Propelling BPM by Research and Innovation Staff Exchange

RISE_BPM

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Conversation mining: process mining for conversational data

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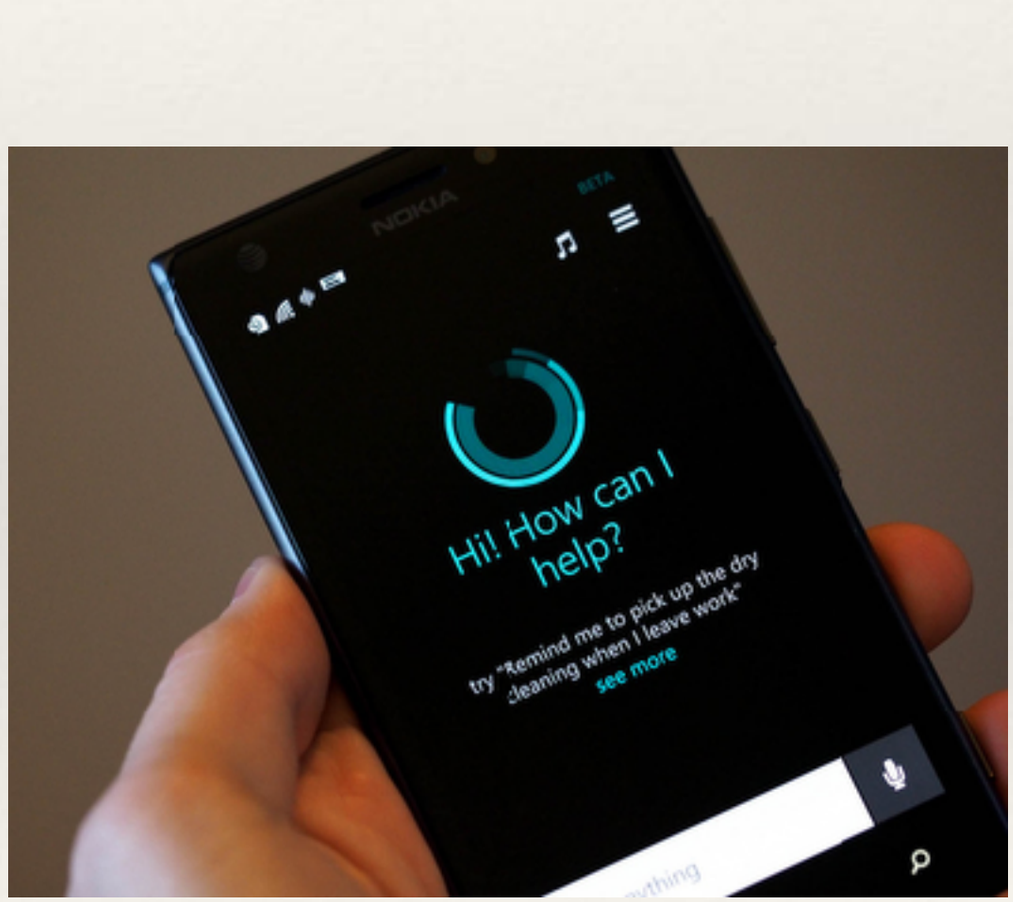
@vendiSV
http://vendi12.github.io

Conversational assistants

- Amazon Alexa, Apple Siri, Microsoft Cortana …



Conversation

- a talk, especially an informal one, between **two or more** people, in which **news and ideas are exchanged** (*Oxford dictionary)*
- **Research question:** what are the mechanisms, which enable an information exchange between the conversation participants?

https://en.oxforddictionaries.com/definition/conversation

Conversational Analysis (CA)

- Schegloff, 1968
- **patterns** in the conversation **structure**:
  - **utterance** - an uninterrupted chain of language
  - **turn**-taking
  - adjacency **pairs**, e.g. question/answer

Emanuel A Schegloff. 1968. Sequencing in conversational openings. *American anthropologist*, 70(6):1075–1095.
https://en.oxforddictionaries.com/definition/utterance

Speech Act Theory (SAT)

- Searle, 1969
- **annotate** utterances
- with **functions** enabled through language (speech acts)
- e.g. promise, prediction, report, etc.

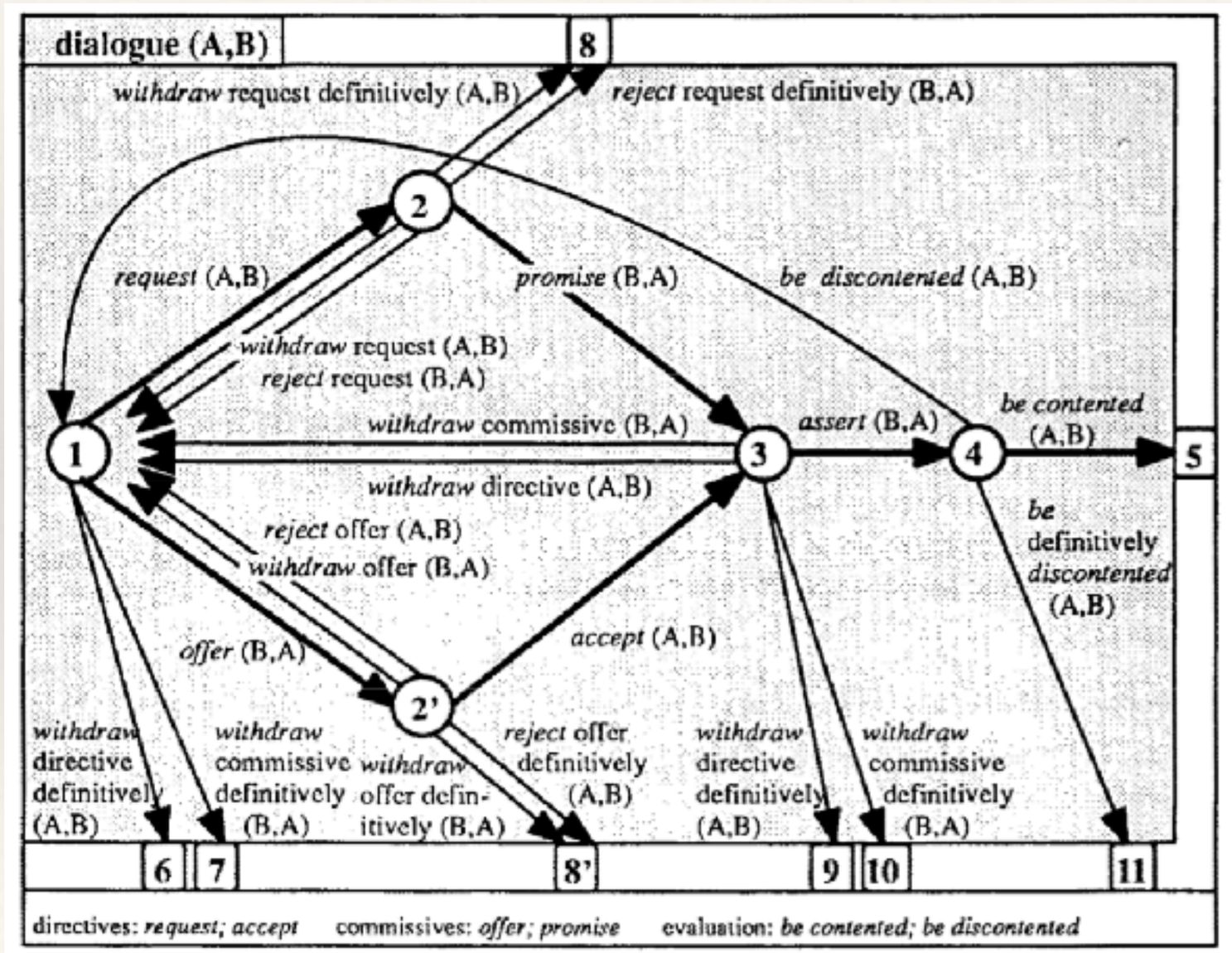
John R. Searle. 1969. *Speech Acts: An Essay in the Philosophy of Language*. Cambridge University *Press, Cambridge, London*.

J.L. Austin, J.O. Urmson, and M. Sbisa´a. 1976. *How to Do Things with Words*. Oxford Paperbacks. Oxford University Press.

John R Searle. 1976. A classification of illocutionary acts. Language in society, 5(1):1–23.

Model of information-seeking dialogues

- Sitter & Stein, 1992



Stefan Sitter and Adelheit Stein. 1992. Modeling the illocutionary aspects of information-seeking dialogues. *Information Processing & Management*, 393 28(2):165–180.

