Behaviour and Reasoning Description Language (BRDL)

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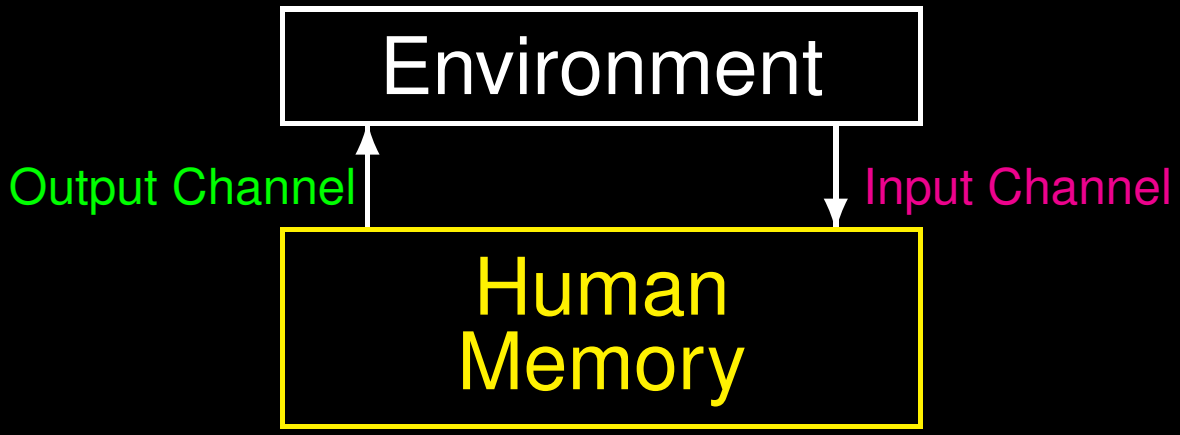
BRDL

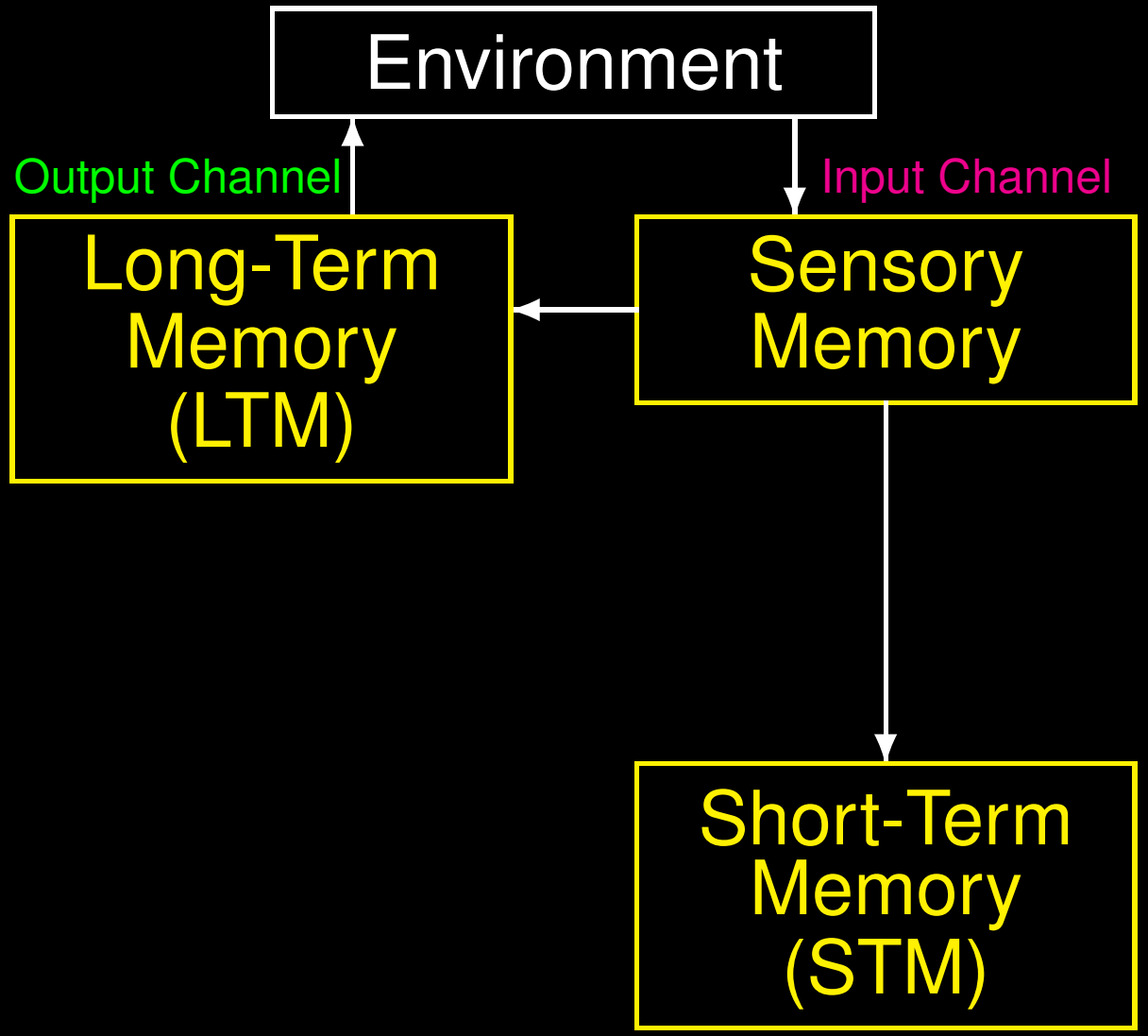
Behaviour and Reasoning Description Language

- knolwledge representation
- knowledge retrieval
- reasoning
- human behaviour
- problem solving

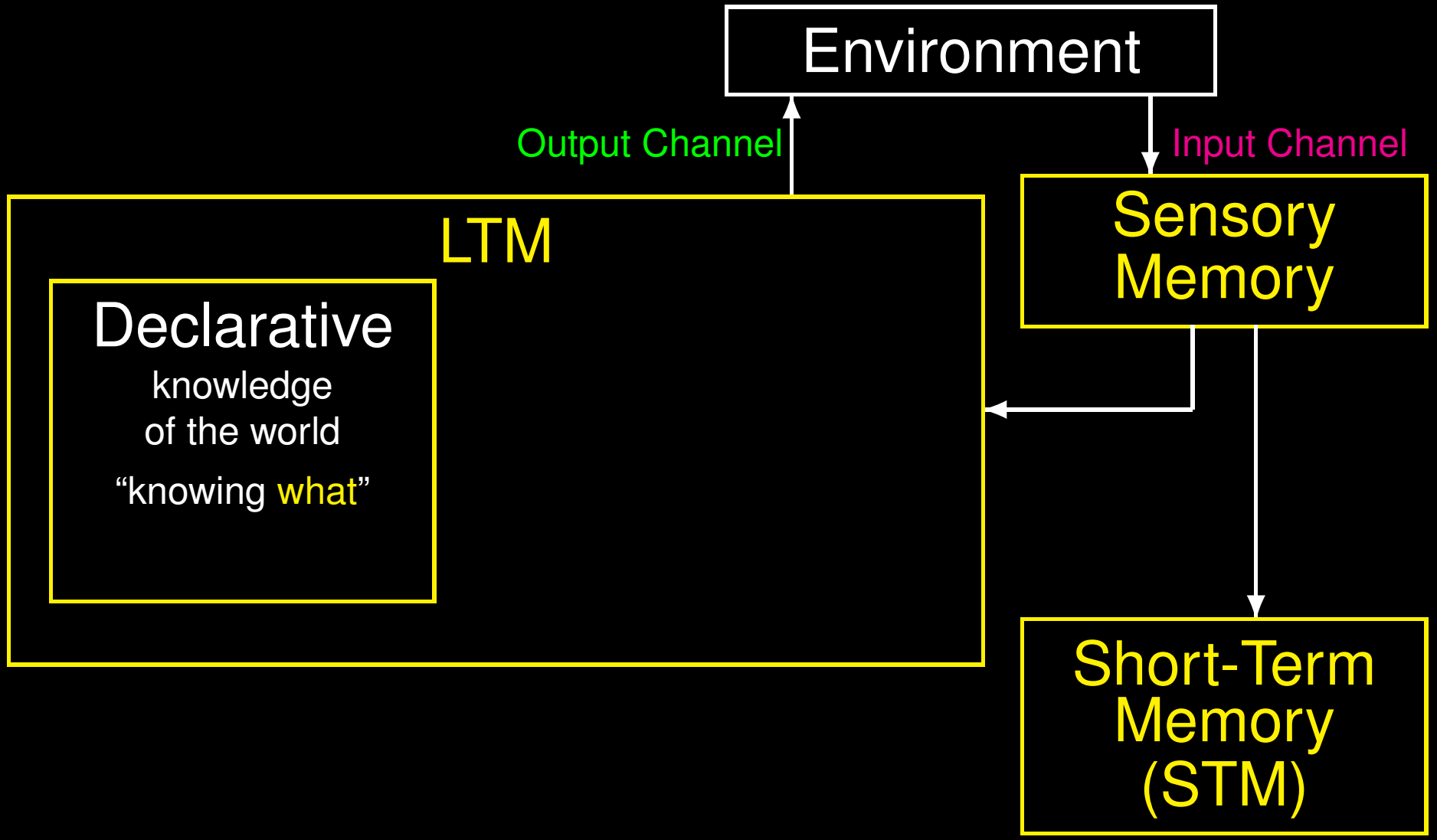
Human Memory



Human Memory



Long-Term Memory (LTM)



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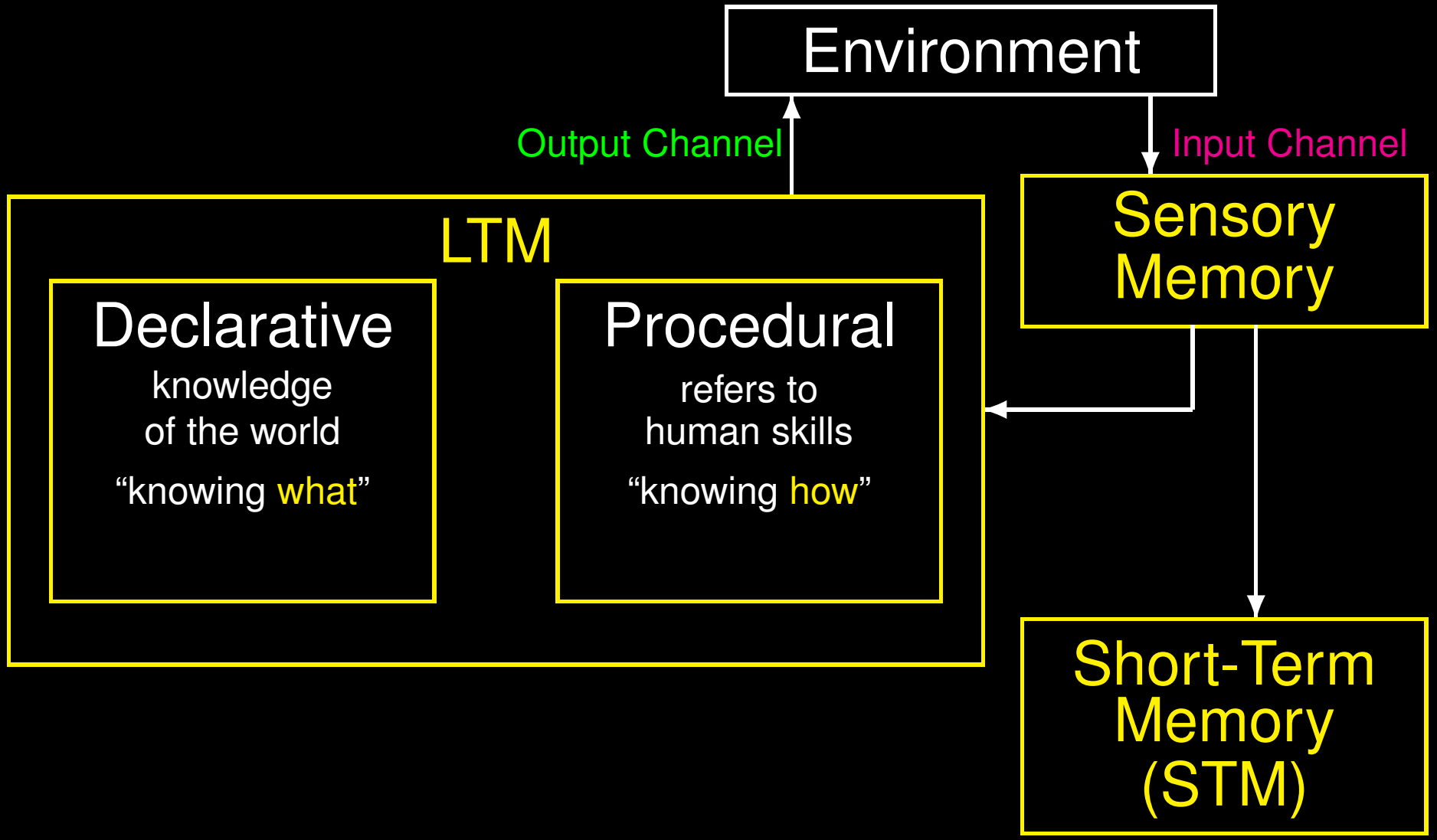
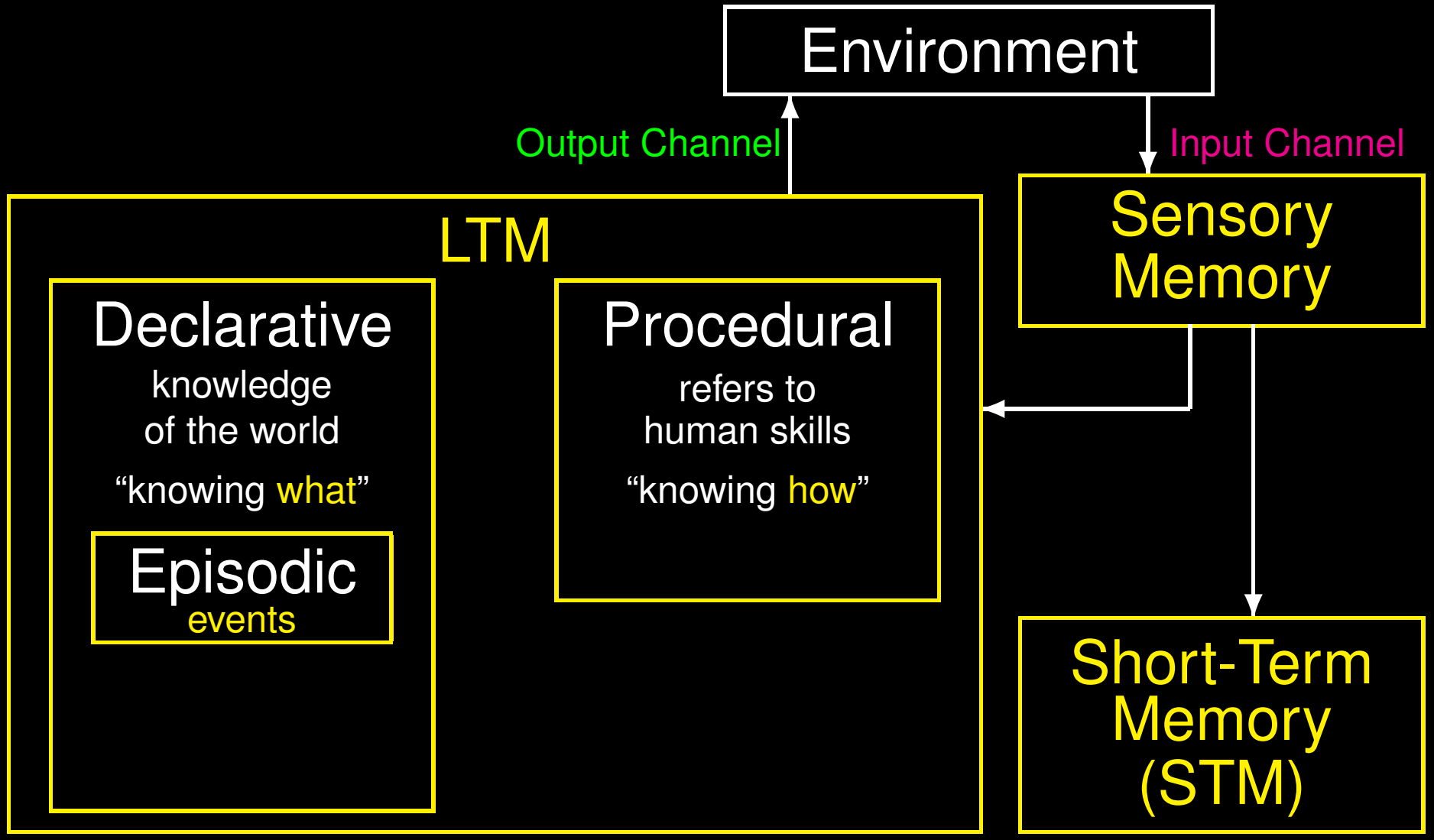


LTM Components



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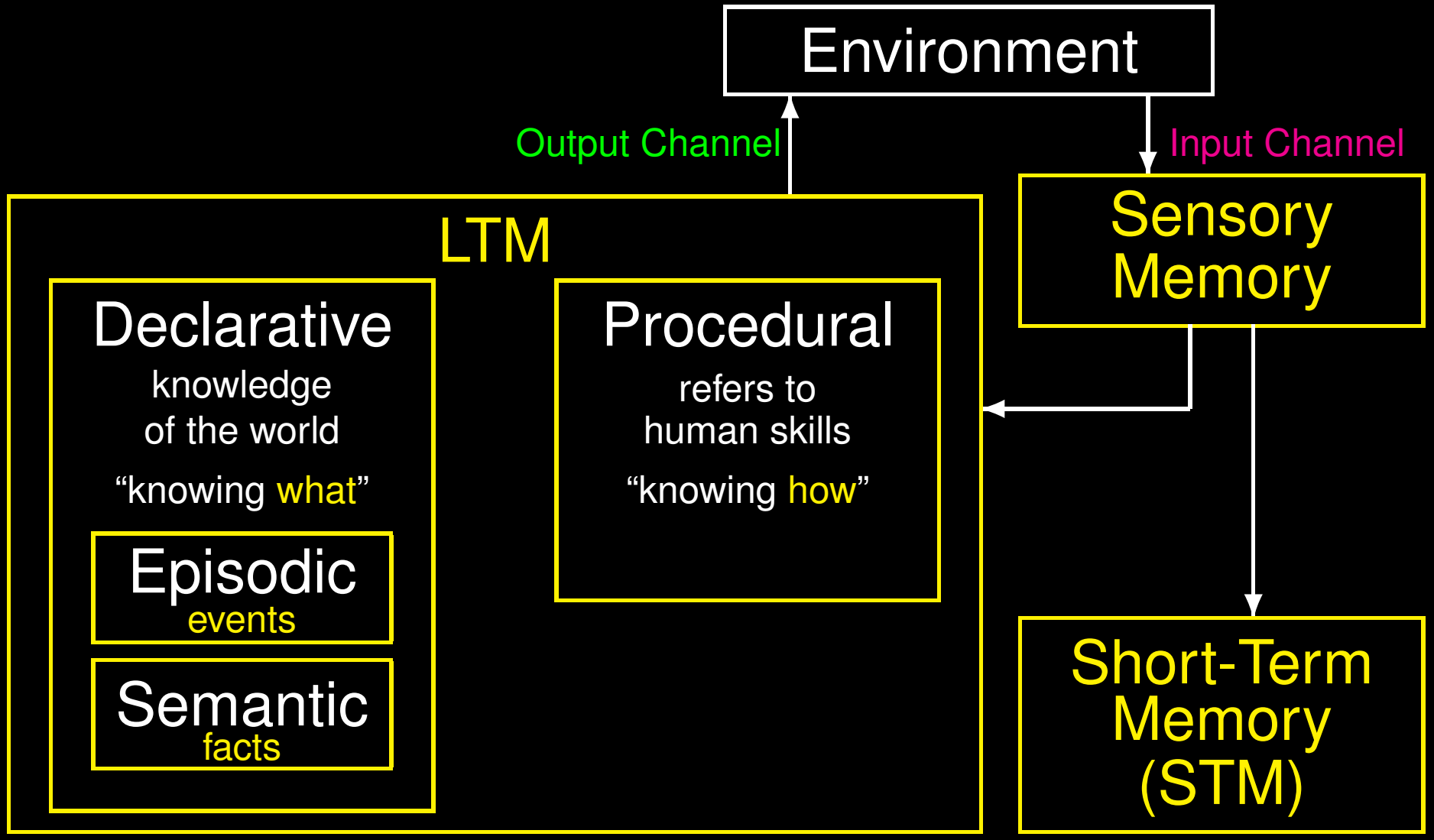
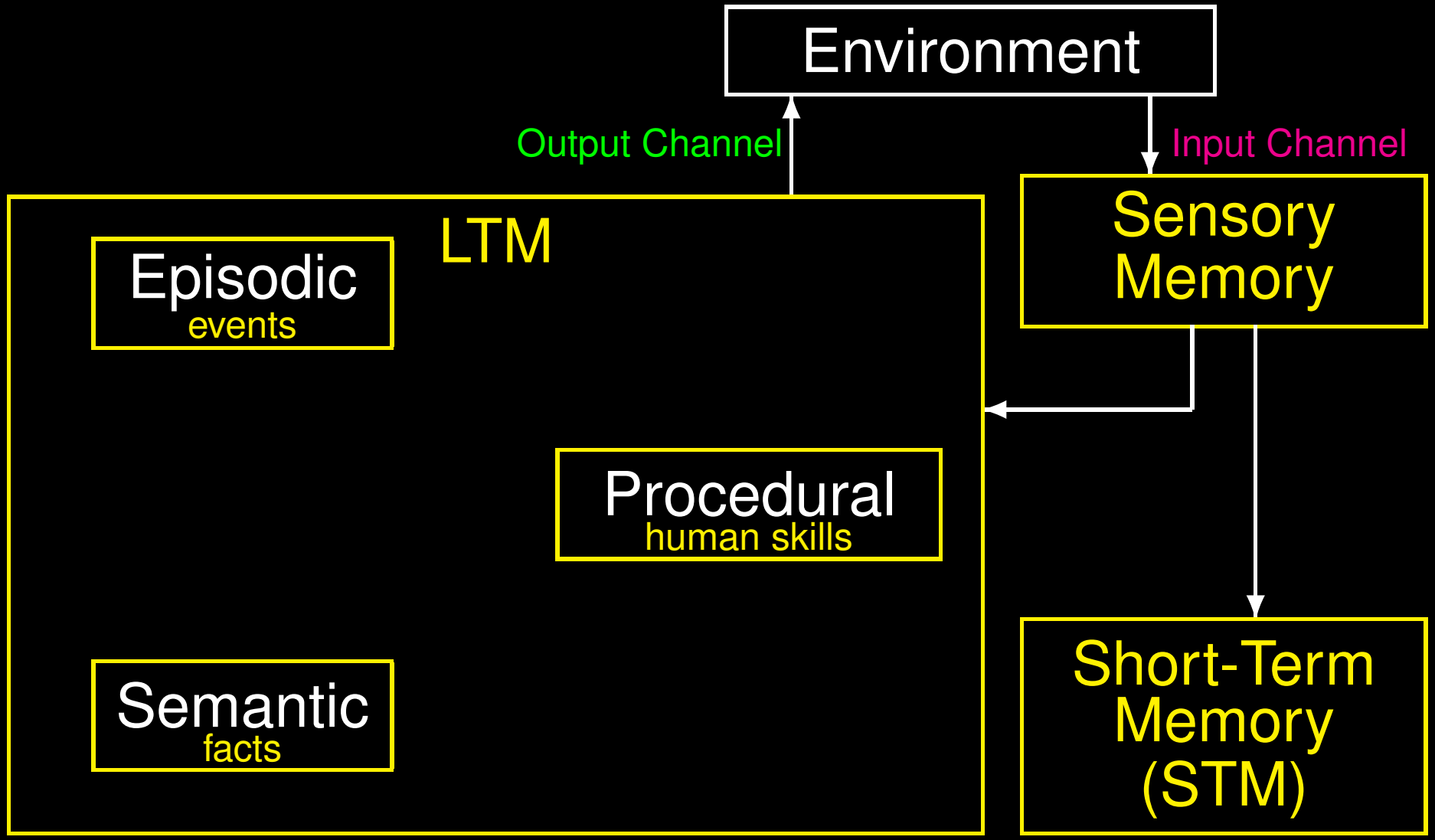


