Dialogue Management

Alexandra Peters

Athens, March 2000

Why corpus based dialogue analysis ?

- Preparation for design of automatic speech processing system
- Provides insight in dialogues
  - Specific characteristics/topics
  - Underlying structure/model
  - Knowledge extraction

Dialogue analysis overview

- Coding of the dialogues
- Constructing dialogue model
- Dialogue management from the operator's point of view
- Modelling operator's knowledge

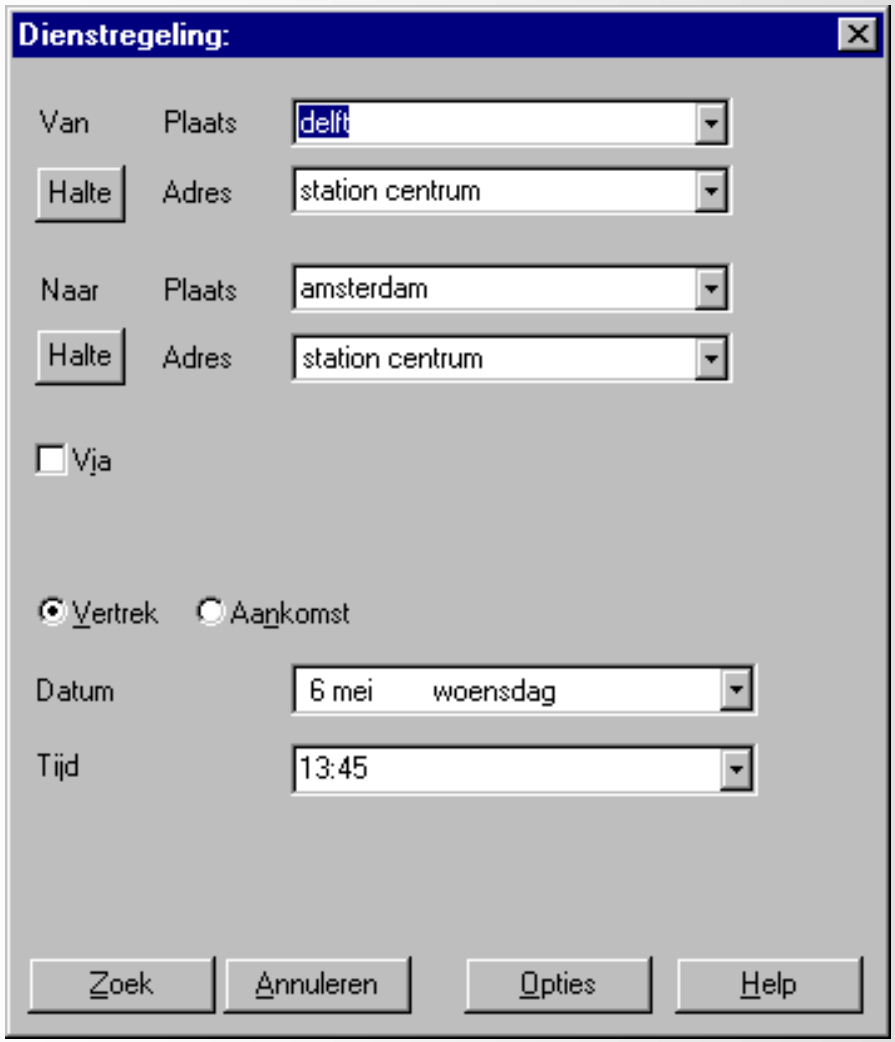
Openbaar Vervoer Reisinformatie (O.V.R.)

- Provides information by telephone concerning public transport services in the Netherlands
- Over 400 telephone operators
- 13 mln calls per year

  9 mln successfully handled

  4 mln waiting queue

O.V.R. travel planner



Non-directive dialogue fragment

operator : Good afternoon, travel information.

client : Good afternoon, I want to go to Utrecht [ehm].

operator : Yes... [noise]

client : And I leave from Delft, no ….. from Rotterdam.

operator : From Rotterdam to Utrecht, yes…

client : I want to be in Utrecht before lunch time.

operator : There is a connection every hour. The first train from Utrecht to Rotterdam leaves at six ten.

client : ….

Directive dialogue fragment

operator : Good afternoon, from which station to which station do you want to travel?

client : Good afternoon, I want to go from Delft to Utrecht.

operator : At what time do you want to leave or arrive?

client : I want to leave this evening at eight o'clock.

operator : Do you have a moment, please?

client : Yes.

operator : The expected arrival at Utrecht central station is eight fifty five. You have to change trains at Rotterdam central station.

client : ….

Dialogue analysis overview

- ***Coding of the dialogues***
- Constructing dialogue model
- Dialogue management from the operator's point of view
- Modelling operator's knowledge

Coding constraints

- Different dialogue acts for operator and client
- One dialogue act per utterance
- Trivial remarks are less important
- No use of prosody
  - Non-verbal utterances are discarded

Dialogue acts

	Operator		*Client*
OO	Opening operator	OC	Opening client
V	Verification	AV	Answer verification
CL	Clarification	ACL	Answer clarification
NI	New information	ANI	Answer new information
R	Repetition	AR	Answer repetition
RO	Remark operator	RC	Remark client
GA	Give answer	QC	Question client
GO	Goodbye operator	GC	Goodbye client

Dialogue example

Dialogue			Coding
operator	:	good afternoon travel information.	OO
client	:	good afternoon I want to know what time the train leaves from Delft to Amsterdam central station	OC
operator	:	what time do you want to arrive	NI
client	:	around eleven o'clock	ANI
operator	:	you can leave at nine fifty eight	GA
client	:	nine fifty eight	RC
operator	:	then you arrive at Amsterdam central station at ten fifty five	GA
client	:	thank you bye	GC
operator	:	your welcome bye	GO

Factors that influence coding

- Prosody
  - Subjective coding
  - Meaning non-verbal utterances
- History and future needed
  - Relations between utterances

Example

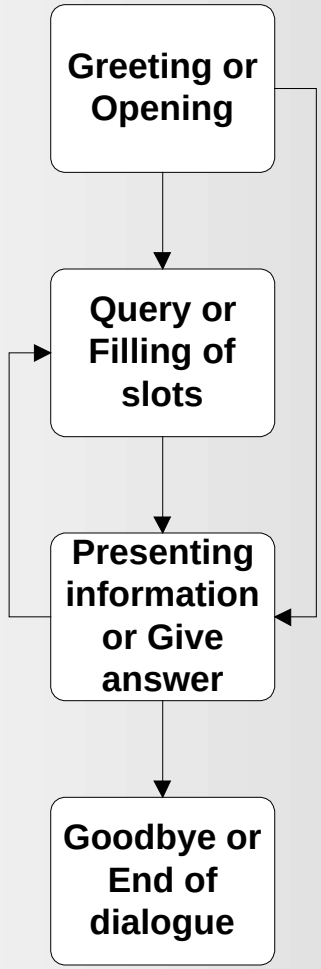
‘Central station’

- *answer*
  - ‘From which station in Amsterdam are you leaving?’
- *verification question*
  - ‘Yes, Amsterdam central station.’
- *remark/paraphrase*
  - ‘And then you arrive at two o’clock in Utrecht.’

