



# CSCL

## Computer-Supported Collaborative Learning

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# Networked Computing

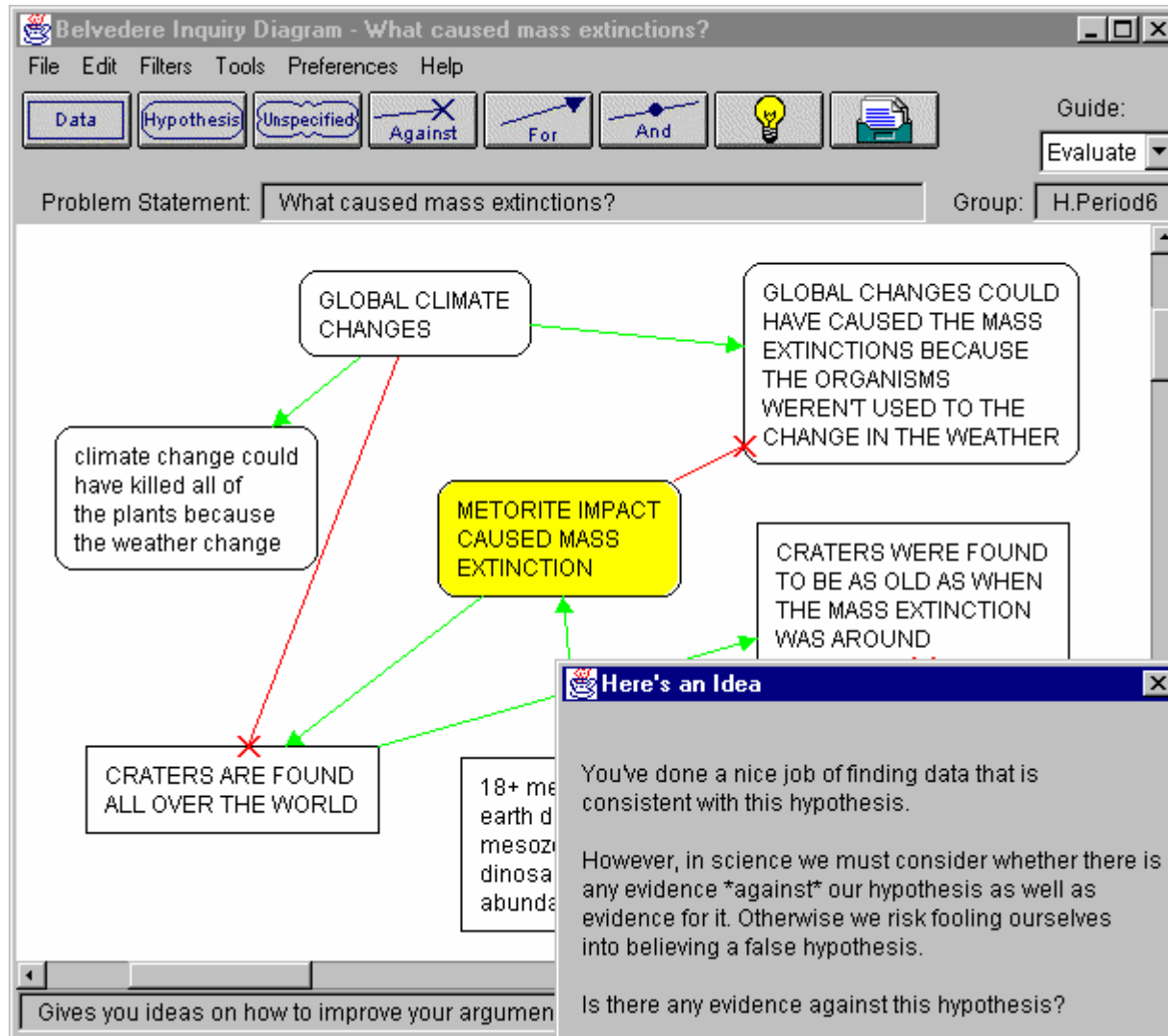
- Networked computing allows for new forms of collaborative learning, e.g.
  - synchronous distant collaborative learning  
i.e. distributed learning groups
  - synchronous face-to-face collaborative learning  
using electronic material
  - asynchronous collaborative learning
  - mobile and ubiquitous scenarios



# General Purpose Tools

- General purpose tools for mediating communication that are used for collaborative learning
  - Email
  - Chat tools
  - Instant messengers
  - Electronic bulletin boards
  - Application sharing tools
  - Simulations
  - Phone conferences
  - Video conferences
  - etc.

