



# **Bazaar: Coordinating Multi-dimensional Support in Collaborative Conversational Agents**

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Carnegie Mellon University**



# Agenda

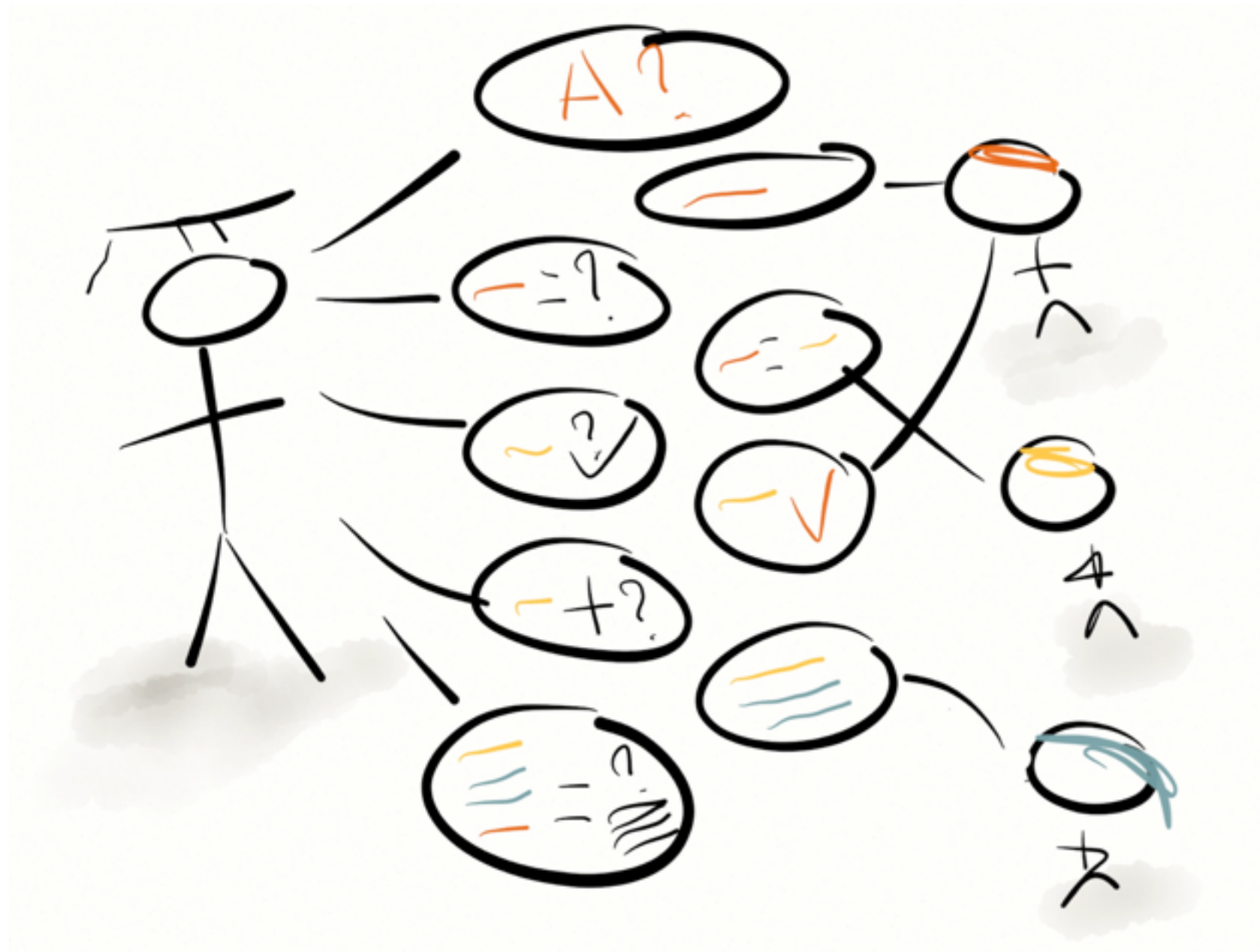
- CACL and Conversational Agents
- Dimensions of Support
- How Bazaar Works
- Tales of the Bazaar
- Moodling with Conversational Agents



# Collaborative Conversational Tutors



# Collaborative Conversational Tutors



# CSCAL with Conversational Agents

- Students working with a **partner and dialogue agent** for support learn 1.24 s.d. more than individuals without support (*Kumar et al., 2007a*)
- **Personalized agents** increase supportiveness and help exchange between students (*Kumar et al., 2007b*)
- Agents that employ **social strategies** are more effective than those that don't (*Kumar et al., 2010; Ai et al., 2010*)
- Students are sensitive to agent **rhetorical strategies** such as displayed bias (*Ai et al., 2010*), openness to **alternatives** (*Kumar et al., 2011*), and **targeted elicitation** (*Howley et al., 2012*)
- Students show learning gains (*Dyke et al., 2012*) and interact more intensely (*Adamson et al., 2013*) when supported by a facilitating agent using **Accountable Talk** moves.



# Collaborative Conversational Tutors







# Multi-Dimensional Multiparty Dialog

S02	12:57:35	noooo i think that the daddy is homozygous dominant and the mommy is heterozygous dominant. GG, Gg
S01	12:58:22	50% of the children are white so if one parent is gg and the other is Gg then this will create a 50% chance of having white
Tutor	12:58:27	So S01, what I hear you saying is recessive traits can be hidden in parents, but still show up in some of the children.
S01	12:58:35	yeah
S02	12:58:39	nooooooooooooo
Tutor	12:58:49	I wonder what S03 has to say.
S02	12:59:10	nothing she dont care
S03	12:59:33	shut up S02!!! i dont understand whats going on
S02	13:00:12	S03, its okay. just re look at the problem mamacitaaaaa
Tutor	13:00:22	Let's move on to the next problem...

dynamic  
feedback

social  
awareness

static  
macro-script



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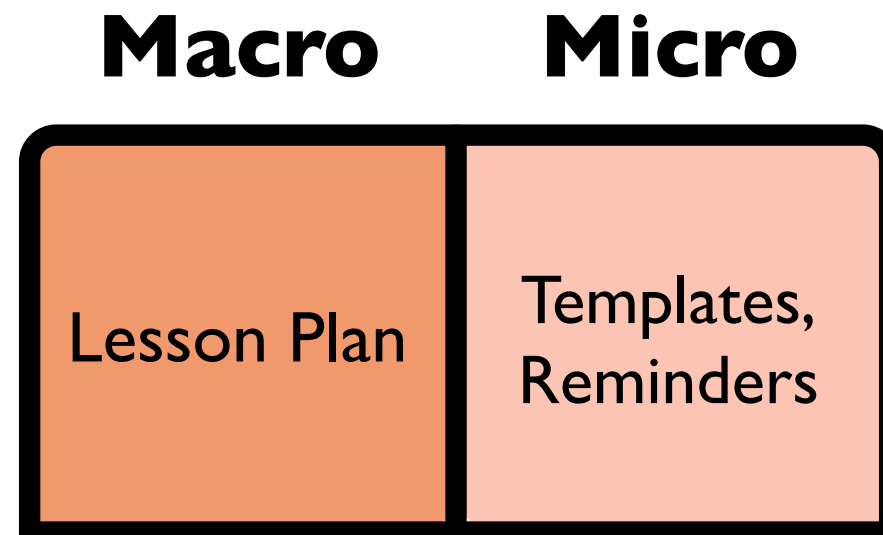


# Support for Collaborative Learning

- Support for collaborative learning can be described as **scripts** that scaffold and sequence the learners' interactions.
- A collaborative activity can be composed of multiple complementary scripts.