Semantic Memory



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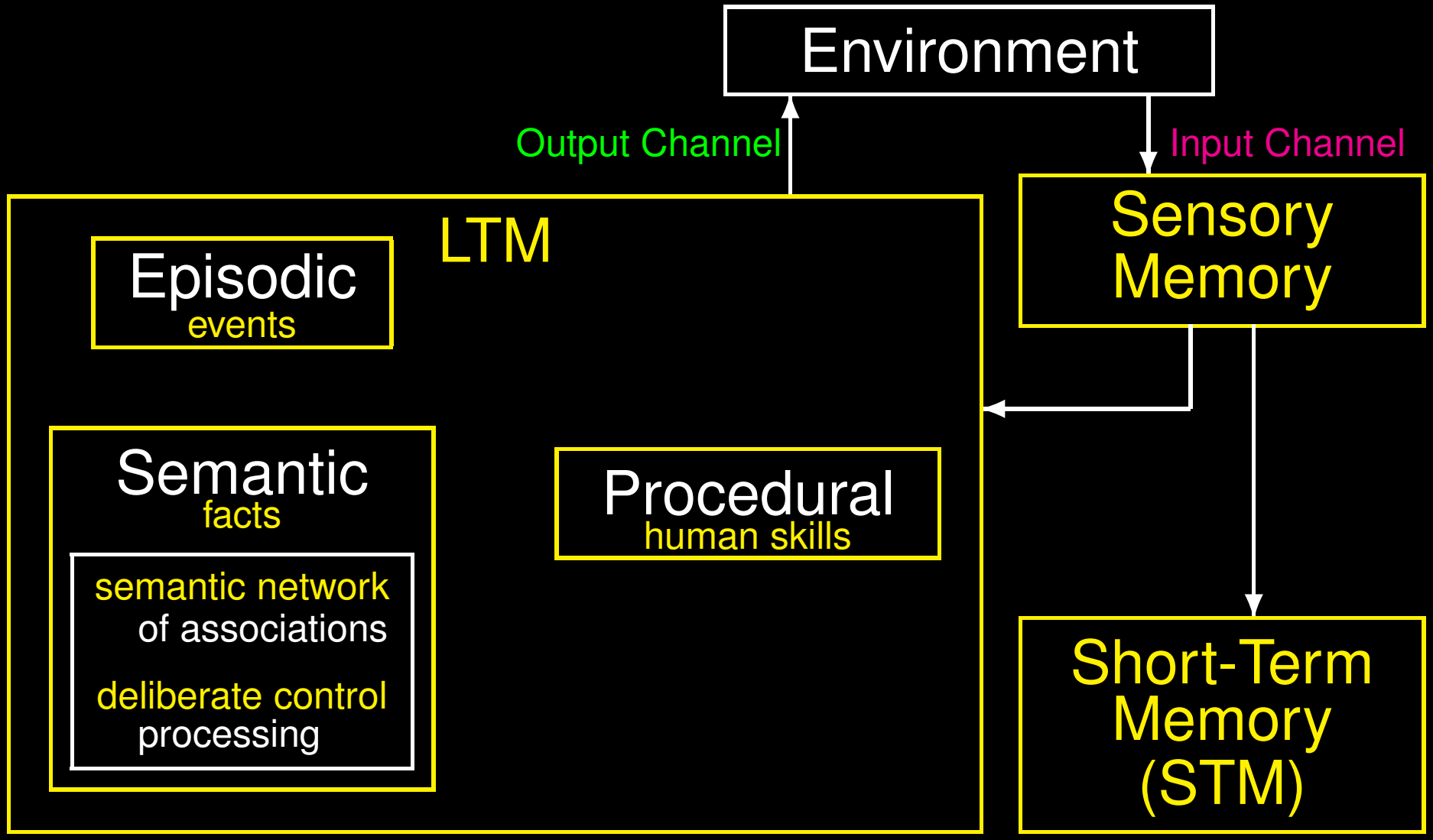

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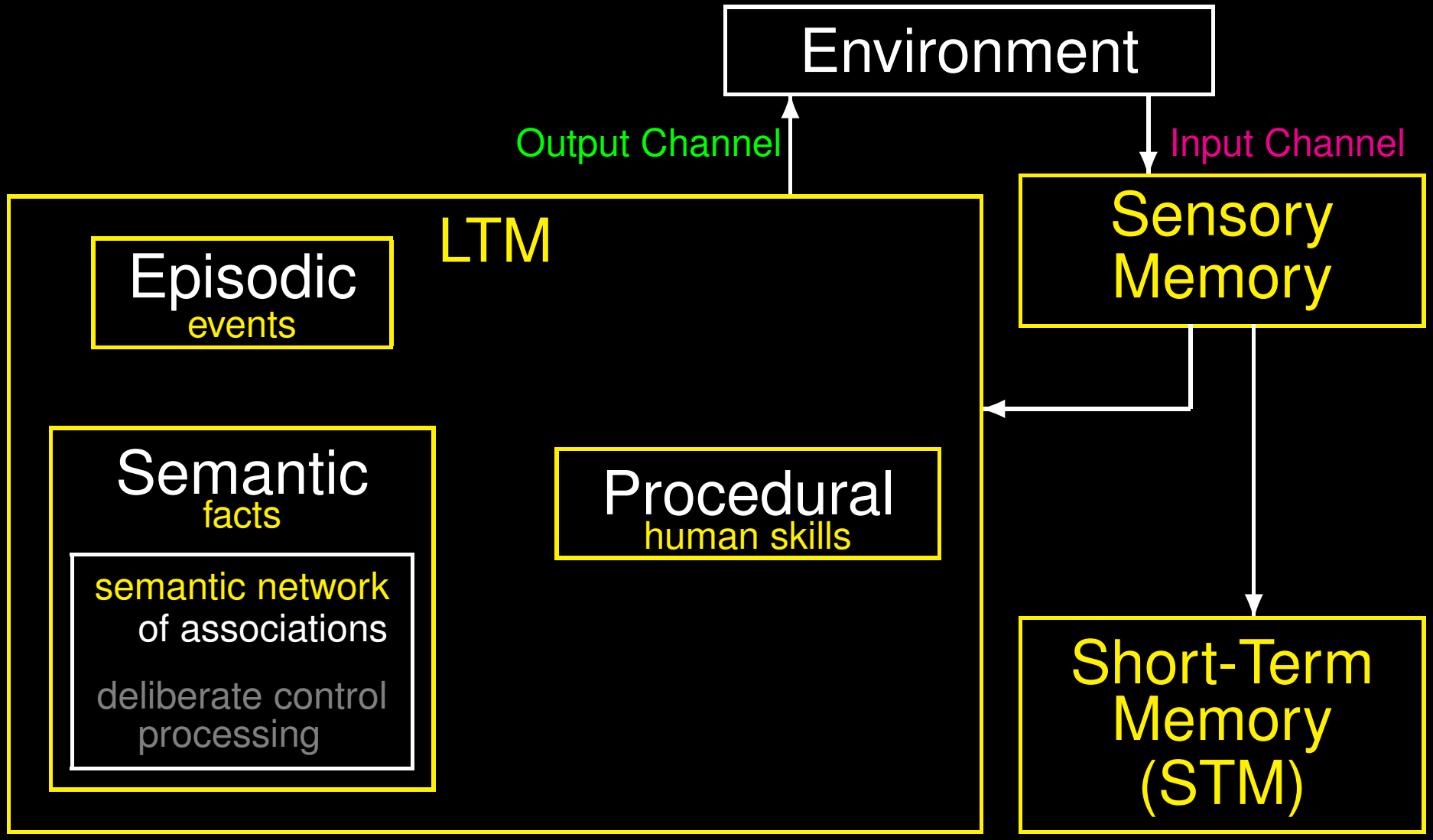
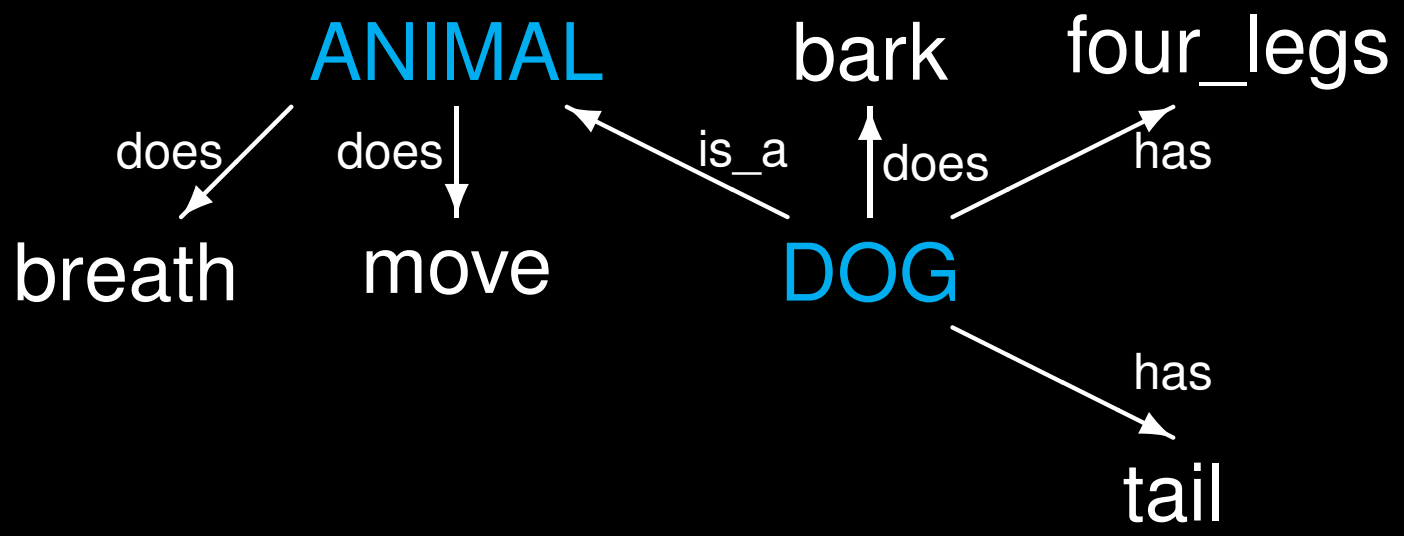


Example of Semantic Network



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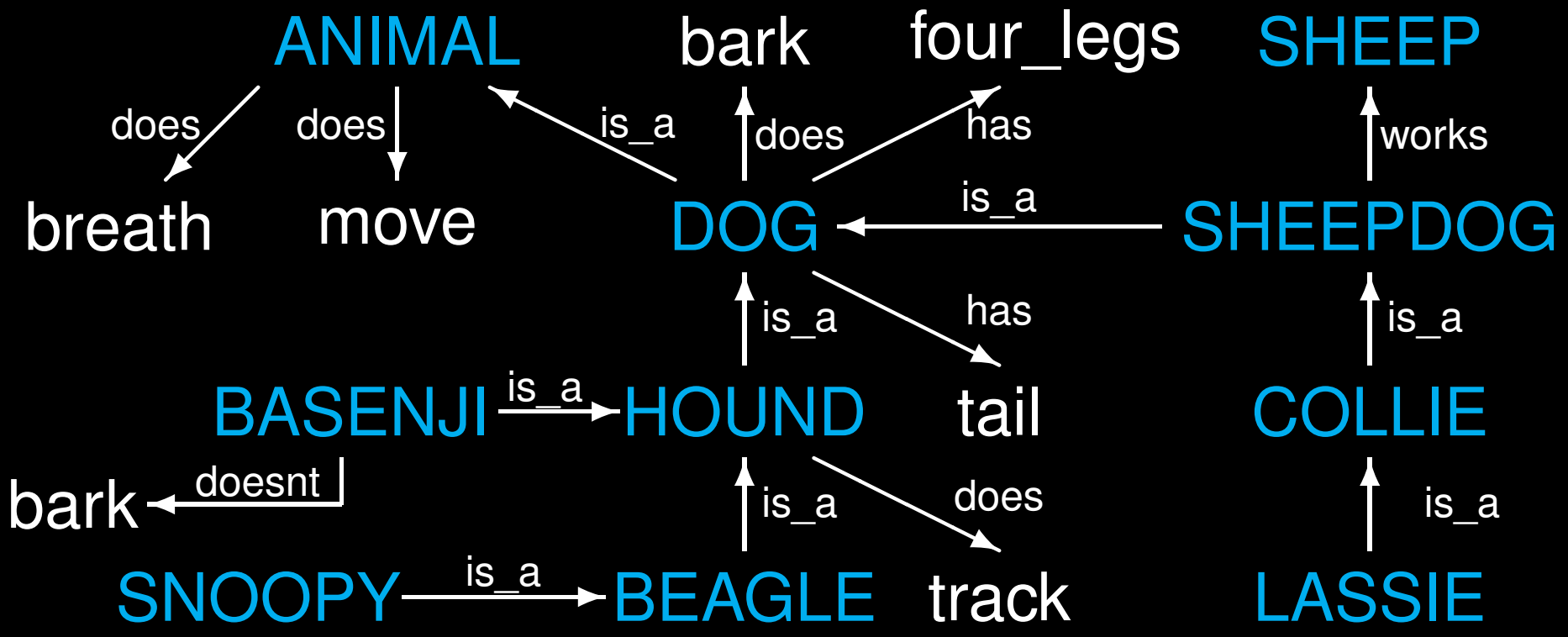
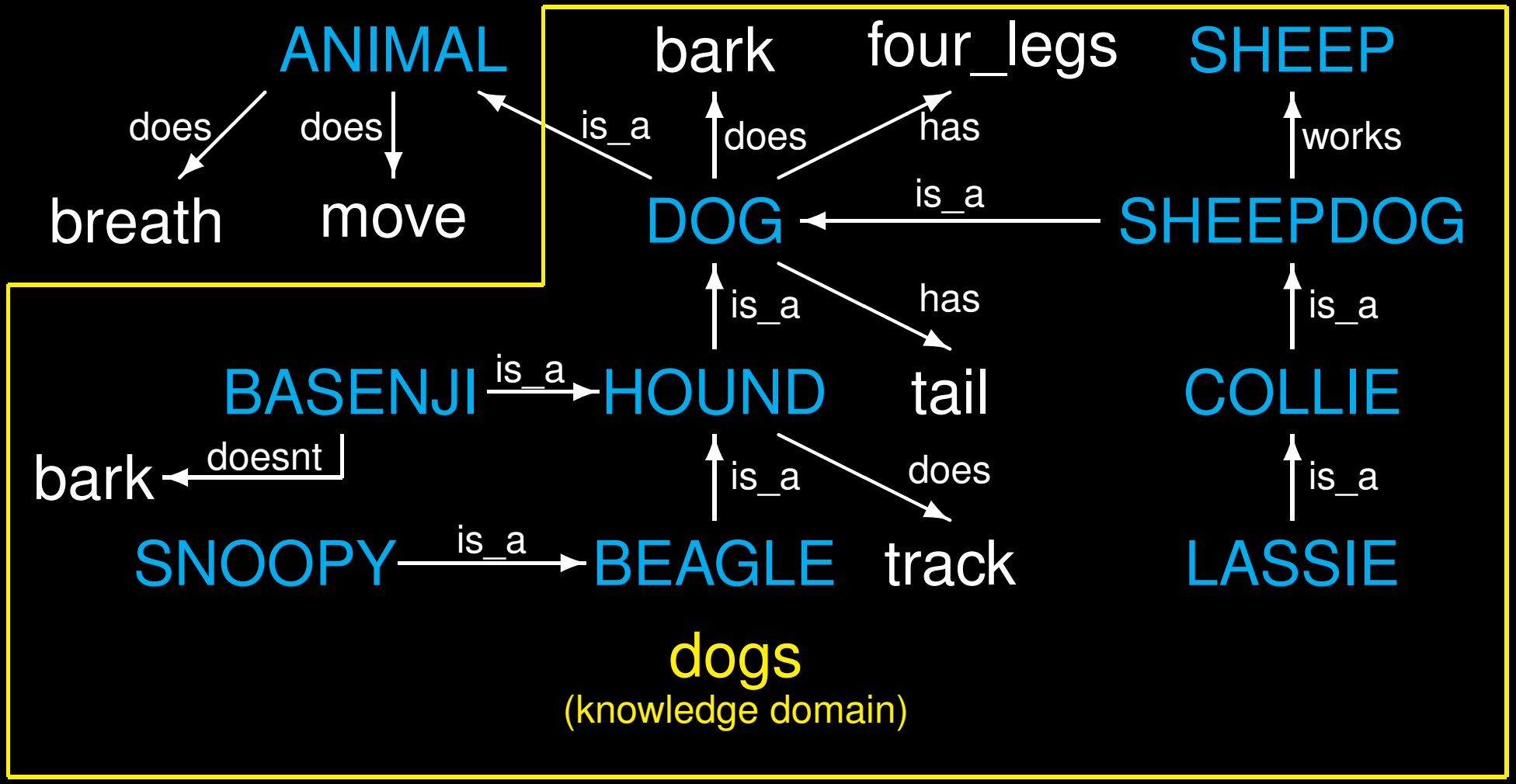


