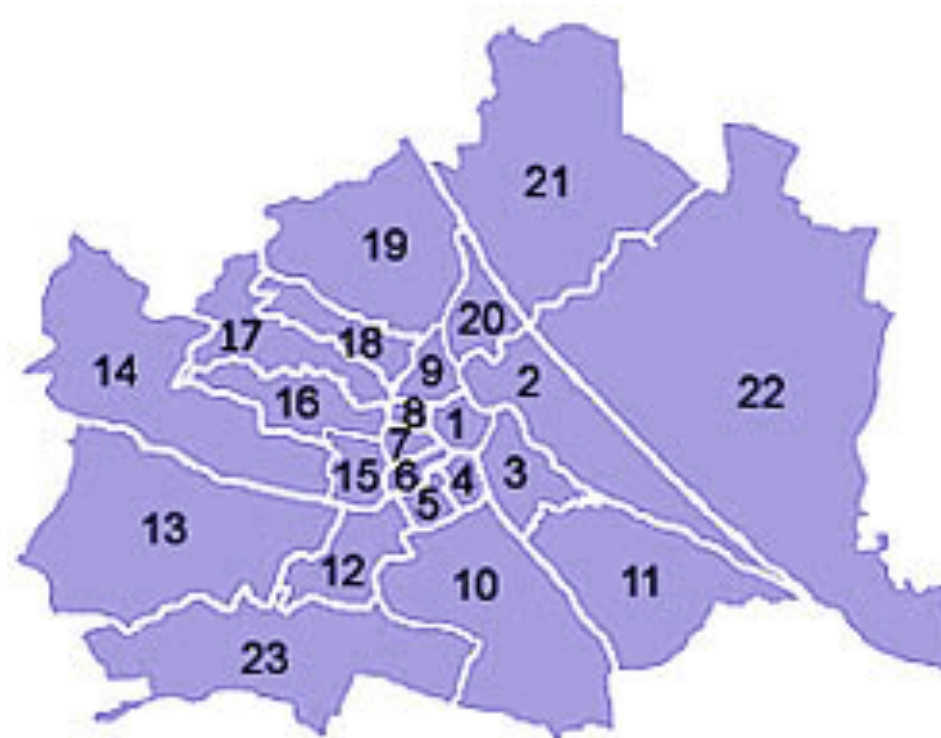


Darrou, Hedayat St., No. 43, Tehran, Iran



Urban Subdivisions

Austria

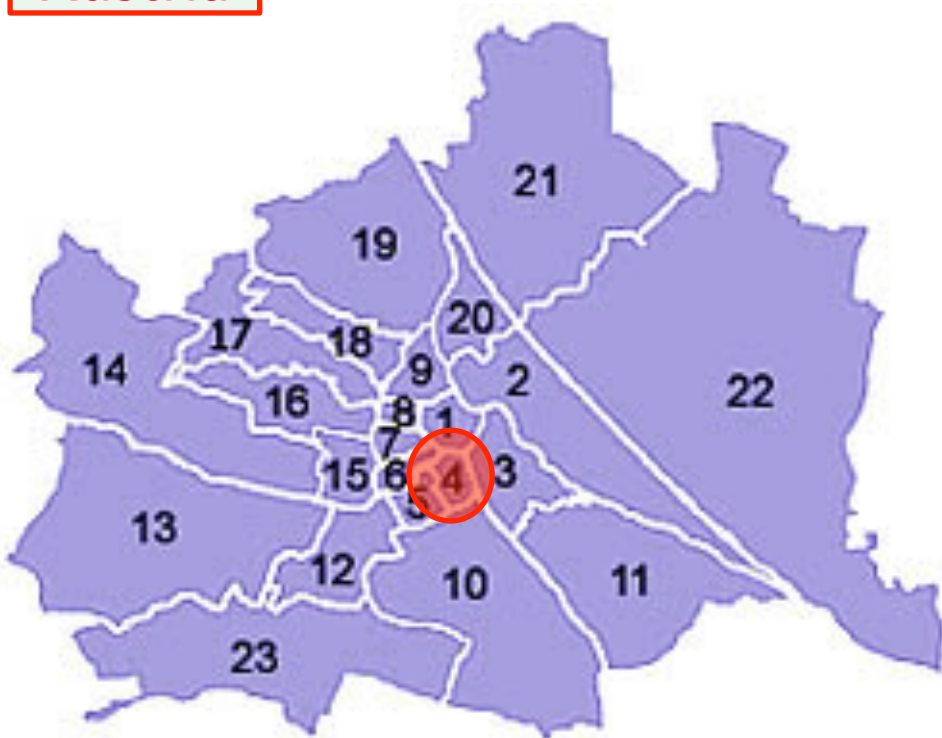


Vienna

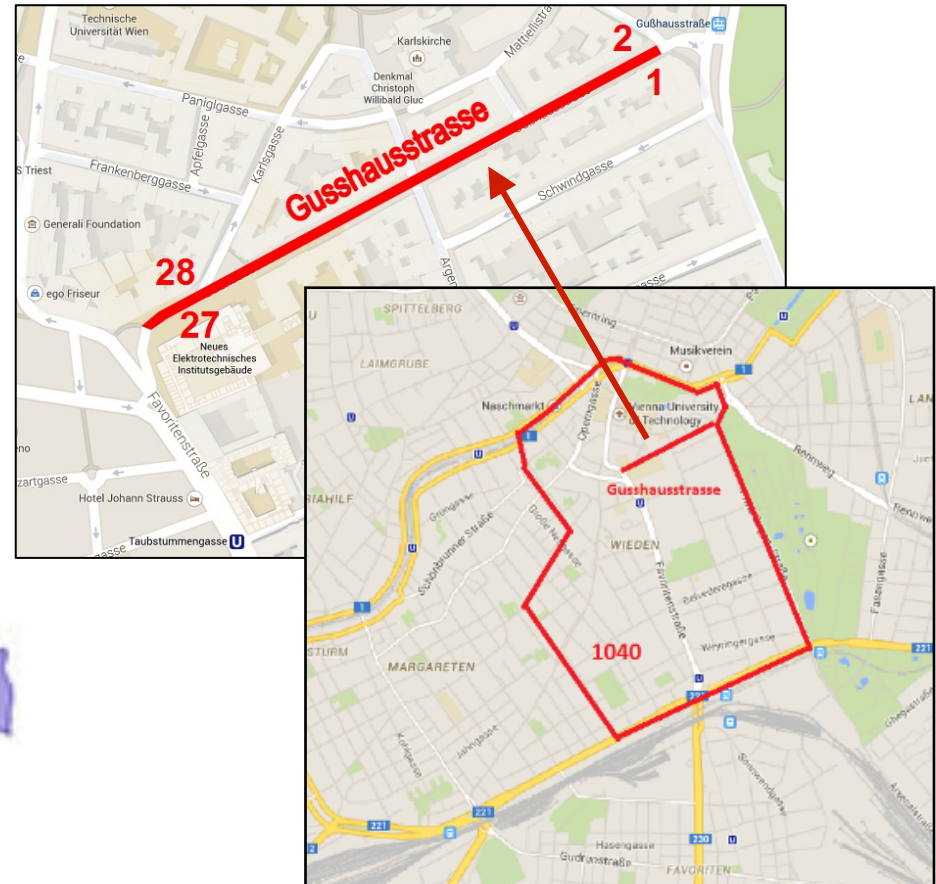