(Dillenbourg and Tchounikine, 2007)

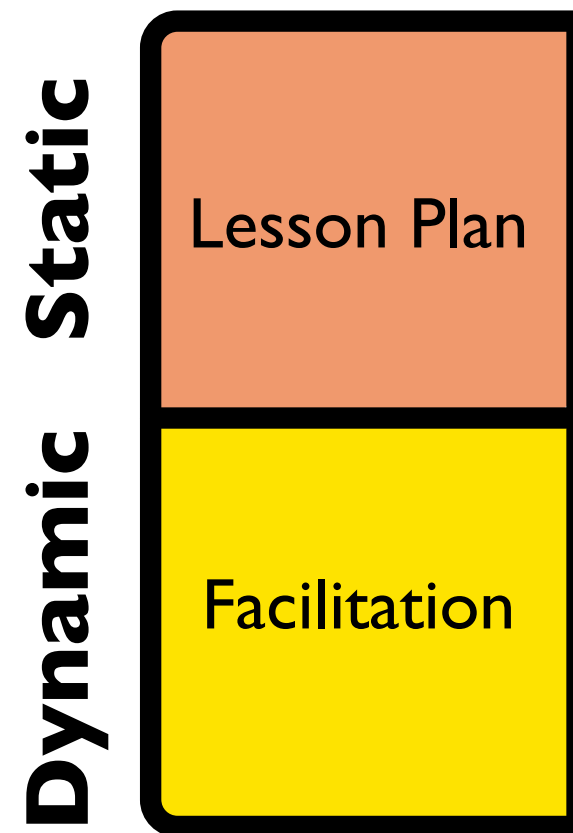
# Dimensions of Support



- **Macro**  
sequence, timing, large structure of activity
- **Micro**  
hints, feedback, support for student actions

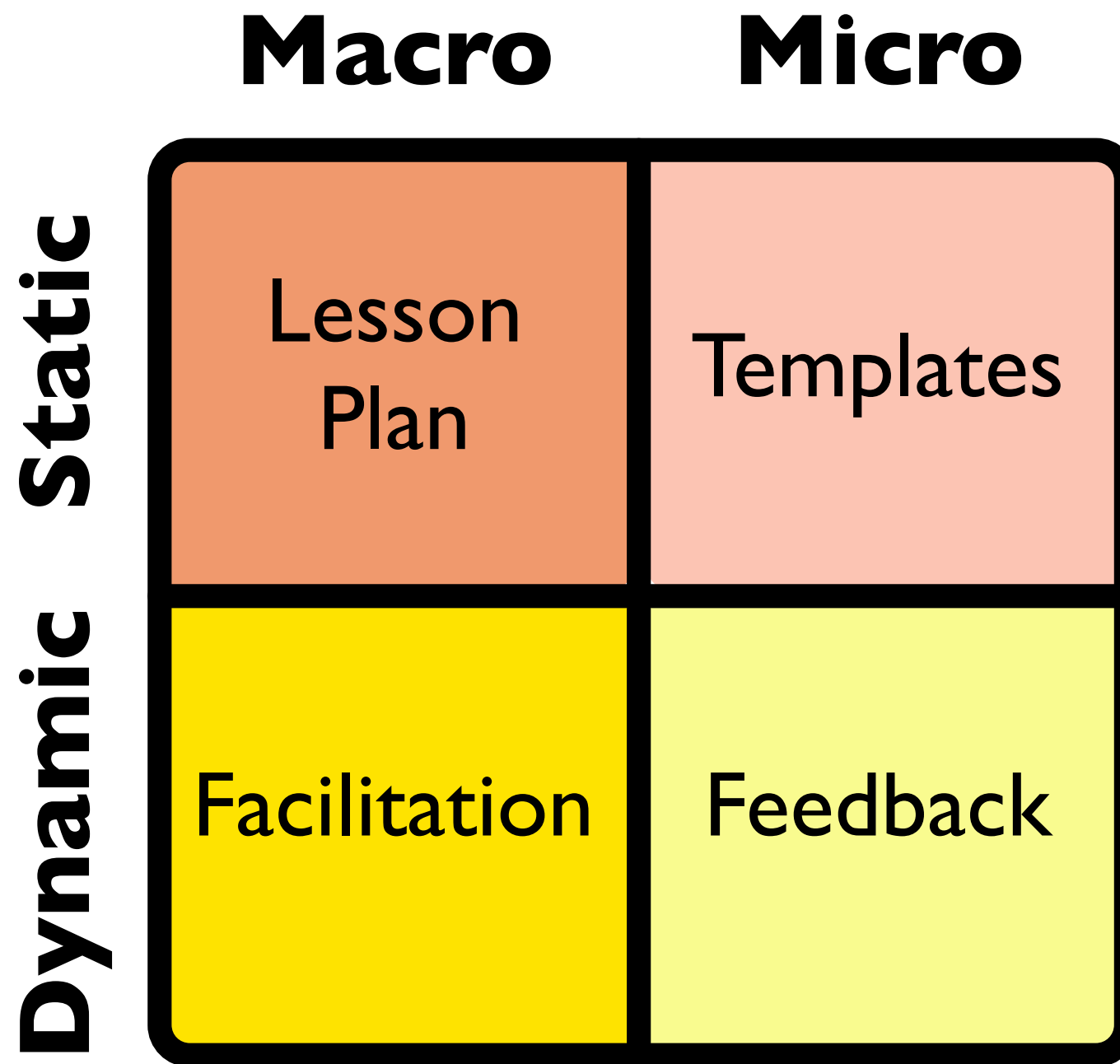


# Dimensions of Support



- **Static**  
pre-defined sequences, sentence templates
- **Dynamic**  
responsive to student behavior, context

# Dimensions of Support



# Dimensions of Support

How to compose and orchestrate  
supports and scripts?