Dialogue analysis overview

- Coding of the corpus
- ➔ ***Constructing dialogue model***
- Dialogue management from the operator's point of view
- Modelling operator's knowledge

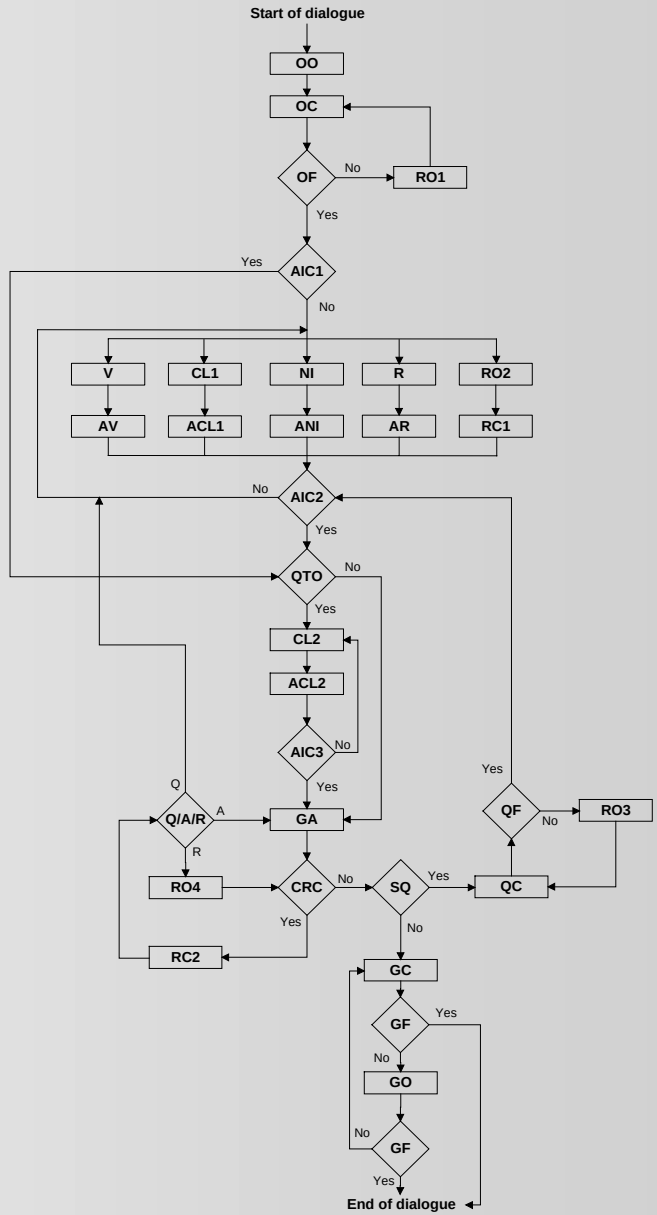
Top level dialogue model



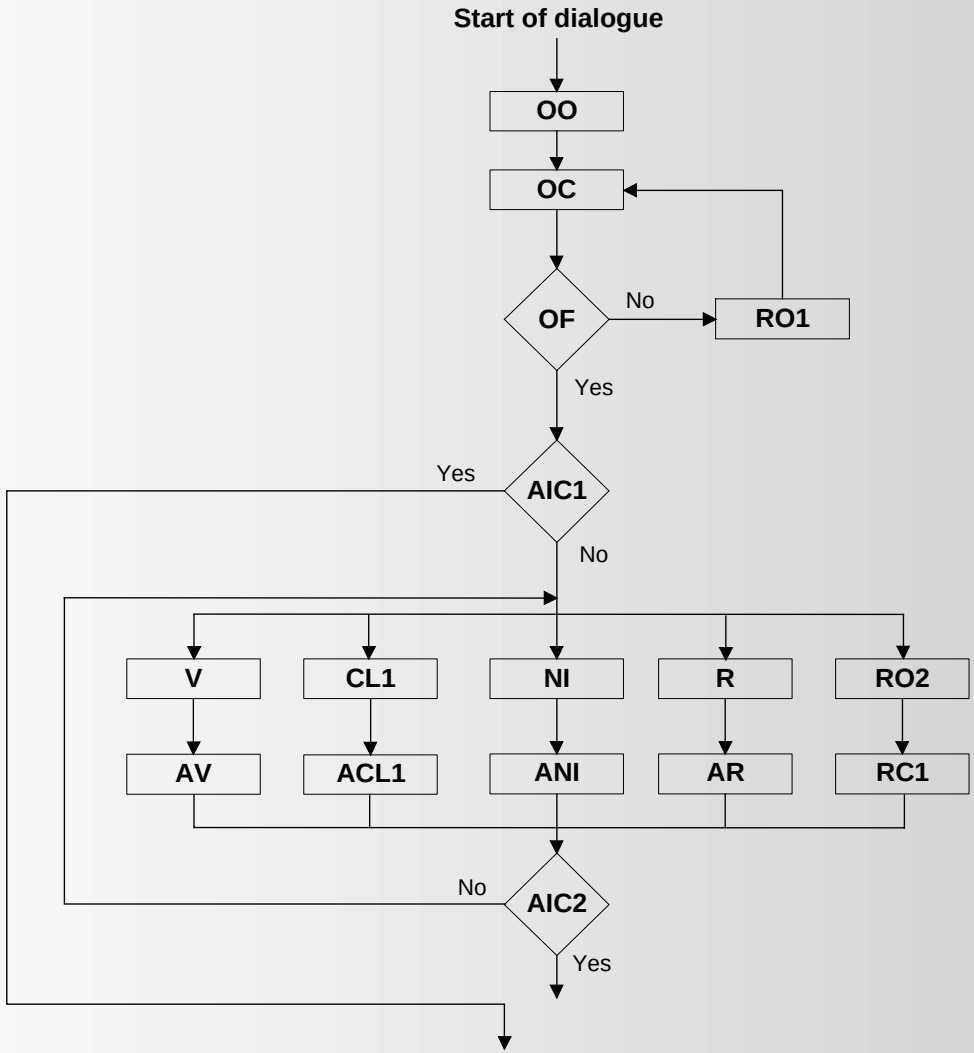
Dialogue example

Greeting or Opening	*operator*:	good afternoon, travel information
	client:	good afternoon, I want to know what time the train from Delft to Amsterdam central station leaves
Query or Filling of slots	*operator*:	what time do you want to arrive
	client:	around eleven o'clock
Presenting information or Give answer	*operator*:	you can leave at nine fifty eight
	client:	nine fifty eight
	operator:	then you arrive at Amsterdam central station at ten fifty five
Goodbye or End of dialogue	*client*:	thank you, bye
	operator:	your welcome, bye

