

Interactive, Socially Intelligent Systems

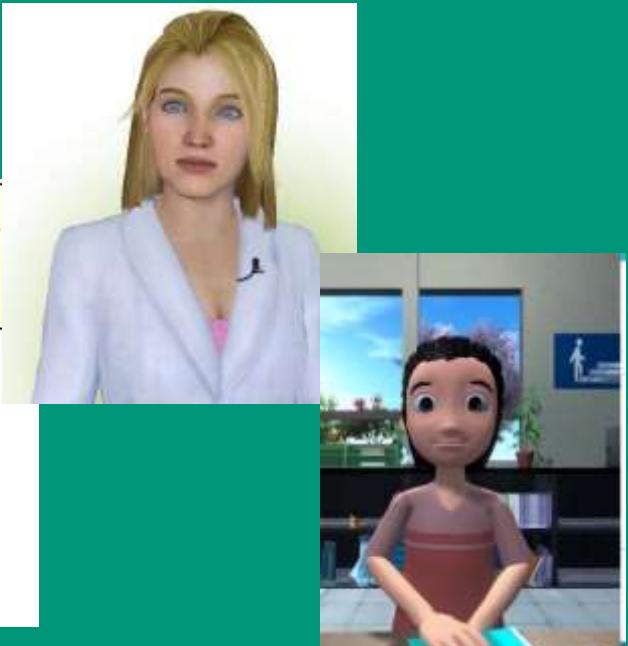
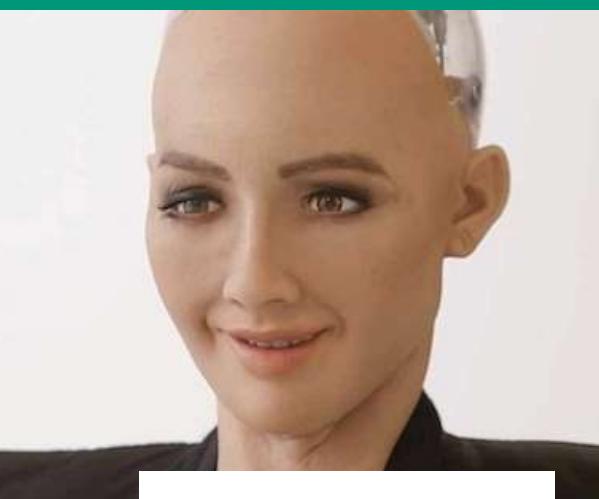
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For SFU CMPT419 / CMPT983 with Dr. Angelica Lim



Outline

- Computers as Social Actors
 - Background
 - Examples of Use
- Embodied Conversational Agent Framework
 - System Overview
 - System Components
 - Evaluation
 - Challenges
- Discussion



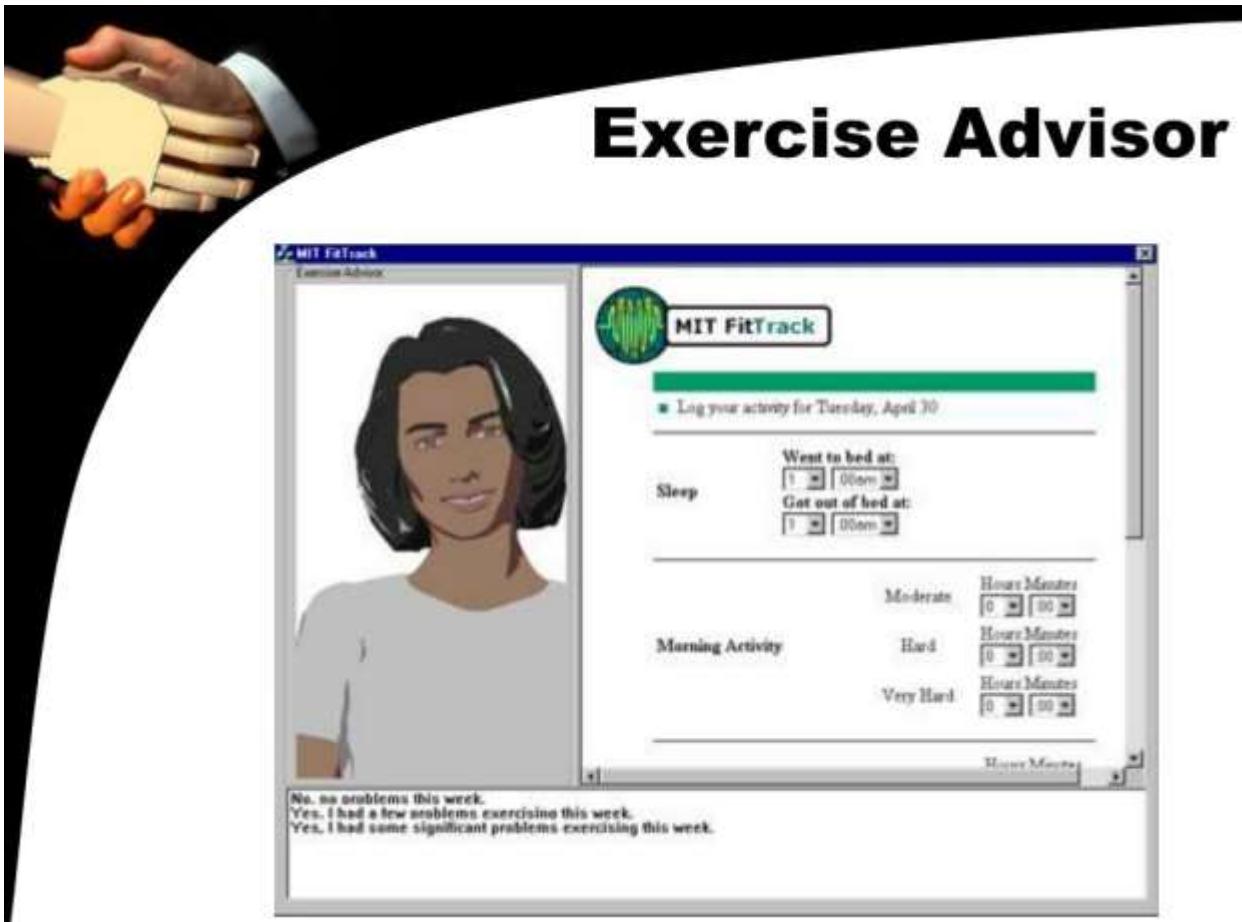
Computers as Social Actors

- Easier interaction
 - Natural interaction methods: conversation, gestures, gaze, emotions
 - Personalization
- People respond to agents similar to how they respond to people (Reeves & Nass, 1996)
 - 4/5 hurling abuse at their PCs, 3/4 swear at their computers. (MORI survey in UK, 1250 users)
 - Assigning personality, gender, stereotypical traits

How can we utilize this?

- Use of socio-emotional cues
 - Likable, trustworthy, engaging, persuasive, collaborative

Usability and Long Term Interaction

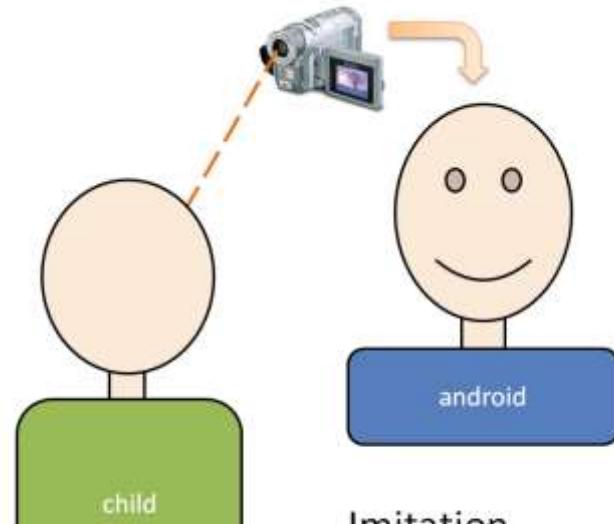
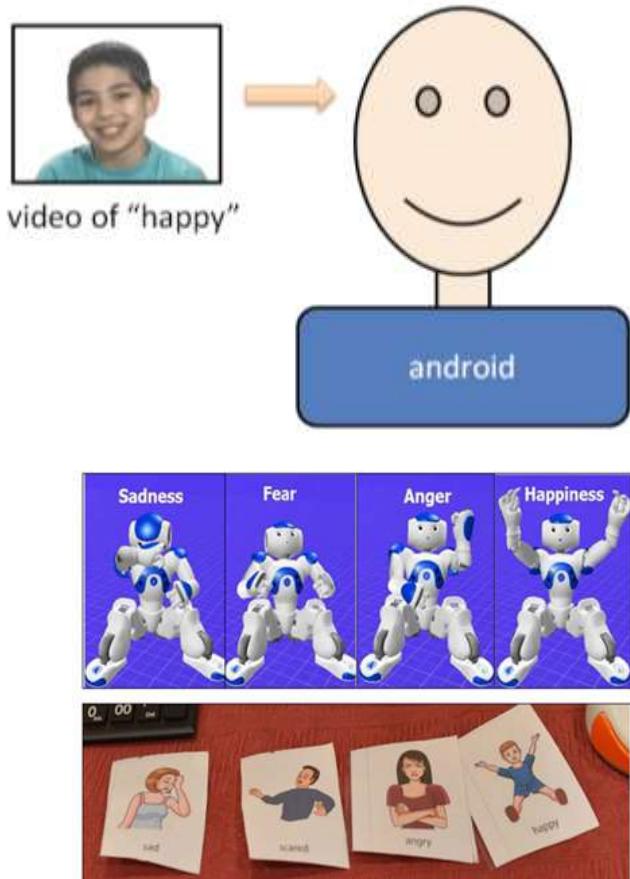


Health exercise domain:

- "Laura and I **respect** each other." ($p < .001$)
- "Laura and I **trust** one another." ($p < .001$)
- "I feel Laura **cares** about me..." ($p < .001$)
- "I feel Laura **appreciates** me." ($p = .009$)
- "I believe Laura **likes** me." ($p < .001$)
- **Liking** of Laura. ($p = .007$)
- Desire to continue working with Laura. ($p = .001$)

Bickmore, T. W., & Picard, R. W. (2005). Establishing and maintaining long-term human-computer relationships. ACM Transactions on Computer-Human Interaction (TOCHI), 12(2), 293-327.