Urban Subdivisions

Austria



Vienna

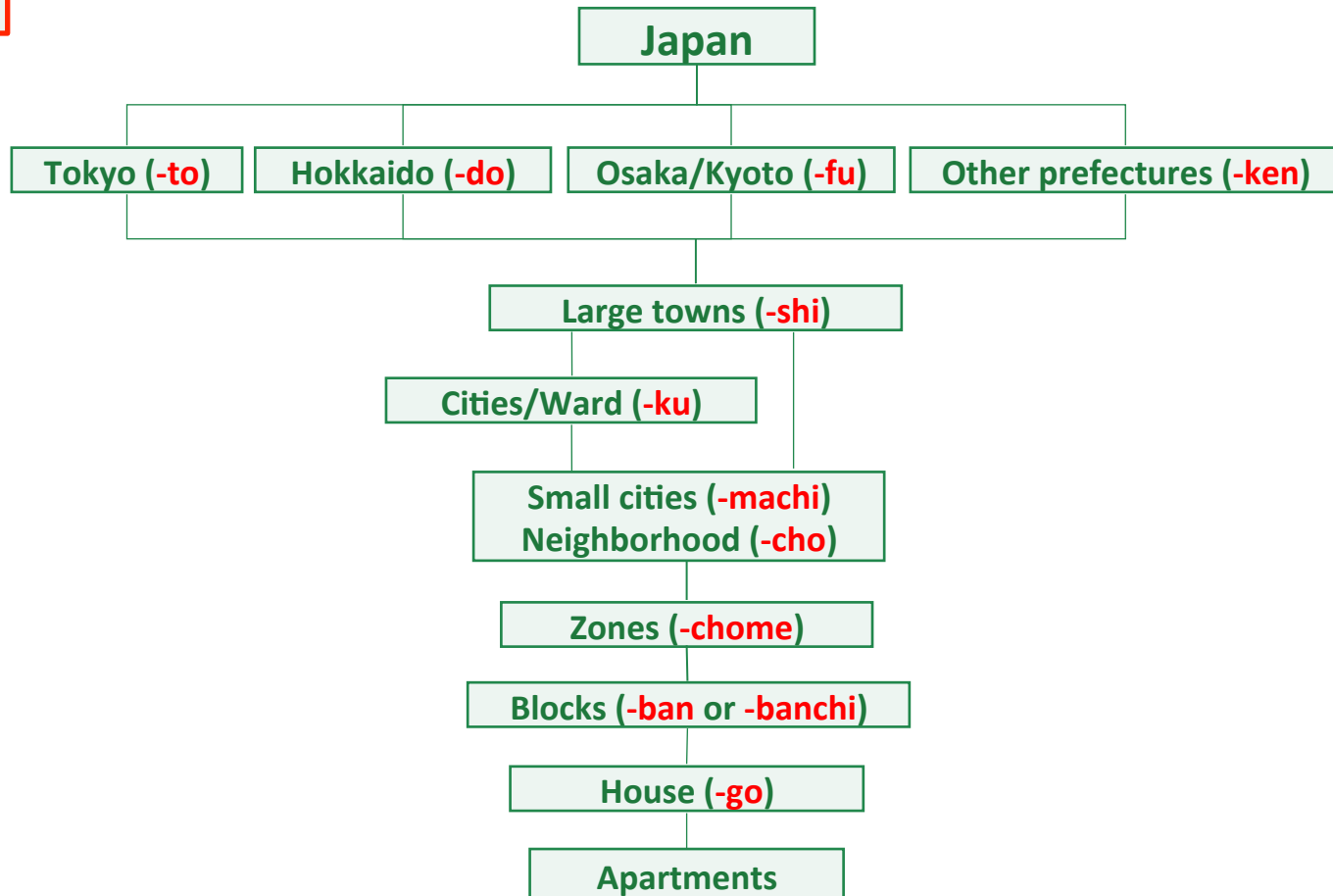


Gushausstrasse 27, 1040 Vienna



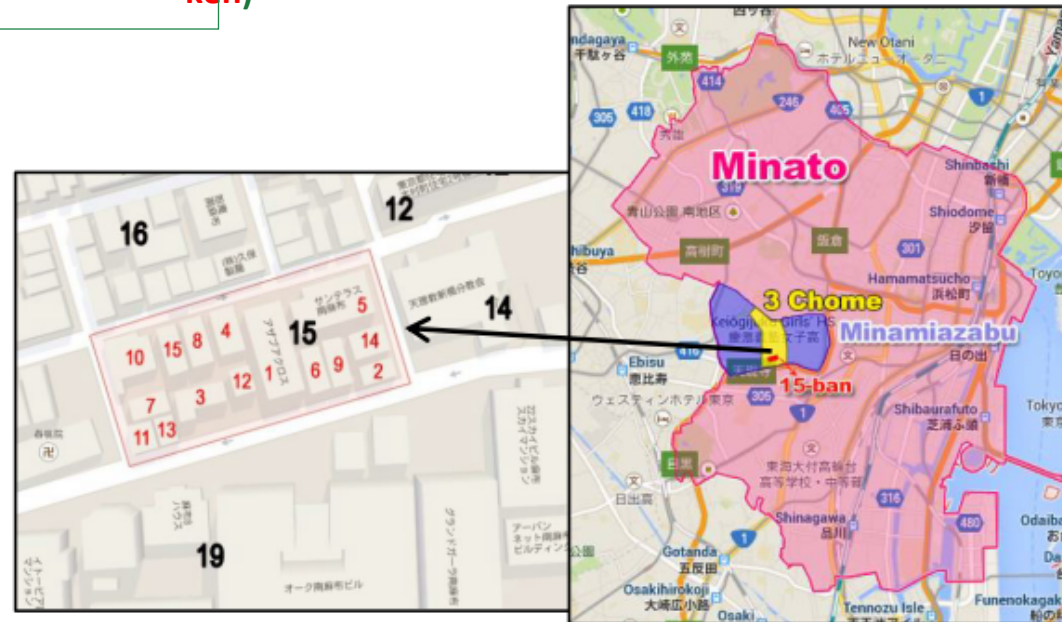
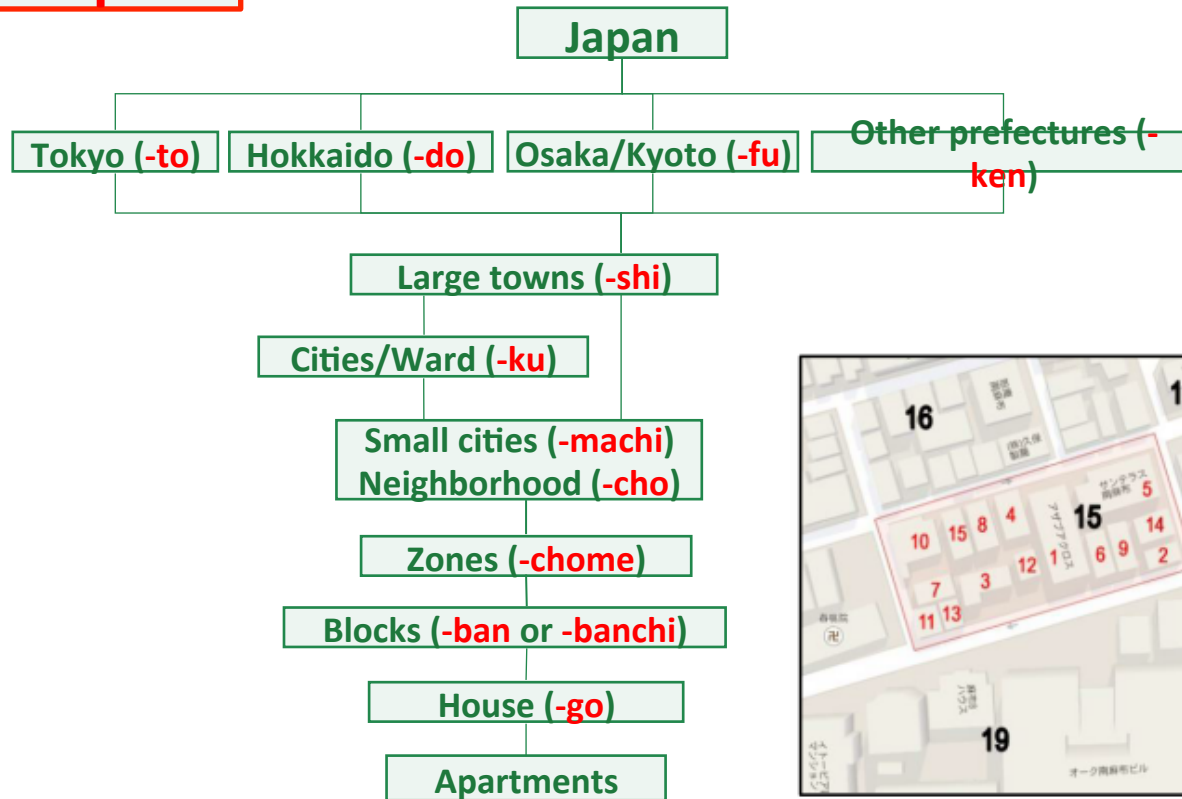