Lower level dialogue model



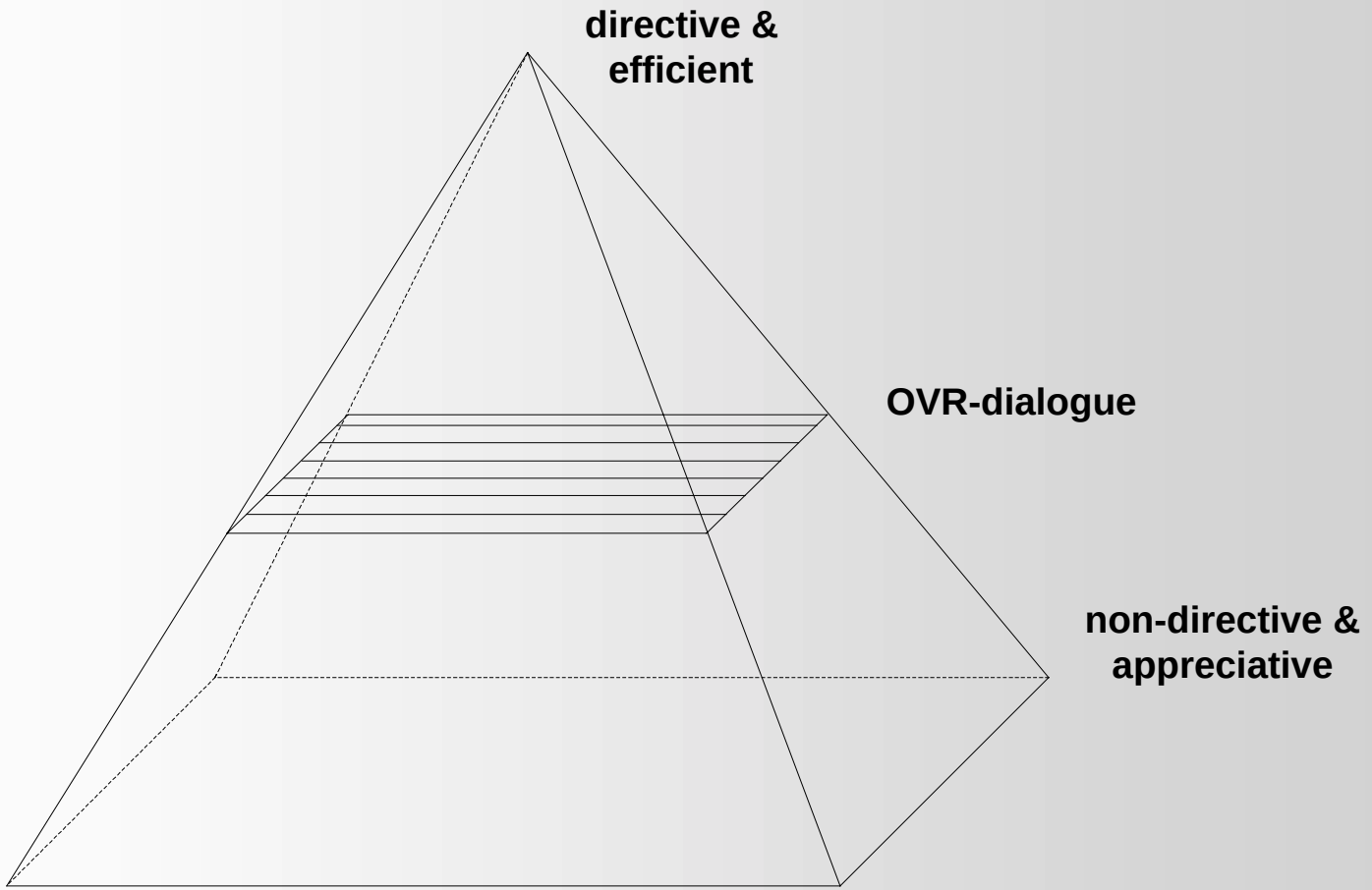
Lower level dialogue model



Dialogue analysis overview

- Coding of the corpus
- Constructing dialogue model
- ➔ ***Dialogue management from the operator's point of view***
- Modelling operator's knowledge

Dialogue strategies



Non-directive dialogue fragment

operator : Good afternoon, travel information.

client : Good afternoon, I want to go to Utrecht [ehm].

operator : Yes... [noise]

client : And I leave from Delft, no ….. from Rotterdam.

operator : From Rotterdam to Utrecht, yes…

client : I want to be in Utrecht before lunch time.

operator : There is a connection every hour. The first train from Utrecht to Rotterdam leaves at six ten.

client : *….*

Directive dialogue fragment

operator : Good afternoon, from which station to which station do you want to travel?

client : Good afternoon, I want to go from Delft to Utrecht.

operator : At what time do you want to leave or arrive?

client : I want to leave this evening at eight o'clock.

