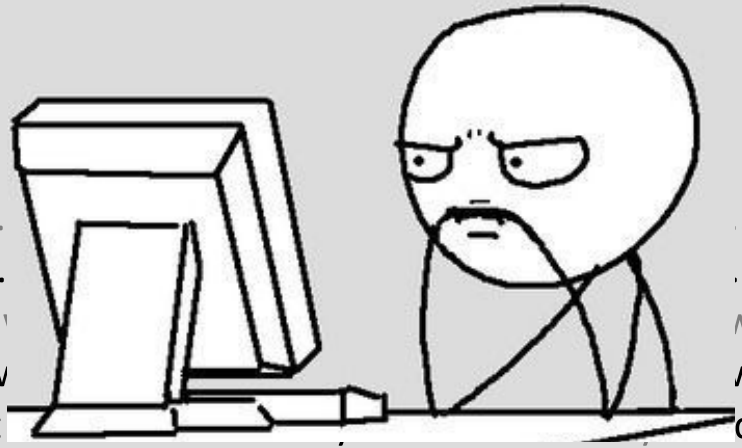
Genesis: The Beginning of Something Big

Zhutian Yang
18 Sep 2019

Comment Your Code!



It doesn't work... why ... It works... why... It doesn't work... why ... It works... why... It doesn't work... why ... It works... why... It doesn't work... why ... It works... why... It doesn't work... why ... It works... why... It doesn't work... why ... It works... why... It doesn't work... why ... It works... why... It doesn't work... why ... It works... why... It doesn't work... why ... It works... why... It doesn't work... why ... It works... why... It doesn't work... why ... It works... why... It doesn't work... why ... It works... why...

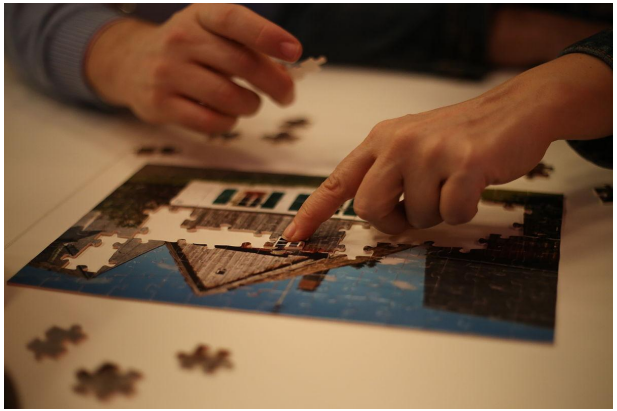
This talk is about Genesis System's ...

Past

11 years
~ 25 papers
10 subsystems

Repo: 120 MB
Codes: 10MB

Present

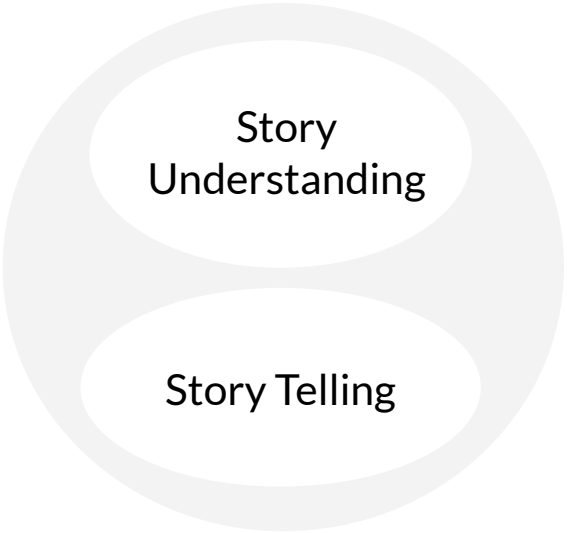


Future

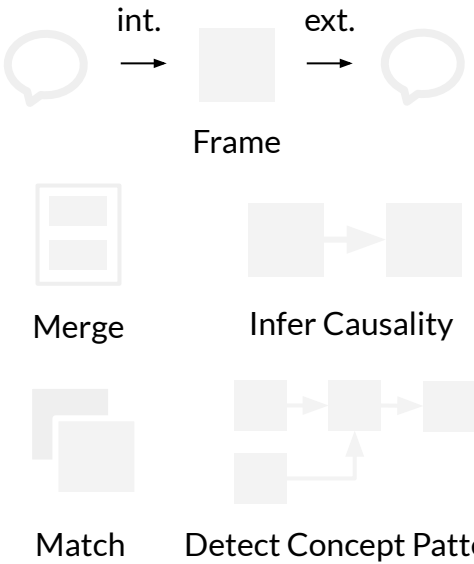
* Genesis documentation: www.ways2think.ai/genesis/
GenesisCore private repo: https://github.com/zt-yang/GenesisCore

Past > Genesis Legacy includes ...

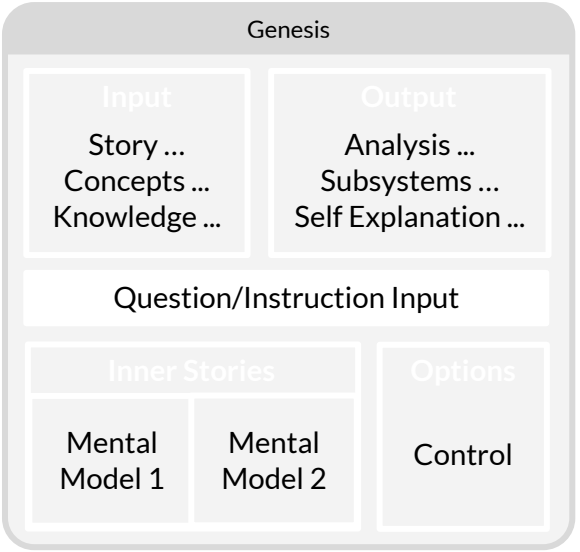
Problems & Competence



Representation & Algorithms



Programs & Systems



* Winston, Patrick Henry, and Dylan Holmes. The Genesis Enterprise: Taking artificial intelligence to another level via a computational account of human story understanding. 2018.

Past > Story Understanding & Telling Capacities

Story file

xx and yy are persons. zz is a substance.
If xx asks yy for some H_2O too, then yy may give xx some H_2O_2.
If xx is given zz, then xx may drink zz.
If xx drinks H_2O_2, then xx dies.

} Rules

Start description of “surprise”.
aa is an action.
xx performed aa and yy performed aa.
yy’s performing aa leads to yy’s being died.
The end.

} Concept Pattern

Two chemists walk into a bar. The first chemist asks the bartender to give him some H_2O. The second chemist asks the bartender for some H_2O too. The second chemist died.

} Story

Past > Story Understanding & Telling Capacities

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Story

Past > Story Understanding & Telling Capacities

Original Elements

Two chemists walk into a bar

The first chemist asks the bartender to give him some H_2O

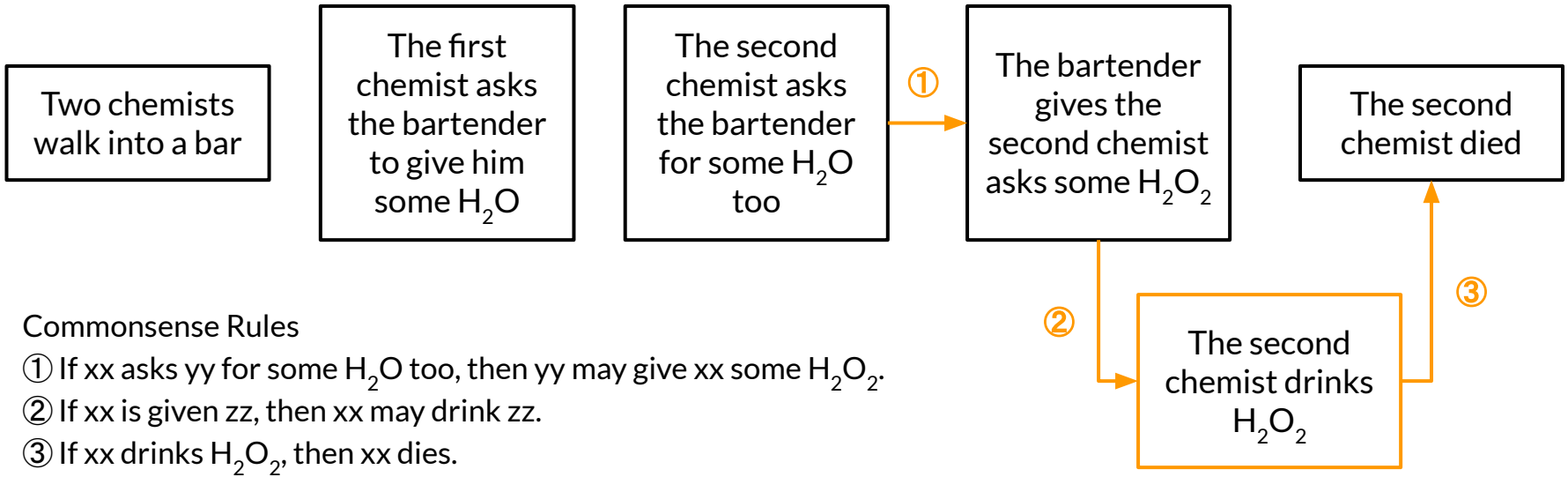
The second chemist asks the bartender for some H_2O too

The bartender gives the second chemist asks some H_2O_2

The second chemist died

Past > Story Understanding & Telling Capacities

Original Elements + Inferred Elements Casual Connections



Commonsense Rules

① If xx asks yy for some H_2O too, then yy may give xx some H_2O_2.