Urban Subdivisions

Japan



Urban Subdivisions

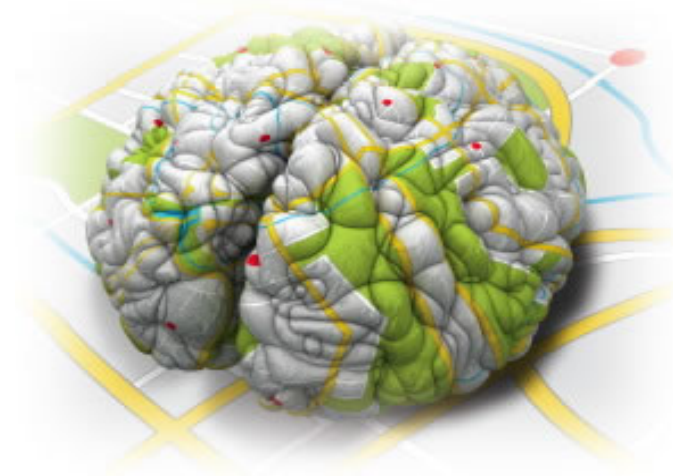
Japan



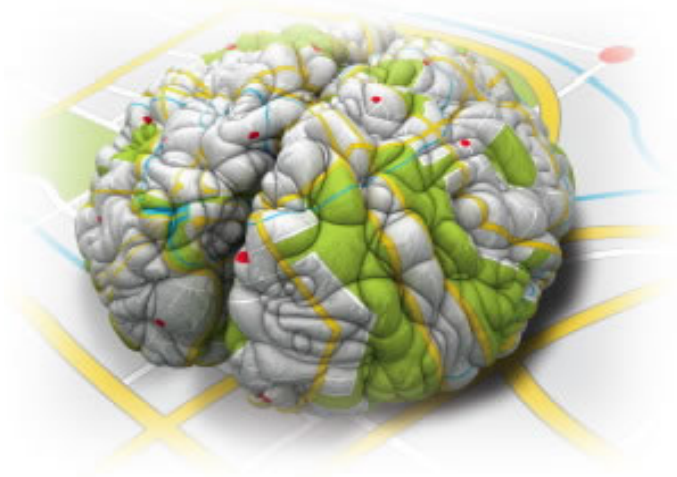
Minato, Minamiazabu-shi, Maeda-machi, 3 Chome, 2-15 ban-14-go



