Chapter 7: Social Cognition
CS-411: Digital Education & Learning Analytics

- ✓ Behaviorism
- ✓ Constructivism
- **Socio-cultural theory**
- ✓ MOOCs
- ✓ DataViz
- ✓ Learning Analytics

Orchestration Graphs

- Exam
- Project

Last year questions are in moodle
Cognitive conflict is the key learning mechanism for constructing knowledge structures.

A learning environment allows the student to learn by trial and error, but needs to provide guidance.

MicroMondes Simulations
Learning Theory

- Behaviorism
- Constructivism
- Socio-cultural theory

Learning Technology

- Lesson (eLearning)
- Exploratory environment

?
1. In a group includes students with different levels of knowledge:
   - The lower students will learn from the explanations provided the better students
   - The better students will learn from explaining the task to the lower students
   - None of them will learn well because the difference of levels
   - Both will learn to work in heterogeneous teams, which is socially important

2. If a group includes students having opposite opinions or conflicting knowledge, will collaborative learning be effective?
   - No, because there will be a negative team spirit
   - No, because the student with incorrect knowledge might convince the one who had the correct knowledge
   - Yes, because this will force them to argue with each other and to elicit their knowledge
   - Yes, because they will learn to collaborate in conflict situations

3. When forming groups of students, what is the best way of combining men and women:
   - Separating them because their differences might prevent them to focus on knowledge
   - Mixing them because differences of collaboration style might increase the group effectiveness
   - Mixing them because they will have to collaborate in mixed groups in their professional life

4. What is the primary role of computers in collaborative learning?
   - Communication tools (chat, forum, …) enable teamwork at distance
   - Collaboration software can be designed to influence collaboration
   - Internet provides students with the knowledge they don't have in the team
   - It is important that students learn to collaborate in teams distributed worldwide
Mastery learning

Individualisation

# kids > # computers (late 90’s)

Collaboration

Socio-Cultural Theories
Is learning in teams more effective than learning alone?
Question 1: Is Collaborative Learning Effective?

<table>
<thead>
<tr>
<th>Learning Gains</th>
<th>&gt;</th>
<th>=</th>
<th>&lt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meta-analyses: collaborative versus individual</td>
<td>&gt;</td>
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<td>&lt;</td>
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<tr>
<td>Slavin, 1983.</td>
<td>26</td>
<td>14</td>
<td>1</td>
</tr>
<tr>
<td>Johnson &amp; Johnson, 1989</td>
<td>829</td>
<td>645</td>
<td>109</td>
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</tbody>
</table>

Thanks to Fabrizio Butera

A decision maker could conclude that the probability that team learning is effective is high enough to use it.

A scientist would instead conclude that team learning is not effective per se, but depends on the conditions... see next slide.
Question 2: When is collaborative learning effective?

Factors:
- **Group** composition: number, level, gender, age, …
- **Task** features: verbalizable, open, …
- **Medium**: face-to-face, synchro/not, text/audio/video, …
- **Context**: school/work

The effects of collaborative depends upon so many variables (plus their interaction effects) that it is impossible to predict that a given teamwork in a specific context will be effective.
Question 3: Which interactions make collaborative learning effective?

1. Elaborated explanations
2. Conflict resolution, Argumentation / Négociation
3. Mutual Regulation

Collaborative learning occurs when team members engage into the ‘productive interactions’ listed above. These interactions are summarized as “the effort” that team members engaged to reach and maintain a shared understanding of the task.
The effort to reach a shared understanding increases as the degree of divergence decreases from \( \Delta_1 \) to \( \Delta_2 \) and then further decreases from \( \Delta_3 \). This can be visualized as a curve indicating the progression from random pairing to today's pairing and finally to (pseudo) agreement.
Question 4: Which design increases the probability that teams produce the interactions that make collaborative learning effective?
Conditions of coll. learning → Interactions
(proactive) (reactive)
STRUCTURE (self-) REGULATE → Effects
Self-regulation Tools
Example of domination in teamwork
Self-regulation Tools

Reflect Table

• K. Bachour, F. Kaplan, W. Hokenmeier
Reflect
“When I noticed that my LEDs weren’t lit indicating my inactivity, I felt frustrated.”