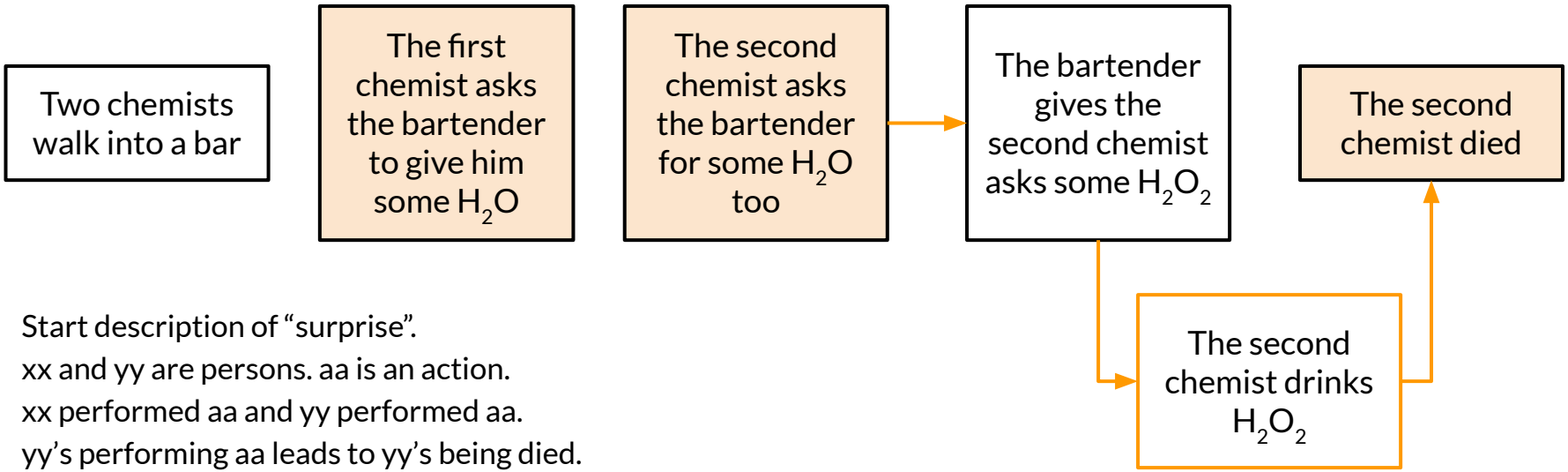
② If xx is given zz, then xx may drink zz.

③ If xx drinks H_2O_2, then xx dies.

* for 7 types of inference rules and 5 types of explicit causal expressions, see http://ways2think.ai/genesis/inference/

Past > Story Understanding & Telling Capacities

Original Elements + Inferred Elements Casual Connections + Concept Patterns



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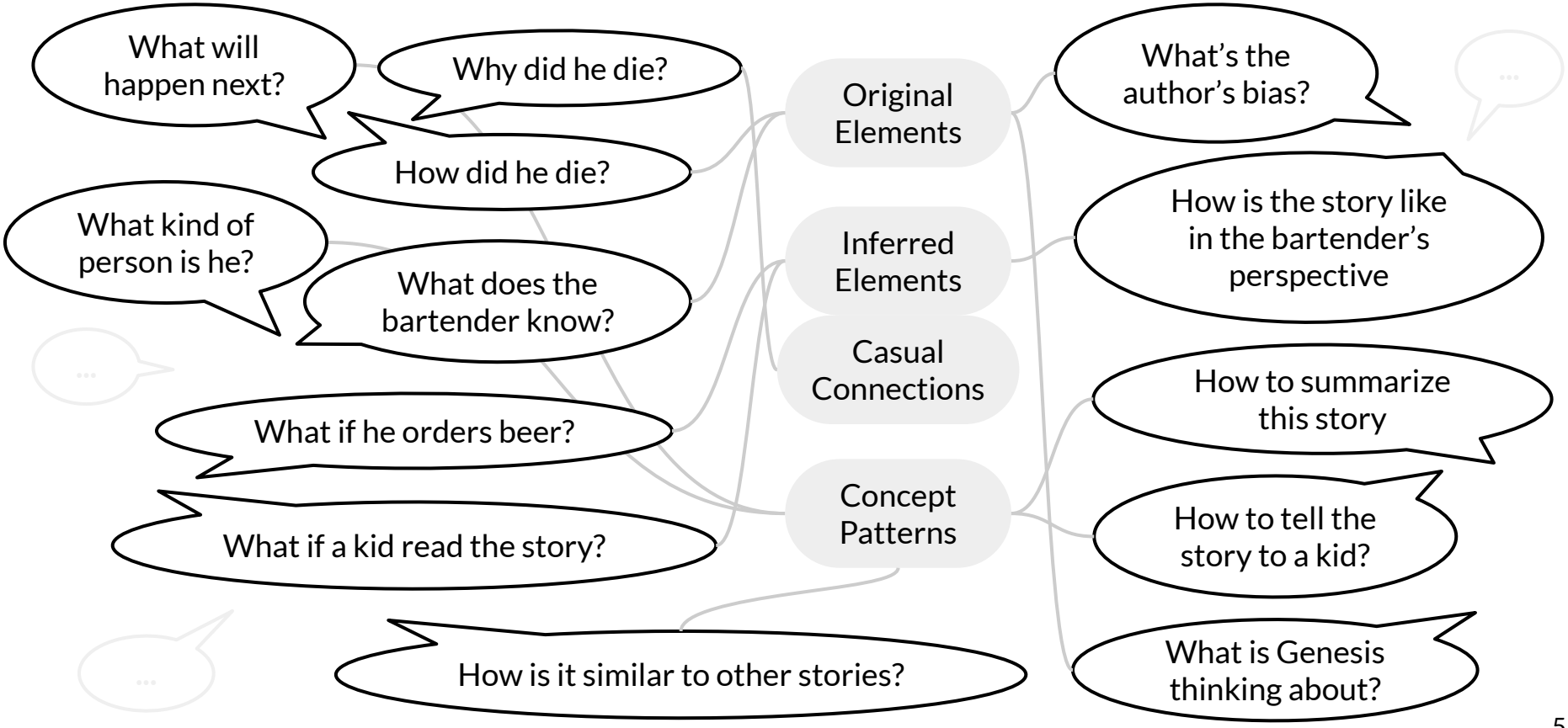
Past > Story Understanding & Telling Capacities



Past > Representation: Nested Role Frames

e.g.
“Genesis is happily reading 20 short stories for me”

Build complex, nested symbolic descriptions of properties, relations, actions, and events

Past > Representation: Nested Role Frames

START triples from
"Genesis is happily reading 20 short stories for me"

[genesis+3043 read+1 stories+3044]
[read+1 has_modifier+1 happily]
[read+1 for+2 i]
[stories+3044 has_property+3 short]
[stories+3044 has_quantity+4 20]
[genesis+3043 has_number singular]
[genesis+3043 has_det null]
[stories+3044 has_det null]
[has_modifier+1 has_position mid_verbal]
[i has_number singular]
[i is_proper yes]
[for+2 has_position trailing]
[read+1 has_person 3]
[read+1 has_tense present]
[read+1 is_progressive yes]
[read+1 is_main yes]
[stories+3044 has_number plural]

Build complex, nested symbolic descriptions of properties, relations, actions, and events

Past > Representation: Nested Role Frames

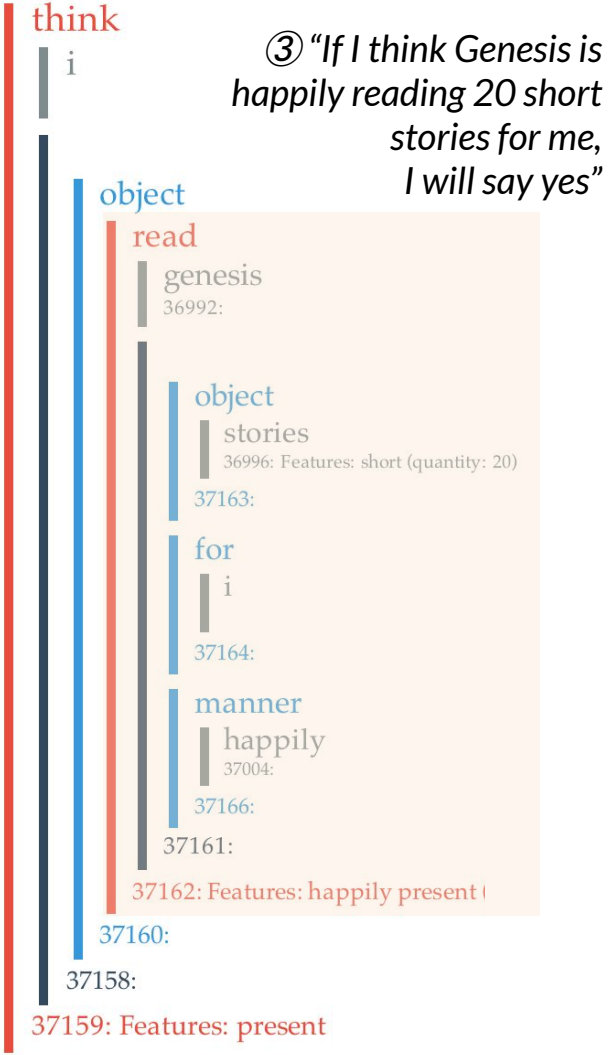
Frame Translation of
"Genesis is happily reading 20 short stories for me"

