

# Knowledge Sources for Bridging Resolution in Multi-Party Dialog

#### A Preliminary Study

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1http://www.ukp.tu-darmstadt.de/people/chmark
2http://www.eml-d.de/english/homes/mieskes
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#### **Overview**



- What is Bridging?
- State of the Art in Bridging Resolution
- Data and Annotation Experiments
- Knowledge Sources for Bridging Resolution
  - WordNet
  - NEW: Wikipedia
- Automatic Knowledge Extraction
- Summary and Conclusion

### Bridging vs. Coreference



**MN059**: OK, so, um, what I started looking at, uh, to begin with is just uh, [content management systems]<sub>i</sub> uh, i- i- in general.

(Some intervening utterances by the same speaker)

**MN059**: Now, if you sort of put on your semantic glasses, uh you say, well that's not all that easy, because there's an implicit um, uh, assumption behind that is that uh, all the users of this system share the same interpretation of the keyword and the same interpretation of uh, whichever taxonomy is used, and uh, I think that's a - that's a very - that's a key point of [these systems]<sub>i</sub> and they sort of always brush over this real quickly without really elaborating much of that and uh - (Bed017)

## Bridging vs. Coreference



**MN015**: Um, *outbreath* uh in a - in a smaller group we had uh, talked and decided about continuation of [the data collection].

FN050: mike noise

**MN015**: So Fey 's time with us is almost officially over, and she brought us some thirty subjects and, t- collected [the data], and ten dialogues have been transcribed and can be looked at. (Bed017)

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- Hahn et al. (1996)
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    - "The accumulator ... The charge time ..."
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    - CHARGE-TIME charge-time-of ACCUMULATOR

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- Poesio et al. (1997)
  - Wall Street Journal (no domain restriction)
    - "The house ... The chimney ..."
  - WordNet
    - Direct or indirect meronymy (also: Syn. and Hyp.)

#### **Data and Annotation: Setup**



- Two project-external annotators
- Ten ICSI Meeting Corpus dialogs
- Simple instructions:
  - 1. Classify NPs as old, mediated, or new
  - 2a. For old: Identify coreferent antecedent
  - 2b. For mediated: Identify bridging antecedent
- MMAX2 annotation tool

### **Data and Annotation: Setup**



<b>=</b>	MMAX2 1.12 /home/chmark/Data/is_data/Bed017.mmax [modified]	×
File Sett	ings Display Tools Plugins Info 🗹 Show ML Panel	
MN015	mouth	•
ME010	O_ <u>K.</u> So, here we are.	
FE004	laugh	
ME003	g	
FN050	laugh	
ME010	3 , 3 , 3	
MN015		
ME010	Um, so we haven't had a meeting for a while, and – and	
ME010	_ , , , , , , _ , _	
ME010	, , , , , , , , , , , , , , , , , , , ,	
ME010		
MN015		
MN015		
FN050		
MN015	· · · · · · · · · · · · · · · · · · ·	
MN015	,,,,,,	
FN050	mike noise	
MN015		
	that, talk to me.	
	Um, and we found another uh, cogsci student who's interested in playing <u>wizard</u> for us. Here we're gonna make it a little bit more	
MN015	· ·	
ME003	1 2 2	
	She's actually suggested to	
MN015		
to	Took and, at the psychology department students, because they have to partake in two experiments in order	
	fulfill some requirements.	
MN015	·	-

### **Data and Annotation: Kappa**



	old	mediated	new	all
Bed016	.78	.71	02	.71
Bed017	.77	.59	.51	.66
<b>Bmr001</b>	.80	.59	.16	.63
<b>Bmr002</b>	.78	.69	.40	.71
<b>Bns003</b>	.73	.55	.16	.59
Bro003	.68	.57	.08	.60
Bro004	.77	.54	.19	.60
Bro005	.79	.69	.29	.71
Bsr001	.76	.69	.49	.71
Btr001	.79	.73	.14	.74

# Data and Annotation: Confusion Matrix



	old	mediated	new	Anno 1
old	<b>2552</b> (86.71%)	221	10	2783
mediated	137	<b>743</b> (58.12%)	13	893
new	23	163	<b>44</b> (17.39%)	230
Anno 2	2712	1127	67	3906

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- Basis for bridging resolution data set



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- Restriction: Definite NP anaphors only



	All anaphors	Definite anaphors only
Same antecedent	86	70
Same head	22	14
Different antecedents	31	27
One antecedent missing	129	72
Two antecedents missing	475	141
$\sum$	743	324



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- 84 pairs covering diverse (semantic) relations
- Selection of sub-set of 16 pairs on the basis of plausibility

#### **Data Set**



Antecedent	<b>Bridging Anaphor</b>
microphone	batteries, switch
university	address
cafe	floor
data collection	data
Bayes-net	input nodes
field trip	logistics
neural net	training
experiment	result
table	column, line
problem	answer
(two) people	(the) weaker voice
France	villages
utterance	beginning
question	answer



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- Missing in Wikipedia (http://en.wikipedia.org)
  - none

#### **Evaluation: Antecedent Entries**



Manual search for anaphor string in antecedent entries

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## **Evaluation: Wikipedia Coverage**



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- Wikipedia API uses local Wikipedia database!