Example of Knowledge Domain



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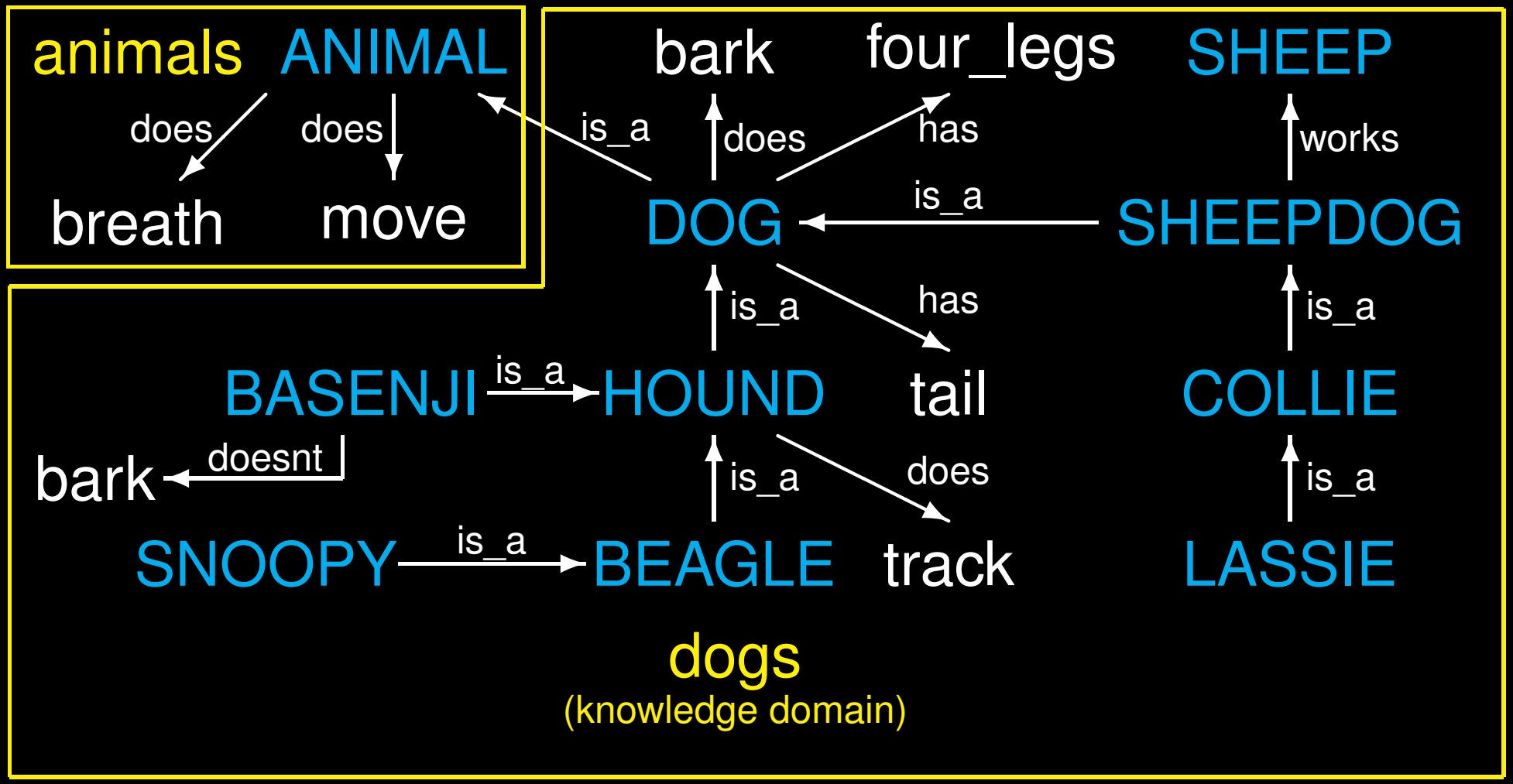

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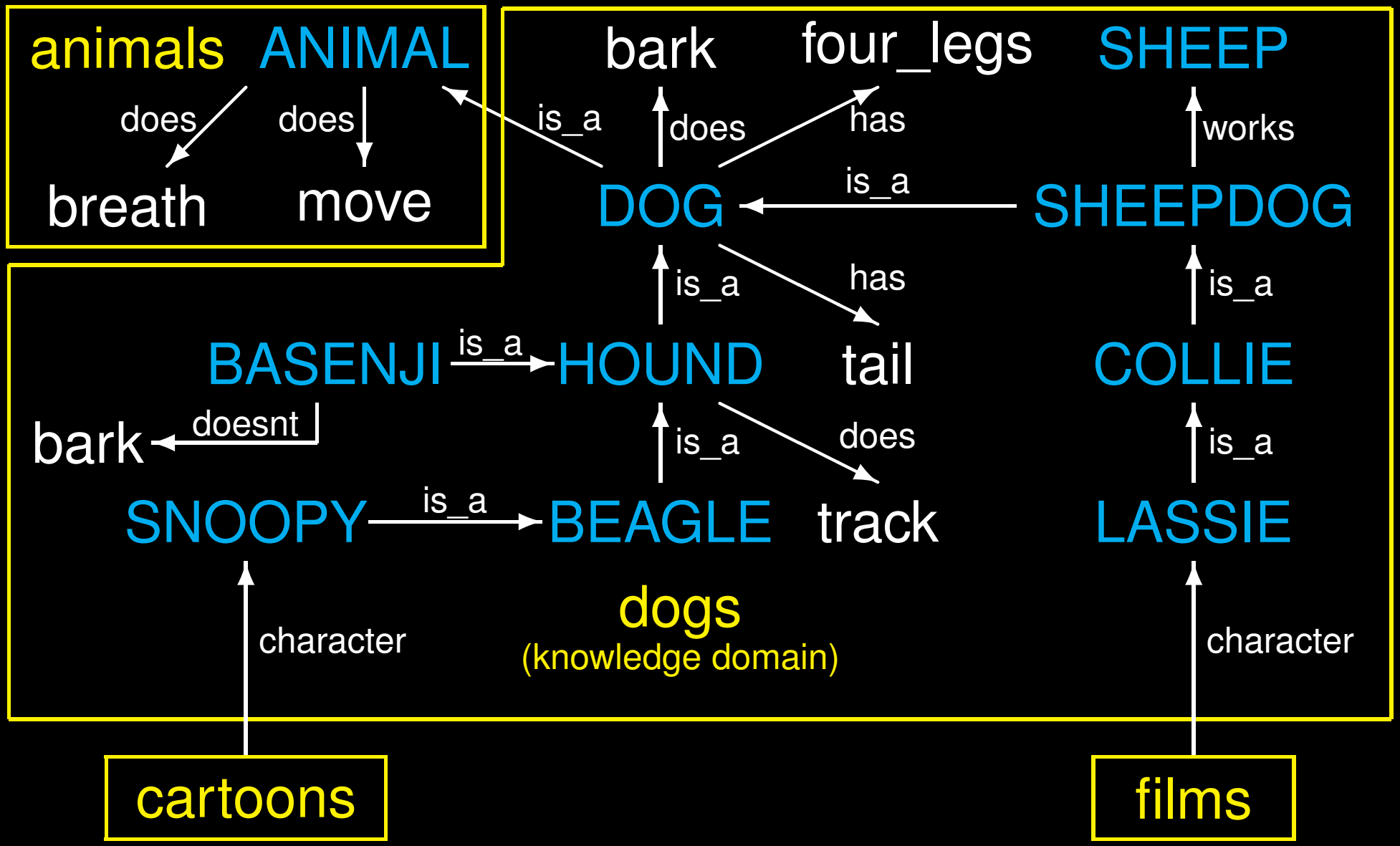
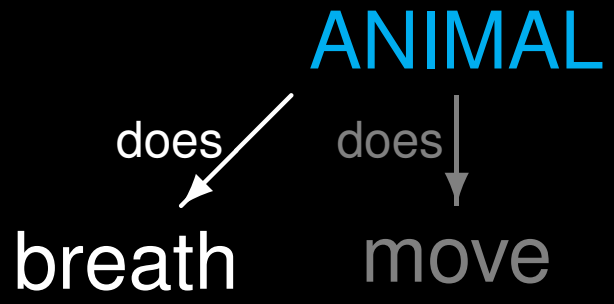


Knowledge Representation

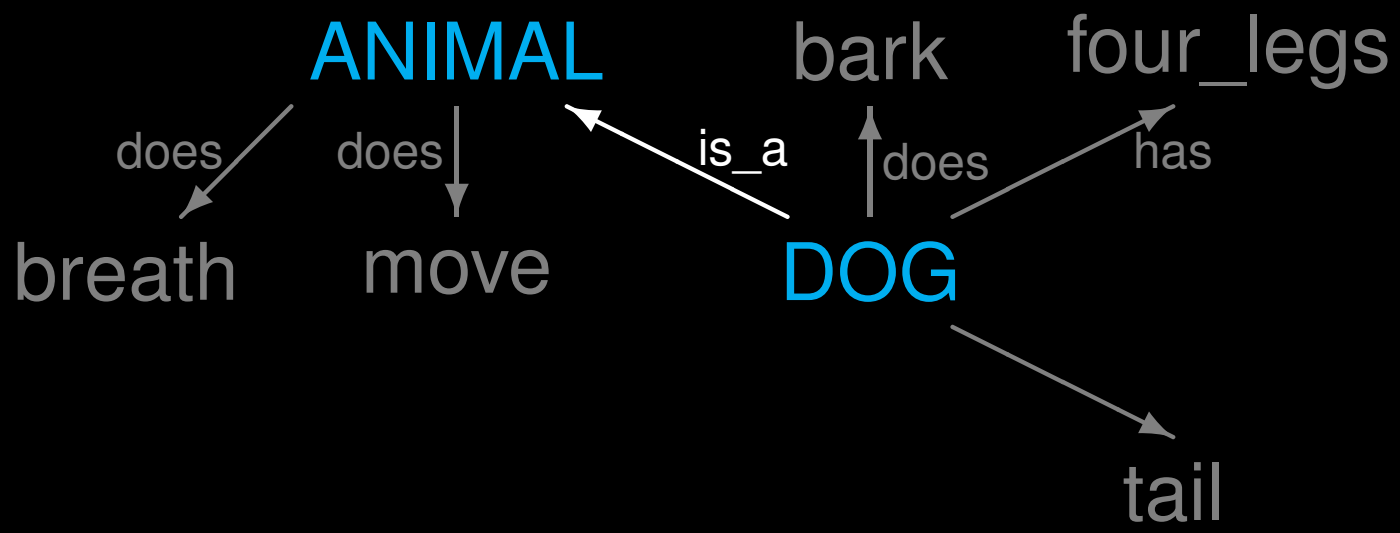
$$animals : animal \mid \overset{d_1}{\Longrightarrow} \mid does(breath)$$



Knowledge Representation

$$animals : animal \mid \overset{d_1}{\Longrightarrow} \mid does(breath)$$

$$dogs : dog \mid \overset{d_2}{\Longrightarrow} \mid is_a(animal)$$



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$$dogs : basenji \mid \overset{d_4}{\Longrightarrow} \mid doesnt(bark)$$

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$$dogs : sheepdog \mid \overset{d_5}{\Longrightarrow} \mid is_a(dog)$$

$$dogs : sheepdog \mid \overset{d_6}{\Longrightarrow} \mid works(sheep)$$

$$dogs : collie \mid \overset{d_7}{\Longrightarrow} \mid is_a(sheepdog)$$

$$dogs : lassie \mid \overset{d_8}{\Longrightarrow} \mid is_a(collie)$$

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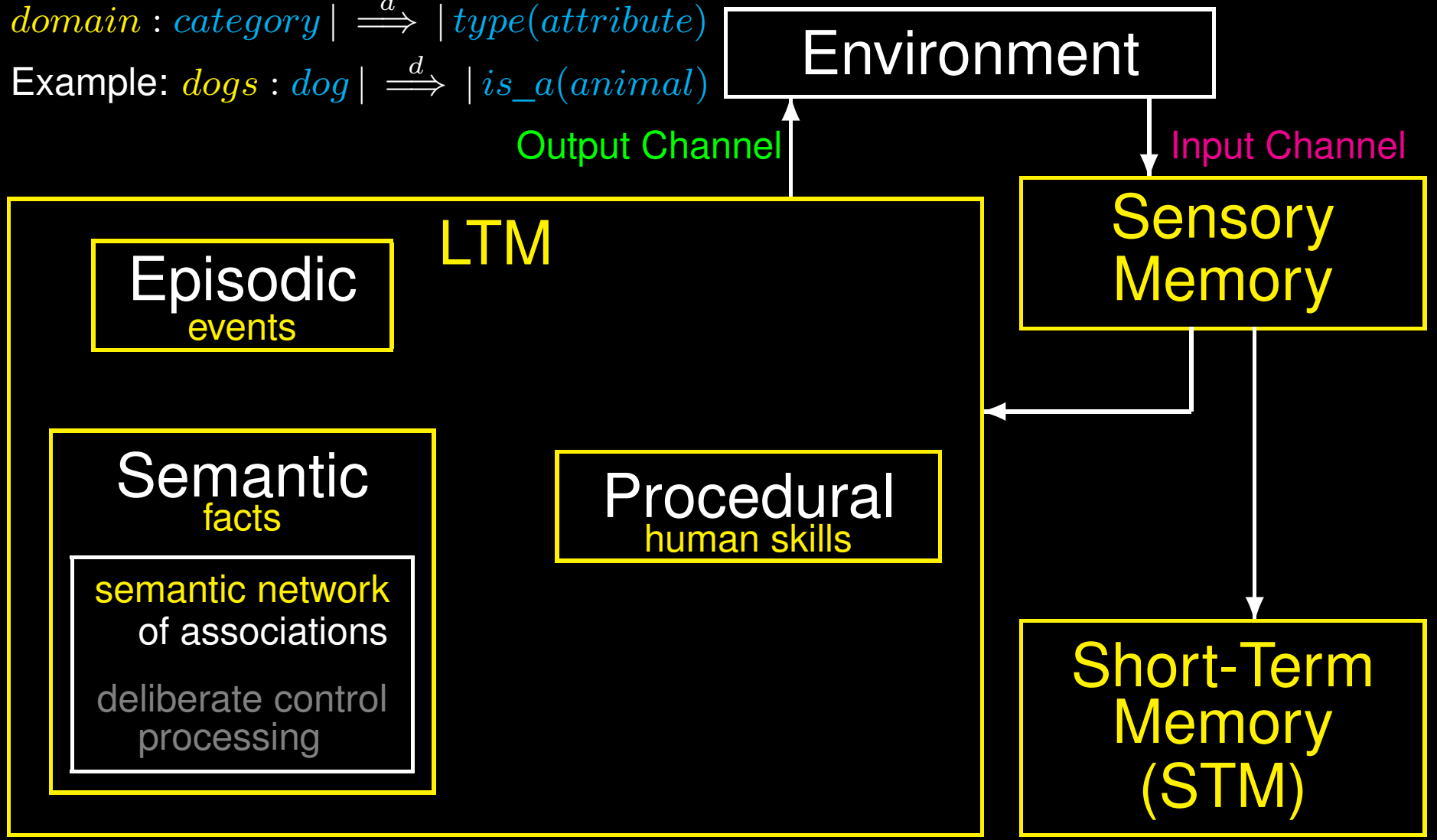
$$dogs : hound \mid \overset{d_9}{\Longrightarrow} \mid does(track)$$

Semantic Network in BRDL

$domain : category \mid \overset{d}{\Longrightarrow} \mid type(attribute)$

Example: $dogs : dog \mid \overset{d}{\Longrightarrow} \mid is_a(animal)$



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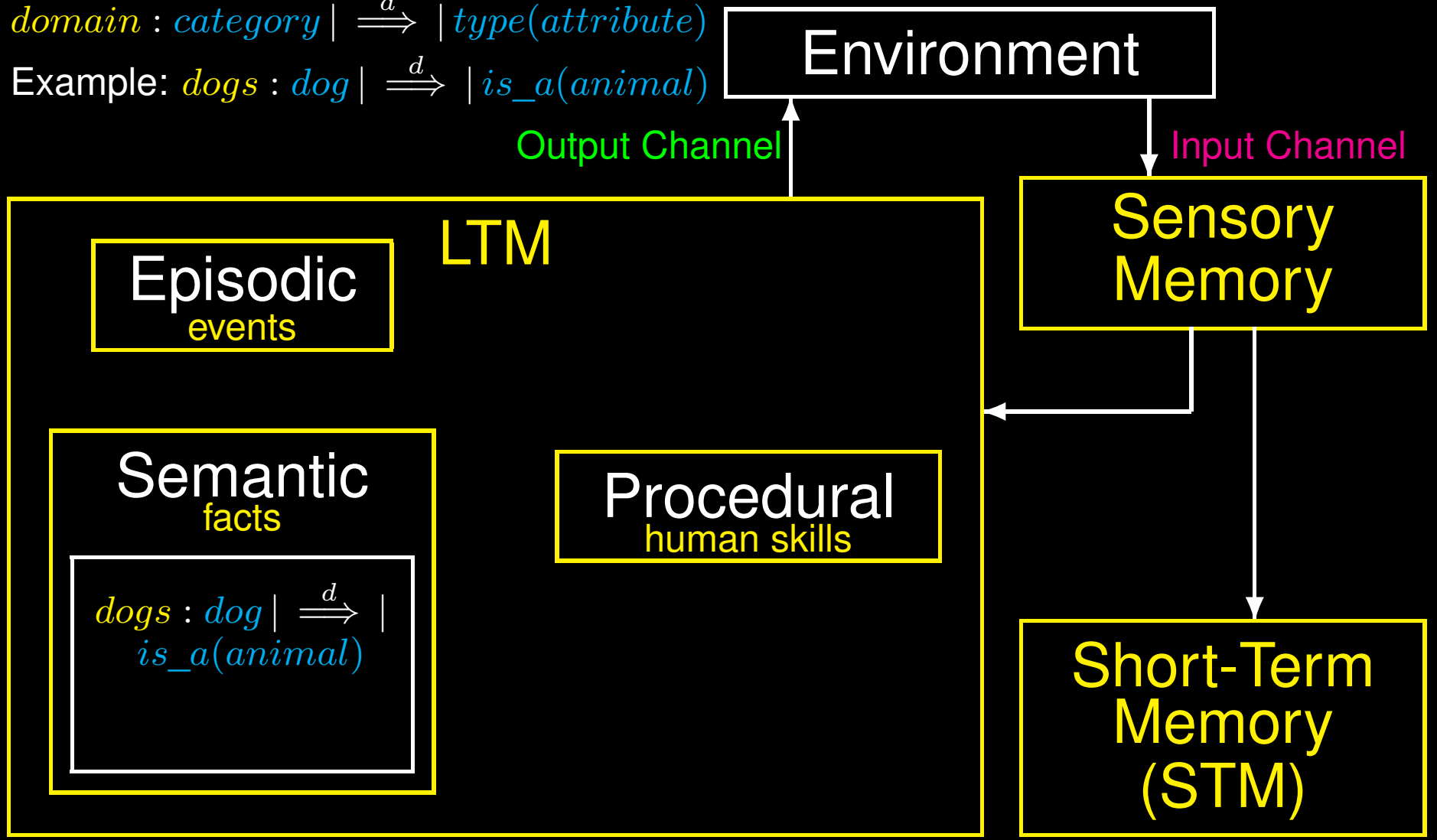
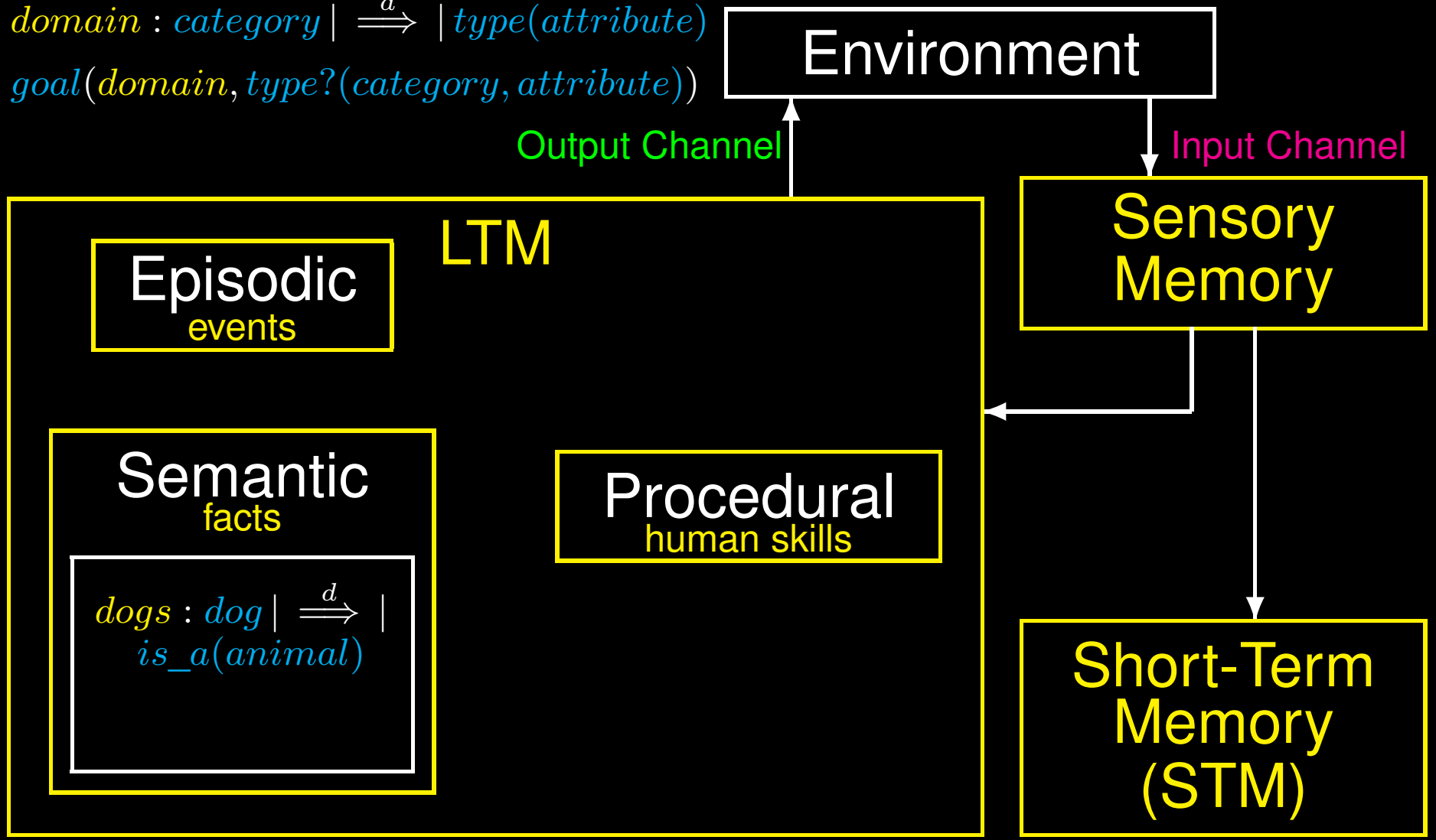