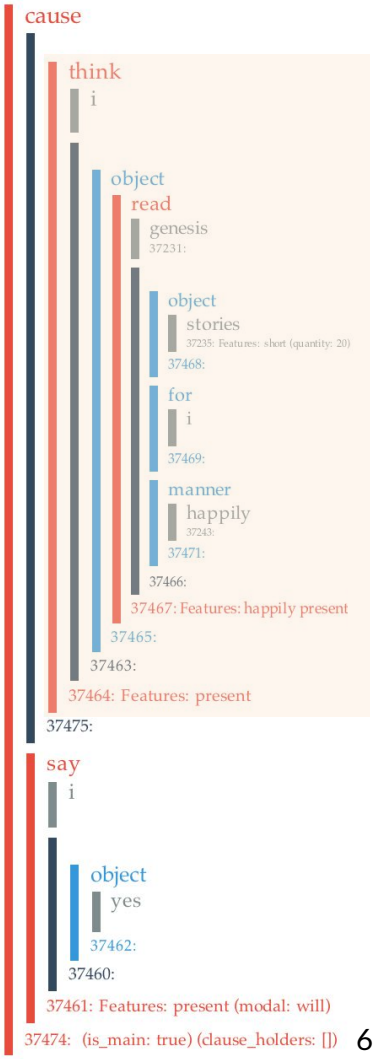
Build complex, nested symbolic descriptions of properties, relations, actions, and events

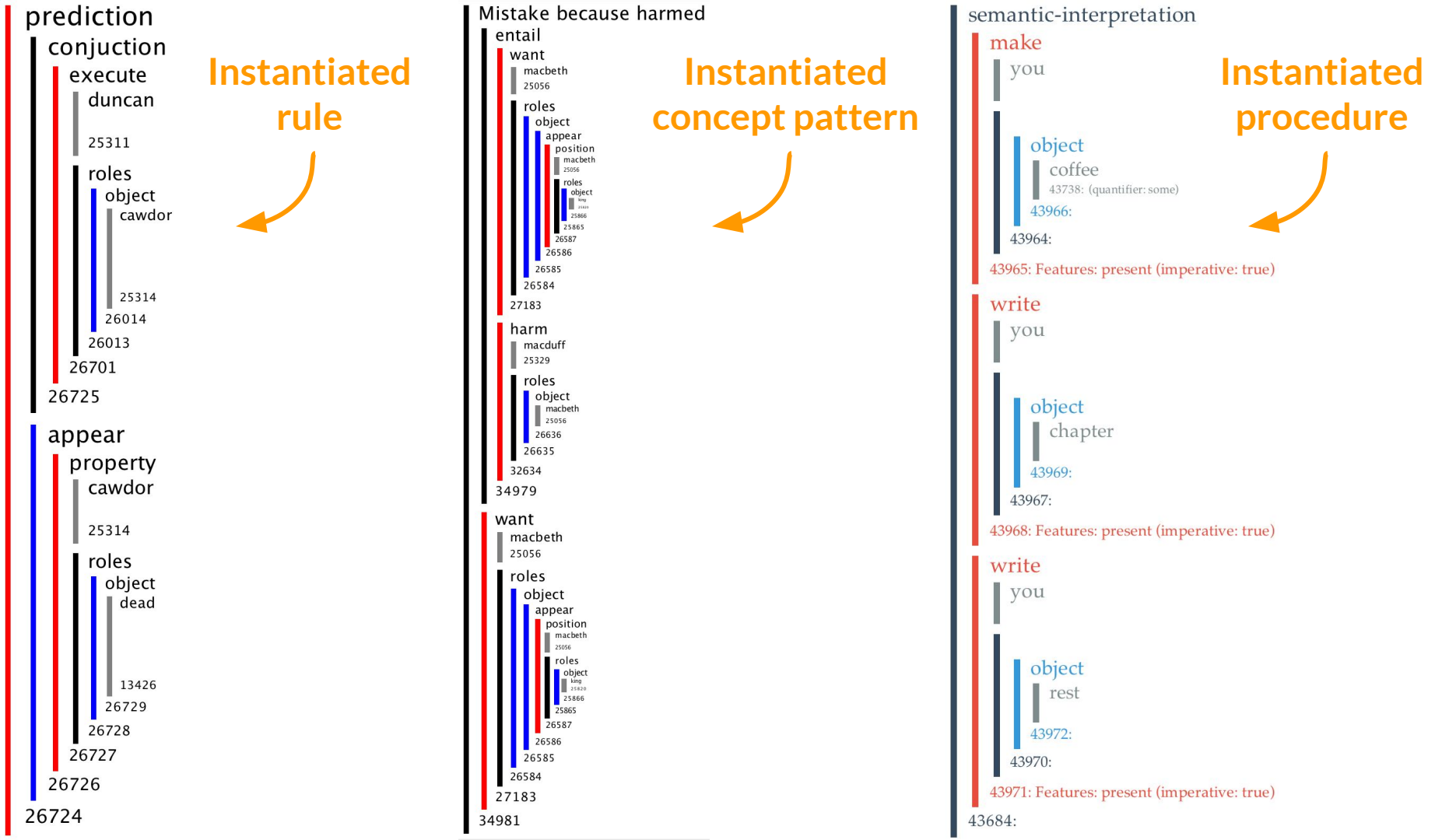
② "I think Genesis is happily reading 20 short stories for me"

① "Genesis is happily reading 20 short stories for me"

③ "If I think Genesis is happily reading 20 short stories for me, I will say yes"






prediction
conjuction
execute
duncan
25311
roles
object
cawdor
25314
26014
26013
26701
26725
appear
property
cawdor
25314
roles
object
dead
13426
26729
26728
26727
26726
26724
Instantiated rule
Mistake because harmed
entail
want
macbeth
25056
roles
object
appear
position
macbeth
25056
roles
object
king
25866
25865
26587
26586
26585
26584
27183
harm
macduff
25329
roles
object
macbeth
25056
26636
26635
32634
34979
want
macbeth
25056
roles
object
appear
position
macbeth
25056
roles
object
king
25866
25865
26587
26586
26585
26584
27183
34981
Instantiated concept pattern
semantic-interpretation
make
you
object
coffee
43738: (quantifier: some)
43966:
43964:
43965: Features: present (imperative: true)
write
you
object
chapter
43969:
43967:
43968: Features: present (imperative: true)
write
you
object
rest
43972:
43970:
43971: Features: present (imperative: true)
43684:
Instantiated procedure

Past > Algorithms of Core Operations

Merge

two frames → a new frame

Merge:

C = A (B)
C = Cause (A, B)
C = Categorization (A, B)
C = Sequence (A, B)
C = Want (A, B)
T = Path (A, B, C, …)
…

Extract:

A = C.getSubject()

Match

two frames → binding pairs

Compare:

C = Teach (Alice, Sam)
D = Instruct (Bob, Tom)
→ bindings = {(Alice, Bob), (Sam, Tom)}

Infer:

C = Cause (Teach (Alice, Sam)
Want (Alice, Drink)
D = Teach (Bob, Tom)
→ consequence = Want (Bob, Drink)

Align

two stories → common sequence

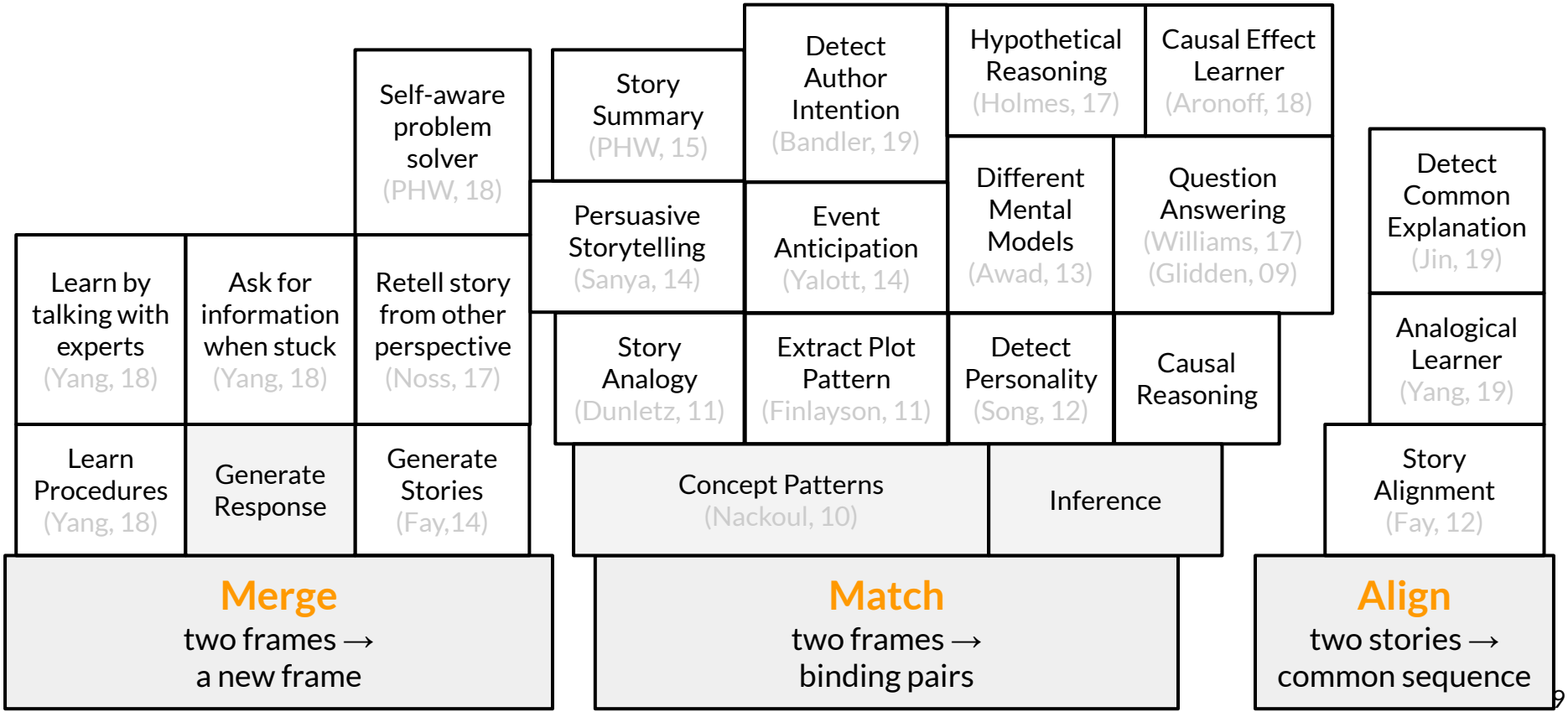
Compare:

Story I: CTAGDXYM
Story II: ACBXTVYN
→ common: CTY
→ difference:
{(C, AC), (CT, ACBXT), ...}

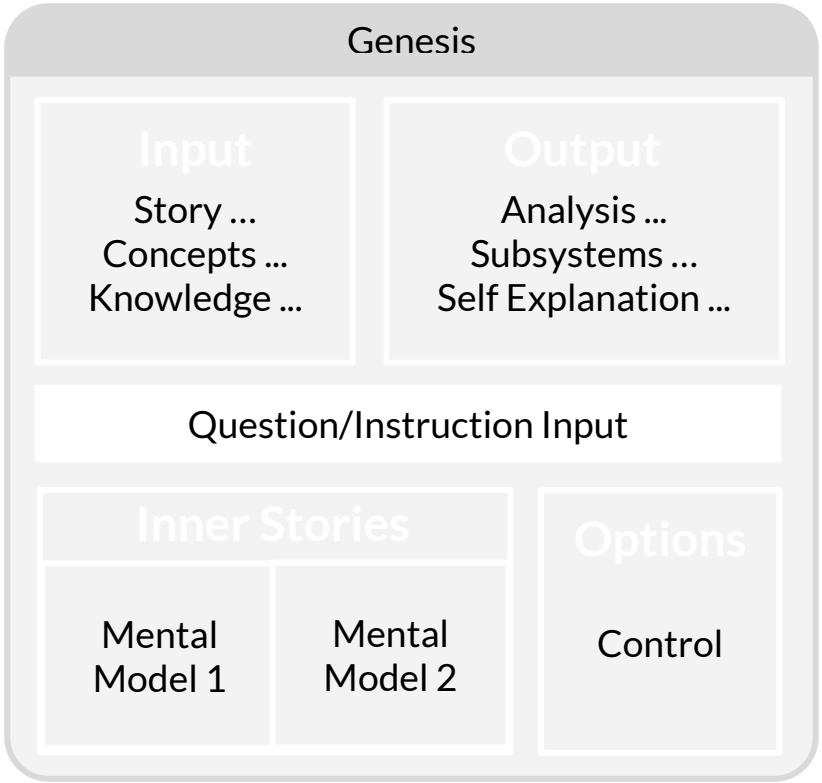
Anticipate:

Story I: CTAGDXYM
Pattern: TYMZ
→ anticipation: Z

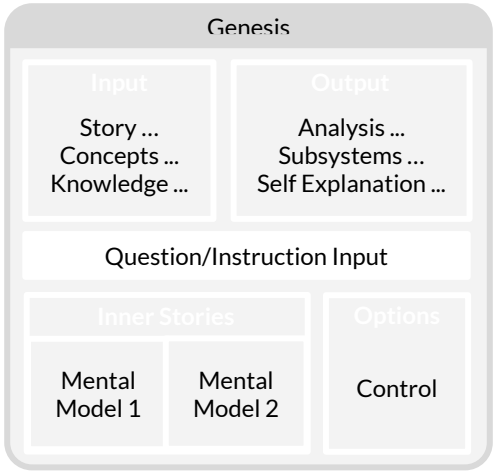
Past > Algorithms of Subsystems

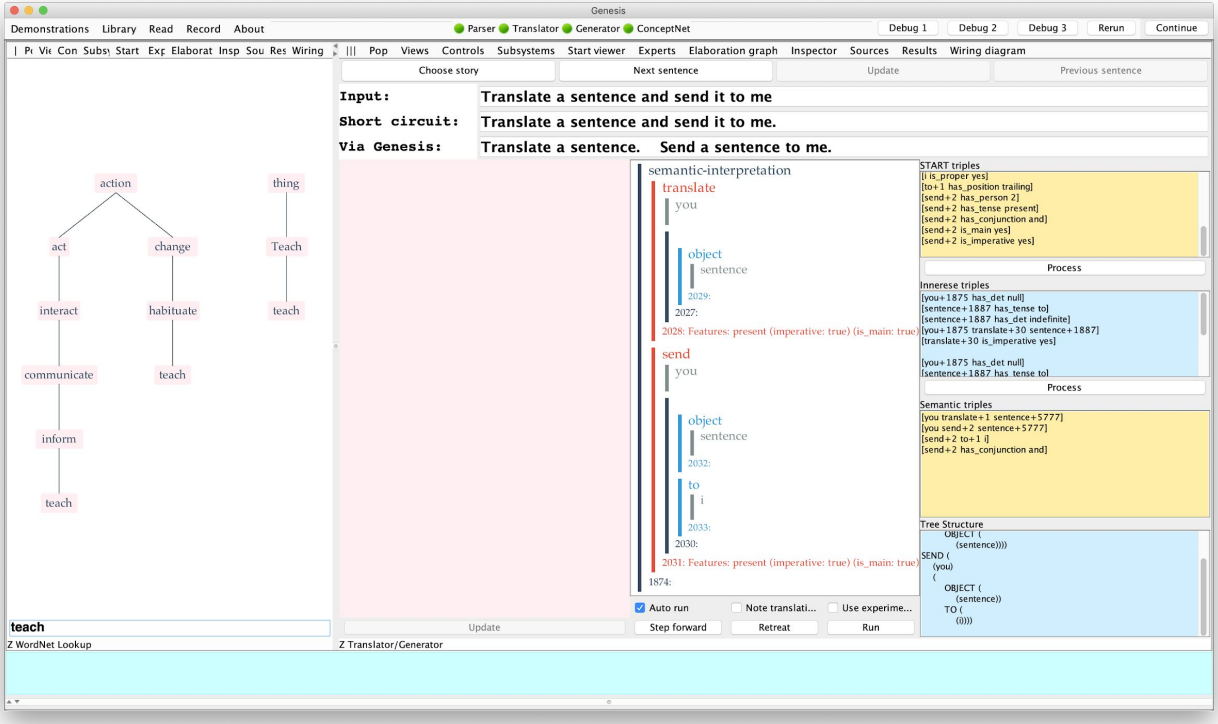


Past > Genesis System



Past > Genesis System → As a NLP toolbox (WordNet, Translator)