# Special Purpose Tool: Belvedere



# Special Purpose Tool: CoolModes

The screenshot displays the Cool Modes 2.04 software interface. The main workspace, titled 'Arbeitsbereich 1', contains a Petri net diagram with three places (S1, S2, S3) and two transitions (T1, T2). S1 and S2 are connected to T1, and T1 is connected to S2. S2 and S3 are connected to T2, and T2 is connected to S3. Each edge is labeled with the number '1'. The transitions T1 and T2 are labeled 'fire'.

An 'Add Plug-In' dialog box is open in the foreground, showing a list of available plug-ins:

- Discuss
- DrawPalette
- Functions
- Graphical Calculator for Products and Sums
- Moon
- Petri Nets
- QocReferenceFrame
- Stochastic Experiments
- System Dynamics
- Turtle

The right-hand panel features a 'Heading' oval, a red circle with the number '1.', and a yellow 'Annotation' box labeled 'Detailed'. Below this, the 'Edges' section includes icons for AgreeEdge, QuestionEdge, DisagreeEdge, and Delete Edge, along with a checkbox for 'only one edge'. A 'Preview' section at the bottom right shows a smaller version of the Petri net diagram.



# CSCCL Research

- *CSCCL research has the advantage of studying learning in settings in which learning is observably and accountably embedded in collaborative activity. Our concern, therefore, is with the unfolding process of meaning-making within these settings, not so-called “learning outcomes”. It is in this way that CSCCL research represents a distinctive paradigm within IT. By this standard, a study that attempted to explicate how learners jointly accomplished some form of new learning would be a case of CSCCL research, even if they were working in a setting that did not involve technological augmentation. On the other hand, a study that measured the effects of introducing some sort of CSCCL application on learning (defined in traditional ways) would not (Koschmann, 2001)*



# Knowledge Transfer vs. Knowledge Building

- Intelligent Tutoring System: **Outcome-oriented**
  - Initially, the system holds the knowledge
  - Finally, the student also has the knowledge
  - The knowledge is transferred to the student
- Collaborative Learning System: **Process-oriented**
  - Initially, the knowledge is distributed among the students
  - Finally, the students share the knowledge, or new knowledge is created, or knowledge has been consolidated
  - The students have improved their collaboration skills

# Knowledge Building Activities

<b>High-Level Task</b>	<b>Cognitive Processes</b>
BRAINSTORMING	Introducing of new ideas that relate to the topic or task and offer a perspective not previously considered.
ARTICULATING	Explaining complex or difficult concepts
REACTING	Provide an alternative or amplified perspective on a concept previously introduced by a student.
ORGANIZING	Assembling existing thoughts or perspectives in such a way that a new perspective emerges.
ANALYSIS	Comparing or contrasting previously articulated views or putting new understanding on existing data.
GENERALIZING	Taking comments or data already presented and extracting new information or knowledge that applies to a broader set of conditions.

Stahl (2000)



# Definitions of Collaborative Learning

- Collaboration is a “... a **coordinated**, synchronous activity that is the result of a continued attempt to **construct** and maintain a **shared** conception of a problem ”  
Roschelle and Teasley (1995)
- “The words ‘collaborative learning’ describe a **situation** in which particular forms of **interaction** among people are expected to occur, which would **trigger** learning mechanisms, but there is no guarantee that that the expected interactions will actually occur.”  
Dillenbourg (1999)



# Theoretical Underpinnings

- **Socio-constructivism**  
Learning is generated by an exchange of messages among individuals with different opinions (conflict). This social interaction produces a change in the mental state of the individual who transforms his representation of a given idea.
- **Socio-cultural approach**  
Learning is generated by the interchange between the inter-psychological level and the intra-psychological level. It is important that a "zone of proximal development" (Vygotsky, 1978) is established through full interactions, and conditions for mutual support are enhanced by developing interpersonal relationship among the participants.
- **Situated view**  
The environment is an integral part of the cognitive activity, and not merely a set of circumstances in which context-independent cognitive processes are performed.



