Modelling Multi-Issue Bargaining Dialogues:

Data Collection, Annotation Design and Corpus

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Abstract: The paper describes experimental dialogue data collection activities, as well semantically annotated corpus creation undertaken within EU-funded METALOGUE project (www.metalogue.eu). The project aims to develop a dialogue system with flexible dialogue management to enable system's adaptive, reactive, interactive and proactive dialogue behaviour in setting goals, choosing appropriate strategies and monitoring numerous parallel interpretation and management processes. To achieve these goals negotiation (or more precisely multi-issue bargaining) scenario has been considered as the specific setting and application domain. The dialogue corpus forms the basis for the design of task and interaction models of participants negotiation behaviour, and subsequently for dialogue system development which would be capable to replace one of the negotiators. The METALOGUE corpus will be released to the community for research purposes.

Task/domain

In **multi-issue bargaining**, parties simultaneously bargain over several goods and attributes, and to search for integrative potential, i.e. interest-based bargaining or win-win bargaining.

Important properties:

- parties can give up more on one issue, but can receive in exchange for a larger share on another;
- parties can delay making a complete agreements or make a partial agreement;
- parties can commit to an agreement on some issues, but may exit agreements during the same interaction or later in a new negotiation round;
- parties may revise their past offers, accept or decline any standing offer, make counter-offers, etc. having a latent risk that bargaining may breakdown

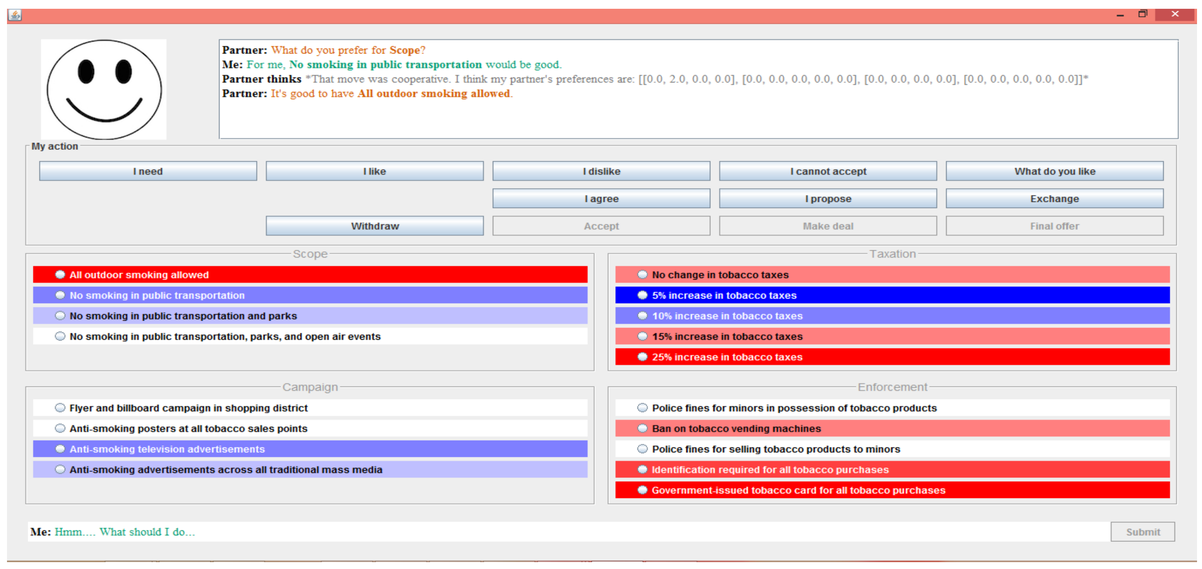
Goal

To capture the *dynamics* related to frequently changing participants' goals related to a wide array of bargainers' strategies. Model that supports active identification of (1) partner's goals and to balance between its own and partner's goals; (2) partner errors and is able to propose improvements.

The ultimate goal is flexible *adaptive* multimodal dialogue management driven by adequate cognitive dialogue modelling of human behaviour

Data collection scenario

Topic: implementation of new anti-smoking regulations; **setting:** Wizard of Oz; **participant number:** two-party dialogues; **roles:** representative of a City Council and a representative of Small Business owners; **issues number:** 4 (scope; taxes; campaign and enforcement); **modalities:** speech; **possible outcomes**: 400



