

# The SAAM Coaching Decision Support System

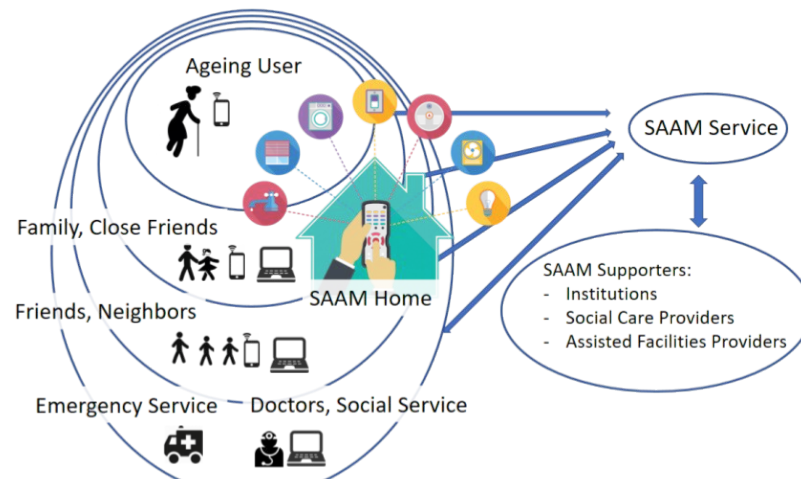
Martin Žnidaršič, Bernard Ženko, Aljaž Osojnik, Peter Rupnik  
Department of Knowledge Technologies  
Jožef Stefan Institute, Slovenia



This project has received funding from the European Union's Horizon 2020  
research and innovation programme under grant agreement No 769661

# Coaching in SAAM

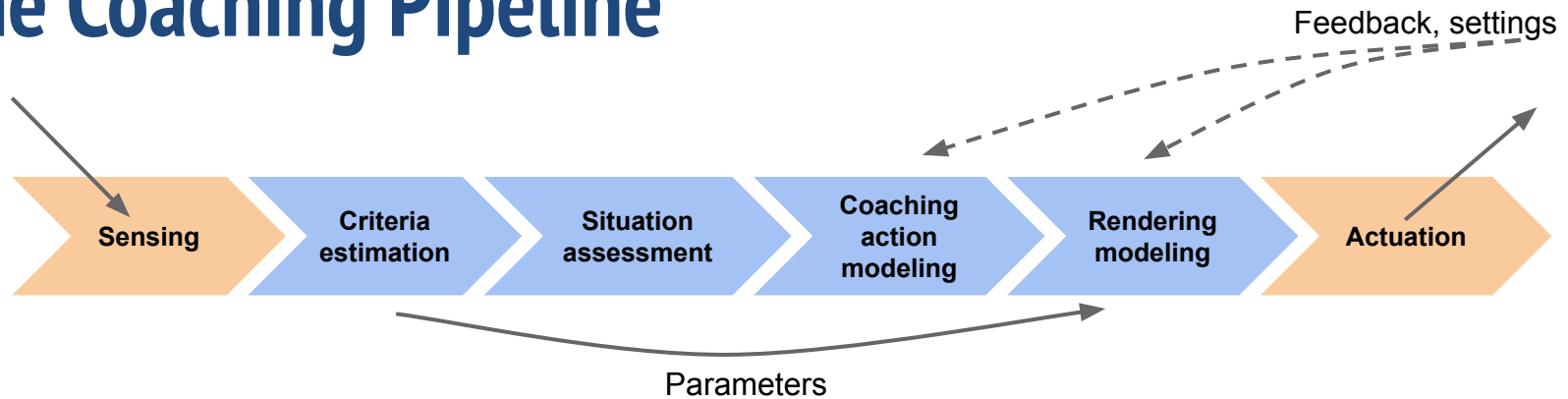
- Support for active ageing and independent living
- Unobtrusive sensing
- Coaching directly and through social circles



- Coaching domains:



# The Coaching Pipeline



- Information path  
from sensors to coaching actions
- Cascade of models for reasoning