# Types of Support for Collaborative Learning

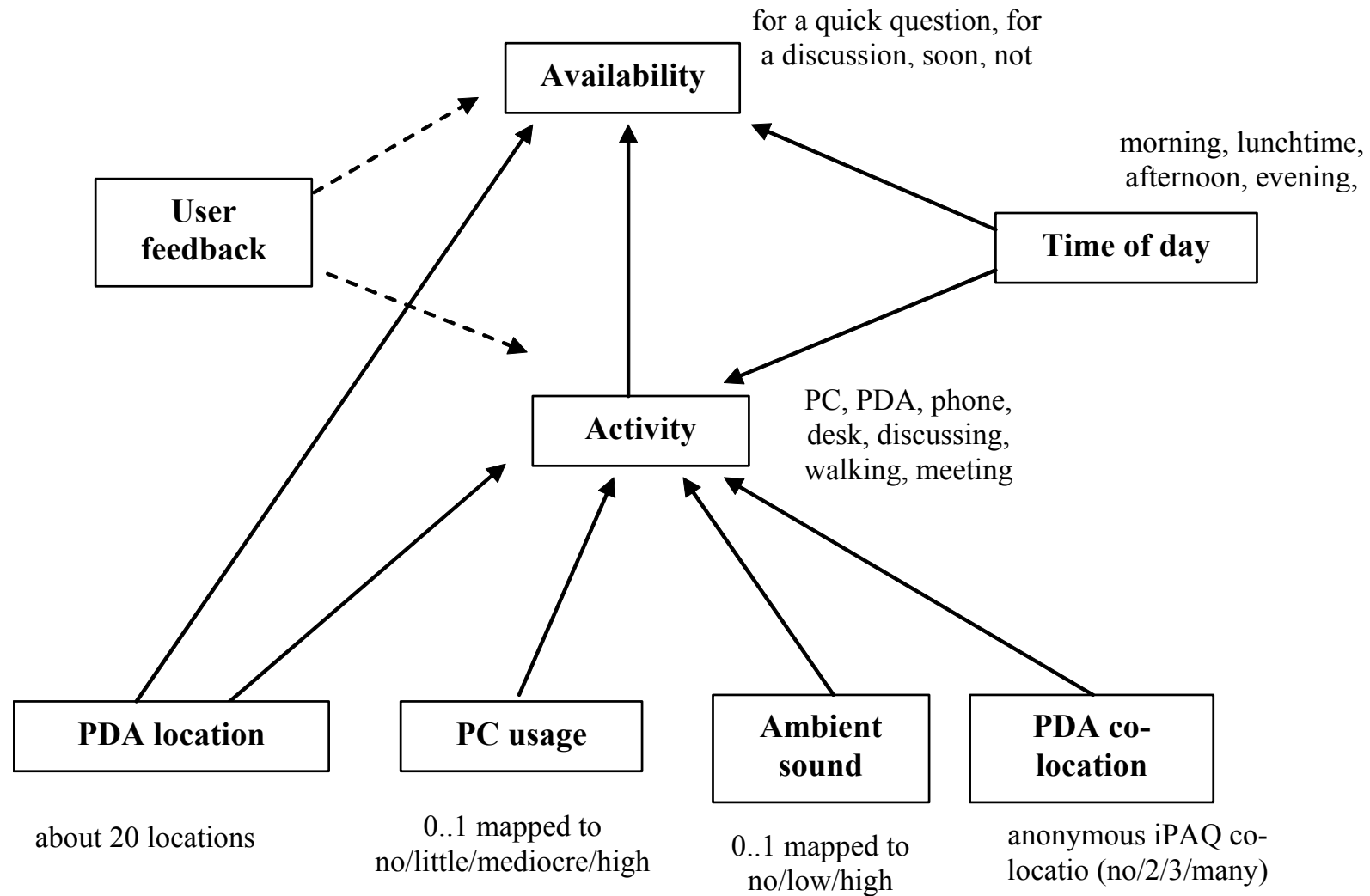
- Setting up initial conditions
- Over-specifying the collaboration contract with a scenario based on roles
- Scaffolding productive interactions by encompassing interaction rules in the medium
- Monitoring and regulating the interactions