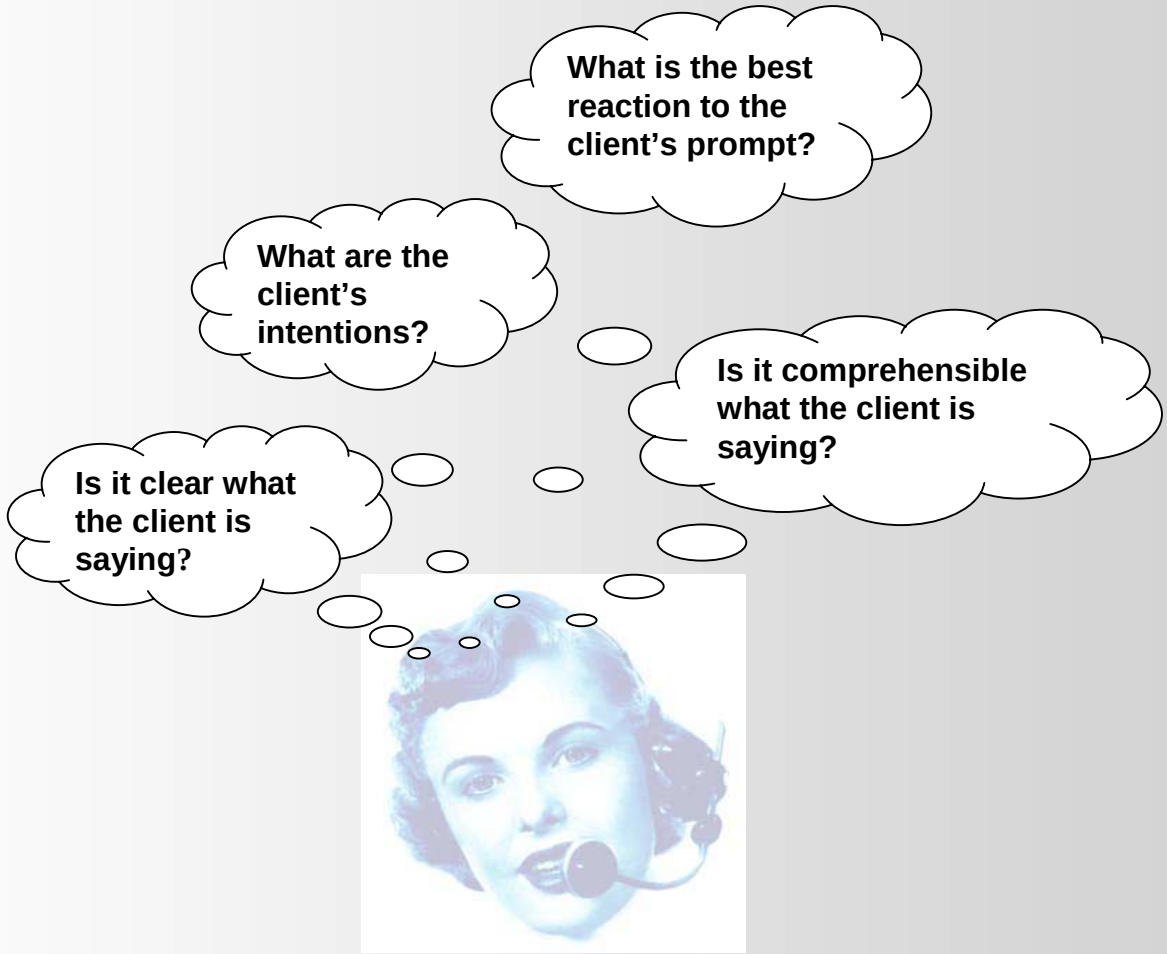
operator : Do you have a moment, please?

client : Yes.

operator : The expected arrival at Utrecht central station is eight fifty five. You have to change trains at Rotterdam central station.

client : ….

Operator's thoughts



Possible hypotheses

Good afternoon, I want to arrive in Amsterdam at 10 o'clock and I leave from Utrecht.

He probably wants to know at what time he can leave for Amsterdam

He probably wants to arrive at ten o'clock tonight because now it's eleven o'clock in the morning

