Methodology of Research for ICT Based Learning Environments

Survival Kit

Salzburg
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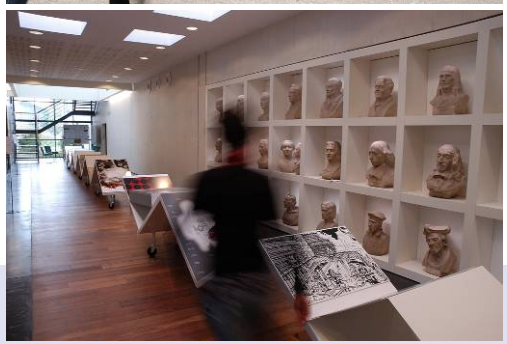
INSTITUT NATIONAL
DE RECHERCHE
PÉDAGOGIQUE

UNIVERSITÉ DE LYON

National Institute for Educational Research

- **Research**
- Expertise
- Teacher training
- Teaching Ressources



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Outline

- 3 Paradigms for Researchers…
- 3 Examples of Research at INRP
- Design-Based Research
- The Triangle of Bermuda of Data
- Conclusion, Important Questions to Address for Researchers

Context: Technologies & Education

New York Times No. 306-NT-520A-6 in National Archives

"To-day's Aerial Geography Lesson"

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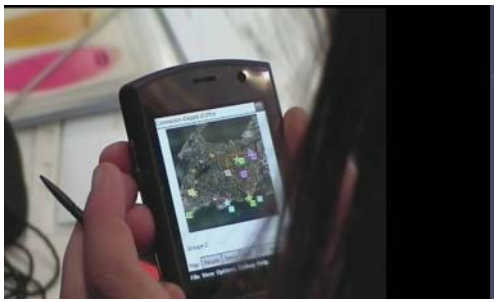
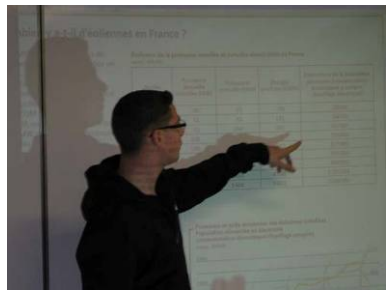
Learning Situations…











ICT-based learning situations are **rich, complex and changing environments**

The Need for a Systemic Approach…

…that leads to methodological difficulties

Criticisms Addressed to Researchers

- A “credibility gap”
- Not able to generalize a particular success or a laboratory insight
- Not creating usable knowledge

A tension between the desire for locally usable knowledge on the one hand, and scientifically sound, generalizable knowledge on the other (Sandoval, 2004)

3 Paradigms for Researchers…

1. Nomothetic

- Search for regularity
- Confirm or infirm
- Based on proofs and comparisons
- The need for simplification and reproductability

… the difficulty to implement such methodology for complex learning situations

2. Pragmatic

- Search for feasibility
- Linked with pedagogical innovation
- Aims at producing knowledge for action
- For practicionners

… how to keep a distance between reflexion and action?

3. Hermeneutic

- Search for significance
- A theoretical construction to understand what is observed
- Extracting the internal coherence of learning