## Coaching pipelines in SAAM:

**Sleep Quality**

**Activity - cooking**

**Activity - outside**

**Social Activity - family**

**Social Activity - friends**

**Social Activity - general**

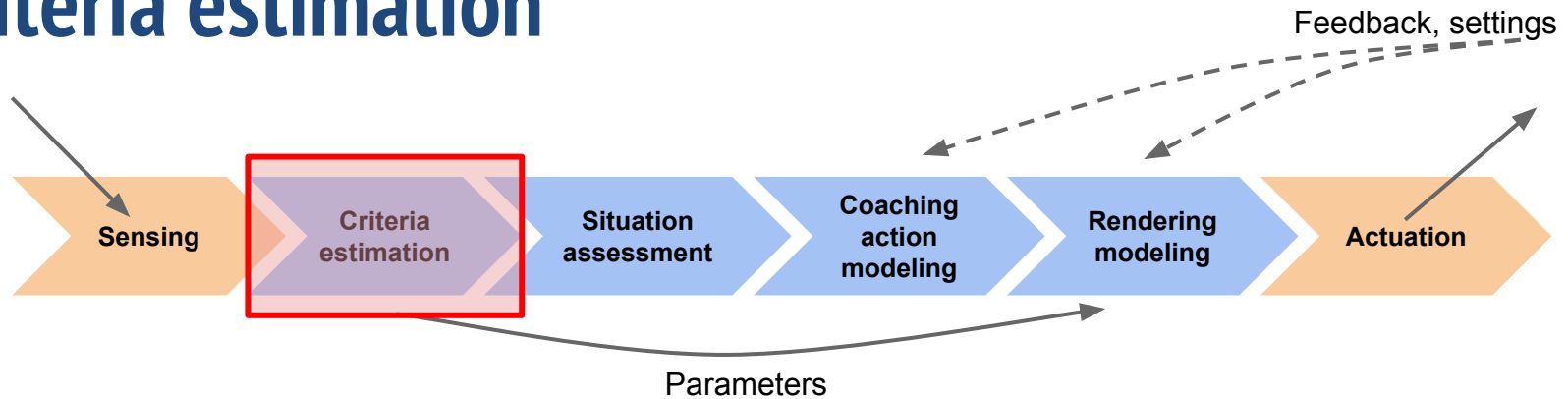
**Social Activity - community**

**Mobility - general**

**Mobility - instructed**



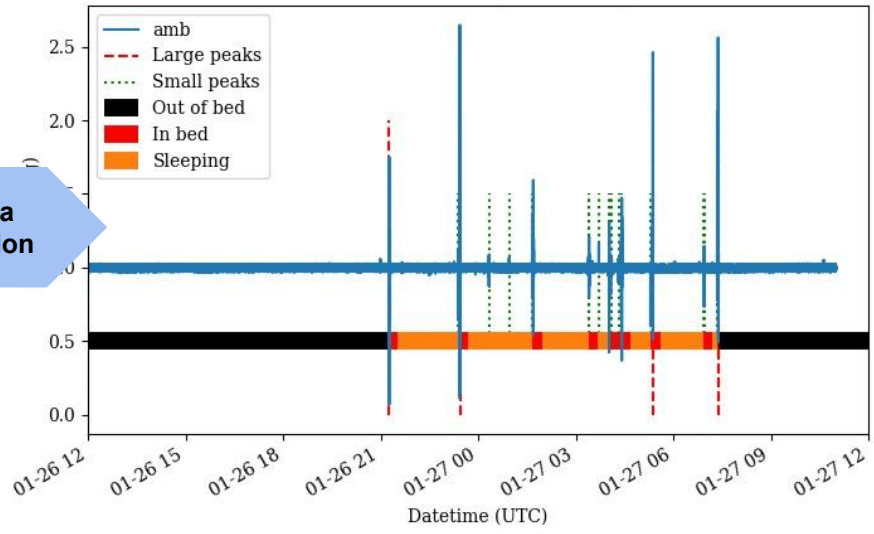
# Criteria estimation



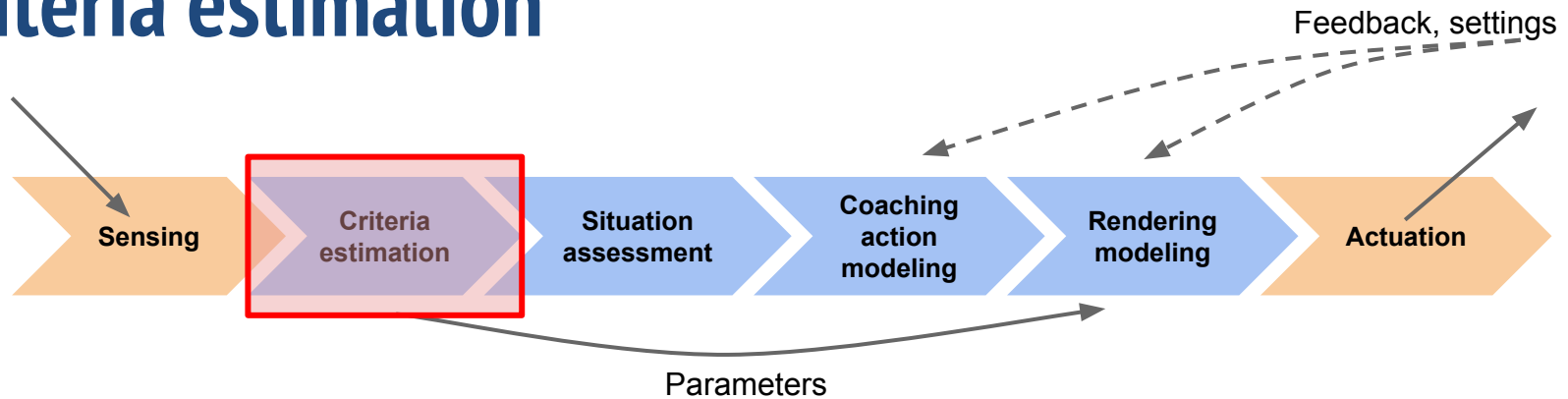
- From raw data to model inputs and parameters

```
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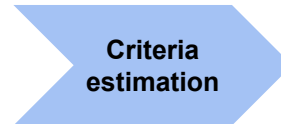
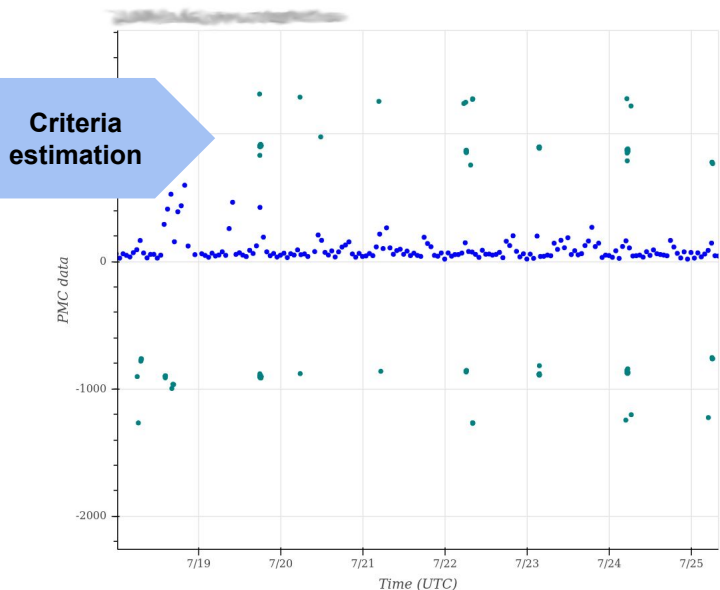
Criteria estimation



# Criteria estimation

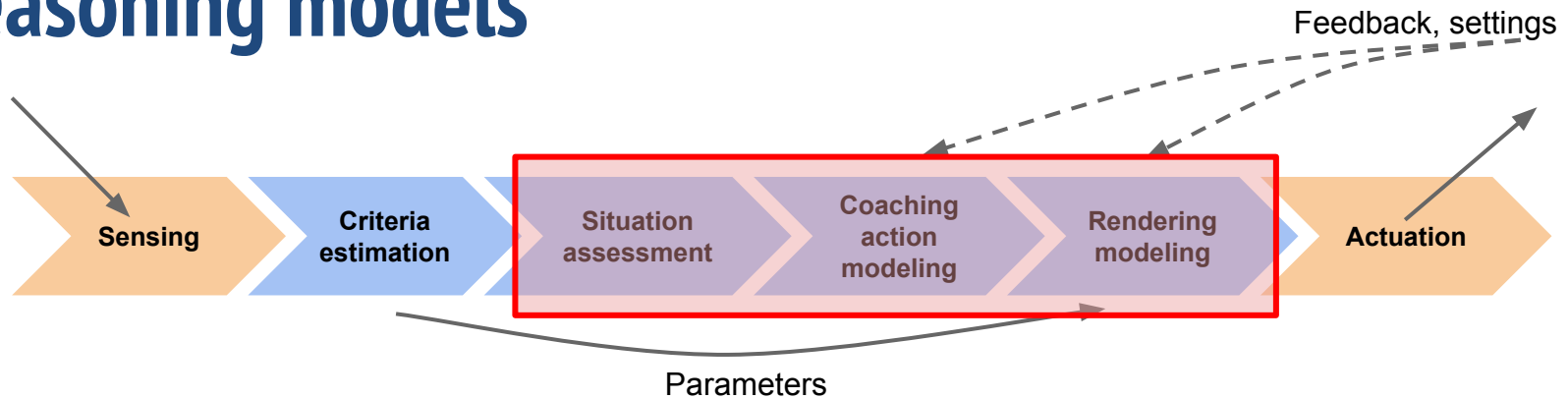


- From raw data to model inputs and parameters



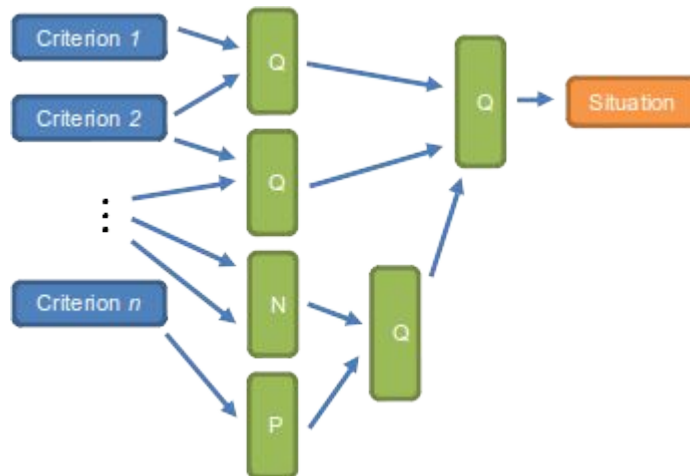
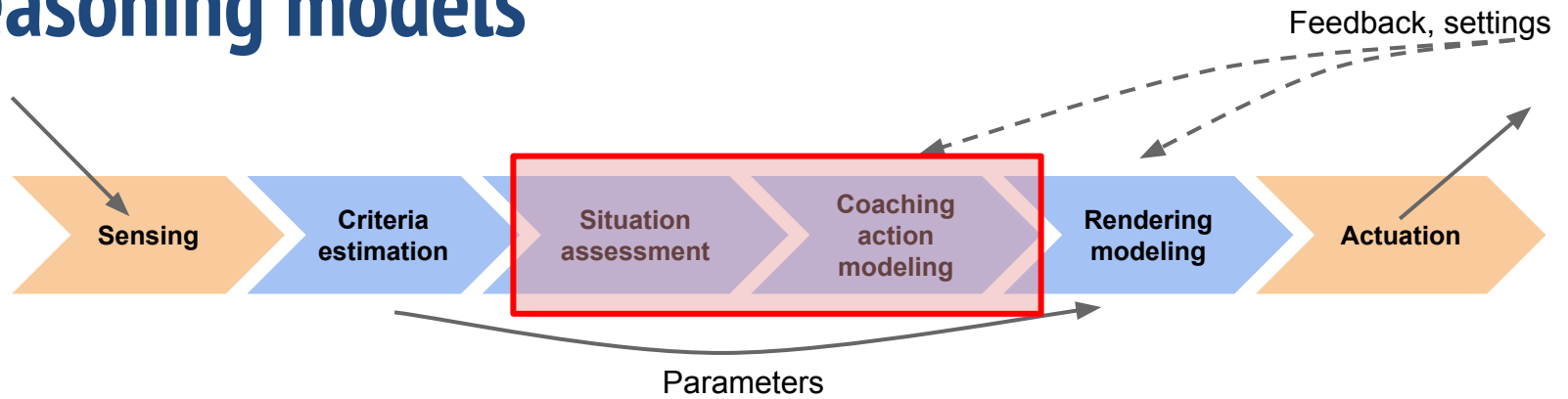
- Number of cooking events today
- Weekly cooking average
- Predicted daily cooking

# Reasoning models

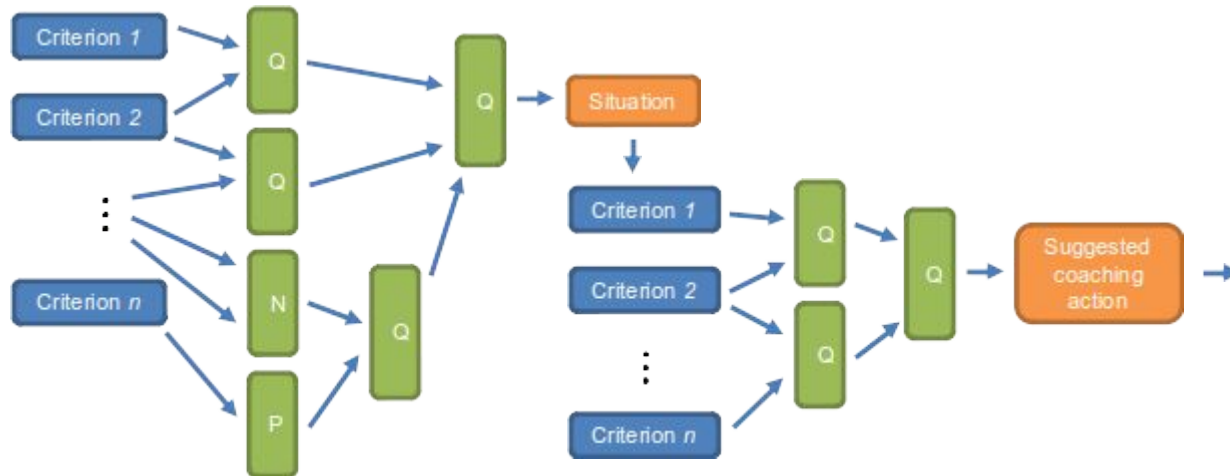
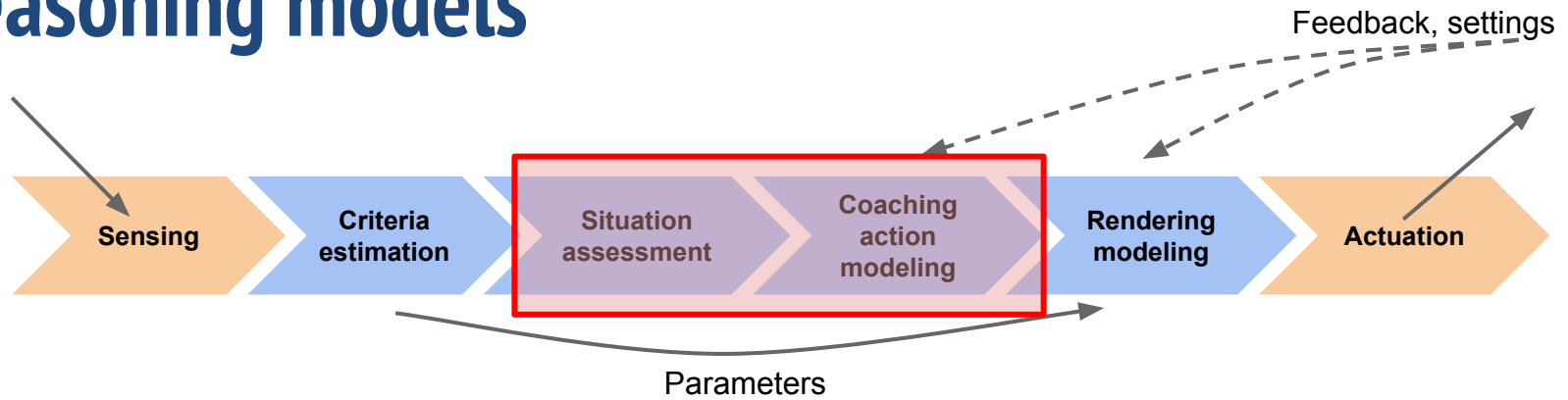


- Assessment of the situation: for example, social activity is low
- Deciding on the coaching action: like, suggest-SUfriend-to-call-PU
- Rendering choices: like, which specific SUfriend, modality, persuasion strategy, etc.
