

Conversational Agents as Facilitators for Group Interaction

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Agenda

- **CSCL and Conversational Agents**
- Dimensions of Support
- How Bazaar Works
- Tales of the Bazaar
- Deploying Conversational Agents



Conversational Agents

How does information that you type in get passed from the keyboard to the hard disk?

The screenshot shows a question: "How does information that you type in get passed from the keyboard to the hard disk?". Below it is a diagram illustrating the flow of data through a computer system. The diagram includes a Central Processing Unit (CPU) at the center, connected to Memory (RAM) and a Hard Drive. An Input Device (a keyboard) is shown with an arrow pointing to the CPU. Another arrow points from the CPU to the Hard Drive. At the bottom, there is a text input field containing the text "through the CPU" and a "Submit" button.

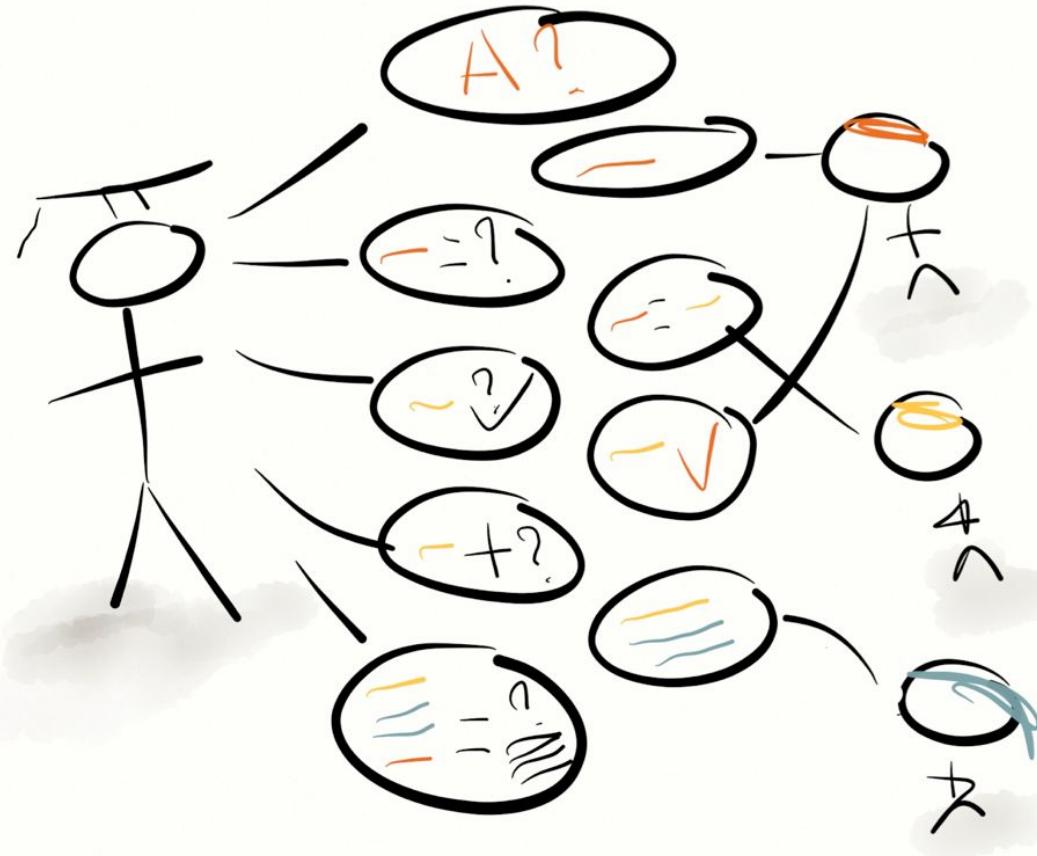


- State-based computer programs
- Interact with human beings through natural language
 - text
 - speech
 - images
 - video

Collaborative Conversational Tutors



Collaborative Conversational Tutors



CSCL 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.

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Multi-Dimensional Multi Party 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 mamacitaaaaaa

Tutor 13:00:22 Let's move on to the next problem...

dynamic feedback

social awareness

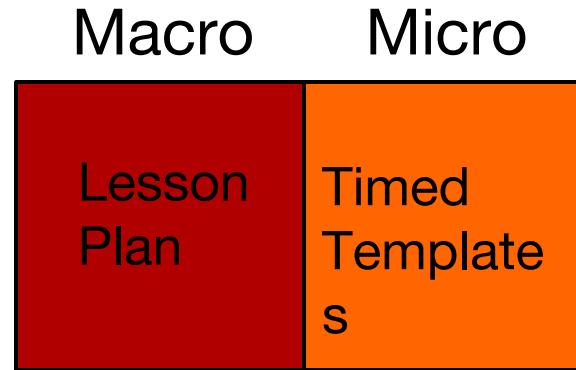
static macro-script

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.

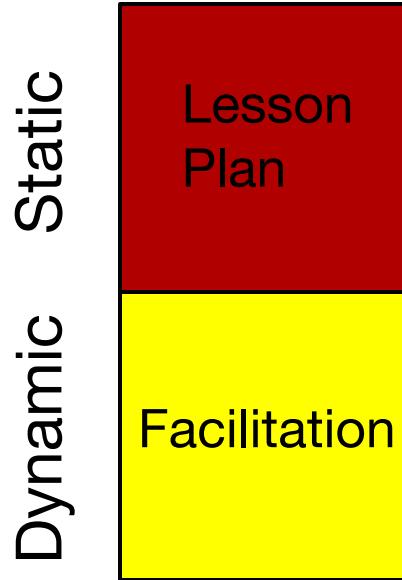
(Dillenbourg and Tchounikine, 2007)