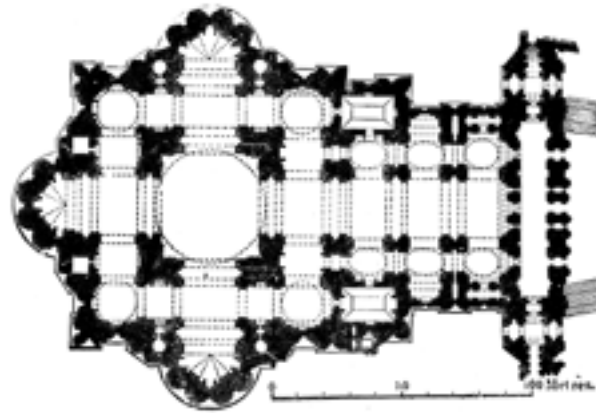


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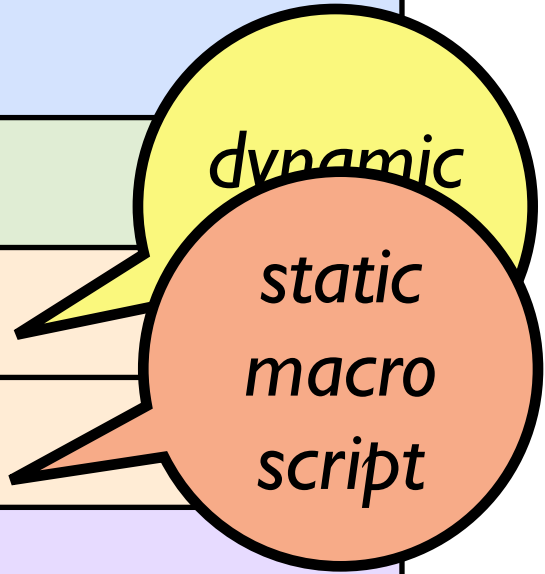
# Basilica



- Modular event-based agent architecture
- Multiple collaborative conversational contexts
- Pioneer platform for dynamic scripting support

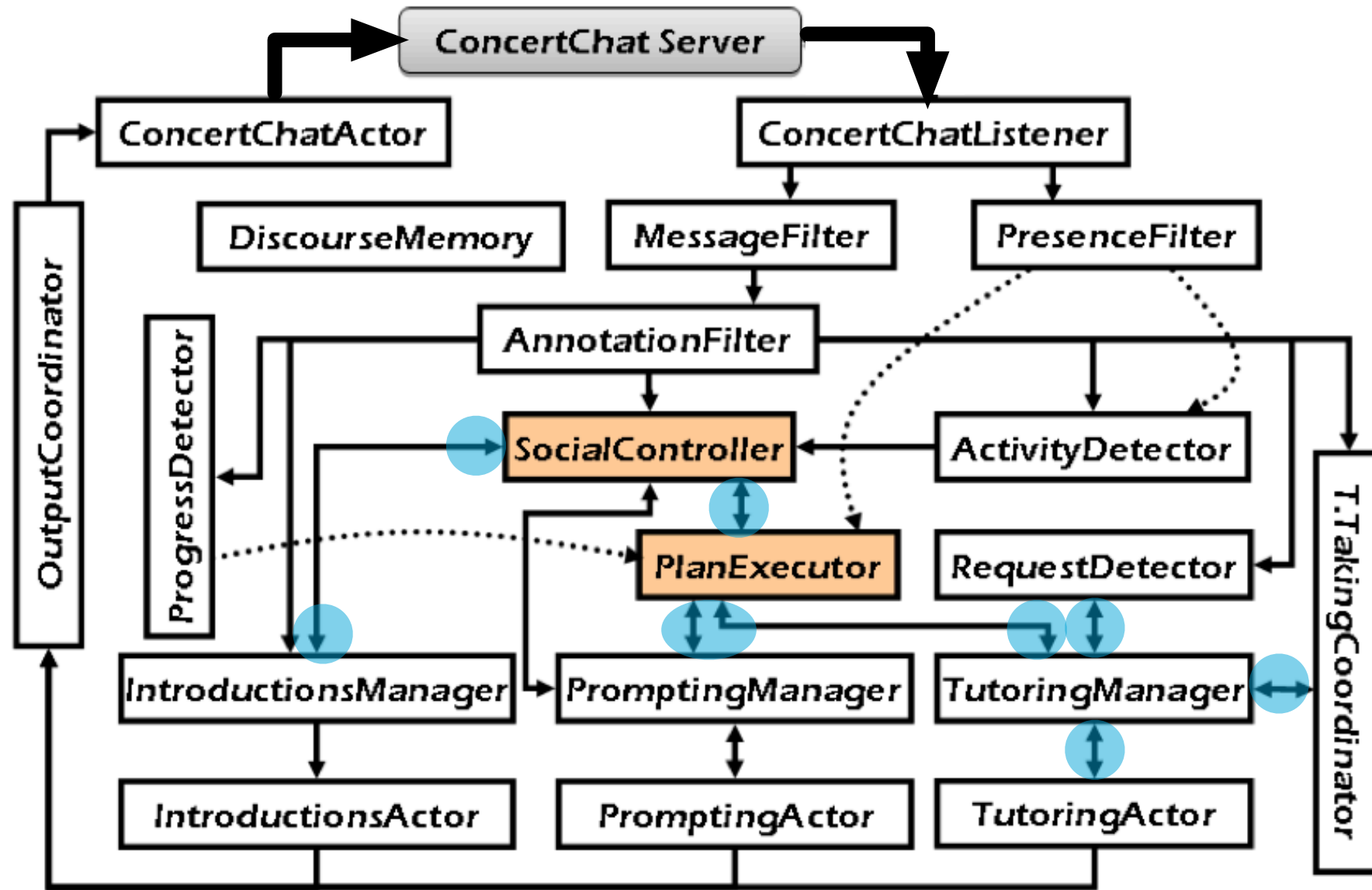
Kumar et al, 2007, 2010

# Behavior Coordination

S01	12:58:35	yeah	
S02	12:58:39	nooooooooooooo	
Tutor	12:58:49	I wonder what S03 has to say.	
Tutor	12:59:00	Let's move on to the next problem...	
S03	12:59:04	...	