Cognitive Subdivisions



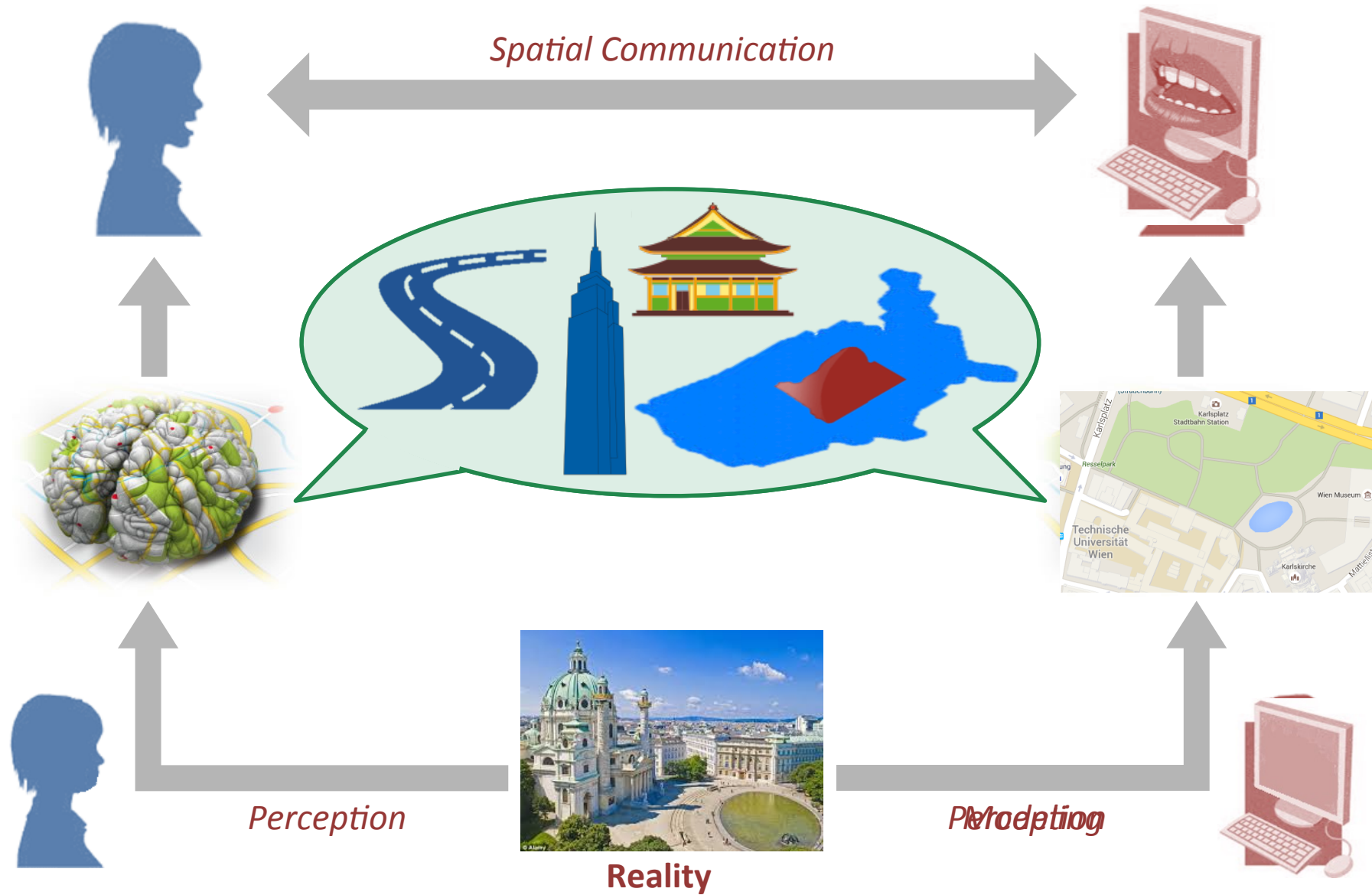
Cognitive Subdivisions



Kuipers (1978)

Information in mind is hierarchical; and the sequences of containing **districts** about the desired places are checked from the "top down" to find the smallest district containing the origin and destination.





Machine-based Navigational Instructions

- Geometric-based instructions
- Passive exploration of the environment
- The least influence on improving the user's spatial knowledge



Human-based Navigational Instructions

- Humans actively employ different forms and representations of spatial information to perform navigational tasks
 - Landmark knowledge
 - Route knowledge
 - Survey knowledge



Enriching Navigational Instructions

Raubal & Winter, 2002

An approach to enrich wayfinding instructions with local landmarks, which automatically extracts local landmarks from datasets and integrates them in wayfinding instructions

Duckham et al., 2010

A weighting model for generating routing instructions that annotate simple routes with references to landmarks



Enriching Navigational Instructions

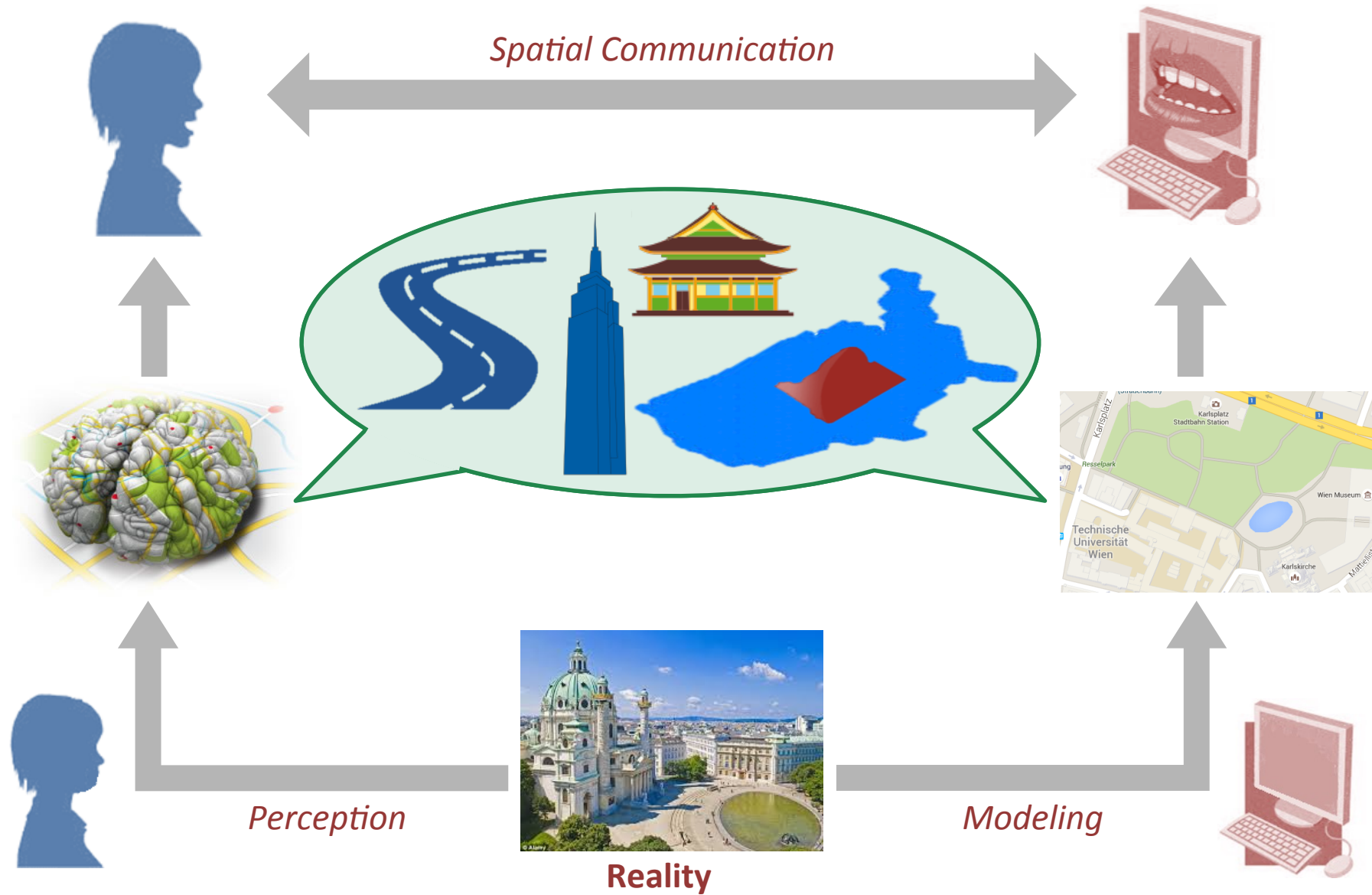
Klippel & Winter, 2005

An approach to formalize the structural salience of objects along routes, upon which landmarks are automatically integrated into route directions