He probably wants to travel today

He probably wants to leave from Utrecht Central Station

He probably wants to travel by train

He probably wants to go to Amsterdam Central Station

Possible prompts

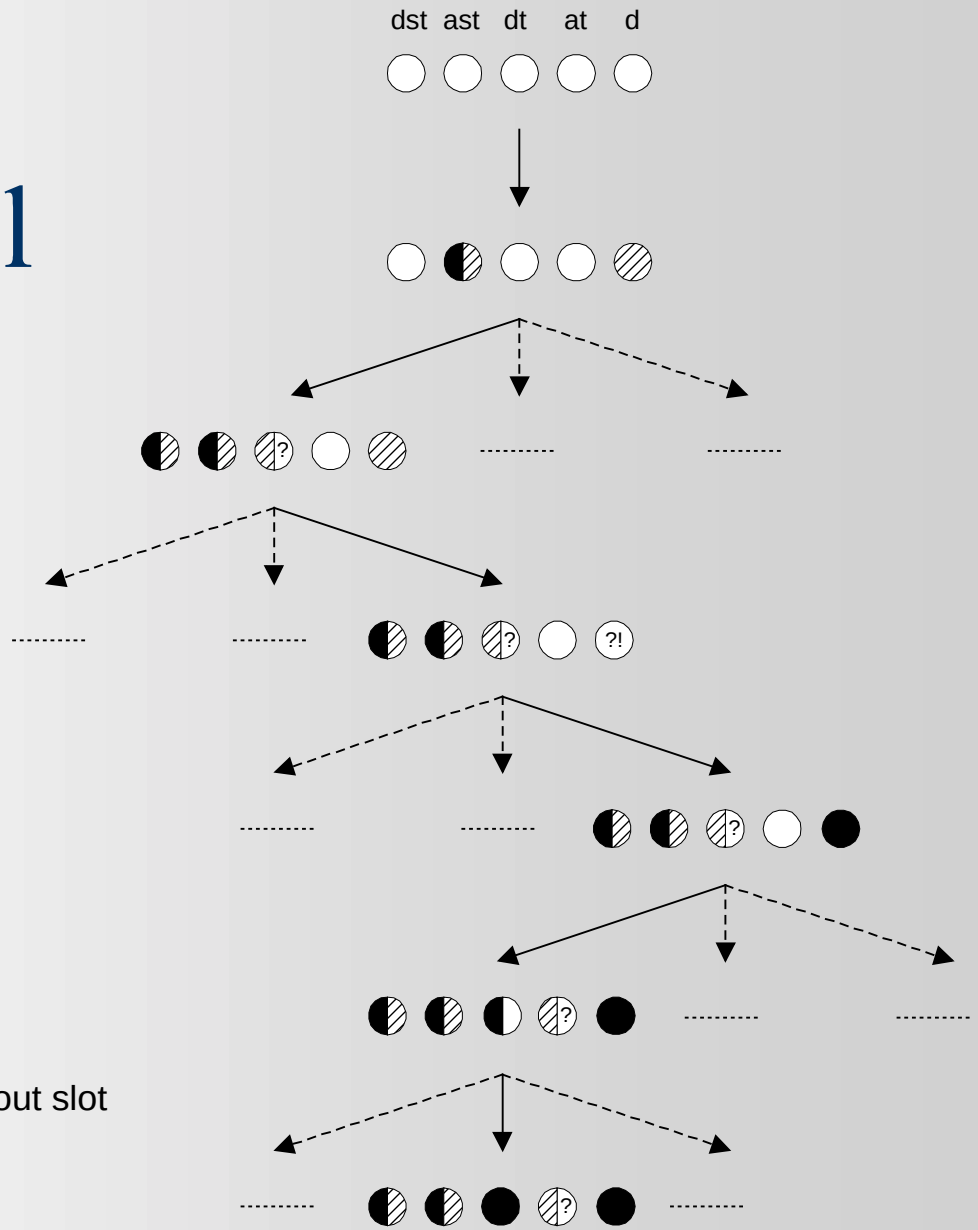
Strategies

- Min-Max principle
- Reduction of ambiguity
- Request for new information
- Completion of information
- Reduction of errors

Examples

- I want to go to Amsterdam..
  - + Yes...
  - – Amsterdam central station?
- I want to be in Delft at nine o’clock tomorrow. At what time can I leave from Utrecht?
  - + Are you leaving from Utrecht central station?
  - – Yes….

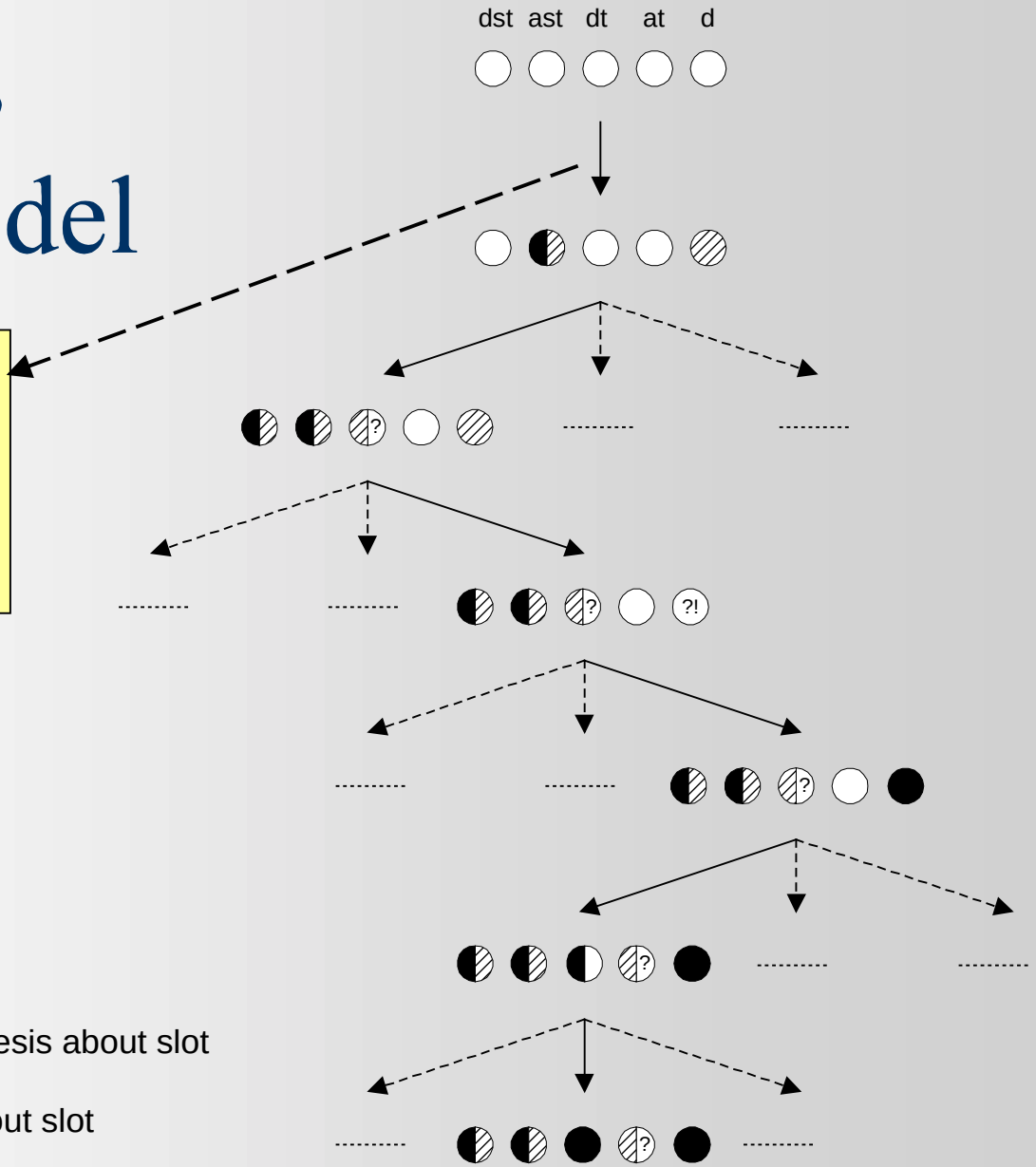
Operator's mental model



- ? slot asked by client
- open slot
- filled slot
- semi-filled slot
- operator has a hypothesis about slot
- ?! operator uncertain about slot

Operator's mental model

Operator:
good afternoon, travel information
Client:
good afternoon, I want to go to Utrecht