Spoken conversational search

- Trippas et al., 2017
- lab experiment
- 13 pairs: User - Retriever
- 9 search tasks: remember, understand, analyse
  e.g.: Where does cinnamon come from?
- 10 mins max

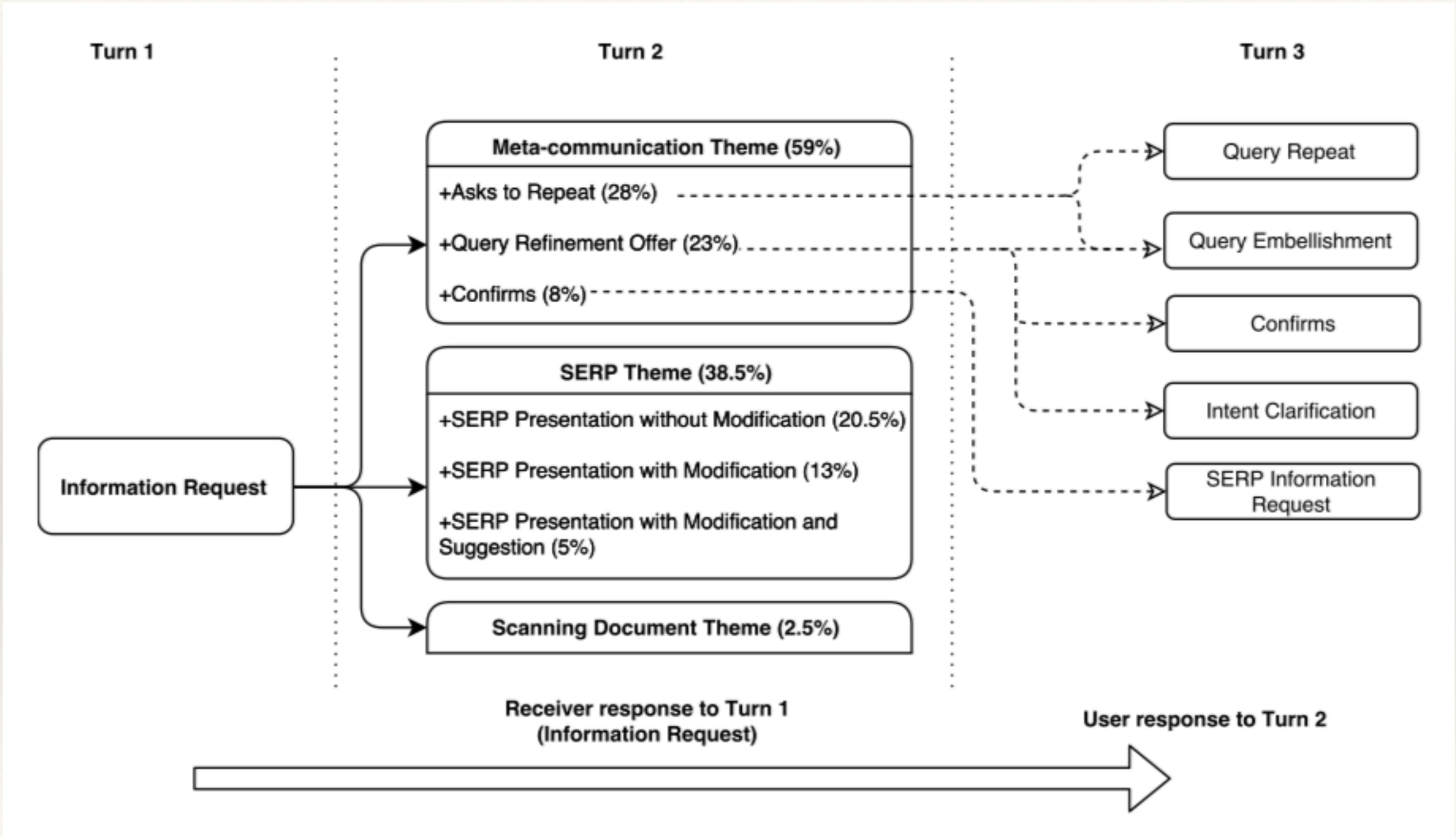
Johanne R Trippas, Damiano Spina, Lawrence Cavedon, and Mark Sanderson. 2017. How do people interact in conversational speech-only search tasks: A preliminary analysis. In *Proceedings of the 2017* ACM on Conference on Human Information Interaction and Retrieval (CHIIR). ACM.

Conversational transcripts

Start.time	Stop.time	Query	Query.compl	Role	Action	Transcript
00:02.7	00:11.6	Where does cinnamon c	remember	A_User	A:Initial information request	In which countries... in which european countries... do they grow cinna
00:40.9	00:51.9	Where does cinnamon c	remember	B_Receiver	B:SERP without modification	There is a bunch or results and the first one is Wikipedia uhm... which j
06:34.3	06:47.6	Airport Security	analyze	A_User	A:Initial information request	Can you type in... uhm...effective effectiveness of new security measur
06:58.0	07:02.8	Airport Security	analyze	B_Receiver	B:Query refinement offer	Australia or at the airport
07:02.9	07:08.2	Airport Security	analyze	A_User	A:Intent clarification	put uhm... put international airports
17:24.0	17:36.1	Outsource job India	understand	A_User	A:Initial information request	What US jobs have been outsourced to India
17:50.2	17:52.7	Outsource job India	understand	B_Receiver	B:Query refinement offer	Can I put in united states
17:52.7	17:53.2	Outsource job India	understand	A_User	A:Confirms	yeah
00:14.6	01:18.6	recycle, automobile tires	understand	A_User	A:Initial information request	Uses for old car then the query or... passenger vehicle tyres... T Y R E
01:19.2	02:27.4	recycle, automobile tires	understand	B_Receiver	B:SERP without modification	So far from the last 12 months I... first results is second hand tyres in S
10:16.5	11:02.5	per capita alcohol consu	analyze	A_User	A:Initial information request	Please compare first word it might put compare average international u
11:07.4	11:09.6	per capita alcohol consu	analyze	B_Receiver	B:Asks to repeat	sorry what... can you repeat that sentence
11:10.3	11:29.9	per capita alcohol consu	analyze	A_User	A:Query repeat	compare average open inverted commas oh sorry compare average in
21:14.0	21:47.5	What language do they	remember	A_User	A:Initial information request	please search for the following phrase... what language language in inv
21:59.7	22:02.1	What language do they	remember	B_Receiver	B:SERP without modification	uhm... it has come up straight away with a result uhm... in google uhm.
00:01.4	00:10.8	Marine Vegetation	understand	A_User	A:Initial information request	maybe start of with type in marine vegetation and read up on what it kin
00:20.2	00:35.2	Marine Vegetation	understand	B_Receiver	B:SERP with modification	ok I have an article about marine vegetation... plants that inhabit the se
10:16.7	10:21.8	Where does cinnamon c	remember	A_User	A:Initial information request	maybe start of with uhm... type in... the origins of cinnamon
10:33.0	10:41.7	Where does cinnamon c	remember	B_Receiver	B:SERP without modification	uhm I have around 1518 Portuguese traders discovered cinnamon at C
20:18.5	21:00.7	per capita alcohol consu	analyze	A_User	A:Initial information request	ok so... uhm... in general I sort of want to try to find out the average con
21:03.0	21:08.8	per capita alcohol consu	analyze	B_Receiver	B:SERP without modification	so I have a document about global consumption of alcohol by the world
00:22.6	00:24.6	Turkey Iraq Water	analyze	A_User	A:Initial information request	turkish river control
00:30.7	00:31.7	Turkey Iraq Water	analyze	B_Receiver	B:Confirms	yeah
00:33.5	00:34.6	Turkey Iraq Water	analyze	A_User	A:SERP information request	What results came up?
01:51.9	01:54.0	What river runs through	remember	A_User	A:Initial information request	Rome water supply
02:05.0	02:16.0	What river runs through	remember	B_Receiver	B:SERP with modification	uhm... yeah uhm... it pops up... it talks about the aqueduct and stuff an
04:57.5	05:01.5	Marine Vegetation	understand	A_User	A:Initial information request	health benefits of marine vegetation
05:11.1	05:12.1	Marine Vegetation	understand	B_Receiver	B:Confirms	uhm... yah
05:12.5	05:15.4	Marine Vegetation	understand	A_User	A:SERP information request	what kind of results come up
00:07.1	00:13.5	Outsource job India	understand	A_User	A:Initial information request	Search for US unemployment plus outsourcing

Johanne R Trippas, Damiano Spina, Lawrence Cavedon, and Mark Sanderson. 2017. How do people interact in conversational speech-only search tasks: A preliminary analysis. In *Proceedings of the 2017* ACM on Conference on Human Information Interaction and Retrieval (CHIIR). ACM.

