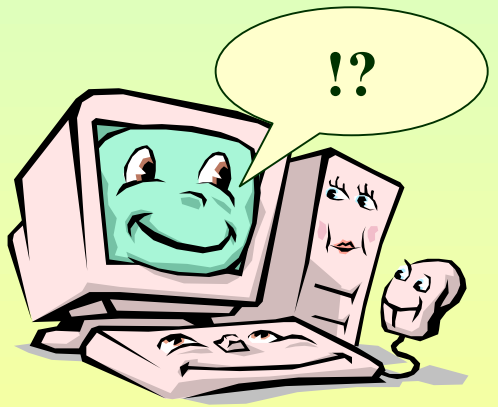
MY_ELIZA

A Multimodal Communication System



Siska Fitrianie

2nd of August 2002

Supervisor: Dr. Drs. L.J.M. Rothkrantz

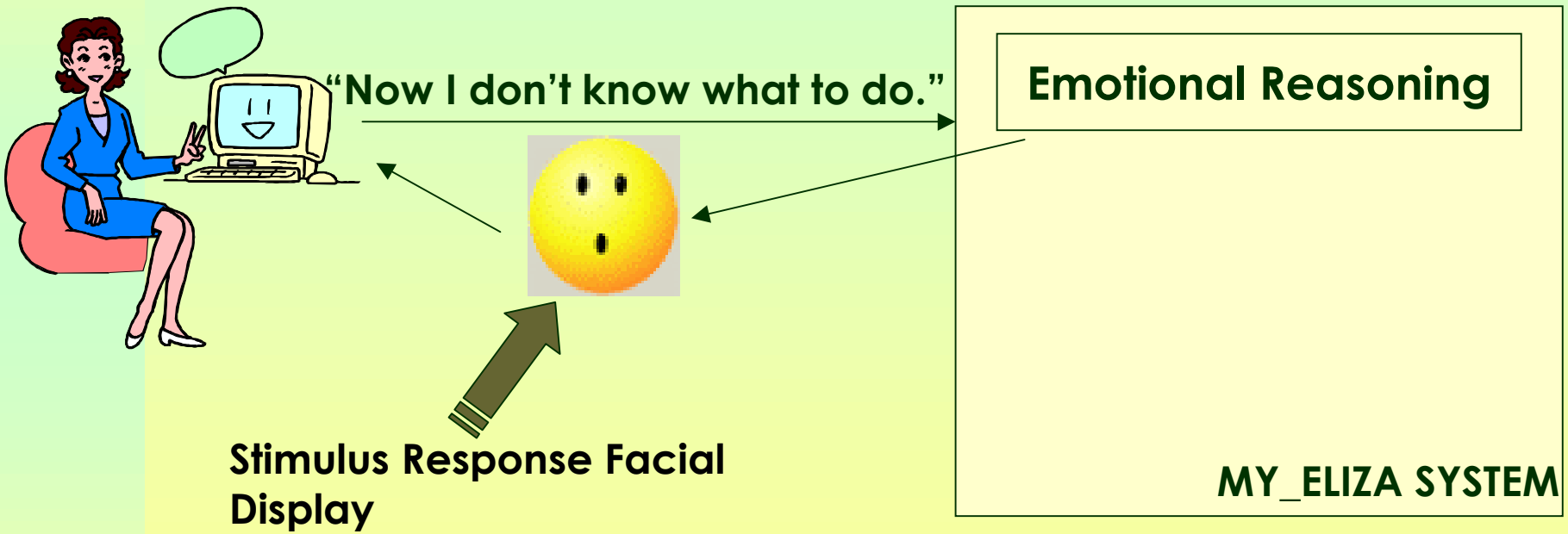
TU Delft

Content

- Problem Definition
- Question-Answering System
- Nonverbal Communication
- My_Eliza System
- Snapshot System Demo
- Conclusion and Recommendation

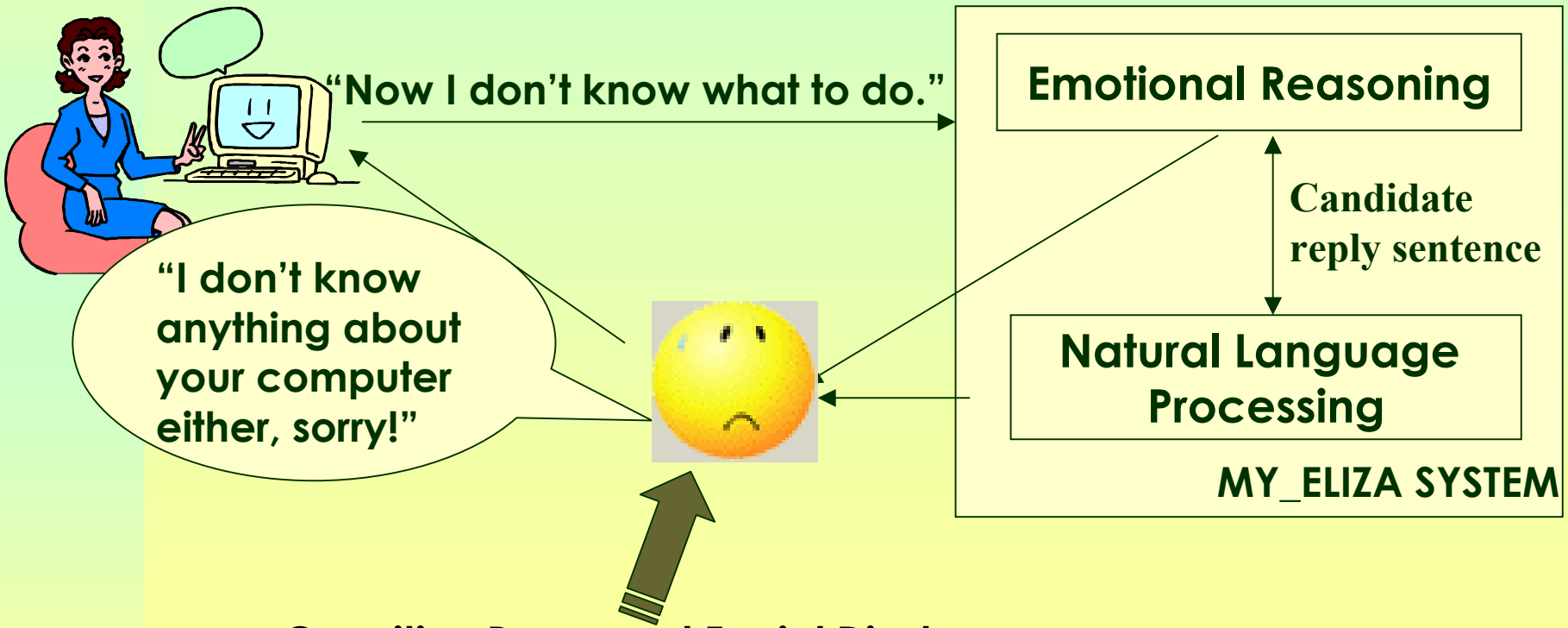
Problem Definition (1)

- Design and develop a multimodal communication system based on Weizenbaum's Eliza.



Problem Definition (1)

- Design and develop a multimodal communication system based on Weizenbaum's Eliza.



Problem Definition (2)

- Weizenbaum's Eliza

```
User : My computer crashed.
Eliza: What about machines worries you?

User : Now I don't know what to do.
Eliza: Why do you not know what to do?
```

- My_Eliza

```
User: My computer crashed.
```

My_Eliza

My_Eliza: Sorry to hear that, what will you do to fix it?

```
User: Now I don't know what to do.
```

My_Eliza

My_Eliza: I don't know anything about your computer either, sorry!

Problem Definition (3)

- Literature Survey
- Seek Existing System
- Identify Emotion Classification and Emotion Eliciting Factors
- Define and Design a new Model
  - Combining two modalities
- Implementation
- Analysis and Testing new Model

Question Answering System

- One of Applications in Natural Language Processing field.
- Chatterbot = Chatter + (ro)bot.
- Simulates typed/written conversation in human natural language.
- Example: Weizenbaum's Eliza as Psychoanalyst (1965).

How Eliza System Works? (1)

- Script = Eliza's memory structure

```
keyword: I
      decomposition rule: * I am *
            reassemble rule: How long have you been (2)?
            reassemble rule: Do you enjoy being (2)?
      decomposition rule: * i don't *
            reassemble rule: Don't you really (2)?
            reassemble rule: Why do you not (2)?
            reassemble rule: Do you wish to be able to (2)?
            reassemble rule: Does that trouble you?
      decomposition rule: * i * you *
            reassemble rule: Do you wish to (2) me?
            reassemble rule: You seem to need to (2) me.
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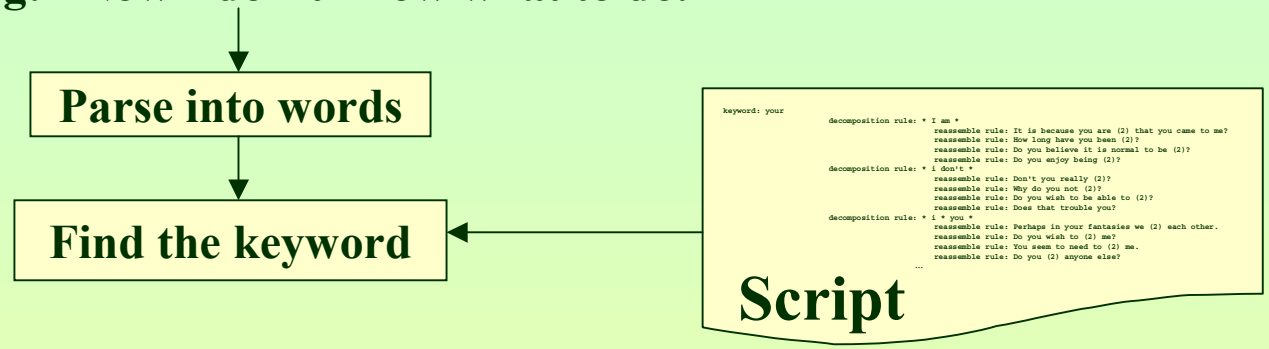
How Eliza System Works? (2)

Input string: ”Now I don’t know what to do.”



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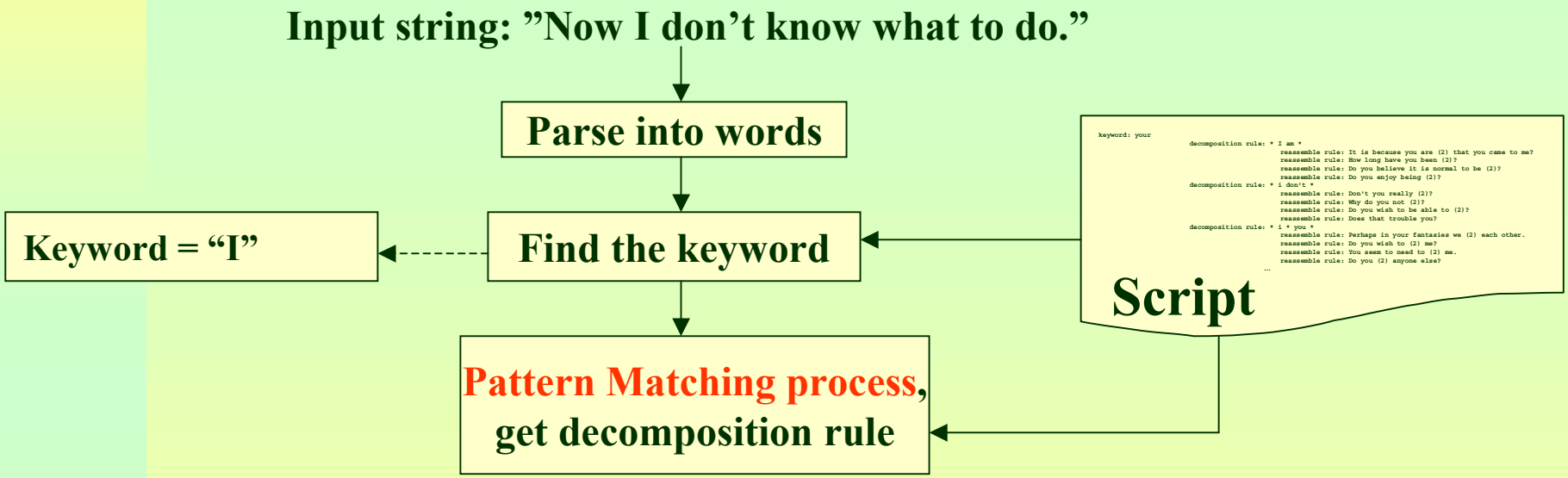

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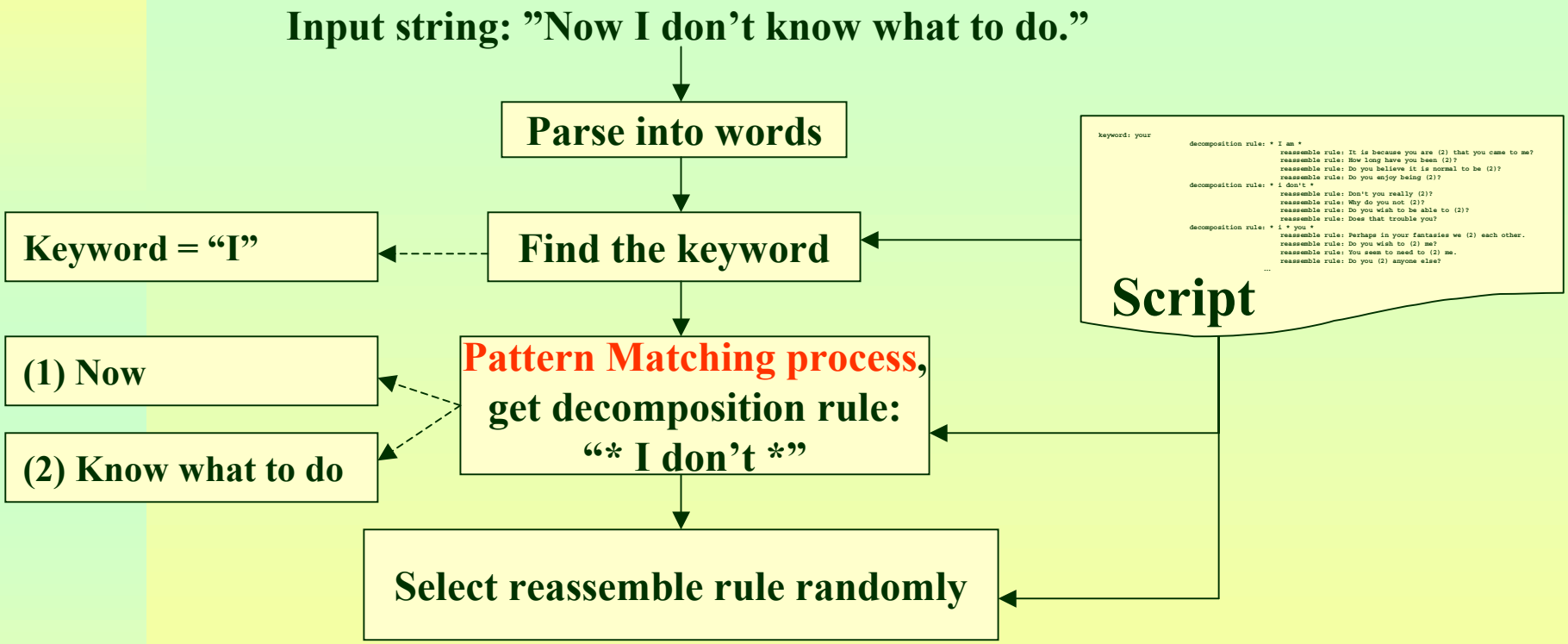

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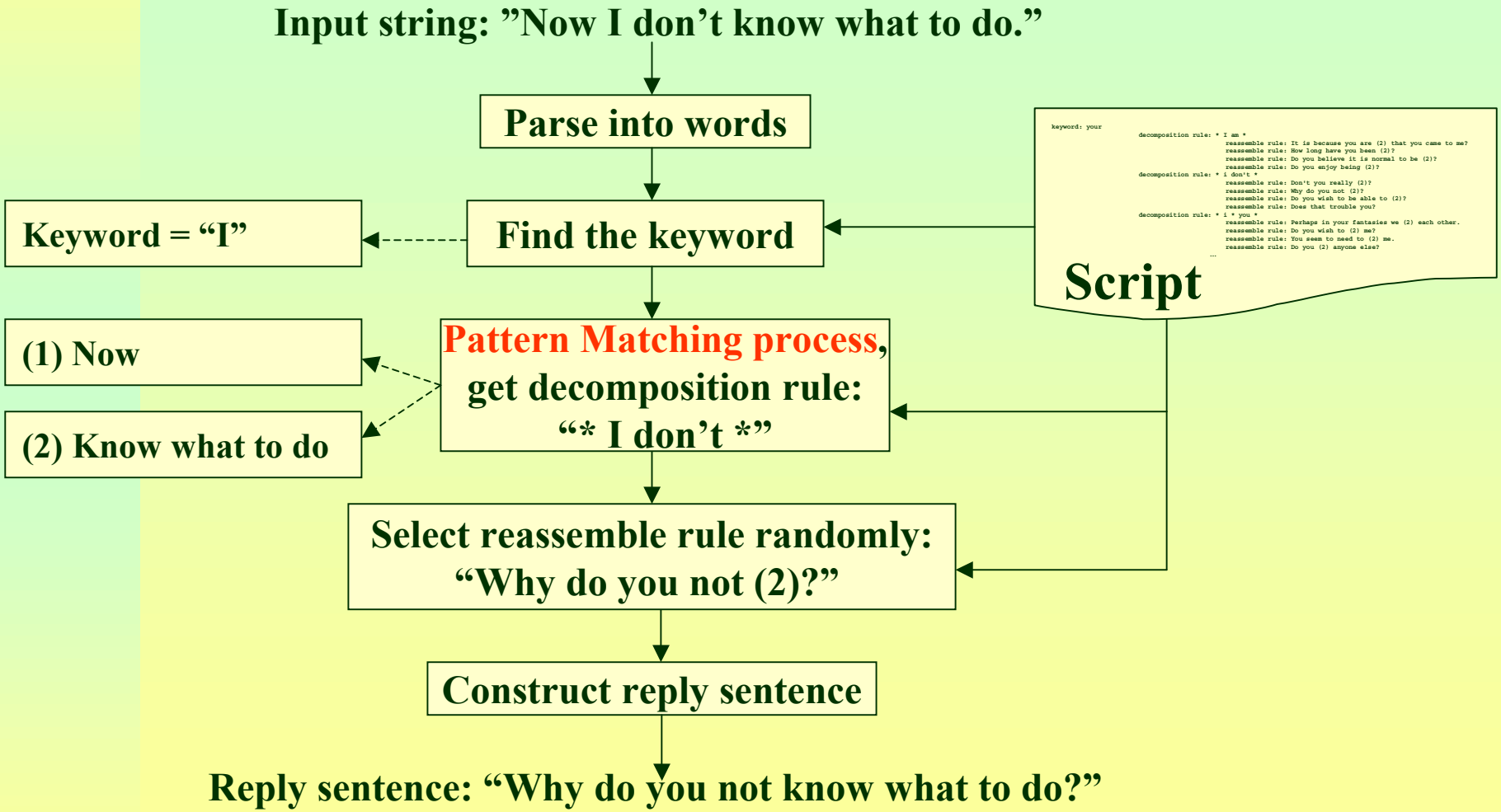

Example