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

	Macro	Micro
Static	Lesson Plan	Timed Templates
Dynamic	Facilitation	Feedback

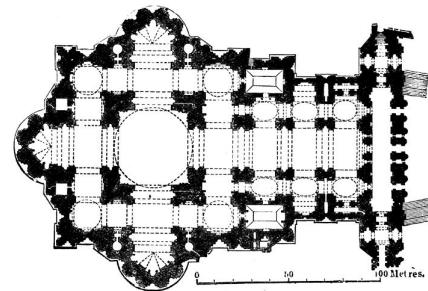


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Basilica



- 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 noooooooooo

*dynamic
feedback*

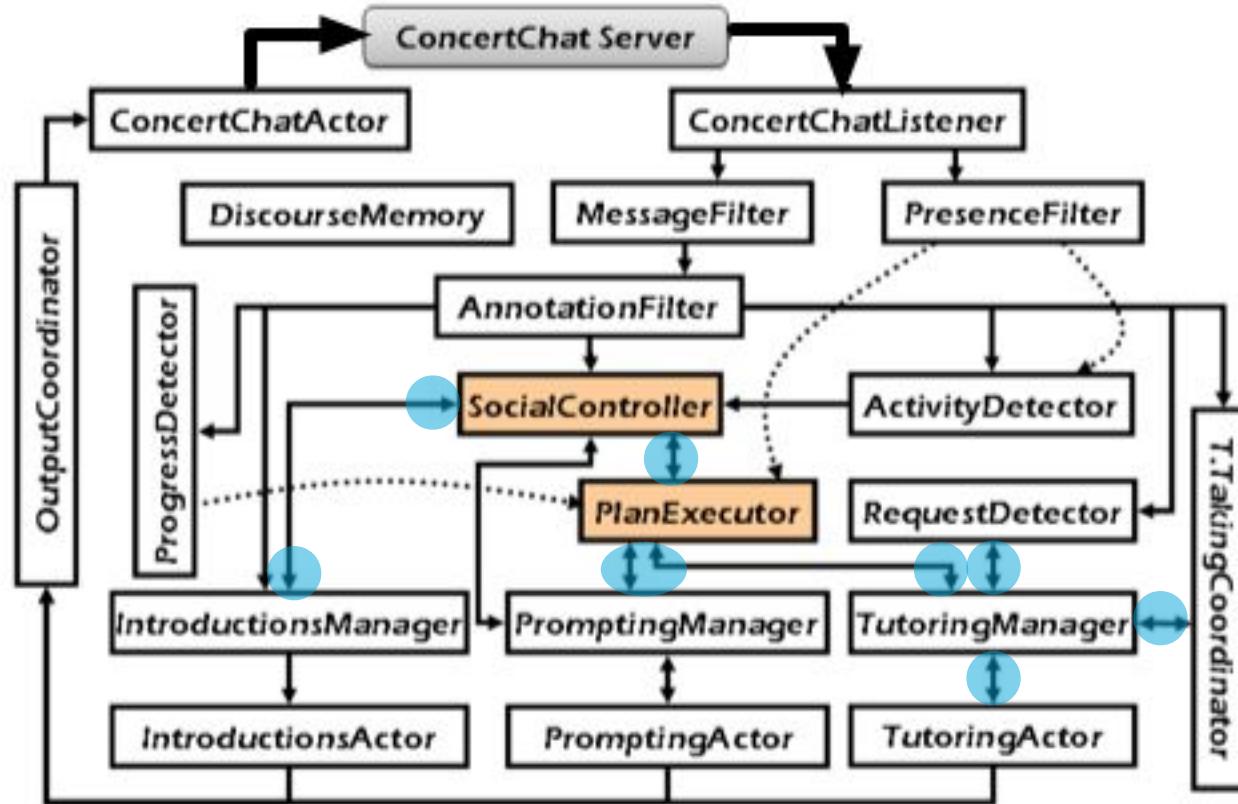
Tutor 12:58:49 I wonder what S03 has to say.

*static
macro
script*

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...

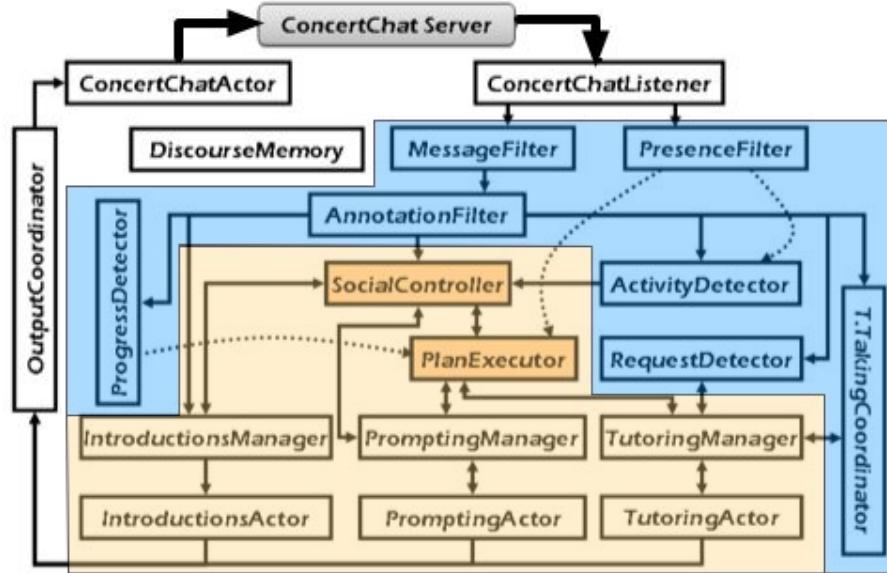
Bazaar



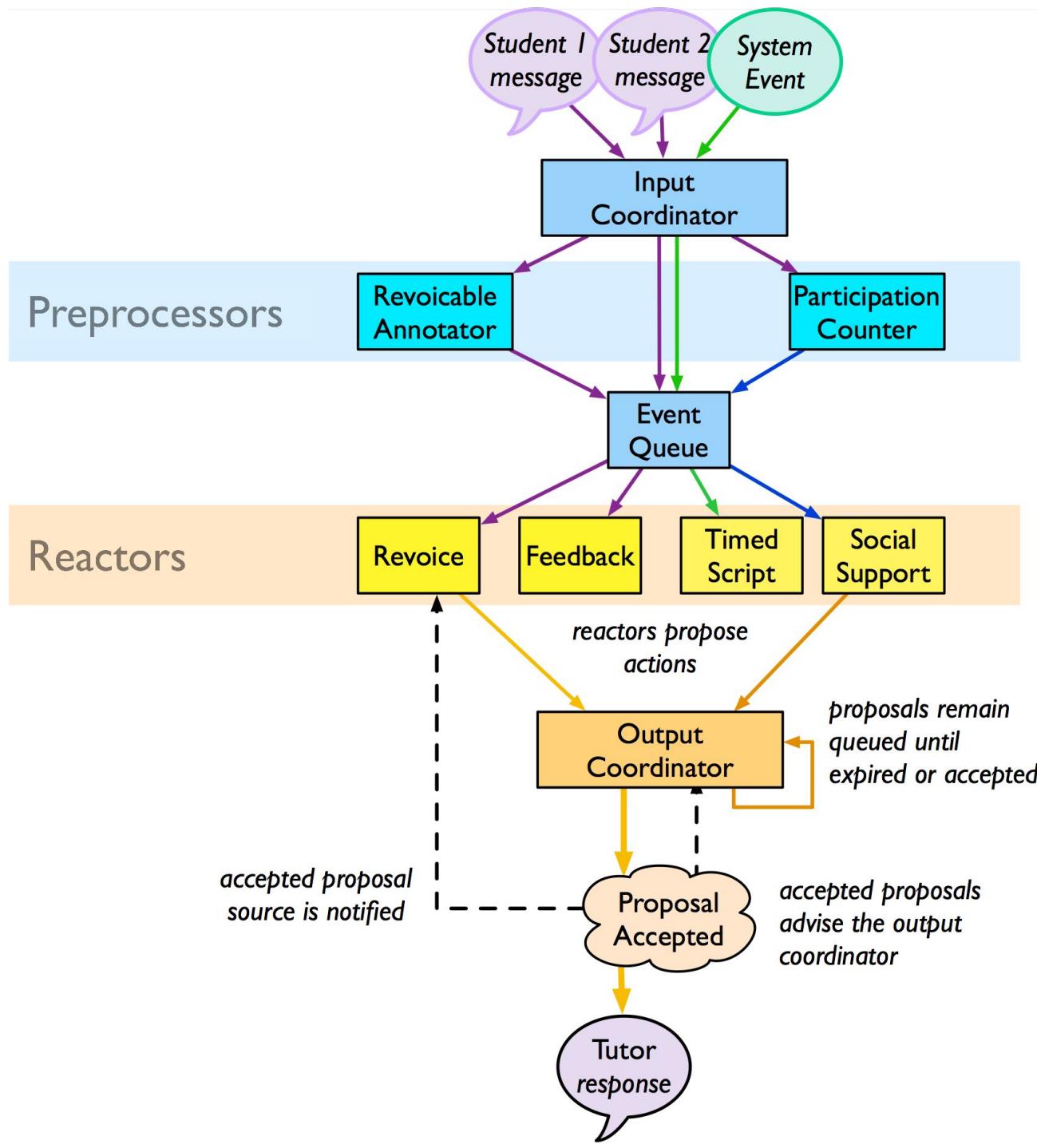
- Based on Basilica
- Simplified event flow
- Built-in coordination between behaviors

.....