Model of conversational search



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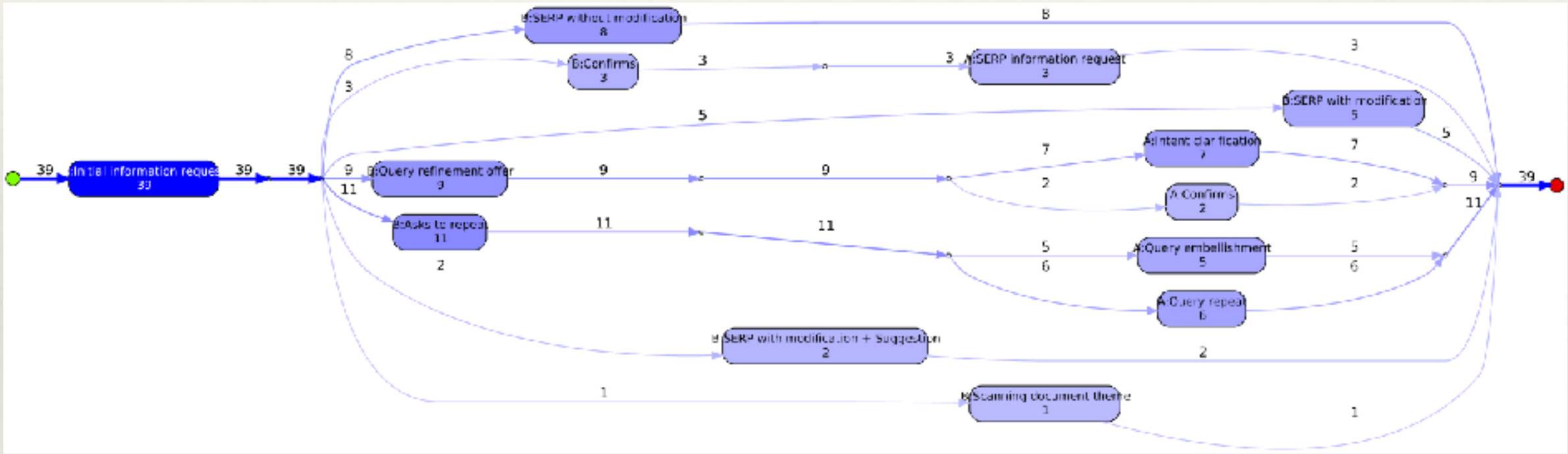
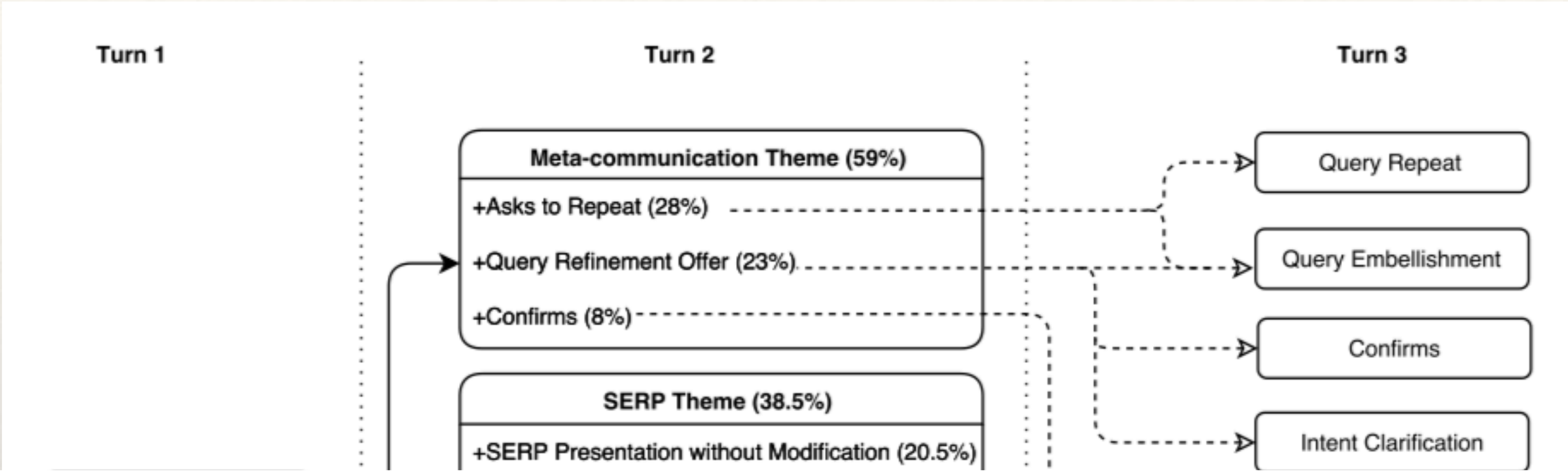
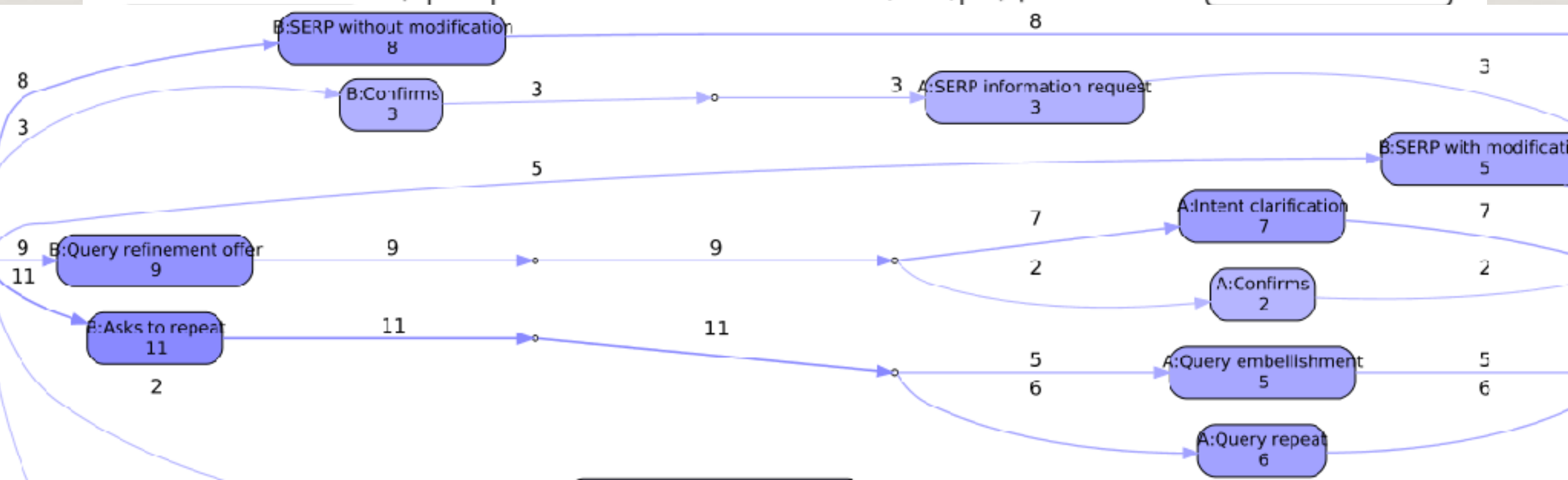
Process discovery