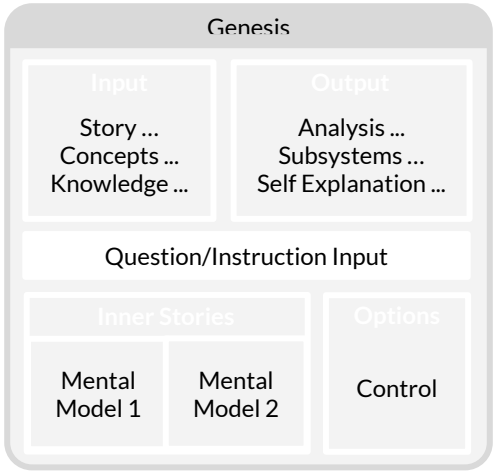


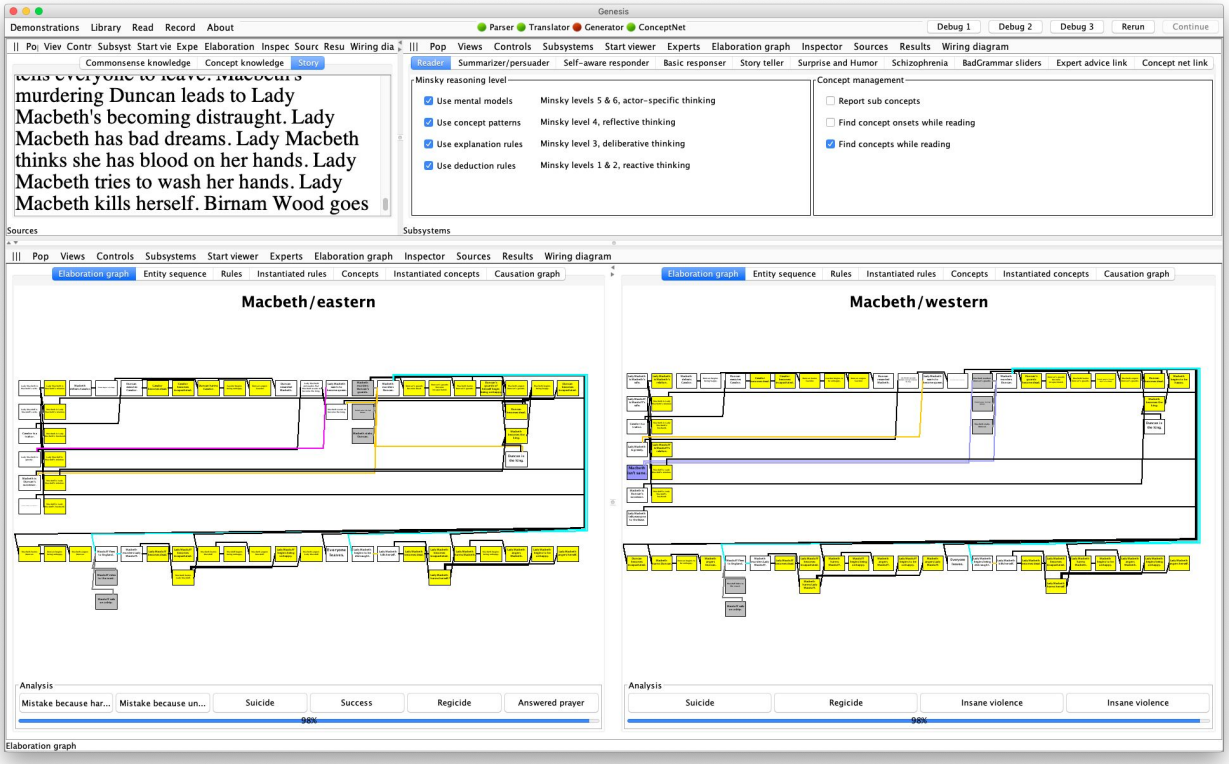


Past > Genesis System

→ As a NLP toolbox (WordNet, Translator)

→ **As story processors** (story analysis & telling)



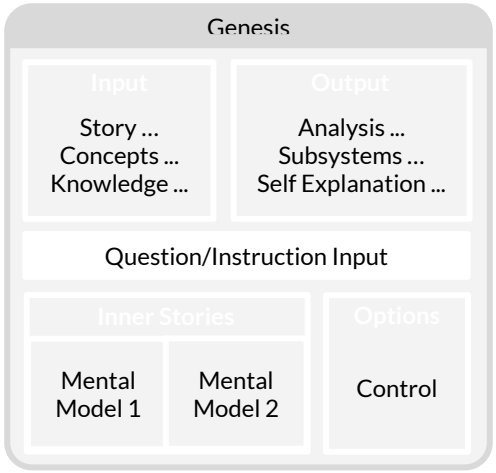


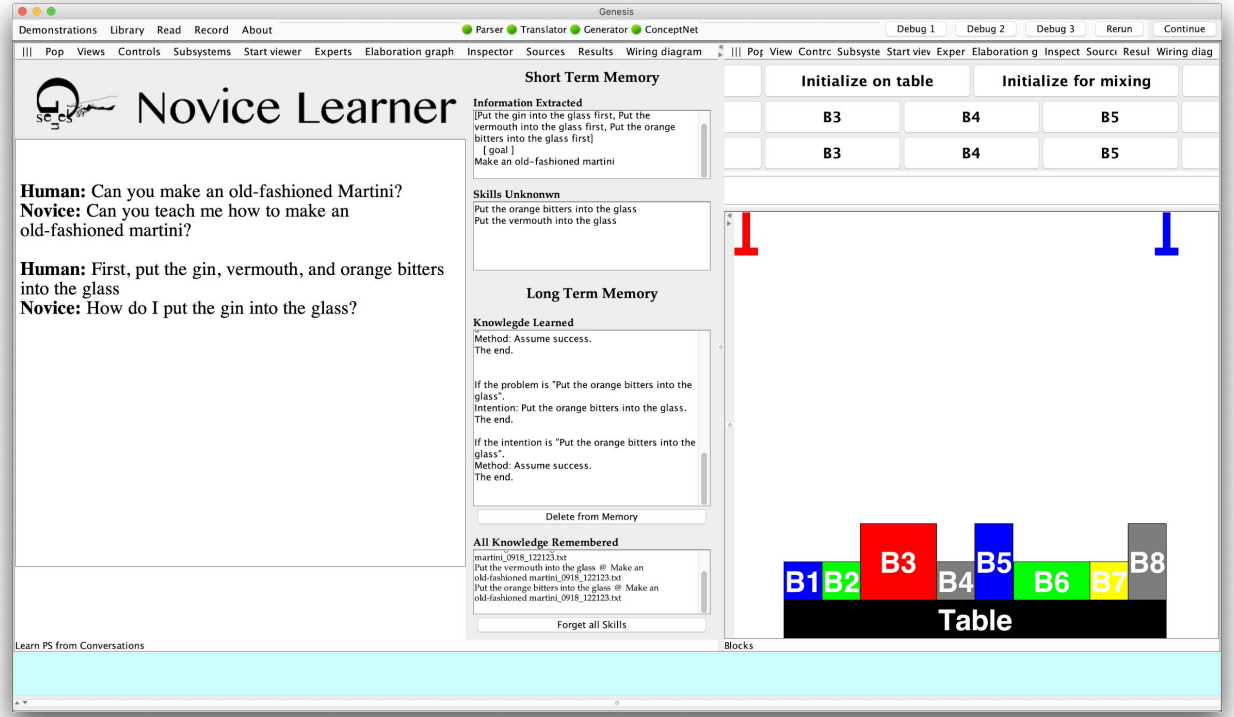
Past > Genesis System

→ As a NLP toolbox (WordNet, Translator)

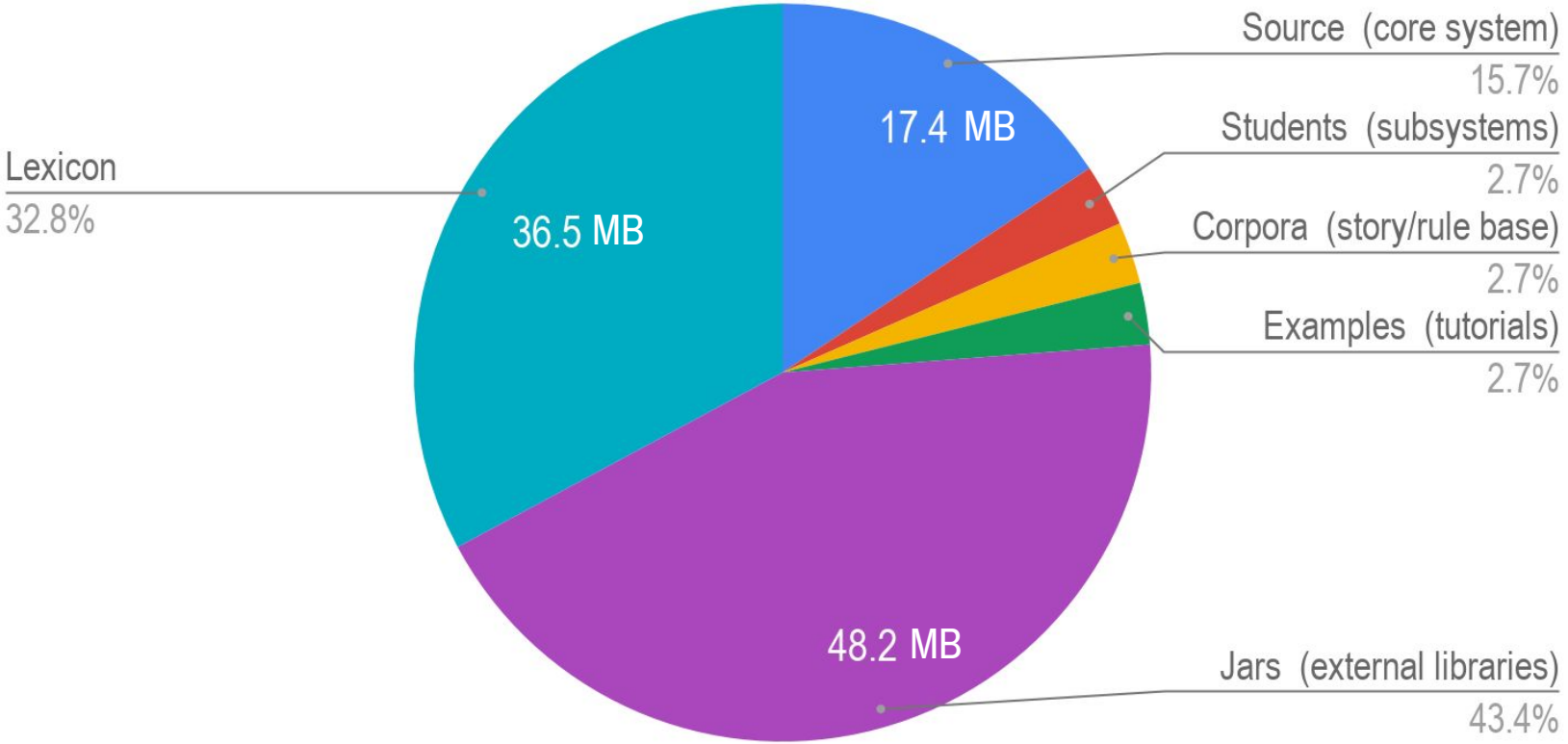
→ As story processors (story analysis & telling)