Basilica, but...



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



Multi-Dimensional Multi party 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 white and the other is black then this will create a 50% chance of having a white child.

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

social support
proposed, but
blocked

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 diagram

social support
times out,
rejected

Tutor 13:00:22 All right, we're wrapping up. Thanks for coming!

revoicing
proposed,
permitted

participation
prompt
proposed, but
blocked

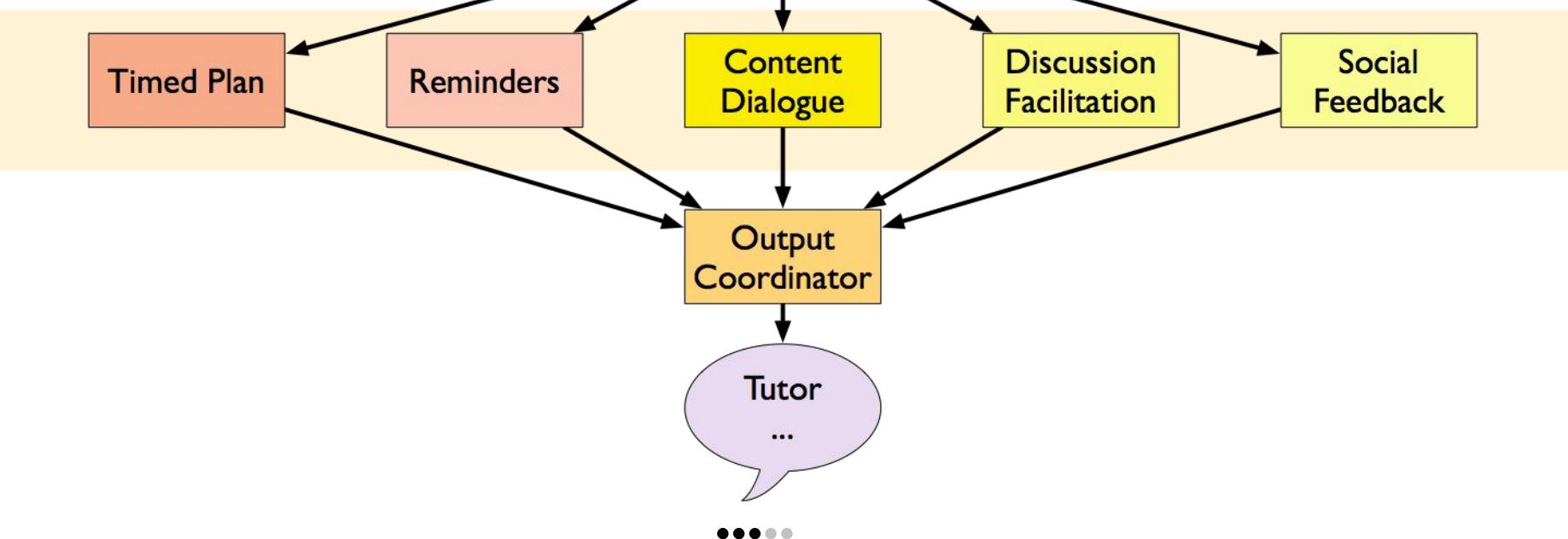
participation
prompt
permitted

timed prompt
proposed,
permitted (high
priority)