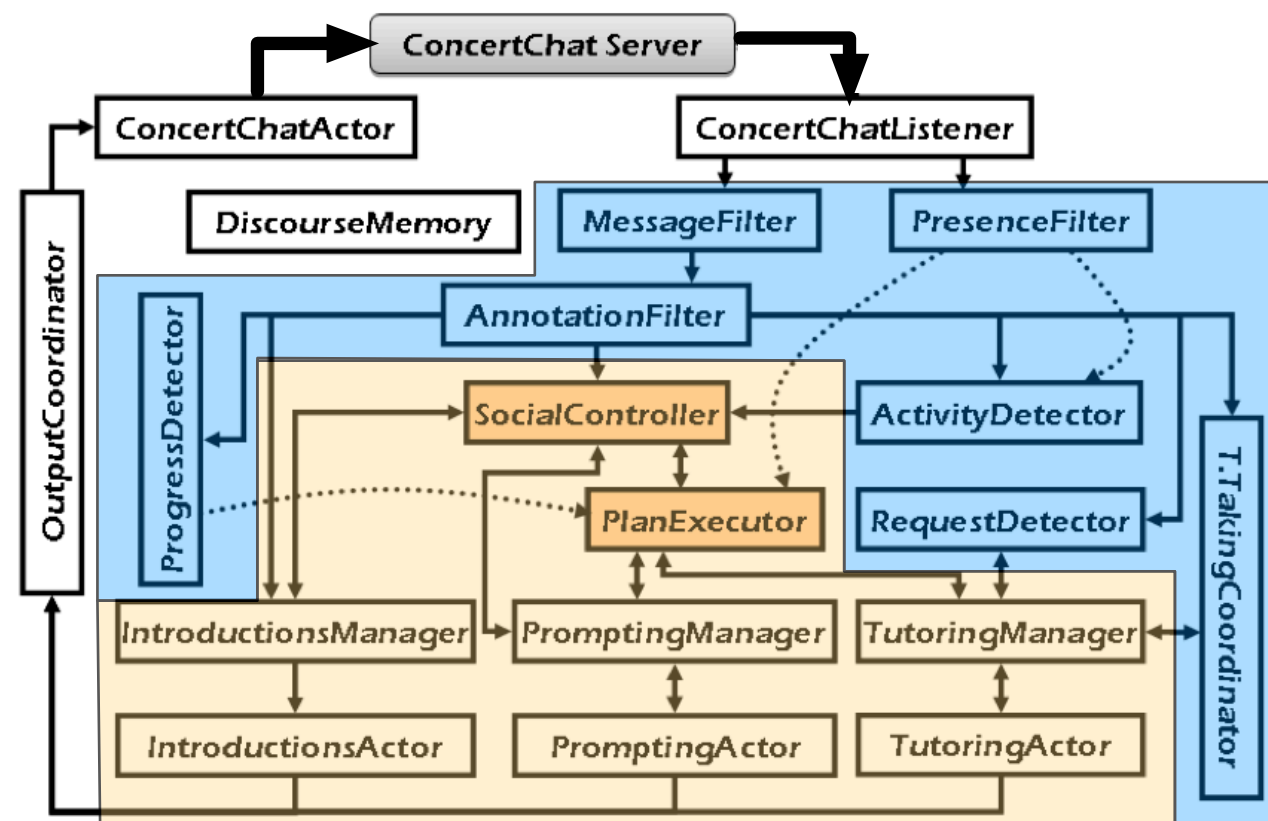


# Basilica Event Flow



most of the two-way links  
manage behavior coordination...

# Basilica, but...



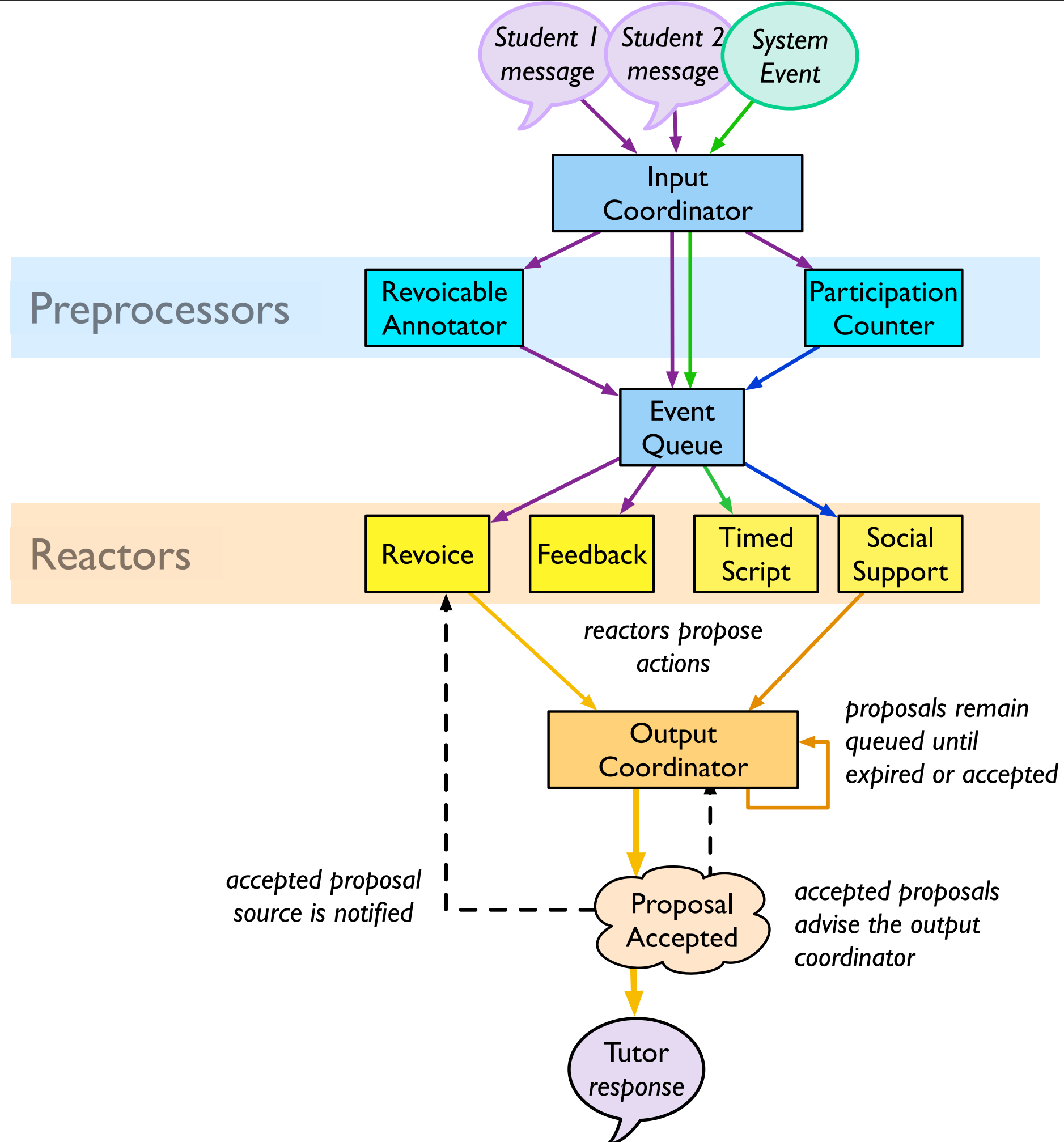
- Make implicit filter-actor pattern explicit
- Move inter-actor coordination out of each component, and into the framework

# Bazaar



- Based on Basilica
- Simplified event flow
- Built-in coordination between behaviors





# Experimental Tradeoffs

	+	-
Narrow Constraints	Repeatable, Predictable, Internal validity	Behavior juxtapositions, Missed opportunities
Flexible Constraints	Adaptible, Natural exchanges, External validity	Adds error variance, Less control of time

# Discussion

- Bazaar is a reusable, freely-available platform for CSCCL research
- Softening timing leads to a tradeoff between internal and external validity
- Support along multiple dimensions can be coordinated gracefully