Knowledge Retrieval

$domain : category \mid \overset{d}{\Longrightarrow} \mid type(attribute)$

$goal(domain, type?(category, attribute))$



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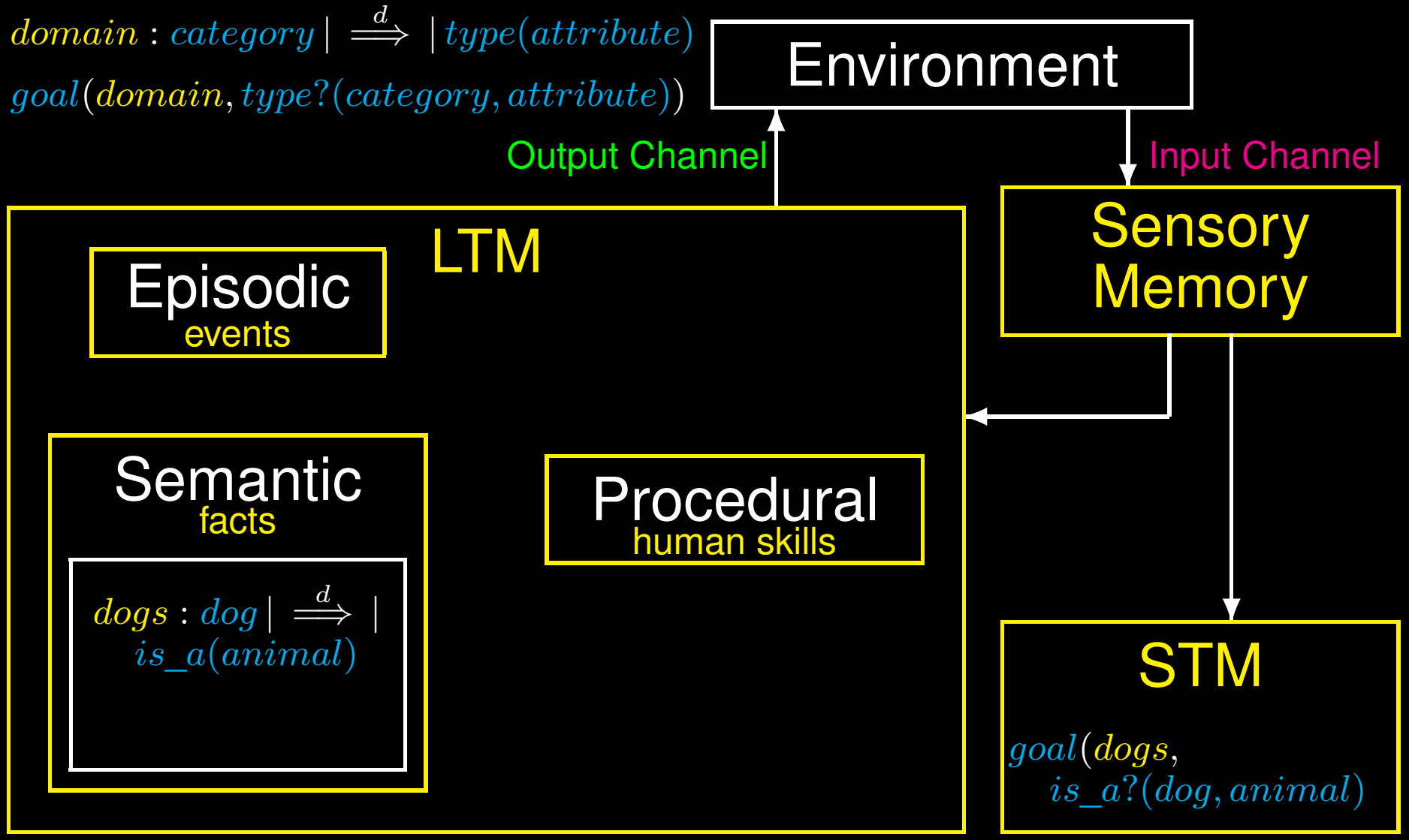

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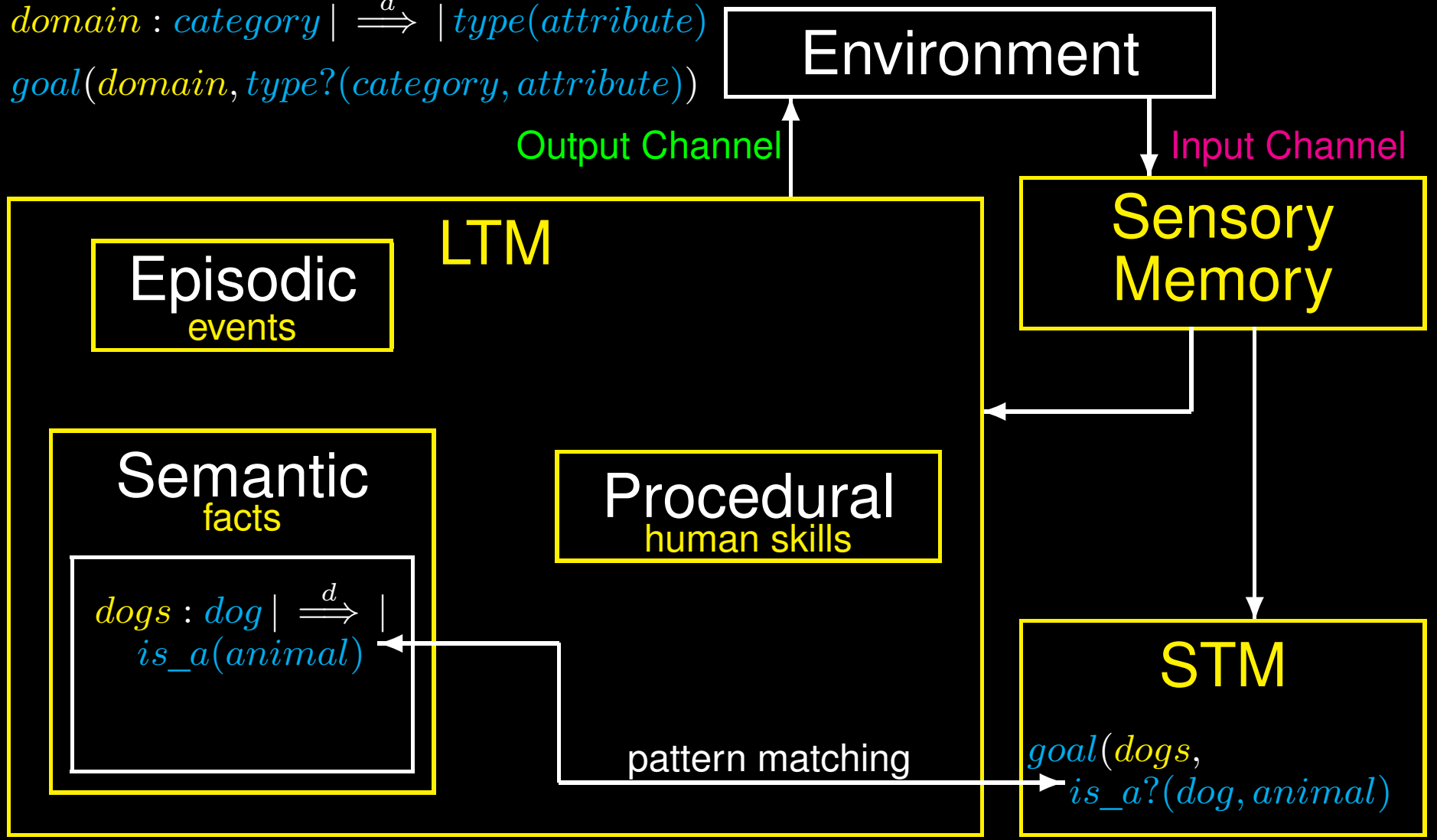
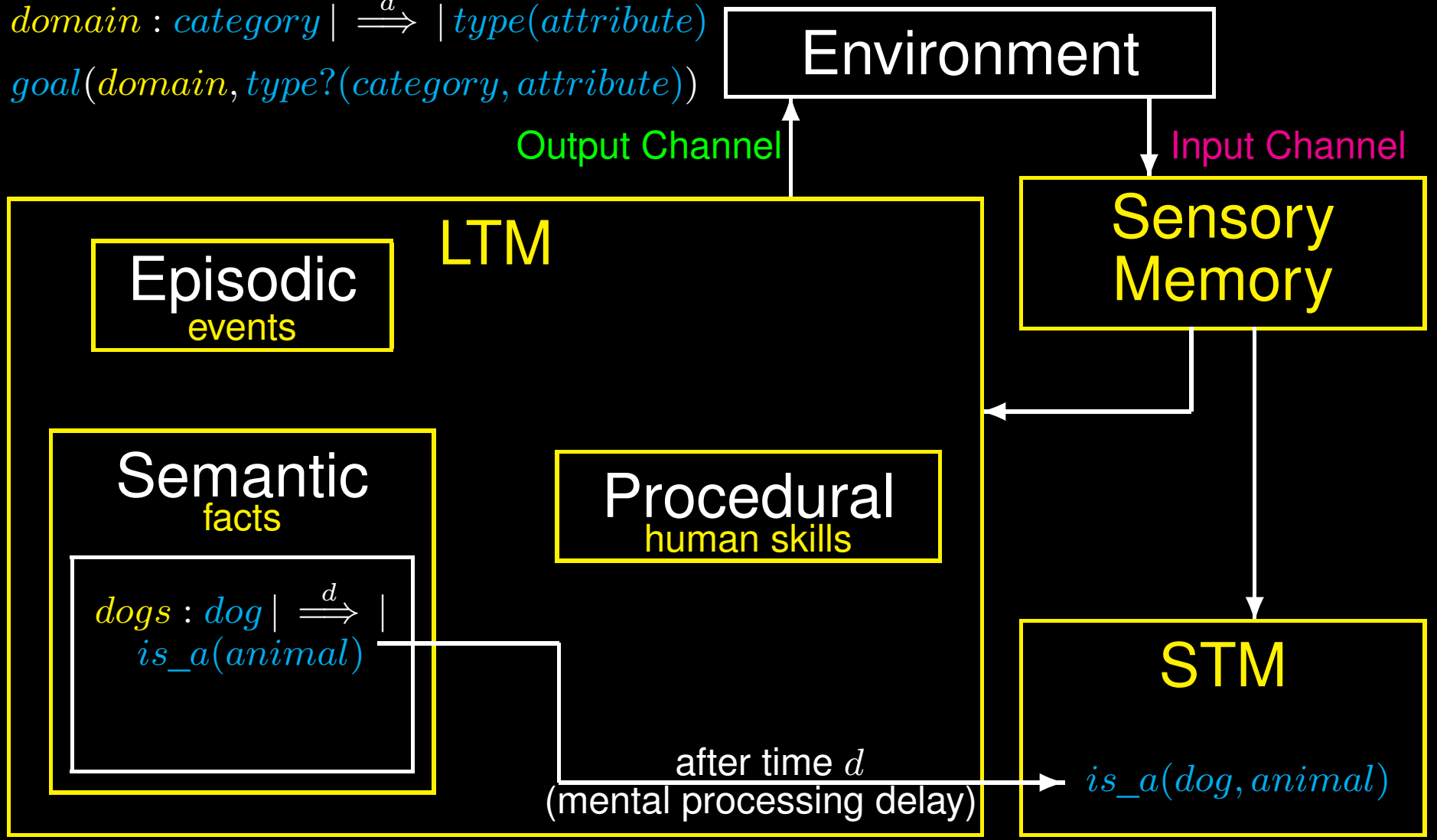


Retrieval Outcome

$domain : category \mid \overset{d}{\Longrightarrow} \mid type(attribute)$

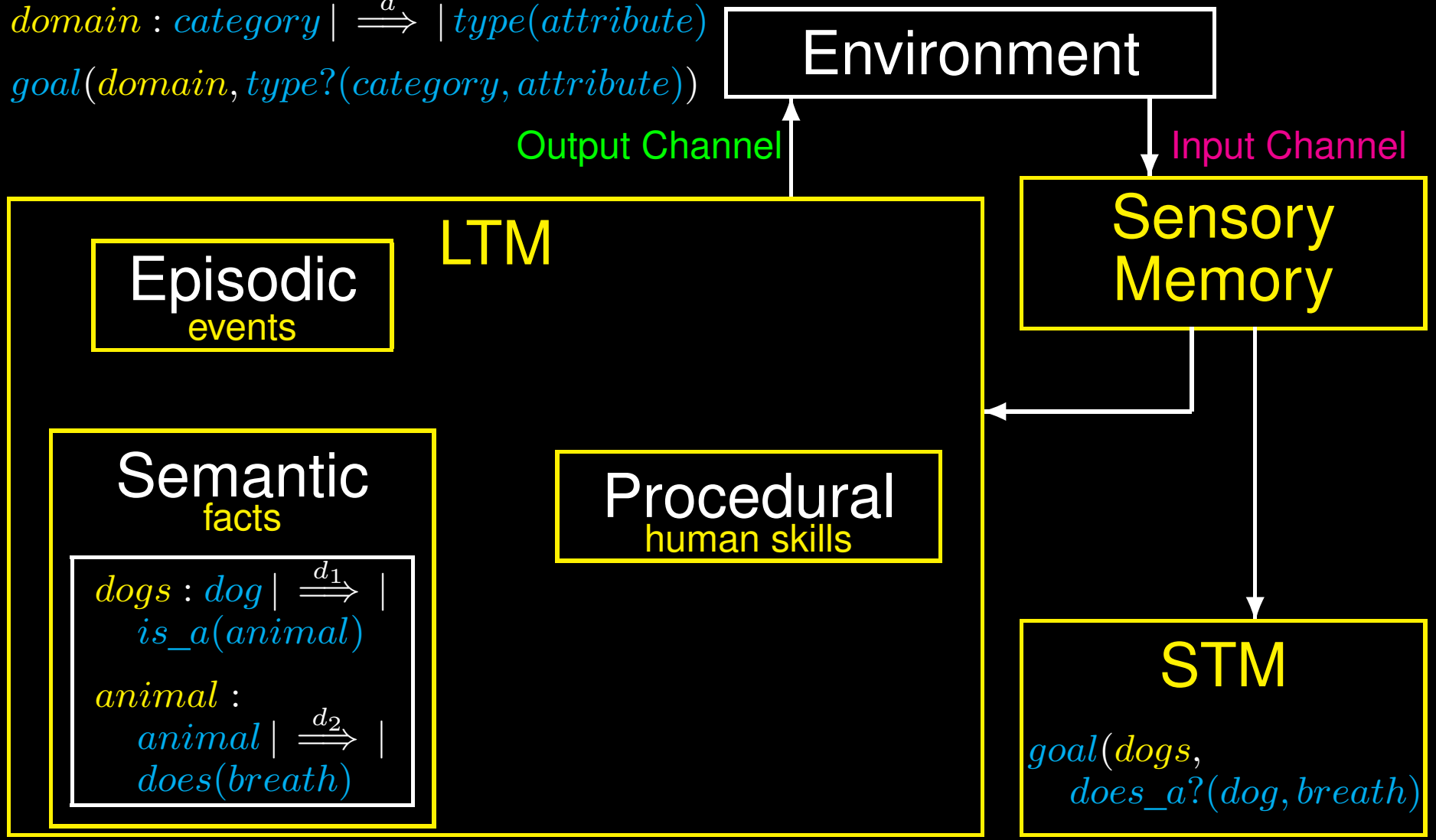
$goal(domain, type?(category, attribute))$