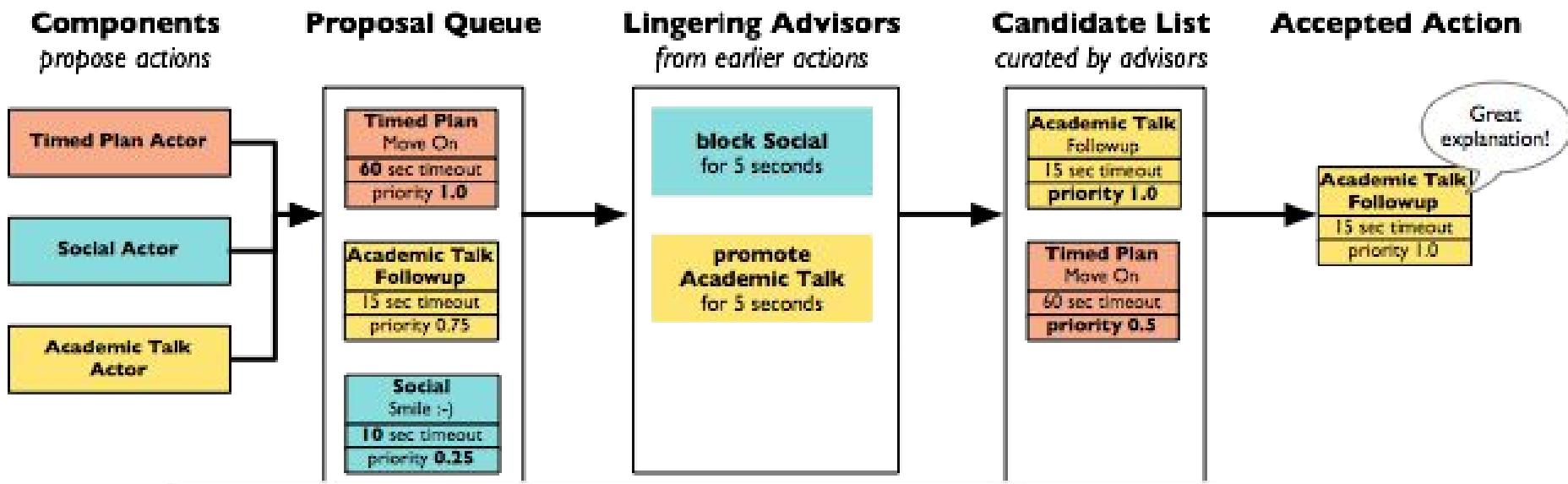
Pre-process



React

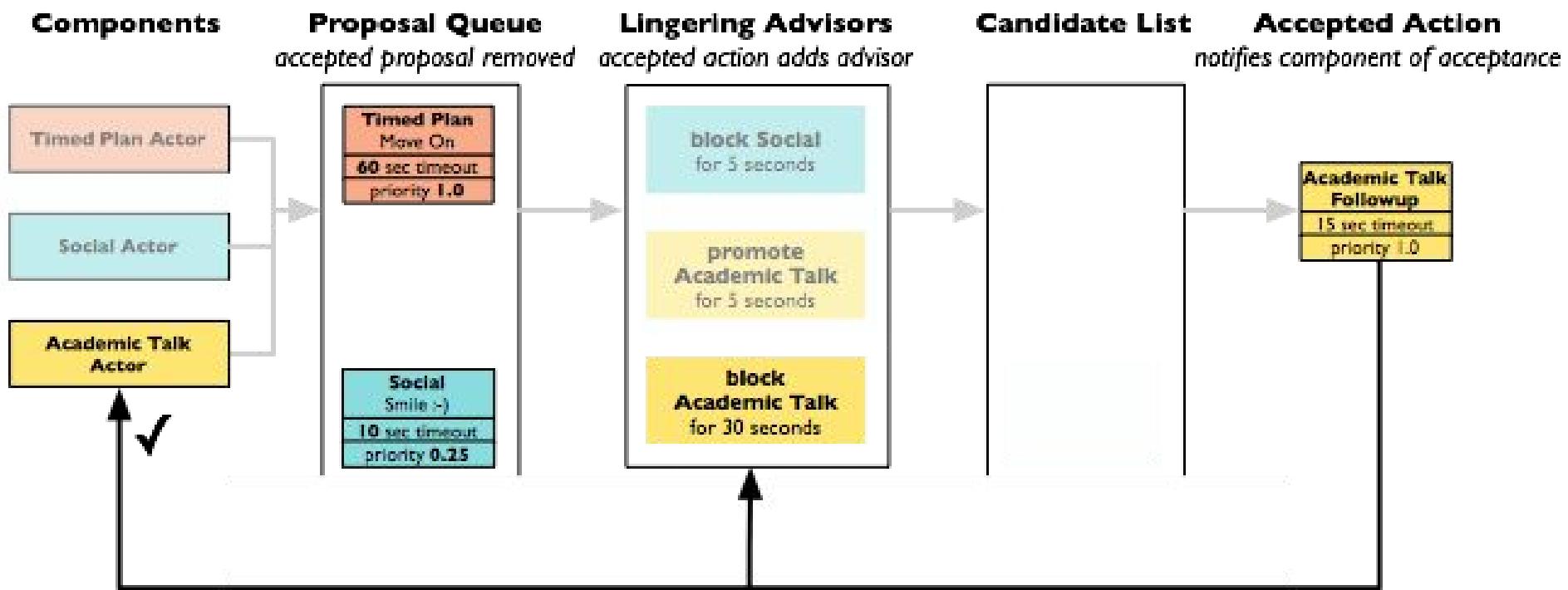


Output Coordinator



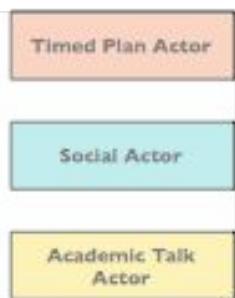
- Actions are proposed with a timeout (window of relevance) and a priority value
- Advisors (left by earlier accepted actions) influence the selection of incoming proposals to:
 - reserve the floor for followups
 - prefer proposals from certain sources

Output Coordinator

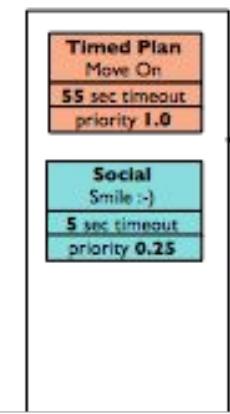


- Accepted proposals leave advisors that linger for a time after the proposal is enacted.
- When a proposal is accepted or rejected, it sends a callback to notify the originating component.

Components

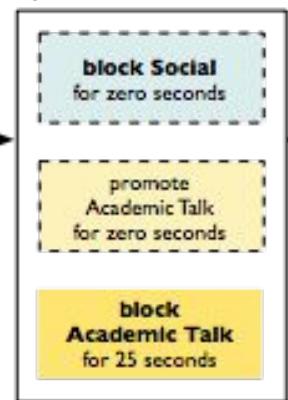


Proposal Queue

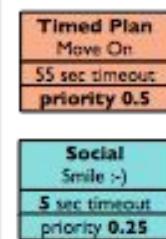


Lingering Advisors

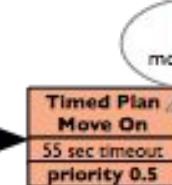
expired advisors removed



Candidate List

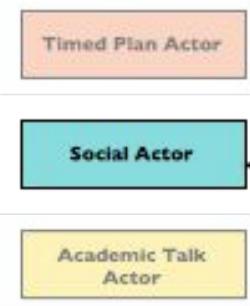


Accepted Action



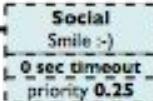
Let's move on...

Components notified of rejection



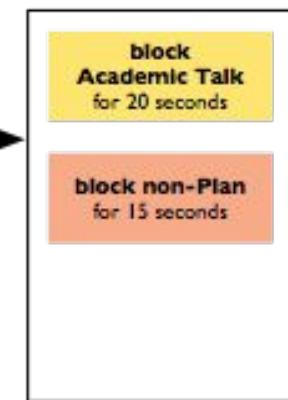
Proposal Queue

expired proposals rejected



Lingering Advisors

expired advisors removed



Candidate List



Accepted Action



Experimental Tradeoffs

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

Discussion

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

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Agenda

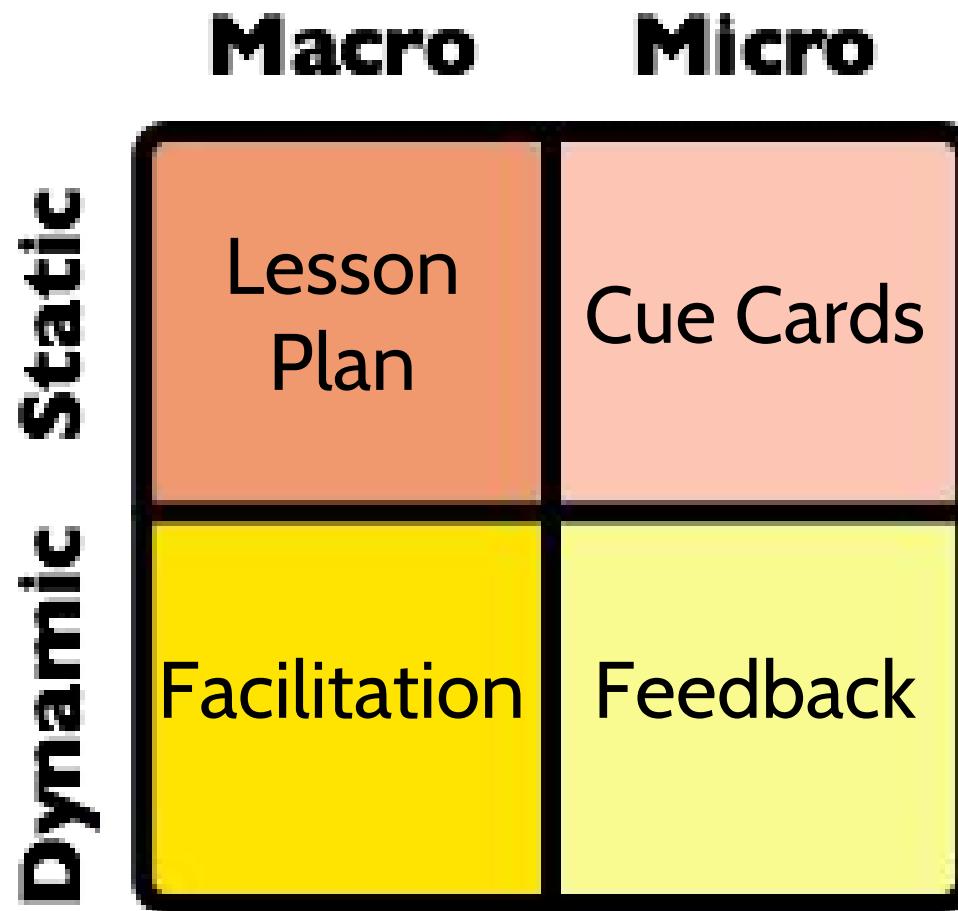
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Tales of the Bazaar

