Slide 1

Orko: Facilitating Multimodal Interaction for Visual Exploration and Analysis of Networks

CPSC 547 – Networks Presentation
Peyvand Forouzandeh

Slide 2

What is Multimodal Interaction?

Using two or more modes of input/output

Different combinations:
– Touch and speech
– Movement and gaze
– Gestures and gaze
– Pen and touch
– … or various combinations of these

Slide 3

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Slide 4

Data visualization user interfaces

- WIMP-based direct manipulation interfaces
- Post-WIMP systems
  1. Touch input
  2. Natural language interfaces (NLIs)

Slide 5

Data visualization user interfaces

- WIMP-based direct manipulation interfaces
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  1. Touch input
  2. Natural language interfaces (NLIs)

3. Multimodal interaction

Slide 6

Combinations of input modalities

Individual   Sequential   Simultaneous


Slide 7
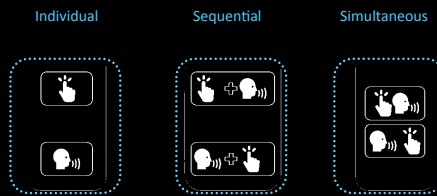
Challenges and complexities in interpreting NLIs

- Multiple interpretation
- Different ways to ask the same query
- Ambiguity
  - Syntactic level
  - Semantic level

Slide 8

Possible query types

- **Explicit:** Operations and targets are specified (sufficient tasks and values information)
- **Follow-up and contextual:** Follow-up to the previous queries or actions (typically lack references to tasks or values associated with the task)
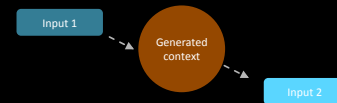- **High-level:** open-ended questions; multiple operations combined together


Slide 9

System architecture
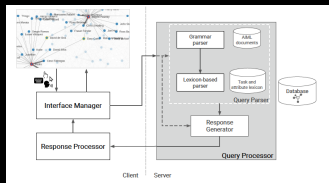
Two step approach parser:
1. Grammar parser
2. Lexicon parser

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Combinations of input modalities

1. The context generated by one input is used to complement the second and highlight connections of the filtered nodes

Input 1 → Generated context → Input 2

2. The system processes the two inputs individually, preserving filters from the spoken query

Input 1 → Context
Input 2 →

Slide 11
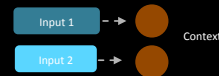
Attributes and connections

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Orko

https://vimeo.com/238502489

Slide 13
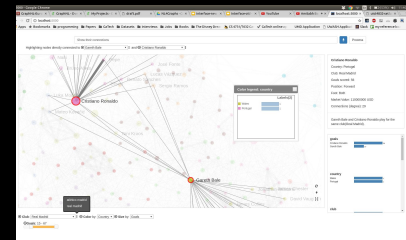
Orko's user interface

A: Natural language input and action feedback

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Orko's user interface

B: Action feedback
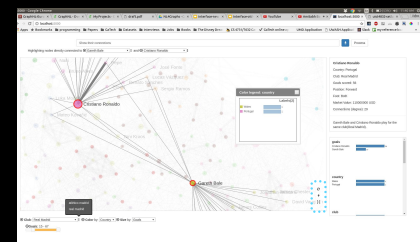

Slide 15
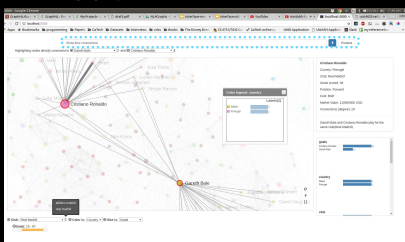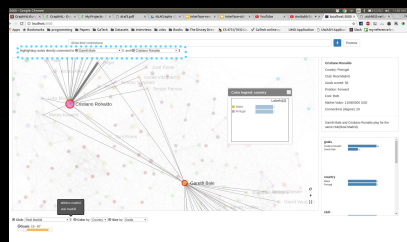
Orko's user interface