Autism Research – Teaching Social Skills



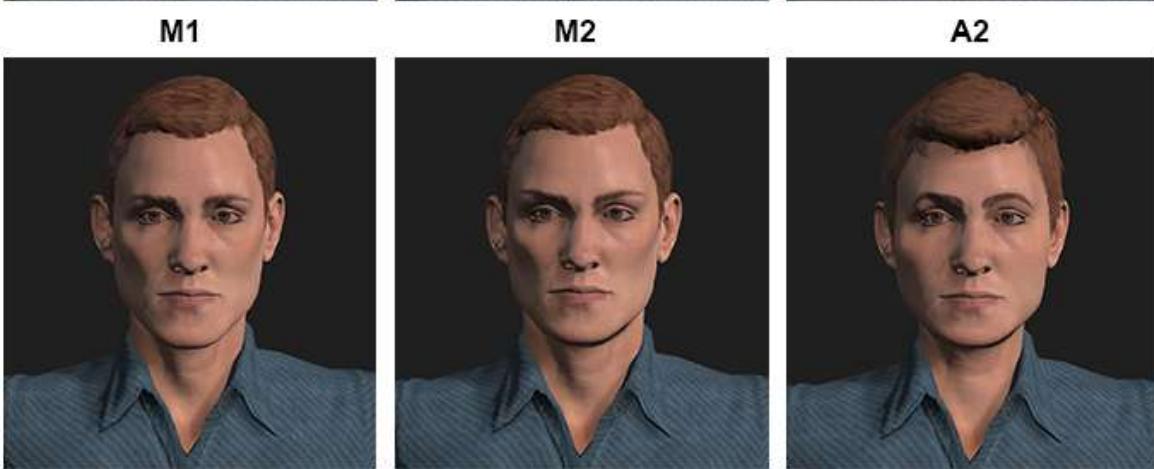
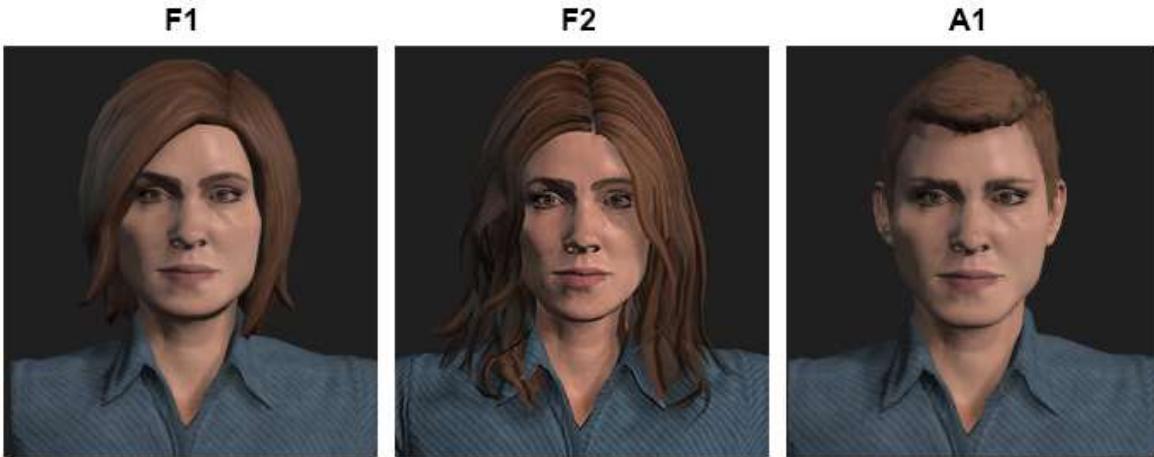
Rudovic, O., Lee, J., Mascarell-Maricic, L., Schuller, B. W., & Picard, R. W. (2017). Measuring engagement in robot-assisted autism therapy: A cross-cultural study. *Frontiers in Robotics and AI*, 4, 36.

Tanaka, H., Negoro, H., Iwasaka, H., & Nakamura, S. (2017). Embodied conversational agents for multimodal automated social skills training in people with autism spectrum disorders. *PloS one*, 12(8), e0182151.

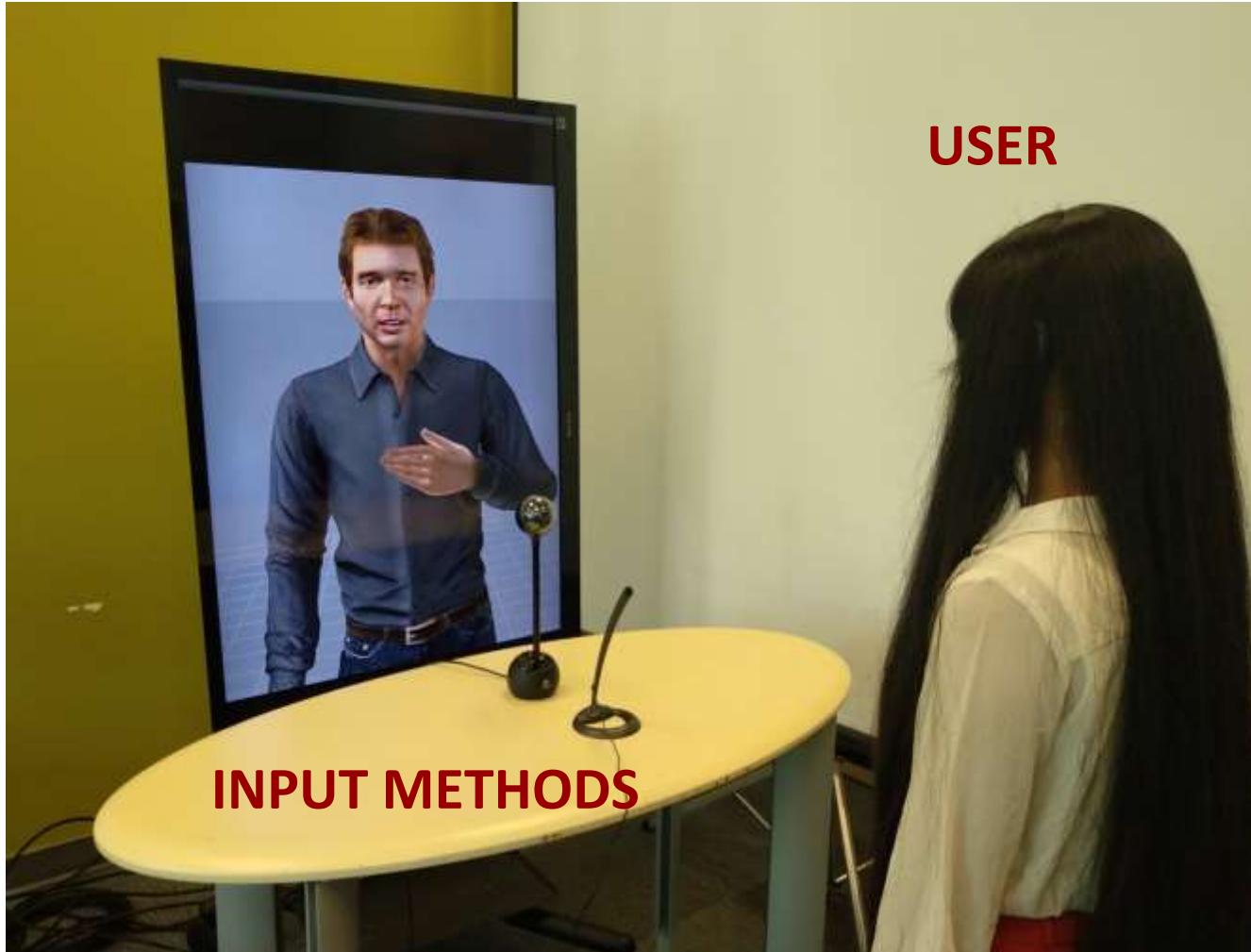
Pictures retrieved from: <https://www.cl.cam.ac.uk/research/rainbow/emotions/robotsASC.html>, <http://robots4autism.com/>

Studying Human Social Behaviors

- Gender Stereotypes in Virtual Agents. (submitted) Nag, P. & Yalcin, N.