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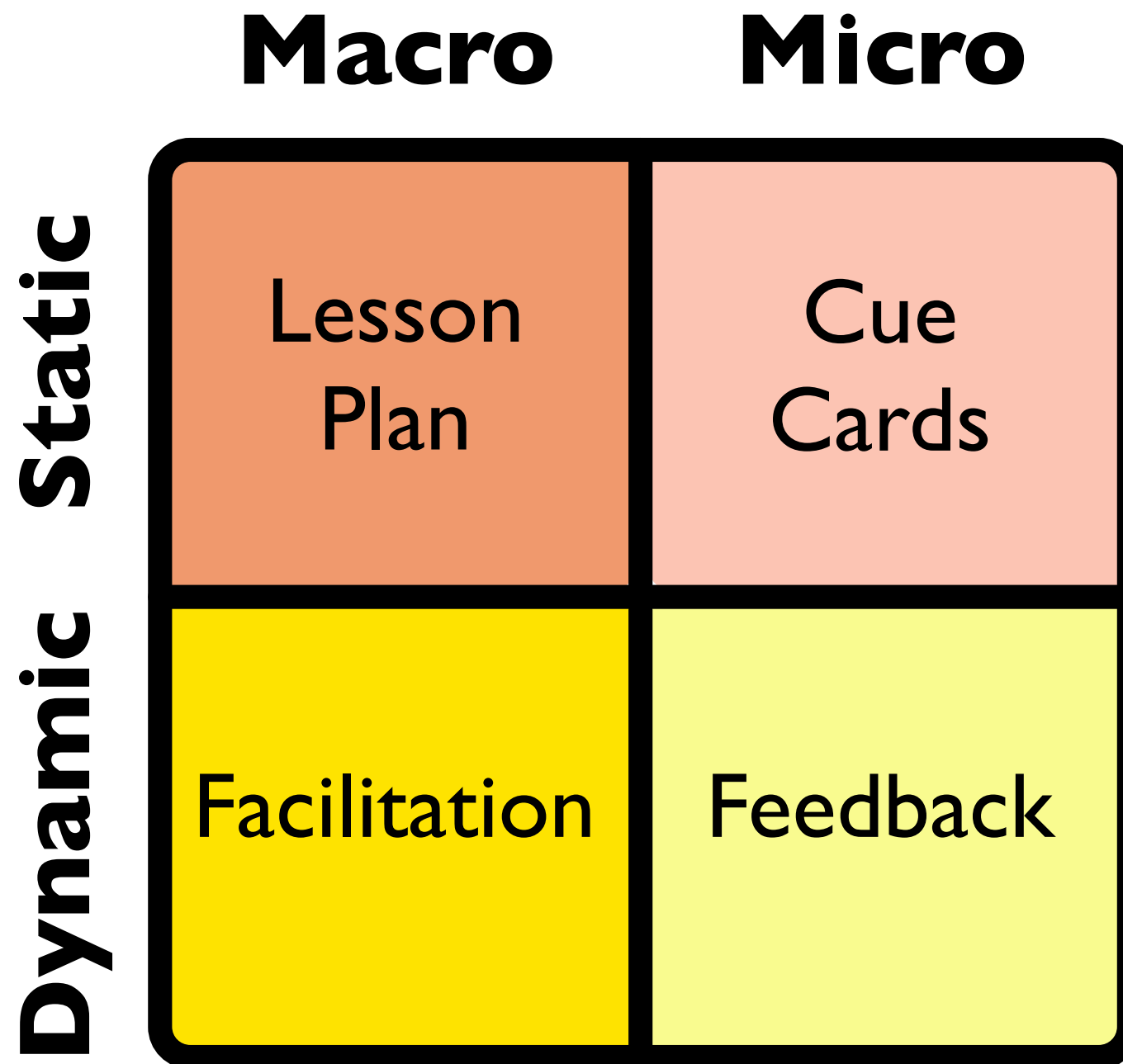
# Tales of the Bazaar

Research Platforms for CSCL



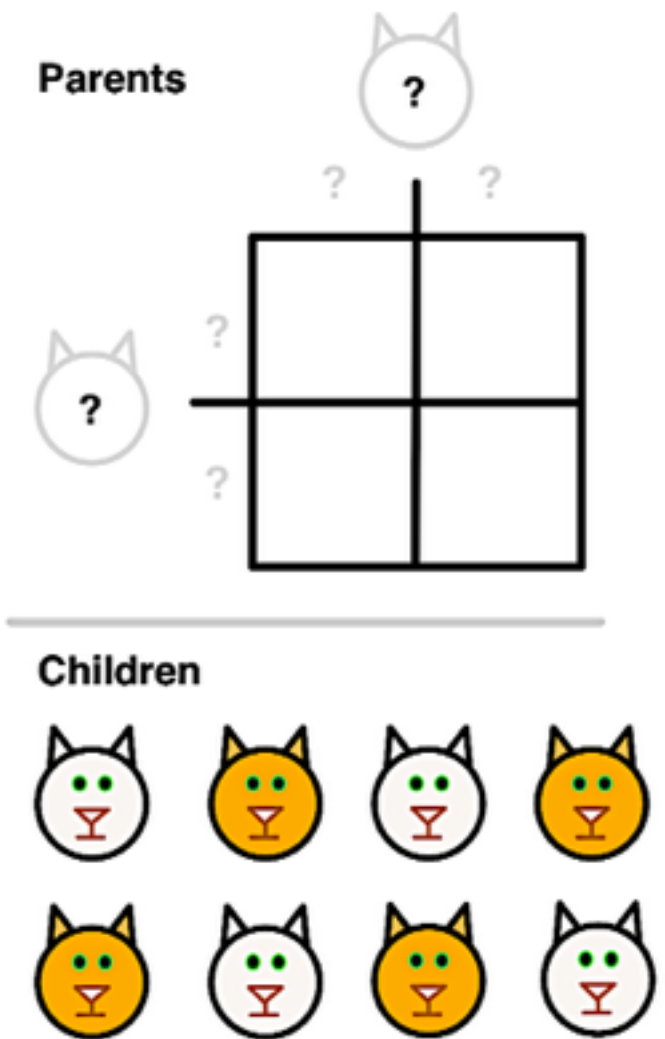


# Dimensions of Support



# Revoicing and APT

- Can tutor-led Academically Productive Talk (APT) increase student learning?
- 9th grade Biology, groups of 3 students
- Tutor offers “Revoice” and “Say More”  
APT moves in response to student contributions:

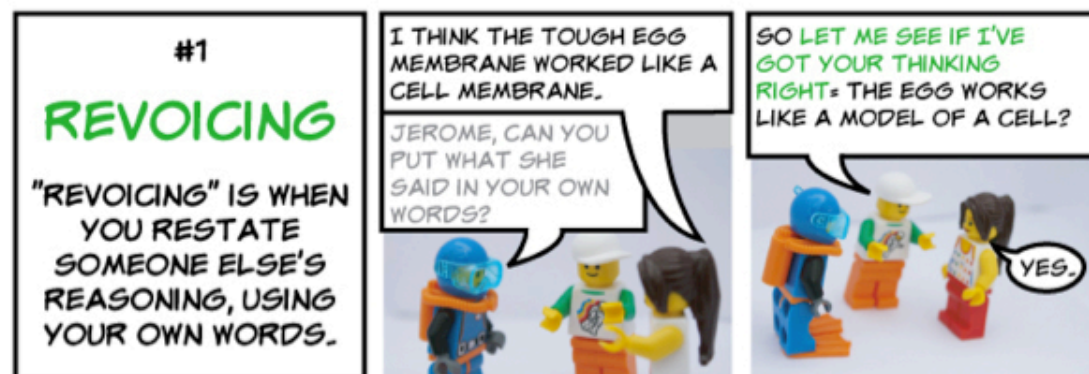


S01	50% of the children are white so if one parent is gg and the other is Gg then this will create a 50% chance of having white babies
Tutor	So S01, what I hear you saying is recessive traits can be hidden in parents, but still show up in some of the children.