→ **As chattable agent** (problem solving, question answering, procedure learning)





Past > Overview of the Codebase ~120MB



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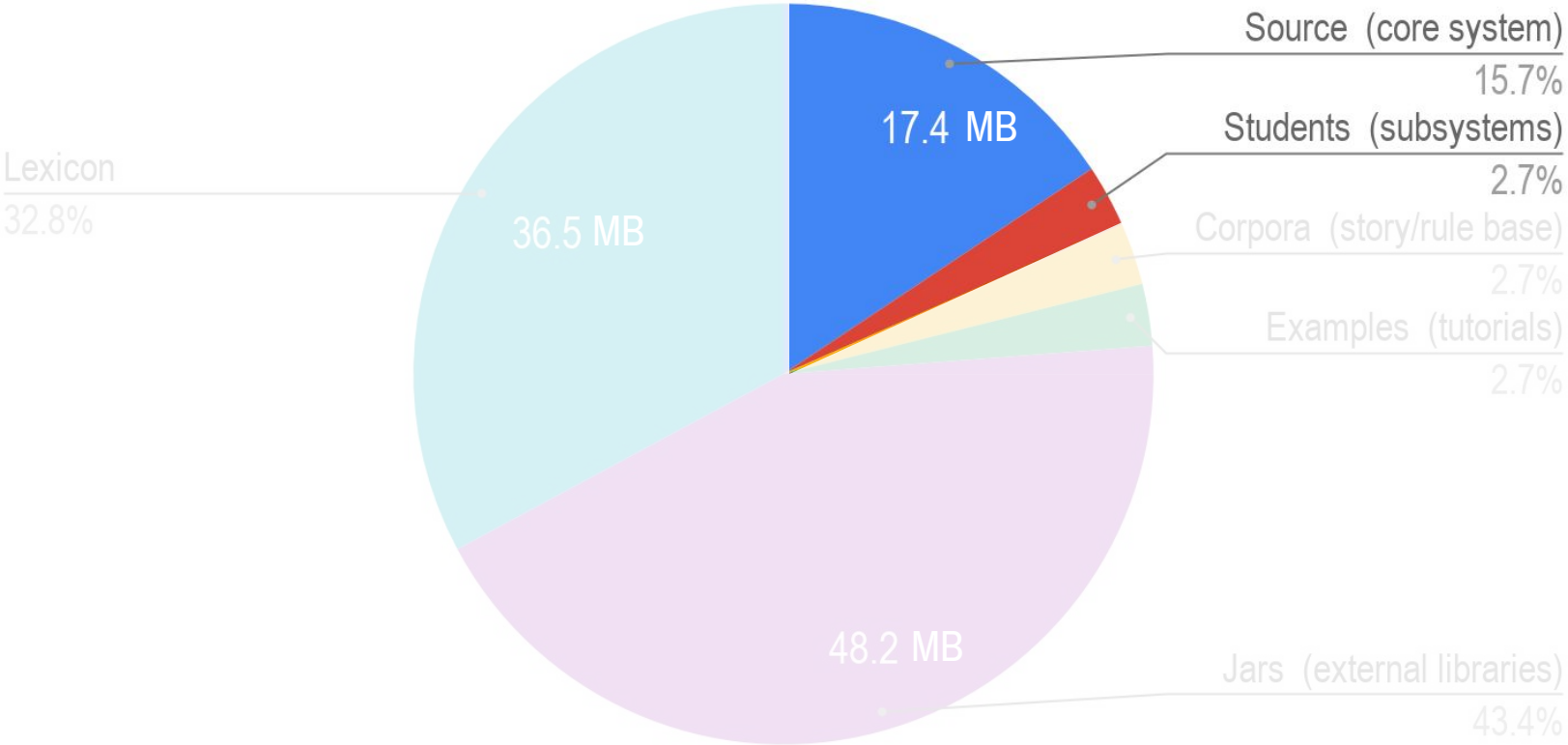
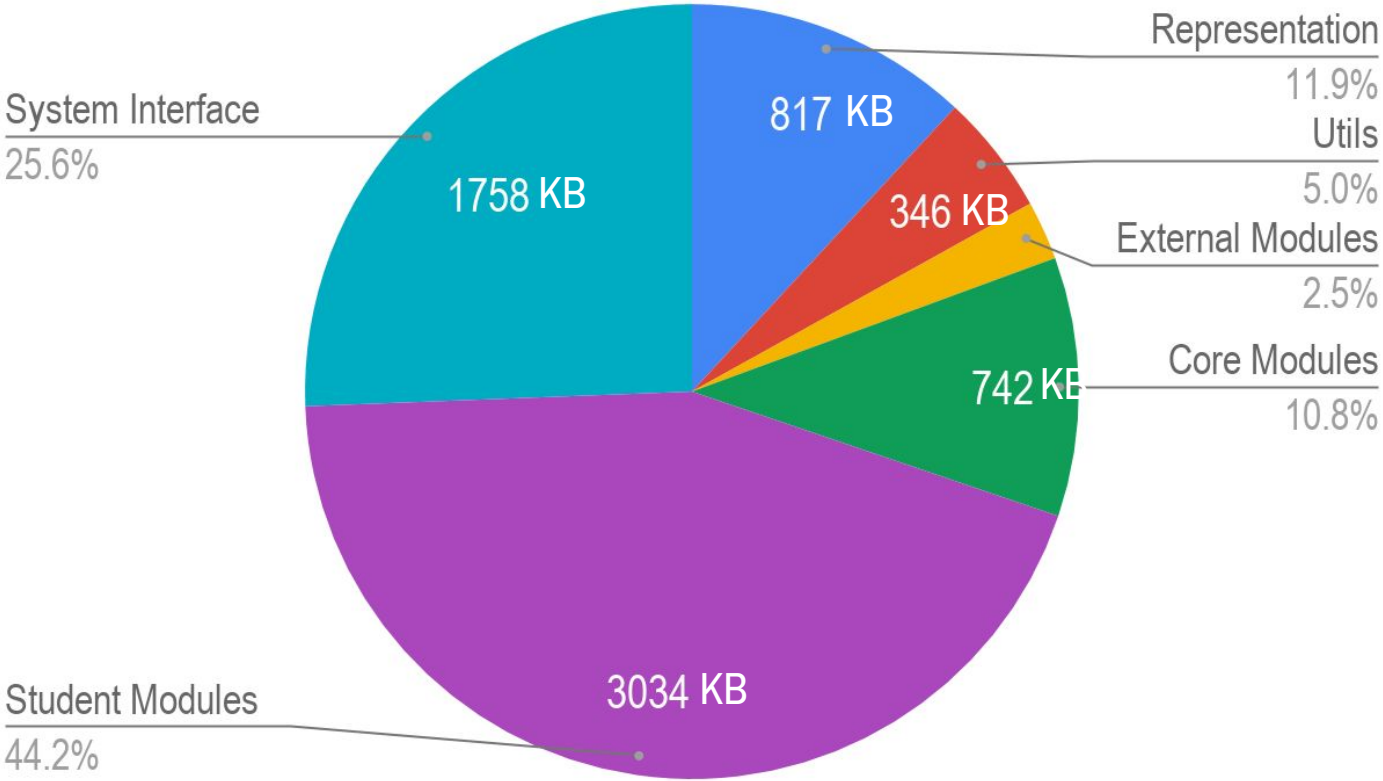


Past > Overview of the Source Codes ~10MB



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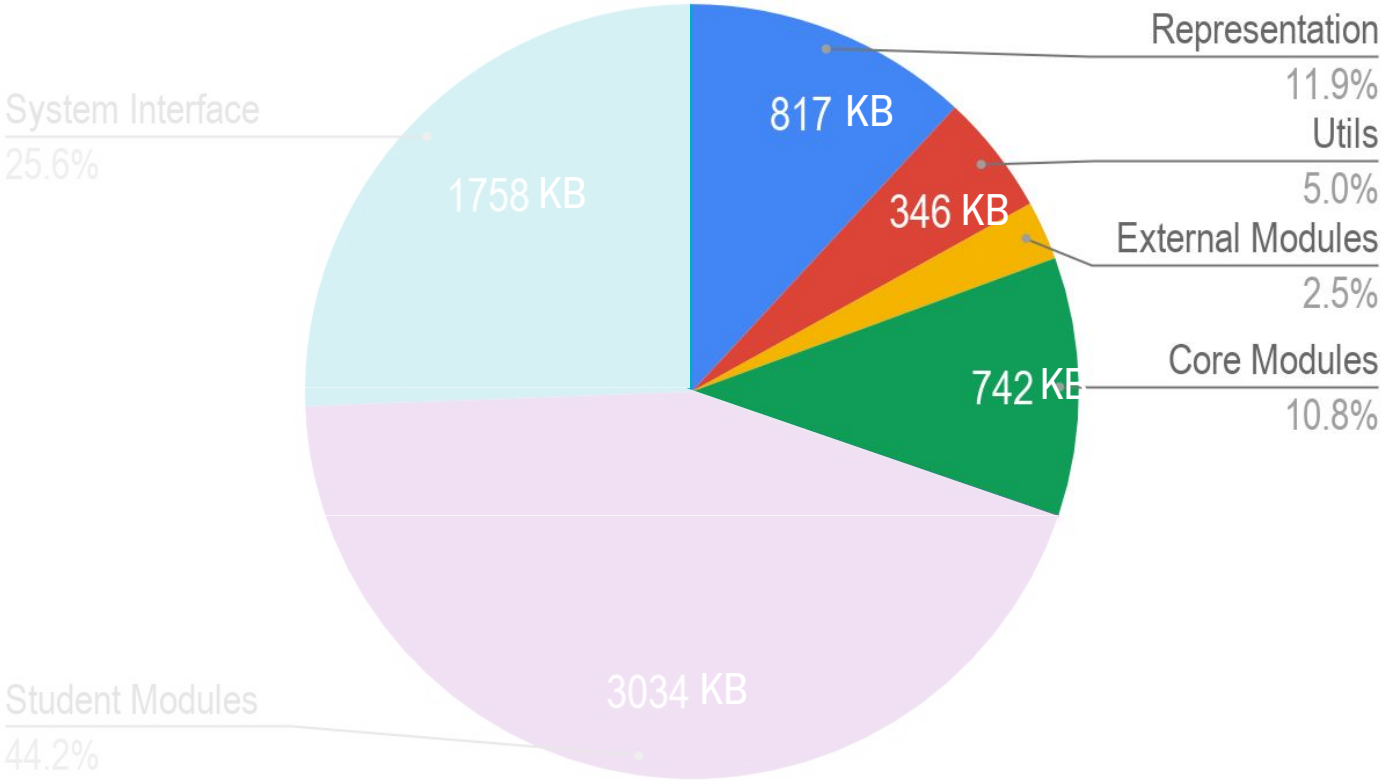