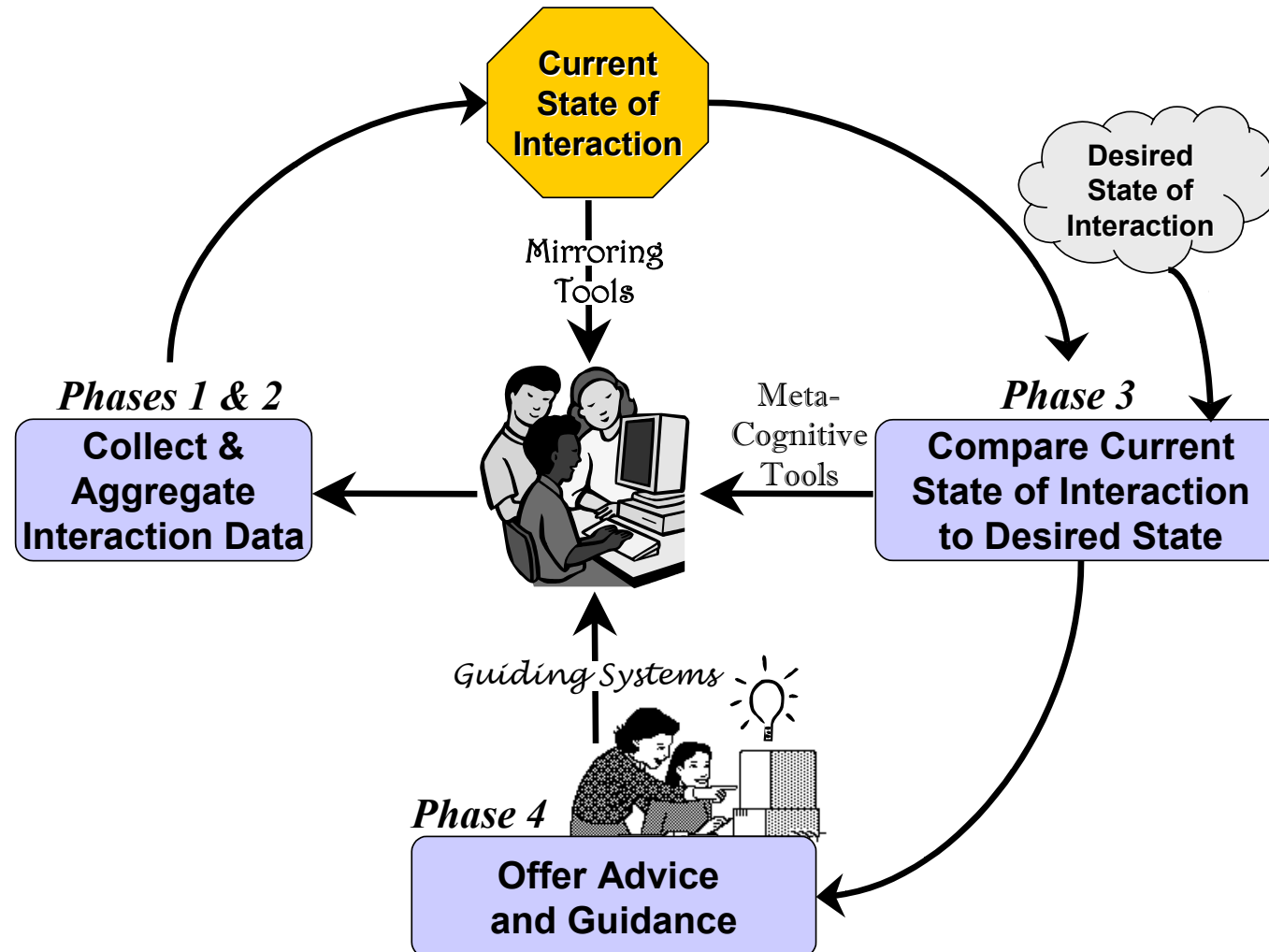
# Group Formation for Joint Problem Solving

- Given a number of students working on comparable problems in an open learning network
  - Find pairs of students that could potentially benefit from cooperation in a joint session.
    - $can\_help(Student1, Student2, Topic) \leftarrow$   
 $knows(Student1, Topic) \ \&$   
 $has\_difficulty(Student2, Topic).$
  - The selection can be based on such criteria as **complementarity** or **competitiveness**.
- Given a group of students
  - Select or generate a problem that forms an adequate challenge for the group as a whole.
  - The problem should not be solvable by one student's knowledge alone, but rather through the union of all the students' individual knowledge bases.