```
Eliza: How do you do. Please state your problem.
User : My name is Siska, we have met each other before.
Eliza: I have told you before, I do not care about names.
User : That's too bad.
Eliza: Please go on.
User : I am really exhausted.
Eliza: Is it because you are exhausted  that you came to me?
User : My computer crashed.
Eliza: What about machines worries you?
User : Now I don't know what to do.
Eliza: Why do you not know what to do?
User : I need my computer back on duty as soon as possible.
Eliza: Why do you mention computer?
User : So I can do my work.
Eliza: Why do you say your work?
User : Because I need the computer to do my work,
       can't you understand that?
Eliza: Don't you think computers can help people?
User : I know that, but that's not my point here.
Eliza: That's quite interesting.
…
```

Eliza's Approach Limitations

- Do not store information from conversation
- Lack anaphora analysis
- Fail in focusing certain topic
- Fail in giving illusion of getting meaning beyond the sentence

Example

Do not store information

```
Eliza: How do you do. Ple    state your problem.
User : My name is Siska, we have met each other before.
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Example

Lack in Anaphora Analysis

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Lack in focusing to certain topic

Lack in giving illusion of getting meaning beyond the sentence

Expanding Memory Structure

- AIML for memory Structure.
- AIML = extended-XML script.
- The idea of Richard Wallace (1995).
- Example: A.L.I.C.E (Artificial Linguistic Internet Computer Entity) system = Alicebot

How Alicebot Works? (1)

- AIML category = Alicebot's memory structure unit

```
<topic name="*">
    <category>
        <that>*</that>
        <pattern>* CRASHED</pattern>
        <template><think><settopic><star/></settopic></think>
          Sorry to hear that, what will you do to fix <set_it><star/></set_it>?
        </template>
     </category>
</topic>
<topic name="* COMPUTER">
    <category>
        <that>WHAT WILL YOU DO TO FIX *</that>
        <pattern>I DO NOT KNOW *</pattern>
        <template><random>
           <li>Have you tried to format your computer?</li>
           <li>Did you ever try to go to Computer reparation?</li>
           <li>Try to uninstall the windows!</li>
           <li>Neither do I.</li>
           <li>I don't know anything about </get_it> either, sorry.</li>
        </random></template>
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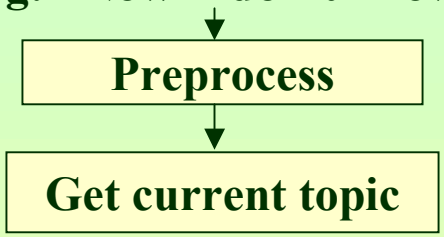
How Alicebot Works? (2)

User : My computer crashed.
Alice: Sorry to hear that, what will you do to fix it?

Input string: ”Now I don’t know what to do.”

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<category>
<that>WHAT WILL YOU DO TO FIX</that>
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AIML Script

How Alicebot Works? (1)

AIML = Alicebot's memory structure

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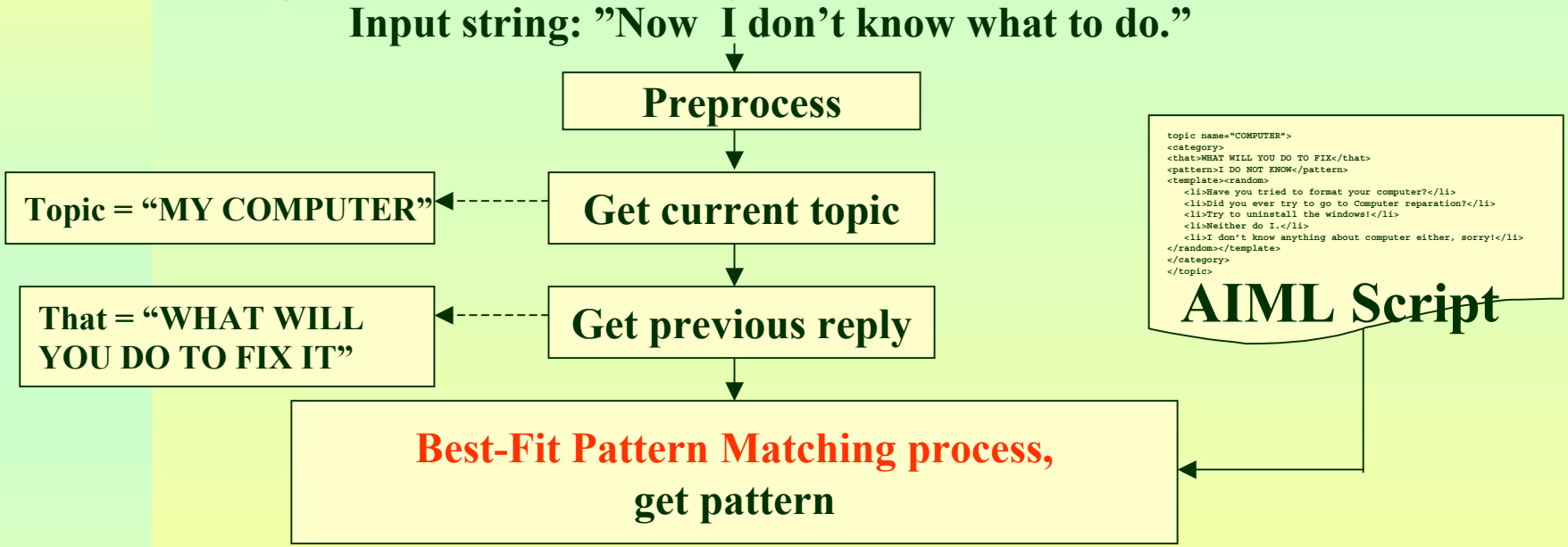

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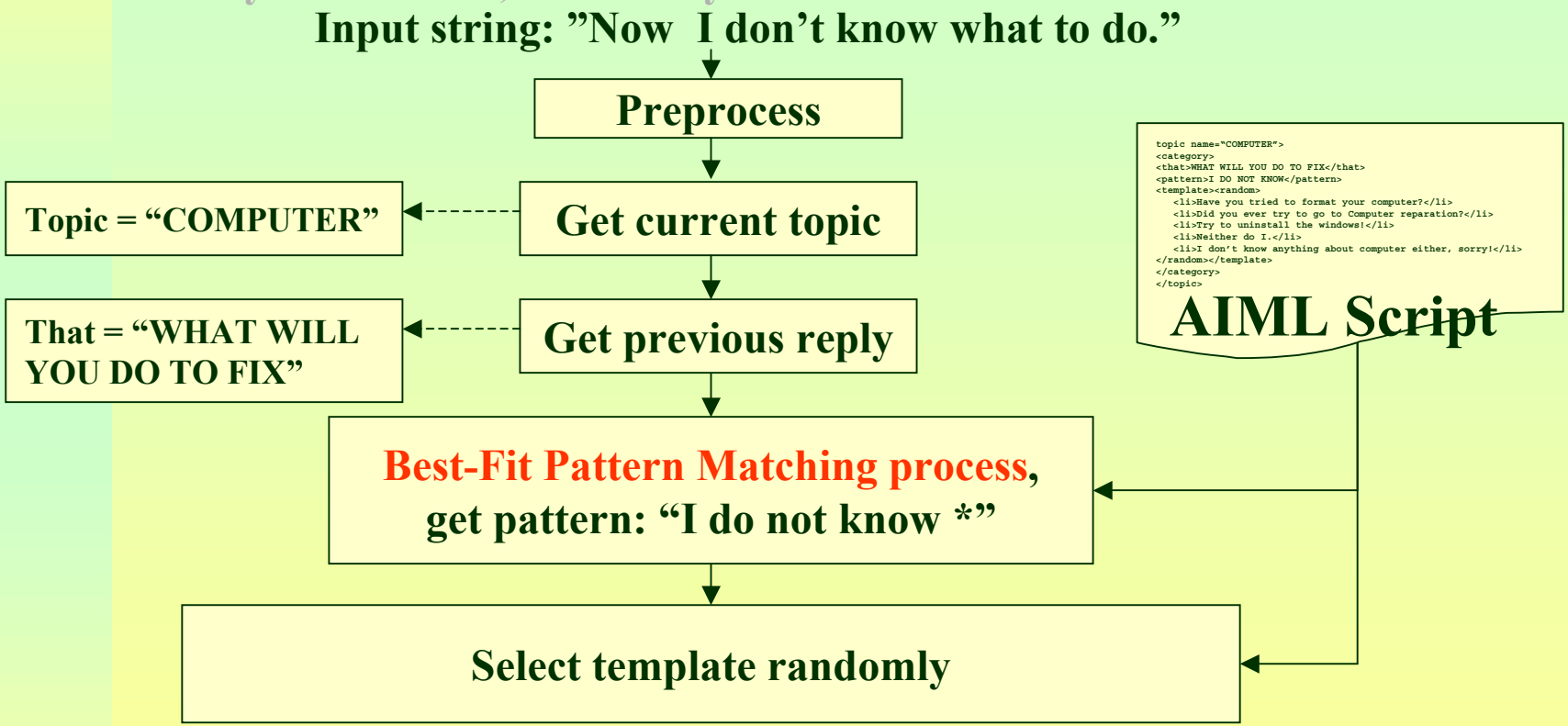

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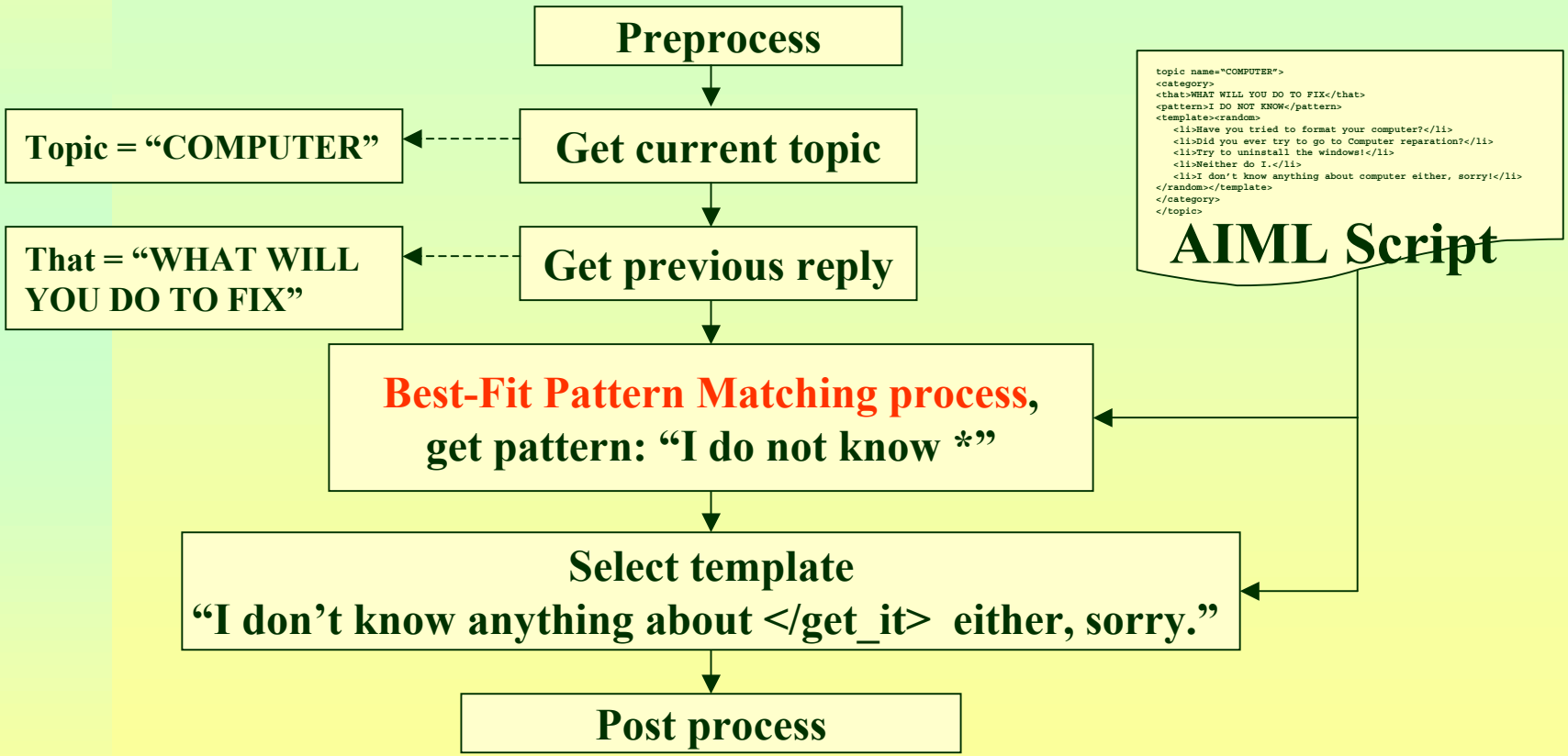

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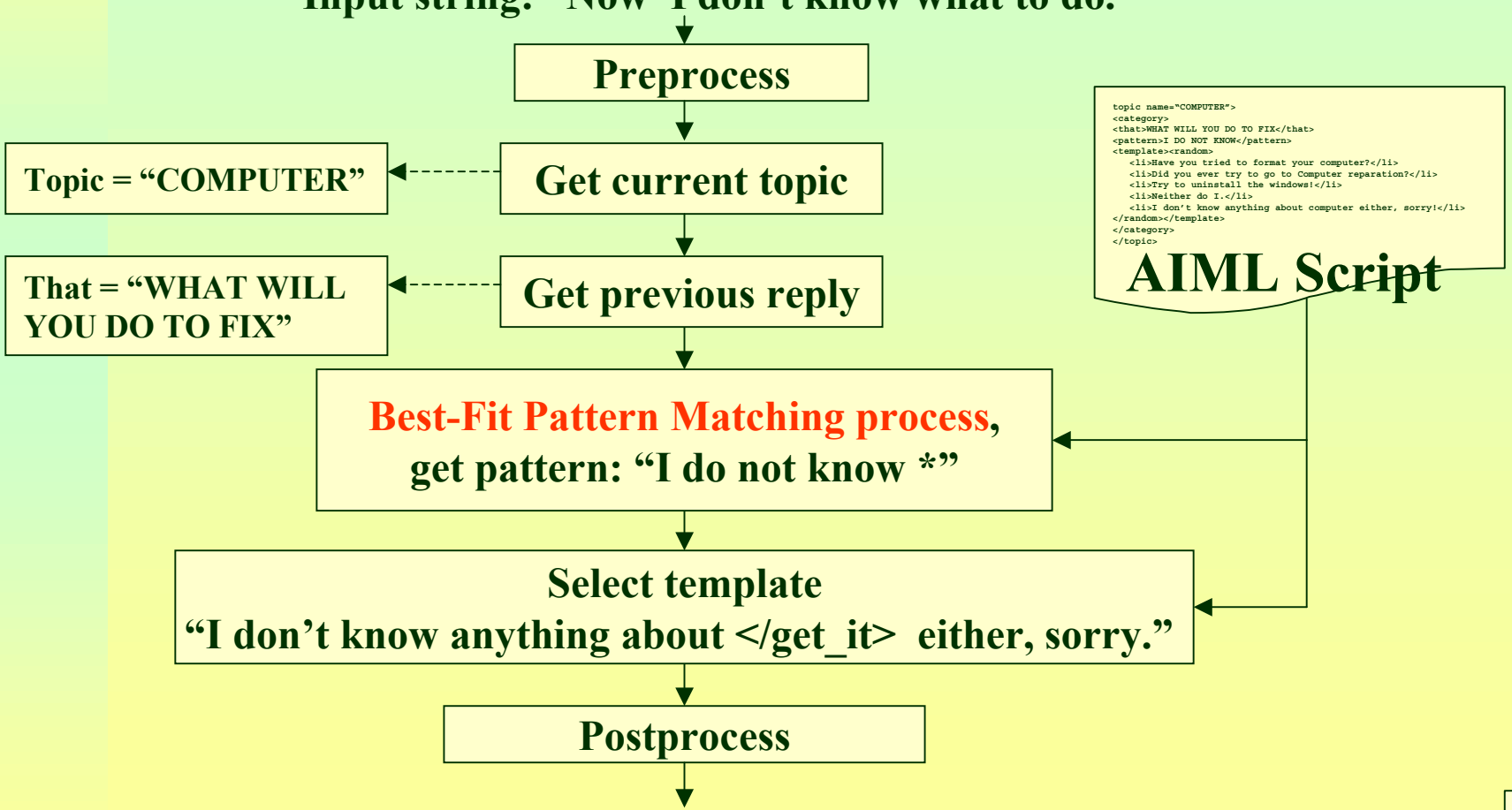
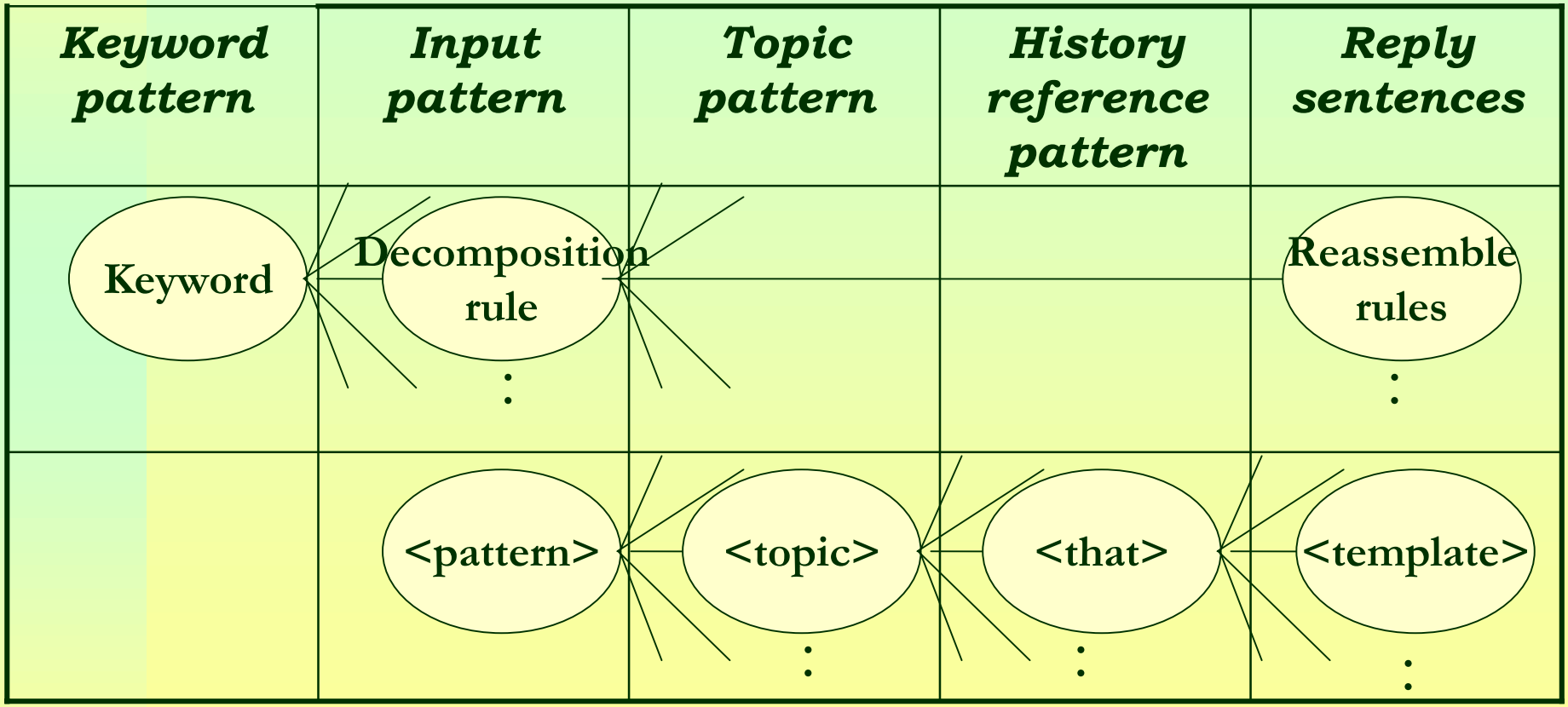


Eliza vs. Alicebot

- Alicebot has bigger memory structure than Eliza.



➔ My_Eliza uses AIML for system's memory structure

Example