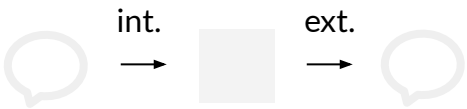
Past > Genesis for Story Understanding

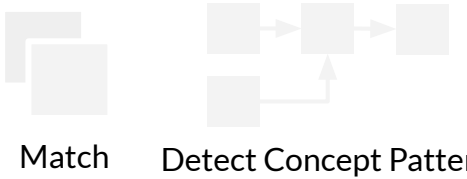
Problems & Competence

Story Understanding

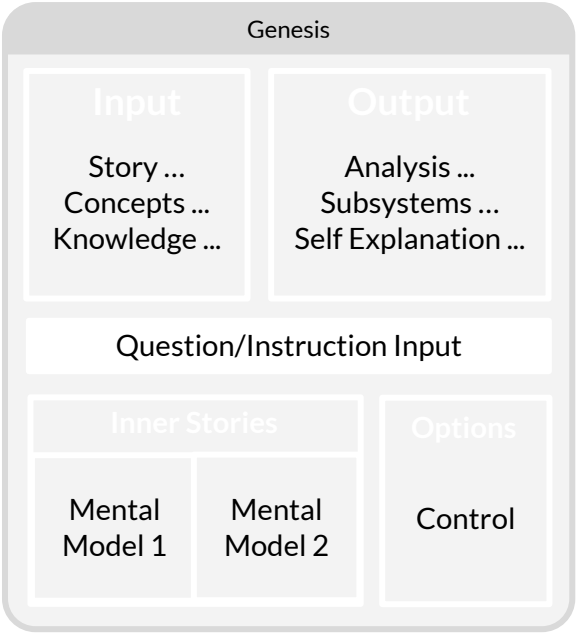
Story Telling

Representation & Algorithms





Programs & Systems



Present > Genesis for Cognitive Modeling

Problems & Competence

Story Understanding

Story Telling

→

Problems & Competence

Story Understanding

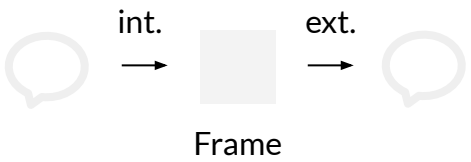
Experience/Memory Understanding

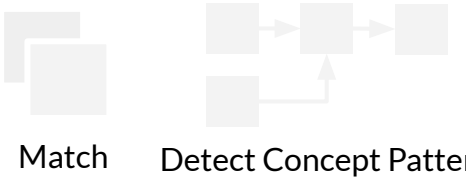
Story Telling

Communication

Present > Genesis for Cognitive Modeling

Representation & Algorithms





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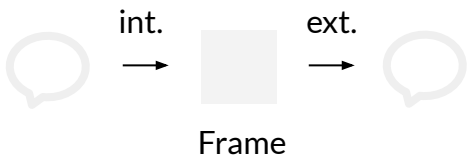
Representation & Algorithms



e.g.

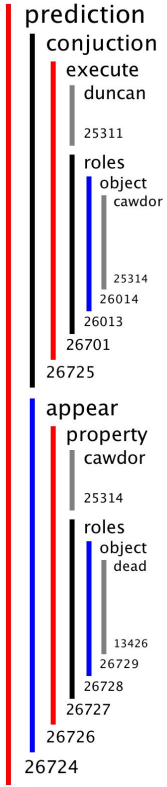
Story elements,
Inference rules,
{ Concept patterns, }
Microstories,
Stories
...

Unified Operations

Infer ~ Anticipate
Learn recipe ~ Learn concept

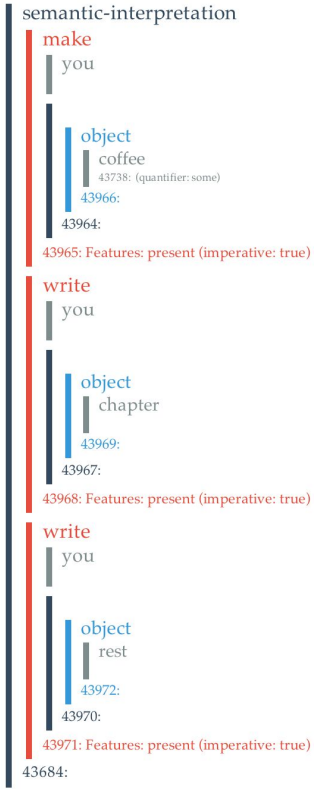
Present > Genesis for Cognitive Modeling

Rule



Concept Pattern

Microstory (Procedure)



Representation & Algorithms

Frame

e.g.

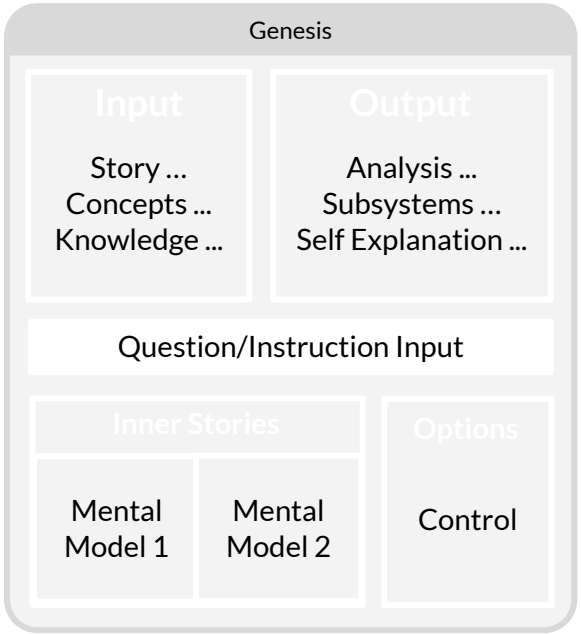
Story elements,
Inference rules,
{ Concept patterns, }
Microstories,
Stories
...

Unified Operations

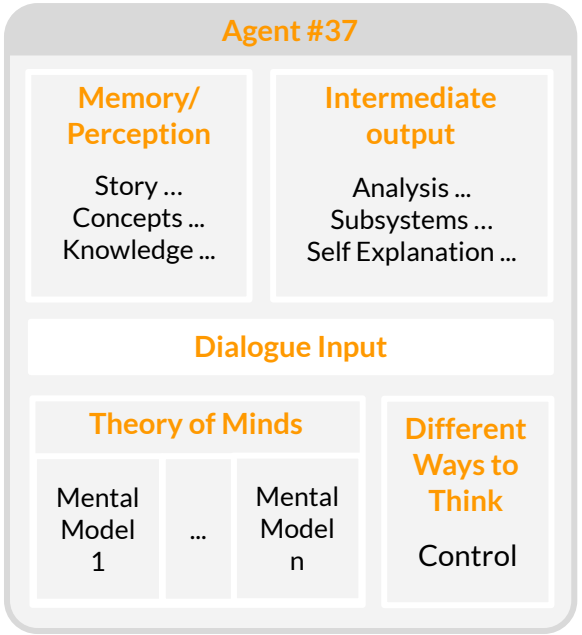
Infer ~ Anticipate
Learn recipe ~ Learn concept