- The models are defined by the domain experts

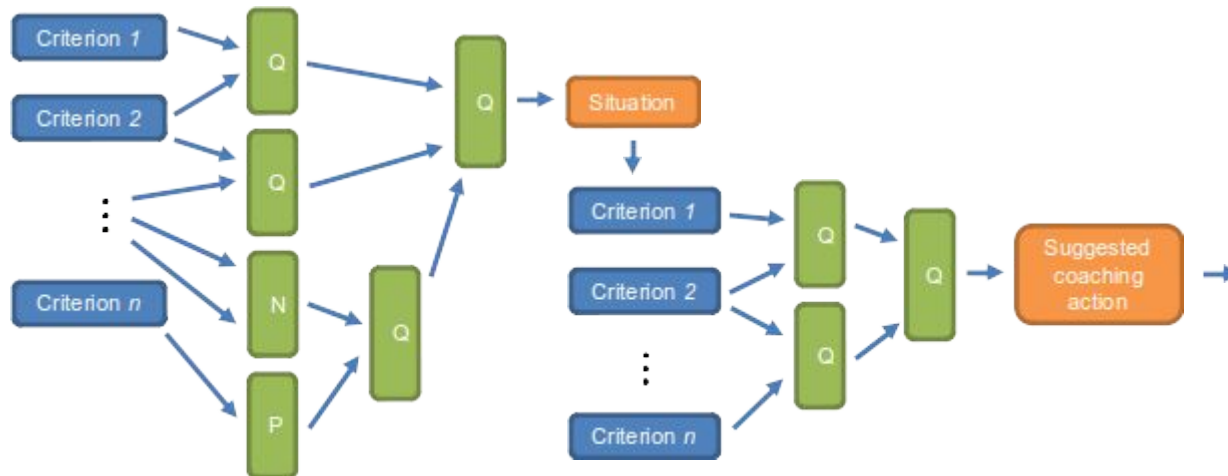
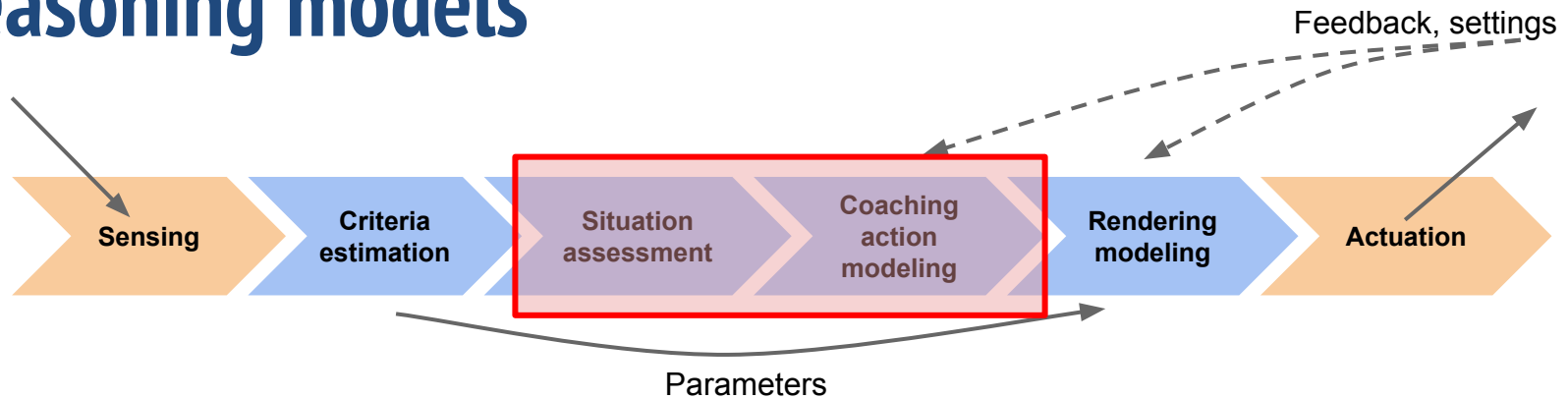
# Reasoning models



# Reasoning models

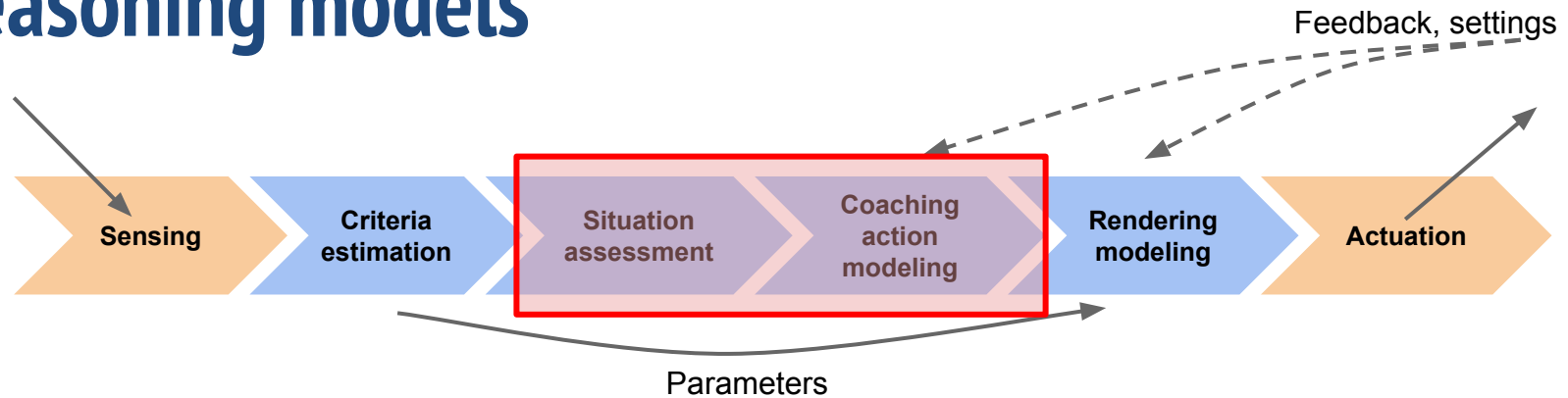


# Reasoning models



- Coaching pipeline design allows easy model exchange

# Reasoning models



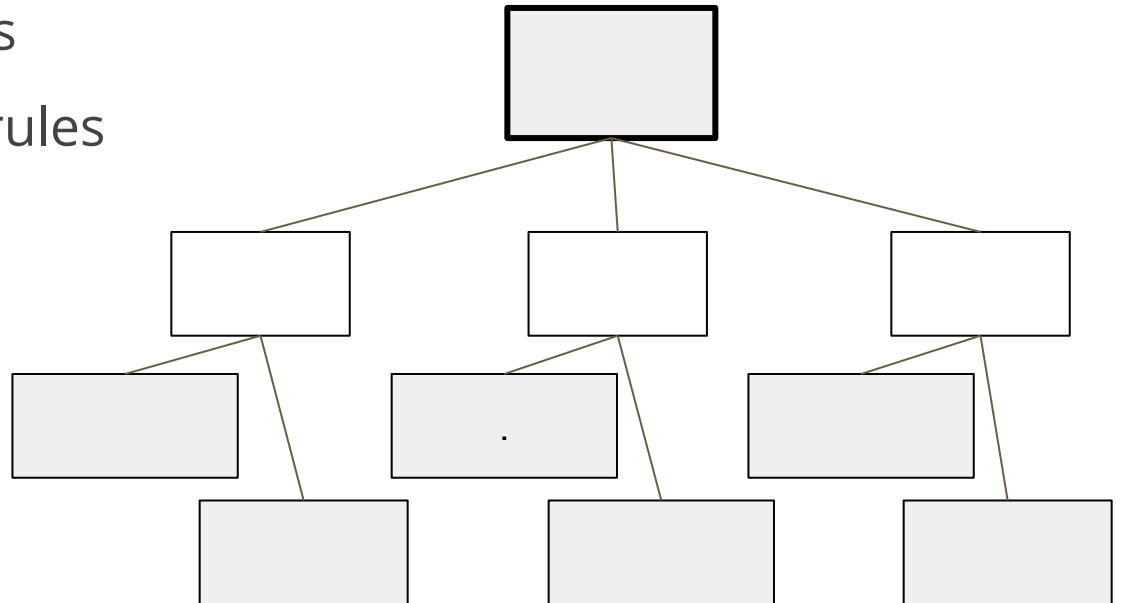
- Hierarchic decision models (**DEX**, MAUT, AHP, ...)
  - Aggregation of multiple criteria
  - **Transparent**
  - **Understandable operation**

Keeney R.L. and Raiffa H. (1993). Decisions with Multiple Objectives: Preference and Value Tradeoffs. Cambridge University Press, New York.

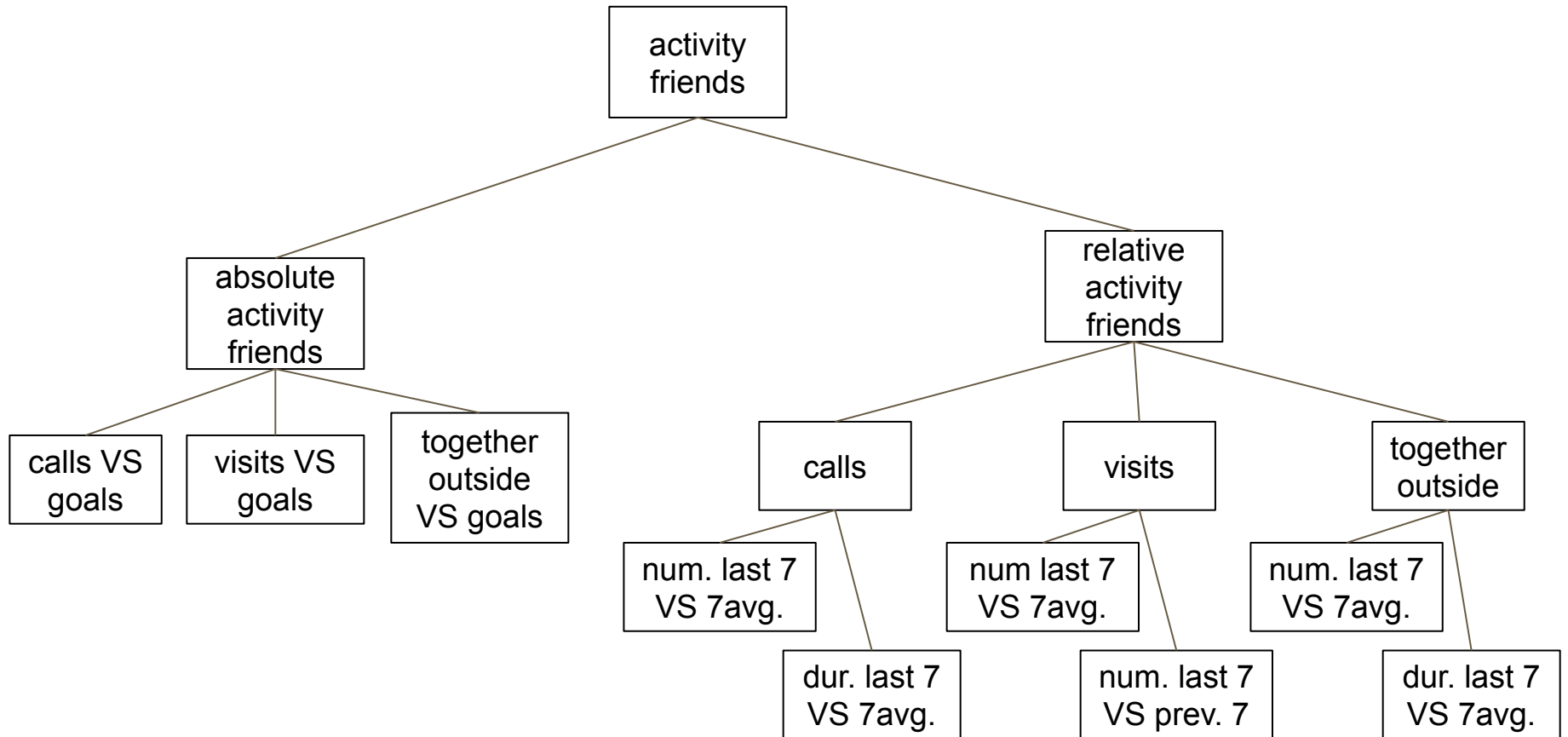
Bohanec, M., Žnidaršič, M., Rajkovič, V., Bratko, I., and Zupan, B. (2013). DEX methodology: three decades of qualitative multi-attribute modeling. *Informatica*, 37(1).

# DEX methodology models

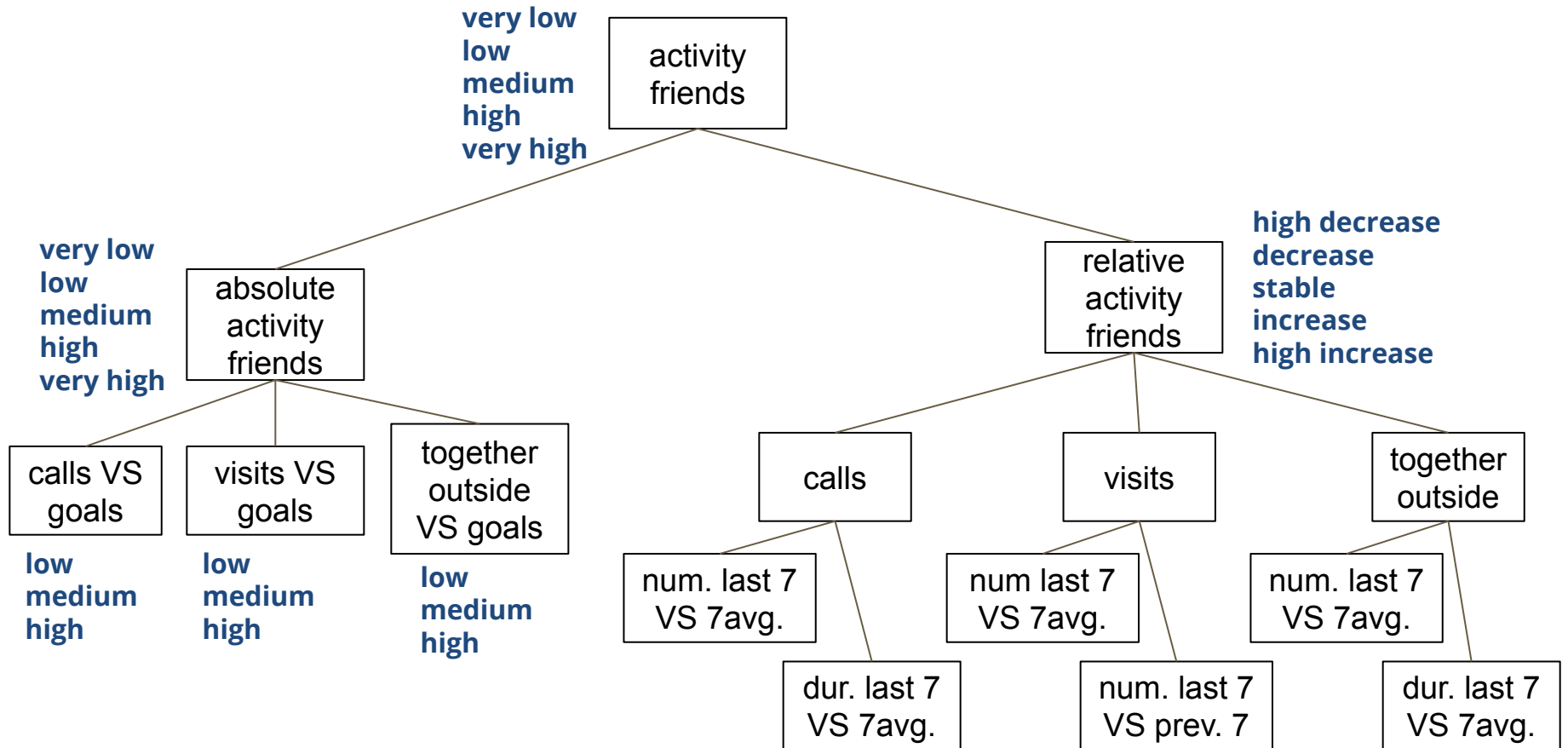
- Multiple criteria
- Hierarchical structure
- Qualitative value scales
- Qualitative reasoning rules



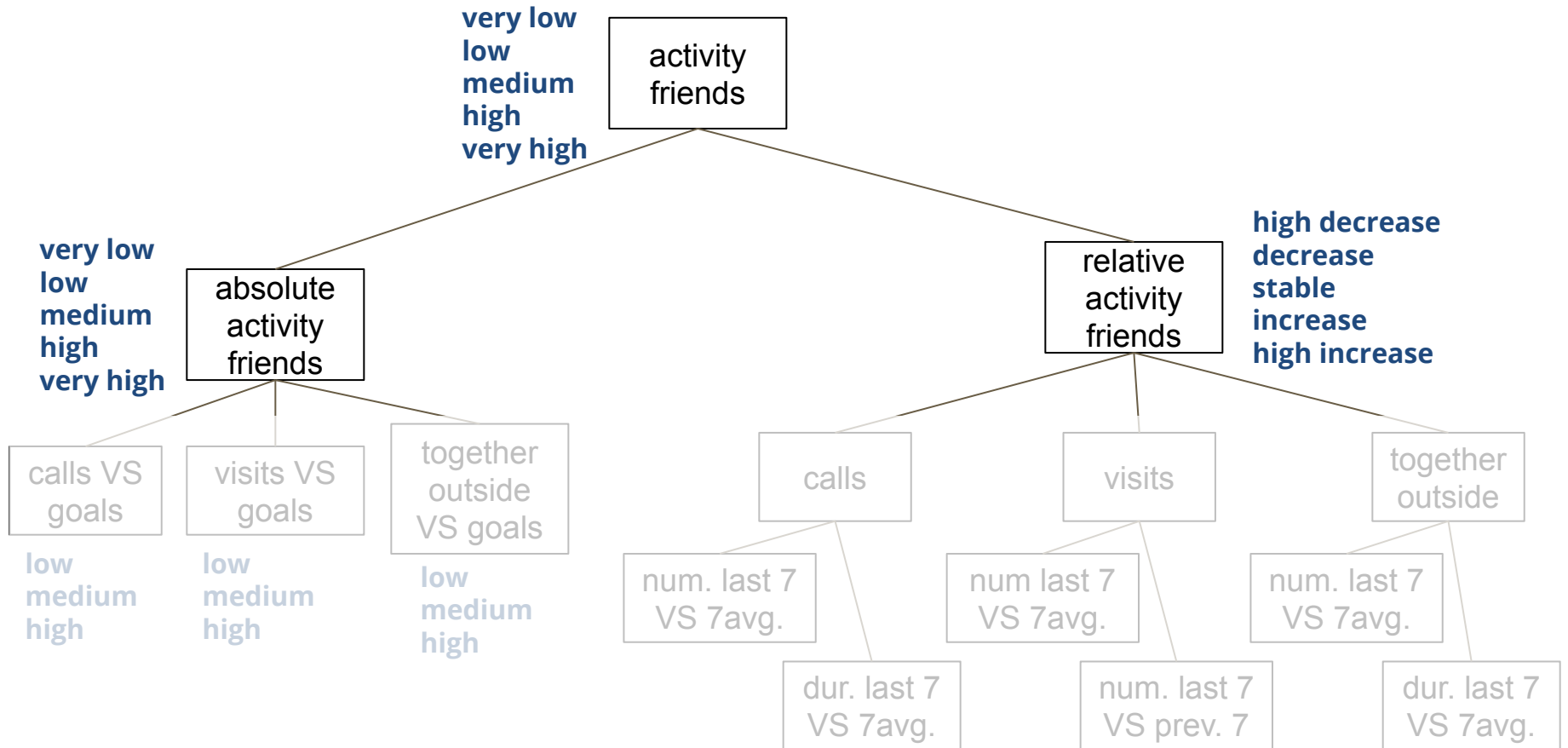
# DEX model example: Social Activity - friends (SA)



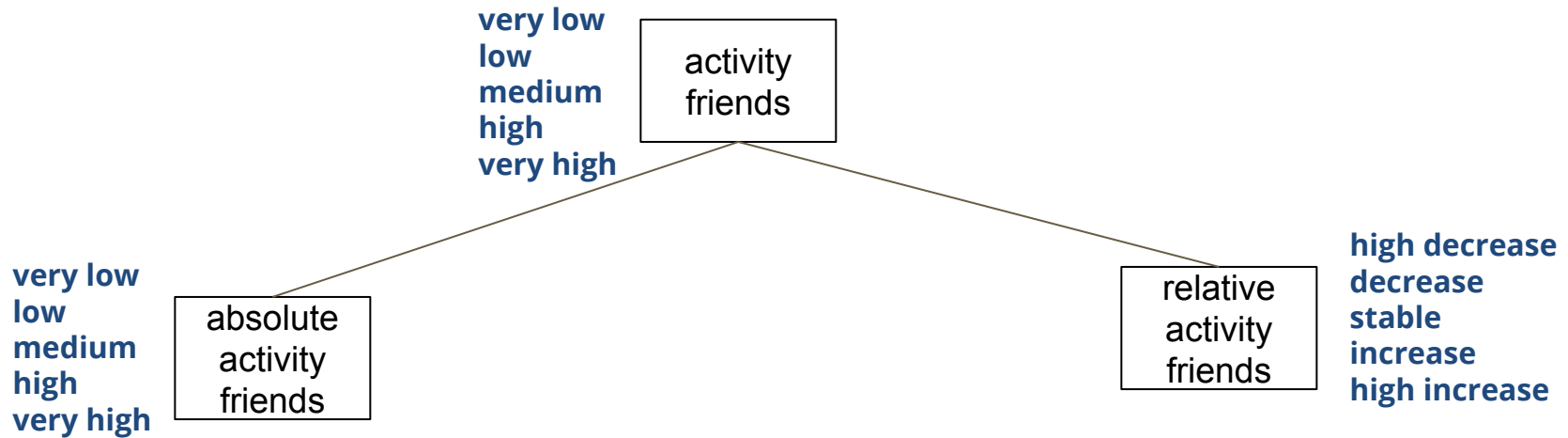