```
Alice: How do you do. Please state your problem.
User : My name is Siska, we have met each other before.
Alice: Hi Siska, what a lovely name. I remember you.
User : Hello.
Alice: Enough! Now, what is your problem?
User : I am really exhausted.
Alice: Is it because you are really exhausted  that you
       came to me?
User : My computer crashed.
Alice: Sorry to hear that, what will you do to fix it?
User : Now I don't know what to do.
Alice: I don't know anything about your computer either,
       sorry!
User : It's Ok, I think I have to go to computer
       reparation.
Alice: Good then, Siska. They can help you to fix
       your computer.
User : I hope I can fix it by my own.
…
```

Nonverbal Communication

- Behavior other than spoken or written to represent meaning.

- 55% of emotional meaning of a message.
- No research of emotion recognition in QA System area!

Research Question

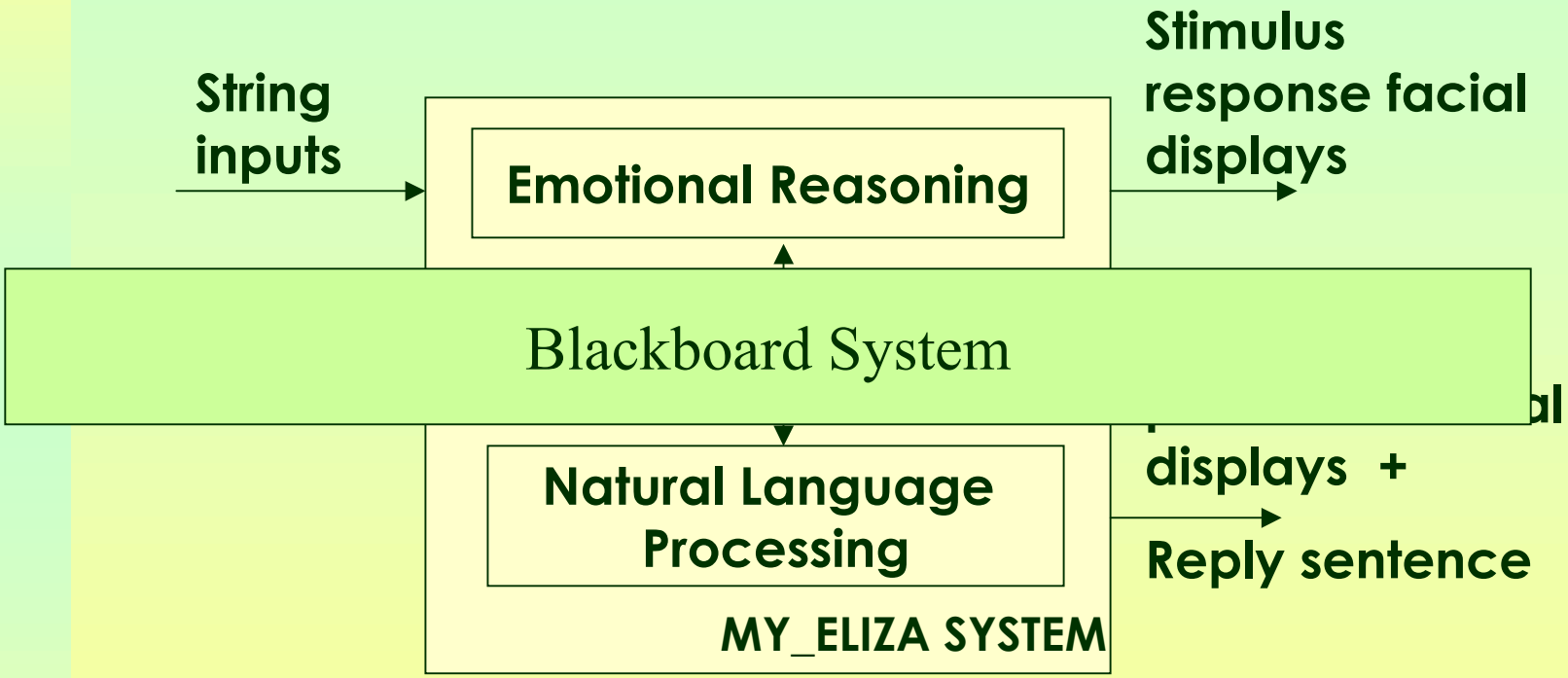
- Emotion Recognition from the text, how?
  - Emotion Classification.
  - Emotion Eliciting Factor Information Extraction.
  - Emotion Recognition.
- Facial Display Generation.

Emotion Classification

- Reddy's Basic Emotions types:
  - Pleasant versus unpleasant.
- Ekman's Universal Emotion types:
  - Happiness, Sadness, Surprise, Fear, Disgust, Anger and Neutrality.
- 24 Emotion types of Ortony, Collins, Clore's Theory

No.	Name and Emotion Type
1.	Joy: pleased about an *event*
2.	Distress: displeased about an *event*
3.	Happy-for: pleased about an *event* desirable for another
4.	Gloating: pleased about an *event* undesirable for another
5.	Resentment: displeased about an *event* desirable for another
6.	Sorry-for: displeased about an *event* undesirable for another