Ganitseva & Coors, 2010

Automatic landmark detection for 3d urban models based on visual and semantic characteristics





Space Subdivision for Indoor Navigation

Xu et al., 2016

An indoor navigation approach considering obstacles and space subdivision of 2D plan

Kruminaite &
Zlatanova, 2014

Indoor space subdivision for indoor navigation

Zlatanova et al., 2013

A conceptual framework of space subdivision for indoor navigation



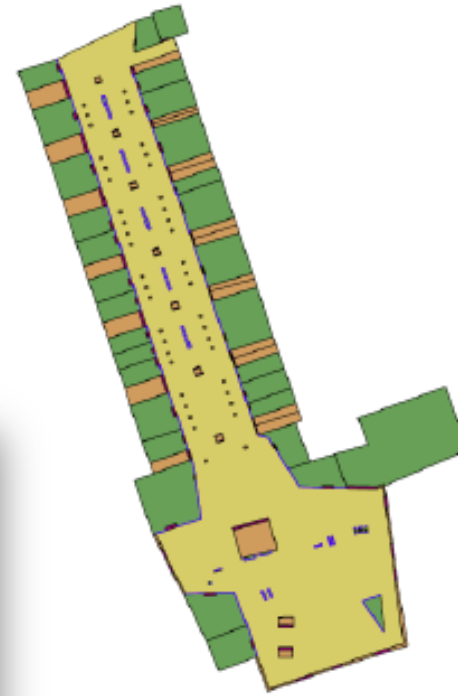
Space Subdivision for Indoor Navigation

- Characteristics
 - Visual
 - Semantic
 - Functional



Space Subdivision for Indoor Navigation

- Characteristics
 - Visual
 - Semantic
 - Functional



Cognitive Subdivisions in Outdoor Navigation

(Potential Applications)

Enriching navigational instructions



Kuipers (1978)

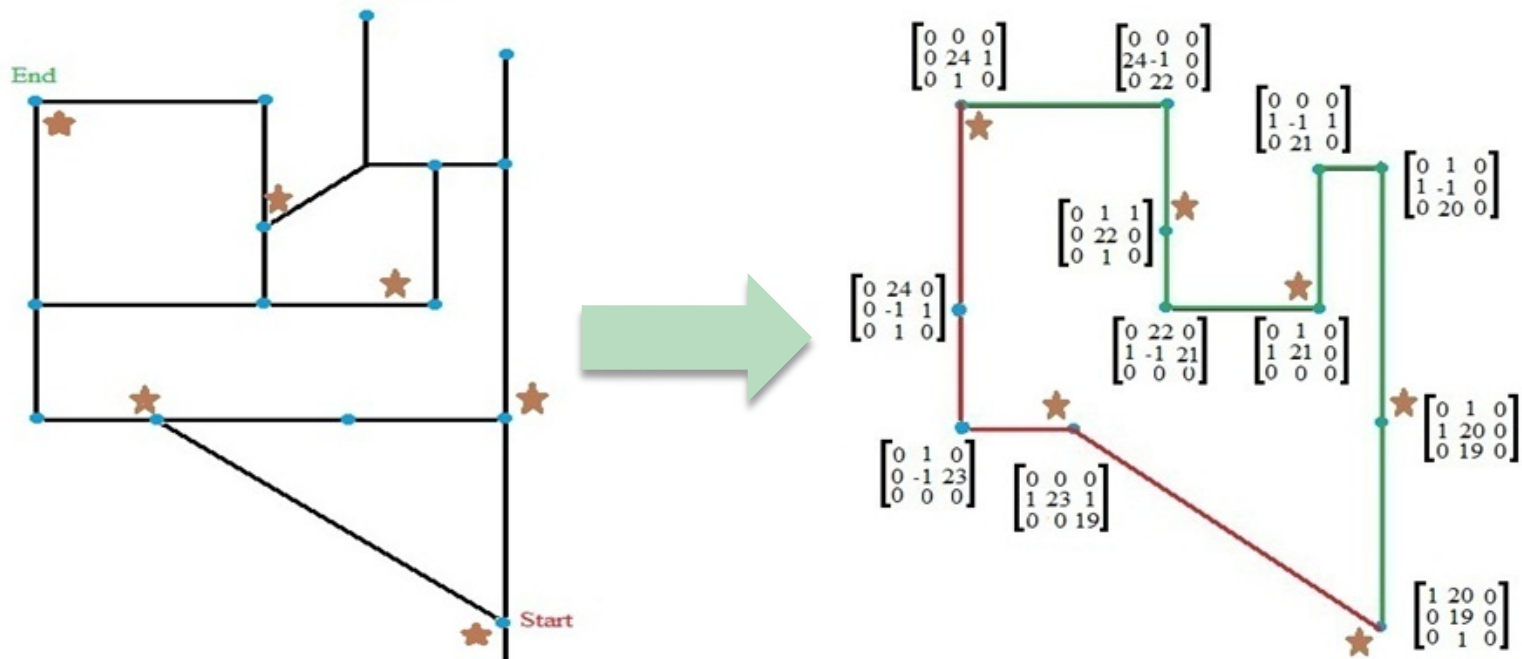
Information in mind is hierarchical; and the sequences of containing **districts** about the desired places are checked from the "top down" to **find the smallest district** containing the **origin** and **destination**.



Cognitive Subdivisions in Outdoor Navigation

(Potential Applications)

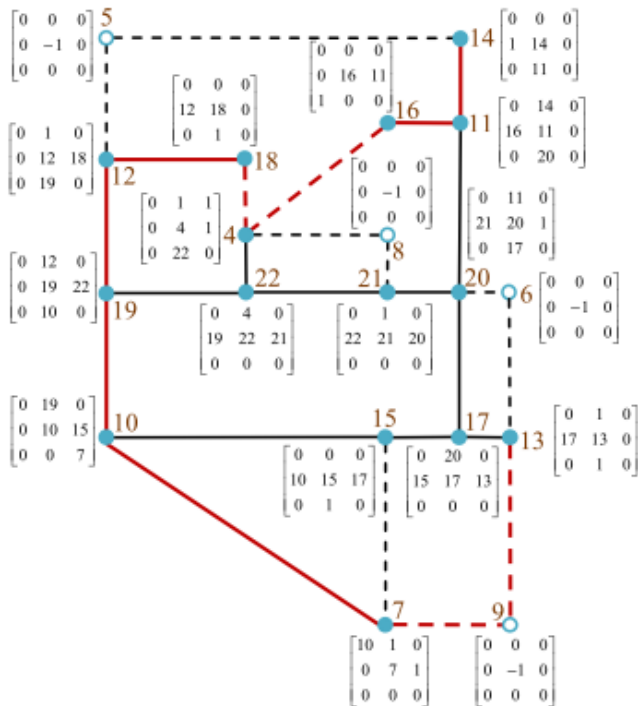
Generalizing navigational instructions



Cognitive Subdivisions in Outdoor Navigation

(Potential Applications)