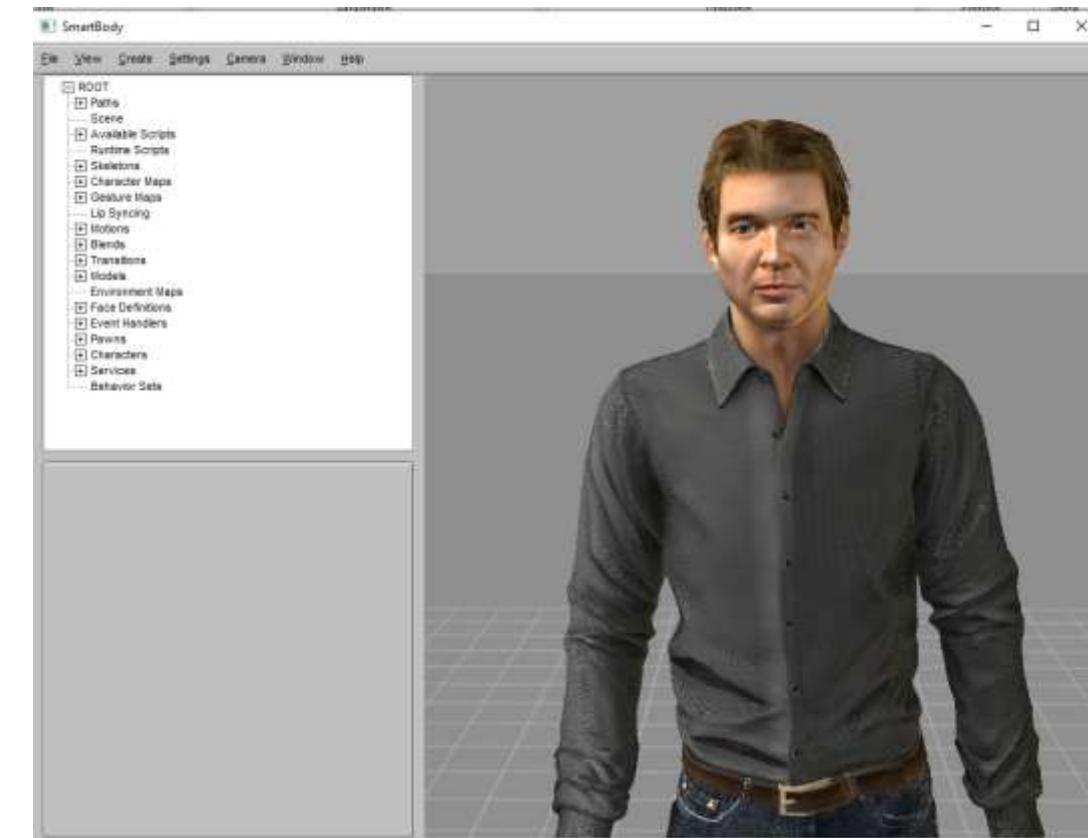
What do you need for an Embodied Conversational Agents?



Behavior Realizer

SMARTBODY : <http://smartbody.ict.usc.edu/>

iVizLab Unity Behavior Realizer: <https://drive.google.com/file/d/1ec-D4QNn0VDoCVCNxlaBRrd3UBKofZ/view?usp=sharing> **more avatars available for this version



BML - Behavior Markup Language

<http://www.mindmakers.org/projects/bml-1-0/wiki>

A Standard Markup Language for Behavior Realizers. An example:

```
<bml>
  <speech id="speech0" type="application/ssml+xml">
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  </speech>
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  <face amount="0.7" au="102" ready="speech0:T0" relax="speech0:T5" type="facs"/>
</bml>
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Behaviors

Behavior Block

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Behaviors

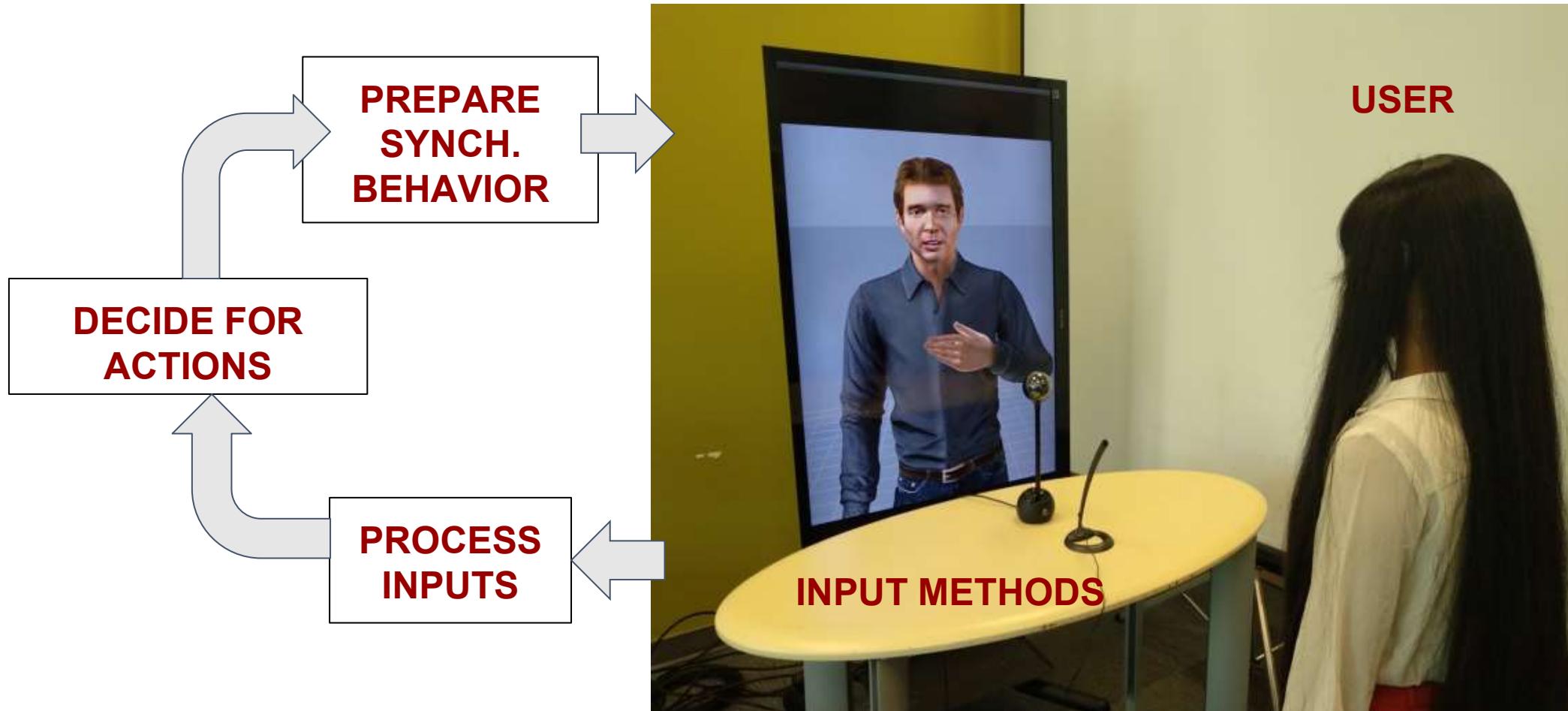
Behavior Block

Synchronization constraint

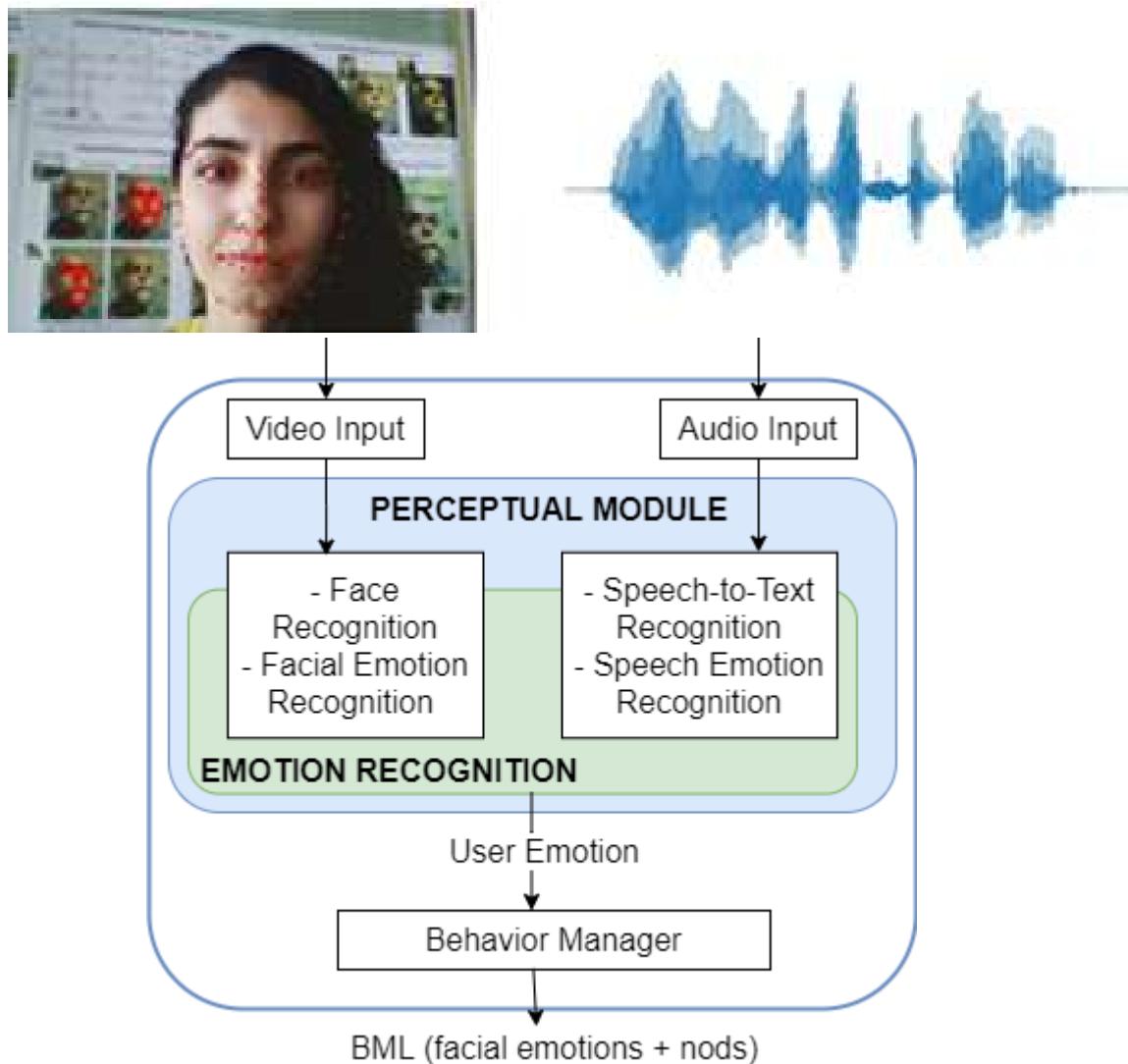
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  <face amount="0.7" au="102" ready="speech0:T0" relax="speech0:T5" type="fac5"/>
</bml>
```