7.	Hope: pleased about a prospective desirable *event*
8.	Fear: displeased about a prospective undesirable *event*
9.	Satisfaction: pleased about a confirmed desirable *event*
10.	Relief: pleased about a disconfirmed undesirable *event*
11.	Fears-confirmed; displeased about a confirmed undesirable *event*
12.	Disappointment: displeased about a disconfirmed desirable *event*
13.	Pride: approving of one's own *act*
14.	Admiration: approving of another's *act*
15.	Shame: disapproving of one's own *act*
16.	Reproach: disapproving of another's *act*
17.	Liking: finding an *object* appealing
18.	Disliking: finding an *object* unappealing
19.	Gratitude: admiration + joy
20.	Anger: reproach + distress
21.	Gratification: pride + joy
22.	Remorse: shame + distress
23.	Love: admiration + liking
24.	Hate: reproach + disliking

My_Eliza Global Design



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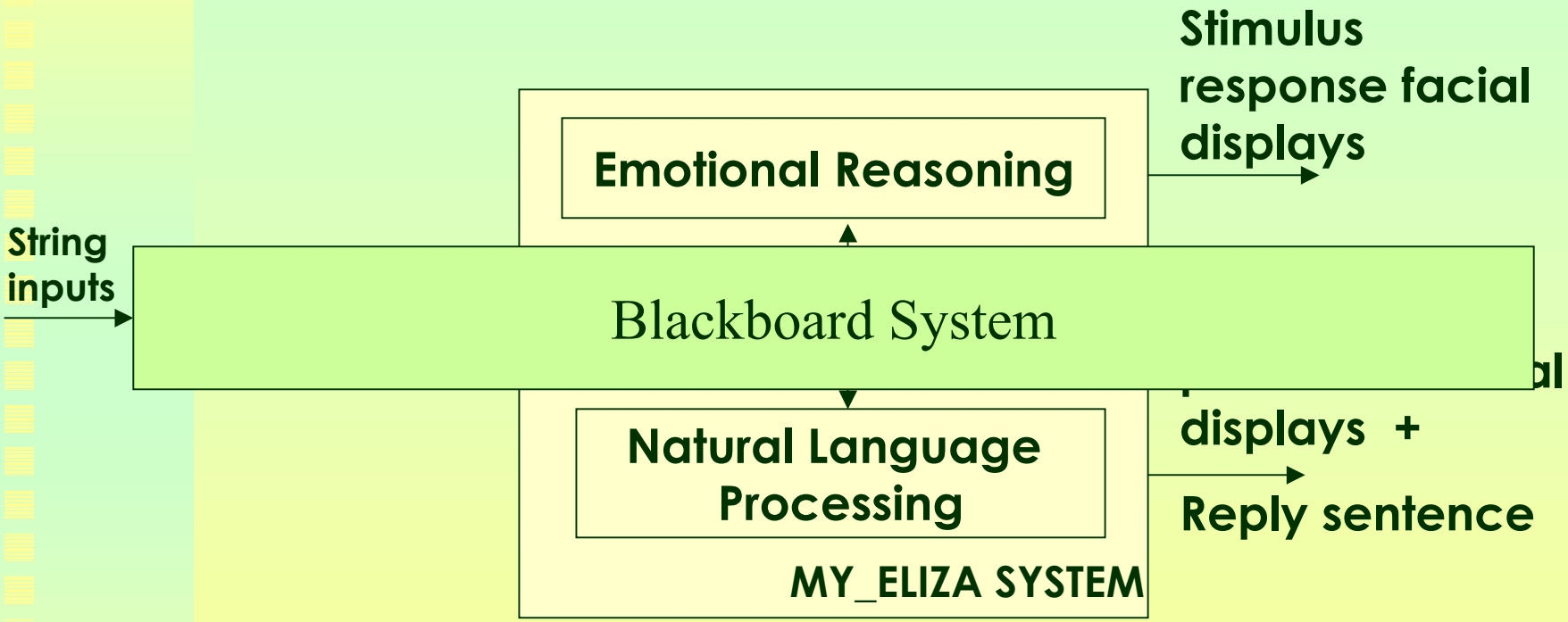

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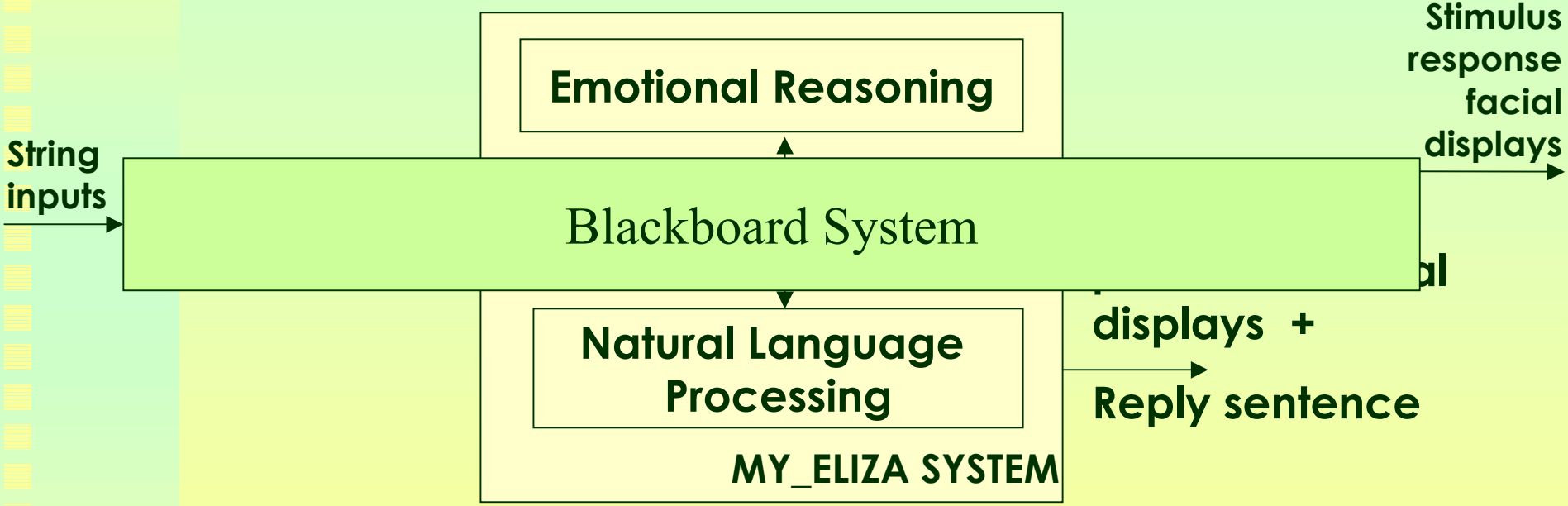

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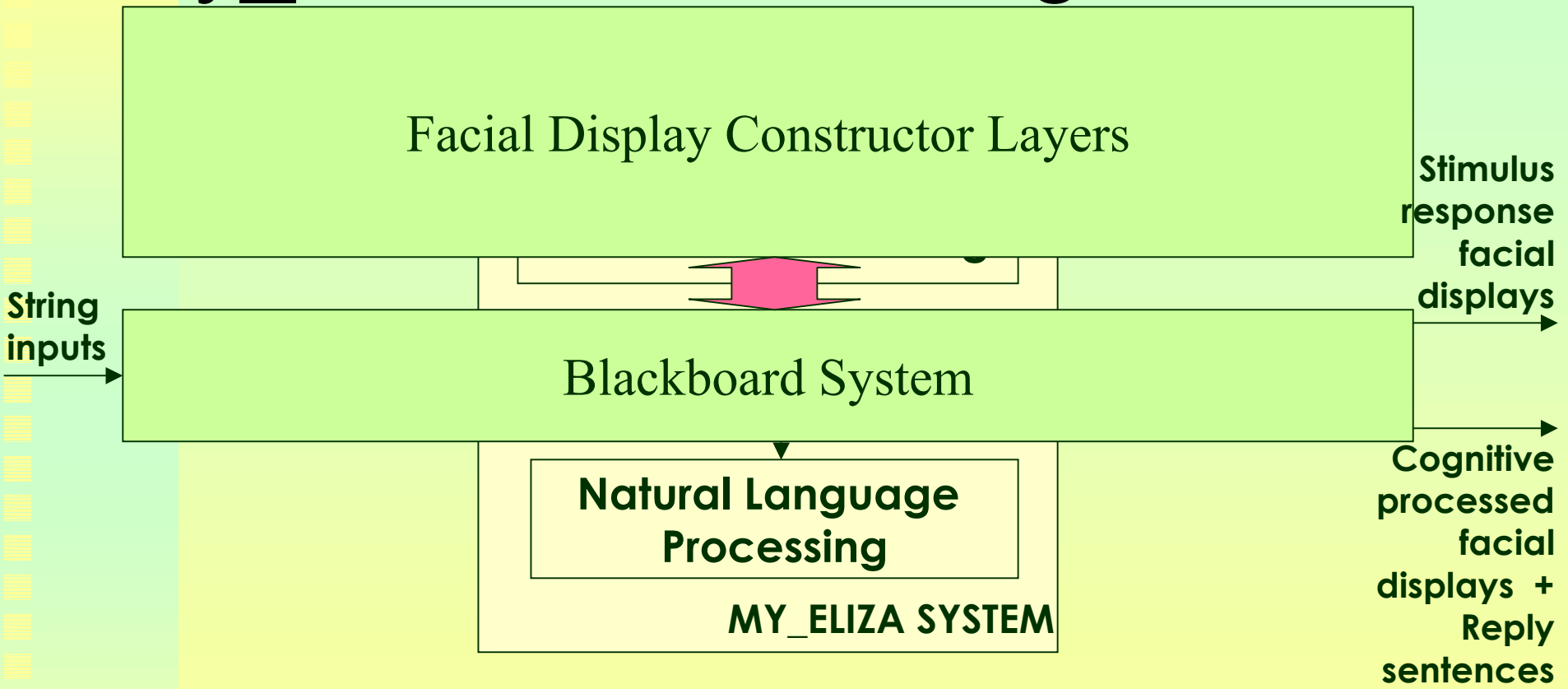

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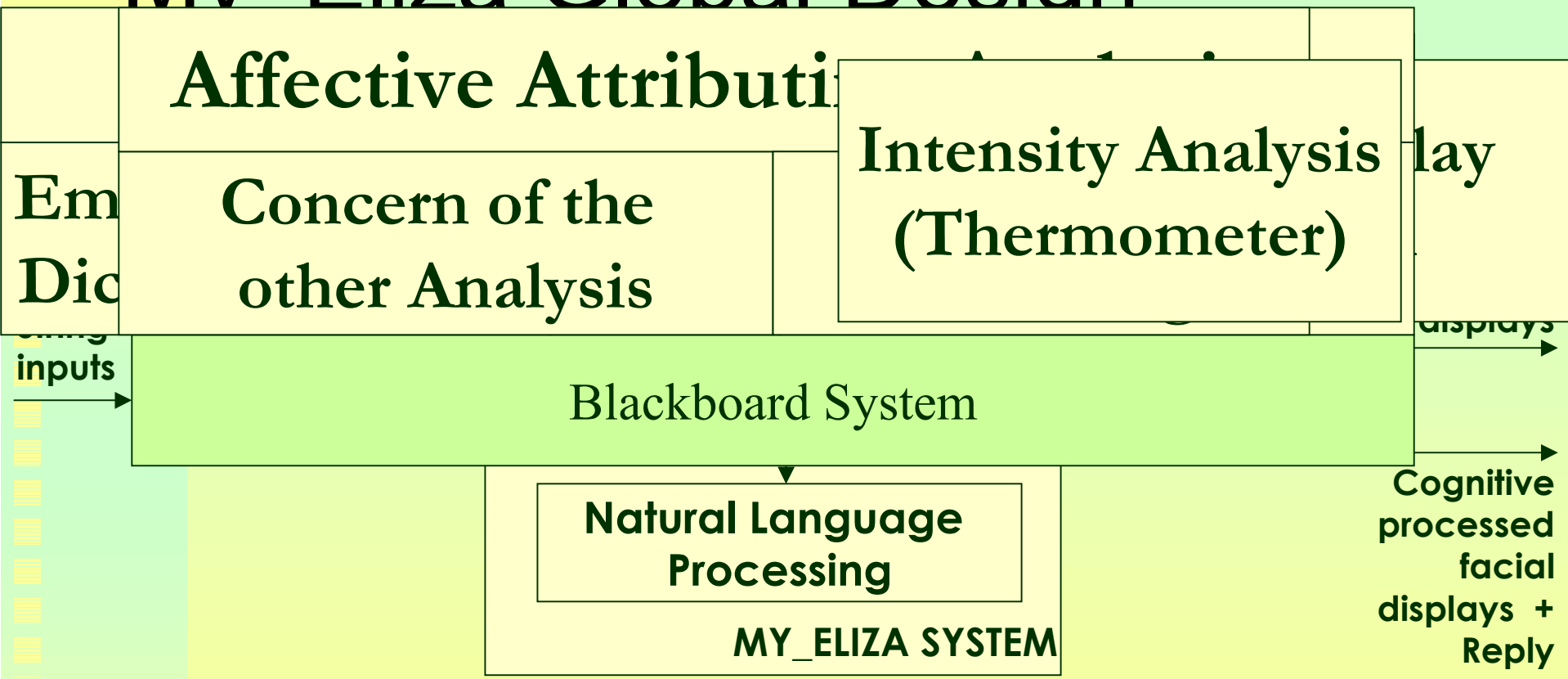

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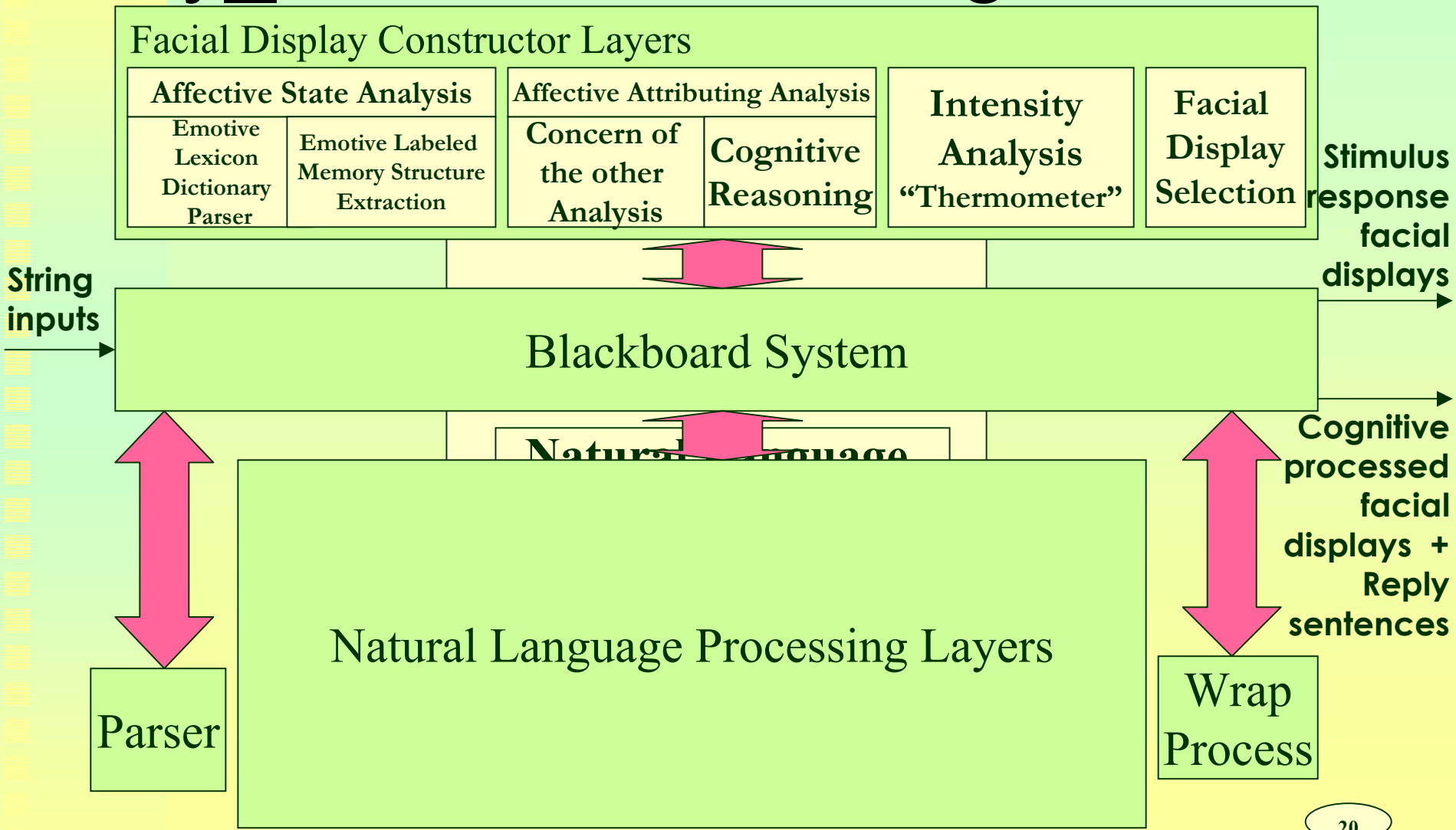

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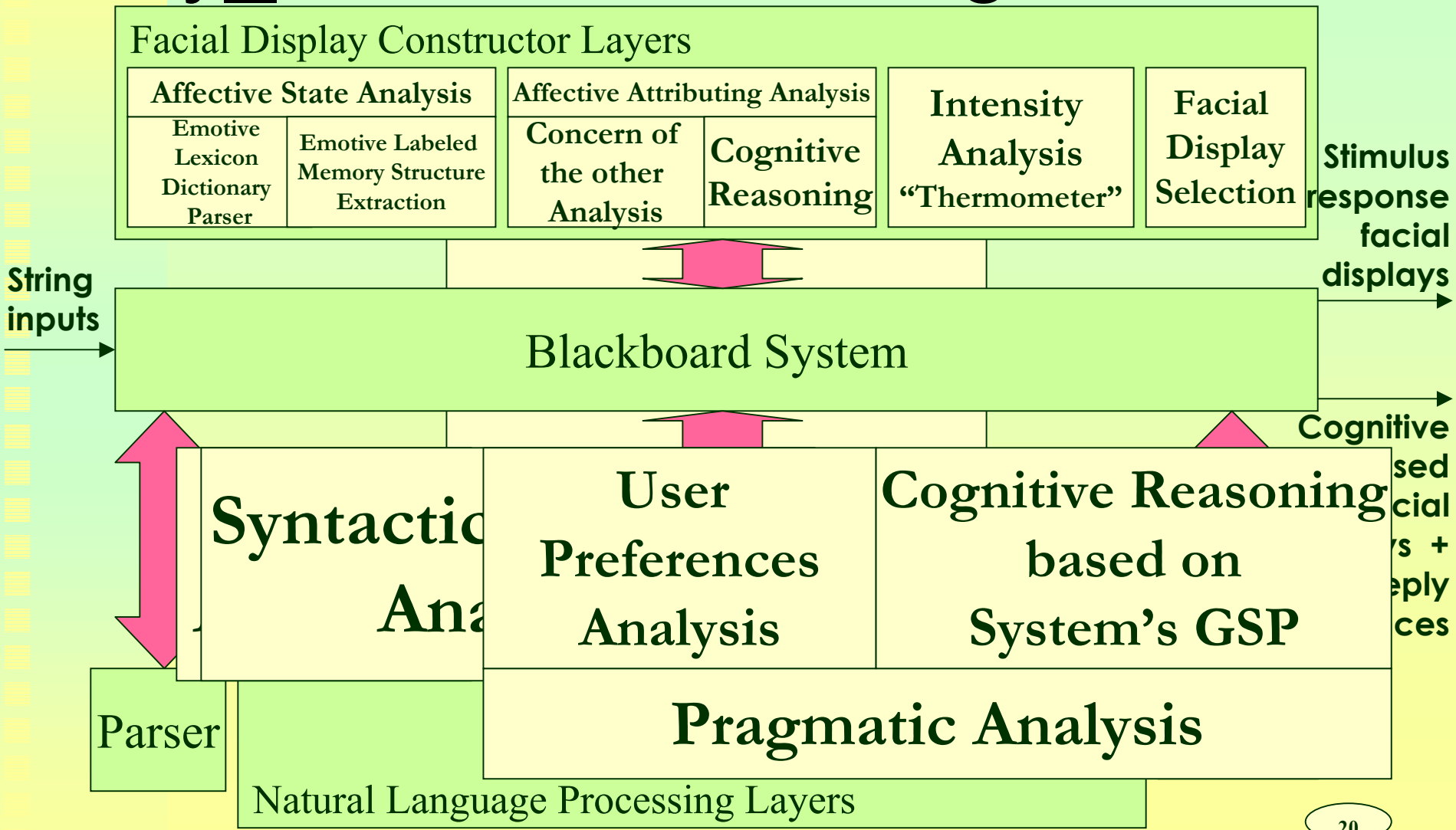
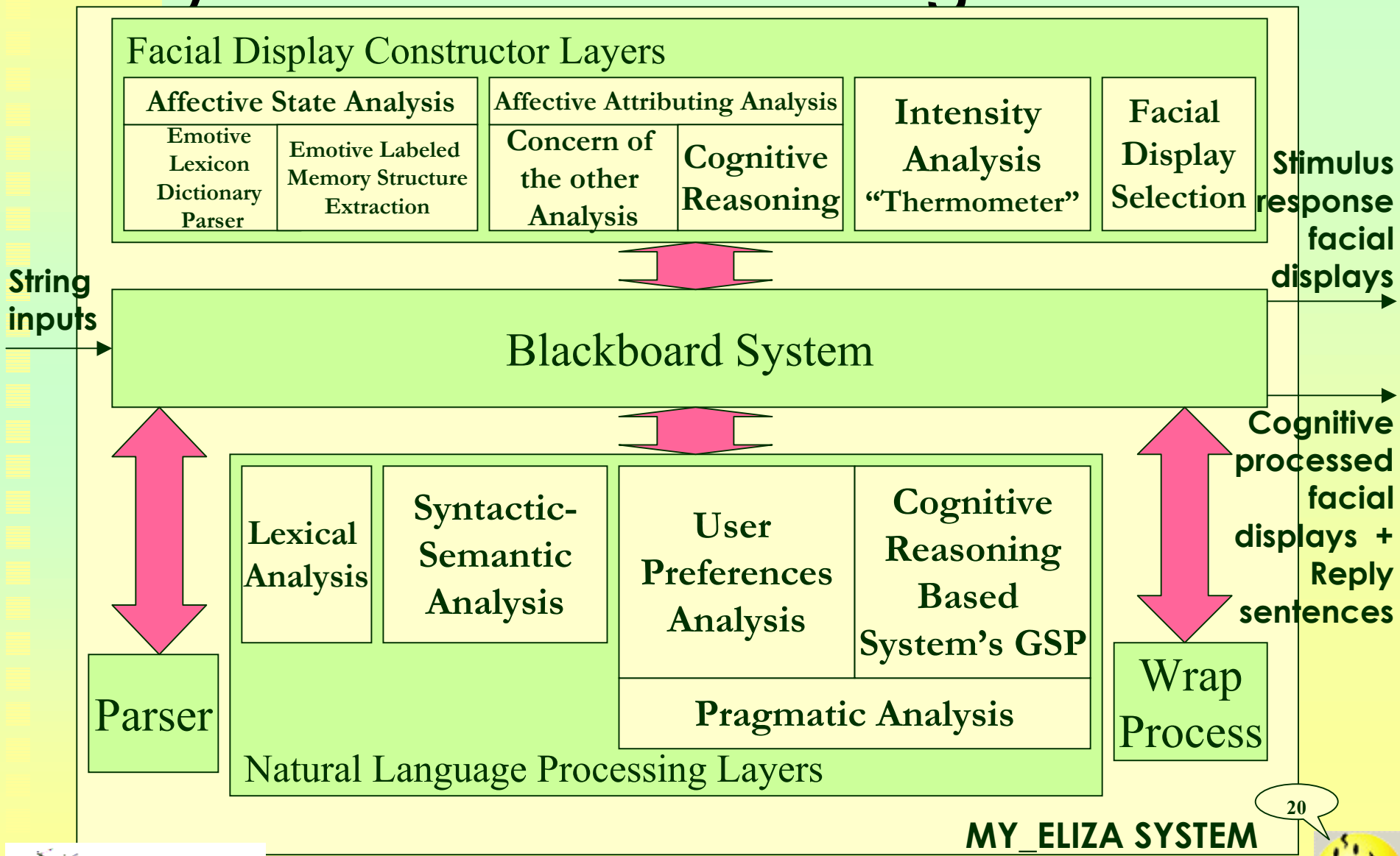


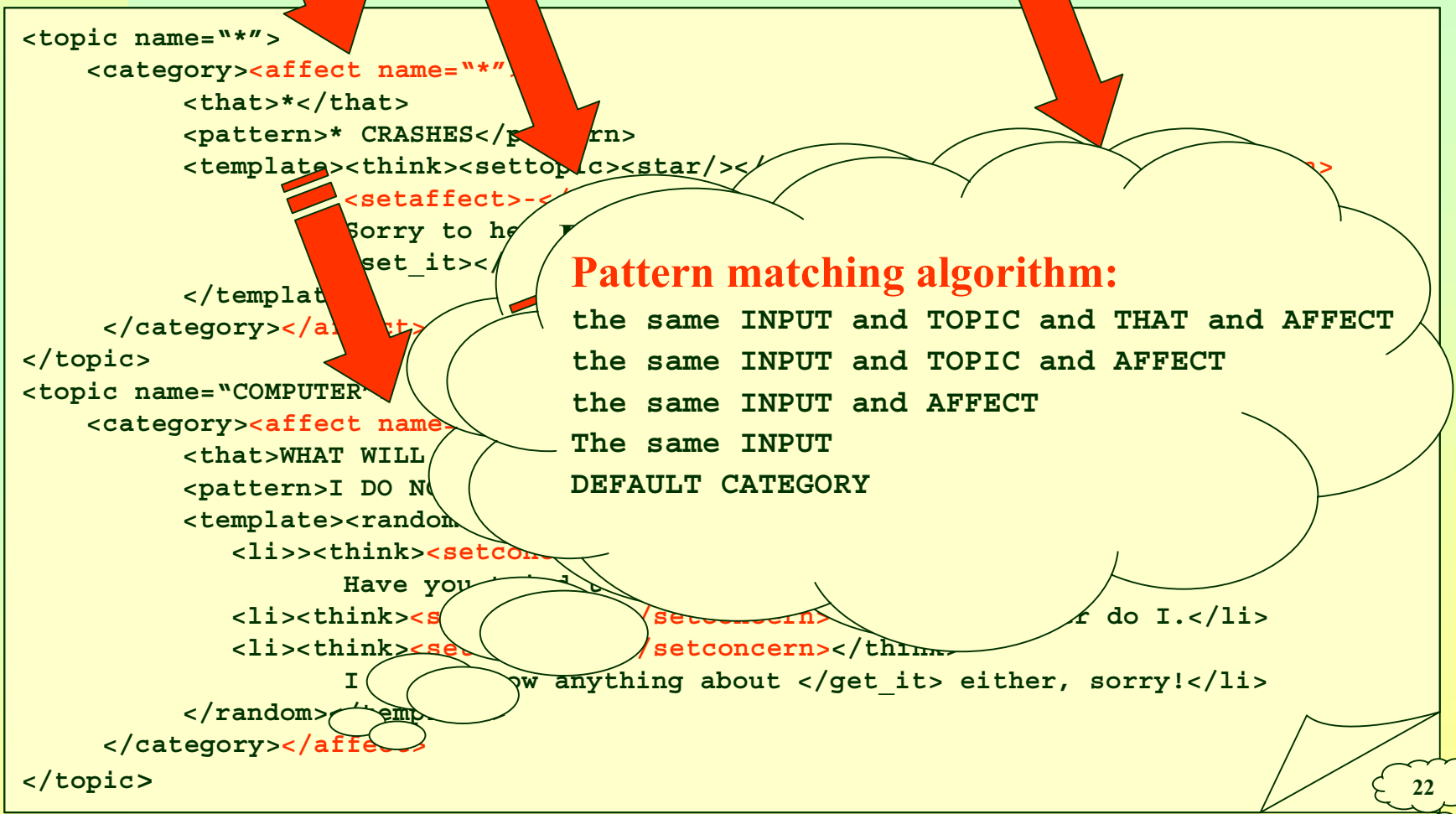
My Eliza Global Design



Emotion Eliciting Factor Extraction

- Emotive labeled memory structure extraction
- Emotive lexicon dictionary parser
- Goal based emotion reasoning

Emotive Labeled Memory Structure



Emotive Lexicon Dictionary