# Revoicing and APT

- Static, macro-scripted (rigidly timed) problem sequence
- Static APT micro-reminders

	Macro	Micro
Static		
Dynamic		



- Dynamic social prompts (Kumar et al, 2010)
- Dynamic revoicings (APT) of student explanations: Bazaar reserves floor-space for student responses, promotes tutor followup moves

# Targeting Student Self-Efficacy

Howley, Adamson, Dyke, Rosé, 2012

- How do targeted prompts affect the self-efficacy of student participants?
- Knowledge construction dialogues delivered by “professor” tutor
- Social moves from “clueless student” tutor, plus targeted questions to high/low efficacy students
- In a time-constrained setting, overly-soft timing can mean all of the dialogues don’t get started.
  - choice of priorities and timeouts is important!


	Macro	Micro
Static		
Dynamic		

# Facilitating Debate

WhiteboardChat: Republicans (abc)

File

Whiteboard:



Last whiteboard action by (1:34:54 AM PST)

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Chat: (331)

**Democrats** 1:32:15 AM PST: hi... i personally believe that women should have choice what to do with their bodies

**Republicans** 1:32:41 AM PST: but many times women are young and immature and take wrong decisions and regret later

**Democrats** 1:33:04 AM PST: abortion should ultimately be the choice of women

**Republicans** 1:33:38 AM PST: abortion leads to certain complications if not carried out properly.. abortion is equal to murder

**Democrats** 1:34:04 AM PST: i believe in pro choice..

**Republicans** 1:34:32 AM PST: fetus has a life and right to grow and live..by abortion we are killing that right

**Talker** 1:34:42 AM PST: Say Something, Republicans

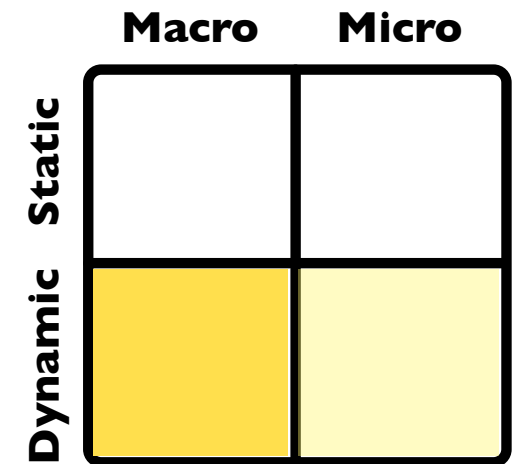
**Talker** 1:34:58 AM PST: (democrats) Science says a sperm cell does not constitute a human being. Science does say a zygote and beyond constitute a human being. Science should be the basis of law. So abortion is not equivalent to murder. Don't you agree to this?

Message:



# Facilitating Debate

- Can a balanced debate engender multi-perspective knowledge?
- Discussant participation is dynamically encouraged
- Dynamically detect the current topic and the dominating “side” of the debate.
- Facilitator/Tutor dynamically directs the conversation by introducing facts and talking points for the weaker side



# Agenda

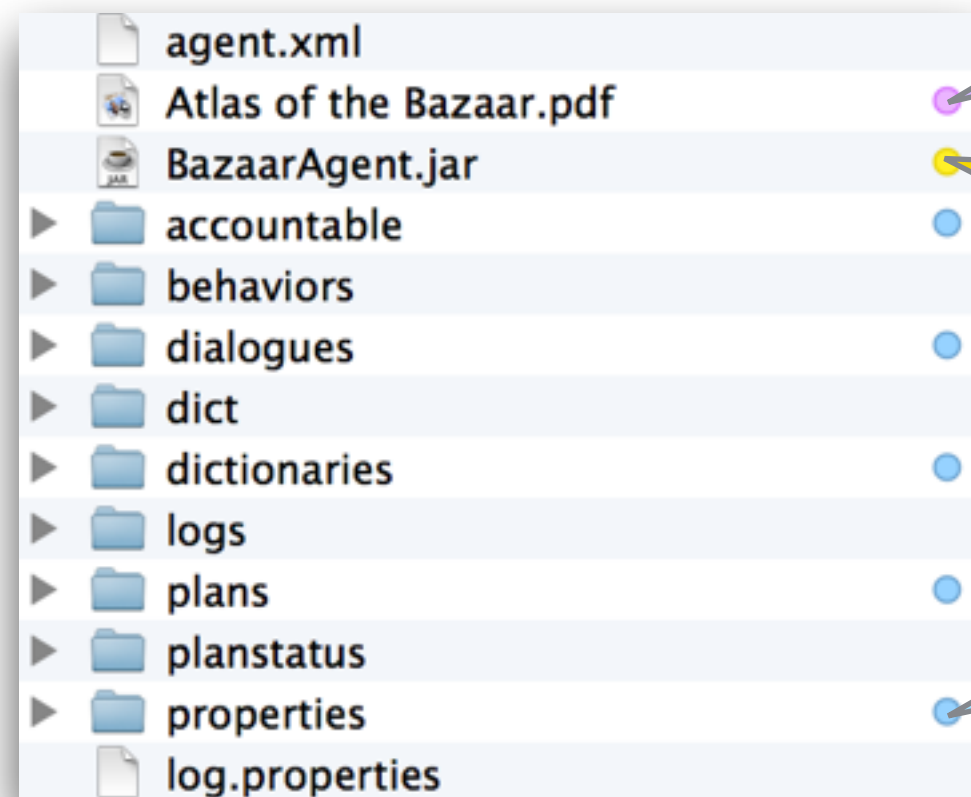
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# Agents in Moodletown

- Support your Moodle course with an agent!
- <http://ankara.lti.cs.cmu.edu/bazaar/MoodleTalkAgent.zip>
- **Assignment:**  
Customize the example agent for a task in your course.  
*Full instructions and documentation are included in the .zip*
  1. Get the example agent running in your course.
  2. Explore the settings to make domain-appropriate adjustments and additions.  
*All the relevant config files are lovingly documented.*
  3. Propose some brand-new behaviors that would be useful for your course.