https://www.futurelearn.com/courses/process-mining/0/steps/15642

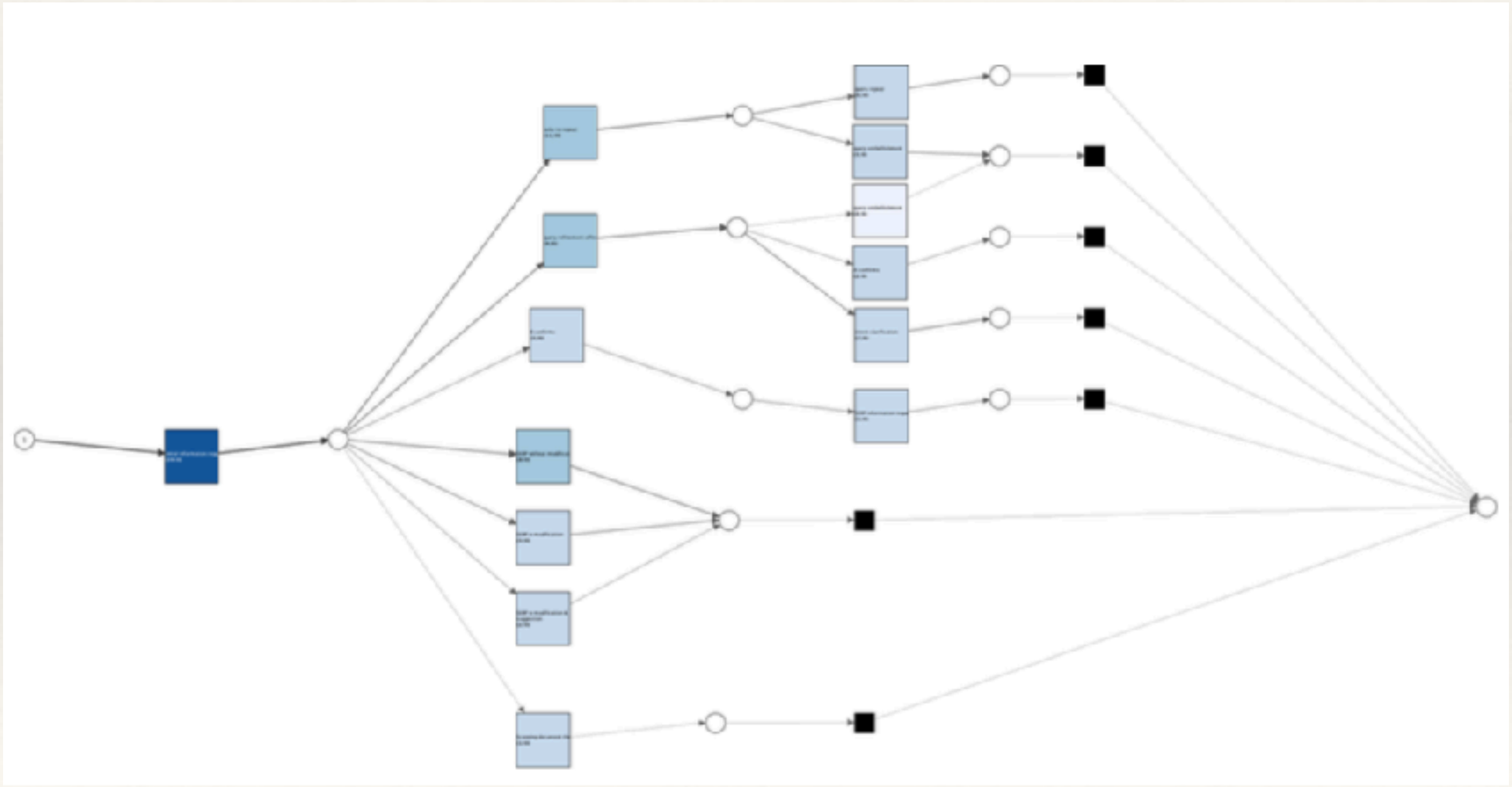
Conformance checking





Conformance checking

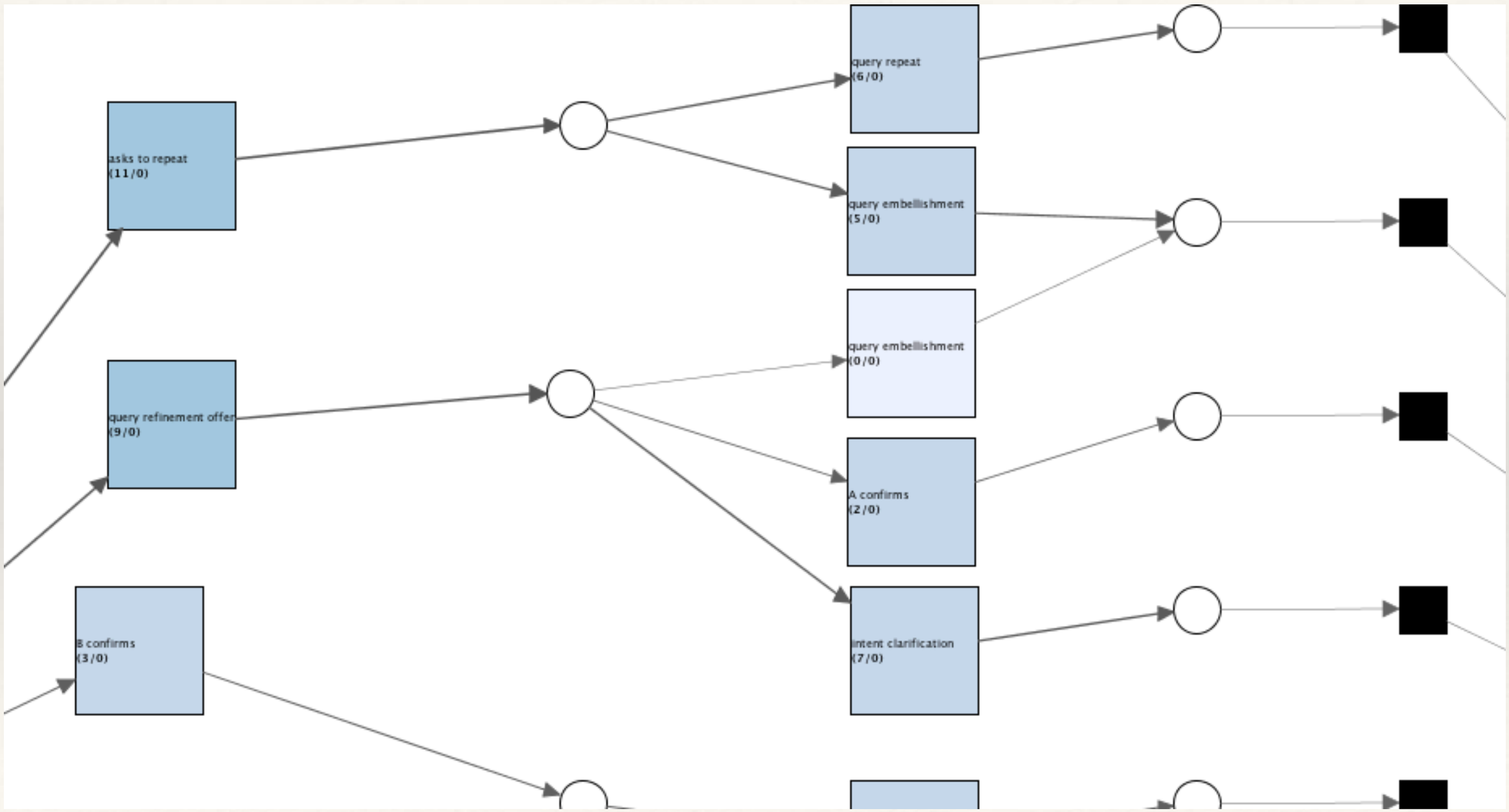
- process model <-> event logs



https://www.futurelearn.com/courses/process-mining/0/steps/15650