Deeper Retrieval

$domain : category \mid \overset{d}{\Longrightarrow} \mid type(attribute)$

$goal(domain, type?(category, attribute))$

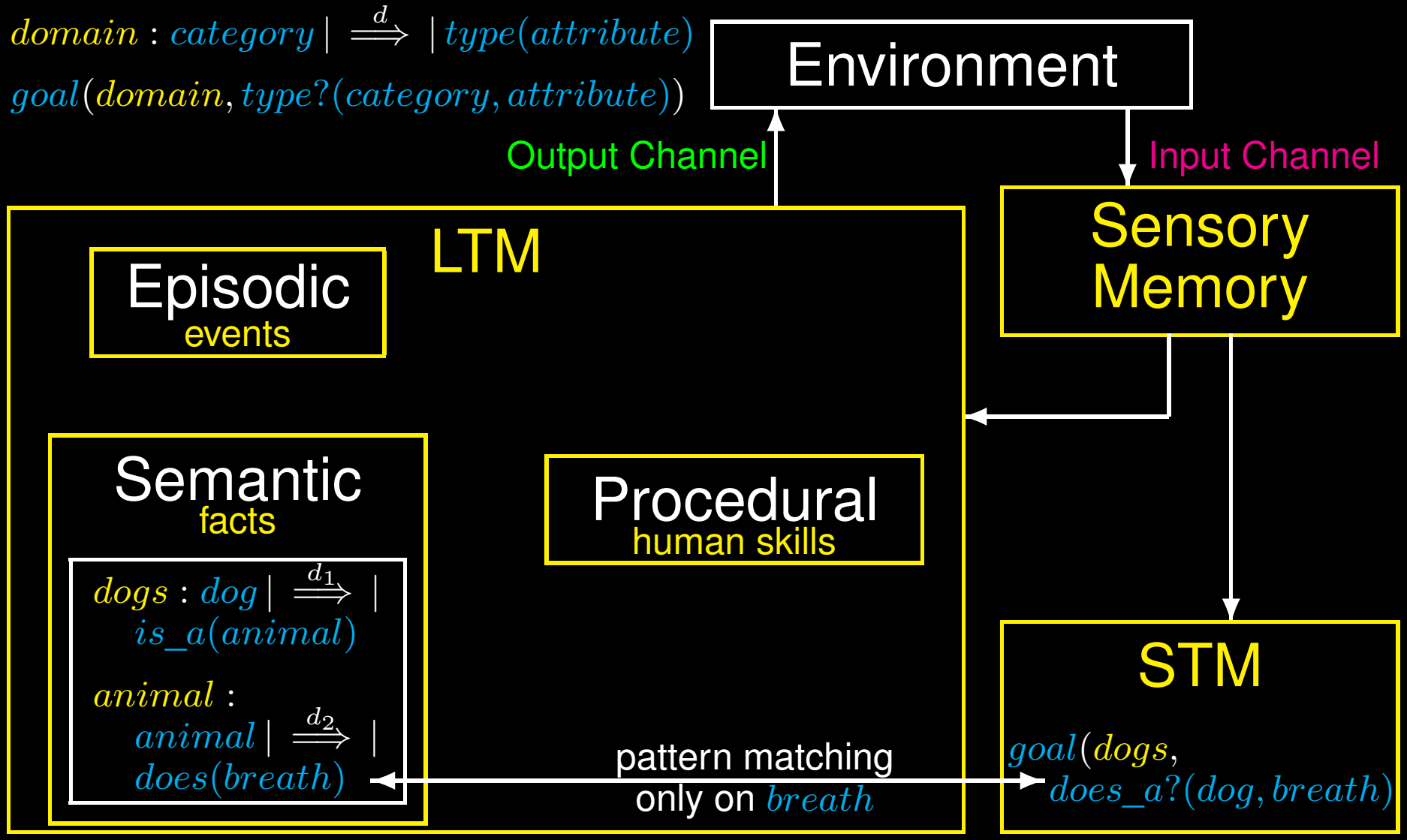


$dogs : dog \mid \overset{d_1}{\Longrightarrow} \mid is_a(animal)$

$animal : animal \mid \overset{d_2}{\Longrightarrow} \mid does(breath)$

$goal(dogs, does_a?(dog, breath))$

Deeper Retrieval



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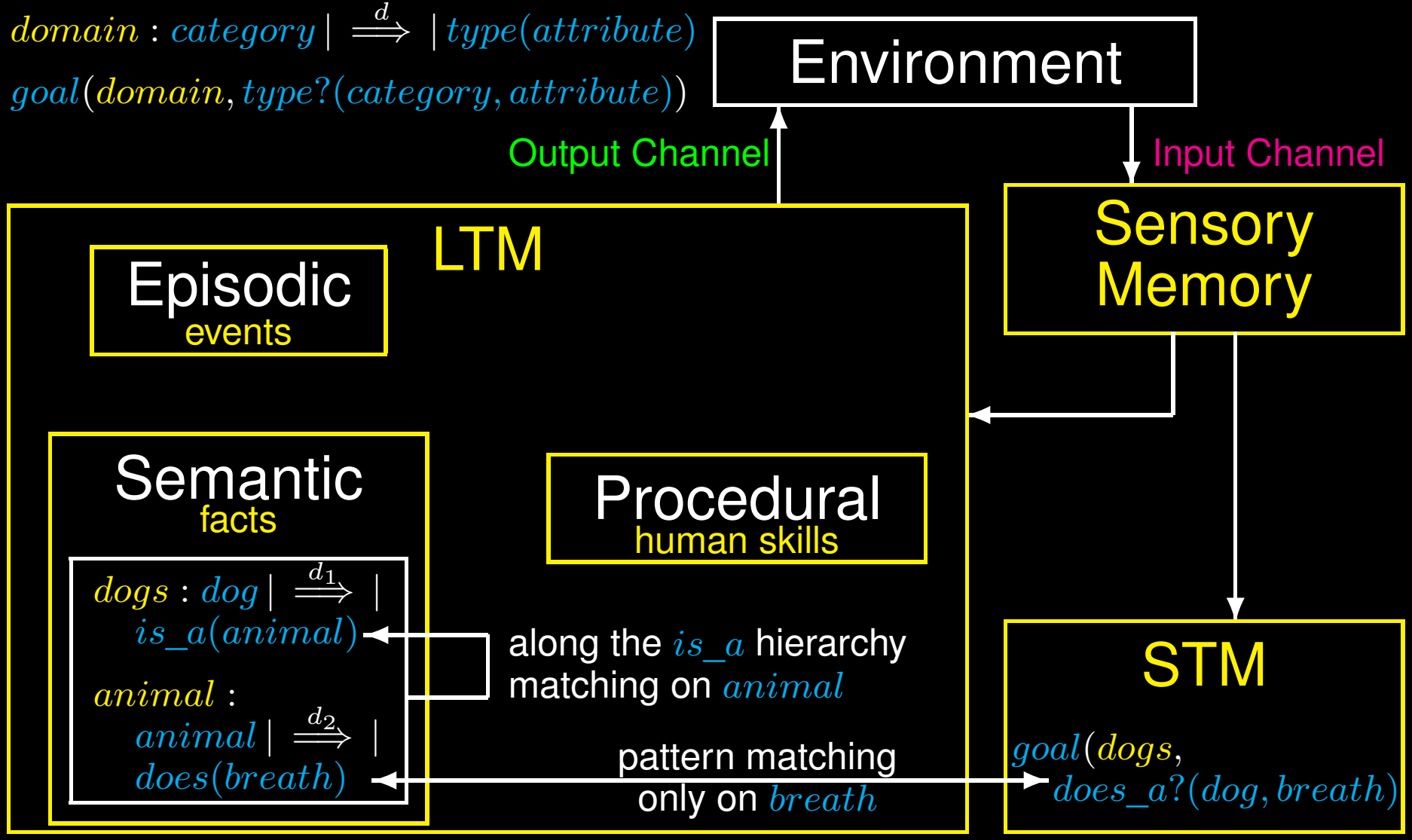
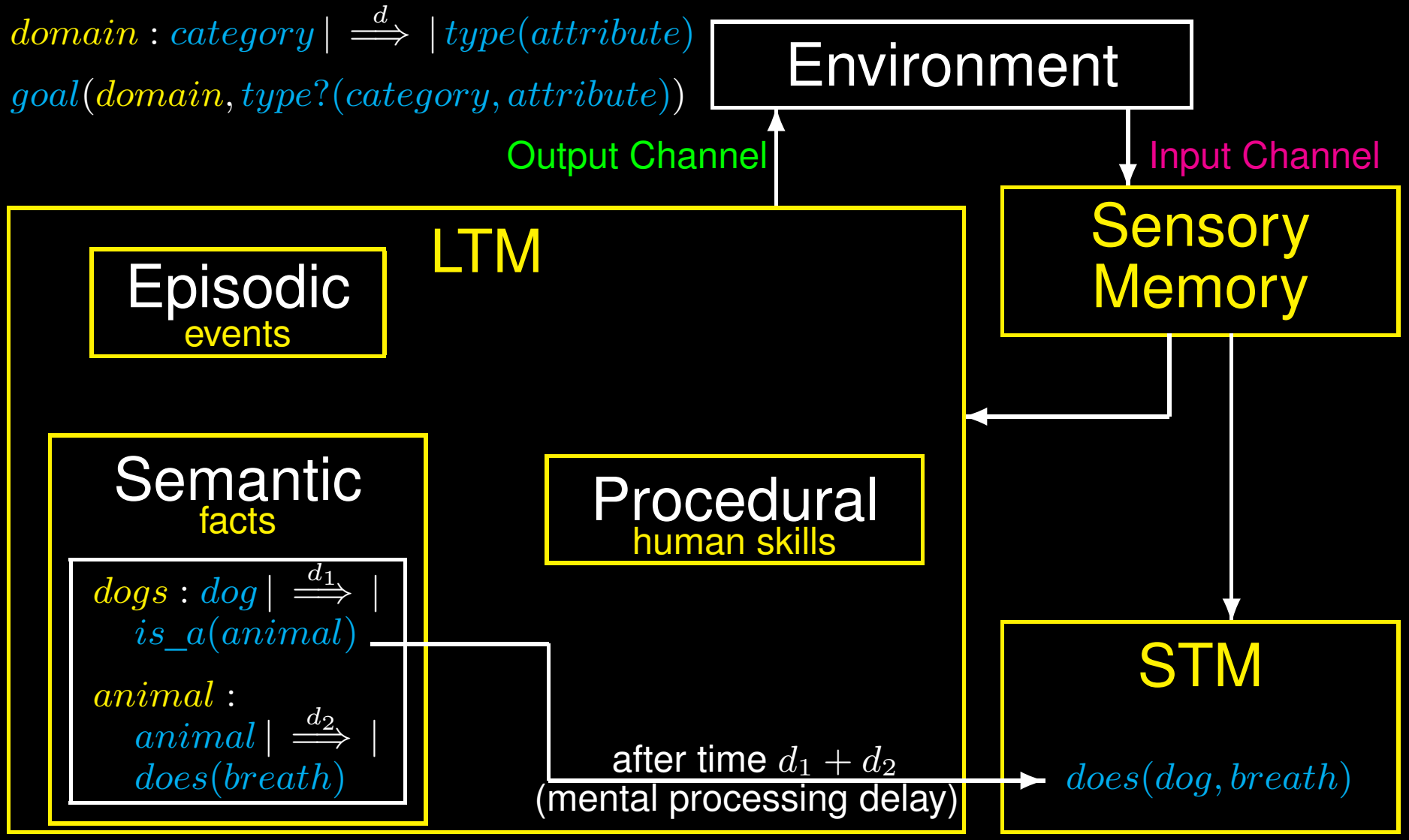
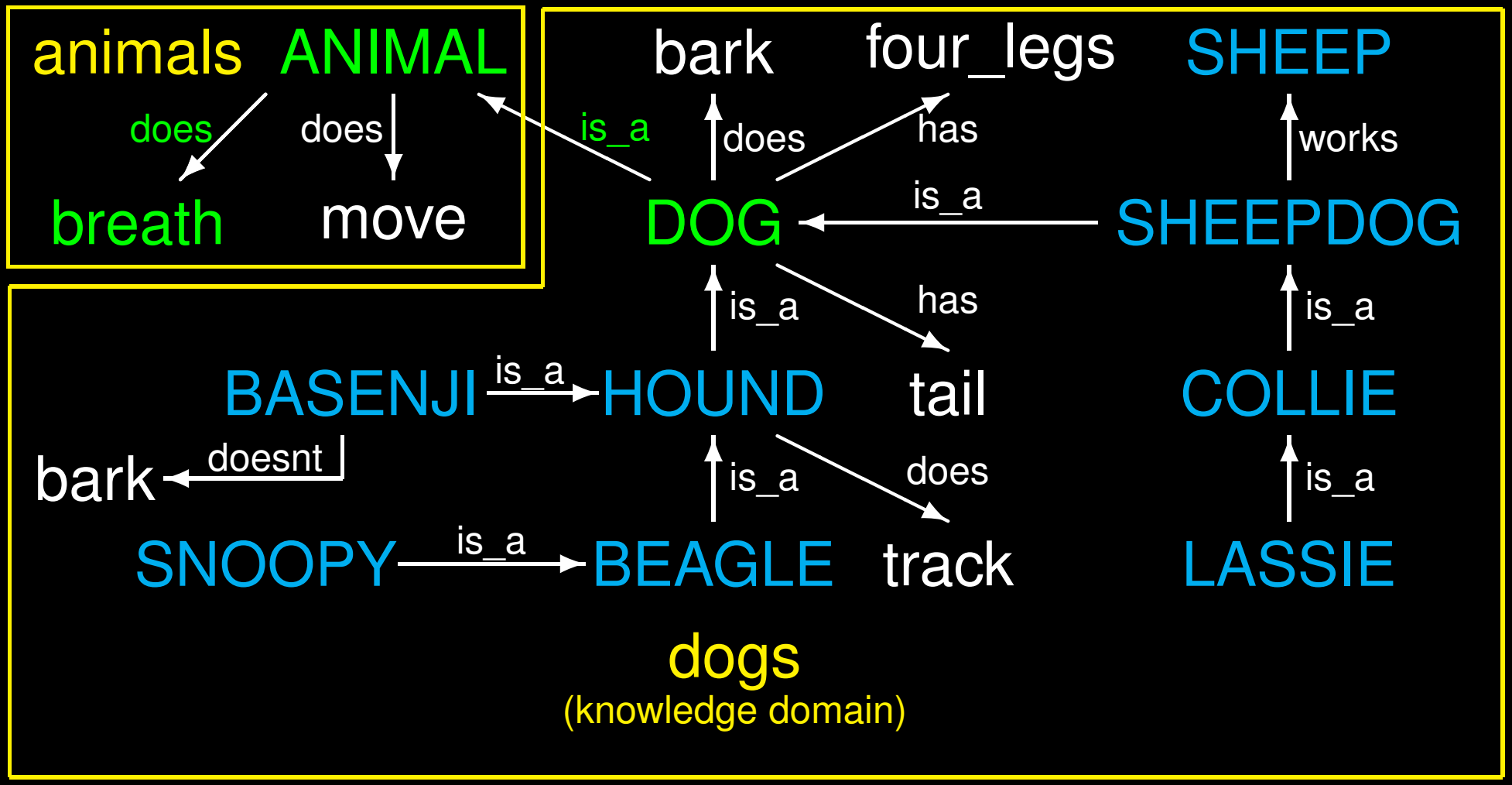