# What's Inside?

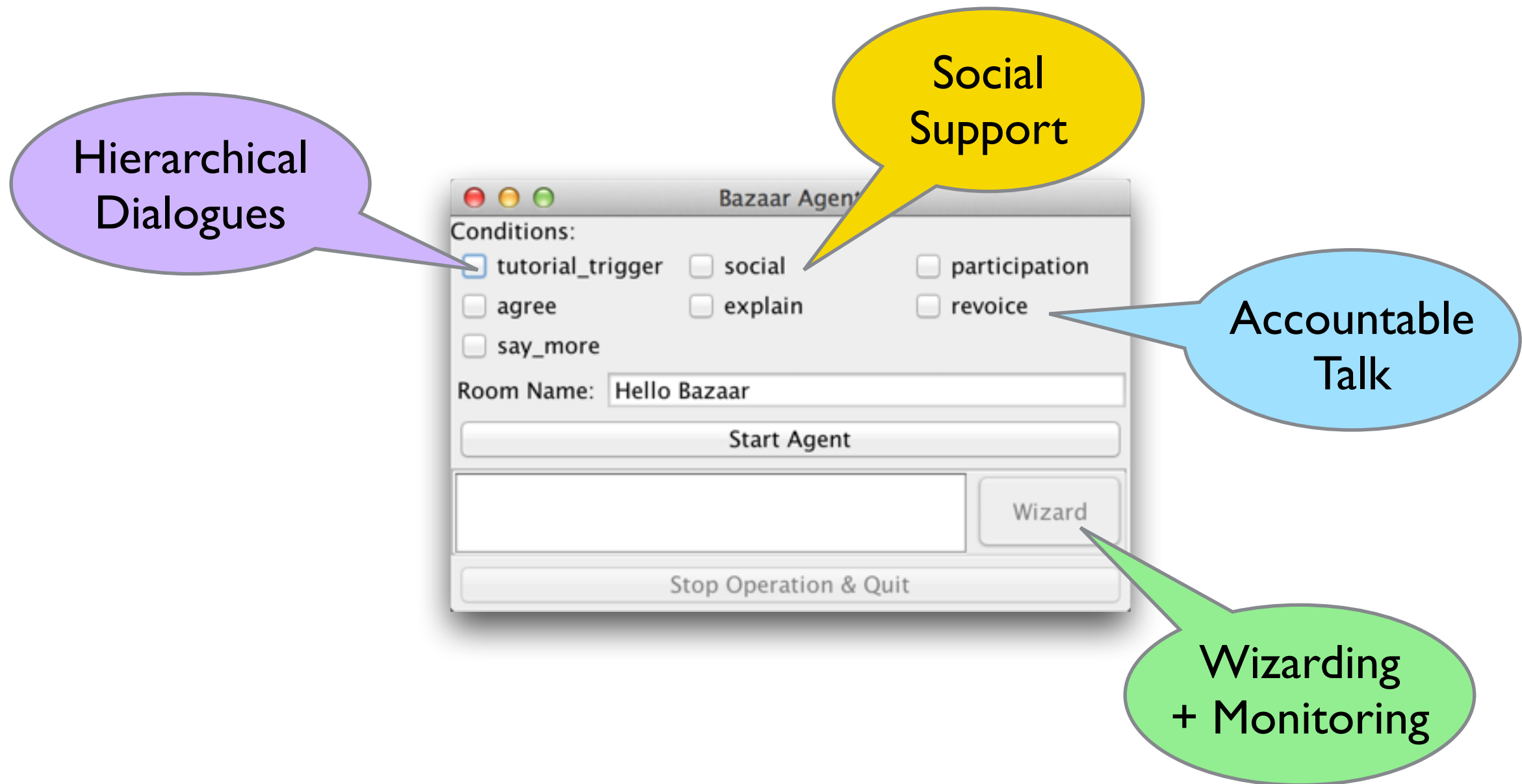


Read This

Double-click this

Change These!

# What does it do?





# Get the agent running!



- Create a Moodle user for your agent to impersonate.
- Create a Chat activity in your Moodle course.
- Edit *properties/MoodleChatClient.properties* to match your Moodle installation's *config.php*
- Press the big friendly button!

Room Name:

•••••

# What can you change?

- Replace the Accountable Talk exemplar statements (and associated synonym files) with statements relevant to your own domain.

*In the “accountable” folder.*

- Edit the macro-script or tutorial dialogues, or create new ones. *In the “plans” and “dialogues” folders.*

- Remove any behaviors you think are unsuitable.

*In properties/operation.properties*

- Adjust the timing, priority, etc. of any of the included behaviors. *In the “properties” folder.*

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# Questions?



`dadamson@cs.cmu.edu`  
[cs.cmu.edu/~dadamson/bazaar](http://cs.cmu.edu/~dadamson/bazaar)









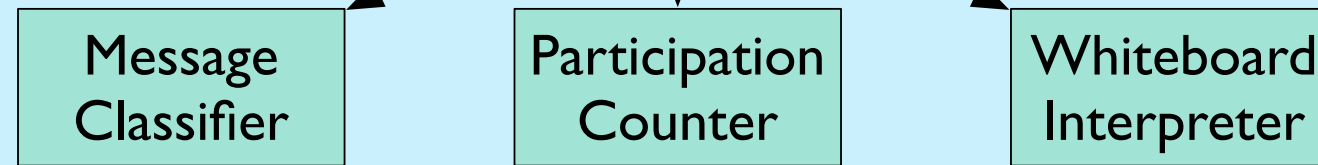
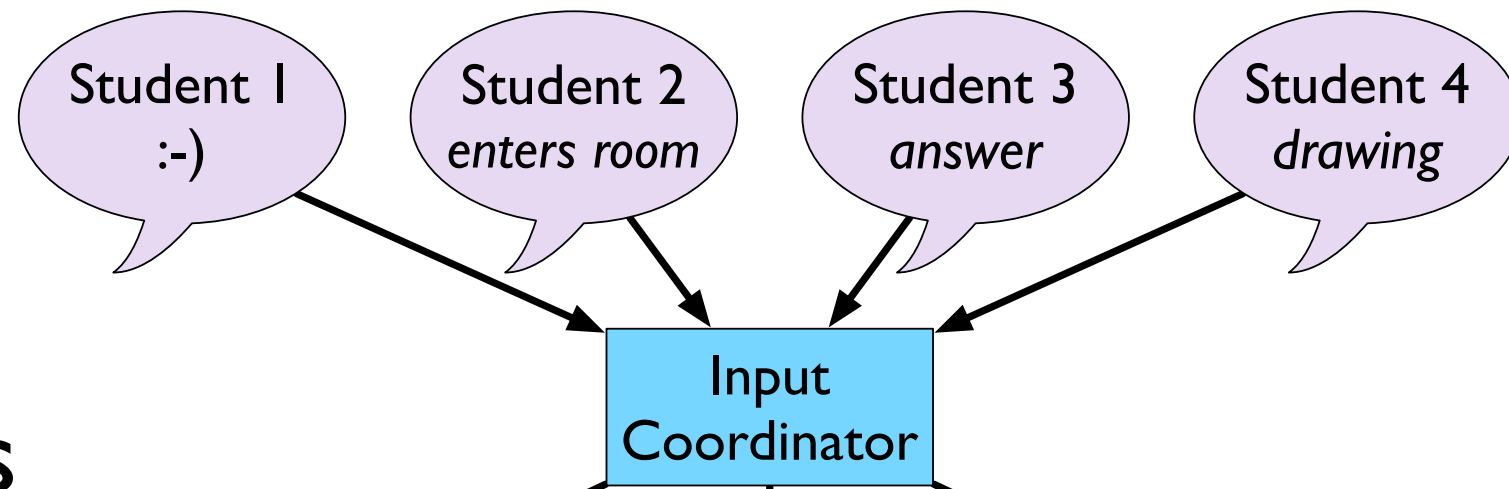