Creating the AI Framework

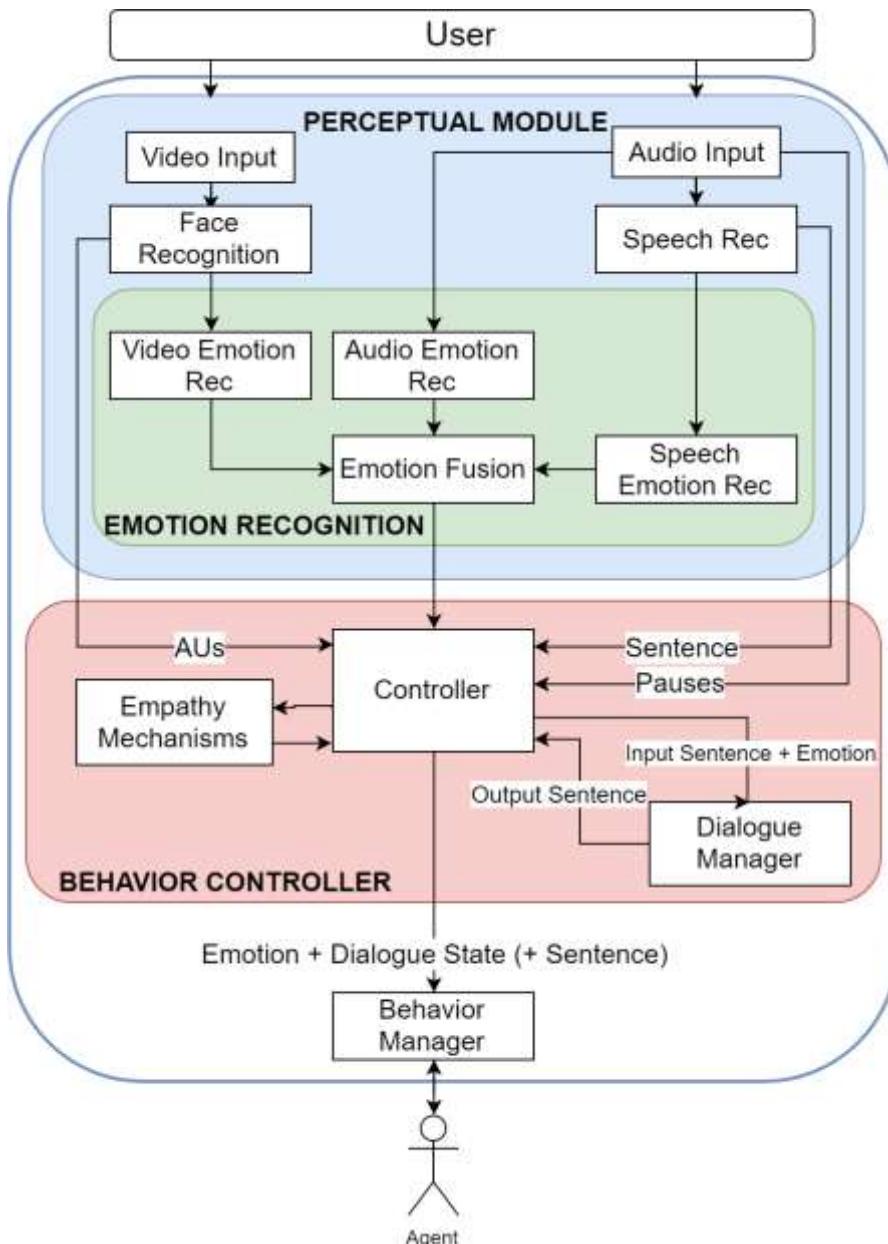


Interested in ECAs?: Echo Bot



https://github.com/onyalcin/echo_bot

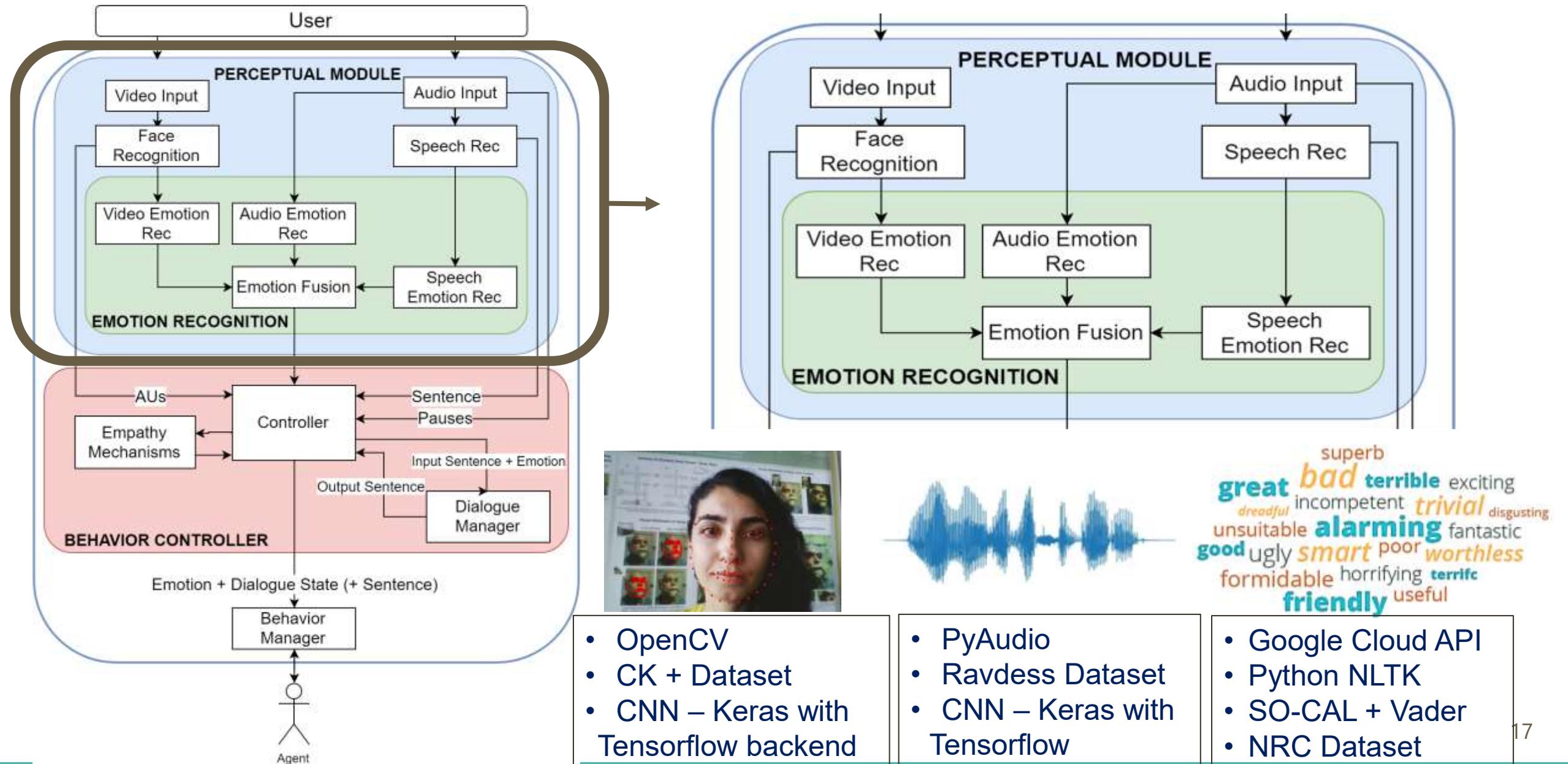
Framework



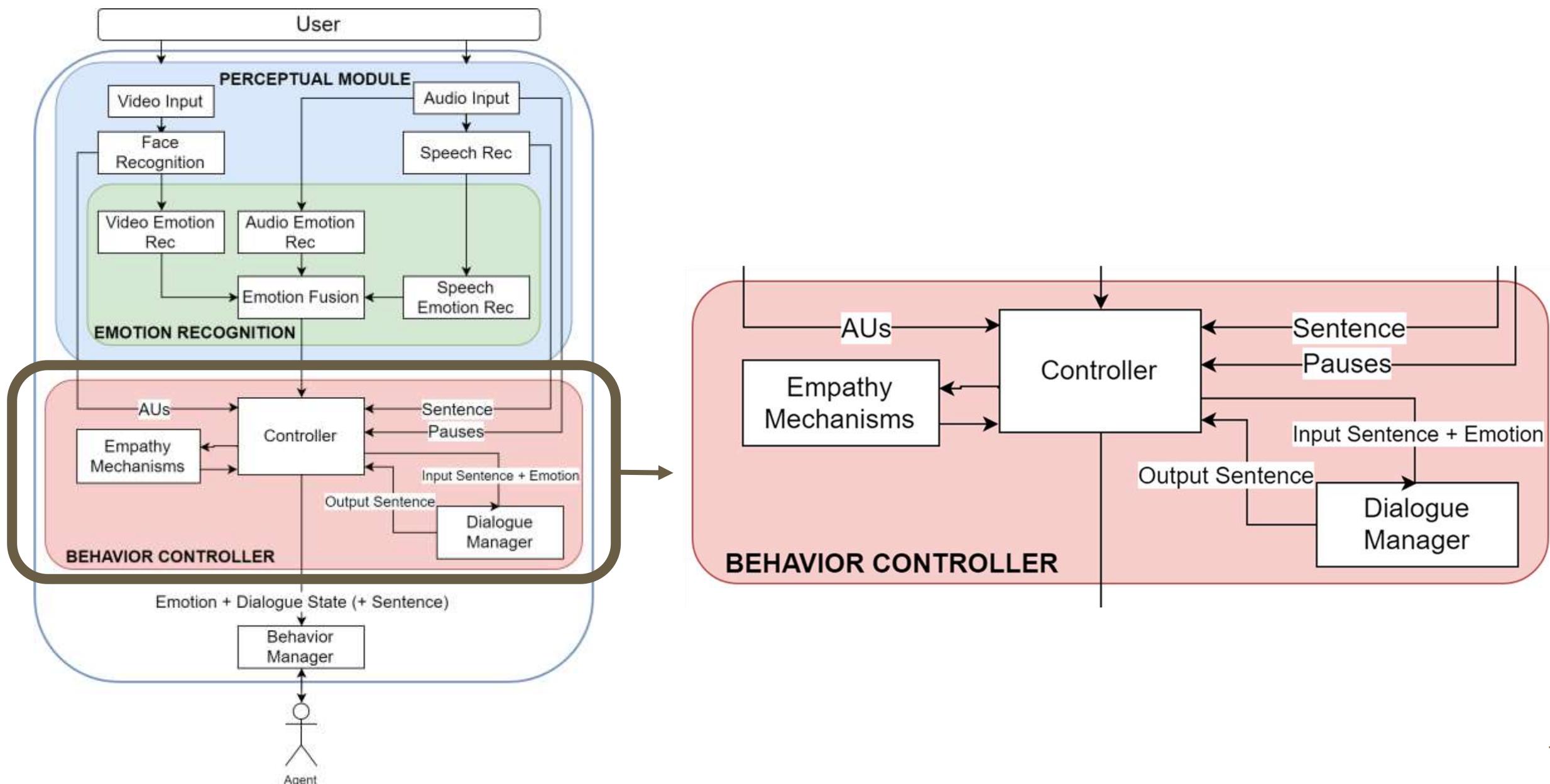
Yalçın, Ö. N. (2019). Empathy Framework for Embodied Conversational Agents. *Cognitive Systems Research*.
<https://doi.org/10.1016/j.cogsys.2019.09.016>

- Code available at github:
<https://github.com/onyalcin/M-PATH/>
- Data generated available at SFU Radar:
<https://researchdata.sfu.ca/islandora/object/islandora%3A10691>
- Python 3.5, Windows platform