Conformance checking

Conformance checking



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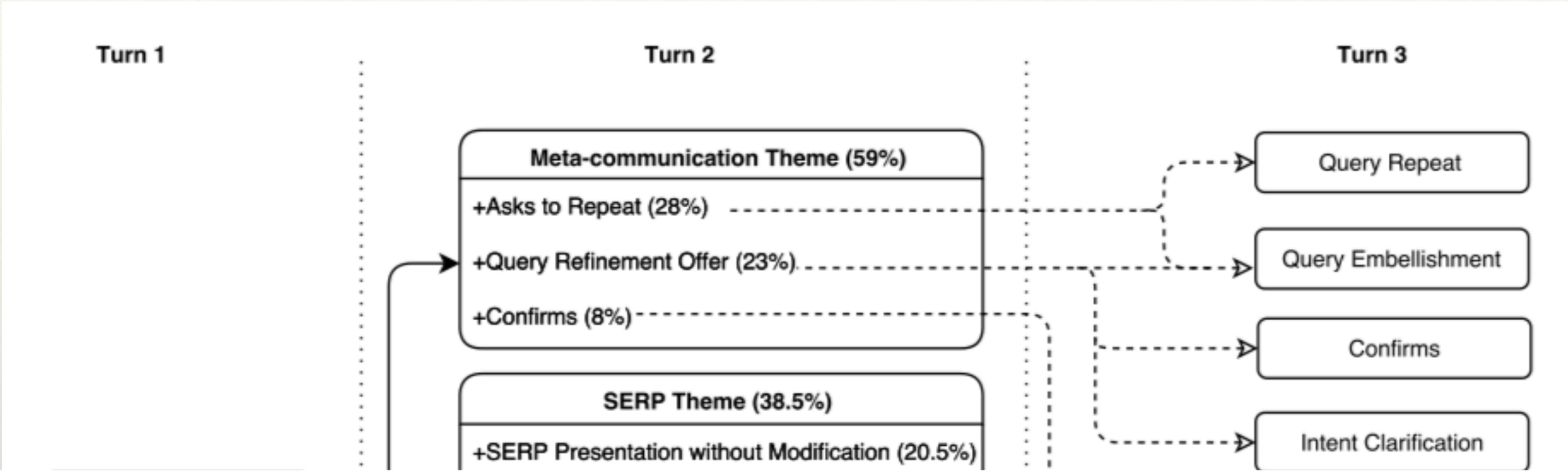
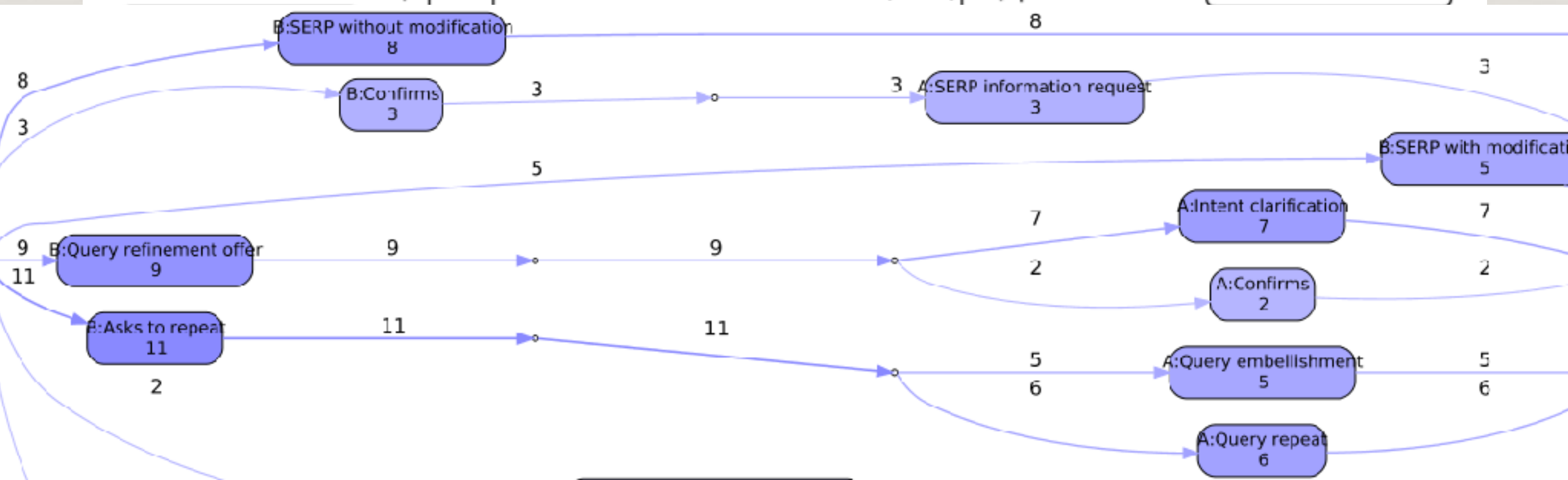
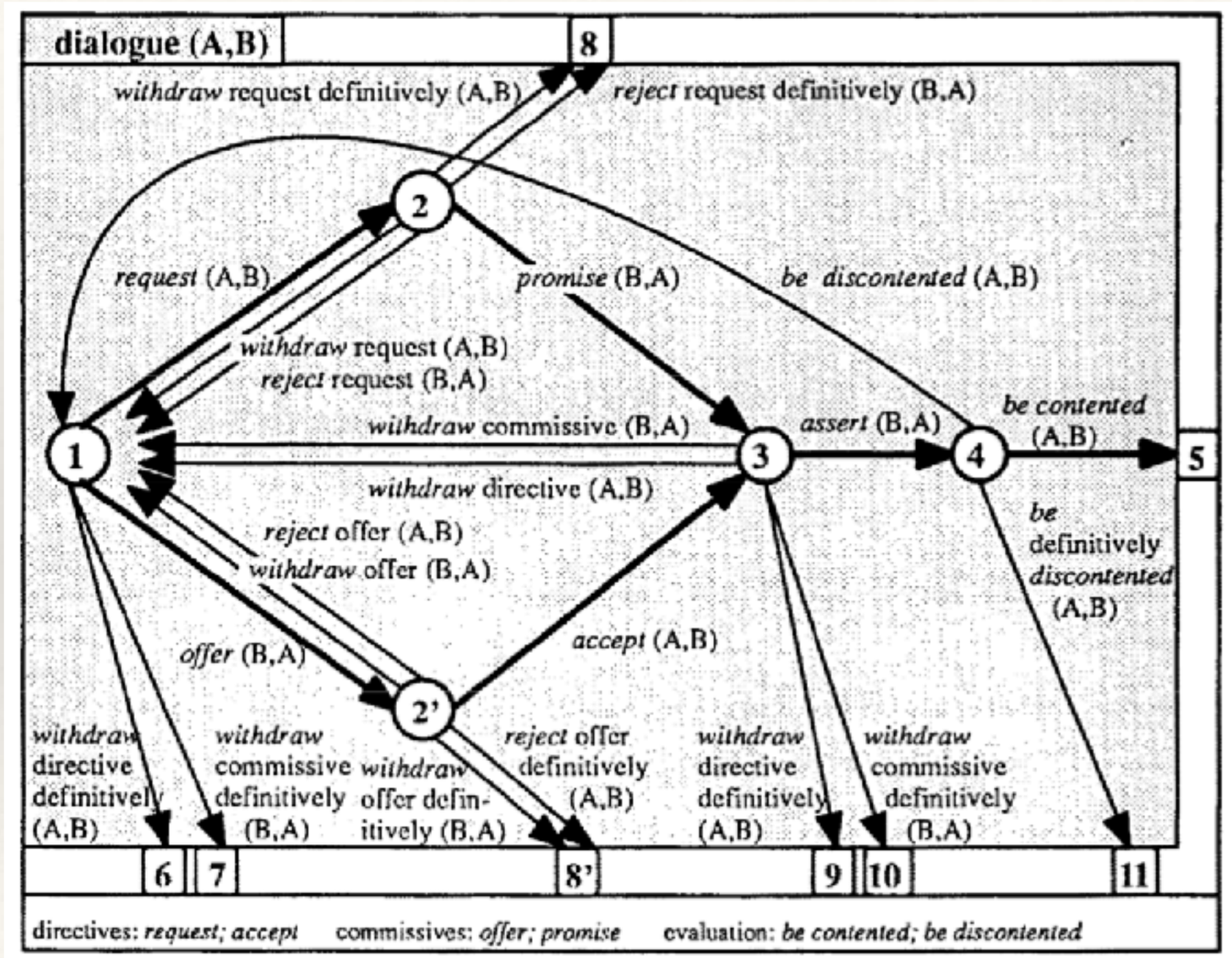
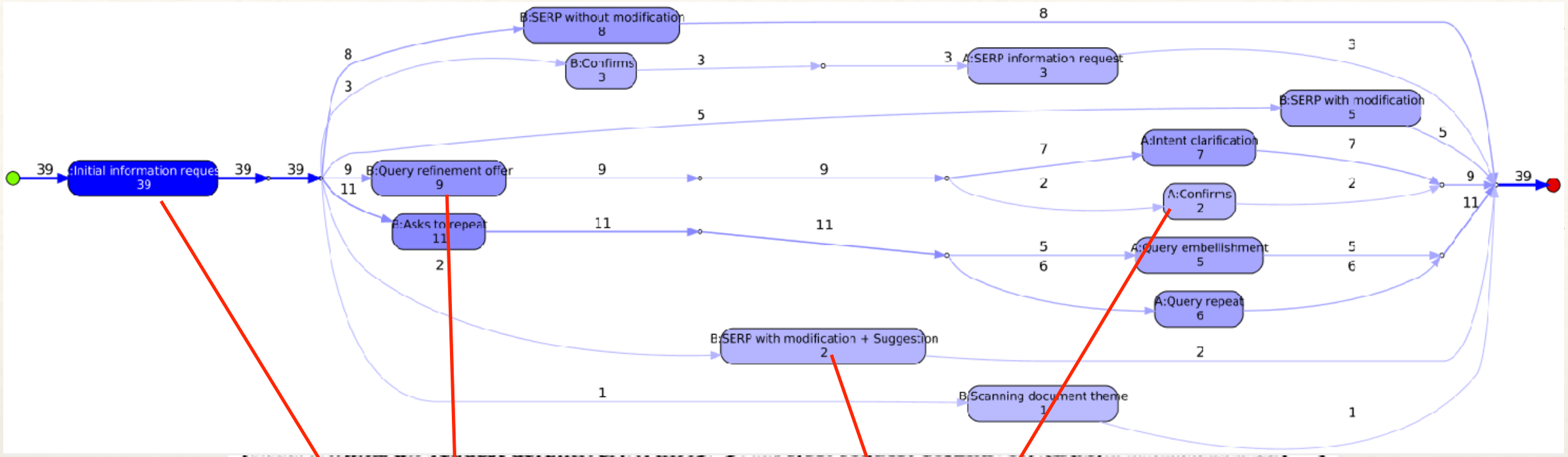
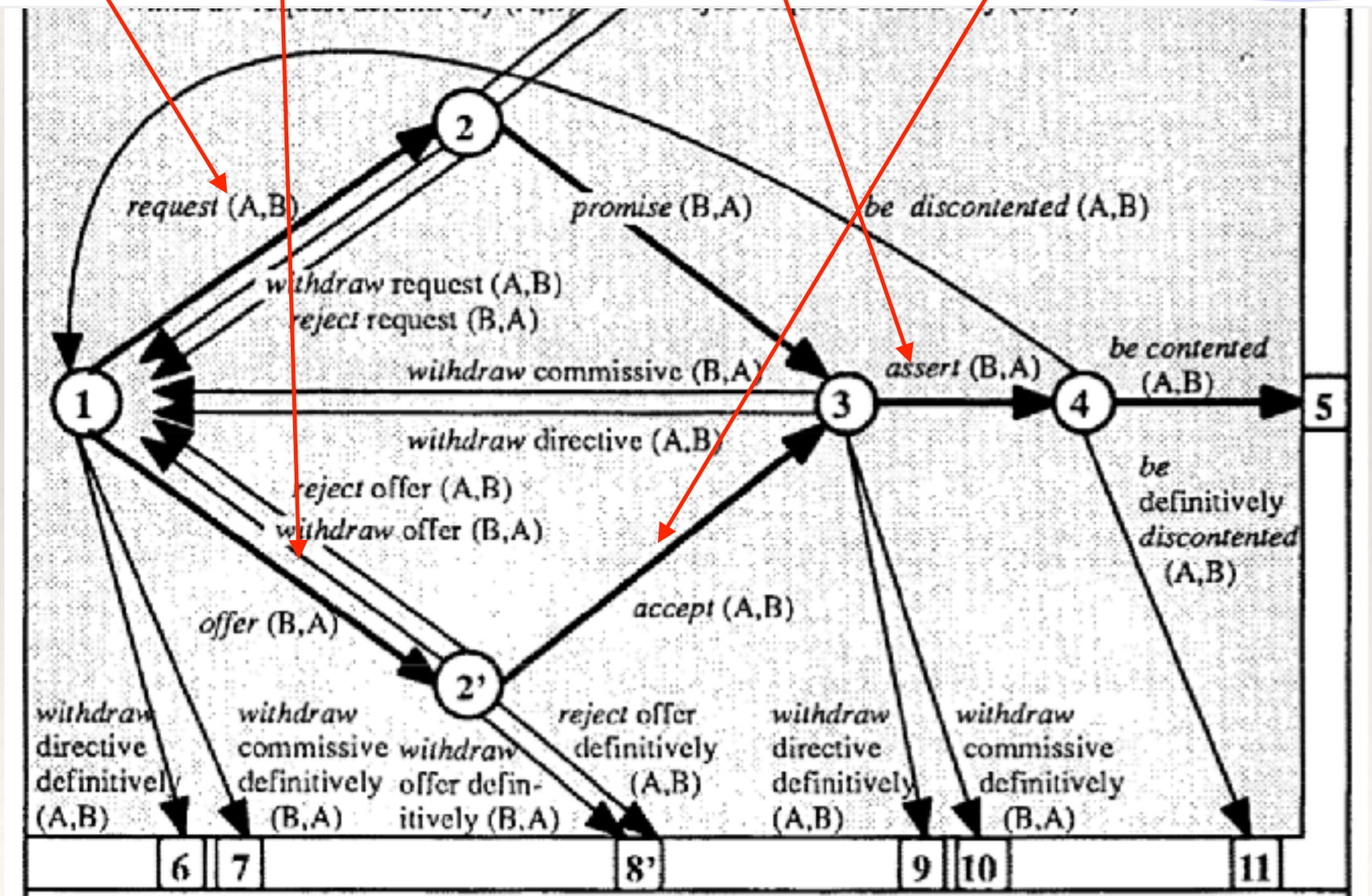