Generalizing navigational instructions

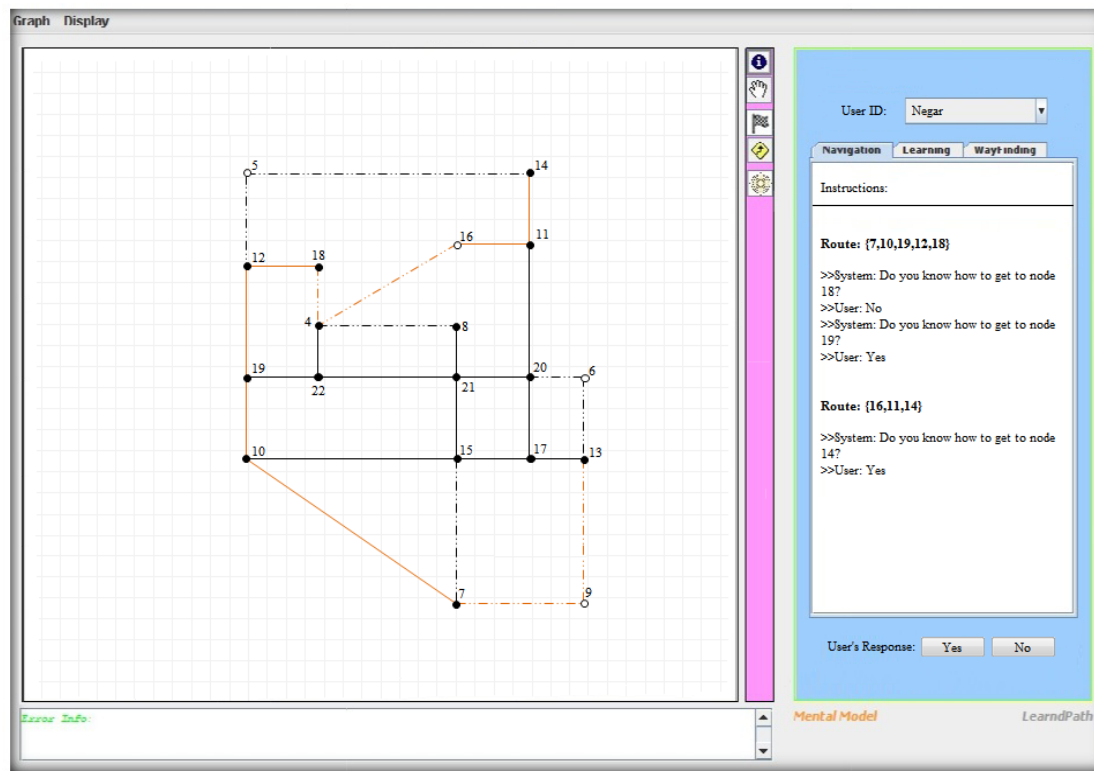


Route Section	Route type	Communication	Result
{13, 9, 7}	Unfamiliar	-	Detailed instruction to navigate to node 7
{7, 10, 19, 12, 18}	Familiar	System: Do you know how to get to node 18?	Go to node 19 (generalizing the route instruction)
		User: No	Detailed instruction to navigate from node 19 to node 18
		System: Do you know how to get to node 19?	
		User: Yes	
{18, 4, 16}	Unfamiliar	-	Detailed instruction to navigate to node 16
{16, 11, 14}	Familiar	System: Do you know how to get to node 14?	Go to node 14 (generalizing the route instruction)
		User: Yes	



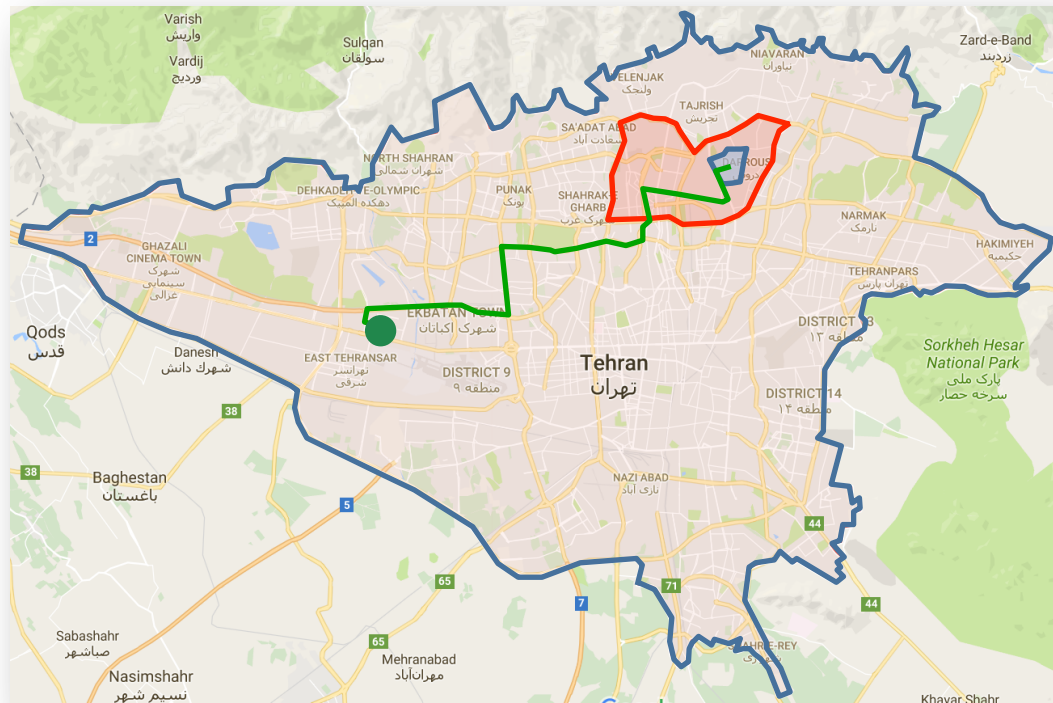
Cognitive Subdivisions in Outdoor Navigation (Potential Applications)

Generalizing navigational instructions



Cognitive Subdivisions in Outdoor Navigation (Potential Applications)

Generalizing navigational instructions



Cognitive Subdivisions in Outdoor Navigation

(Potential Applications)

Including in Destination Descriptions

- **Destination Description** (Tomko & Winter, 2009)
 - 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



Cognitive Subdivisions in Outdoor Navigation

(Potential Applications)