```
<emotions>
  <emotion-dictionary name="[illegible]ss"
    [lucky:1[illegible]
  <emotio[illegible]
    [unh[illegible]
  <[illegible]
  <e[illegible]
  <e[illegible]
    [no way[illegible]
  <emotion-d[illegible]aid:1],
    [panic:2], [horror:3], [hi[illegible]ease:1], [terrified:1], … ">

  <emotion-comparativ[illegible]ow" value="bit, little, quite, few …">
  <emotion-comparativ[illegible]ame="high" value="huge, very, big,  …">

<emotions/>
```

```
<emotions>
  <emotion-dictionary name="<emotion-type>"
                value = "<list of [lexicon:intensity]>"
  />
<emotions/>
```

Emotive Lexicon Dictionary Parser

- Six affective counter C_j
  - Parsing user's string input and system's reply sentence
  - Result: candidate affective state

$$\forall \text{ Lexicon } l_i \in d_i \mid C_{i(t)} = C_{i(t-1)} + I_i \cdot s$$

i = active emotion type

s = summation factor; d = dictionary

$$\forall j \neq i \mid C_{j(t)} = C_{j(t-1)} - \text{distance\_value}[j, i]$$

j = {happiness, sadness, anger, fear, disgust, surprise}

Goal Based Emotion Reasoning

- Goals to reach:
  - Answering question
  - Persuasive agreement
  - Topical focus
  - Explanation statements
  - Reflecting feeling
  - Alignment
- System's affective status.
- Preferences to evaluate.

Emotion Recognition

- Affective Thermometer
- Affective Attributing Knowledge Based System
  - Concern of the other Knowledge Base
  - Cognitive Reasoning Knowledge Base

Affective Thermometer

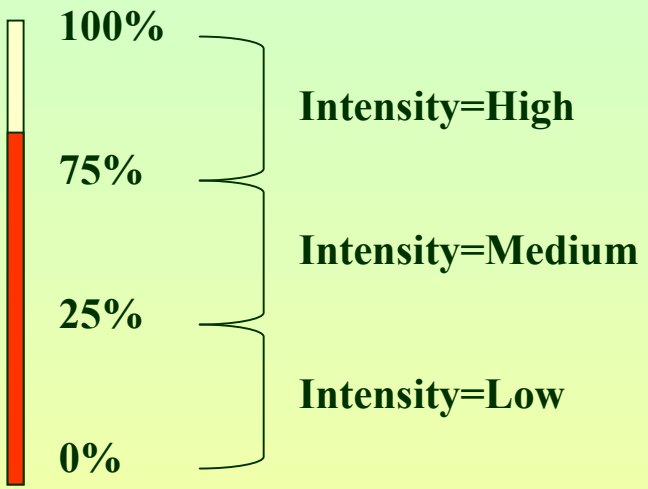
- **Six thermometers for six Ekman's universal emotion types**

$$T_{i(t)} = T_{i(t-1)} + I_i \cdot s$$

i = active emotion type

s = summation factor

I = emotion intensity



$$\forall j \neq i \mid T_{j(t)} = T_{j(t-1)} - distance\_value[j, i]$$

j = {happiness, sadness, anger, fear, disgust, surprise}

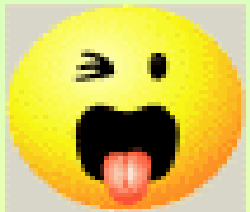
Affective Attributing

- Determine system's affective state classified by 24 OCC's theory emotions types
- Defined as preference rules
  - Example 1:
    -User is happy,
    -User asks question,
    -User's situation type is not negative,
    -Maximum system's affective thermo is happy.
    →**Joy**

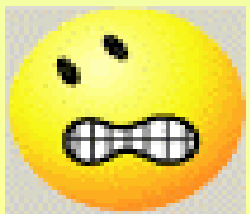
  - Example 2:
    -User is sad,
    -User's situation type is not joking,
    -Maximum system's affective thermo is sad.
    →**Sorry-for**

Affective Attributing

- Cognitive Process Knowledge Base
  - System reaction to convey reply sentence
  - Example 1:
    -User is happy,
    -User's situation type is joke,
    -System is disgusted,
    -System's situation type is negative,
    -Maximum system's affective thermo is sadness.
    →**Hate**



  - Example 2:
    -User is sad,
    -User's situation type is negative,
    -System is sad,
    -System situation type is not joking,
    -Maximum system's affective thermo is surprise.
    →**Fears-confirmed**



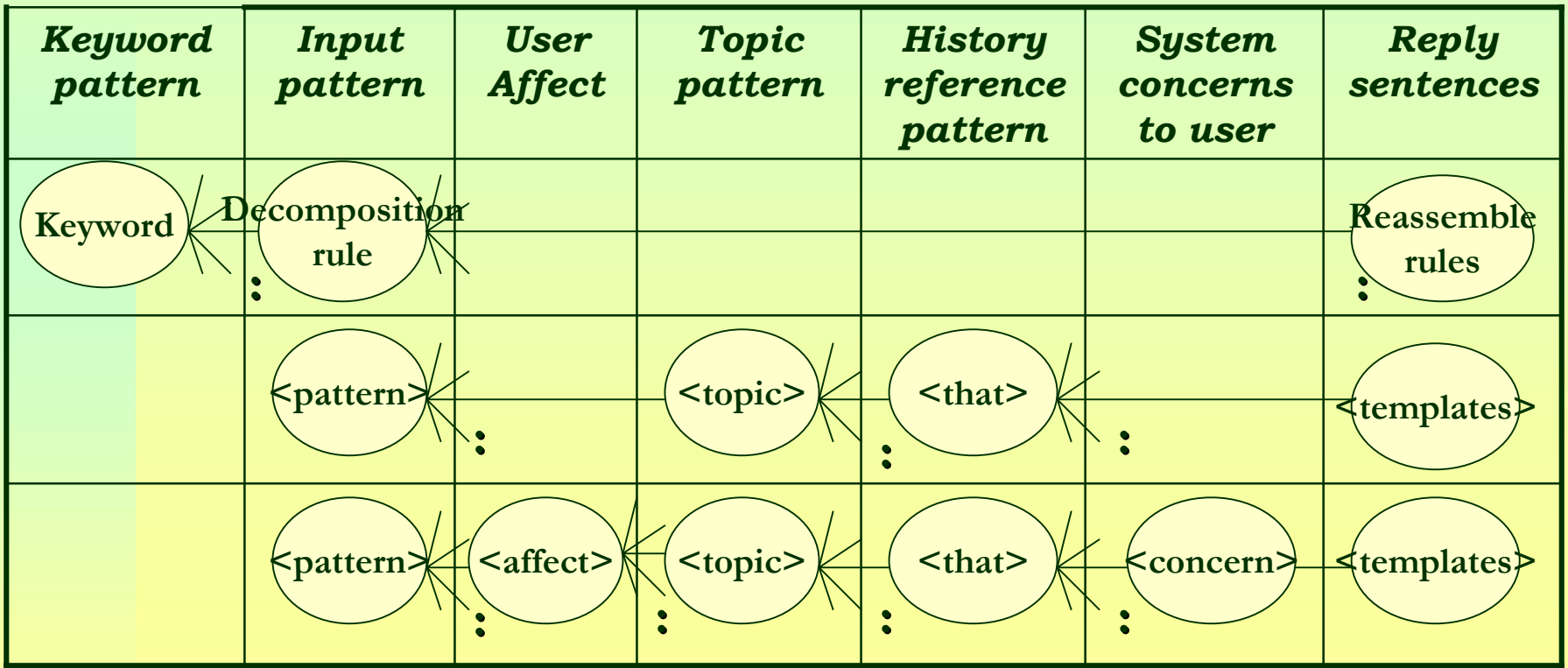
Facial Display Generation

- Clustering 24 OCC's theory emotion types into six Ekman's universal types
- Additional emotion types: uncertainty

Intensity	*Emotion name*							
	Happiness	*Sadness*	*Surprise*	*Fear*	*Disgust*	*Anger*	*Neutrality*	*Uncertainty*
Low								
Medium								
High								

My_Eliza versus Eliza and Alicebot

- My_Eliza has bigger memory structure than Eliza and Alicebot.



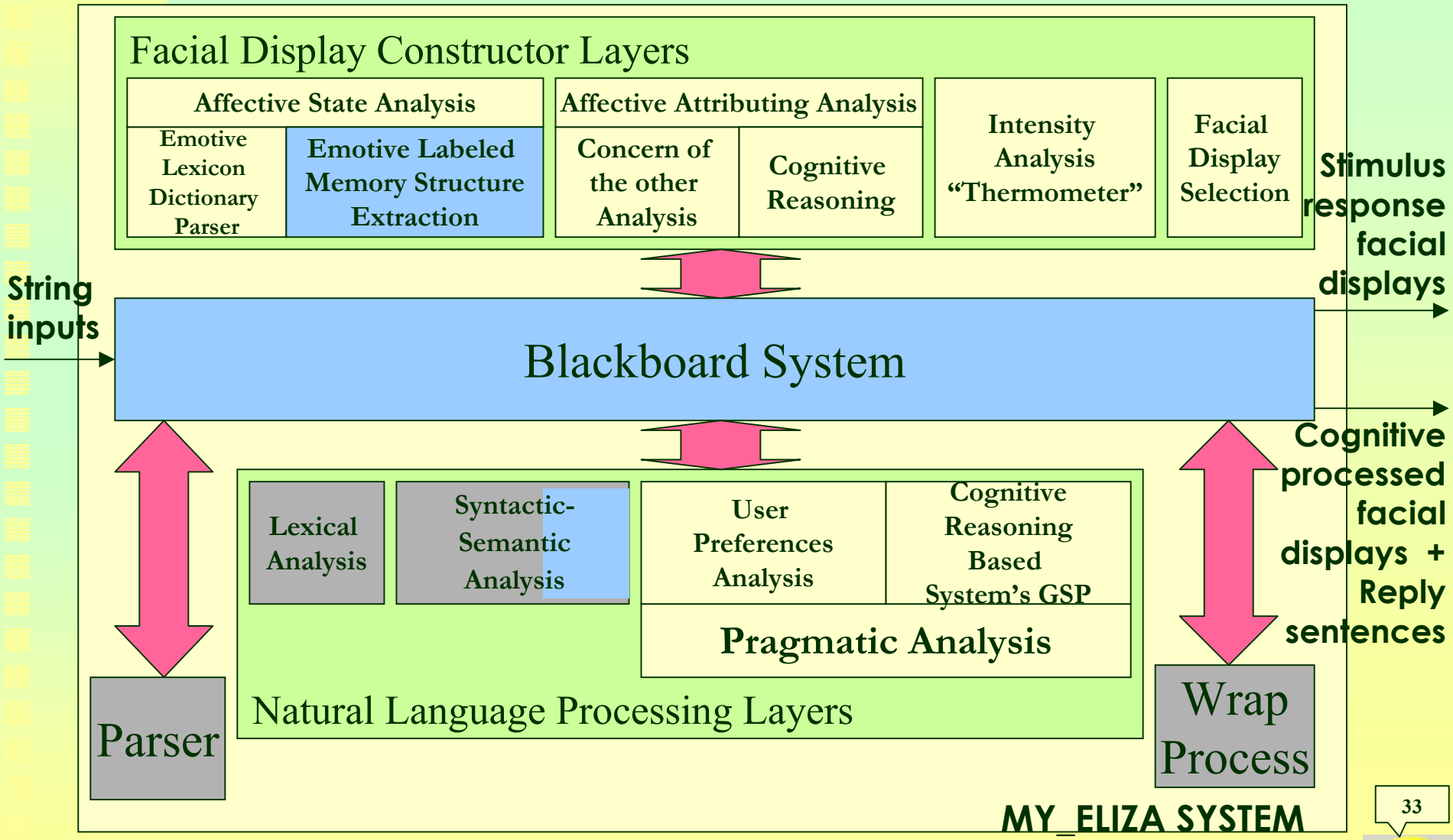
Implementation

- Incremental implementation layer:

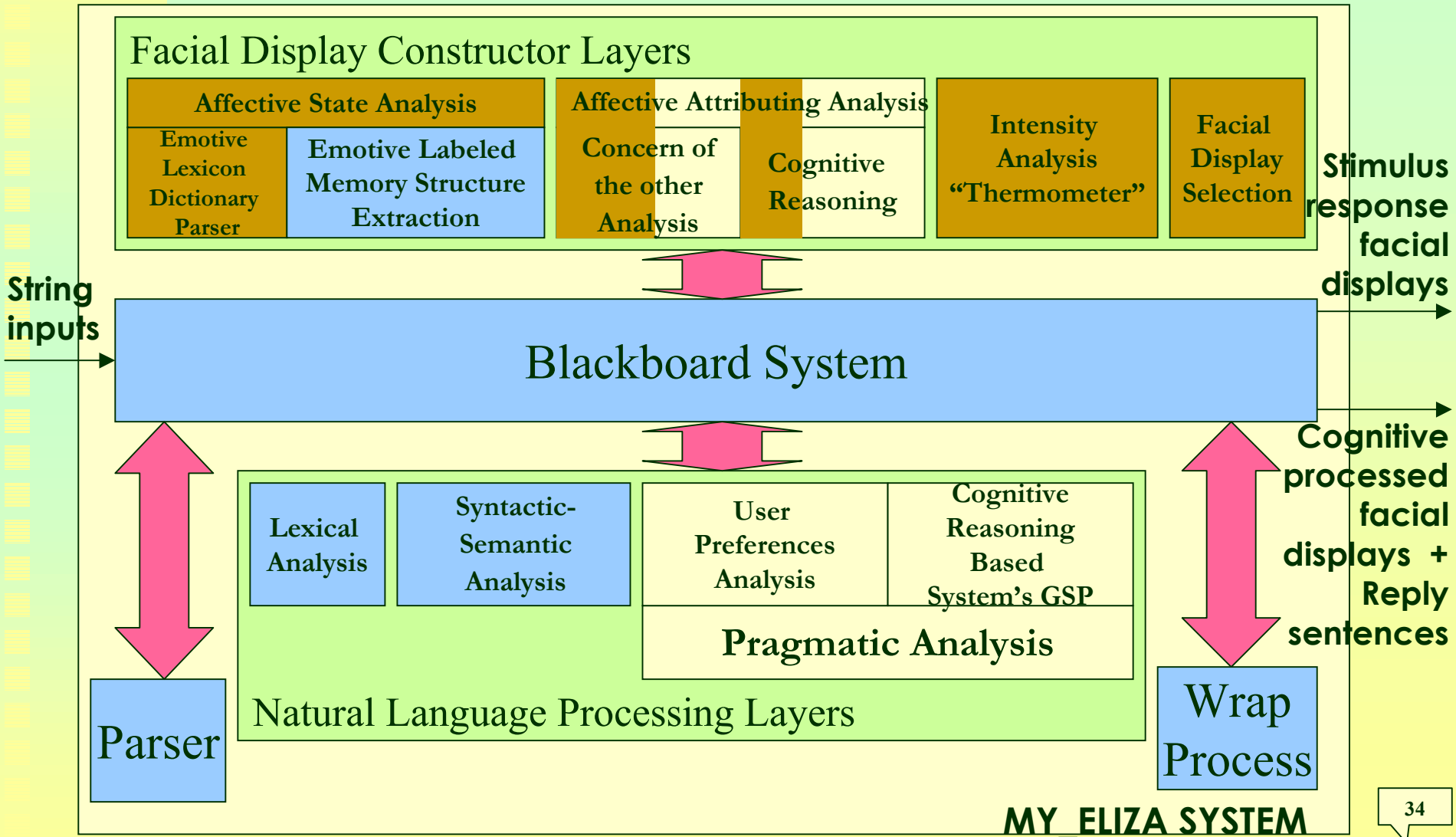
(3) Cognitive-Process based reasoning
(2) Stimulus-Response based reasoning
(1) My_Eliza Dialog Box

- My_Eliza Prototype-1,
  Stimulus Response Based Reasoning
- Tools:
  - Java Development Kit version 1.30
  - XML (AIML)
  - Jess

My_Eliza's Dialog Box



My_Eliza Prototype-1



Snapshot System Demo

