Chapter 2:

Orchestration Graphs

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Collaboration Script: Pedagogical scenario for increasing the probability that interactions X,Y,Z occur in teamwork.
Pedagogical scenario.

The teacher begins by giving a 20-minute lecture, followed by a 20-minute problem solving task on computers, where the automatic grader accepts several correct solutions.

After a pause, those who did not find any solution follow a longer lecture.

The other learners are divided into groups formed with individuals who elaborated different correct solutions. They are asked to rank their solutions from the most suitable to the least.
A script is a sequence of activities...

\{a_i\} | a_i: t_s, t_e, \pi, \text{object, product, } \{c\}, \text{traces, } \{\text{metadata}\}
An **integrated** learning scenario is a sequence of activities located at **different social planes**.

**Social Planes**

- **Class**
  - Reflect: $a_2$
  - Debriefing lecture: $a_4$

- **Team**
  - Argumentation: $a_3$

- **Individual**
  - Reply: $a_1$
  - Write summary: $a_5$
\{a_i\} | a_i: t^s, t^e, \pi, object, product, \{c\}, traces, \{metadata\}
Social planes

- Individual plane (intra-psychological plane): students work on a task by themselves.
- Group plane (inter-psychological plane): students work in teams. They are assigned a joint task to achieve.
- Class plane (social plane): the activity involves all the students in the class. The concept of class is used in a broad sense (e.g. MOOC participants).
- Periphery plane: activities involve actors who do not belong to the class, but have a stable educational relationship with it: the director, other teachers, other classes, parents, …. They typically have a log-in.
- Community plane: activities engage temporary actors from the community, such as a museum guide, a butcher, an expert in astronomy…. The “community” around a class is the set of people who have occasional interactions with the class.
- World plan: activities include disseminating information via the Internet, radio, publications, exhibitions, feedback on online objects (e.g., “likes” or forum postings), etc.

This arbitrary segmentation corresponds to widespread educational practices.
Remarks

• A plane does not describe the individual cognitive processes, but the social structure of activities (e.g. individual reasoning at $\pi_3$)

• A plane does not necessarily correspond to a physical space or to a virtual space (but it sometime does)

• The notion of plane does not correspond to the notion of scale: 1,000 students may do exercises individually ($\pi_1$), while 10 students may listen a lecture ($\pi_3$).
An integrated learning scenario: education is not a religion, a designer does not need to choose or belong to a theory, but simply select the most relevant learning activity for the learning objectives.

Skinner (Chapter 4)  Piaget (Chapter 5)  Vygotsky (Chapter 6)
“integrated” in the pedagogical meaning: the activities make a consistent pedagogical whole.

“integrated” in the technical meaning: the data produced by an activity are reused by other activities; they are connect by operators.
An orchestration graph is defined by a set of Vertices and a set of Edges that connect vertices

$$G = (V, E) \text{ where } E = V \times V$$

$$V = \{a_i\} \mid a_i: t^s, t^e, \pi, \text{ object, product, } \{c\}, \text{ traces, } \{\text{metadata}\}$$

$$E = \{e_{ij}\} \mid e_{ij}: (a_i, a_j, \{\text{operators}\}, \{\text{controls}\}, \text{ label, weight, elasticity})$$
A sequence of operators constitute a workflow

« A workflow consists of an orchestrated and repeatable pattern of business activity enabled by the systematic organization of resources into processes that transform materials, provide services, or process information. It can be depicted as a sequence of operations, declared as work of a person or group, an organization of staff, or one or more simple or complex mechanisms ». (Wikipedia)
Workflows have been designed for automating bureaucratic processes such as processing insurance claims.

(Last week, it was operated manually.)
The goal of this formalizing pedagogical scenarios is to bring at large scale rich scenarios that are seem difficult to be scaled.
Let’s try this scenario for a geology MOOC…

(A₁) Introductory lecture on erosion

https://www.youtube.com/watch?v=B3iDcDGqFG8
Let’s try this scenario for a geology MOOC…

(A_2) Please upload 3 pictures of erosions

http://www.yorkccd.org/erosion-and-sediment-control/

http://www.maine.gov/dep/land/erosion/
Let’s try this scenario for a geology MOOC…

(A₃) Lecture on types of erosion

http://www.detectingdesign.com/geologiccolumn.html
20’000 students
X 3 pictures
/ 2 (Filter automatically very bad pictures)

= 30’000 pictures
(A₄) Answer 3 questions (teams of 2)

Workflows?

Is it geological erosion or accelerated erosion?

Is it geological erosion or accelerated erosion?

Which one illustrates the best erosion?
Geological erosion

Accelerated erosion
Select top 5% pictures

- 500 Geological erosion
- 600 Accelerated erosion
Let’s try this scenario for a geology MOOC…

(A5) Debriefing lecture by HangOut on different types of erosion

http://bnnovation.com/tag/google-hangouts/
Draw the orchestration graph, with the workflow

\( (A_1) \) Introductory lecture on erosion

\( (A_2) \) Please upload 3 pictures of erosions

\( (A_3) \) Lecture on types of erosion

\( (A_4) \) Answer 3 questions (teams of 2)

\( (A_5) \) Debriefing lecture by HangOut
Op1
Op2
Op3
## Library of Graph Operators

<table>
<thead>
<tr>
<th>Aggregation</th>
<th>Distribution</th>
<th>Social</th>
<th>BackOffice</th>
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<tbody>
<tr>
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<td>(B) Updating</td>
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The graph G = (V, E) is defined as follows:

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)

**Pedagogical idea**

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**Workflow**

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<td>(S+) Identity</td>
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**Learning Analytics**
Why is $a_i$ necessary for $a_j$?

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Orchestration Graphs

1. Home-made model, not an established theory
2. Modeling rich pedagogical scenarios in order to bring them at scale
3. Pedagogy is hidden inside technology, e.g. changing an operator changes the pedagogical idea
4. A model is a simplification of the reality; this model does not capture the affective side of learning
5. It does not only apply to learning technologies, but to any situation