Present > Genesis for Cognitive Modeling

Programs & Systems



Programs & Systems



Future > Steps towards a Cognitive Architecture

Genesis Story Understanding System

Genesis

Input

Story …
Concepts …
Knowledge …

Output

Analysis …
Subsystems …
Self Explanation …

Question/Instruction Input

Inner Stories

Mental Model 1

Mental Model 2

Options

Control

Story-Grounded Cognitive Architecture

Agent #37

Memory/ Perception

Story …
Concepts …
Knowledge …

Intermediate output

Analysis …
Subsystems …
Self Explanation …

Dialogue Input

Theory of Minds

Mental Model 1

…

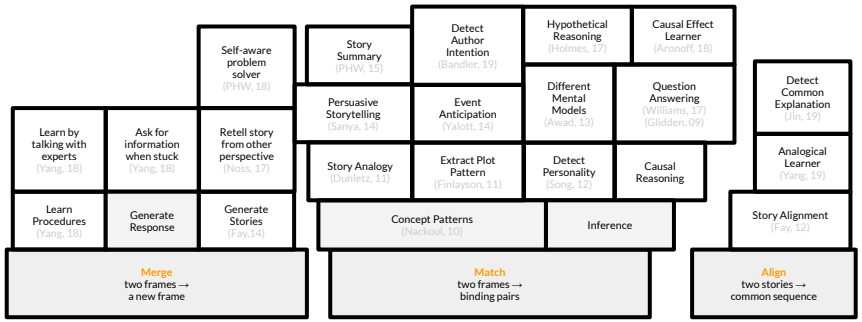
Mental Model n

Different Ways to Think

Control

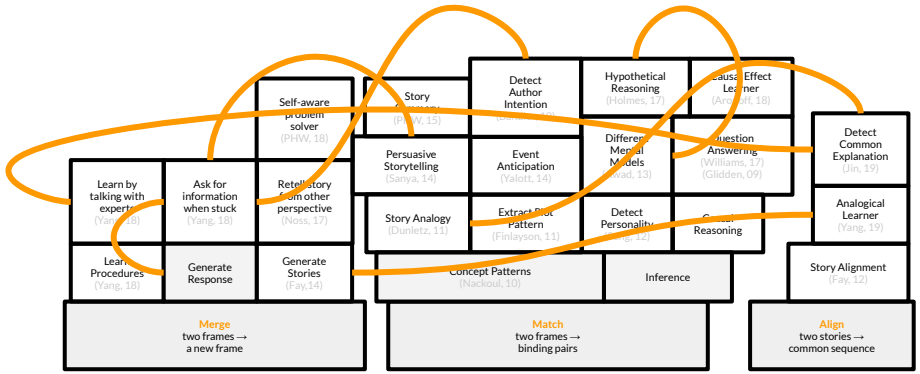
Future > Steps: Modules → Architecture → Agents

Genesis Story Understanding System



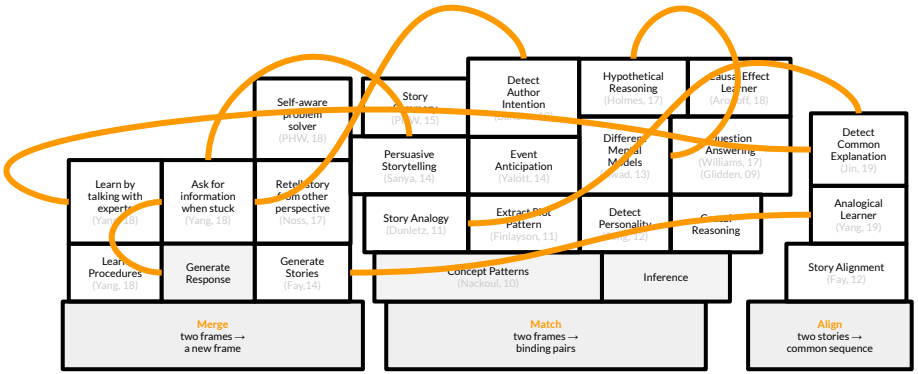
Future > Steps: Modules → Architecture → Agents

Story-Grounded Cognitive Architecture



Future > Steps: Modules → Architecture → Agents

Story-Grounded Cognitive Architecture



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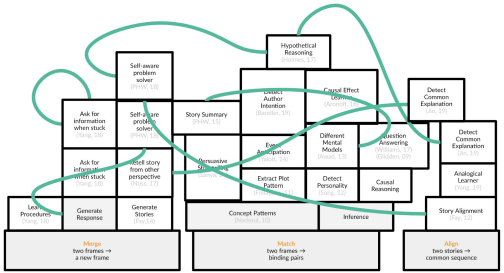
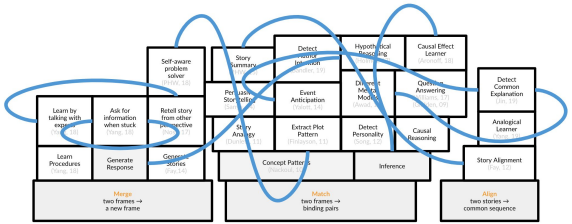
Interactive Agents with Different Initiation

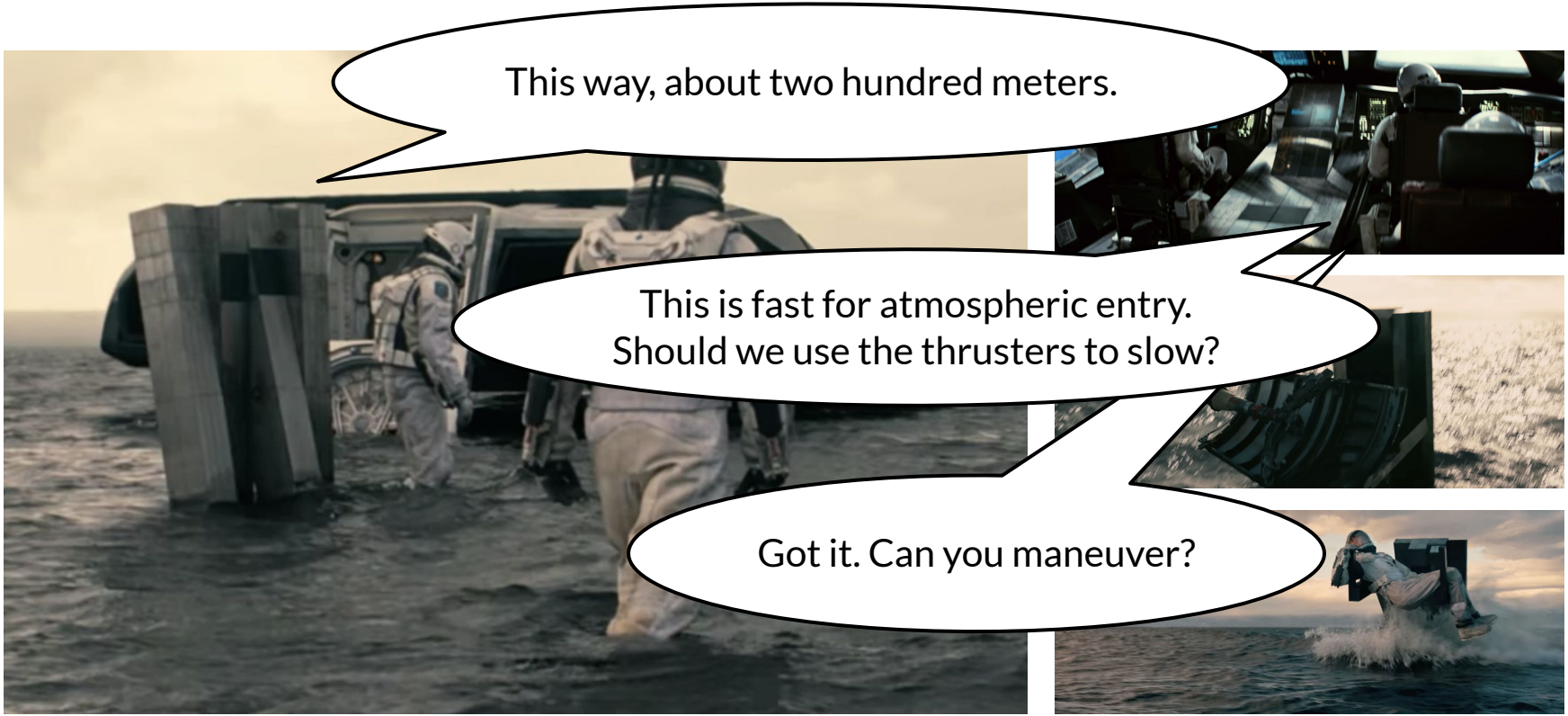




Future > New Domain: Cosmic Exploration

* Scenes from movie, Interstellar (2014)

Future > New Domain: Cosmic Exploration



* Scenes from movie, Interstellar (2014)

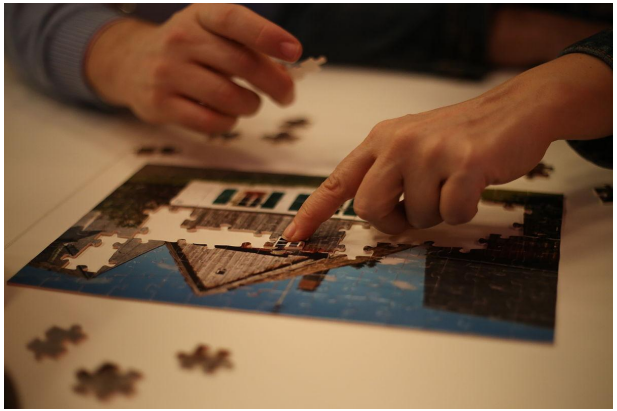
Contributions: See a New Beginning of Genesis

Past

11 years
~ 25 papers
10 subsystems

Repo: 120 MB
Codes: 10MB

Present



Future

* Genesis documentation: www.ways2think.ai/genesis/
GenesisCore private repo: https://github.com/zt-yang/GenesisCore