Model

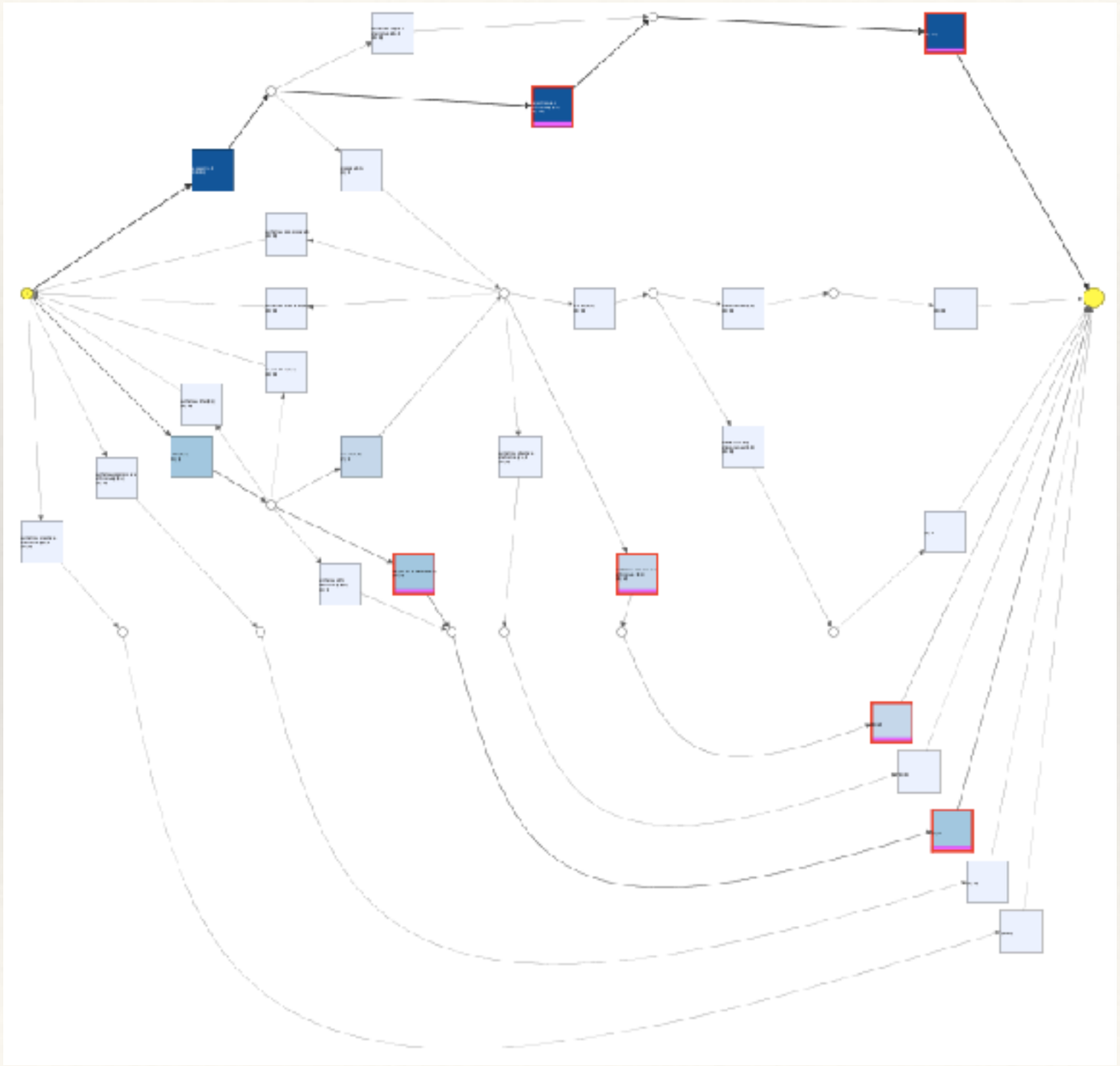

dialogue (A,B)
8
withdraw request definitively (A,B)
reject request definitively (B,A)
2
request (A,B)
promise (B,A)
be discontented (A,B)
withdraw request (A,B)
reject request (B,A)
withdraw commissive (B,A)
assert (B,A)
be contented (A,B)
1
3
4
5
withdraw directive (A,B)
reject offer (A,B)
withdraw offer (B,A)
be definitively discontented (A,B)
offer (B,A)
accept (A,B)
2'
withdraw directive definitively (A,B)
withdraw commissive definitively (B,A)
withdraw offer definitively (B,A)
reject offer definitively (A,B)
withdraw directive definitively (A,B)
withdraw commissive definitively (B,A)
6
7
8'
9
10
11
directives: request; accept
commissives: offer; promise
evaluation: be contented; be discontented


B:SERP without modification
8
B:Confirms
3
A:SERP information request
3
B:SERP with modification
5
A:Intent clarification
7
A:Confirms
2
B:Query refinement offer
9
B:Asks to repeat
11
A:Query embellishment
5
A:Query repeat
6
B:SERP with modification + Suggestion
2
B:Scanning document theme
1
39
39
39
39
9
11
9
9
7
2
11
11
5
6
5
6
2
1
8
8
3
3
3
5
7
2
9
11
39


request (A,B)
promise (B,A)
be discontented (A,B)
withdraw request (A,B)
reject request (B,A)
withdraw commissive (B,A)
assert (B,A)
be contented (A,B)
withdraw directive (A,B)
reject offer (A,B)
withdraw offer (B,A)
be definitively discontented (A,B)
offer (B,A)
accept (A,B)
withdraw directive definitively (A,B)
withdraw commissive definitively (B,A)
withdraw offer definitively (B,A)
reject offer definitively (A,B)
withdraw directive definitively (A,B)
withdraw commissive definitively (B,A)
1
2
2'
3
4
5
6
7
8'
9
10
11
directives: request; accept
commissives: offer; promise
evaluation: be contented; be discontented