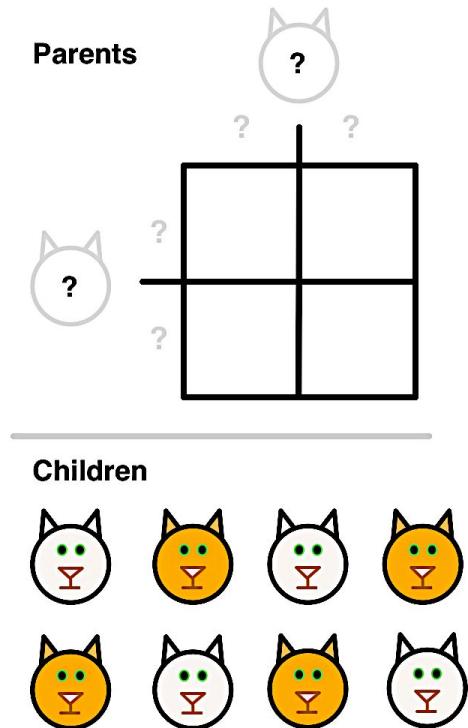
Research Platforms for CSCL

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:

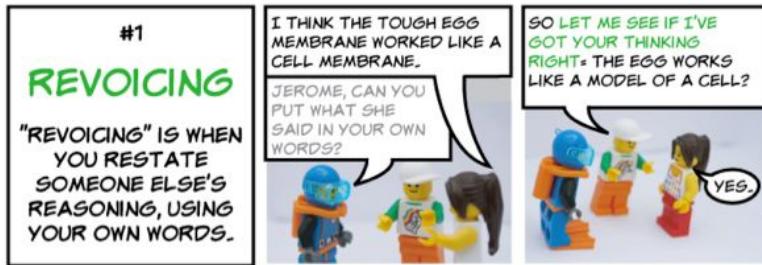


S01 50% of the children are white so if one parent is gg and the other is Gg then this will create a 50% chance of having white babies

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	Type to enter text	Type to enter text
Dynamic		Type to enter text

- Dynamic social prompts (Kumar et al, 2010)
- Dynamic revoicings (APT) of student explanations: Bazaar reserves floor-space for student responses, promotes tutor follow up 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
Dynamic	Type to enter text	
Static		Type to enter text

Facilitating Debate

WhiteboardChat: Republicans (abc)

File

Whiteboard:



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

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

Democrats 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:

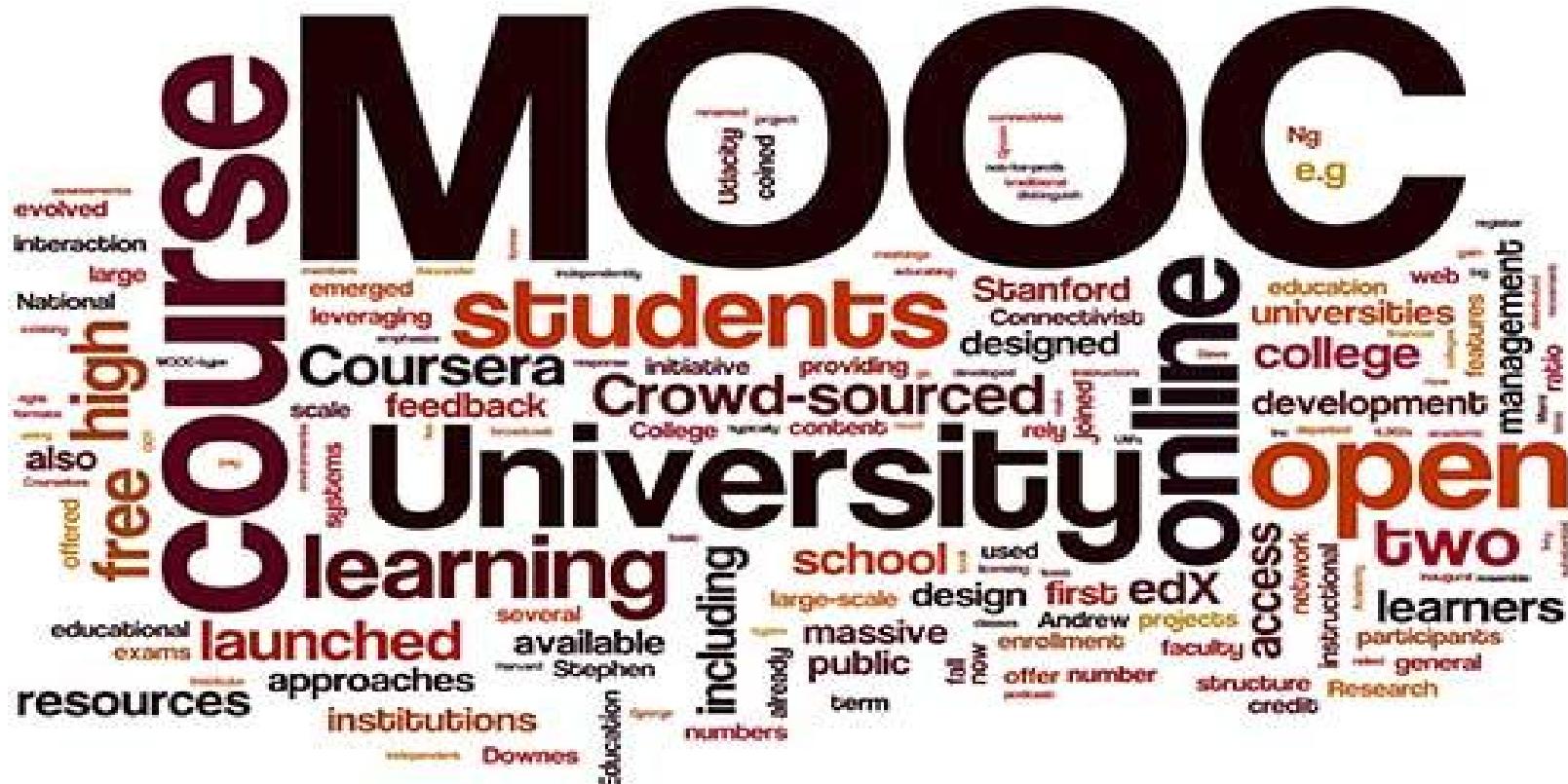
© 2005-2006 Fraunhofer IPSI, Darmstadt, Germany