# DEX model example: Social Activity - friends (SA)



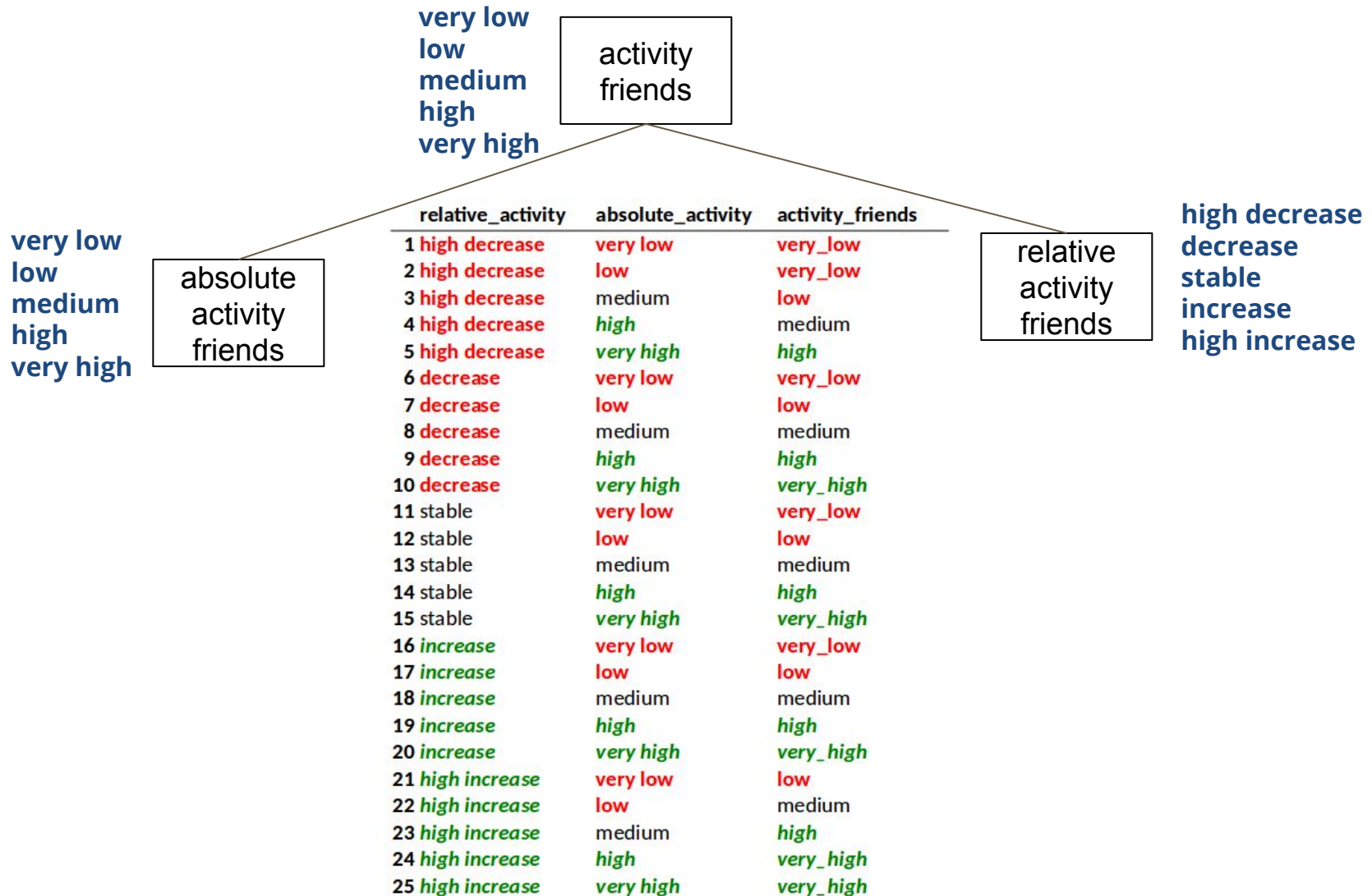
# DEX model example: Social Activity - friends (SA)



# DEX model example: Social Activity - friends (SA)



# DEX model example: Social Activity - friends (SA)



# DEX model example: Social Activity - friends (CA)

'toPU\_Suggest\_going\_out\_to\_an\_event\_or\_social\_place',  
'toPU\_Suggest\_going\_out\_to\_an\_event\_or\_social\_place\_with\_a\_friend',  
'toPU\_Send\_positive\_message',  
'toPU\_Suggest\_calling\_friends',  
'toPU\_Suggest\_inviting\_friends',  
'toSU\_Suggest\_PU\_to\_go\_out\_to\_a\_social\_place\_with\_a\_friend',  
'toSU\_Friend\_Suggest\_going\_out\_to\_a\_social\_place\_with\_PU',  
'toSU\_Suggest\_to\_suggest\_action\_to\_a\_friend',  
'toSU\_Friend\_Suggest\_calling\_the\_PU',  
'toSU\_Friend\_Give\_positive\_message\_to\_PU',  
'toSU\_Friend\_Suggest\_visiting\_the\_PU',  
'no\_action'

activity  
friends  
coaching  
action

activity  
friends

very low  
low  
medium  
high  
very high

lowest  
activity

calls  
visits  
tog. outside  
none

invite  
possible

yes  
no

interaction  
preference

to PU  
to SU  
none

# DEX model example: Social Activity - friends (CA)

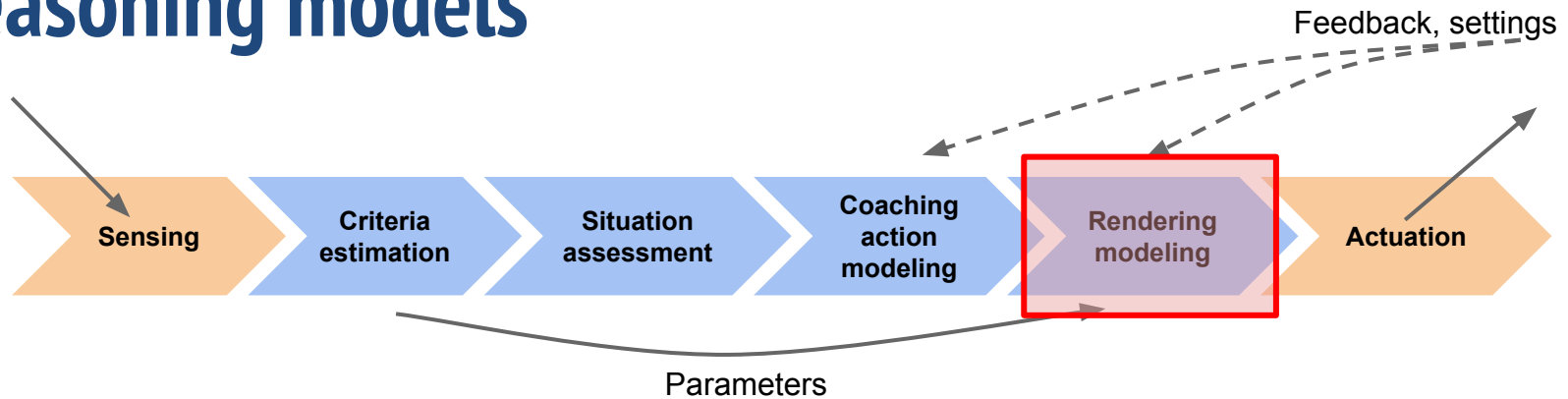