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- Else, search for lemmatized bridging anaphor head in
  - full antecedent page text, or
  - antecedent page outlink text only.

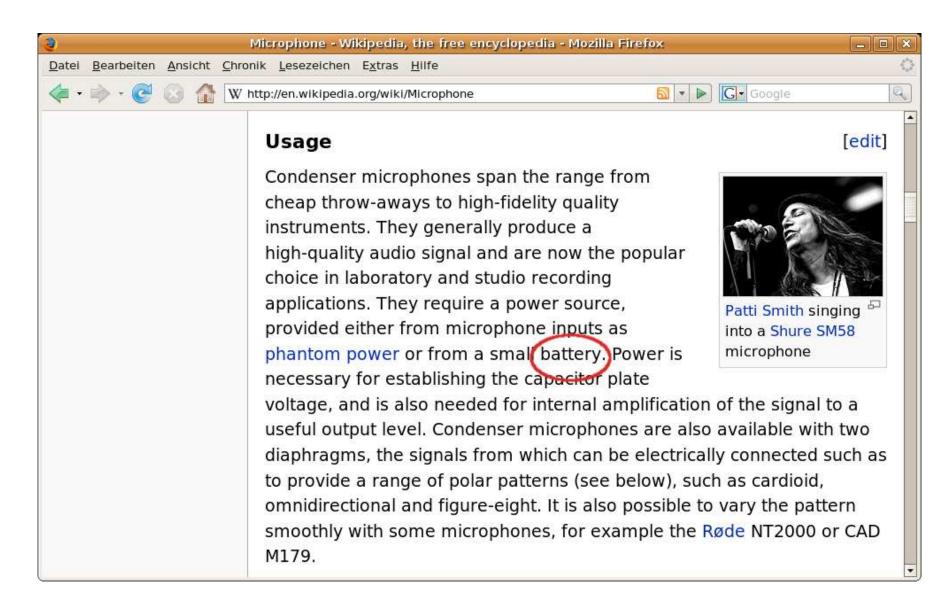


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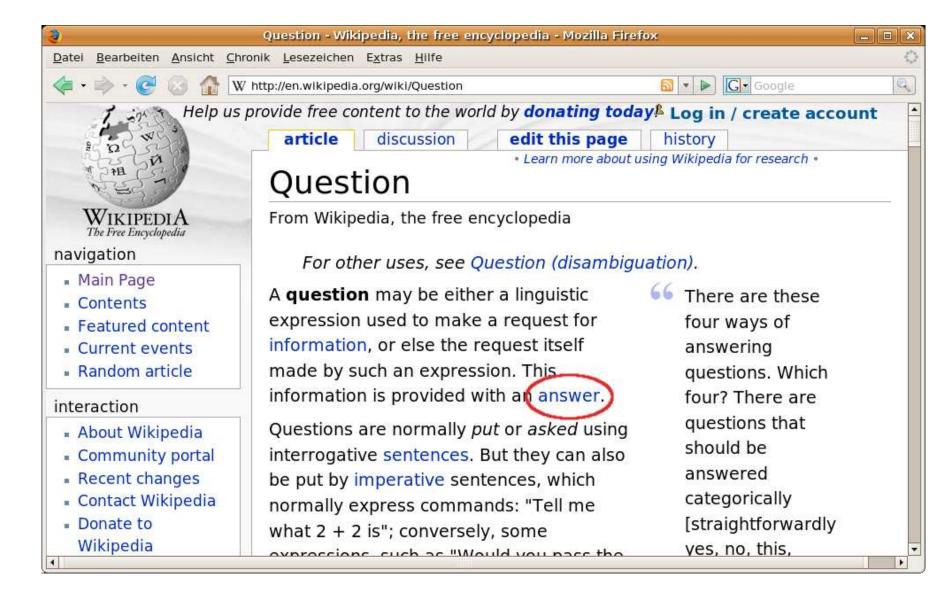


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  - full antecedent page text, or
  - antecedent page outlink text only.
- Outlink text = text under a hyperlink
- Rationale: Outlink text is important for the source page.











Bridging	Bridging	Antecedent	Bridging Anaphor Found	
Antecedent	Anaphor	Entry Found?	In Page Text	In Outlink
microphone	batteries	yes	yes	no
data collection	data	no	-	-
neural net	training	yes	yes	no
experiment	result	yes	yes	no
table	column	no	-	-
easy problem	answer	yes	yes	no
question	answer	yes	yes	yes



- Automatic procedure failed to detect two entries:
  - Data collection entry missing in local Wikipedia version
  - Table entry is a disambiguation page



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  - Data collection entry missing in local Wikipedia version
  - Table entry is a disambiguation page
- Outlink text only relevant in one out of five cases.



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- WordNet has limited coverage, but contains fundamental relations not found in Wikipedia.
- Wikipedia has better coverage, in particular due to much longer entries.
- Automatic access to required knowledge can be provided b an API.
- Automatic treatment of disambiguation pages needs to be improved (e.g. Ponzetto & Strube 2007)

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- The MMAX2 annotation tool is available at mmax2.sourceforge.net
- The Wikipedia API is available at www.ukp.tu-darmstadt.de/software/jwpl/