Deeper Retrieval Outcome

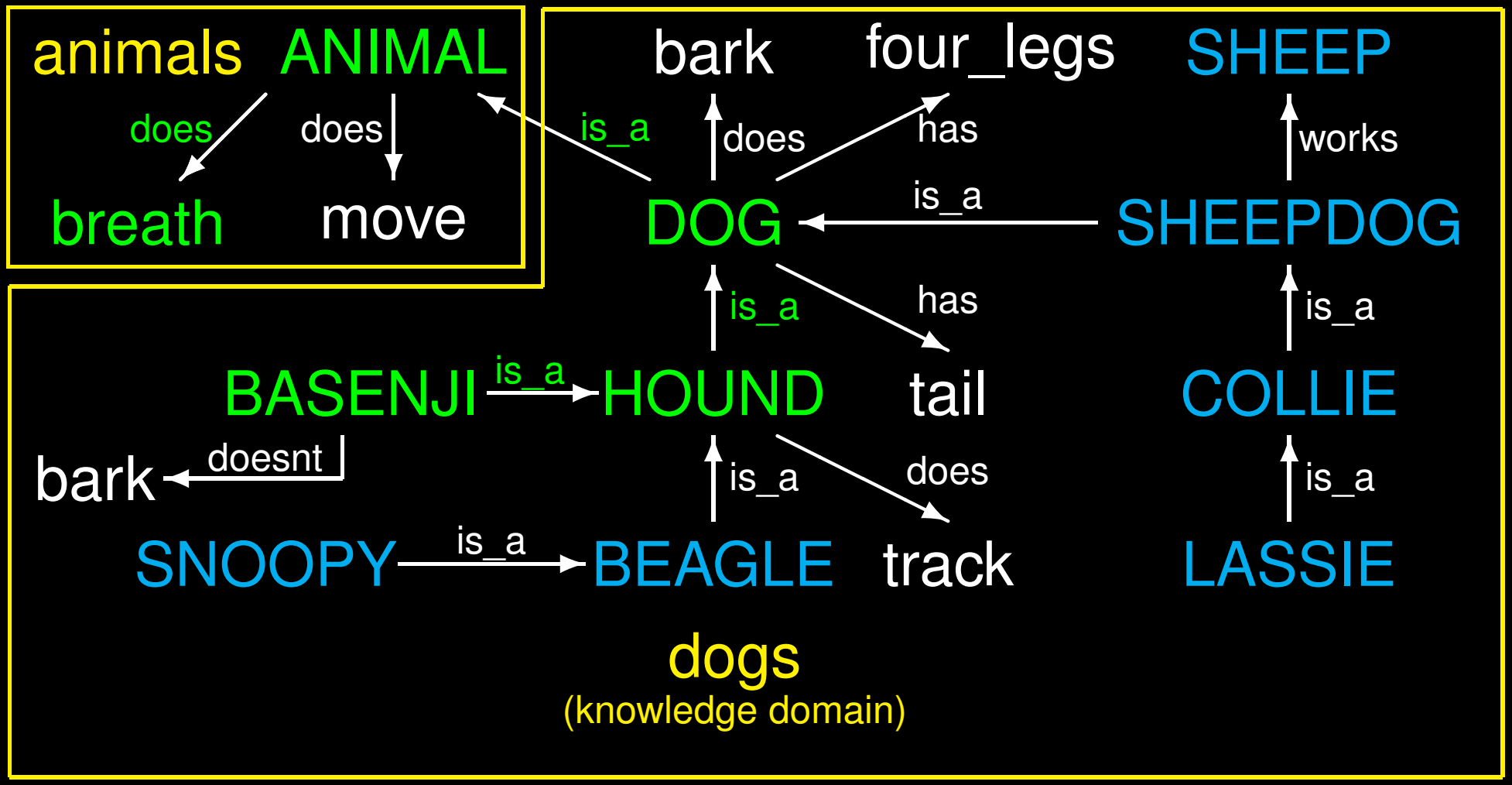


Climbing the Semantic Network



$$does(dog, breath)$$

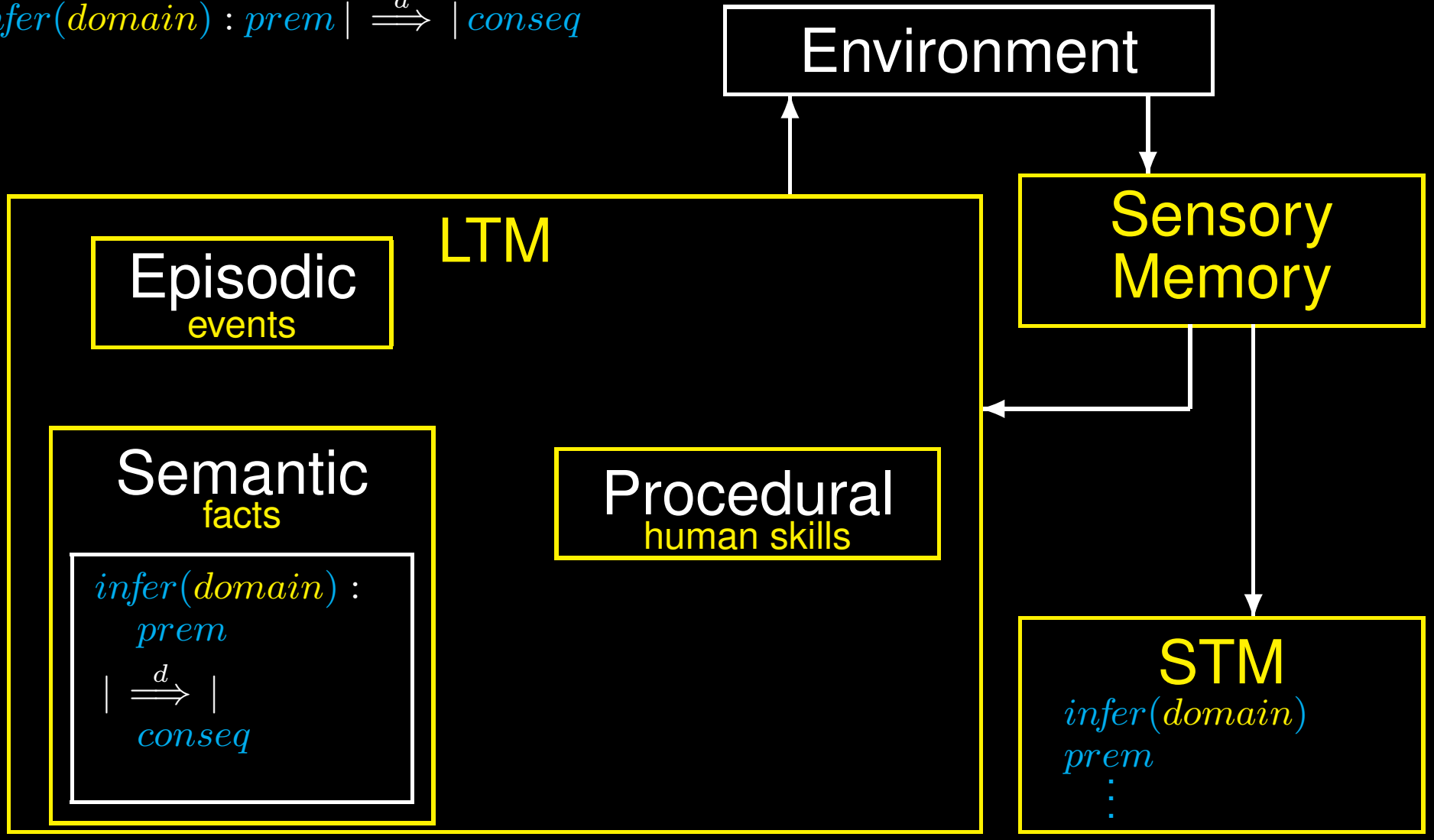
Climbing the Semantic Network



$$does(basenji, breath)$$

Deliberate Control: Reasoning

$infer(domain) : prem \mid \stackrel{d}{\Longrightarrow} \mid conseq$



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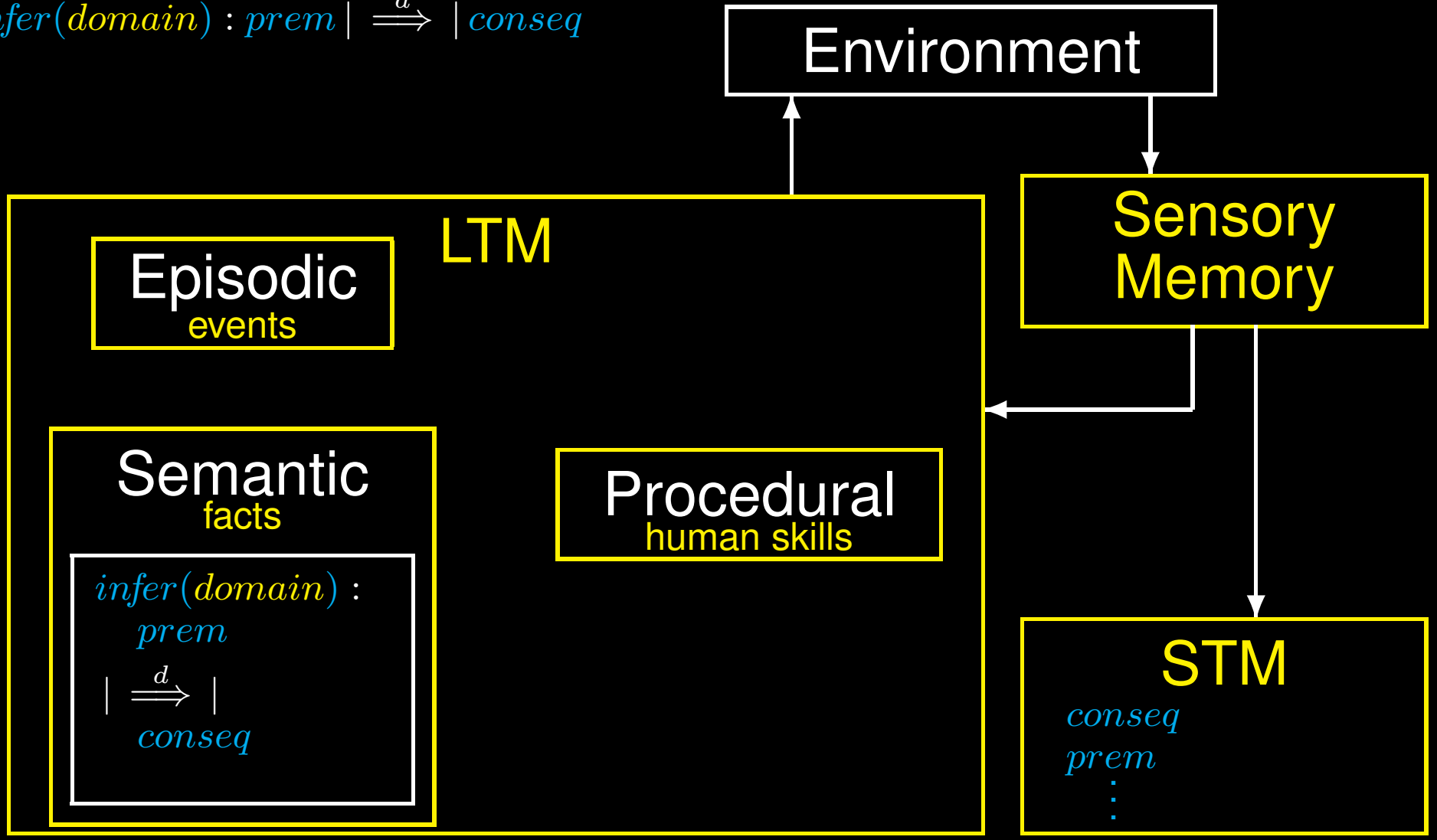
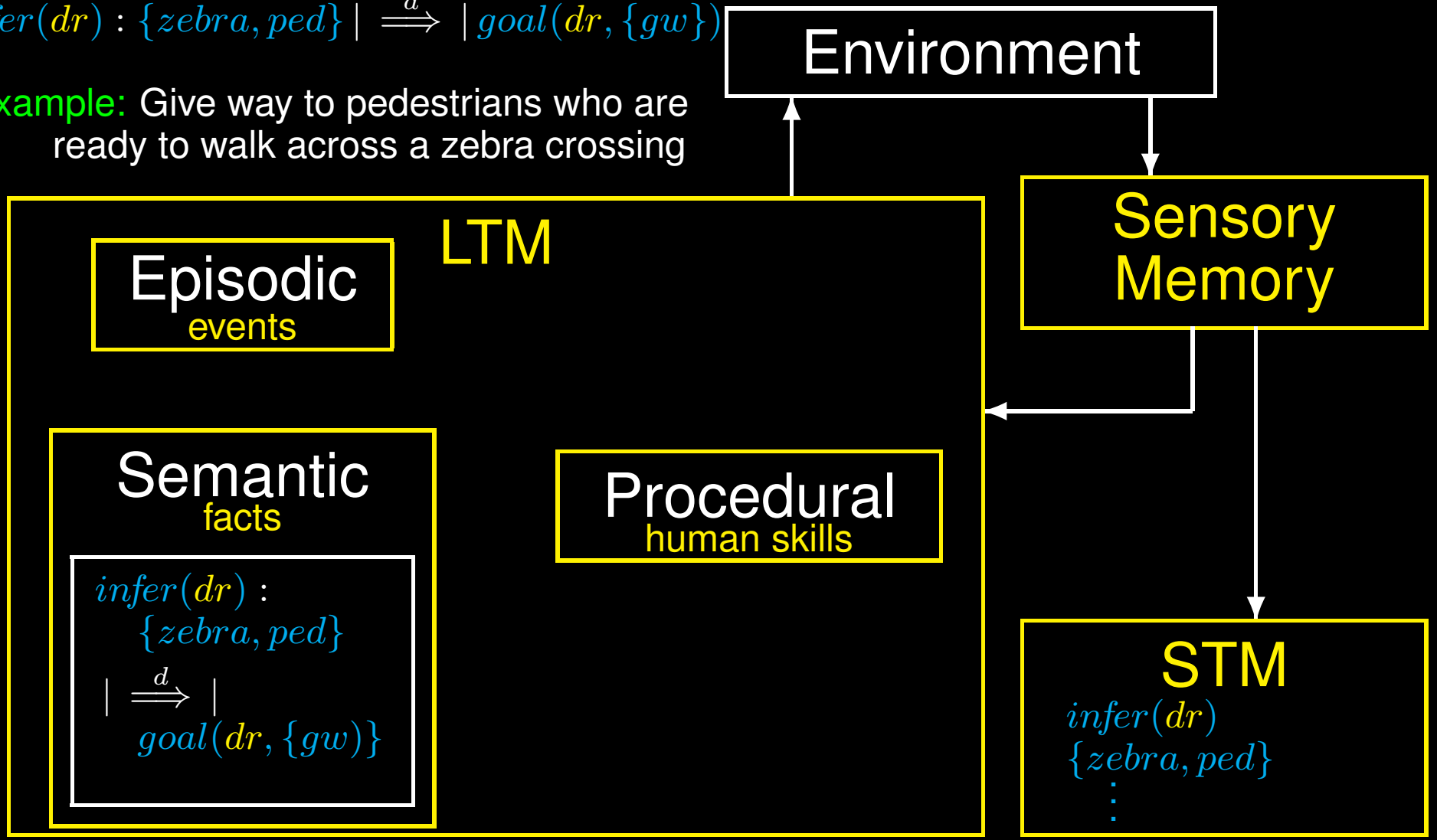


Reasoning Example

$infer(dr) : \{zebra, ped\} \mid \stackrel{d}{\Longrightarrow} \mid goal(dr, \{gw\})$

Example: Give way to pedestrians who are ready to walk across a zebra crossing



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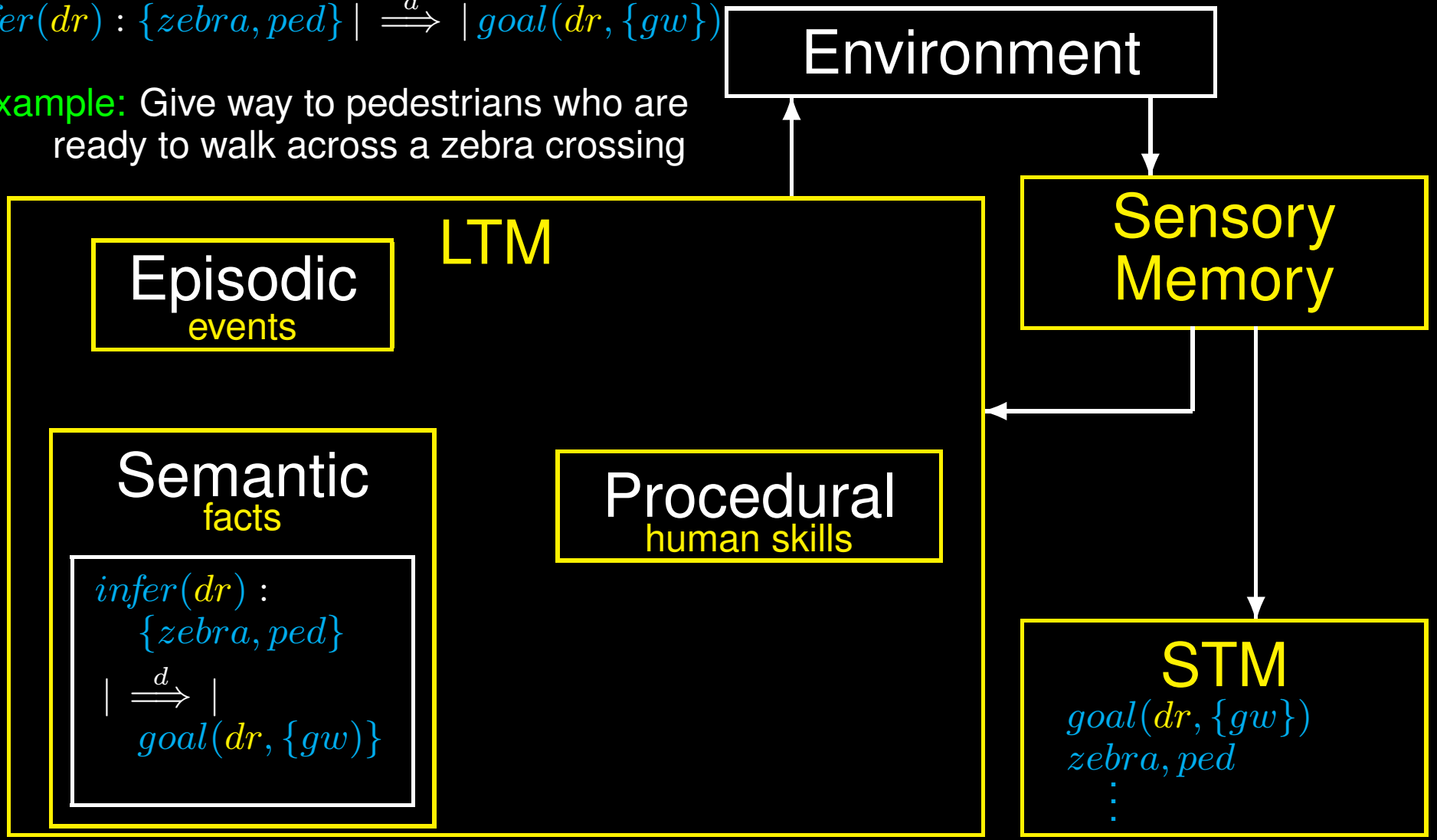

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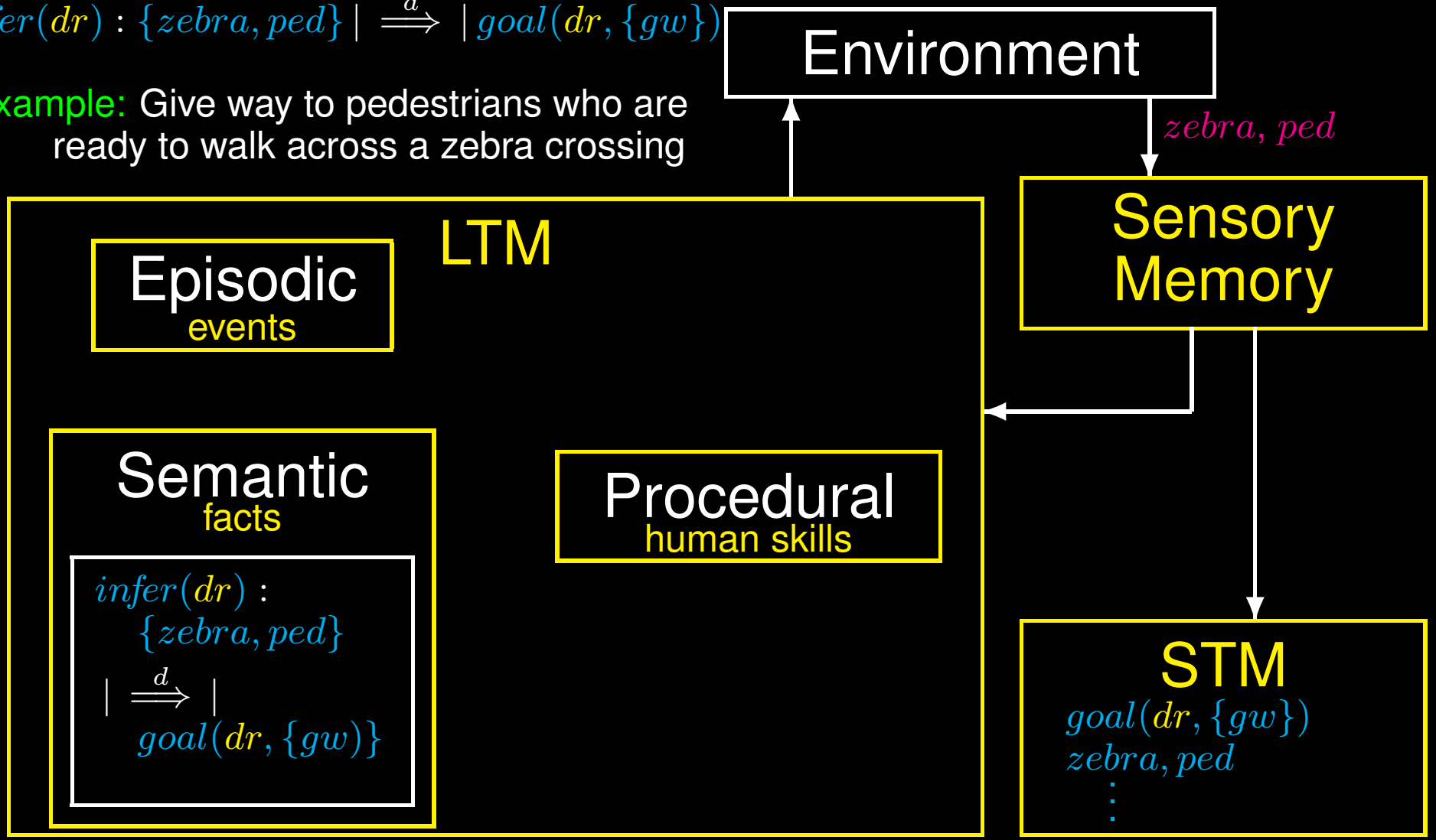

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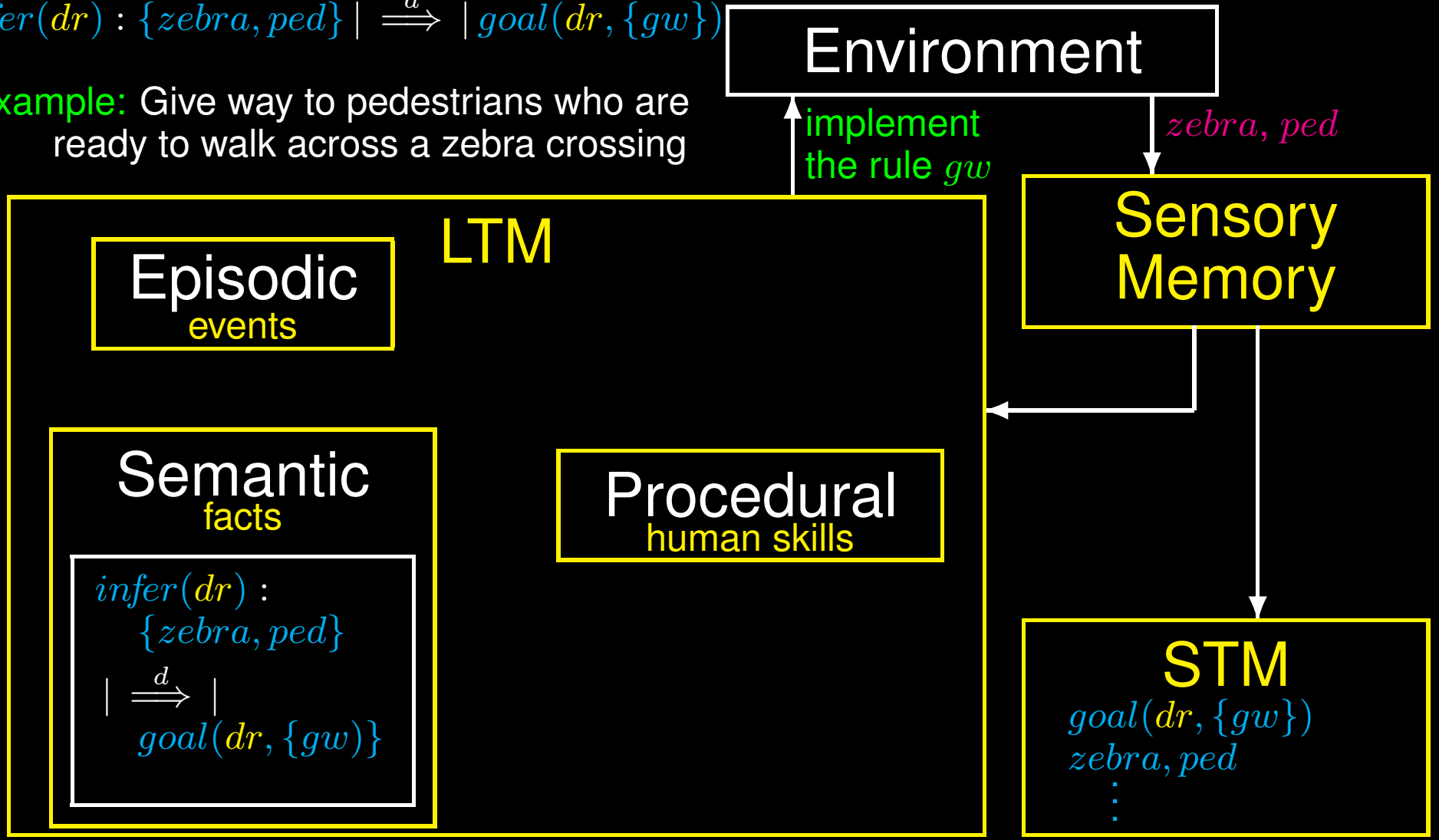
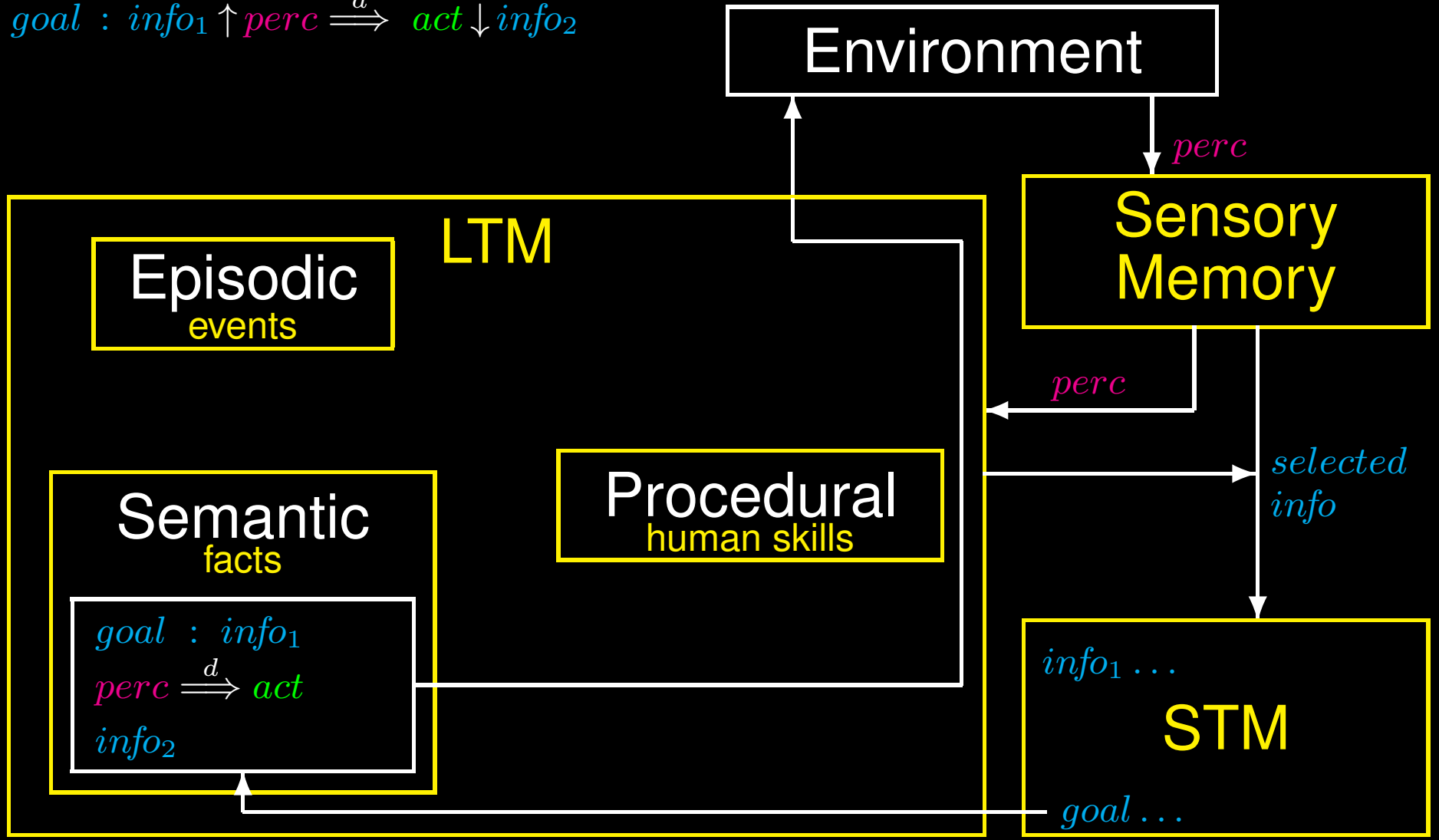


Deliberate Control: Behaviour

$goal\ :\ info_1 \uparrow perc \overset{d}{\Longrightarrow} act \downarrow info_2$