activity  
friends  
coaching  
action

| activity friends         | lowest activity | invite possible | interaction preference | activity friends coaching action  |
|--------------------------|-----------------|-----------------|------------------------|---|
| 1 <b>very_low</b>        | calls           | yes             | to_PU                  | toPU_Suggest_calling_friends  |
| 2 <b>very_low</b>        | calls           | yes             | to_SU                  | toSU_Friend_Suggest_calling_the_PU  |
| 3 <b>very_low</b>        | calls           | yes             | no_preference          | toPU_Suggest_inviting_friends: <b>0.0</b><br>...<br>toSU_Friend_Suggest_calling_the_PU: <b>0.5</b><br>toPU_Suggest_calling_friends: <b>0.5</b><br>...<br>no_action : <b>0.0</b> |
| 4 <b>very_low</b>        | calls           | no              | to_PU                  | toPU_Suggest_calling_friends  |
| 5 <b>very_low</b>        | calls           | no              | to_SU                  | toSU_Friend_Suggest_calling_the_PU  |
| ... ..                   | ...             | ...             | ...                    | ...   |
| 12<br>0 <b>very_high</b> | none            | no              | no_preference          | no_action   |

# Characteristics of the methodology

- + Transparency
- + Understandability
- + Proven in practice
- + Fast execution, model serialization, support with free software
- Knowledge representation and reasoning combined
  - good (understandability) and bad (model focused representation, not general)
- Unnatural modelling with numeric criteria
- Combinatorial problems
- Implausible combinations

# Reasoning models



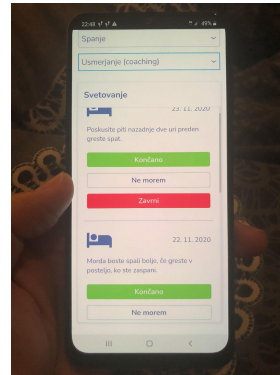
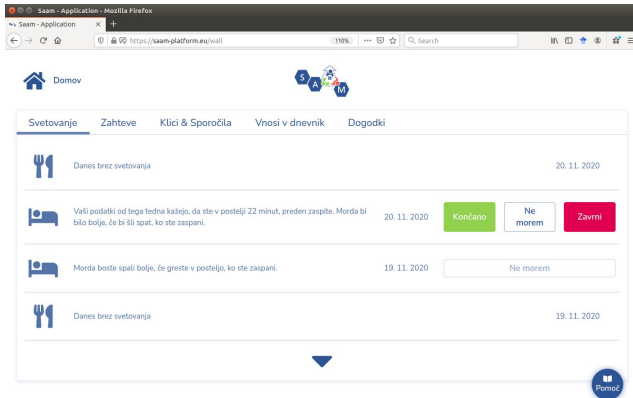
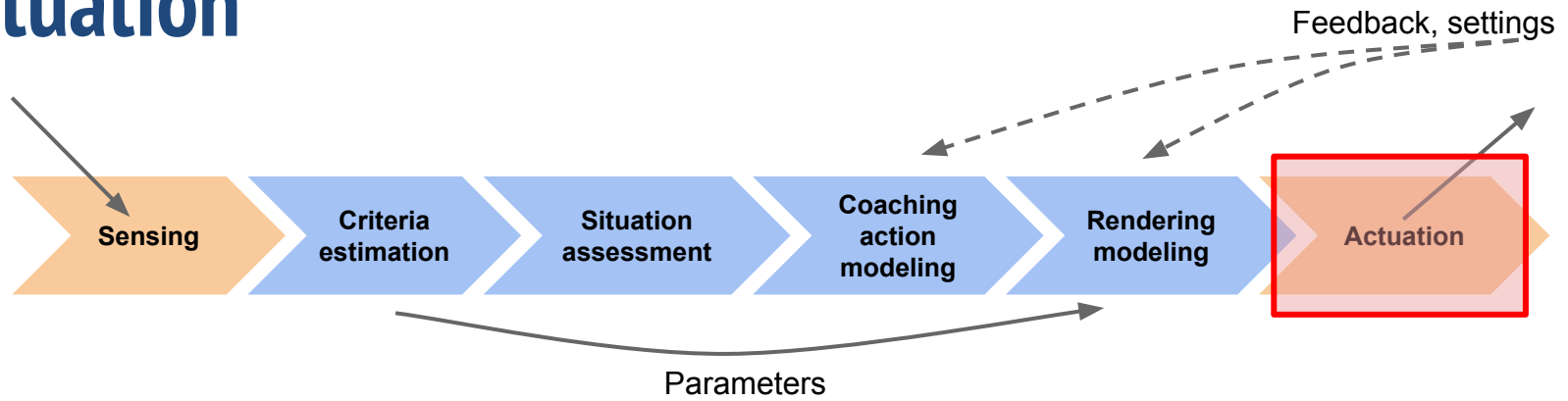
- Rendering choices: like, which specific SUfriend, modality, persuasion strategy, etc.

- Individual rules
- Implemented closer to core server's DBs

social\_family

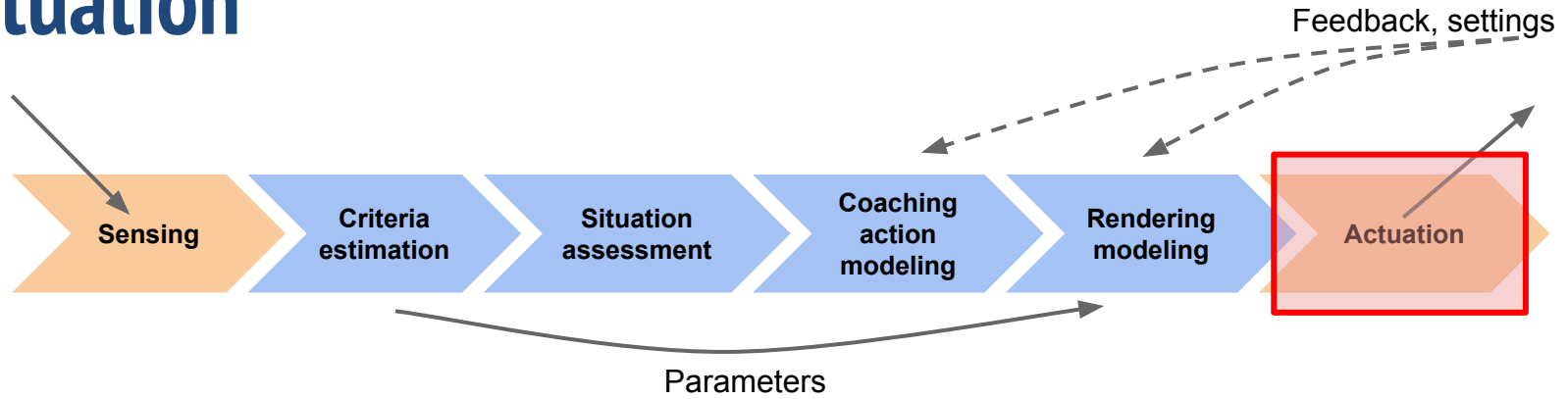
| Coaching action  | Exact wording (suggestion)  | Exact wording (commitment)  | Voice message (suggestion)  | Voice message (commitment)   |
|--|---|---|---|--|
| toPU_Suggest_going_out_to_an_event_or_social_place_with_Family | <p>suggestion1:<br/>"There is X event happening soon. Perhaps you could go there with SU_family."</p> <p>suggestion2:<br/>"How about going to X event with your SU_family?"