C: Network Canvas
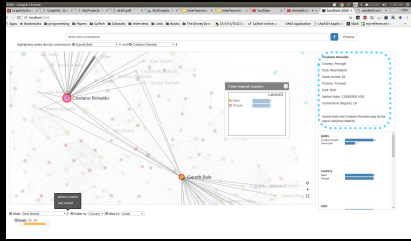

Slide 16
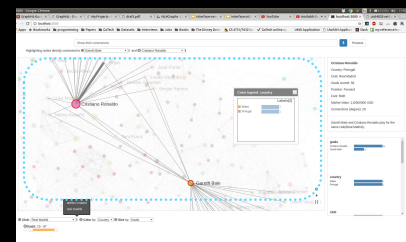
Orko's user interface

D: Quick access icons
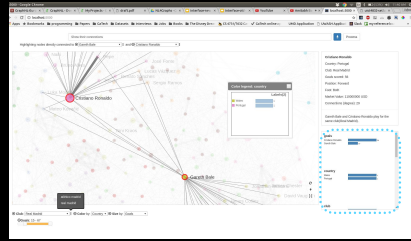
Orko's user interface

E: Details container

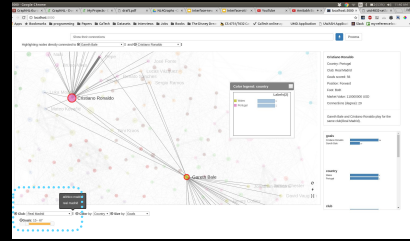17

Orko's user interface

F: Summary container

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Orko's user interface
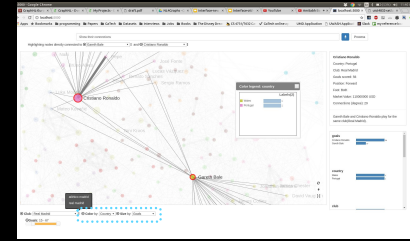
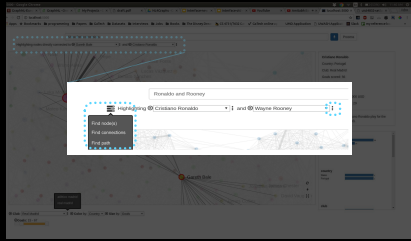G: Filtering widgets

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Orko's user interface

H: Visual encoding widgets

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Orko's user interface

B: Action feedback – Ambiguity widget

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Evaluation – user study

- Jeopardy-style evaluation approach
  - Facts: to modify the visualization and show each fact
  - Tasks: 10 tasks to explore the network and identify specific entities
  - Questions: to measure satisfaction and usability
  - Informal interview

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Evaluation – user study

	P1			P2			P3			P4			P5			P6		
	S	T	ST	S	T	TS	S	T	ST	S	T	ST	S	T	ST	S	T	TS
T1		1		2										1			1	
T2	2			1										1			1	
T3	2	1		3	1			1		3	1		3	1			2	
T4	2	1		3			4						3		6		3	
T5	2			2				1	1				2	4		4	1	1
T6	1		1					2	1	1			1	3		4		
T7	1	1		2	3		1	1			1		3	1		2	2	
T8	1			1			1	1		1	1		1	1			1	
T9	2						2			2			2	1		1	1	
T10	2	2	2	8	1	2		6	2	2	5		2	5		2	3	1

Summary of interactions per task for 6 participants

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Results and observations

- Preferences of modalities:
  - Speech: typically for search, filtering, and topology-based tasks involving multiple nodes
  - Touch: typically for tasks like highlighting connections of individual nodes and changing values of existing graphical encodings

Modalities preferred

- Spoken
- Touch
- Multimodal

18%
30%
50%
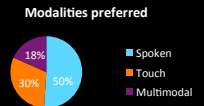
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Results and observations

- NLI and interpretation
  - Query interpretation: Issues with queries with multiple values and not separated by conjunctions
- Contextual and follow-up queries
  - Multitouch gestures: requested
  - Repeat preference: instead of follow-up utterances
- Proactive behavior

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Critique

- Natural and fluid way to explore networks
- Features well integrated
- Clear breakdown and UI
- Immediate visual feedback and proactive behavior (help user think about other questions)
- Flexibility of choices between audio and textual feedback
- Successful in explicit queries and most follow-up and contextual

- Evaluation – experienced participants and specific example (Football)
- Only force-directed layout (Region-based identifications not useful – Scalability issues)
- Limited touch gestures
- Some features not used (ambiguity widget, follow-up gestures, task suggestions)
- Simultaneous interaction was not examined
- Ignored high-level questions
- Auto-complete function

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