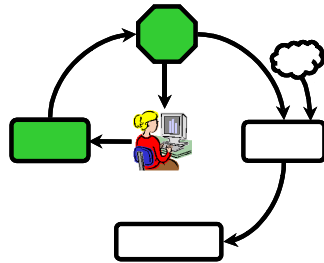
# Trained Bayesian Net for Contextual Parameters



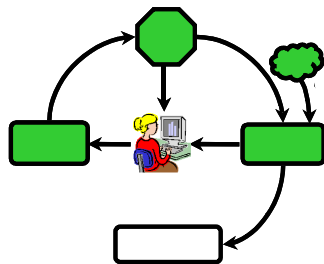
# Monitoring and Regulating the Interactions



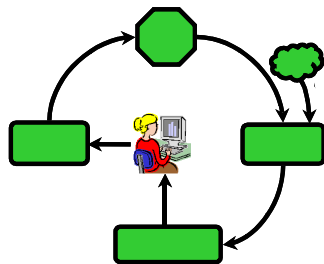
# Different Types of Support Tools



*Mirroring Tools*



*Metacognitive Tools*



*Guiding Systems*

- **Mirroring Tools**
  - collect and aggregate data about the students' interaction
  - reflect this information back to the user, for example, as graphical visualizations
  - raise students' awareness about their actions and behaviors
- **Metacognitive Tools**
  - display information about what the desired interaction might look like alongside a visualization of the current state of indicators
  - provide the referents needed by the learners or human coaches to diagnose the interaction
  - users of metacognitive support tools are responsible for making decisions regarding diagnosis and remediation.
- **Guiding Systems**
  - propose remedial actions to help the learners
  - the desired model of interaction and the system's assessment of the current state are typically hidden from the students
  - the system uses this information to make decisions about how to moderate the group's interaction

# Action-based Collaboration Analysis

The screenshot shows the 'Easy Discussing v0.1' interface. At the top, it says 'Coupling' and 'Easy Discussing v0.1 connected to test@expert6/7'. The main workspace contains several text boxes: 'Saturation', 'Hue', and 'Brightness' are connected by lines, suggesting a concept map. There are also text boxes with content: 'Hue: The perception of red, green, or blue colors depends on the wave length of light. We are able to differentiate between 200 tones.' and 'Idee (!) Let's first write down all the headlines.' A 'Discussion' window on the right shows a chat log with names like Martin, Bärbel, and marc, and their messages. Below the chat is a 'Feedback' section with a pie chart and a bar chart. The pie chart is divided into three segments (black, blue, cyan) and labeled with 'Bärbel', 'marc', and 'Martin'. The bar chart has three bars of the same colors, also labeled with 'Bärbel', 'marc', and 'Martin'. At the bottom, there is a 'Mode' section with 'drag mode' selected and 'line mode' unselected. A 'Palette' section has a text field and four category fields labeled 'Idee (!)', 'Frage (-)', 'Pro (+)', and 'Contra (-)'. A 'Visualizations' section has a pie chart and a bar chart. A 'Feedback' section has a visualization of tallied user contributions.