</p> | <p>commitment1:<br/>"You have set a goal to go out more often with your family to events and your favourite social places. You are able to meet your goal: there is X event happening soon. Perhaps you could go with SU_family."</p> | <p>suggestion1:<br/>"There is an event happening soon. Perhaps you could go there with your family."</p> <p>suggestion2:<br/>"How about going to an</p> | <p>commitment1:<br/>"You have set a goal to go out more often with your family to events and your favourite social places. You are able to meet your goal: there is an event happening</p> |

# Actuation



+ visits, calls, etc.

# Actuation



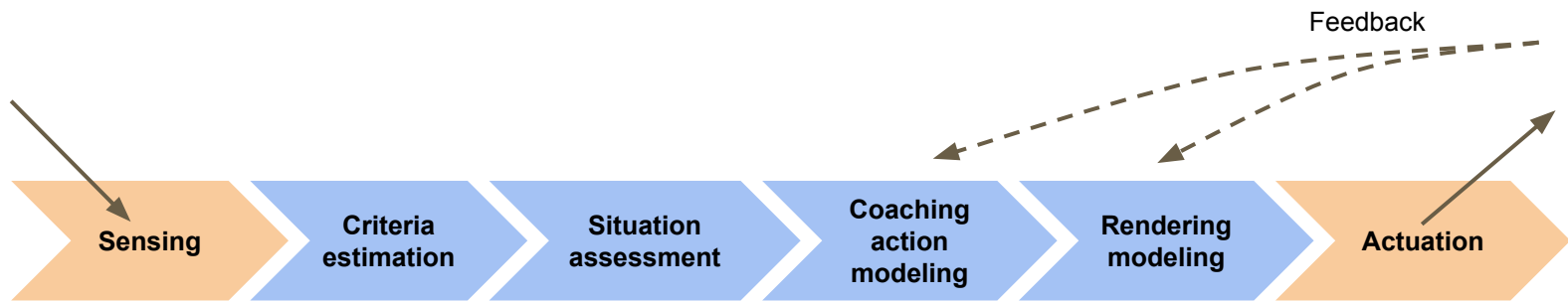
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**END**



Suggested rendering

| relative_activity | absolute_activity | activity_friends |
|-------------------|-------------------|------------------|
| 1 high decrease   | very low          | very_low         |
| 2 high decrease   | low               | very_low         |
| 3 high decrease   | medium            | low              |
| 4 high decrease   | high              | medium           |
| 5 high decrease   | very high         | high             |
| 6 decrease        | very low          | very_low         |
| 7 decrease        | low               | low              |
| 8 decrease        | medium            | medium           |
| 9 decrease        | high              | high             |
| 10 decrease       | very high         | very_high        |
| 11 stable         | very low          | very_low         |
| 12 stable         | low               | low              |
| 13 stable         | medium            | medium           |
| 14 stable         | high              | high             |
| 15 stable         | very high         | very_high        |
| 16 increase       | very low          | very_low         |
| 17 increase       | low               | low              |
| 18 increase       | medium            | medium           |
| 19 increase       | high              | high             |
| 20 increase       | very high         | very_high        |
| 21 high increase  | very low          | low              |
| 22 high increase  | low               | medium           |
| 23 high increase  | medium            | high             |
| 24 high increase  | high              | very_high        |
| 25 high increase  | very high         | very_high        |

