Building Multimodal Dialogue Systems in Grammatical Framework

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What are Dialogue Systems?

- User interaction
- Involve natural language
- Examples:
  - automated flight information
  - car navigation systems
  - “smart home” systems
- Running example: Gothenburg tram map

What is Multimodality?

- Using multiple modes of communication:
  - Speech
  - Pointing
  - Drawings
  - Text
  - ...

What is Grammatical Framework?

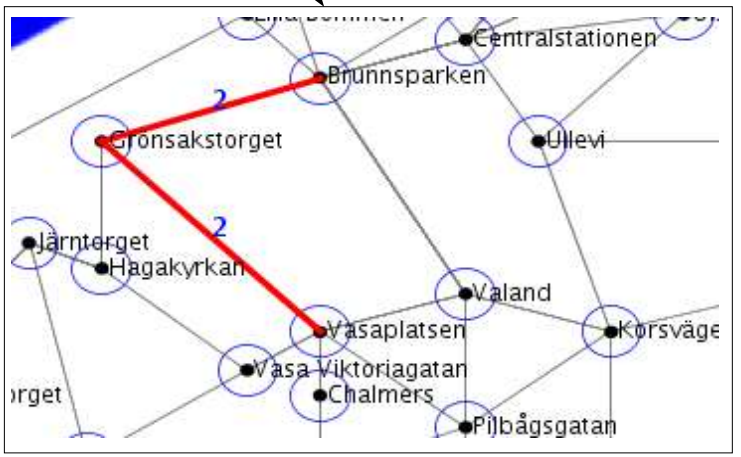
- Grammar formalism
- Based on type theory
- Abstract syntax
- Concrete syntax
  - Linearization functions
- Parsing for free

Parallel Multimodality

- Complete information in each modality:

Route 2 [Brunnsparken, Grönsakstorget, Vasaplatsen]

"Take line three from Brunnsparken to Vasaplatsen"

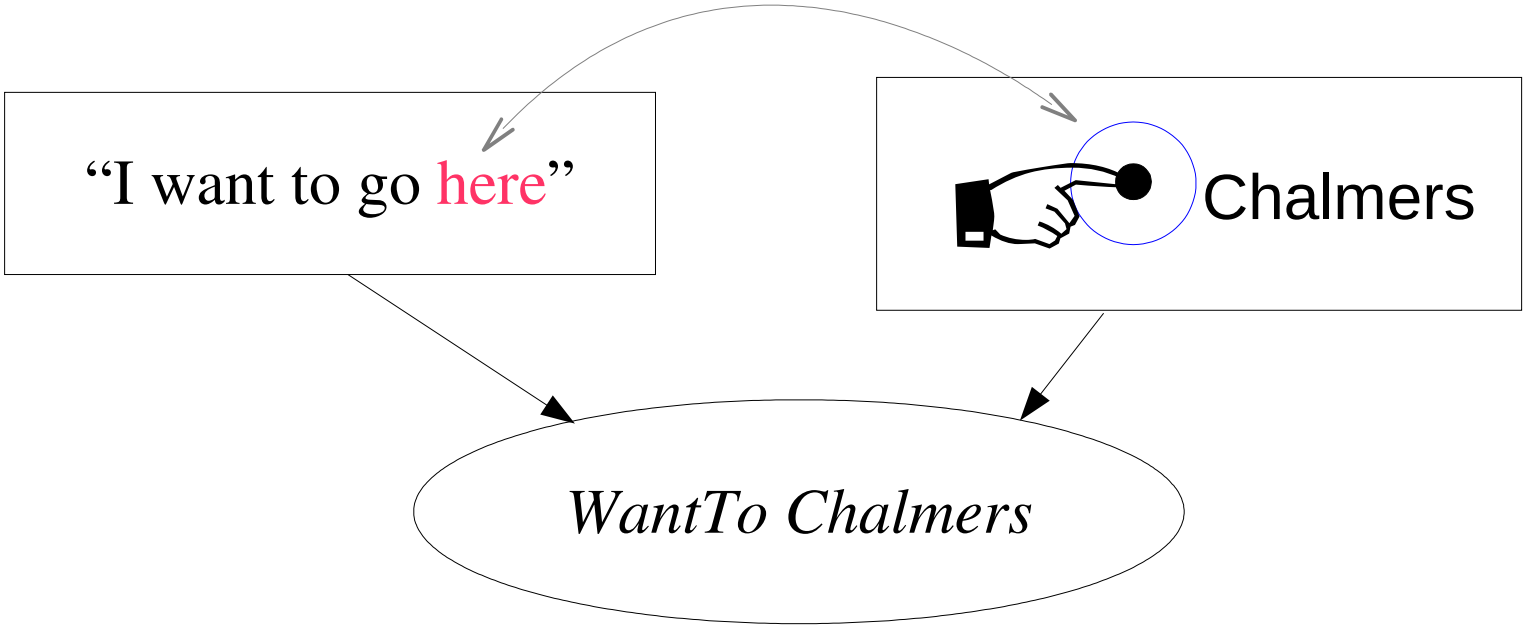


Parallel Multimodality in GF

- One concrete syntax / modality (like multilinguality):
  - Abstract syntax:
    fun Leg : Line -> Stop -> Stop -> Route
  - English speech:
    lin Leg l f t = { s = "Take" ++ l.s ++ "from" ++ f.s
    ++ "to" ++ t.s }
  - Map drawings:
    lin Leg l f t = { s = "drawEdge(" ++ f.s ++ ","
    ++ t.s ++ ","
    ++ l.s ++ ")" }

Integrated Multimodality

- Information presented by a combination of modalities:



Integrated Multimodality in GF

- Abstract syntax:

cat Input

cat Place

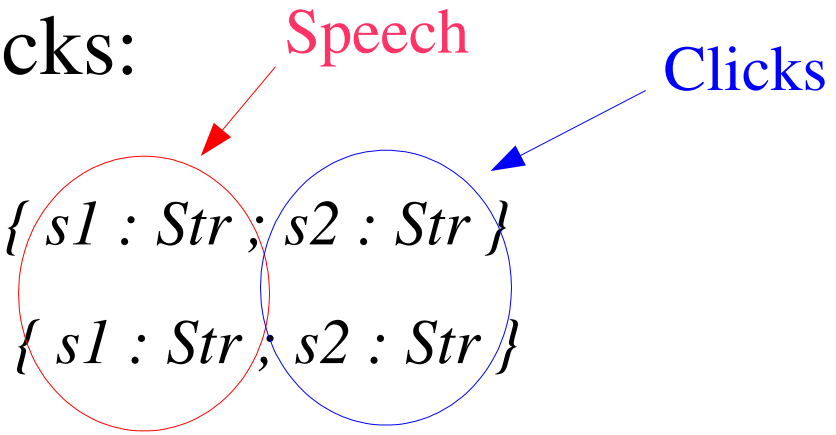
fun GoFromTo : Place -> Place -> Input

fun NamedPlace : String -> Place

fun ClickPlace : Click -> Place

Integrated Multimodality in GF

- English + clicks:




```
lincat Input = { s1 : Str ; s2 : Str }

lincat Place = { s1 : Str ; s2 : Str }

lin GoFromTo x y = {
   s1 = ["I want to go from"] ++ x.s1 ++ "to" ++ y.s1;
   s2 = x.s2 ++ y.s2
}

lin NamedPlace p = { s1 = p.s ; s2 = "" }

lin ClickPlace c = { s1 = "here" ; s2 = c.s }
```

Demo: Gothenburg tram map