New cards can be dragged into the workspace & individually labeled (drag mode)

Bird's Eye View Schematic overview of entire workspace

Discussion Contributions are automatically marked with author's name

Input Users type and mark contributions here (using IBIS notation, (?!,+,-)

Feedback Visualization of tallied user contributions in discussion and workspace (Each user is assigned a different color)

Visualizations Pie charts & histograms

Mode Switch between drag and line mode

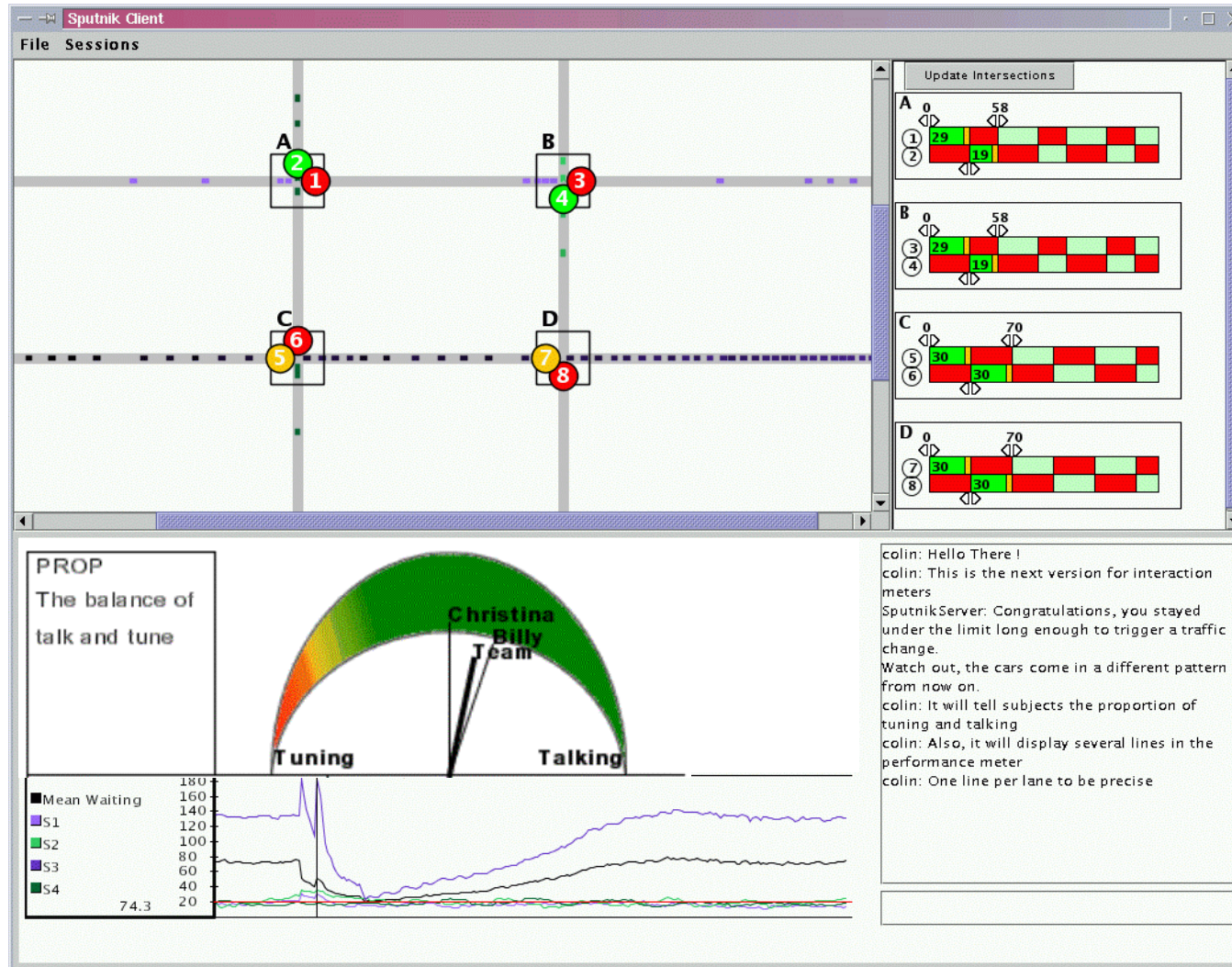
Palette A basic text field and 4 category fields (?!,+,-)

# Prompts

The image shows a screenshot of a collaborative software interface for creating Entity-Relationship (ER) diagrams. The interface is divided into several sections:

- Left Sidebar:** Contains navigation and user management options such as "Suggestions", "ER Data Modeling", "Change Problem", "ER Help", "Star Wars", and "Teammates" (listing "Cristal" and "Ruben"). It also has "ask/take pencil" and "leave pencil" buttons.
- Problem Description:** A text area at the top center containing the text: "El municipio de Monterrey ha adquirido todas las líneas de camiones para implantar un servicio muy eficiente de camiones urbanos, controlado por el municipio. Usted ha sido asignado para construir el modelo de datos (diagrama Entidad-Relación) que soportará a este servicio tomando en".
- Our Groupwork Area:** A workspace where a diagram is being built. It shows a relationship "realiza" between entities "RUTA" (1) and "VIAJE" (N). A callout "Feedback from Coach" points to this relationship. A "Shared Group Workspace" callout points to the diagram area.
- My Work Area:** A workspace for individual work. It shows a more complex diagram with entities "RUTA", "PUNTO-DE-CONTROL", "CHOFER", and "SALIDA". Relationships include "realiza", "se ofrece", and "es asignada". A callout "Private Individual Workspace" points to this area.
- Opinion Area:** A section with three buttons: "OK" (Total Agree), "NOT" (Disagree), and "?" (Not Sure).
- Chat Area:** A text-based communication window at the bottom right. It contains a chat log with messages from "Coach" and "Ruben", and a "Send Message" button.

# Graphical Visualization of Interaction Parameters



# Sentence Opener Communication Interface

- Interaction Types
  - Request
  - Inform
  - Motivate
  - Task
  - Acknowledge
  - Discuss
  - Maintenance
  - Mediate

The screenshot displays the 'Comet: A Collaborative Object Modeling Environment' window. The main workspace shows an Object Modeling Technique (OMT) diagram with two classes: 'employee' (yellow box) and 'company' (red box). A line connects them with the label 'works for'. A text box above the diagram contains the following text: 'Example Exercise: Prepare a diagram using the Object Modeling Technique (OMT) showing relationships among the following object classes: employee, company, office, library, work contract, computer, supplies.'