Deliberate Control: Behaviour

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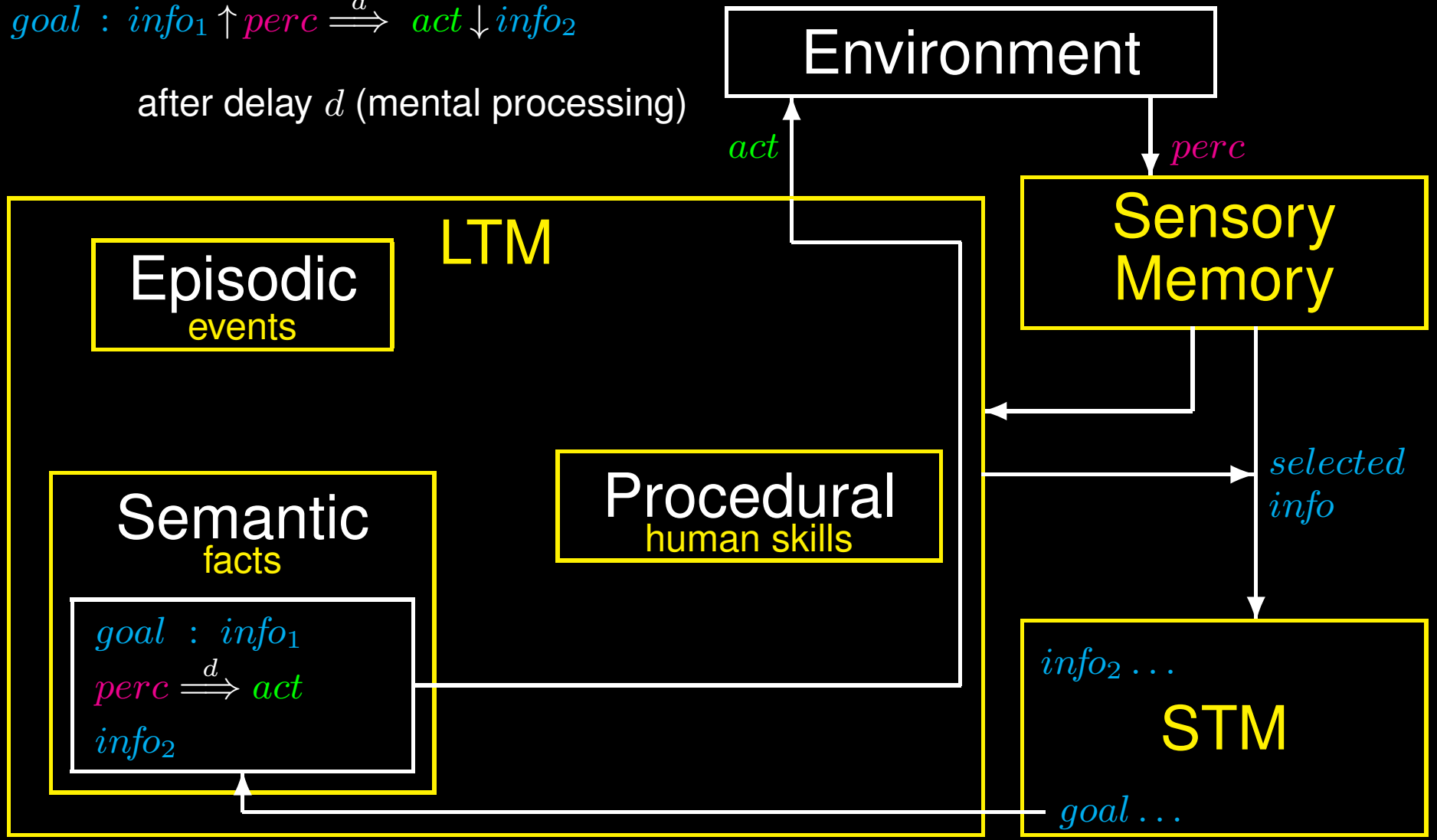
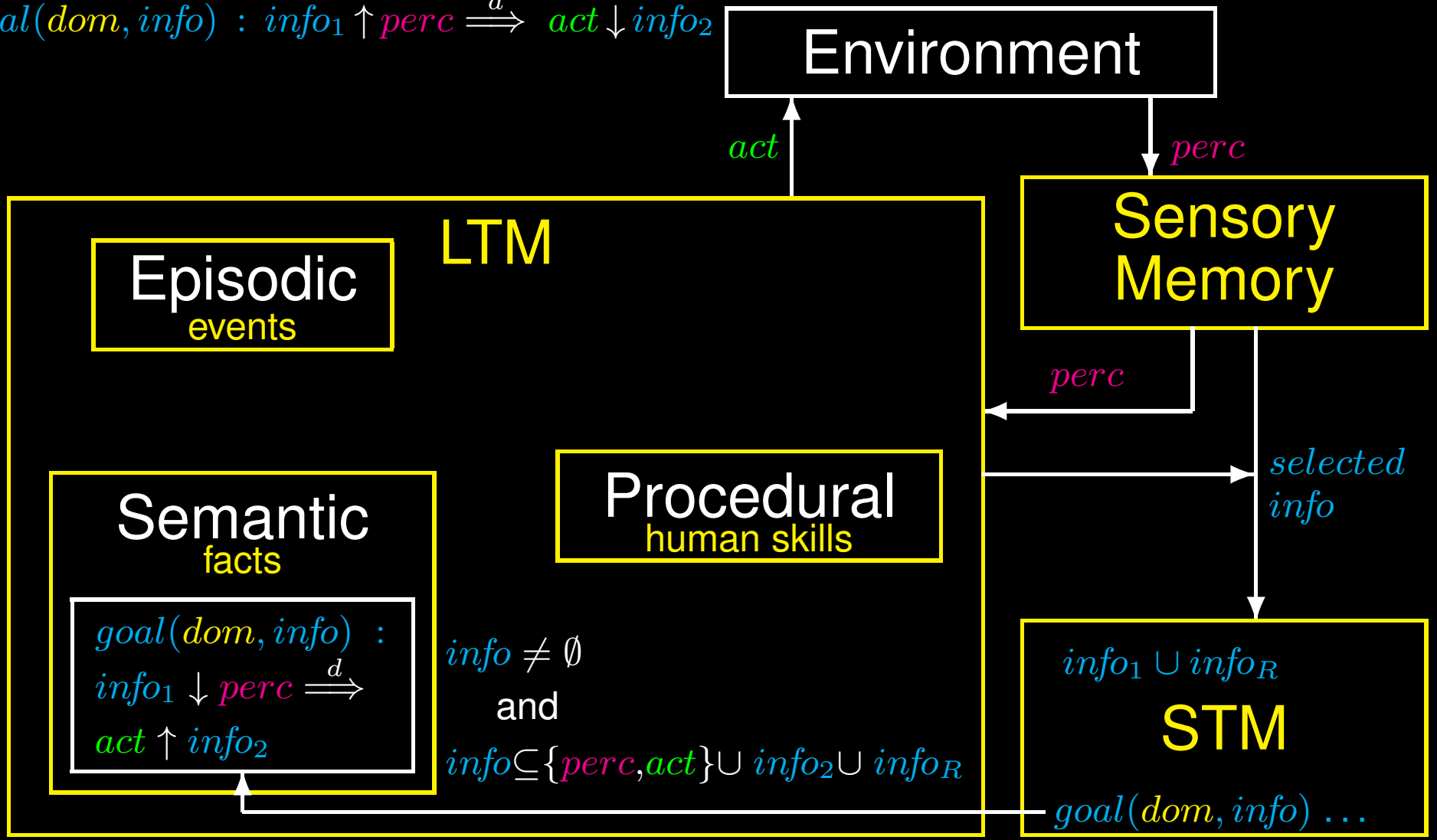
after delay d (mental processing)



Goal Achievement

$goal(dom, info) \ : \ info_1 \uparrow perc \overset{d}{\Longrightarrow} act \downarrow info_2$



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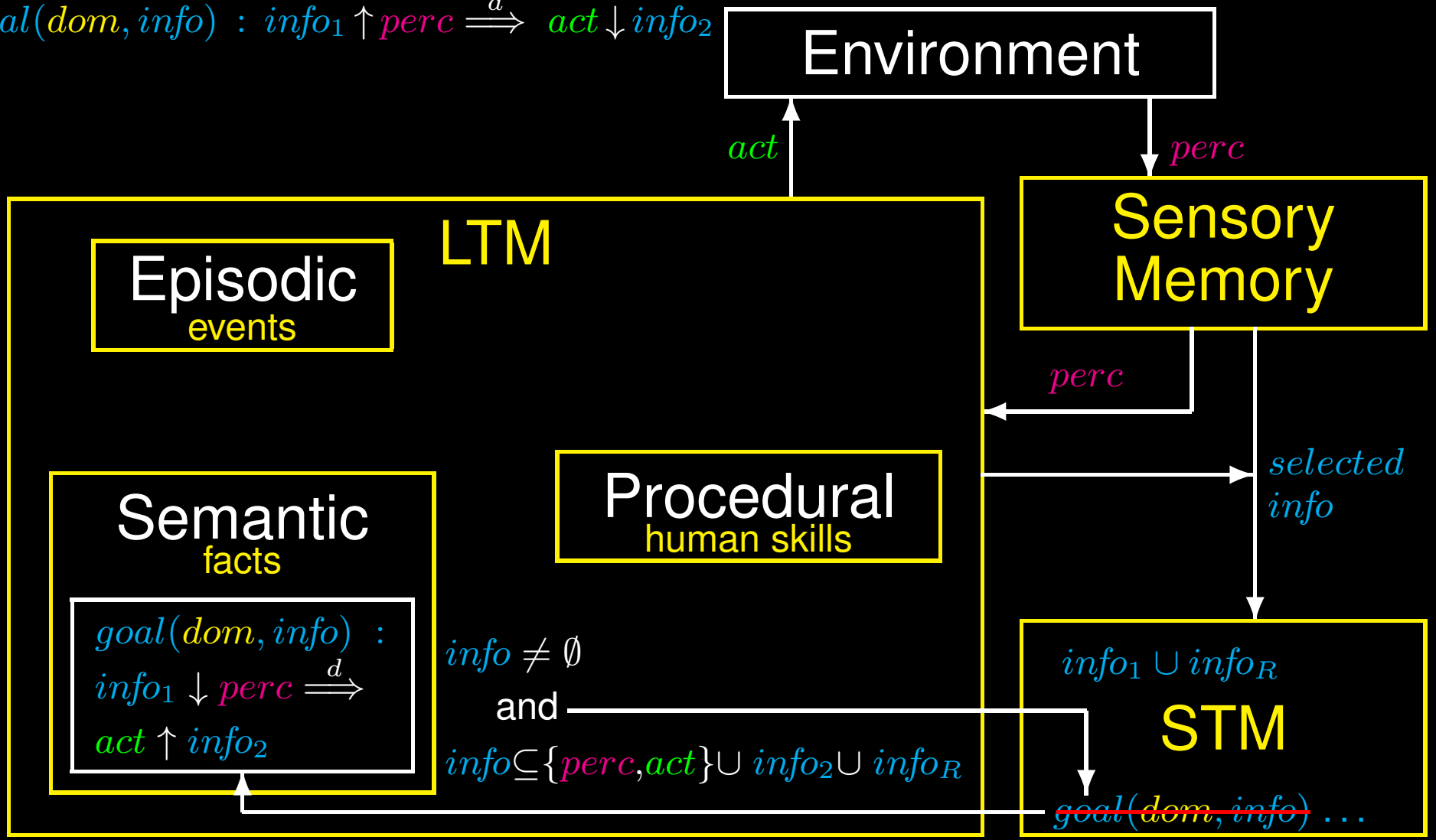
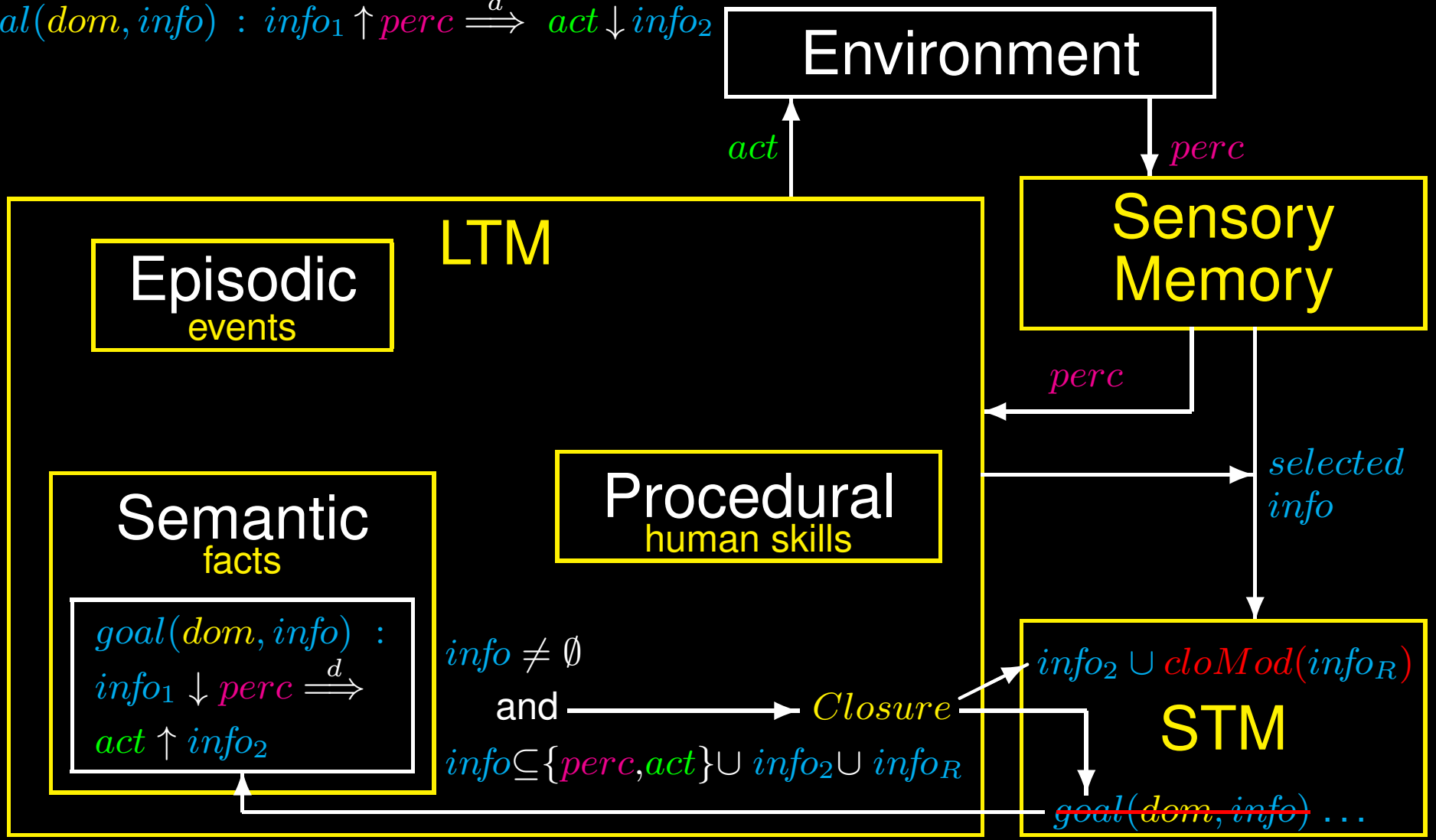


Closure

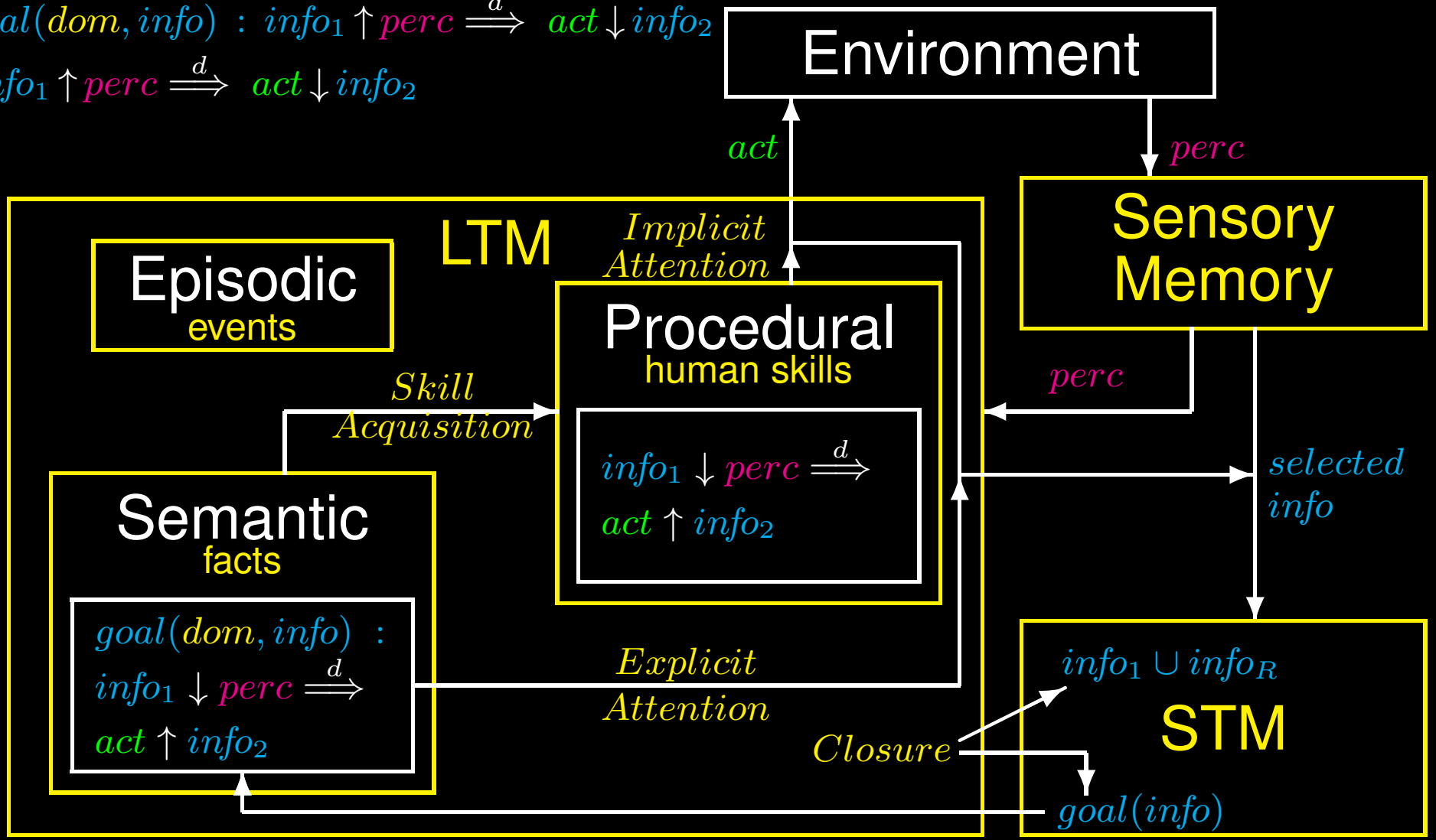
$goal(dom, info) \ : \ info_1 \uparrow perc \overset{d}{\Longrightarrow} act \downarrow info_2$



$\Longrightarrow$ *Automatic Control*

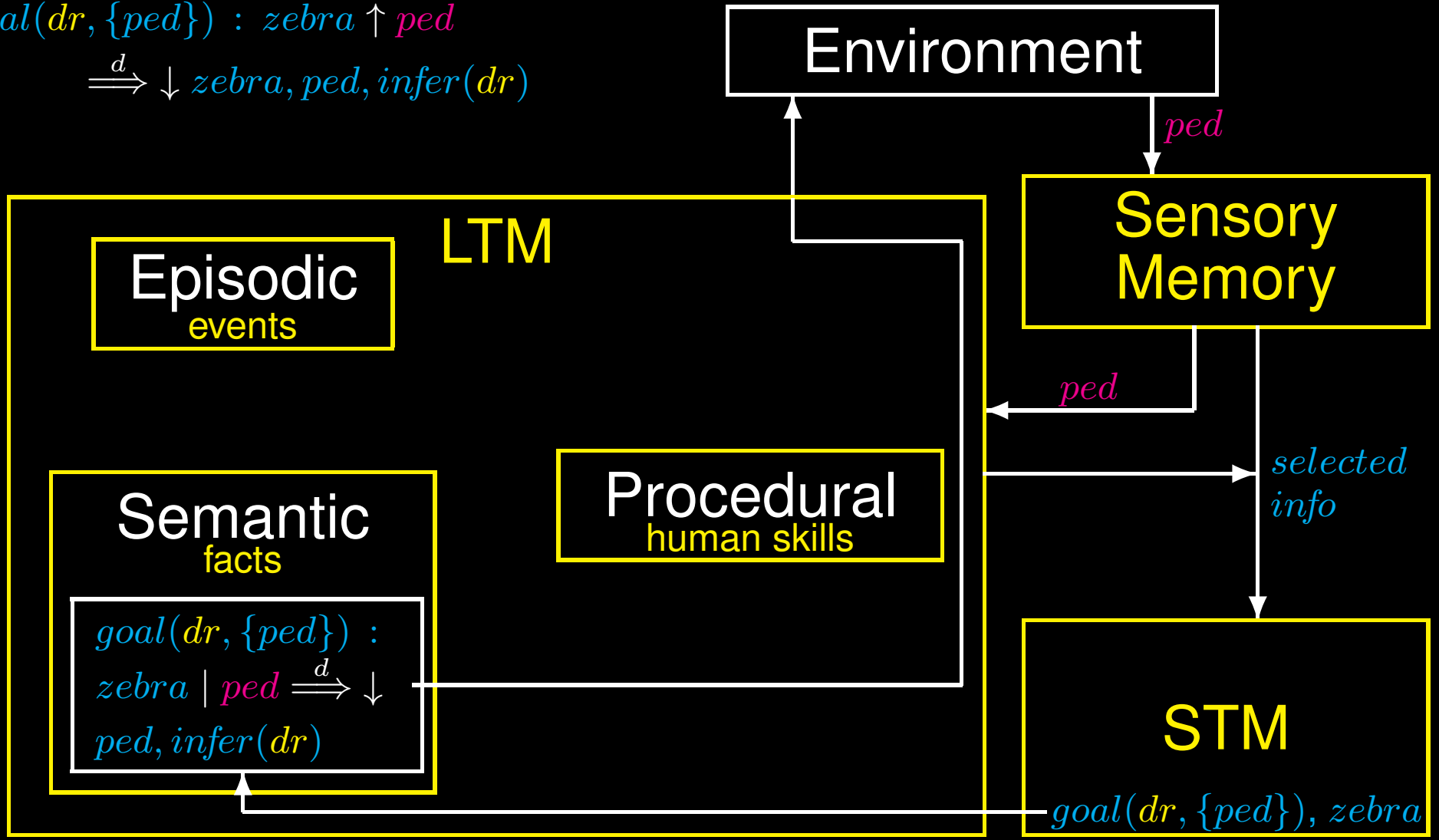
$goal(dom, info) \ : \ info_1 \uparrow perc \overset{d}{\Longrightarrow} act \downarrow info_2$