“I sometimes refrained from speaking to avoid having a lot more lights than the others. This obliged me to listen to the others.”
Khaled Bachour, Frédéric Kaplan, Jean-Baptiste Haué, Quentin Bonnard, Wolfgang Hokenmaier

**Self-regulation Tools**

**T-Test:**

$t = 2.176, \ p = 0.036$
Self-regulation Tools

Report

Individual Speaking Time

Individual Arousal

Group Speaking Time

Turn Takings

13.05.2011

09:46 - 10:38

Flaviu Roman
Conditions of coll. learning → Interactions → Effects

(proactive) STRUCTURE

(reactive) REGULATE

SCRIPTS

Semi-Structured Interfaces
Belvedere (Suther et al.)

Graphical Interfaces
Semi-Structured Interfaces

Baker & Lund
Fischer & Weinberger

Semi-Structured Interfaces

Task information and timer

Scripted discourse

Learning environment orientation map

Case information
Multi Input Devices: the participation of each learner is “designed” because each mouse only access some screen functions.
Multi Input Devices: the participation of each learner is “designed” because each mouse only access some screen functions.

M. Nussbaum, UC Chile
“Computer-supported collaborative learning” (CSCL)

1990-2000: Technologies **enable** collaboration

2000-2010: Technologies **shape** collaboration (design)
Pedagogical scenario for increasing the probability that interactions X, Y, Z occur in teamwork.
Today we used a script “ArgueGraph”
Collaboration Script: Pedagogical scenario for increasing the probability that interactions X,Y,Z occur in teamwork.
“Jigsaw”

- Task: How to prevent a large earthquake?
- Roles:
  - Maire of San Francisco
  - Insurance agent
  - Security officer
  - Geologist
- Context: Previous experiments in Denver

In the Jigsaw script, every team member receives a subset of the information necessary to solve the task. This task cannot be solved without the contribution of each individual.
Jigsaw

Phase “Groups”

Phase “Experts”
CSCL Script 2

Class

Intro

Task groups

a1

Team

a2

a2a

a2b

a2c

a2d

Expert groups

a3a

a3b

a3c

a3d

Decision

Debriefing

a4

a5

Roles

Individual
Grid

Place the concepts below on your grid to define the link between two concepts to define their similitude or difference with the help of other members. You might change the concepts place to define other relations.

"Democracy" vs "Election"

Relationship: Similar

Comments: Democracy is a form of government in which it is recognized that ultimate authority belongs to the people, who have the right to participate in the decision-making process called elections, to appoint and dismiss their rulers.
This script concerns declarative knowledge; namely, domains where students have to acquire a certain number of concepts and relate them to each other. Each team has to build a concept grid—a sort of concept map. Each team is composed of several roles (the number of roles can be determined by the teacher) and each role necessitates reading several papers (the number of papers can be determined by the teacher) that correspond to the selected role. Typically, a student will play the role “Piaget” by reading papers from Piaget. Each student selects a role that has not yet been selected by another team member, and the system simply distributes readings assigned to each role. Then, when each student has learned about a subset of concepts, the team has to build a grid in such a way that students can define (text entry) the relationship between two grid neighbor concepts. The way in which concepts are distributed among team members will determine who explains which concepts to whom in the grid construction activity.
DockLamp

A concept map

Holding a concept

Creating a link

Deleting a link

Deleting using paper

Deleting using fingers

Son Do Lenh
Post-test: The cool interface led to lower learning outcomes because there was no need for negotiation.

No effect in Learning Gain

- $\mu_{\text{COM}} = 25.63$, $\mu_{\text{TAN}} = 21.88$,
- $t(14) = 1.24, p > .05$, two-tailed

More Learning From Partners for Computer

- $\mu_{\text{COM}} = 13.63$, $\mu_{\text{TAN}} = 9.13$,
- $t(14) = 2.40, p < .05$, two-tailed

Son Do Lenh
The effort to reach a shared understanding
Mastery learning

Individualisation

# kids > # computers

Socio-Cultural Theories

CSCL
“Every function in the child's cultural development appears twice: first, on the social level, and later, on the individual level; first, between people (interpsychological) and then inside the child (intrapsychological). This applies equally to voluntary attention, to logical memory, and to the formation of concepts. All the higher functions originate as actual relationships between individuals.”

Lev Vygotski
(1896-1934)
Side ? Time ? ok

Is this North-East?

What time is it?