? slot asked by client

open slot

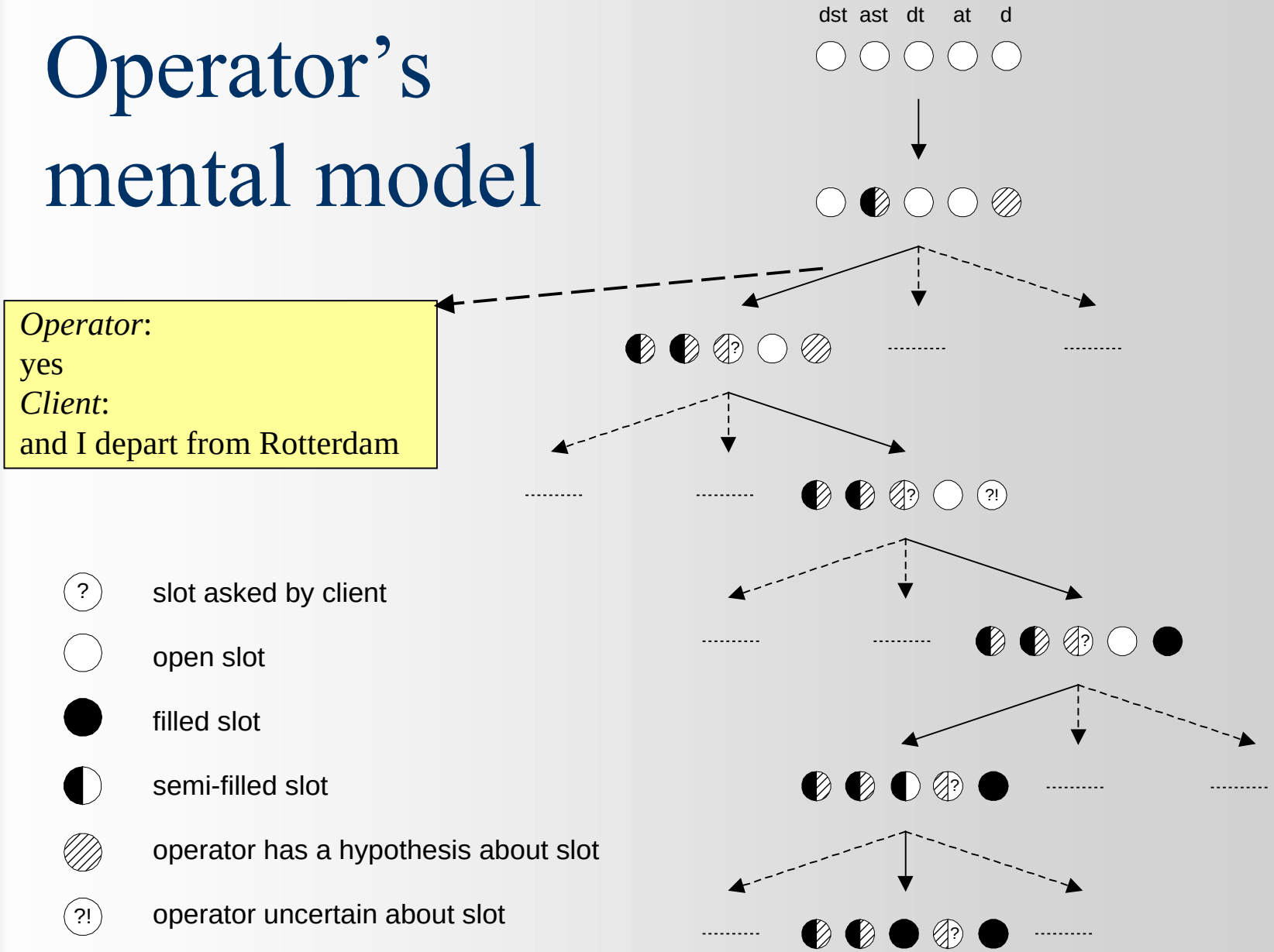
filled slot

semi-filled slot

operator has a hypothesis about slot

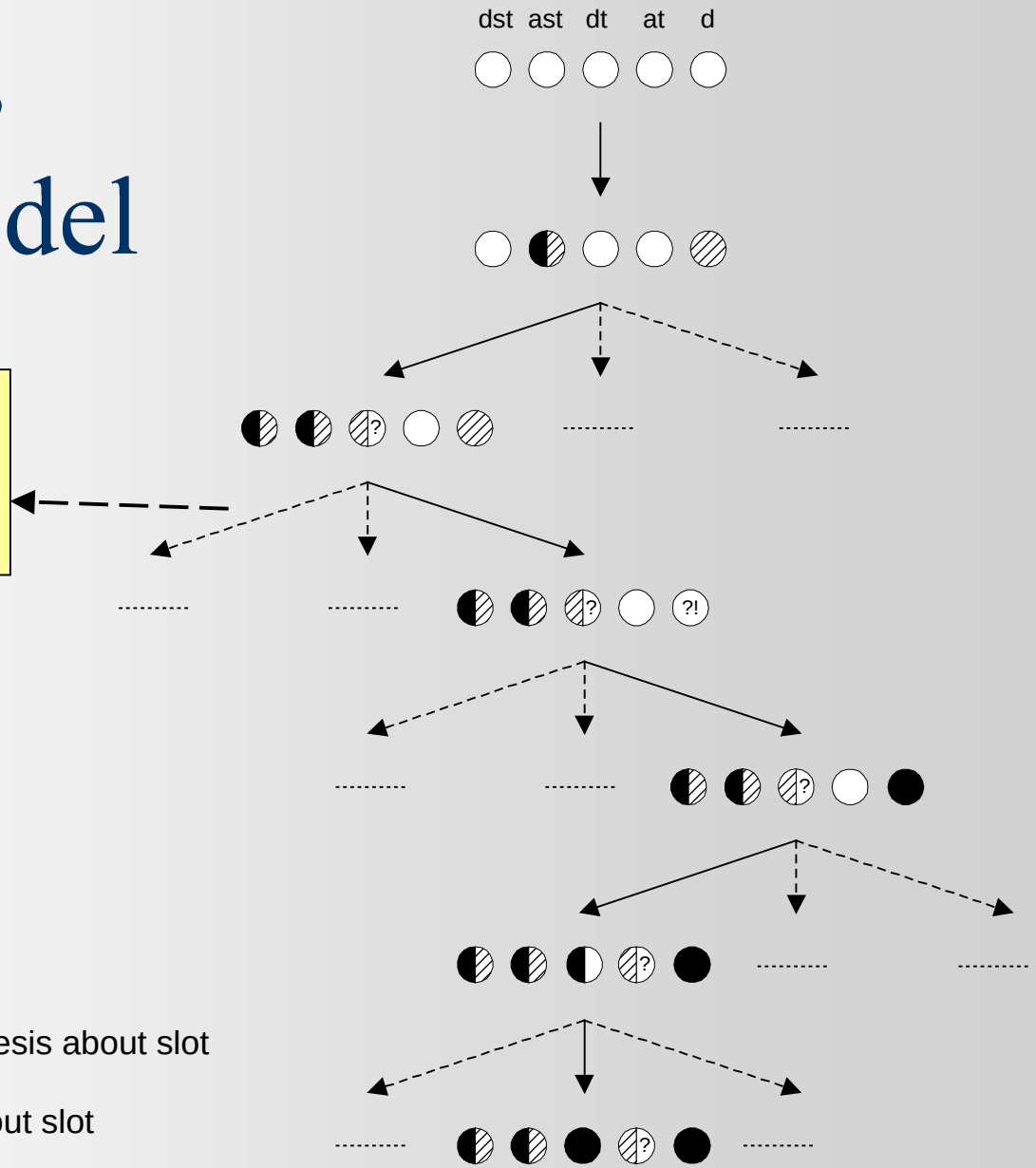
?! operator uncertain about slot

Operator's mental model



Operator's mental model

Operator:
when do you want to travel
Client:
the day after tomorrow



? slot asked by client

open slot

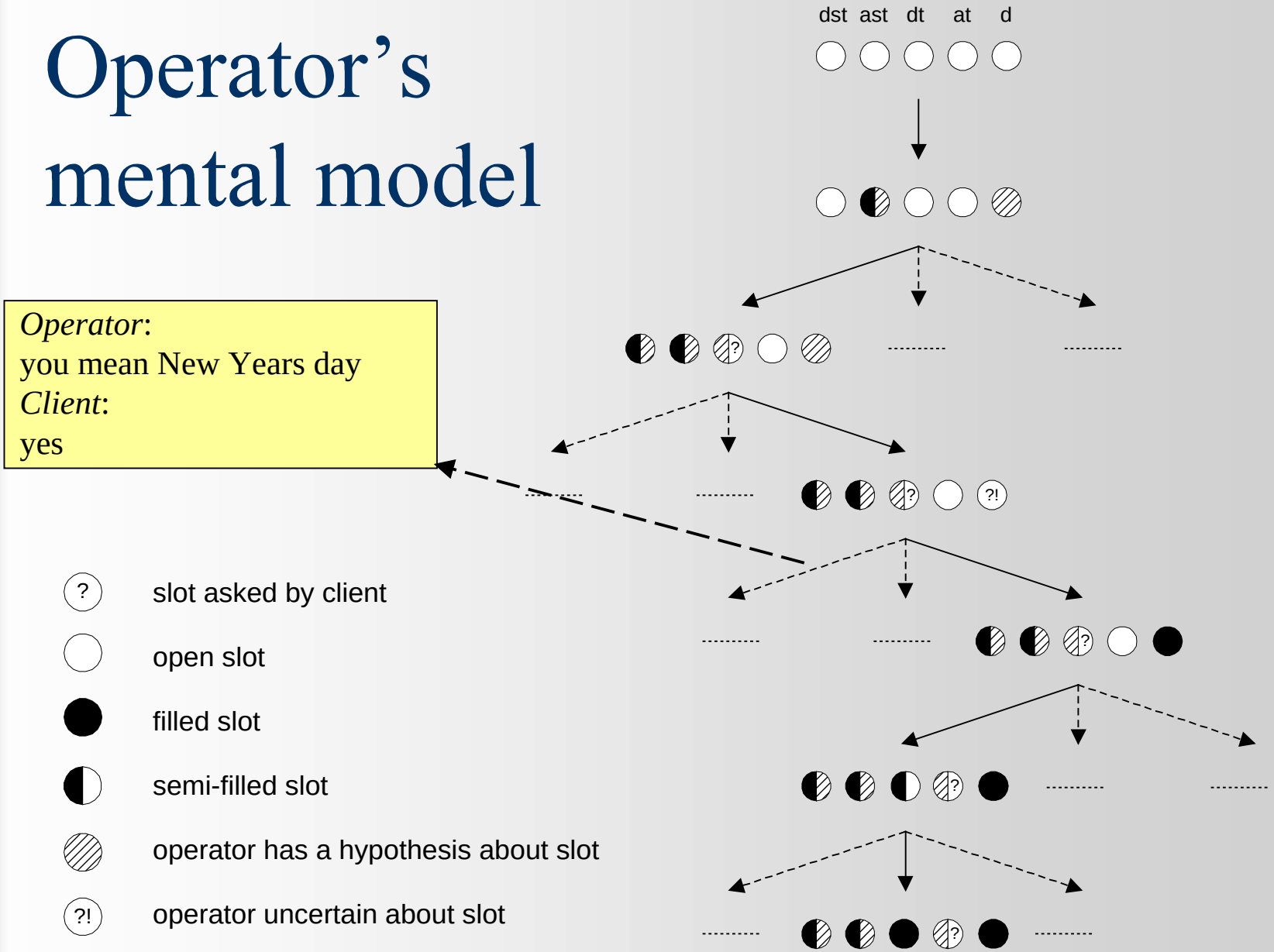
filled slot

semi-filled slot

operator has a hypothesis about slot