Including in Destination Descriptions



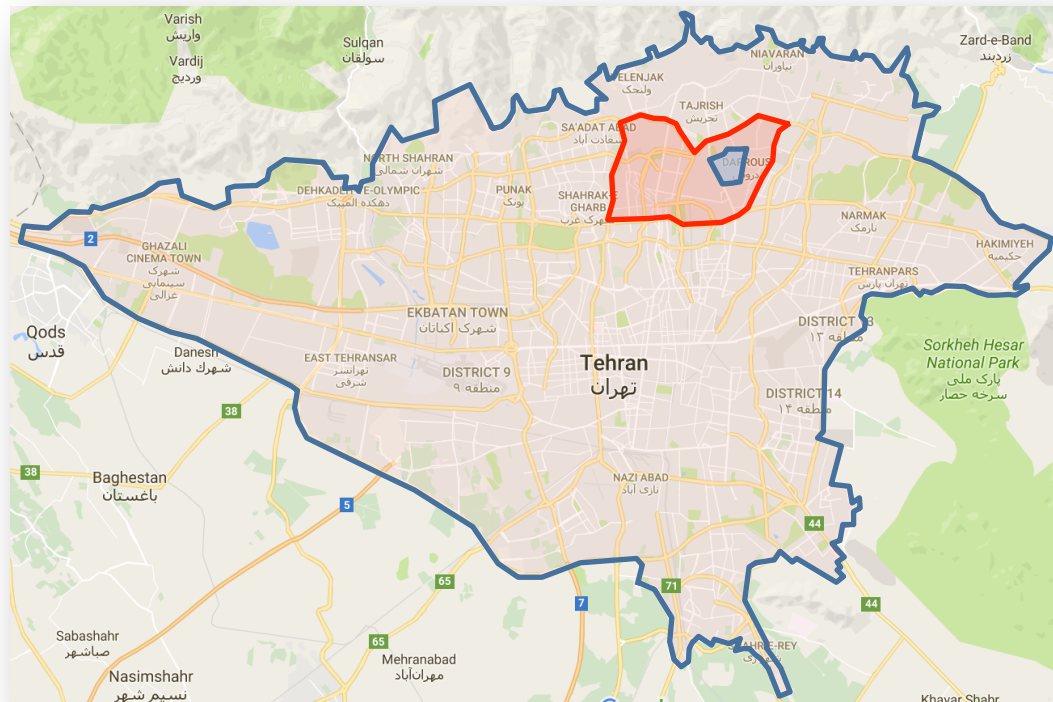
Example: Next to the opera house, off Kartnerstrasse



Cognitive Subdivisions in Outdoor Navigation

(Potential Applications)

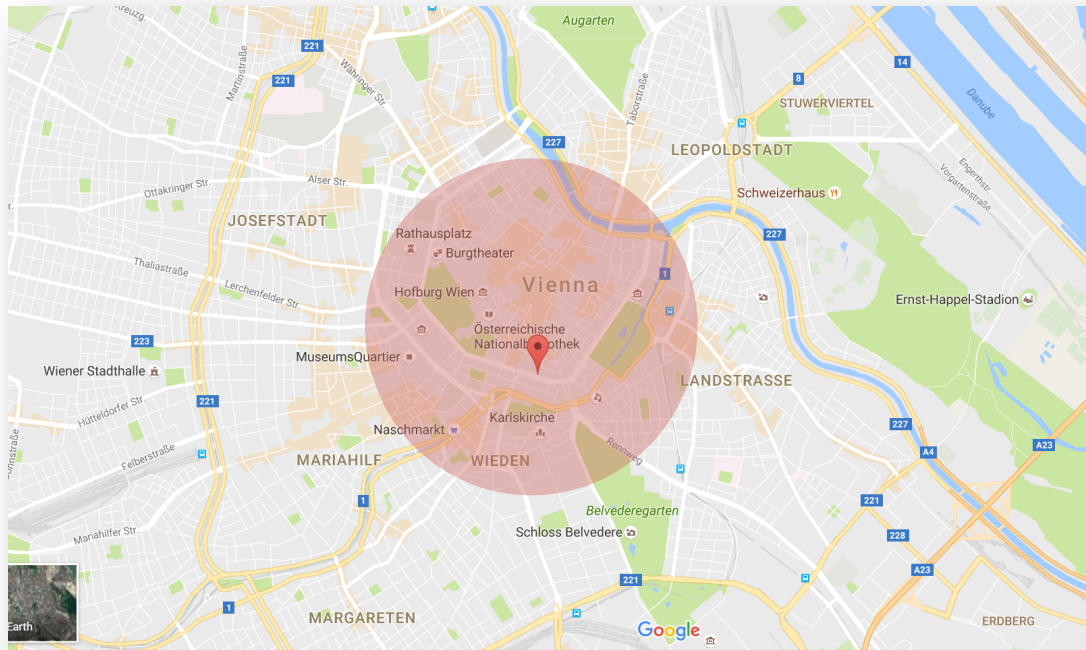
Including in Destination Descriptions



Cognitive Subdivisions in Outdoor Navigation

(Potential Applications)

Including in Destination Descriptions



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



Cognitive Subdivisions in Outdoor Navigation

(Possible Challenges)

Definition of Subdivisions

- Administrative
- Cognitive
 - Visual
 - Semantic
 - Functional
 - ...



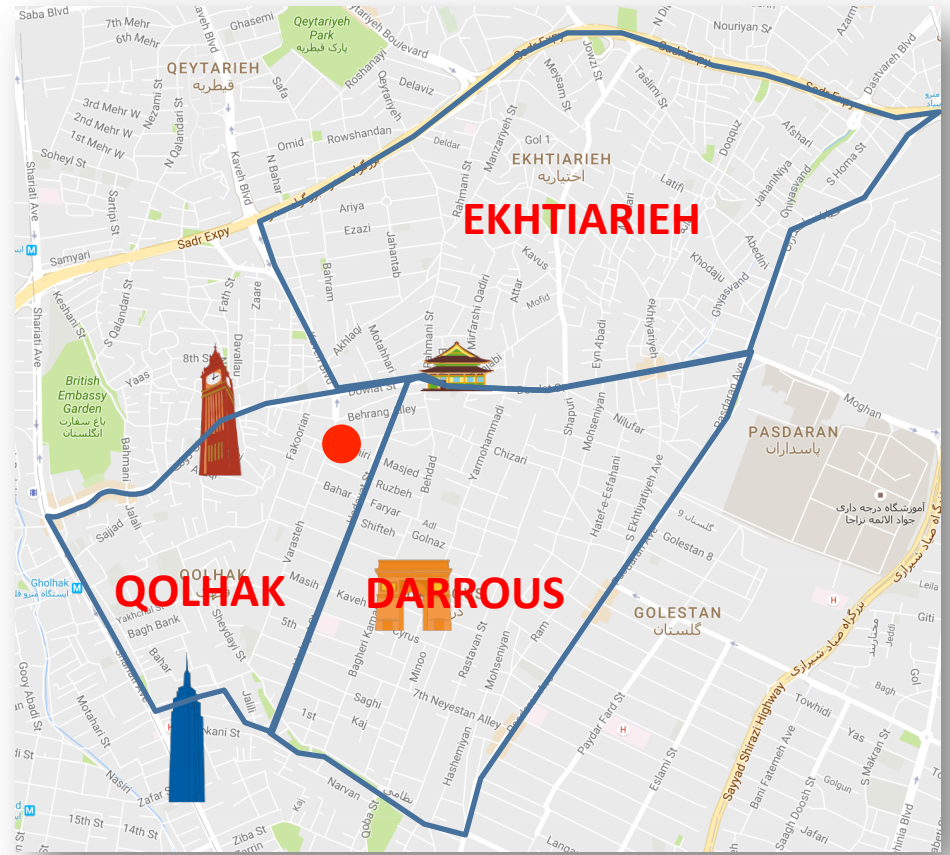
Cognitive Subdivisions in Outdoor Navigation