Conformance checking

Conformance checking



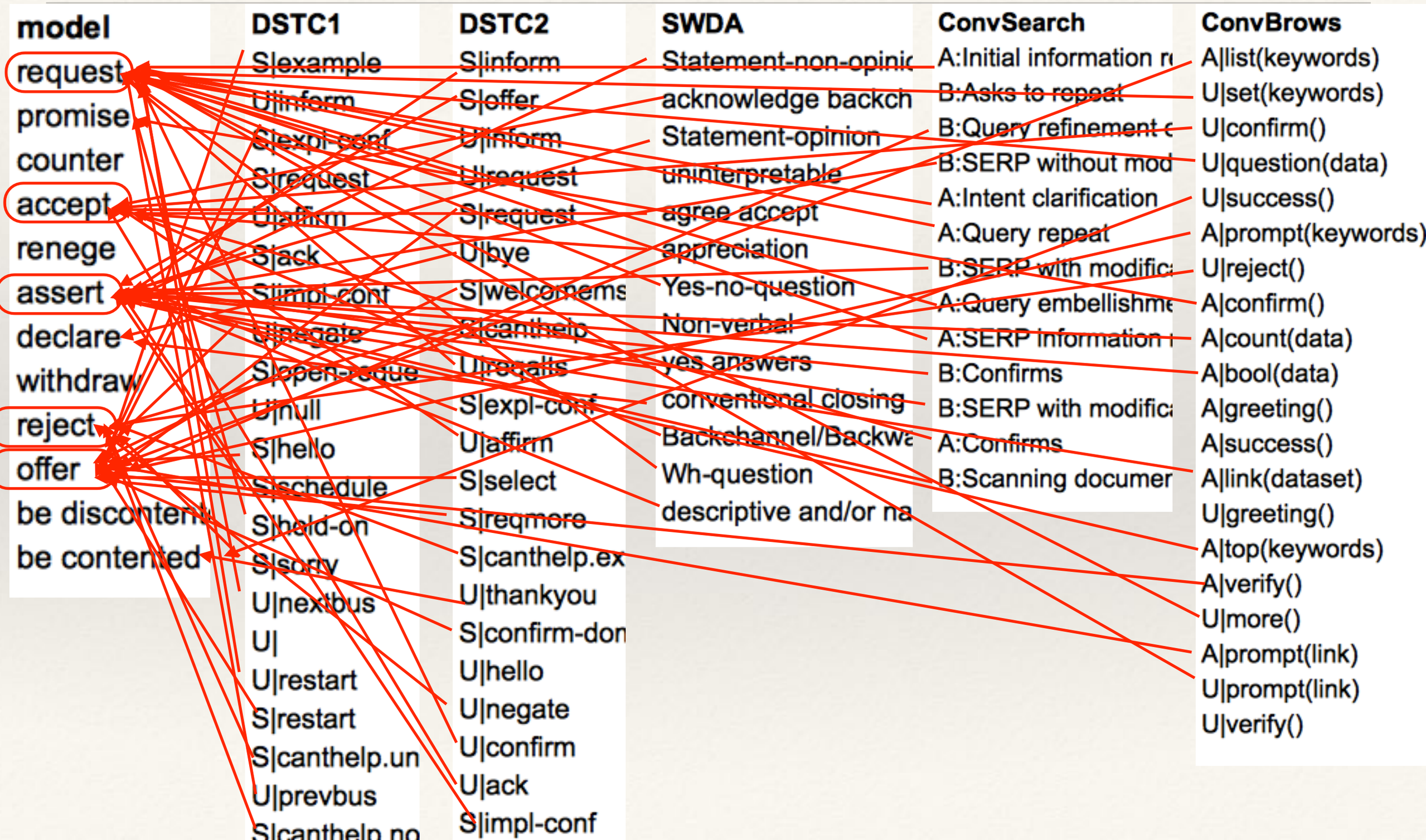
Data sets

- **Human-computer** dialogues:
  - Dialog State Tracking Challenge 1 & 2
- **Human-human (computer mediator)** dialogues:
  - Spoken Conversational Search
  - Open Data Exploration
- **Human-human** conversations:
  - Switchboard Dialog Act Corpus
  - ICSI Meeting Recorder Dialog Act Corpus
  - NPS Chat Corpus

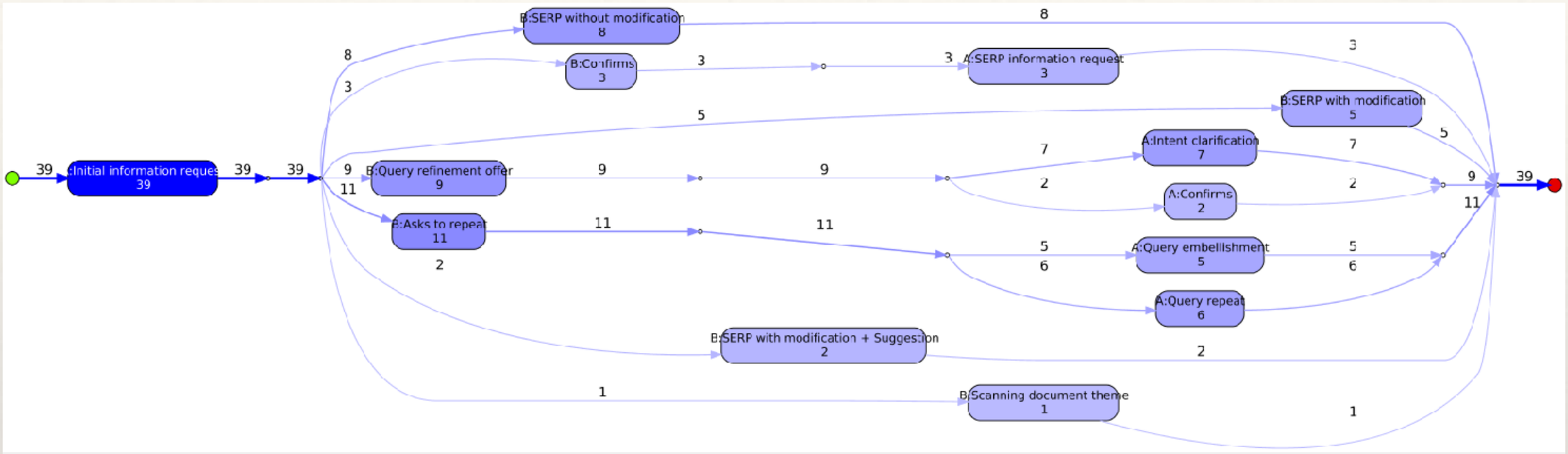
Ontology alignment

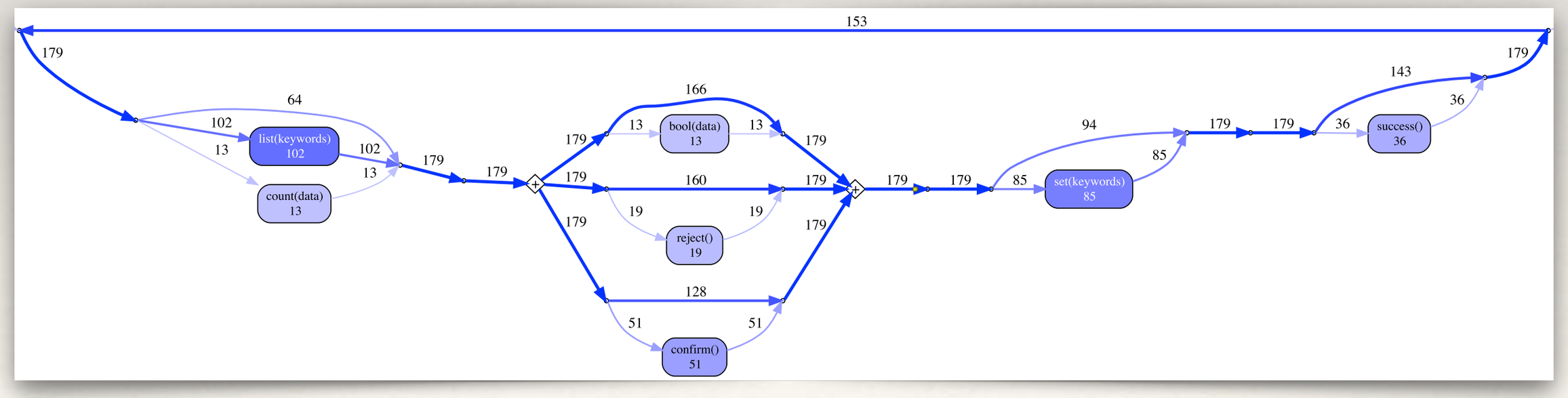
model	DSTC1	DSTC2	SWDA	ConvSearch	ConvBrows
request	S|example	S|inform	Statement-non-opinic	A:Initial information r	A|list(keywords)
promise	U|inform	S|offer	acknowledge backch	B:Asks to repeat	U|set(keywords)
counter	S|expl-conf	U|inform	Statement-opinion	B:Query refinement c	U|confirm()
accept	S|request	U|request	uninterpretable	B:SERP without mod	U|question(data)
renege	U|affirm	S|request	agree accept	A:Intent clarification	U|success()
assert	S|ack	U|bye	appreciation	A:Query repeat	A|prompt(keywords)
declare	S|impl-conf	S|welcomems	Yes-no-question	B:SERP with modifica	U|reject()
withdraw	U|negate	S|canthelp	Non-verbal	A:Query embellishme	A|confirm()
reject	S|open-reque	U|reqalts	yes answers	A:SERP information r	A|count(data)
offer	U|null	S|expl-conf	conventional closing	B:Confirms	A|bool(data)
be discontent	S|hello	U|affirm	Backchannel/Backwa	B:SERP with modifica	A|greeting()
be contented	S|schedule	S|select	Wh-question	A:Confirms	A|success()
	S|hold-on	S|reqmore	descriptive and/or na	B:Scanning documer	A|link(dataset)
	S|sorry	S|canthelp.ex			U|greeting()
	U|nextbus	U|thankyou			A|top(keywords)
	U|	S|confirm-don			A|verify()
	U|restart	U|hello			U|more()
	S|restart	U|negate			A|prompt(link)
	S|canthelp.un	U|confirm			U|prompt(link)
	U|prevbus	U|ack			U|verify()
	S|canthelp.no	S|impl-conf			