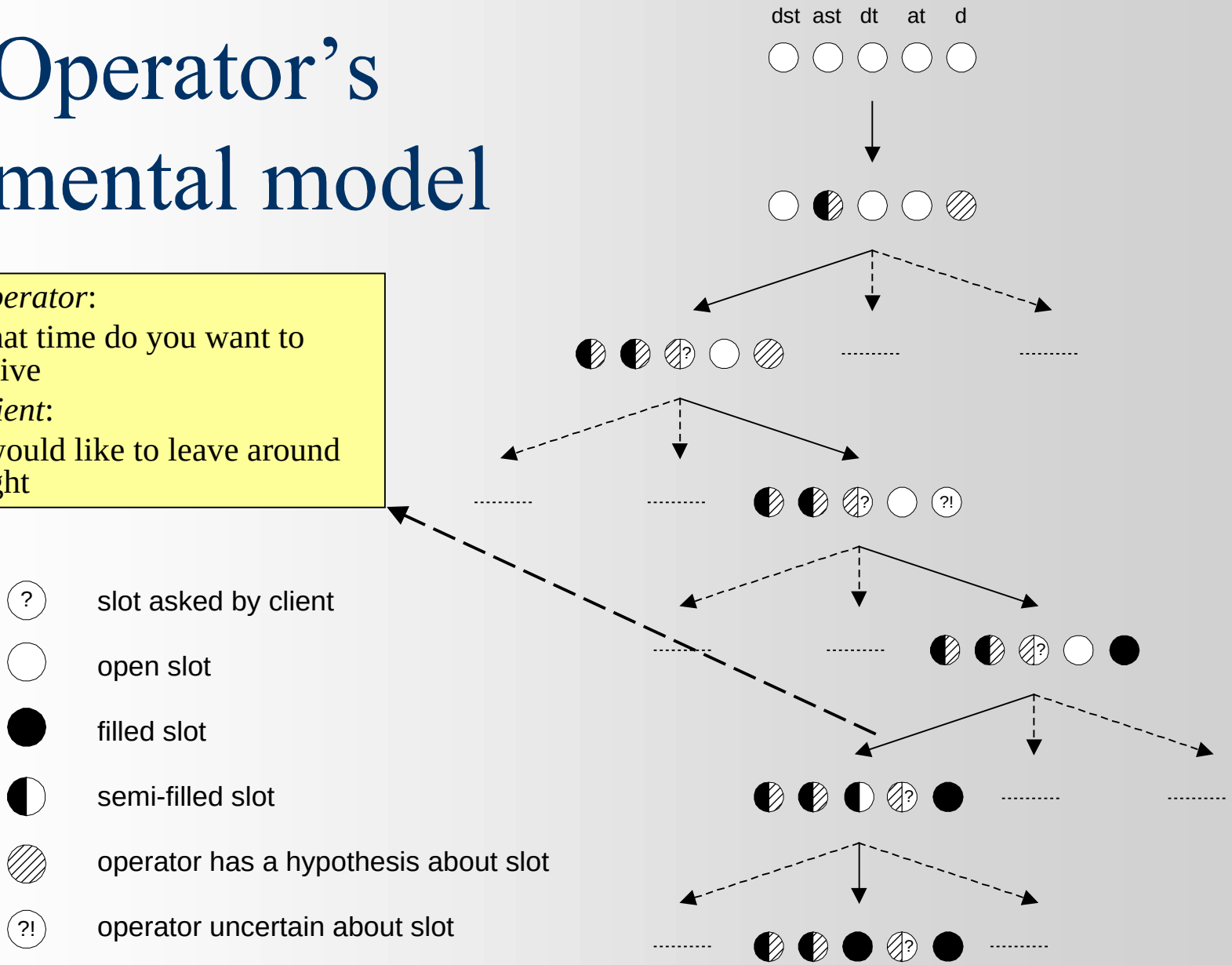
?! operator uncertain about slot

Operator's mental model



Operator's mental model

Operator:
what time do you want to arrive
Client:
I would like to leave around eight



? slot asked by client

open slot

filled slot

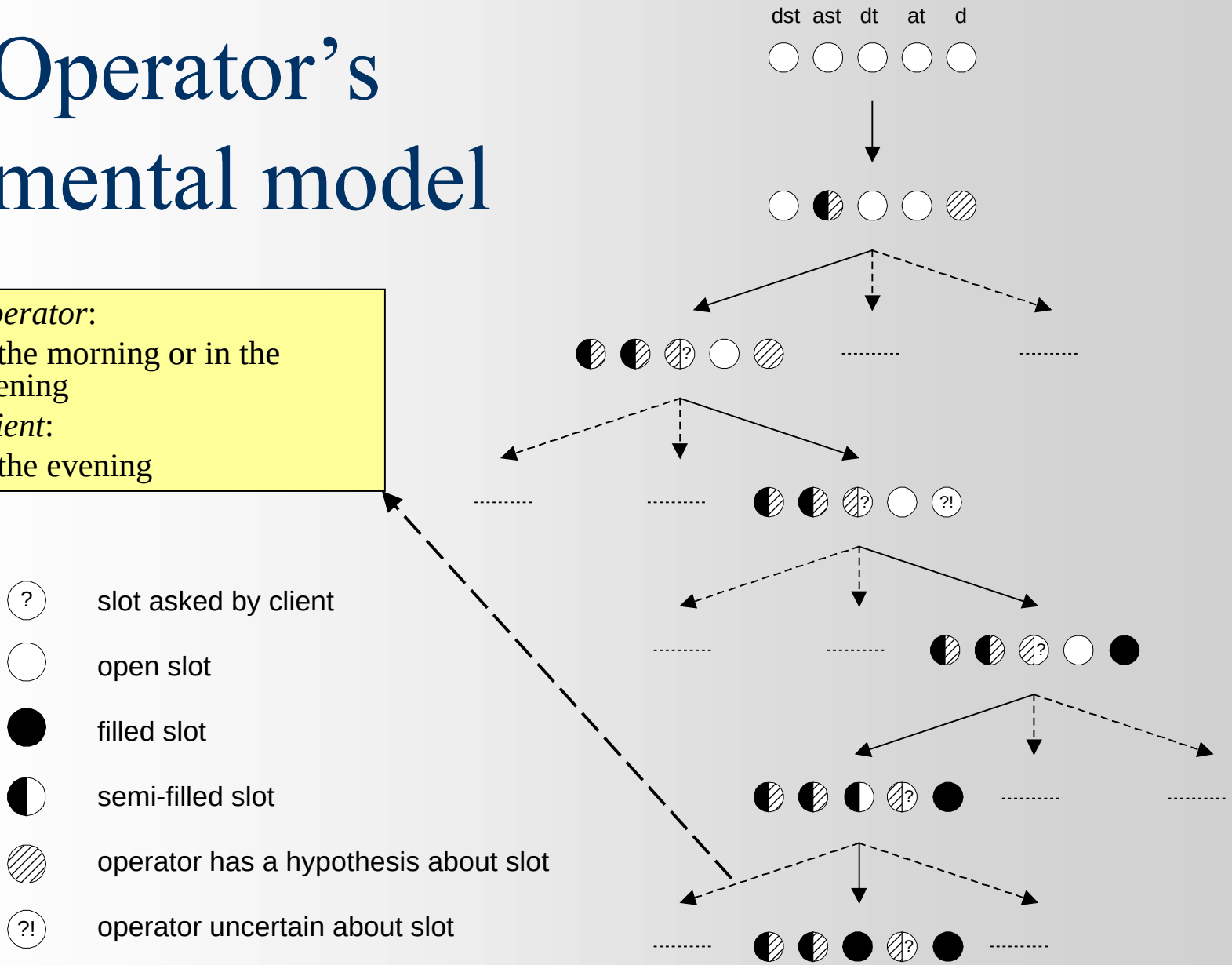
semi-filled slot

operator has a hypothesis about slot

?! operator uncertain about slot

Operator's mental model

Operator:
in the morning or in the evening
Client:
in the evening



? slot asked by client

open slot

filled slot

semi-filled slot

operator has a hypothesis about slot

?! operator uncertain about slot

Dialogue analysis overview

- Coding of the dialogues
- Constructing dialogue model
- Dialogue management from the operator's point of view
- ➔ Modelling operator's knowledge

Operator's knowledge

- Terminology
- Time interpretation
- Geographical knowledge
- Time tables
- Common sense
- Dialogue management

Questions?

Lunch?