Corpus

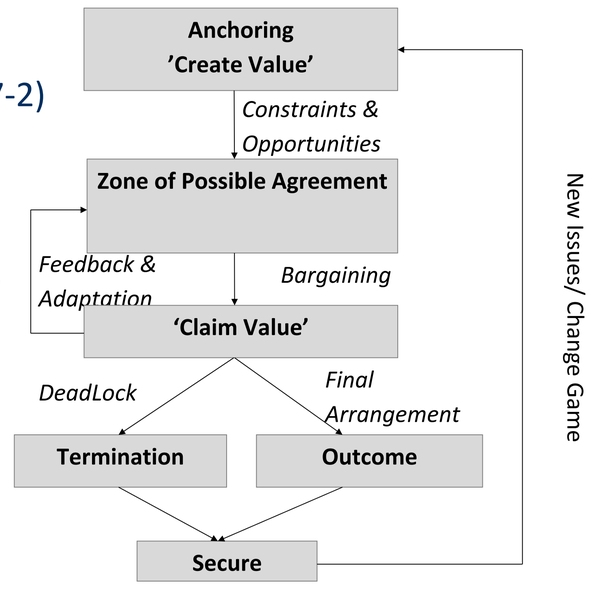
16 unique subjects (age between 19 and 25); 50 dialogues with total duration of 8 hours comprising about 4.000 speaking turns

Type	Content	Format	Comment
Preference cards	9 negotiation cases	html for web-presentation stand-alone GUI (Java)	defined for each negotiator
Metadata	participants (id, native language sex, age at collection)	xml	
Signals	sound recordings wav files	mono, 96000Hz sample rate 24-bit sample format mono, 16-bit sample format cut	1 channel per speaker per speaker/per turn
Automatic Speech Recognition	turn (id, start, end, string)	plain text	automatic
Transcriptions	turn (id, start, end, string)	TEI compliant	manual
Typed interactions	turn (id, string)	csv format	
DA annotations	dialogue act (sender, dimension, communicative function, qualifier functionalDependenceRelation feedbackDependenceRelation) rhetoricalLinks negotiation moves (separately)	Anvil and DiAML	manual

Modelling

Semantic units and relations

- Dialogue acts (according to ISO 24617-2)
- Negotiation Moves (extension to ISO 24617-2 as task/domain-specific functions)
- Set of qualifiers (certainty, sentiment, conditionality and modality)
- Set of rhetorical relations



Utt_ID	Speaker	Start-End time	Utterance (wording)	DA_ID	DA tag[dependence]	Negotiation Move	Rhetorical
u1	p1	00.00-00.16	in this city I would suggest all outdoor smoking allowed	da1	task;suggest	offerValue	
u2	p2	00.16-00.17	uh-uhu	da2	autoPositive[u1]		
u3	p1	00.17-00.25	no changes in tobacco taxes and then anti-smoking television advertisement	da3	task;suggest	offerValue	list[da1]
u4	p1	00.25-00.30	and police fines for minors again	da4	task;suggest	offerValue	list[da1,da3]
u5	p2	00.30-00.31	uh-uhu	da5	autoPositive[u3,u4]		
u6	p1	00.31-00.33	so what do you think	da6	task;setQuestion	elicitOfferValue	
u7	p2	00.32-00.33	uhm	da7	turnTake;stal		
u8	p2	00.33-00.34	yeah	da8	autoPositive[u1,u3,u4]		
u9	p2	00.34-00.36	that's bit difficult for me	da9	task;setAnswer[da6]	declineOfferValue[da6]	
u10	p2	00.36-00.42	because that really doesn't meet our goals	da10	task;inform		justify[da9]
u11	p2	00.41-00.49	but we can sure look if we can find a solution maybe	da11	task;suggest		contrast[da10]
u12	p2	00.49-00.56	maybe I start with the worst points for me	da12	discourseStructuring; suggest		
u13	p1	00.55-00.56	okay	da13	discourseStructuring; acceptSuggest[da12]		
u14	p2	00.55-01.01	it's the scope of the smoking ban	da14	discourseStructuring; topicShift		
u15	p1	01.01-01.02	uh-uhu	da15	discourseStructuring; agreement[da14]		
u16	p2	01.00-01.12	only to allow outdoor smoking is not enough	da16	task;inform	declineOfferValue[da1]	
u17	p2	01.13-01.28	i think it would be fine if we stop smoking in public transportation	da17	task;inform	counterOfferValue[da1]	
u18	p1	01.36-01.37	okay i would go for that point	da18	task;agreement[da17]	acceptOfferValue[da17]	

ISO 24617-2 dimension	Relative frequency (in %)
Task	47.6
AutoFeedback	18.7
AlloFeedback	2.3
Turn Management	6.6
Time Management	6.6
Discourse Structuring	14.9
Own Communication Management	2.1
Partner Communication Management	na
Social Obligation Management	1.2

Negotiation Move	Relative frequency (in %)
ElicitOfferValue	19.3
OfferValue	28.7
AcceptOfferValue	14.7
DeclineOfferValue	6.0
CounterOfferValue	7.3
Concession	1.3
BargainIn	2.5
BargainDown	2.6
Deal	14.0
Withdraw	1.8
BreakDown	0.2
ExitDeal	0.7
ExitBreakDown	0.2
BlockOfferValue	0.7

Dialogue Manager