# Multi-Dimensional Multiparty Dialog

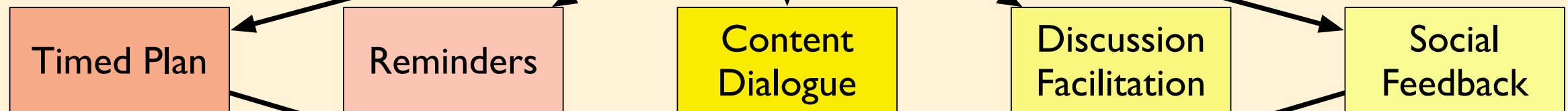
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Tutor	12:58:27	So S01, what I hear you saying is that the traits can be hidden in parents, but still show up in children.	participation prompt proposed, but blocked
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S03	12:59:33	shut up S02!!! i dont understand genetics on	
S02	13:00:12	S03, its okay. just re look at the Punnett square. aaaaaa	timed prompt proposed, permitted (high priority)
Tutor	13:00:22	All right, we're wrapping up. Thank you for participating.	social support times out, rejected

# Pre-process

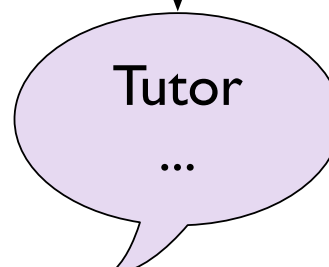


# React

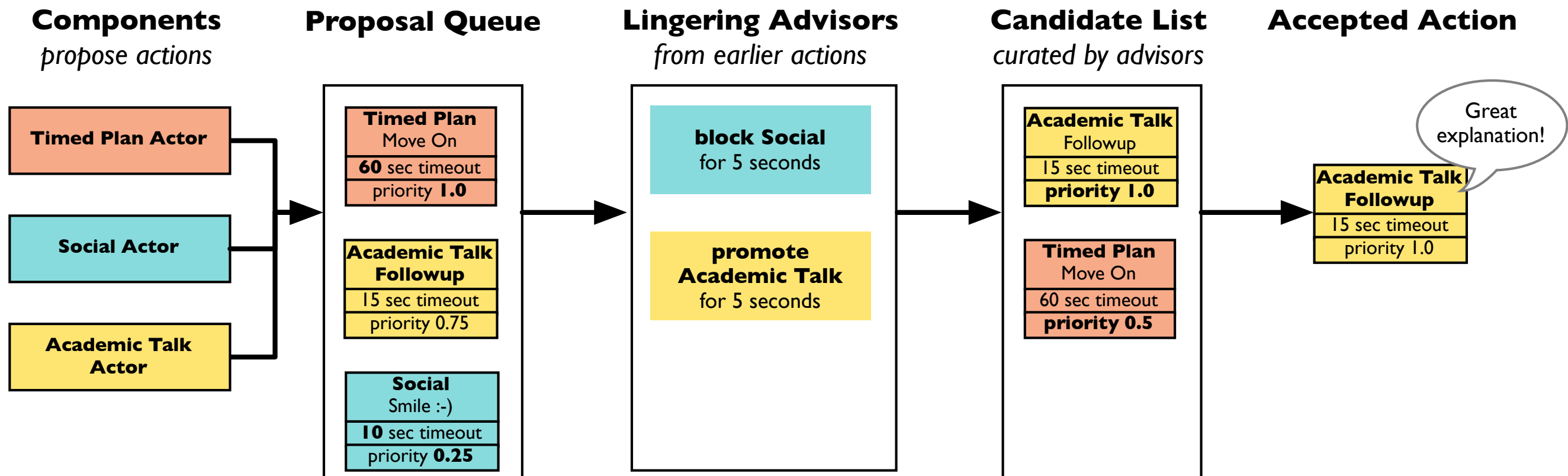
Event Queue



Output Coordinator

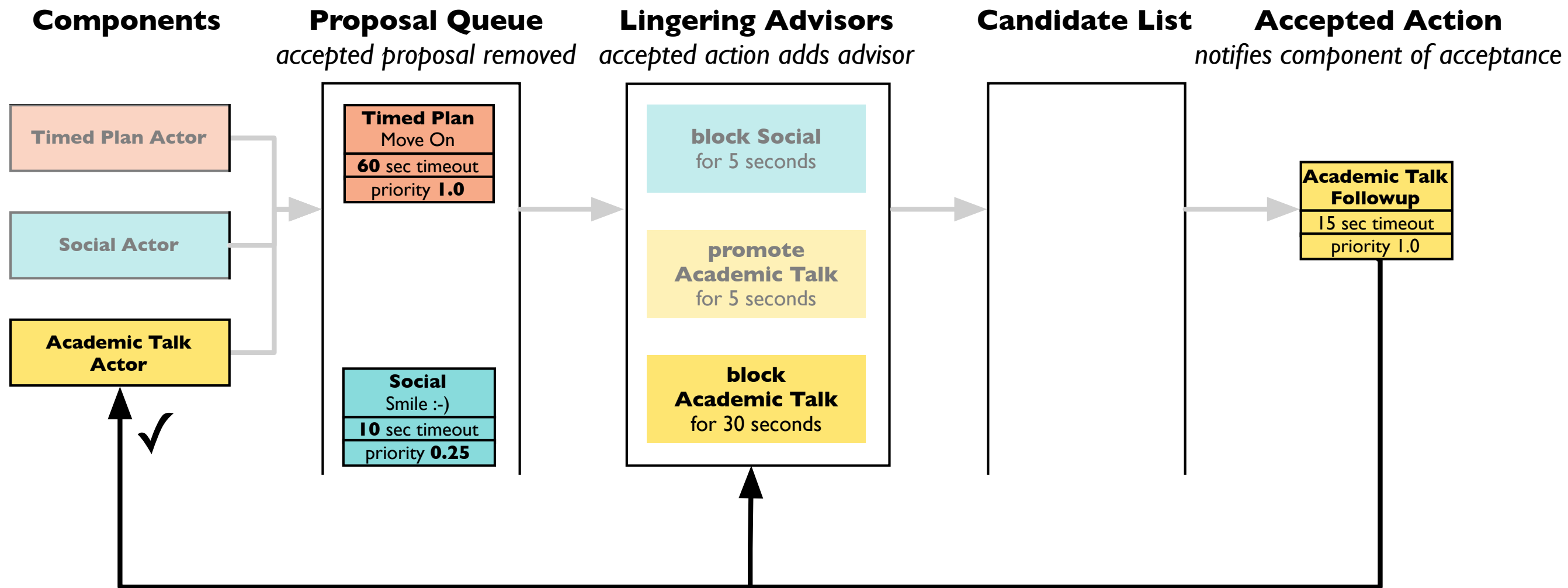


# Output Coordinator



- Actions are proposed with a timeout (window of relevance) and a priority value
- Advisors (left by earlier accepted actions) influence the selection of incoming proposals to:
  - reserve the floor for followups
  - prefer proposals from certain sources

# Output Coordinator



- Accepted proposals leave advisors that linger for a time after the proposal is enacted.
- When a proposal is accepted or rejected, it sends a callback to notify the originating component.