Perceptual Module



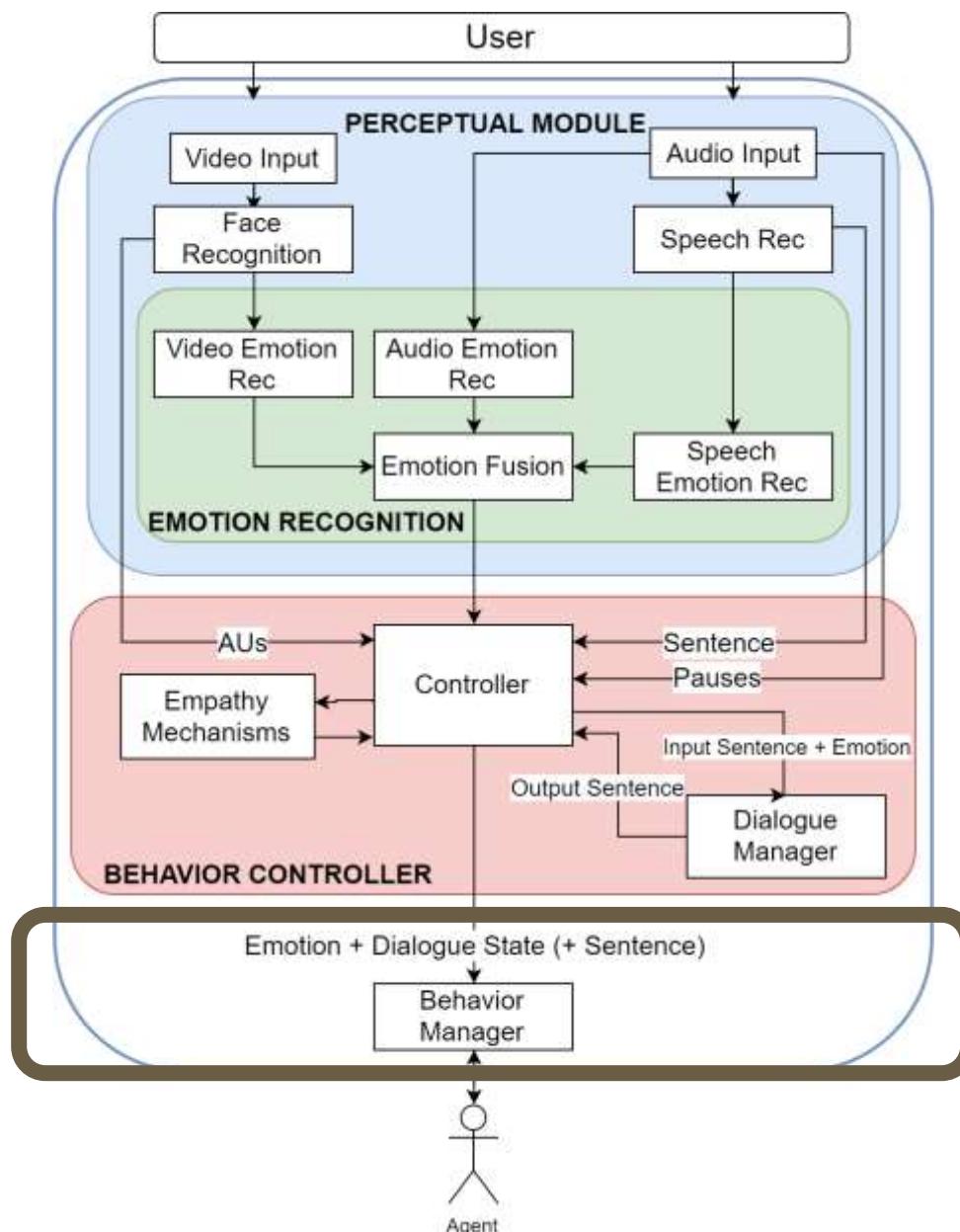
Controller



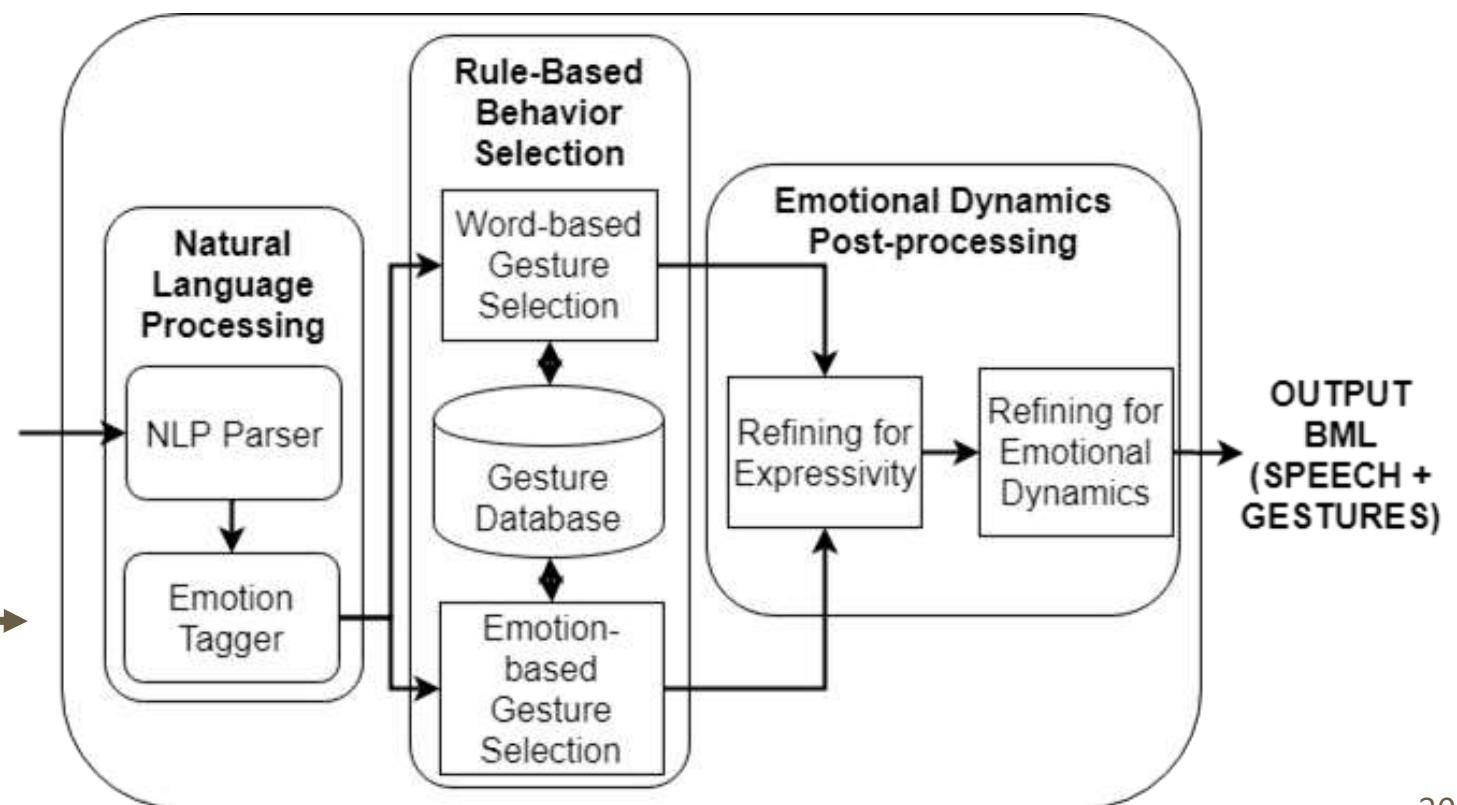
Psychological Consultation Scenario

SPEAKER	UTTERANCE	RESPONSE TYPE
M-PATH	How often do you feel little interest or pleasure in doing things?	Context-based
User	Very often	
M-PATH	(1) I'm sorry to hear that (2) Maybe you should try to build up a routine. You can pick up a new habit with your friends (3) How often have you been feeling down, depressed, irritable, or hopeless lately?	(1) Emotional Reaction (2) Coping Reaction (3) Context-based
User	My problem is i am not used to wake up early	