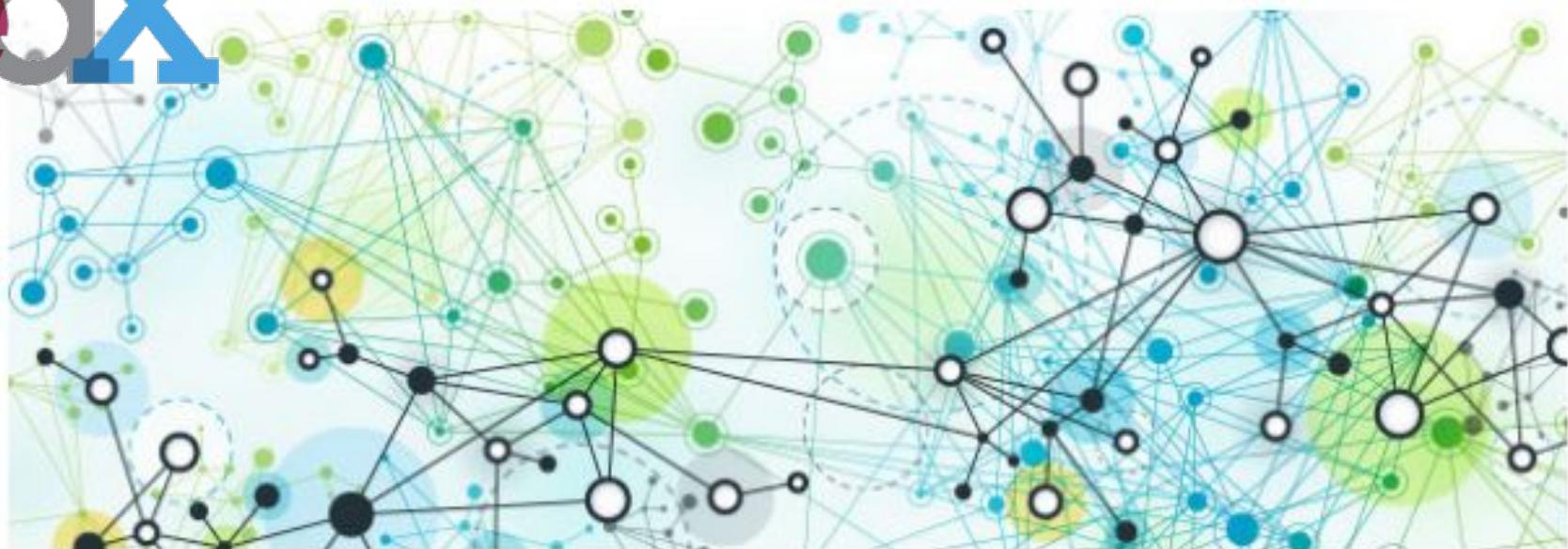
Facilitating Debate

- 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

	Macro	Micro
Dynamic	Type to enter text	Type to enter text
Static		

BAZAAR





Data, Analytics and Learning

An introduction to the logic and methods of analysis of data to improve teaching and learning.



Athabasca
University



COLUMBIA
UNIVERSITY

Carnegie
Mellon
University

Discussion

Student1 has joined the discussion. 8:10:33 PM

VirtualCarolyn 8:10:36 PM
In this collaborative activity, we will reflect on the use of Gephi for social network analysis with the Twitter and blog networks (Week 12) from the dataset provided in the course materials about the dataset for social network analysis. First, take a moment to introduce yourselves.

Student2 has joined the discussion. 8:10:41 PM

VirtualCarolyn 8:10:50 PM
When you've finished introducing each other, press the "We're Ready" button (or type "ready") to begin.

Student2 8:11:05 PM
Hi there, this is my first chat

Student1 8:11:20 PM
Me too, I joined the class late

Student1 has shared an image. 8:12:16 PM

Student1 has shared an image. 8:12:41 PM

Student1 8:12:52 PM
I pasted in a network visualization

We're Ready

Student2 8:13:09 PM
Himmmm

Student2 8:13:18 PM
I had trouble with the assignment, maybe you can help me

I

Send Message We're Ready

Information

Student1 8:12:16 PM

Student1 8:12:41 PM

Want to share an image? Paste its URL here!

Share Image URL

Week302

Collaborative interaction supported by a virtual agent

Prompt 1: In this collaborative activity, we will reflect on what you have learned about the field of learning analytics. First, take a couple of minutes to introduce yourselves.

Prompt 2: Now that you have viewed the videos, share what you found most interesting about learning analytics.

Prompt 3: Reflect on the structure of the dual-layer structure of the course. Describe your experience of coming to understand different course elements.

...

Prompt n: Now this activity has come to an end. Thanks for a great chat! Why don't you exchange contact information to stay in touch?



Positive Impact of Chat Participation on Dropout

Survival analysis

- students who made at least one attempt to participate in a chat during the first 6 weeks
- unit of analysis: each 2 day period

Dependent variable:

- drop = 1 on the last 2 day time window when at least one click was recorded (0 otherwise)

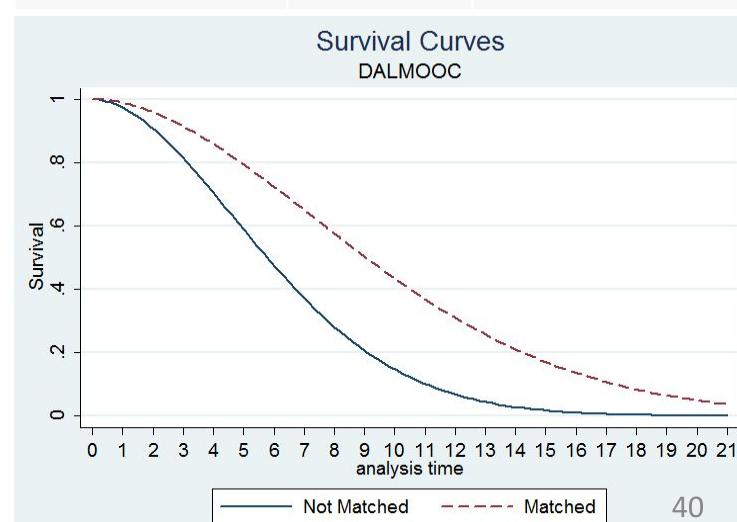
Control variables

- clicks on videos
- clicks on discussion forums

Independent variables:

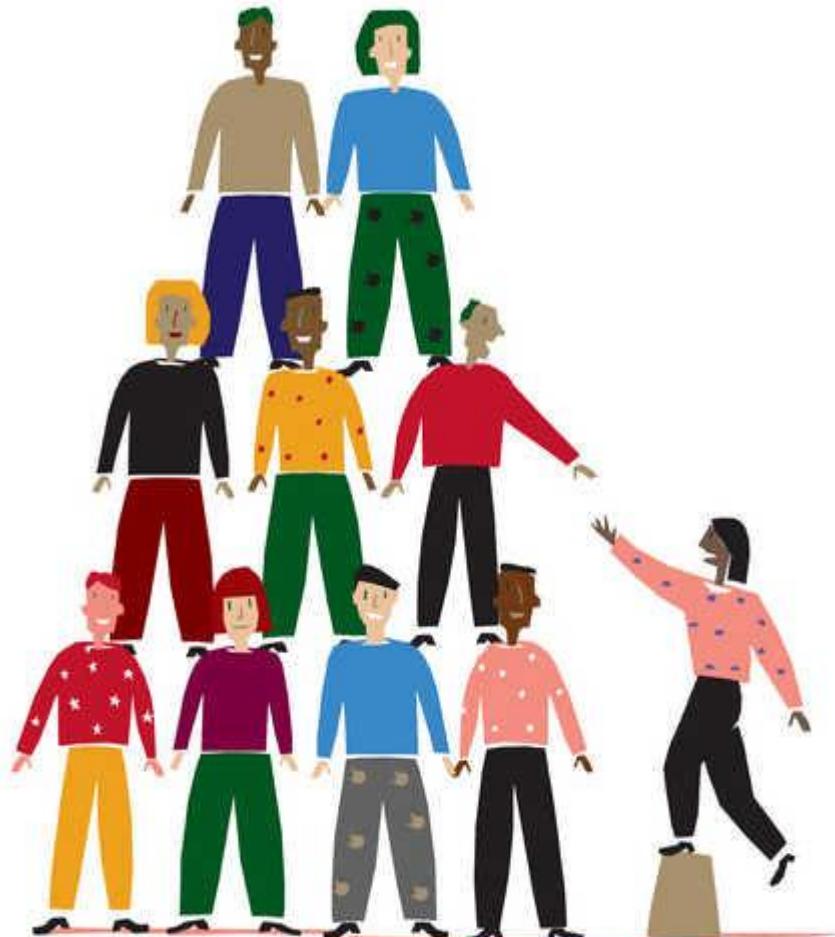
- attempts to be matched for a chat
- successful match (binary)
- interaction between Attempts and Match

Independent Variable	Hazard Ratio	P Value
Video Clicks	2.38	P < .0001
Forum Clicks	.51	P < .0001
Match Attempts	2.33	P < .0001
Match Success	.44	P < .01
Interaction between Attempts and Match	.76	P < .05



Two separate problems

Getting people into groups



Making the group work once it is formed



Getting people into groups

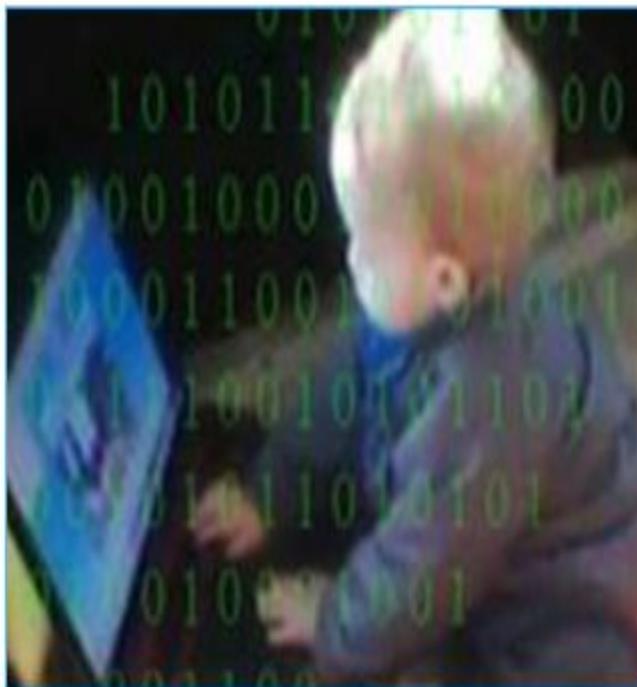
Single chat room for
multi party chat

Summarization of
ongoing discussion





BDE MOOC



Big Data in Education

Learn how and when to use key methods for educational data mining and learning analytics on large-scale educational data.

TEACHERS COLLEGE
COLUMBIA UNIVERSITY

Making the group work once it is formed

- Knowledge construction dialogues
- Academically Productive Talk moves
- Other facilitation moves like *consolidation*

Pilot studies in a fake meteorology course on edge edX for - *An Exploratory Study: Assisting Synchronous Chat in a MOOC through Agent Facilitation Moves*

WEATHER MOOC

- Watch a video on introductory concepts to meteorology
- Synchronous chat collaboration with a group of people and an agent
- Give a short quiz on the concepts

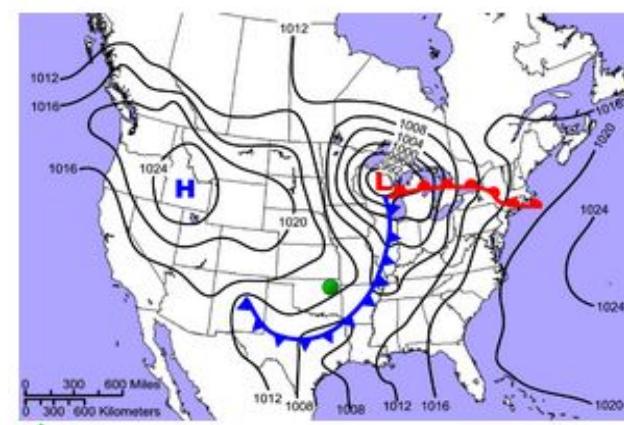
The screenshot shows a YouTube video player. The video content displays a diagram illustrating low pressure centers. It features a cloud icon with arrows indicating air spiraling inward, a red 'L' symbol with a clockwise arrow, a vertical blue arrow pointing upwards labeled 'PRESSURE', and a thermometer icon. Below the video player is a standard control bar with a play button, the text '2:53 / 2:53', a speed selector set to '1.0x', and other standard video controls.

DISCUSSION CHAT (EXTERNAL RESOURCE) (1.0 points possible)

[Chat Room](#)

IMAGE MAPPED INPUT (1/1 point)

Press the left mouse button over the area of the map above where you would expect to find the coolest temperatures.



[Check](#)

[Show Answer](#)

Discussion

VirtualCarolyn 8:16:51 PM

I noticed that you are talking about low pressure wind direction. If you want to check your knowledge on low pressure wind direction with me say 'LET'S DISCUSS ABOUT low pressure wind direction' and I will ask some questions on it.