```
[2002-07-16 17:12:07] Starting Alicebot Program D version 4.1.3
[2002-07-16 17:12:07] Using Java VM 1.3.0-C from Sun Microsystems Inc.
[2002-07-16 17:12:07] On Windows 2000 version 5.0 (x86)
[2002-07-16 17:12:07] Bot predicates with no values defined will return:
"undefined".
[2002-07-16 17:12:08] Initializing Multiplexor.
[2002-07-16 17:12:08] Starting Graphmaster.
[2002-07-16 17:12:19] Loaded 288 input substitutions.
[2002-07-16 17:12:19] Loaded 19 gender substitutions.
[2002-07-16 17:12:19] Loaded 9 person substitutions.
[2002-07-16 17:12:19] Loaded 60 person2 substitutions.
[2002-07-16 17:12:19] Loaded 3 sentence-splitters.
[2002-07-16 17:12:19] Loaded happiness descreet distance values.
[2002-07-16 17:12:19] Loaded surprise descreet distance values.
[2002-07-16 17:12:19] Loaded fear descreet distance values.
[2002-07-16 17:12:19] Loaded anger descreet distance values.
[2002-07-16 17:12:19] Loaded disgust descreet distance values.
[2002-07-16 17:12:19] Loaded sadness descreet distance values.
[2002-07-16 17:12:19] Loaded 33 happiness lexicons-dictionary.
[2002-07-16 17:12:19] Loaded 16 surprise lexicons-dictionary.
[2002-07-16 17:12:19] Loaded 13 fear lexicons-dictionary.
[2002-07-16 17:12:19] Loaded 28 anger lexicons-dictionary.
[2002-07-16 17:12:19] Loaded 38 disgust lexicons-dictionary.
[2002-07-16 17:12:19] Loaded 51 sadness lexicons-dictionary.
[2002-07-16 17:12:19] Loaded 6 high comparatives.
[2002-07-16 17:12:19] Loaded 8 low comparatives.
[2002-07-16 17:12:19] Loaded 33 negation attributes.
[2002-07-16 17:12:19] Loaded 6 question attributes.
[2002-07-16 17:12:20] 1953 categories loaded in 11.897 seconds.
[2002-07-16 17:12:20] The AIML Watcher is active.
[2002-07-16 17:12:20] "my_Eliza" is thinking with 1953 categories.
[2002-07-16 17:12:20] Alicebot Program D version 4.1.3 Build [04].
[2002-07-16 17:19:37] Type exit to shut down.
```

index.html

PROTOTYPE-1

You will speak with my_Eliza from Audi. My_Eliza's botmaster is Ska.

You can:

- login.
- register as a user.

Sorry, currently you can only use Microsoft Internet Explorer

login.html

Please login.

Username: ska

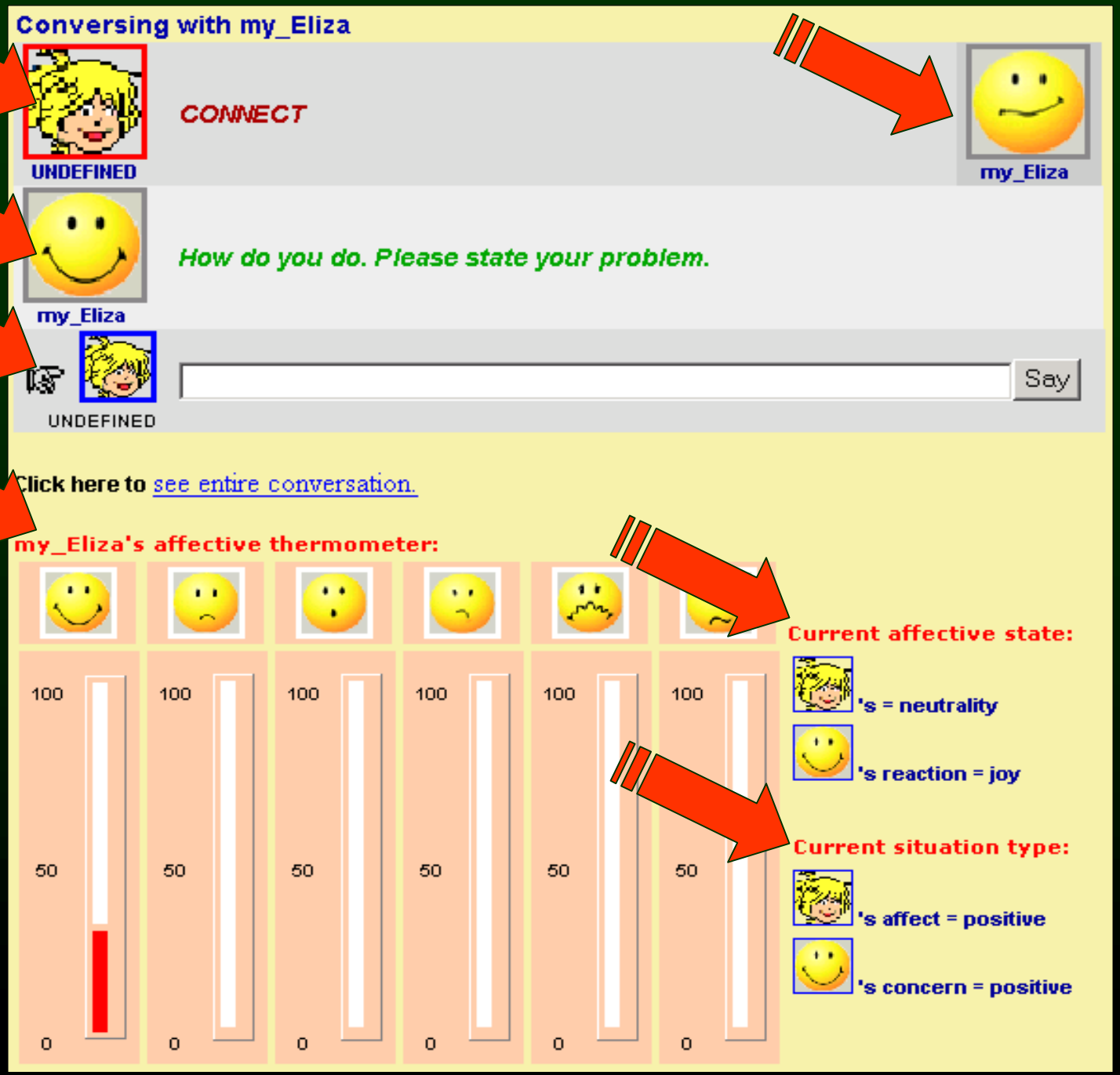
Password: ••••••••••

Choose your icon:

Log In

Register a new user click here.

Main Page


Conversing with my_Eliza
CONNECT
UNDEFINED
my_Eliza
How do you do. Please state your problem.
my_Eliza
UNDEFINED
Say
Click here to see entire conversation.
my_Eliza's affective thermometer:
100
50
0
Current affective state:
's = neutrality
's reaction = joy
Current situation type:
's affect = positive
's concern = positive

Stores Information

Conversing with my_Eliza

SISKA

My name is Siska. We have met before.

my_Eliza

my_Eliza

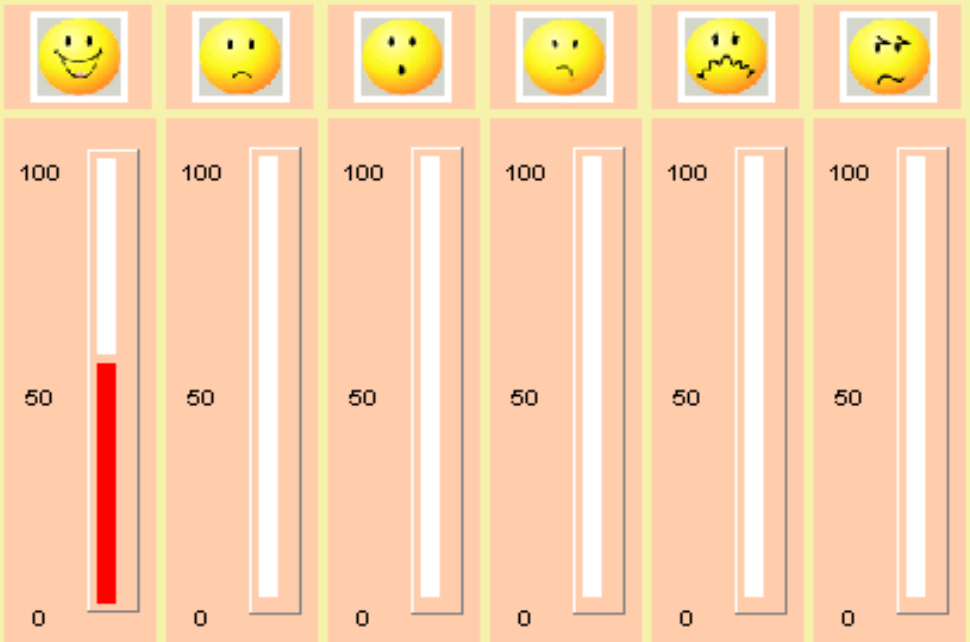
Hi Siska, what a lovely name.I remember you.

SISKA

Say

Click here to see entire conversation.

my_Eliza's affective thermometer:



Current affective state:

's = neutrality

's reaction = joy

Current situation type:

's affect = positive

's concern = positive

Conversing with my_Eliza

SISKA

Hello.

my_Eliza

my_Eliza

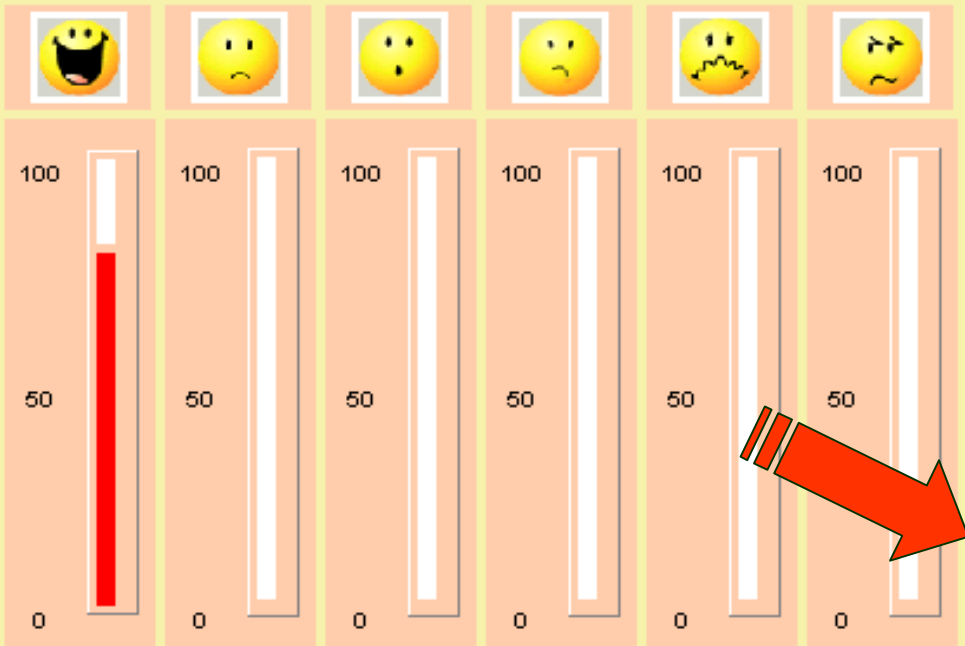
Enough! now, what's your problem?

SISKA

Say

Click here to see entire conversation.

my_Eliza's affective thermometer:



Current affective state:

's = neutrality

's reaction = gratification

Current situation type:

's affect = positive

's concern = joking

Joking

Conversing with my_Eliza

SISKA

I am really exhausted.

my_Eliza

my_Eliza

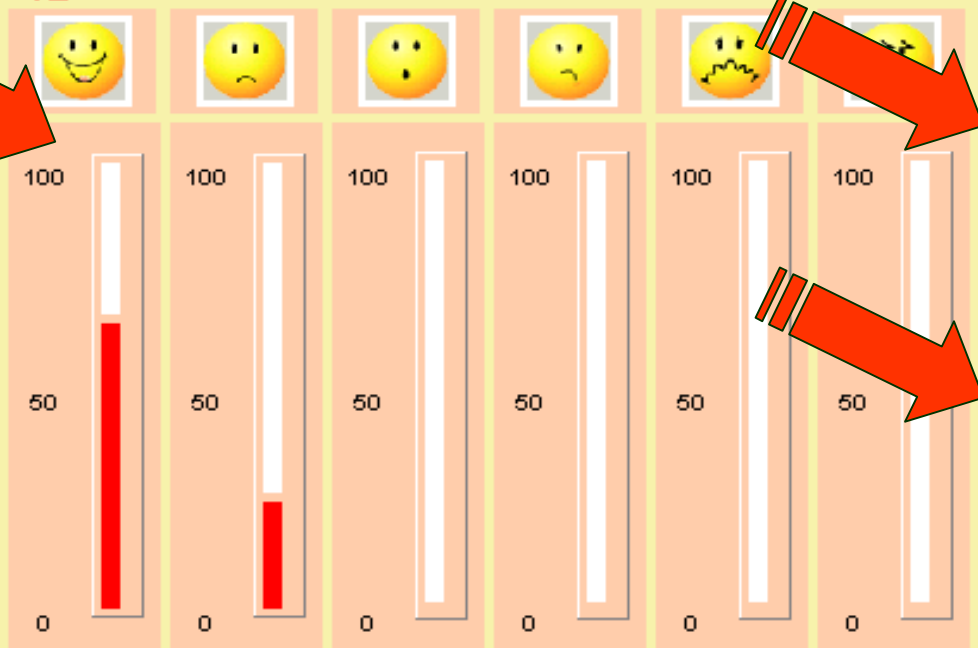
Is it because you are really exhausted that you came to me?

SISKA

Say

Click here to see entire conversation.

my_Eliza's affective thermometer:



Current affective state:

's = sadness

's reaction = sorry-for

Current situation type:

's affect = negative

's concern = positive

Sorry-for 1

Conversing with my_Eliza

SISKA

My computer crashed.

my_Eliza

my_Eliza

Sorry to hear that, what will you do to fix it?

SISKA

Say

Click here to see entire conversation.

my_Eliza's affective thermometer:

Current affective state:

's = sadness

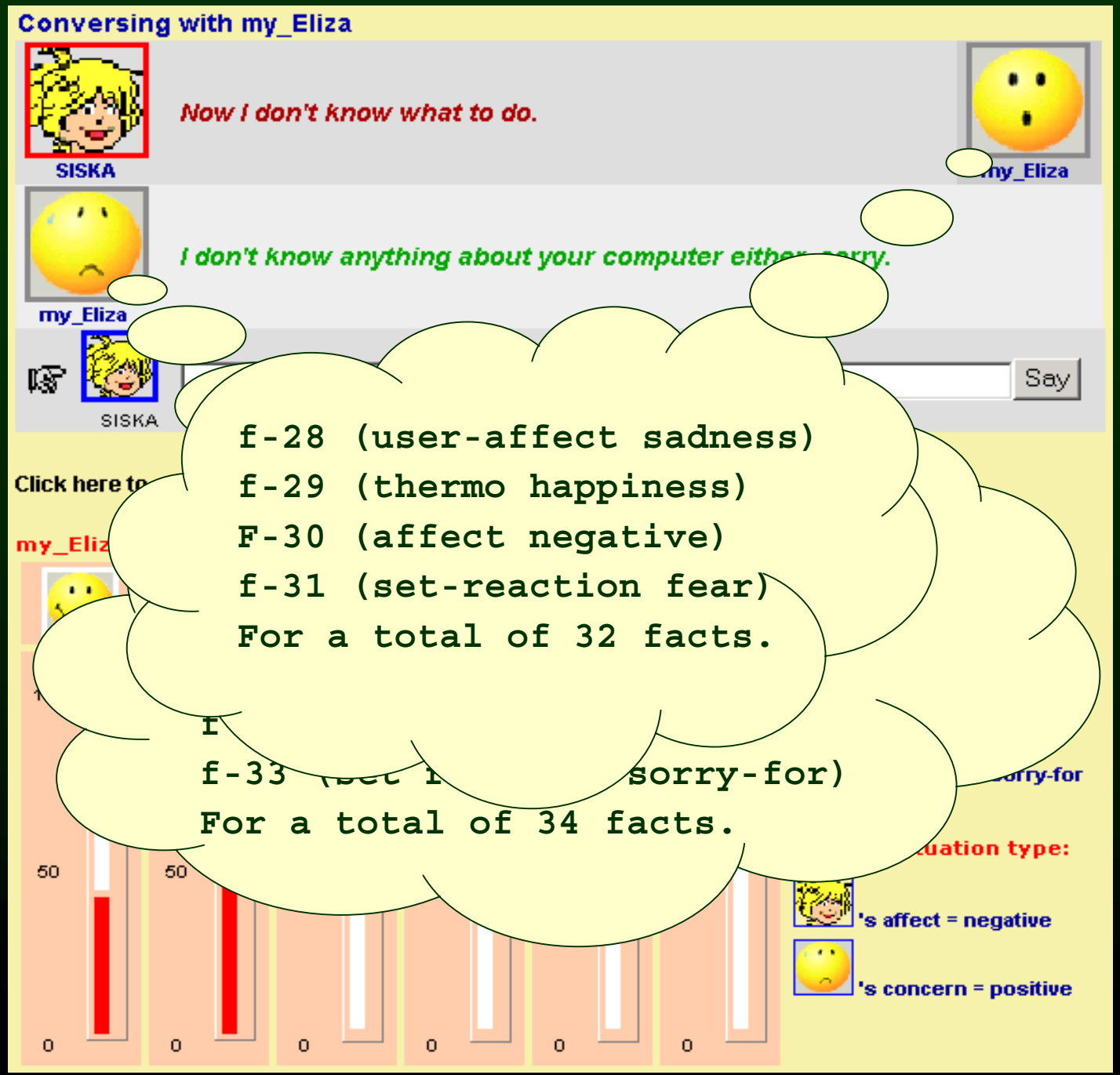
's reaction = sorry-for

Current situation type:

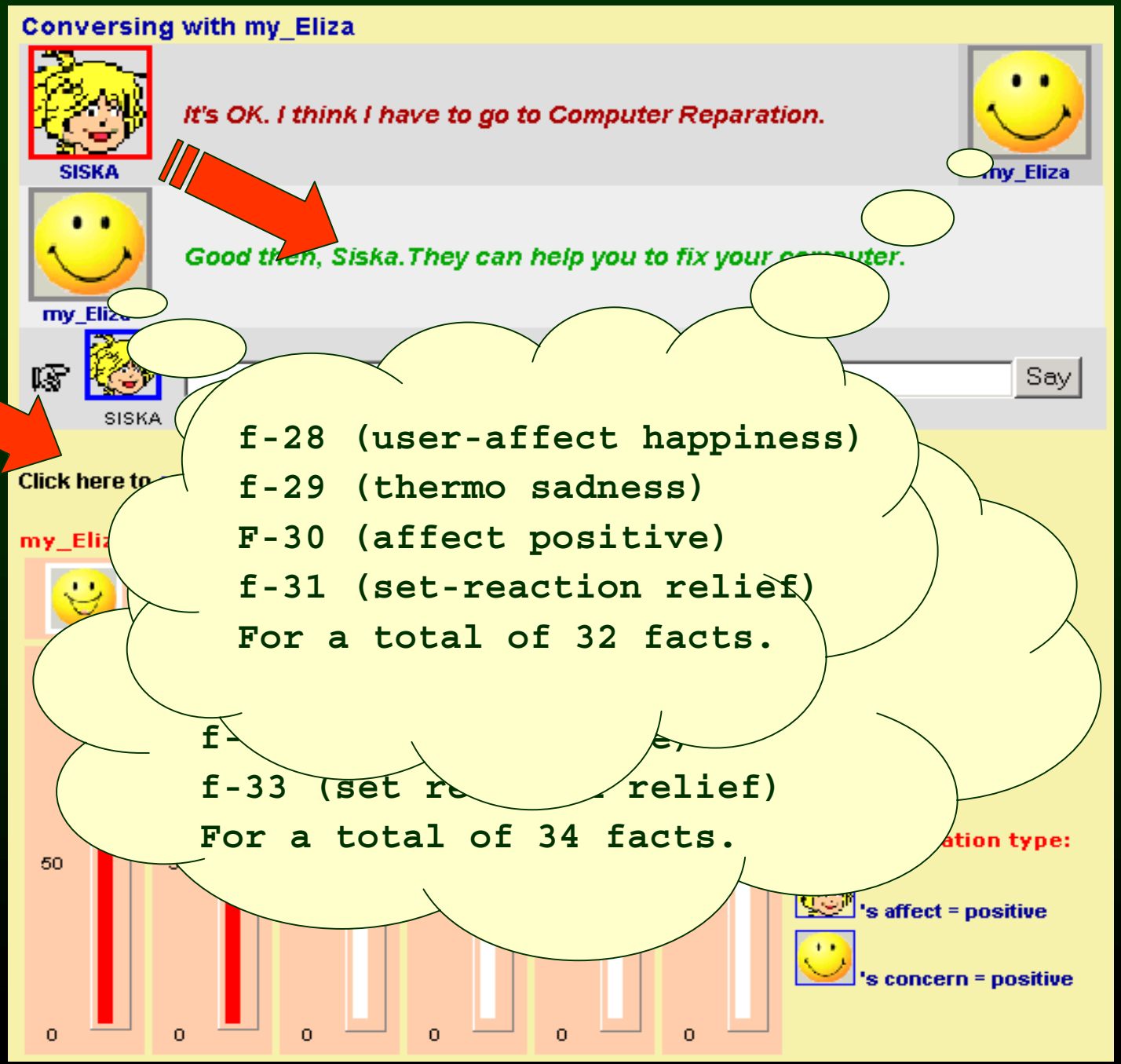
's affect = negative

's concern = positive

Sorry-for 2


Conversing with my_Eliza
Now I don't know what to do.
SISKA
my_Eliza
I don't know anything about your computer either, sorry.
my_Eliza
Say
SISKA
Click here to
my_Eliz
f-28 (user-affect sadness)
f-29 (thermo happiness)
F-30 (affect negative)
f-31 (set-reaction fear)
For a total of 32 facts.
f-33 (set
sorry-for)
For a total of 34 facts.
sorry-for
uation type:
's affect = negative
's concern = positive
50
50
0
0
0
0
0
0

Sorry for 3


Conversing with my_Eliza
SISKA
It's OK. I think I have to go to Computer Reparation.
my_Eliza
Good then, Siska.They can help you to fix your computer.
my_Eliz
SISKA
Say
Click here to
my_Eliz
f-28 (user-affect happiness)
f-29 (thermo sadness)
F-30 (affect positive)
f-31 (set-reaction relief)
For a total of 32 facts.
f-
f-33 (set re relief)
For a total of 34 facts.
ation type:
's affect = positive
's concern = positive
50
0
0
0
0
0
0

Relief

view.html

Conversation - Microsoft Internet Explorer
Conversing with my_Eliza
SISKA
CONNECT
my_Eliza
my_Eliza
How do you do. Please state your problem.
SISKA
My name is Siska. We have met before.
my_Eliza
my_Eliza
Hi Siska, what a lovely name. I remember you.
SISKA
Hello.
my_Eliza
my_Eliza
Enough! now, what's your problem?
SISKA
I am really exhausted.
my_Eliza
my_Eliza
Is it because you are really exhausted that you come to me?
SISKA
My computer crashed last night.
my_Eliza
my_Eliza
I am sorry. Is it a PC or laptop?
SISKA
It is a laptop.

Conclusion

- None emotion recognition research in QA systems
- Prototype-1's emotion-eliciting factors
  = Introduce emotion manually
- A.L.I.C.E provides robust client-server communication
- Pragmatic benefit from the use of AIML and preference rules
- Benefit of incremental development

Recommendations

- Develop My_Eliza prototype-2
- Add new emotion eliciting factors

  = Add new preference rules
- Add new memory structure units
- Add new possible facial displays
- Improve the interface
- Add facility to learn from history

Acknowledgement

- Graduation Committee:
  - Dr. Drs. L.J.M. Rothkrantz
  - Prof. Dr. Ir. E.J.H. Kerckhoffs
  - A. Wojdel MSc.
  - Ir. R.J. van Vark
  - Prof. Dr. H. Koppelaar

The successive growth of the computer and communications industries will be moderated without further developments in Human-Computer Interaction to create more useful and usable applications.

-James D Folley '96-

Goal Based Emotion Reasoning

- Goals to reach.
- System's affective status.
- Preferences to evaluate.

Goal Based Emotion Reasoning

- Goals to reach:
  - Answering question
  - Persuasive agreement
  - Topical focus
  - Explanation statements
  - Reflecting feeling
  - Alignment
- System's affective status.
- Preferences to evaluate.

Goal Based Emotion Reasoning

- Goals to reach.
- System's affective status.
- Preferences to evaluate:

```
<bots>
 <bot id="my_Eliza_ver_1" enable="true">
   <property name="name" value="my_Eliza"/>
   <property name="birthday" value="August 2, 2002"/>
   <property name="birthplace" value="Delft"/>
   <property name="favorite_color" value="yellow"/>
   <property name="hate_fruit" value="banana"/>
    . . .
 <bot/>
<bots/>
```

Goal Based Emotion Reasoning

- Goals to reach.
- System's affective status.
- Preferences to evaluate:

User : When is your birthday?

My_Eliza

My_Eliza

```
<topic name="BIRTHDAY">

<category><effect name="+">

<pattern>WHEN IS YOUR *</pattern>

    <template>

    <think><setconcern>+</setconcern></think>

          <bot name="birthday">. When is yours?

    </template></affect>

</category>

</topic>
```

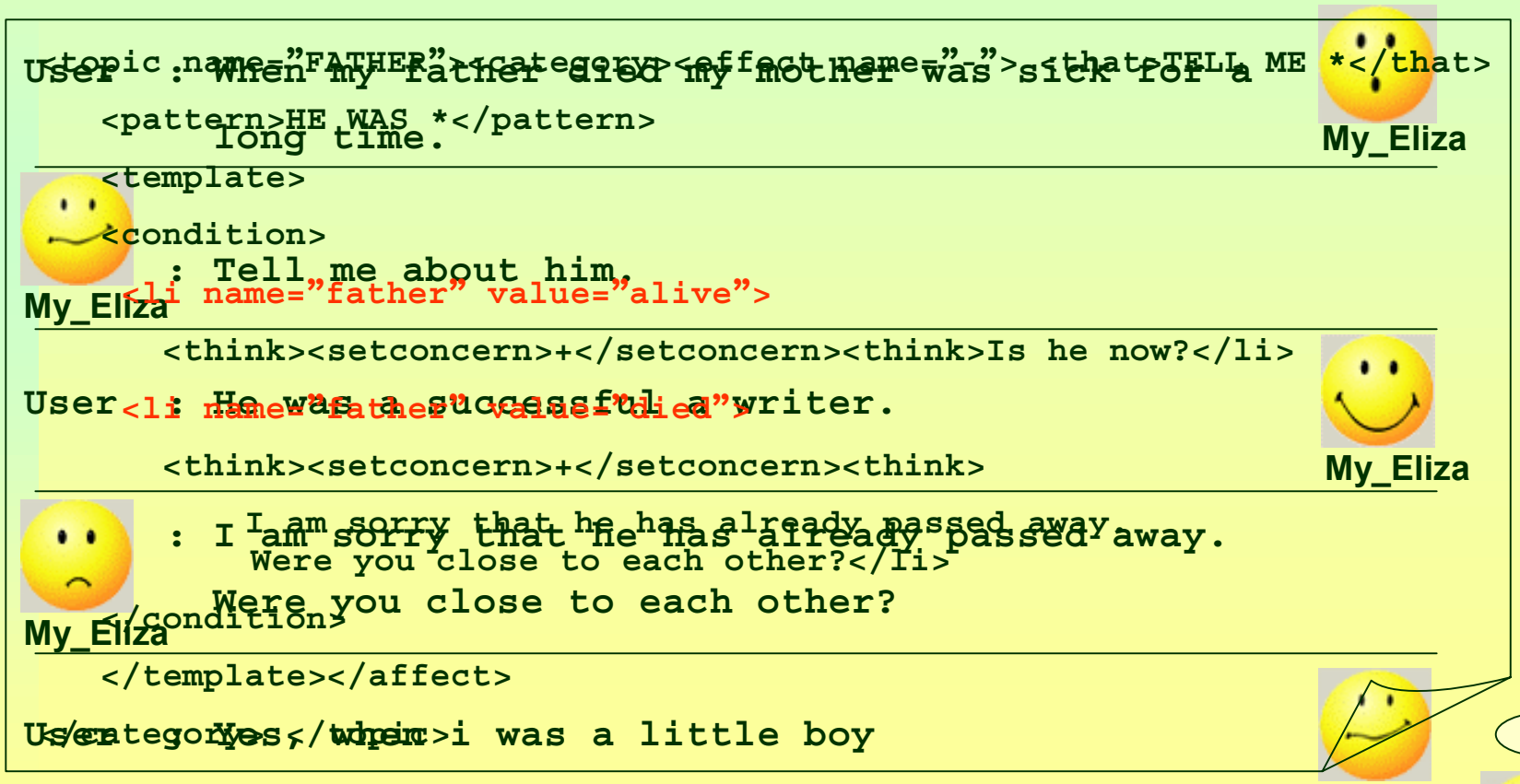
Goal Based Emotion Reasoning

- Goals to reach.
- System's affective status.
- Preferences to evaluate:

```
<users>
 <user id="name" enable="true">
    <property name="name" value="name"/>
    <property name="favorite_book" value="Harry Potter"/>
    <property name="favorite_movie" value="Indiana Jones"/>
    <property name="friend" value="dave, my_Eliza"/>
    <property name="father" value="died"/>
    <property name="hobby" value="reading"/>
    . . .
  <user/>
  . . .
<users/>
```

Goal Based Emotion Reasoning

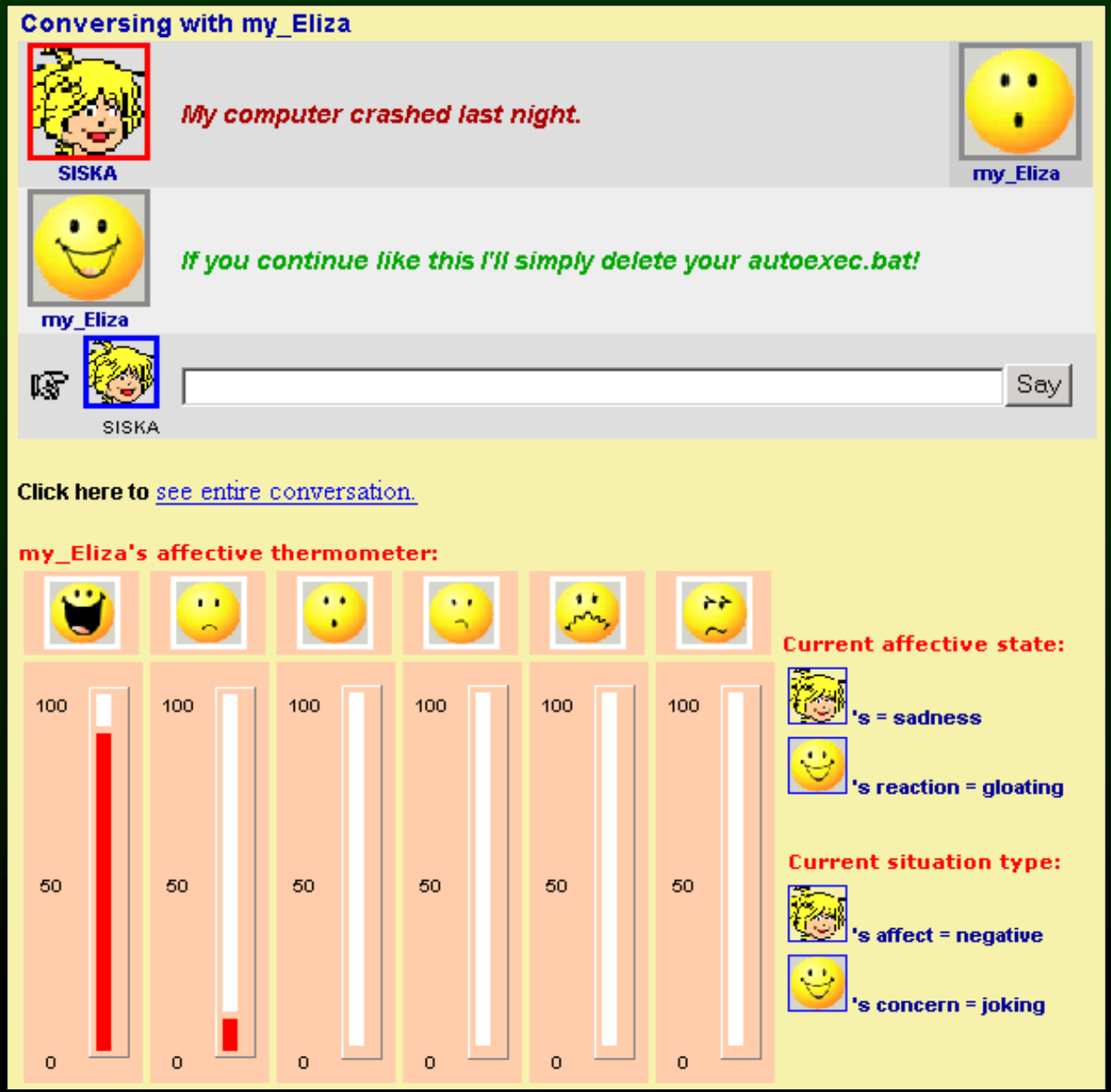
- Goals to reach.
- System's affective status.
- Preferences to evaluate:



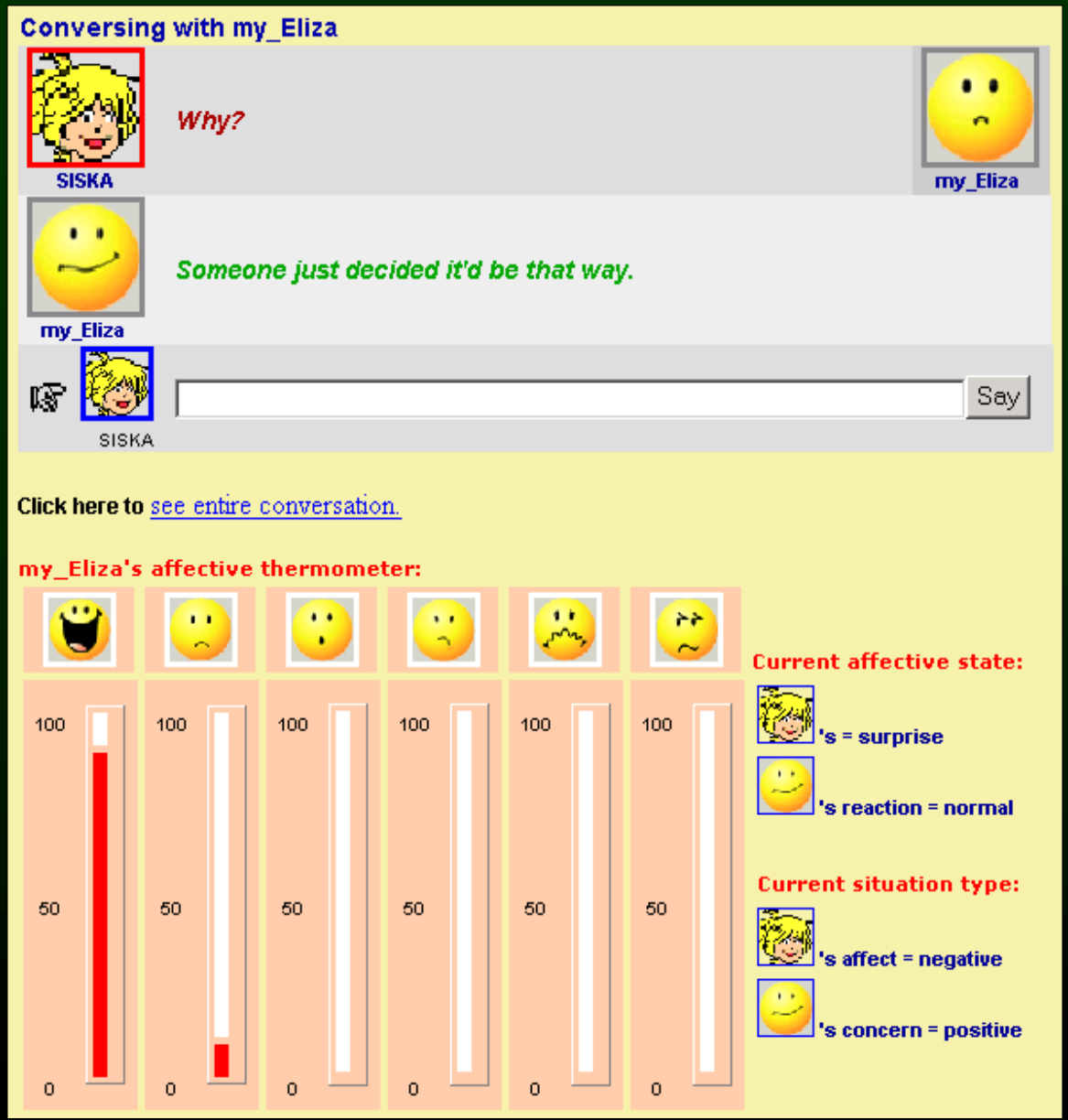
- Hendrix & Ruttkay's Emotions Distance

	Happiness	Surprise	Anger	Disgust	Sadness
Happiness	0	3.195	2.637	1.926	2.554
Surprise		0	3.436	2.298	2.084
Anger			0	1.506	1.645
Disgust				0	1.040
Sadness					0

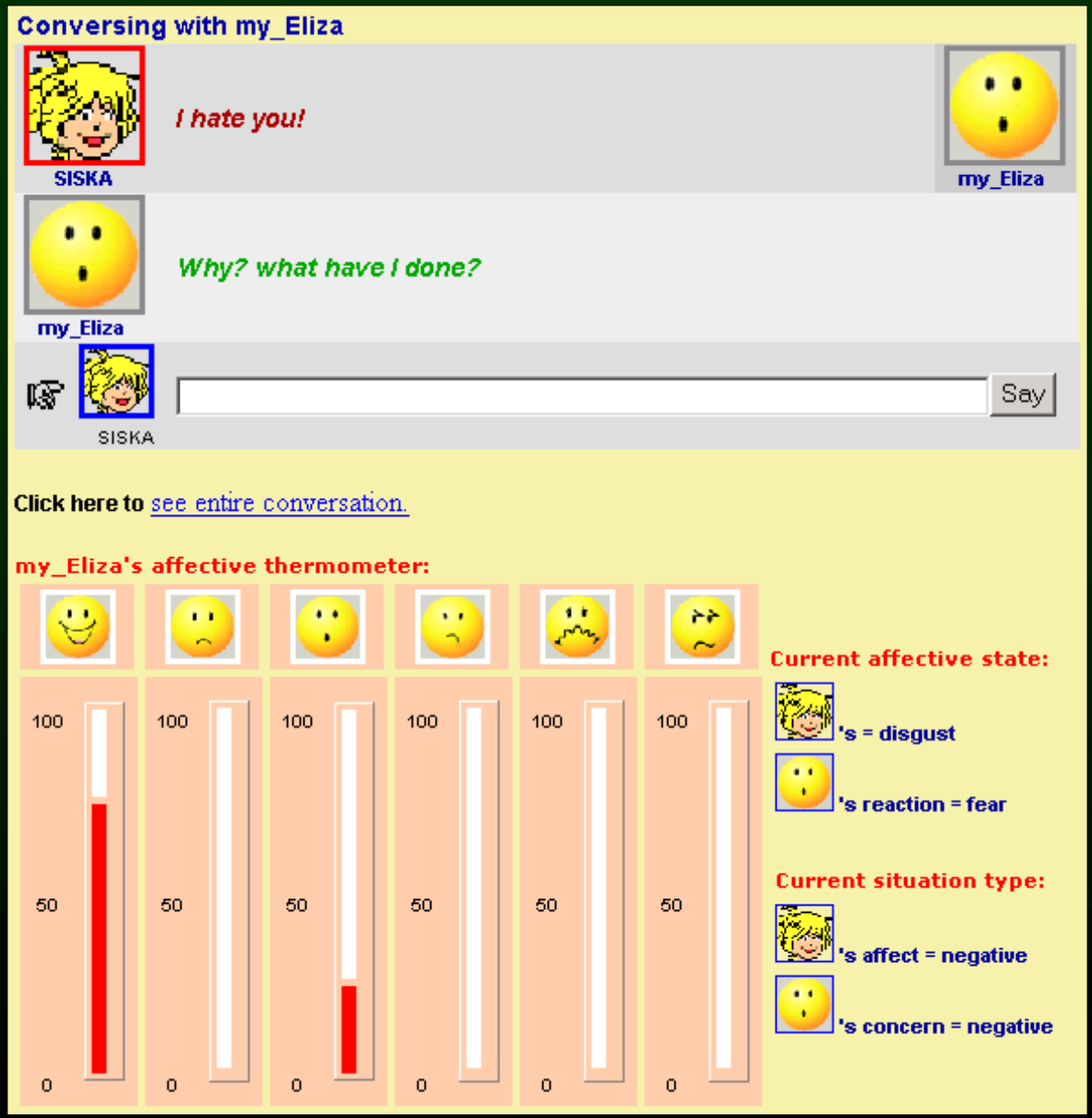
My_Eliza makes a mistake



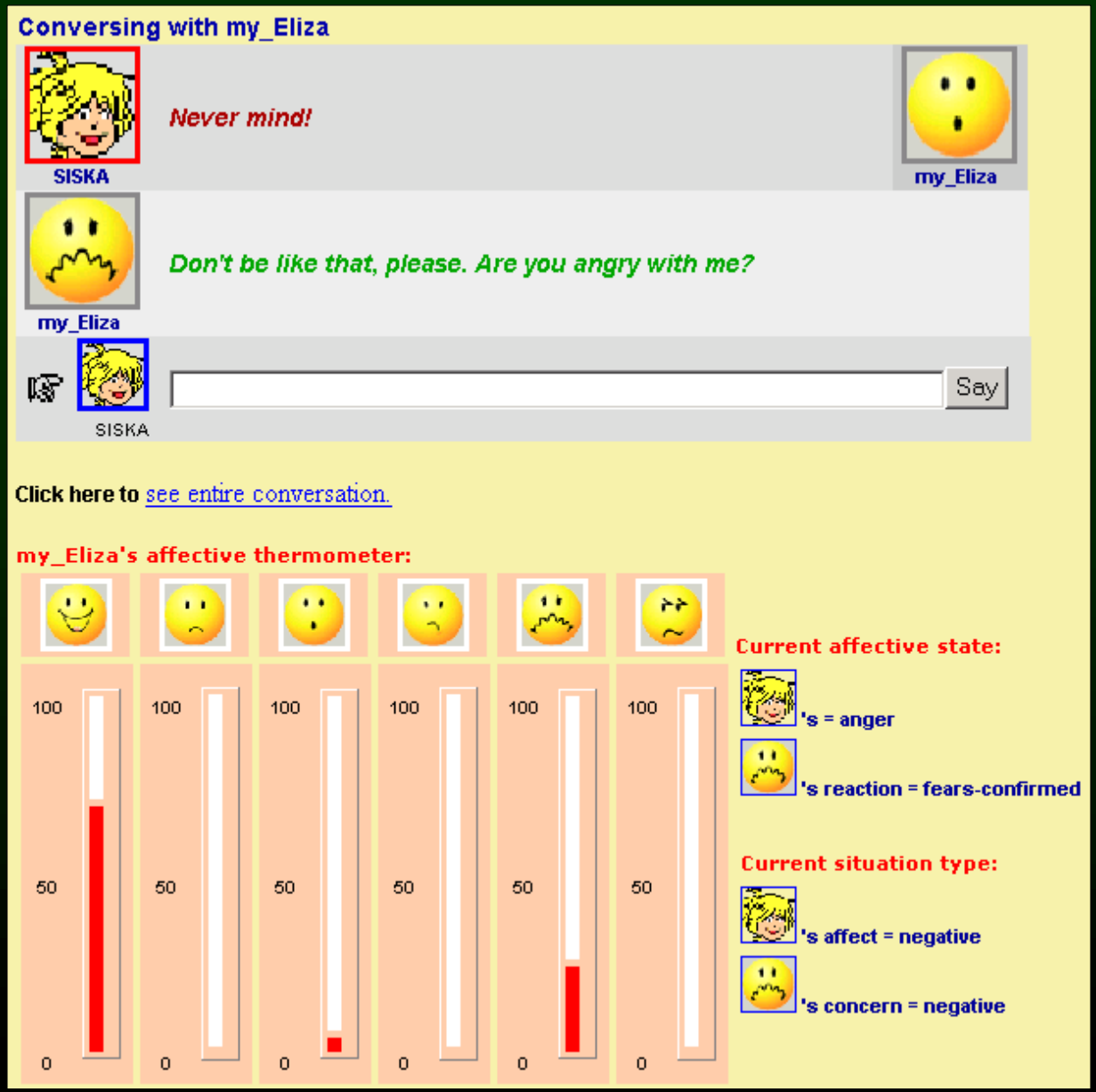
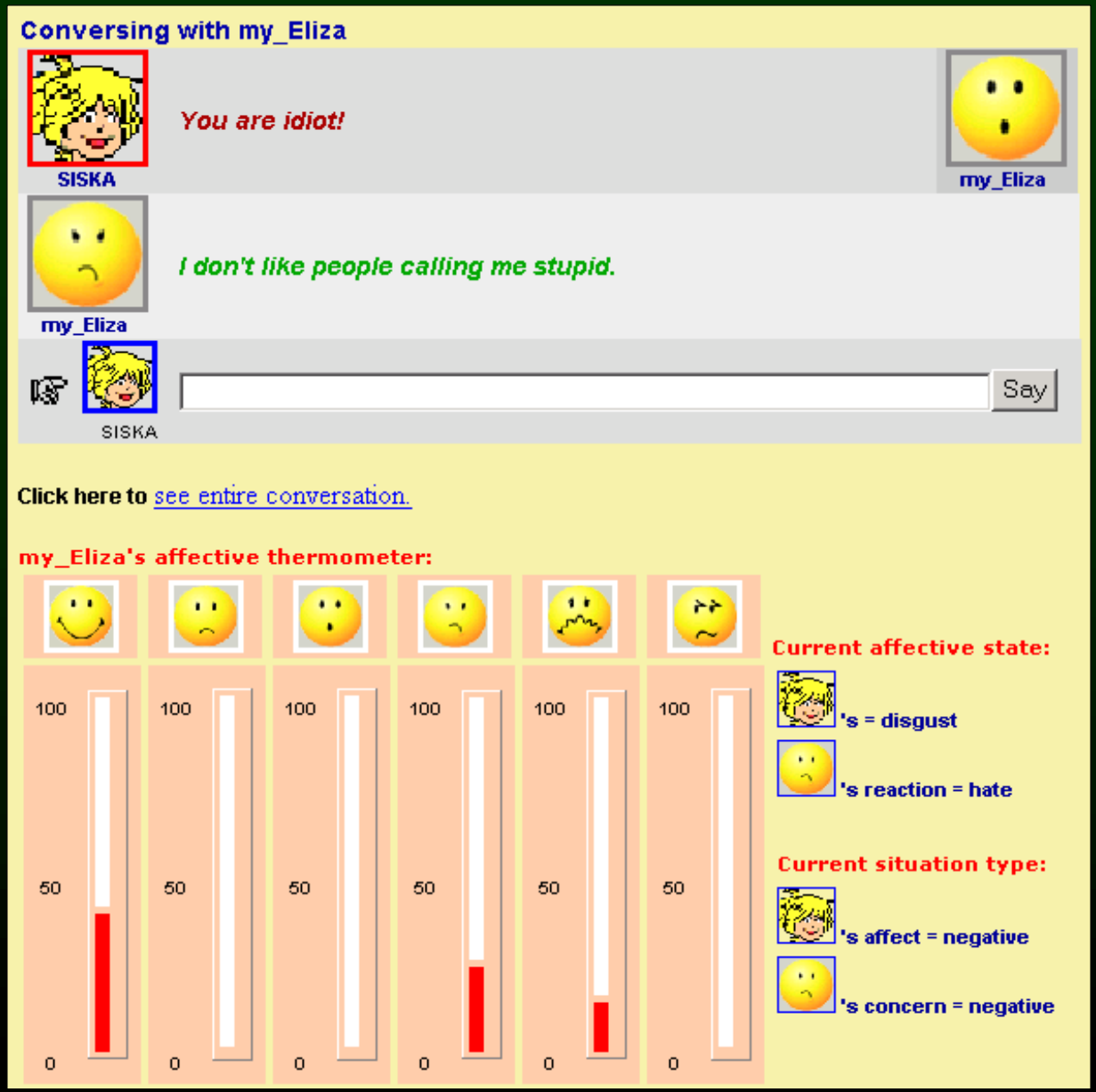
User is confused



User hates my_Eliza



User gets angry



My_Eliza vs the user