$info_1 \uparrow perc \overset{d}{\Longrightarrow} act \downarrow info_2$



Deliberate Behaviour Example

$goal(dr, \{ped\}) \ : \ zebra \uparrow ped$
$\overset{d}{\Longrightarrow} \downarrow zebra, ped, infer(dr)$



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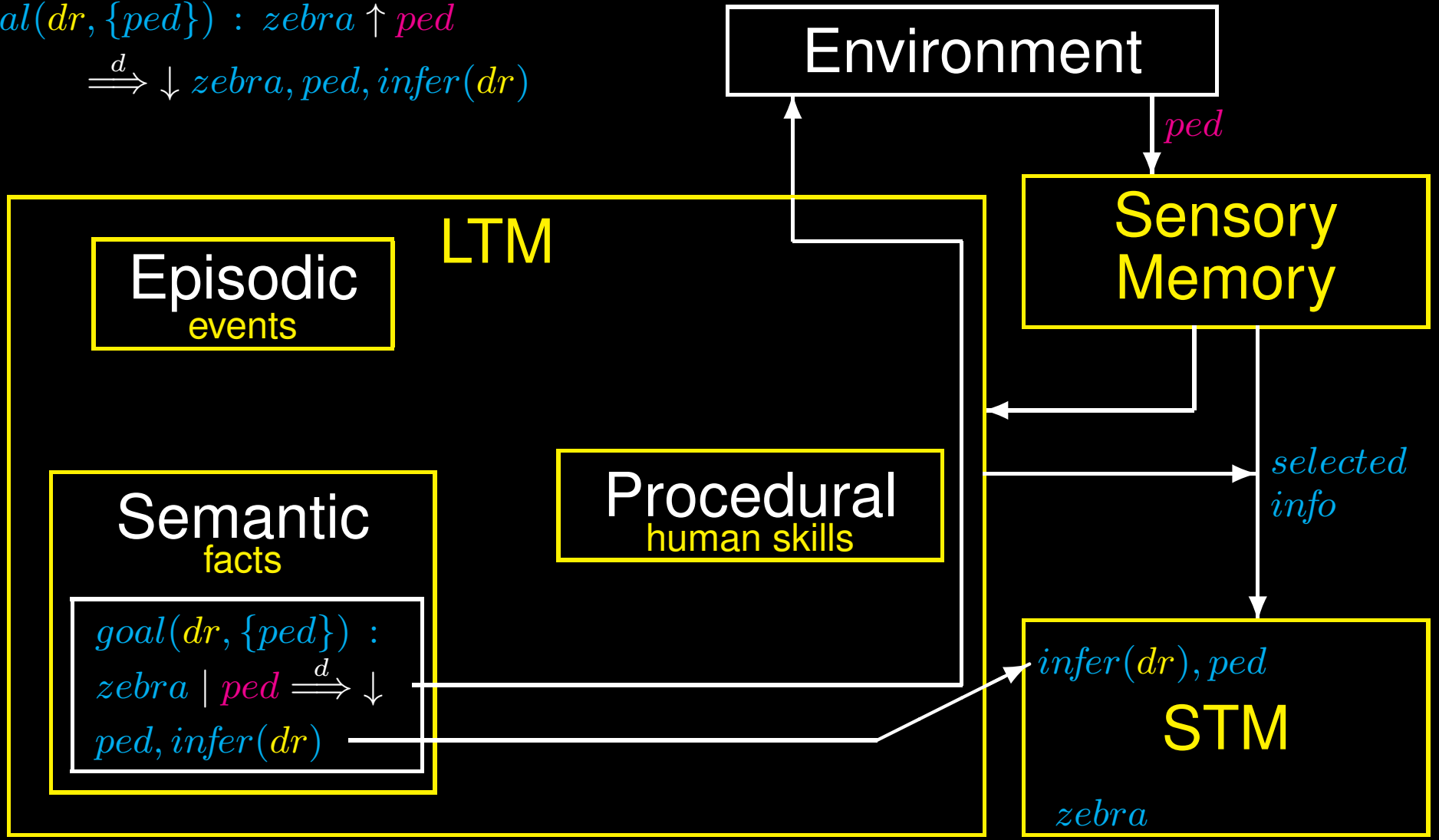

Behaviour+Reasoning

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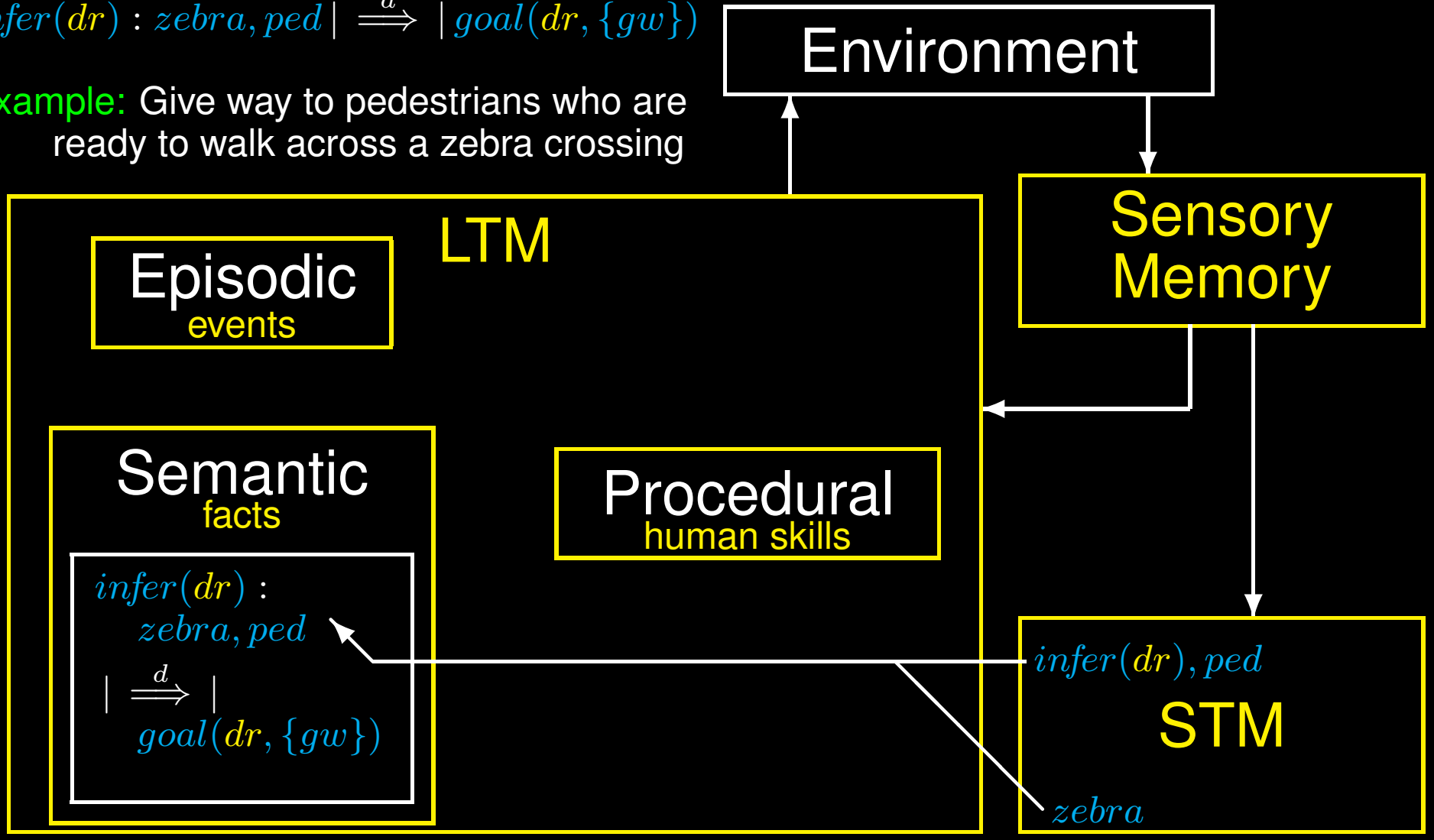
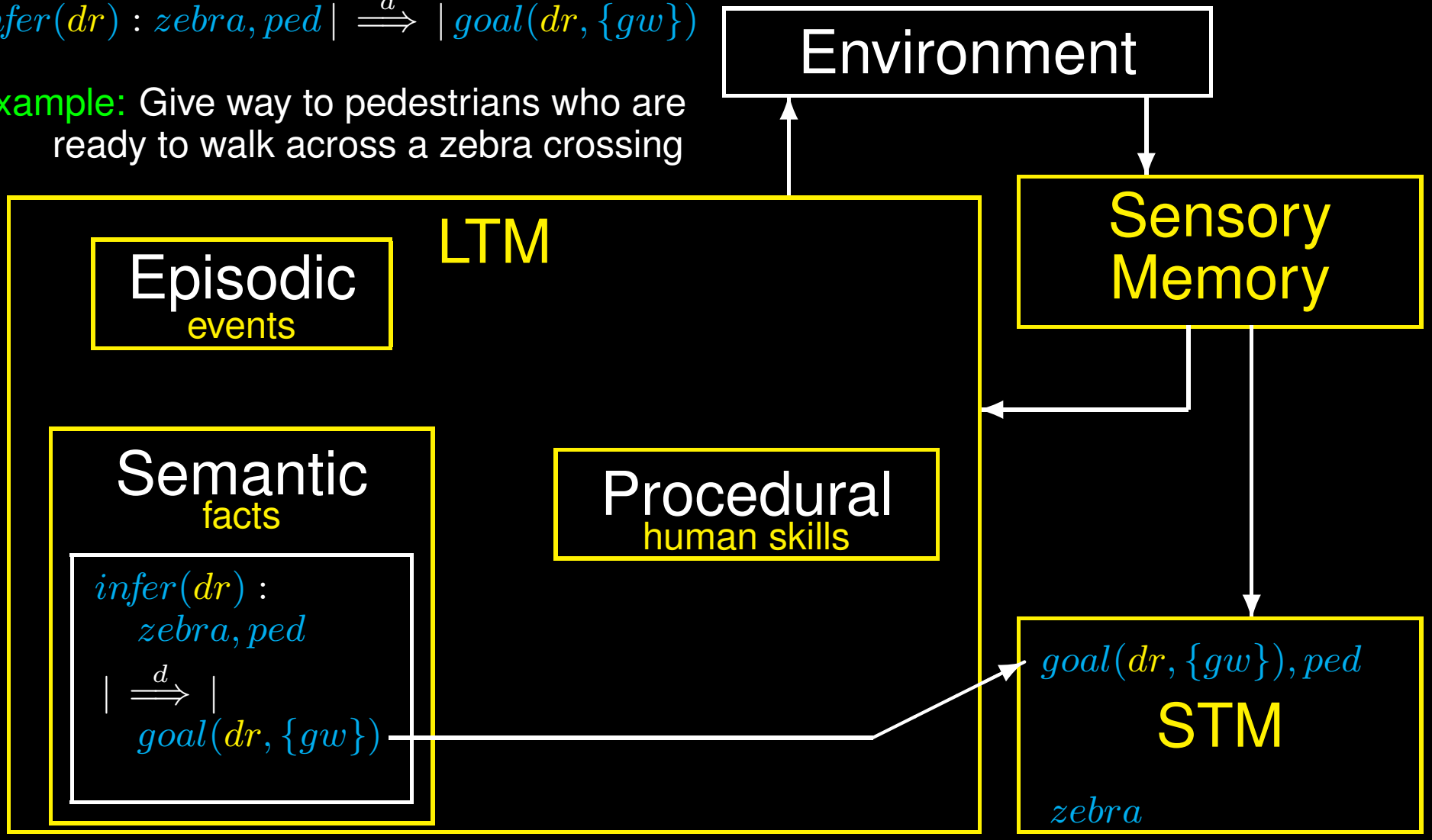


Behaviour+Reasoning

$infer(dr) : zebra, ped \mid \stackrel{d}{\Longrightarrow} \mid goal(dr, \{gw\})$

Example: Give way to pedestrians who are ready to walk across a zebra crossing



Behaviour+Reasoning: Action

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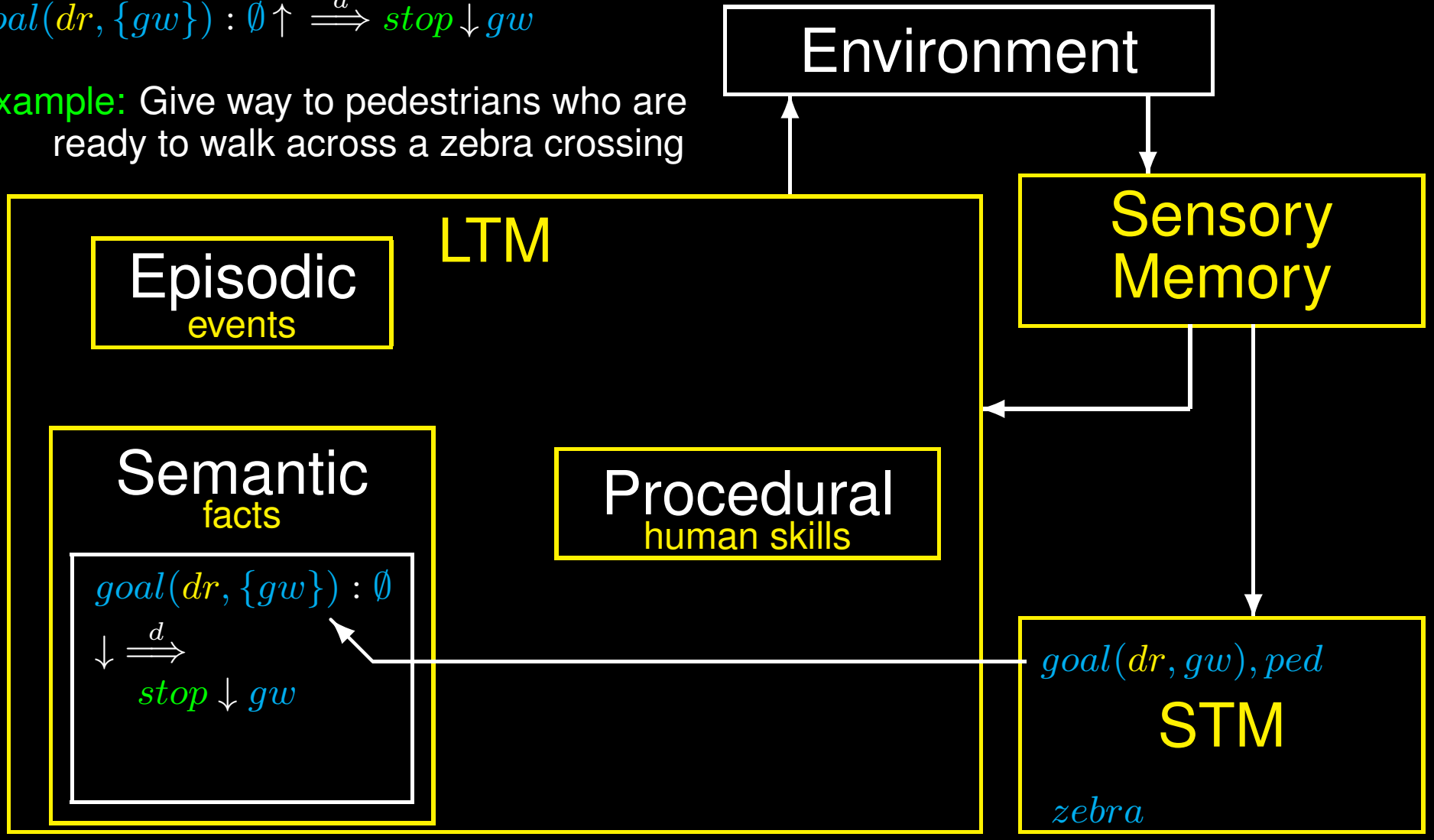

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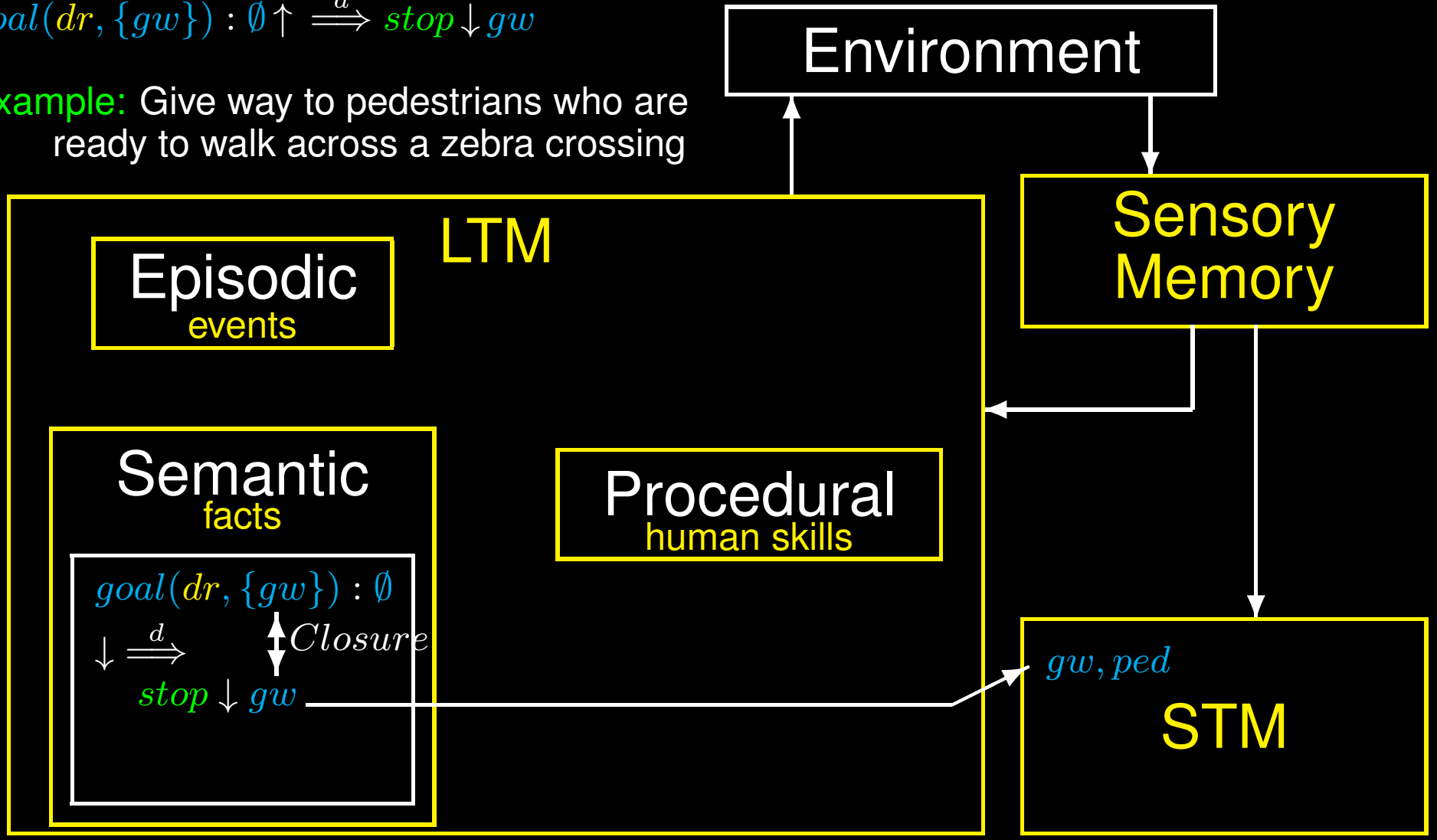

Conclusion

Behaviour and Reasoning Description Language

- knolwledge representation
- knowledge retrieval
- reasoning
- human behaviour
- problem solving

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Future Work

- Implementation of problem solving
- Use the language to
  - compare alternative theories of cognition
  - formally verify interactive systems