M-PATH	I understand.	Topic Fallback
User	I feel down most of the time because I do not have a friend circle in campus	
M-PATH	(1) I'm so sorry you feel like that. (2) Try not to withdraw from your social life, your family and friends. They can improve your mood a lot	(1) Emotional Reaction (2) Coping Reaction

Behavior Manager



Yalçın, Ö. N. & DiPaola, S. (submitted). "Automated Affective Gesture Generation for Embodied Conversational Agents." *Journal on Multimodal User Interfaces*.



Psychological Consultation Scenario

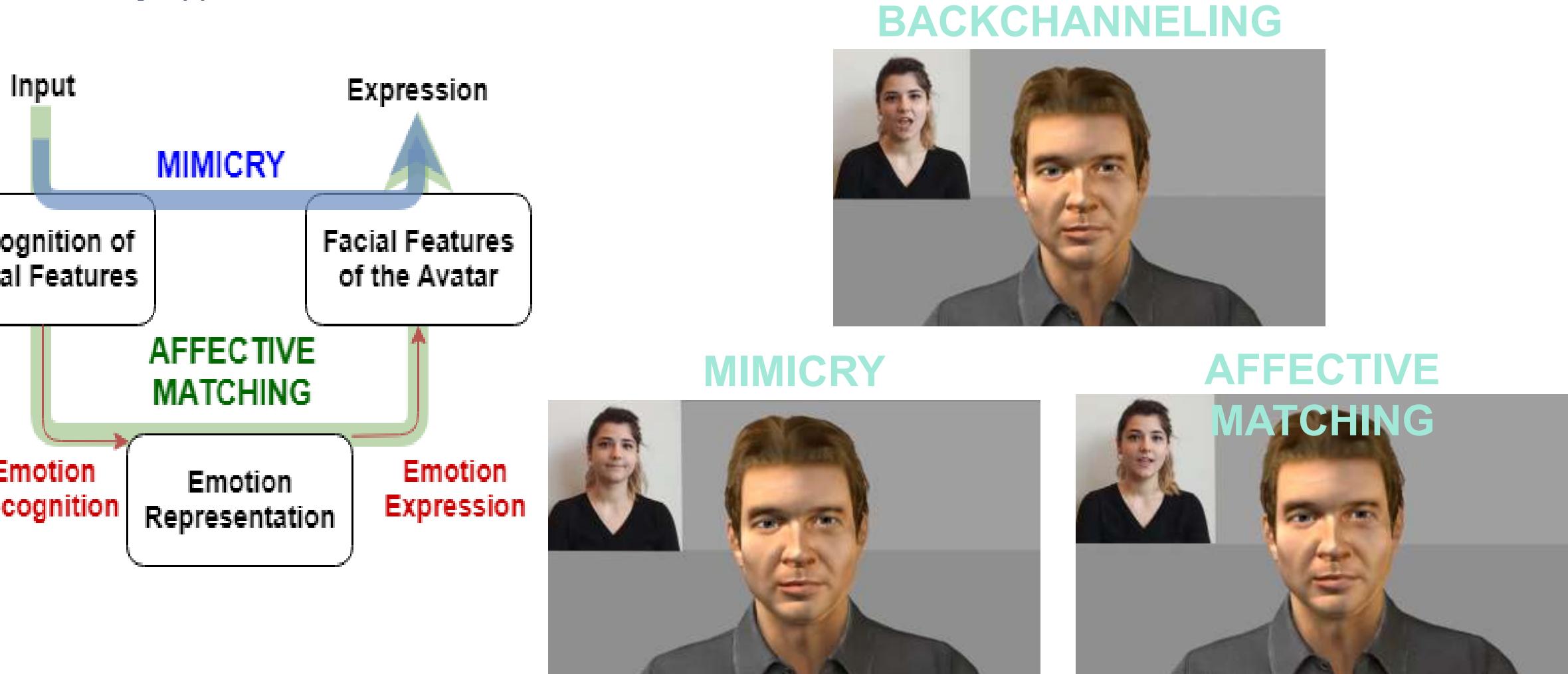


How to Evaluate?