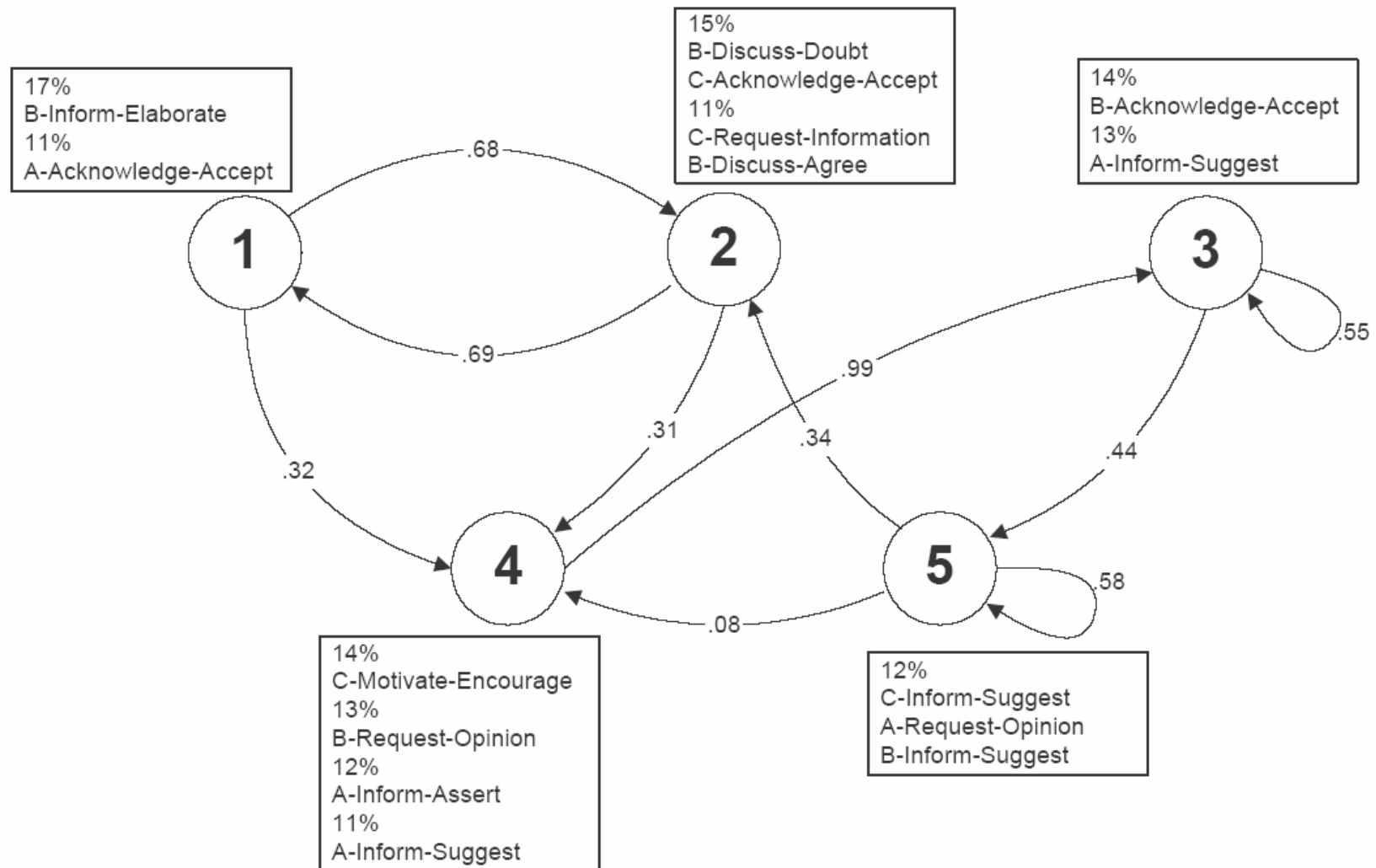
Below the workspace is a communication interface. It includes a 'Request' section with options like 'Do you think', 'Can you explain why/how', 'Do you know', 'Please show me', 'Can you tell me more', and 'Why do you think that'. There is an 'Inform' section with options like 'I think', 'Perhaps we should', 'To elaborate', 'I'm reasonably sure', 'Let me explain it this way', 'To justify', and 'Also'. A 'Motivate' section has buttons for 'Good Point' and 'Very Good'. A 'Task' section has buttons for 'Are you ready', 'To summarize', 'Let me show you', 'OK. Let's move on', and 'Goodbye'. An 'Acknowledge' section has buttons for 'OK', 'Yes', 'No', and 'Thank you'. A 'Discuss' section has buttons for 'But we need to consider', 'I agree because', 'Yes, I agree', 'I disagree because', 'Alternatively', 'Therefore', 'If ... then', 'I'm not so sure', and 'Both are right in that'. A 'Maintenance' section has buttons for 'Excuse Me' and 'Right?'. A 'Mediate' section has a button for 'Let's ask the teacher'.

The communication interface also features a 'Current Discussion' window with a list of messages and two small portrait photos of participants. The messages are:

1. << Alan is joining the conversation ! >>
- Alan : Are you ready to start?
2. << Amy is joining the conversation ! >>
- Amy : Yes Let's begin
3. Alan: OK
4. Alan: I think we should make classes employee and company
5. Alan: Also we should associate them so employees can work for companies

Below the list, there is a text input field containing: '{Re Line 4} Please show me how to do this'

# Trained Hidden Markov Model for Effective Knowledge Sharing



# Knowledge Sharing Interactions

## General Explanations for Each Effective Group

<b>Group A<sub>e</sub></b>	<b>Group B<sub>e</sub></b>	<b>Group C<sub>e</sub></b>
1. Receiver requests information about KE	1. Receiver requests information about KE	1. Sharer explains or illustrates KE
2. Sharer provides explanation	2. Sharer provides explanation	2. Receiver motivates / encourages
3. Receiver agrees	3. Receiver requests further clarification	
	4. Sharer provides further clarification	

## General Explanations for Each Ineffective Group

<b>Group A<sub>i</sub></b>	<b>Group B<sub>i</sub></b>	<b>Group C<sub>i</sub></b>	<b>Group D<sub>i</sub></b>
1. Sharer proposes KE	1. Sharer attempts to explain KE	1. Sharer proposes KE	1. Receiver requests explanation of KE
2. Sharer explains or gives instructions for action	2. Receiver acknowledges	2. Receiver doubts	2. Sharer explains poorly (no further discussion)
3. Receiver acknowledges or requests confirmation			