Oliver 8:17:11 PM

LET'S DISCUSS ABOUT low pressure wind direction

Germán 8:17:11 PM

let's discuss about low pressure wind direction

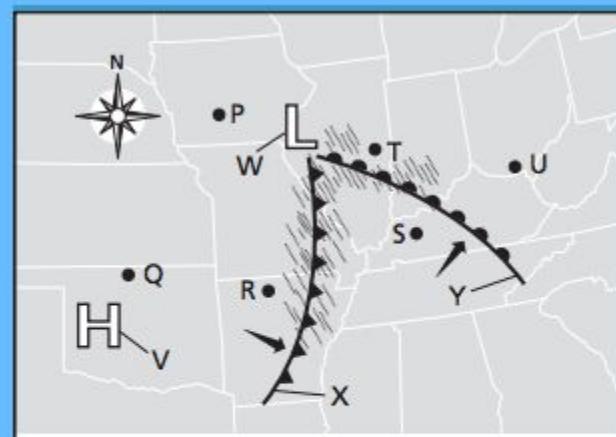
VirtualCarolyn 8:17:11 PM

Will you like to answer some questions related to low pressure and wind direction ?

Germán 8:17:15 PM

yes

Information



Key:

- ▲▲▲ Cold front
- Warm front
- Direction front moves
- L Low-pressure center
- H High-pressure center
- ▨ Precipitation
- Location

MEDICINAL CHEMISTRY

THE MOLECULAR BASIS OF DRUG DISCOVERY



produced by DAVIDSON X

in partnership with



NOVARTIS

INSTITUTES FOR
BIOMEDICAL RESEARCH

ongoing /

Agenda

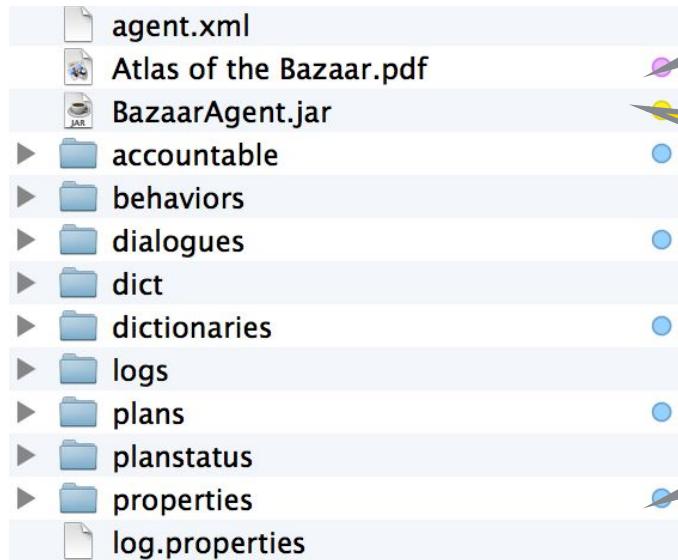
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Bazaar Activity

- Deploy an agent in a web chat server!
 - <http://erebor.lti.cs.cmu.edu/bazaar/BazaarAgent.zip>
 - **Activity::**
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!

Get the agent running!

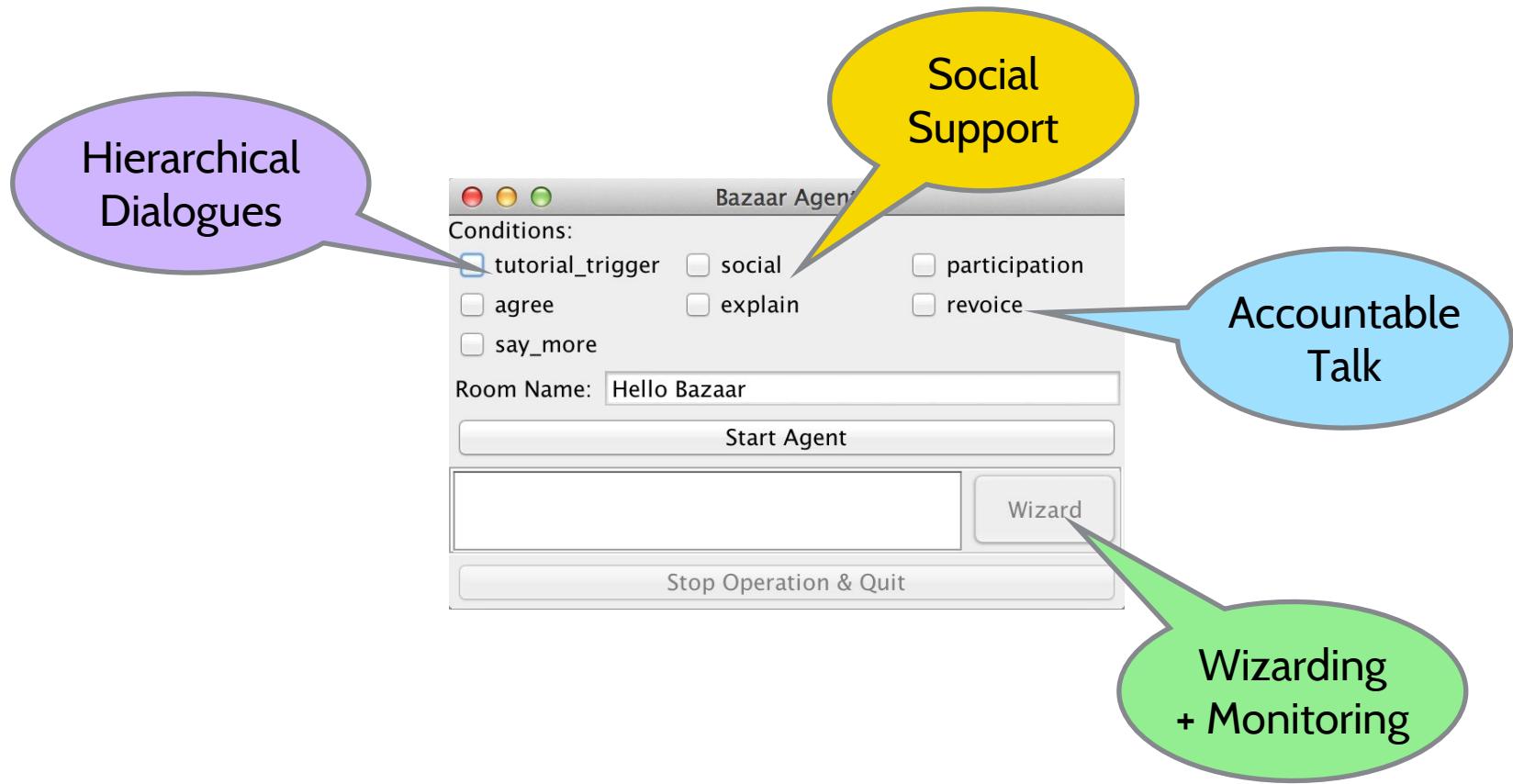


- Join your chat room via OLI: `bazaar..lti.cs.cmu.edu:80/chat/<your chat room name>/<your account id>`
- Double-click BazaarAgent.jar in the BazaarAgent folder.
- Enter `<your chat room name>` in the “Room Name” field
- Press the big friendly button!

•••••

Room Name:	<input type="text" value="Hello Bazaar"/>
<input type="button" value="Start Agent"/>	

What does it do?



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.*

.....

Questions?



gtomar@cs.cmu.edu
cs.cmu.edu/~dadamson/bazaar