Evaluation Type	Humans	HCI
Feature-Level	<p>"Reading the Mind in the Eyes" test (Baron-Cohen et. al. 1997), "Reading the Mind in the Voice" test (Golan et al., 2007)</p> <p>Understanding appraisals (Baron-Cohen et al., 1986), The Picture-Stories task (Baron-Cohen et al., 1986)</p>	<p>Emotion Recognition/Expression Accuracy (speech recognition,)</p> <p>User model accuracy, Belief-Desire-Intention, Process Validity</p>
System- Level	<p>Self-report: Davis's Interpersonal Reactivity Index (IRI) (Davis, 1983), The Empathy Quotient (EQ) (Baron-Cohen & Wheelwright, 2004), The Toronto Empathy Questionnaire (Spreng et al., 2009)</p>	<p>Self-report Observational:<ul style="list-style-type: none">• Behavioral Tests• Perceived Empathy Measures• Expert OpinionsPhysiological:<ul style="list-style-type: none">• Neural activity, Heart rate, skin conductance etc. (see Neumann et. al., 2015 for review)</p>

Evaluation: Low-level Empathic Behaviors

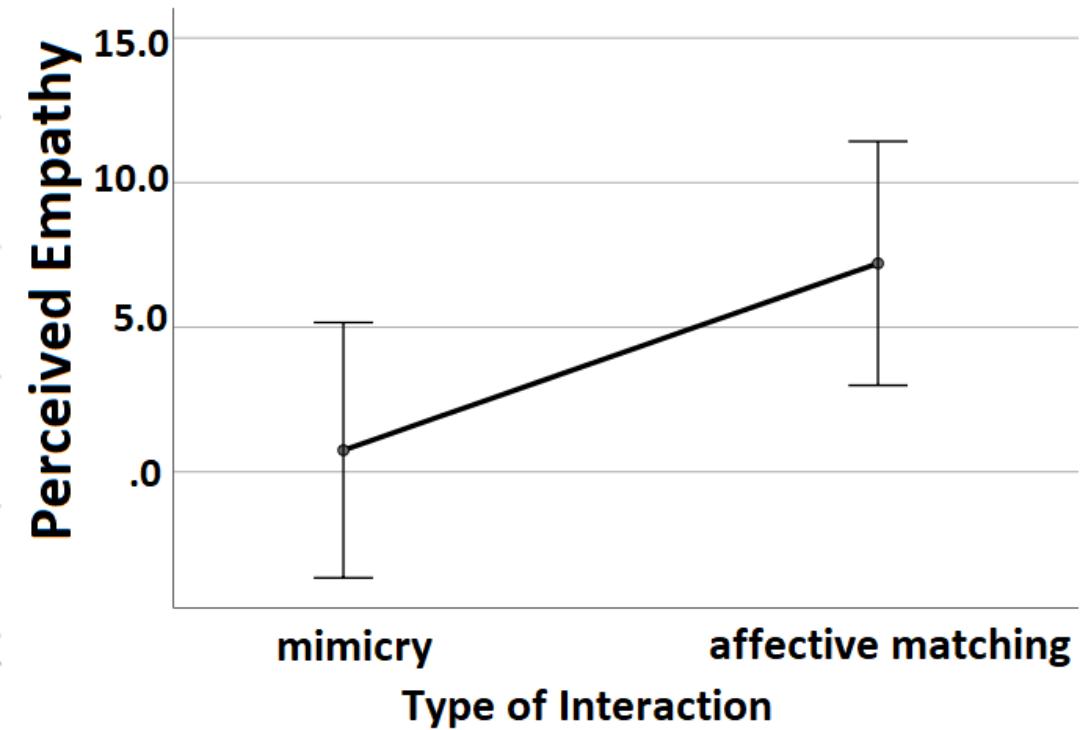
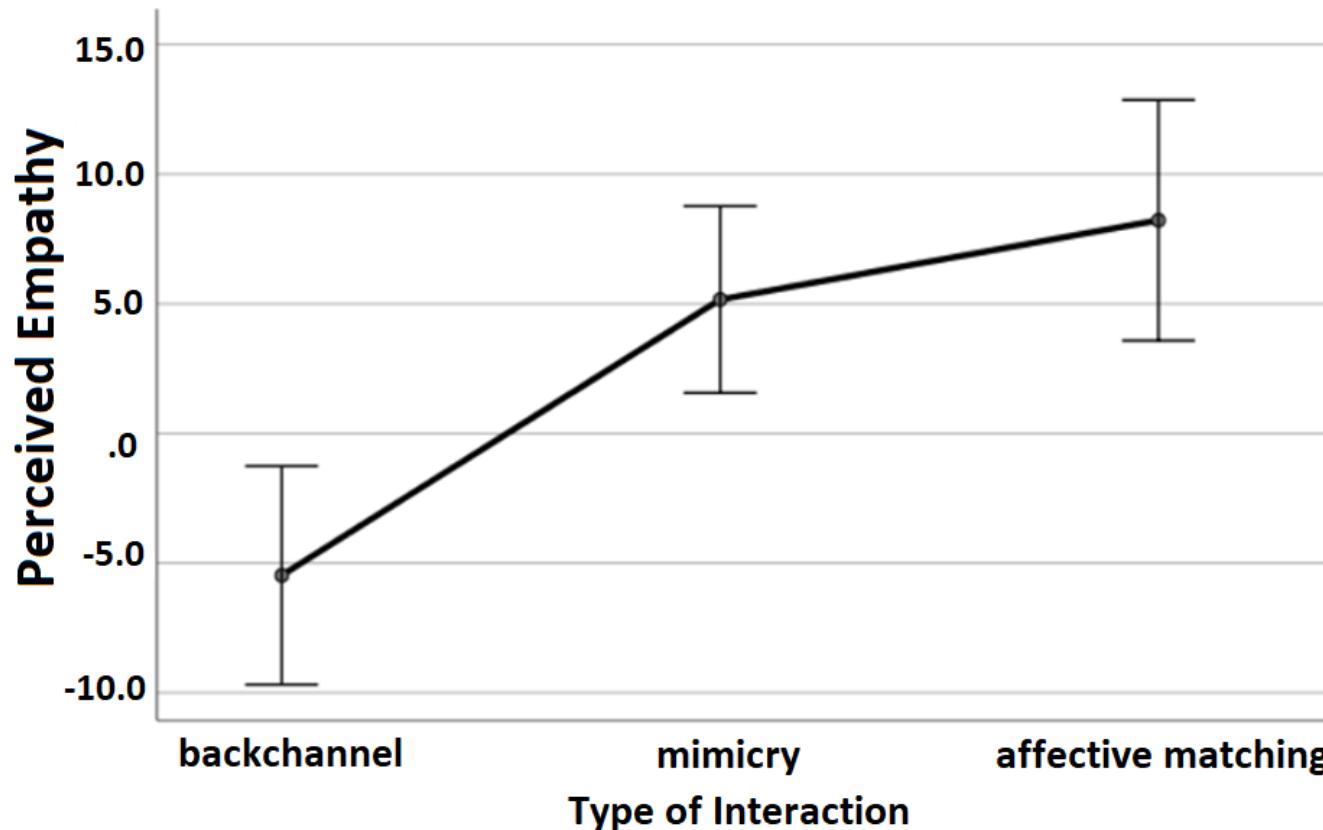
Yalçın, N. Y. & DiPaola, S. (2019). "Levels of Emotional Contagion in an Embodied Conversational Agent." *Proceedings of the 41st Annual Meeting of the Cognitive Science Society*, pp. 3143-3149.



Evaluation: Low-level Empathic Behaviors

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- A total of 84 subjects participated in three studies.
- MTurk environment
- Perception of empathy: Toronto Empathy Q.



Evaluation: Effect of Dialogue

- Empathic vs Non-empathic version
- Evaluation (5-point likert scale statements):
 - Perceived Empathy (Toronto Empathy Questionnaire) , scores vary between -32 to +32

Table 8.4: Results of the Evaluation

Variable	Empathic agent		Non-empathic agent		F(1,15)	p
	M	SD	M	SD		
Empathy	3.38	8.18	-1.12	7.80	6.43	.02*
Usefulness	3.06	1.00	2.56	0.96	4.29	.05*
Human-like	2.56	0.63	1.81	0.98	10.38	<.01**
Believable	2.88	1.02	2.38	0.96	5	.04*
Preferred to paper	2.06	1.24	1.69	1.40	8.99	<.01**
Preferred to human	2.88	1.36	2.62	0.96	1.36	.26
Trust	1.81	1.02	1.64	0.95	0.71	.41

Challenges

Implementation

- Complex set of behaviors
- **Multimodal** input/output
 - Fusion
 - Priority
 - Rule-based
- **Real-time** and **synchronized** behavior
- Consistency

Criticism:

"Empathetic technology" cannot succeed because technology cannot feel what people feel.

Can you give an example where one person cannot feel what another person feels, and yet their empathy succeeds?