Not that way

No

10:30

Side ? Time ? ok

Internalisation
We internalise social interaction because thinking is a dialogue with oneself.
The zone of proximal development (ZPD) has been defined as "the distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance, or in collaboration with more capable peers" (Vygotsky, 1978, p. 86).
Multiple Sclerosis News

Select article from list below.

Page 1 of 6.

1. Emotional response to music can reduce pain, suggests Montreal study
   Jan. 13, 2005

2. BioMS Medical receives approval for key multiple sclerosis trial in Britain
   Dec. 10, 2004

Take control of your health. Subscribe to Multiple Sclerosis Monthly Newsletter for FREE!

Preferred Format: HTML

I have read and accept terms of the Privacy Policy.

Email: [Enter email] Sign up!

3. FDA approves new drug to treat multiple sclerosis
   Nov. 24, 2004

4. Popular MS drug may lack evidence
   Nov. 22, 2004

5. Jury begins deliberations in three-week assisted suicide trial
   Nov. 3, 2004

6. Medical users spurning new batch of 'stronger' Health Canada marijuana
   Jul. 12, 2004

7. U.S. Medicare lottery favours some, others must wait until 2006
   Jun. 25, 2004

8. Bayer bids to market marijuana-based multiple sclerosis treatment in Canada
   May. 11, 2004

9. Alberta Tories, families question adequacy of $555 monthly disabled income
   May. 9, 2004

10. Researchers set out to identify triggers for multiple sclerosis
    May. 5, 2004

11. Nearly a third of legal marijuana users reject government pot
    Apr. 29, 2004

12. Sick Kids researchers show strong association between MS, Apr. 20, 2004

13. Patients_paths_for_childcare
    Apr. 19, 2004

14. FDA approved drug for MS
    Apr. 16, 2004

15. Multiple sclerosis severity linked to depression
    Apr. 16, 2004

16. Study: Multiple sclerosis drug can help reduce pain
    Apr. 15, 2004

17. Oregon to let some dying patients seek assisted suicide
    Apr. 15, 2004

18. Medical marijuana users spurn 'stronger' batch of drug
    Apr. 14, 2004

19. Patients paths for Medicaid
    Apr. 14, 2004

20. Disappearing with Medicare: Multiple sclerosis patients wait for care
    Apr. 14, 2004

21. New drug to treat multiple sclerosis
    Apr. 14, 2004

22. U.S. Medicare lottery favours some, others must wait
    Apr. 14, 2004

23. Study: Multiple sclerosis may be more common
    Apr. 14, 2004

24. FDA approves new drug to treat multiple sclerosis
    Apr. 14, 2004

25. Oregon to allow dying patients to seek assisted suicide
    Apr. 14, 2004

26. Medical marijuana users spurn 'stronger' batch of MS drug
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27. Disappearing with Medicare: Multiple sclerosis patients wait for care
    Apr. 14, 2004

28. New drug to treat multiple sclerosis
    Apr. 14, 2004

29. U.S. Medicare lottery favours some, others must wait
    Apr. 14, 2004

30. Study: Multiple sclerosis may be more common
    Apr. 14, 2004
The social structure of a knowledge community is not flat

(Dutch policemen in charge of drugs)

Social Network Analysis
Online Learning Communities

- Visitor (no stable identity)
- Novice (learns how to integrate)
- Regular (comfortably participating in community life)
- Leaders (keep the community running)
- Elders (long-time regulars and leaders who share their knowledge and pass along the culture)

Learning a culture by participation

Mastery learning

MOOCs

Socio-Cultural Theories

Individualisation

Adapating speed; selecting exercises, …

Collaboration

Forums, concept maps, …
Summary of chapter 7

1. Collaborative learning is often effective, but not systematically.

2. It is effective when rich interactions occur such as explanation, argumentation, mutual regulation.

3. To make it more effective, the technology or the script increases the necessity for students to produce these interactions.

4. The theory behind emphasizes that cognition is inherently social because thinking mostly relies on language.
Orchestration Graphs (CS411- Chapter 10)

G = (V, E) where  E= V X V
V = \{a_i\} | a_i: t^s, t^e, \pi, object, product, \{c\}, traces, \{metadata\}
E = \{ e_{ij} \} | e_{ij}: (a_i, a_j, \{operators\}, \{controls\}, label, weight, elasticity)