(Possible Challenges)

Relevancy

District

- Saliency
- Position respect to the destination
- Context

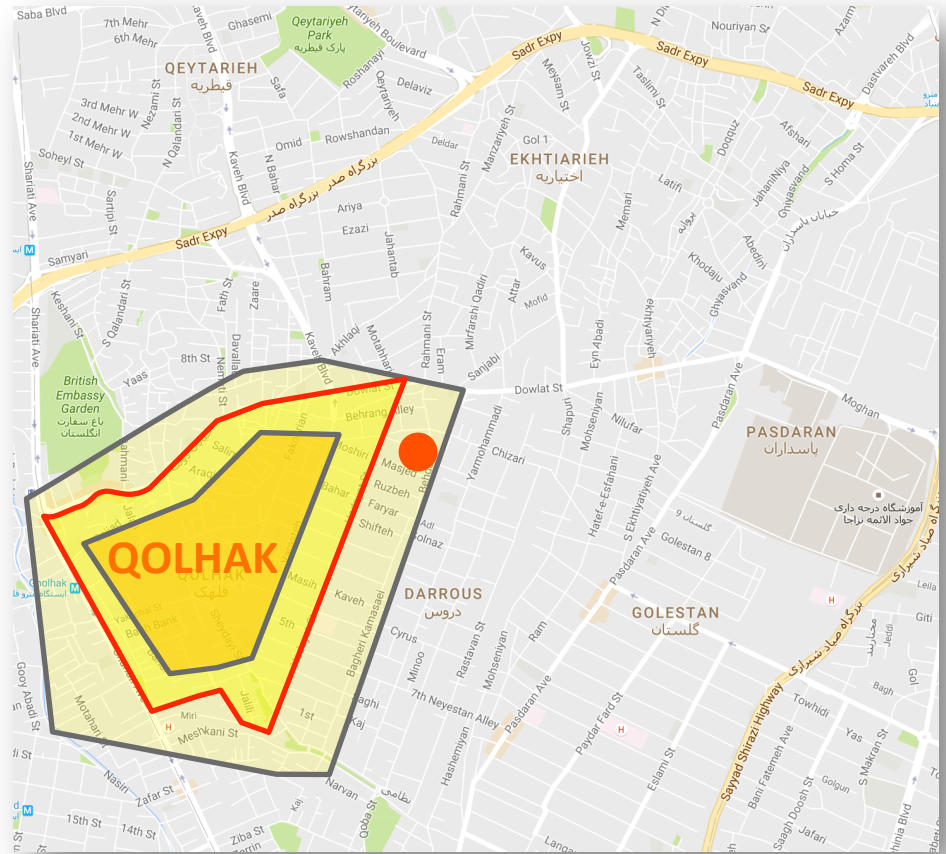


Cognitive Subdivisions in Outdoor Navigation

(Possible Challenges)

Uncertain boundaries

- Geographically
- Linguistically

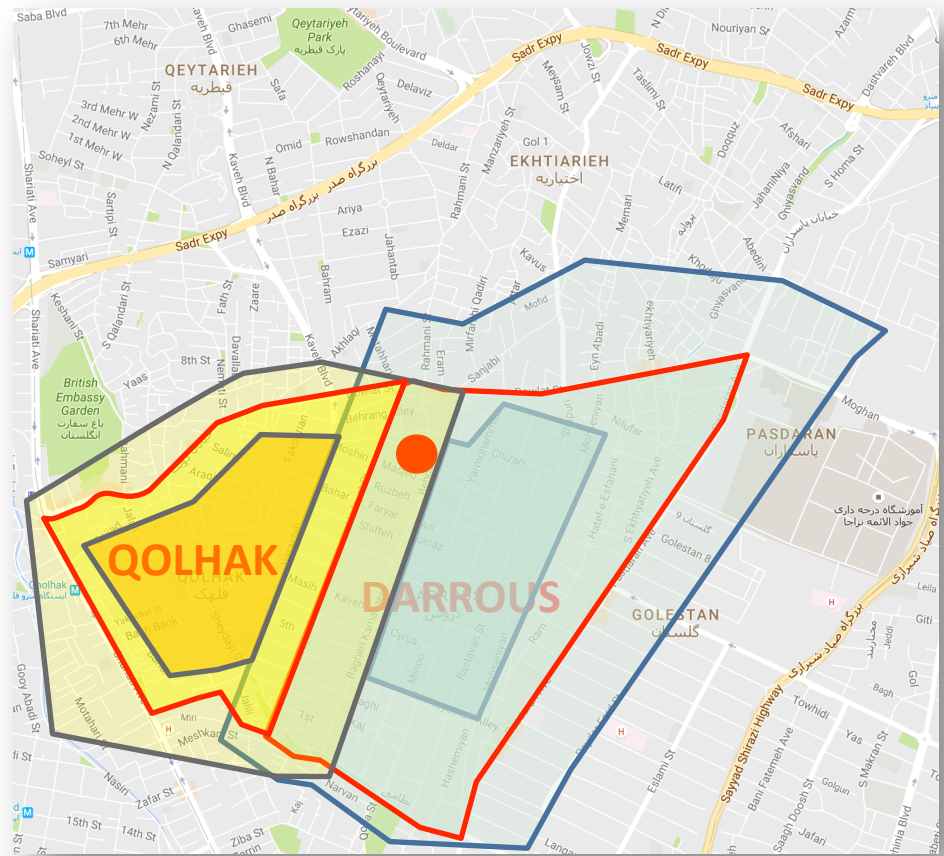


Cognitive Subdivisions in Outdoor Navigation

(Possible Challenges)

Uncertain boundaries

- Geographically
- Linguistically



Cognitive Subdivisions in Outdoor Navigation

(Possible Challenges)

Uncertain boundaries



**University of
Zurich** ^{UZH}



Congressi
Stefano Franscini
Swiss Federal Institute
of Technology Zurich

URPP Language and Space

Spatial Boundaries and Transitions in Language and Interaction
Perspectives from Linguistics and Geography



Thank you for your attention!



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