Ontology alignment

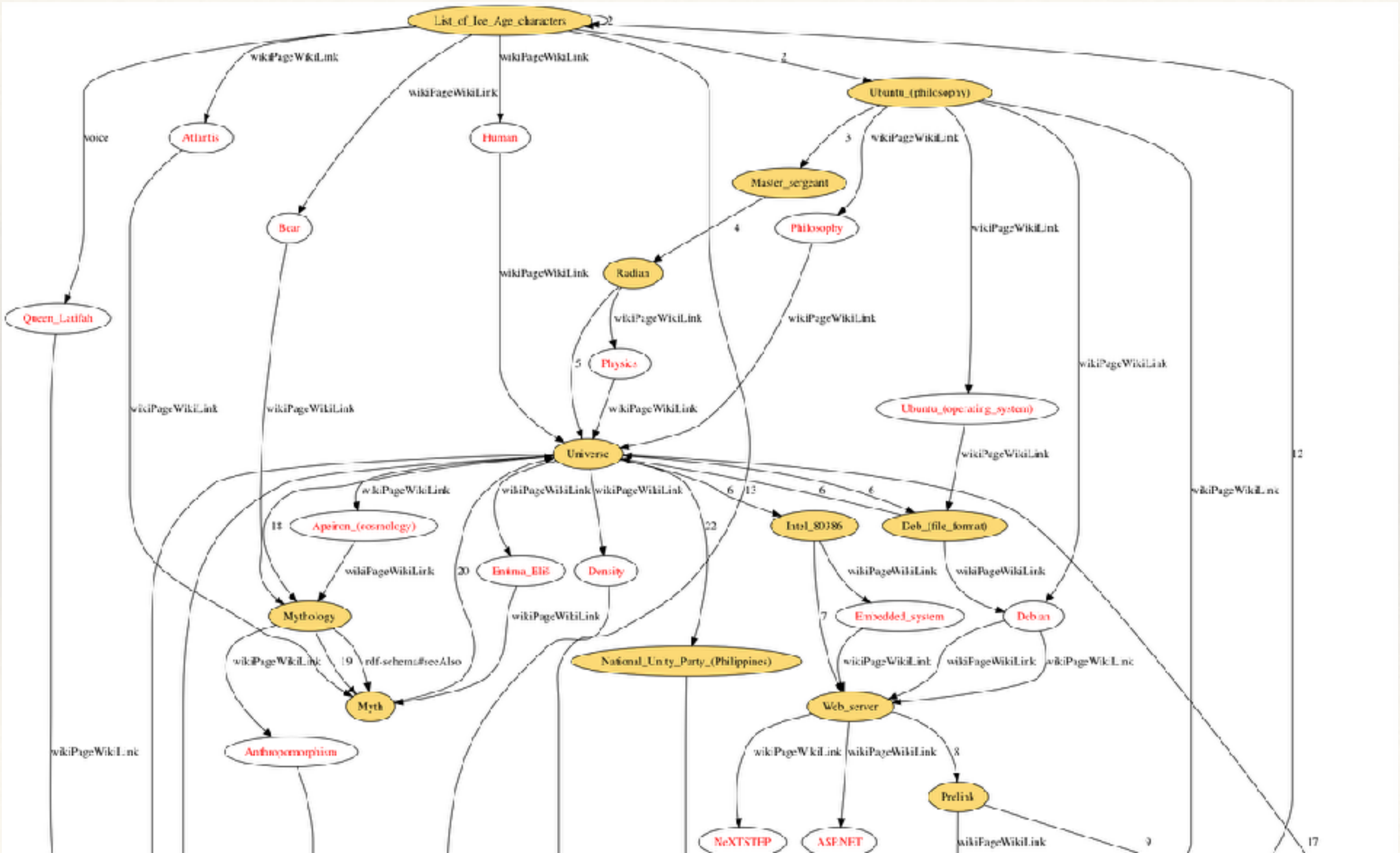


Process discovery





Conversational semantics



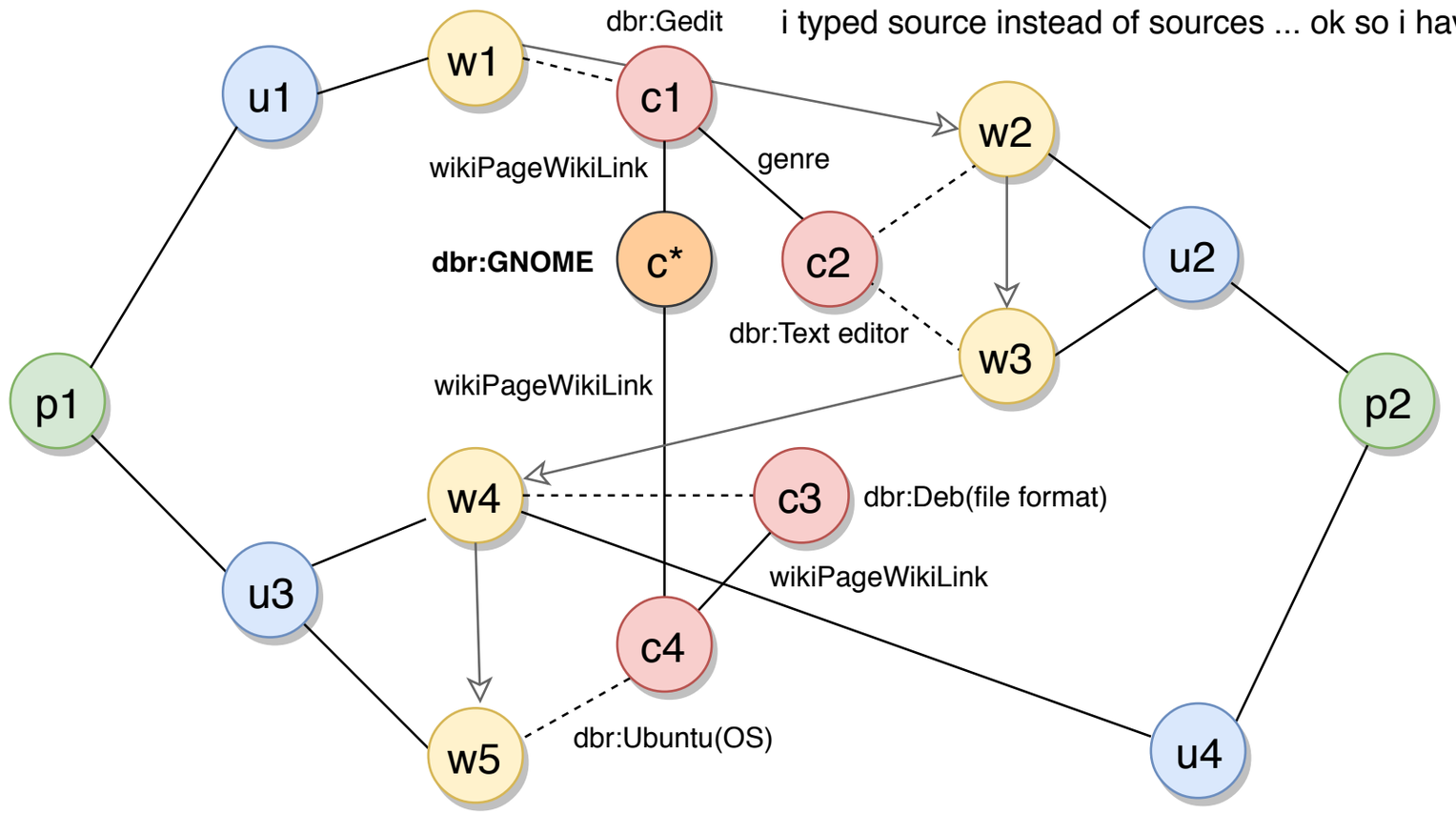
Dialogue graph

w1

mdg: gksudo **gedit** /etc/apt/source.list
(type from command line)

w2 w3

crunchbang666: the **text editor** has opened the file source.list but there is no content
i typed source instead of sources ... ok so i have it open



w4 w5

mdg: see the line # **deb** http://gb.archive.**ubuntu**
all you have to do is delete the ""#"" character

w4

crunchbang666: just the **deb** or the deb-src line too?