Thank you! Questions?

oyalcin@sfu.ca

<https://github.com/onyalcin/>

<https://onyalcin.github.io/>

<https://ivizlab.org/>

[https://github.com/onyalcin/echo bot](https://github.com/onyalcin/echo_bot)

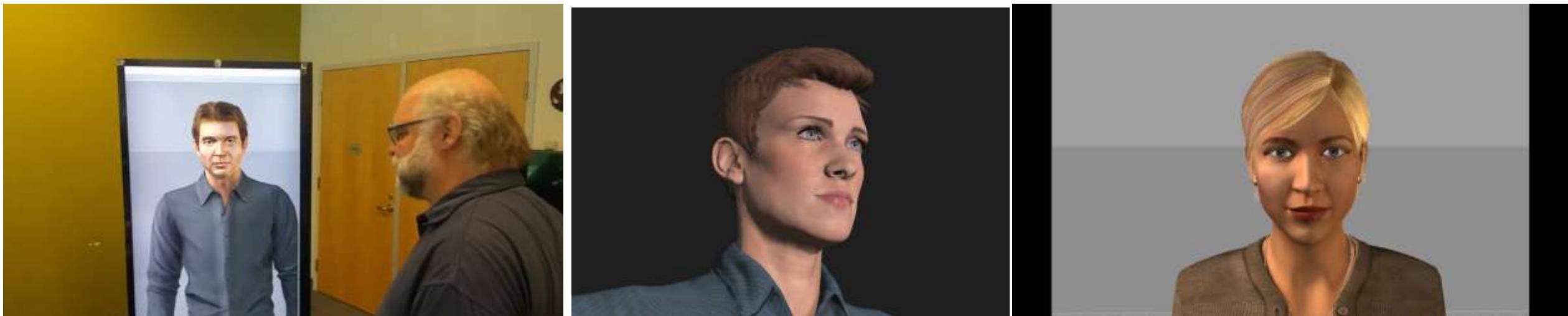
<http://smartbody.ict.usc.edu/>

<https://drive.google.com/file/d/1ec-D4QNn0VDoCVCNxlaBRrd3UBKofZ/view?usp=sharing>



Embodied Conversational Agents (ECAs)

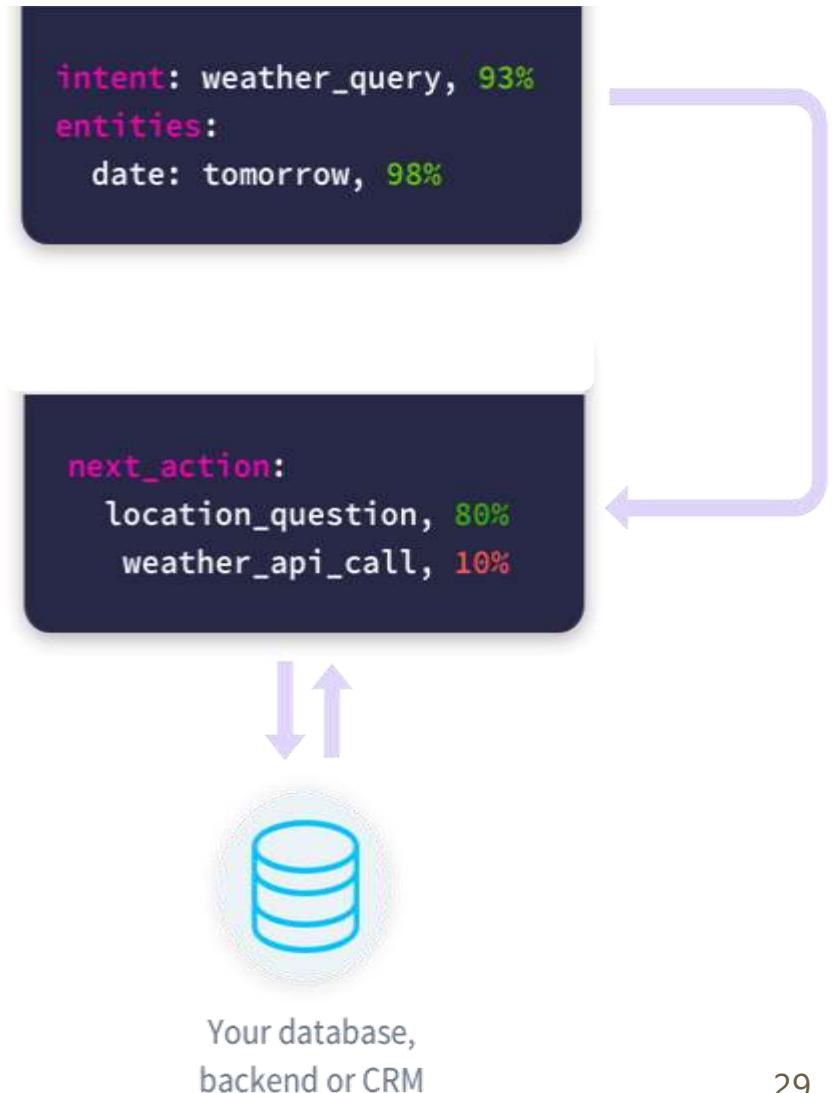
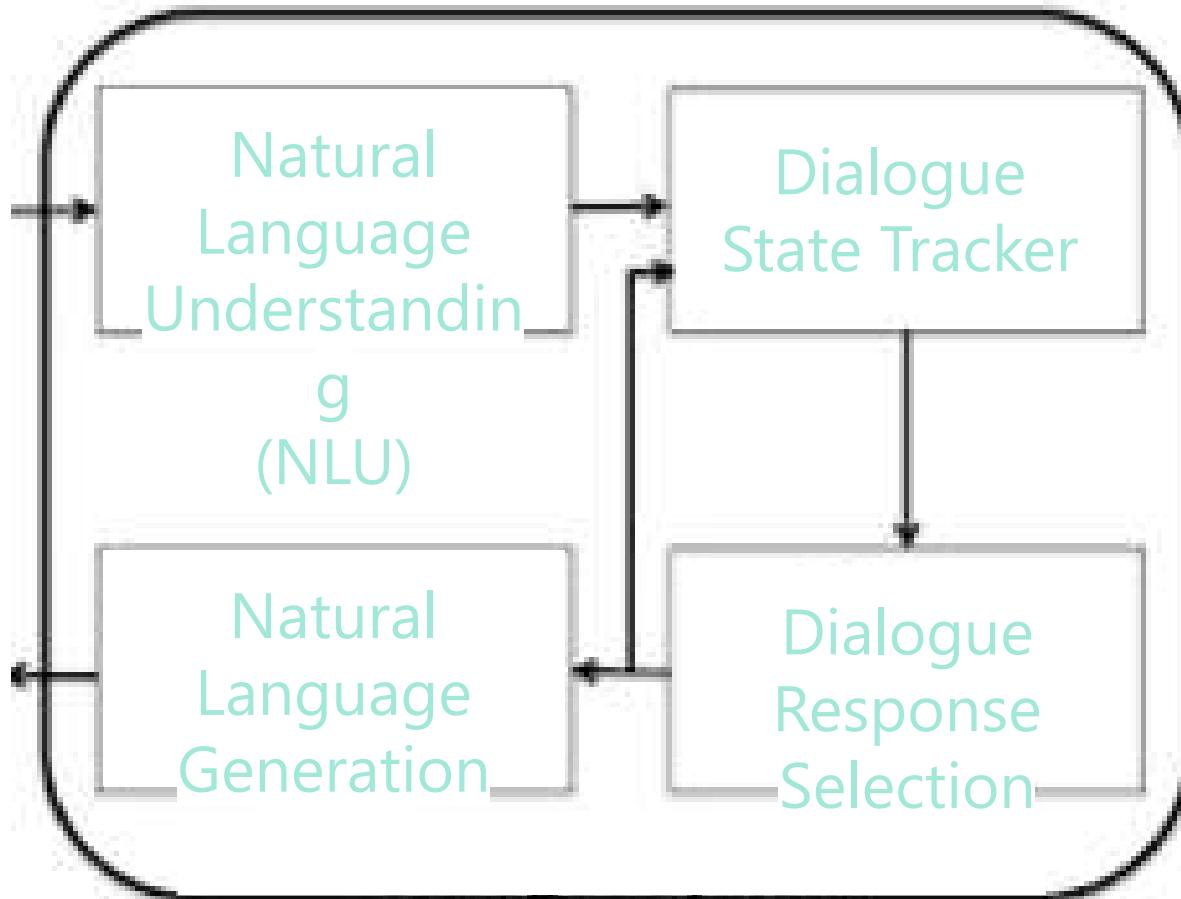
... are **agents** that can interact with users with a **multimodal, situated** (and often anthropomorphic), and **real-time interaction** to emulate a similar experience of ***human-to-human conversational interaction*** (Cassell, Bickmore, Campbell, & Vilhjálmsdóttir, 2000).



Dialogue Management

USER INPUT
"What is the weather tomorrow?"

SYSTEM RESPONSE
"Where are you based?"



Dialogue Management

Tools:

- RASA : <https://rasa.com/docs/getting-started/>
- <https://github.com/RasaHQ/rasa>
- DialogFlow (<https://dialogflow.com/>), Azure (<https://azure.microsoft.com/en-ca/services/bot-service/>), Watson Assistant (<https://www.ibm.com/cloud/watson-assistant/>)

Datasets:

- <https://breakend.github.io/DialogDatasets/>

Further implementations for a rainy day ...

Dialogue:

- <https://github.com/SenticNet/conv-emotion>
- <https://github.com/deepmipt/DeepPavlov>
- <https://tutorials.botsfloor.com/dialog-management-799c20a39aad>
- Xiaoice: <https://arxiv.org/abs/1812.08989>

Audio Emotion Recognition:

- <https://github.com/marcogdepinto/Emotion-Classification-Ravdess>
- RAVDESS : <https://smartlaboratory.org/ravdess/>

Sentiment Analysis:

- <https://github.com/cjhutto/vaderSentiment>
- <http://saifmohammad.com/WebPages/lexicons.html>