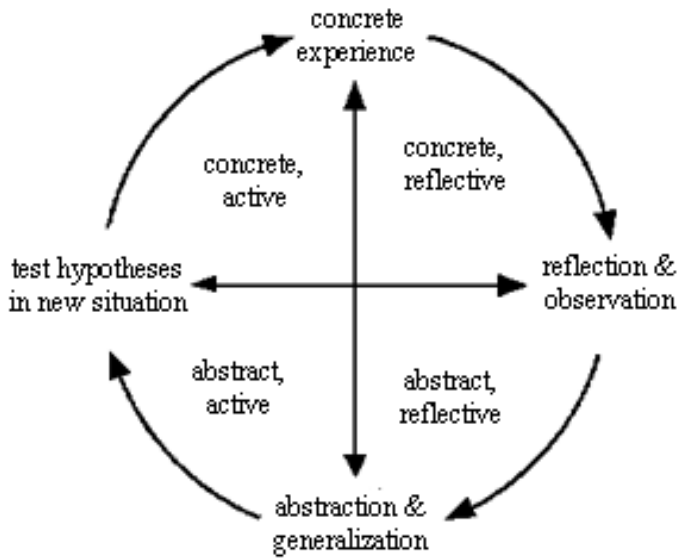


Figure 1: Kolb's Experiential Learning Cycle

… difficult to generalize the outcomes from a specific learning situation

3 Examples of Research at INRP

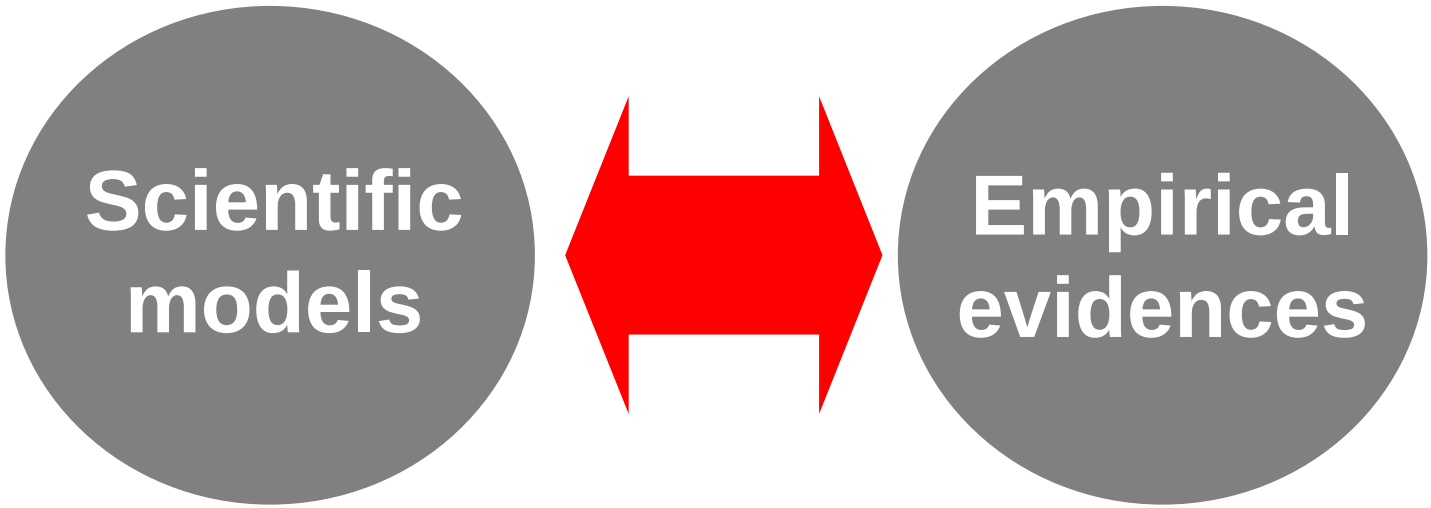
Uses of Geotechnologies for a Fieldwork Course (Sanchez, 2008)

Are the French-Alps a continent to continent collision range?

A Preparation (2h) B Fieldwork (2 days) C Exploitation (2h)

Background/Research Question

Science as the capacity to make links…



RQ: How do the use of geotechnologies can influence this students activity?

Recording the Students' Traces

traces_Olivier_07-Nov-2005_16h00m50.xml - ...

Fichier Edition Format Affichage ?

```
<?xml version="1.0" encoding="UTF-8"?>
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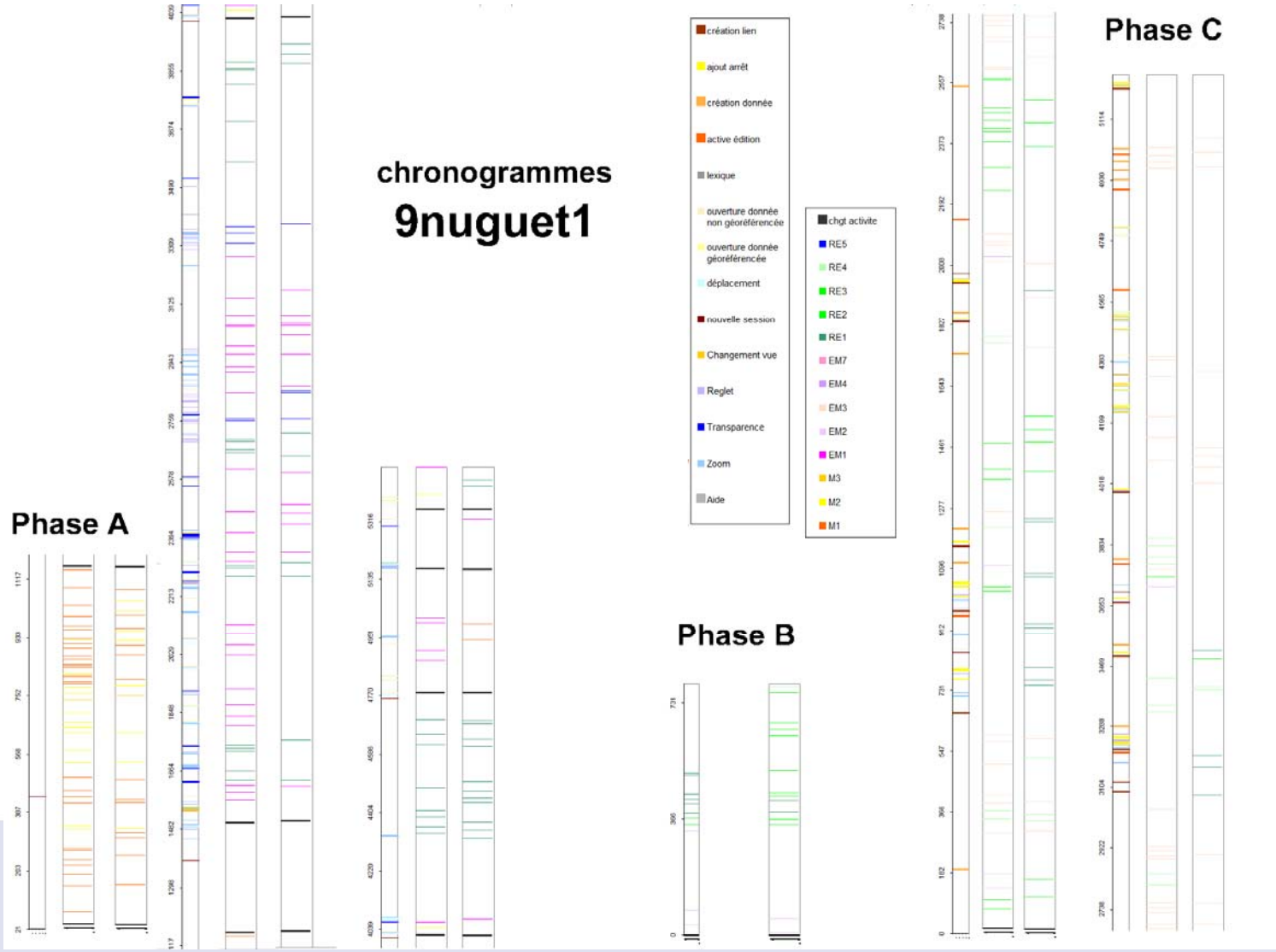
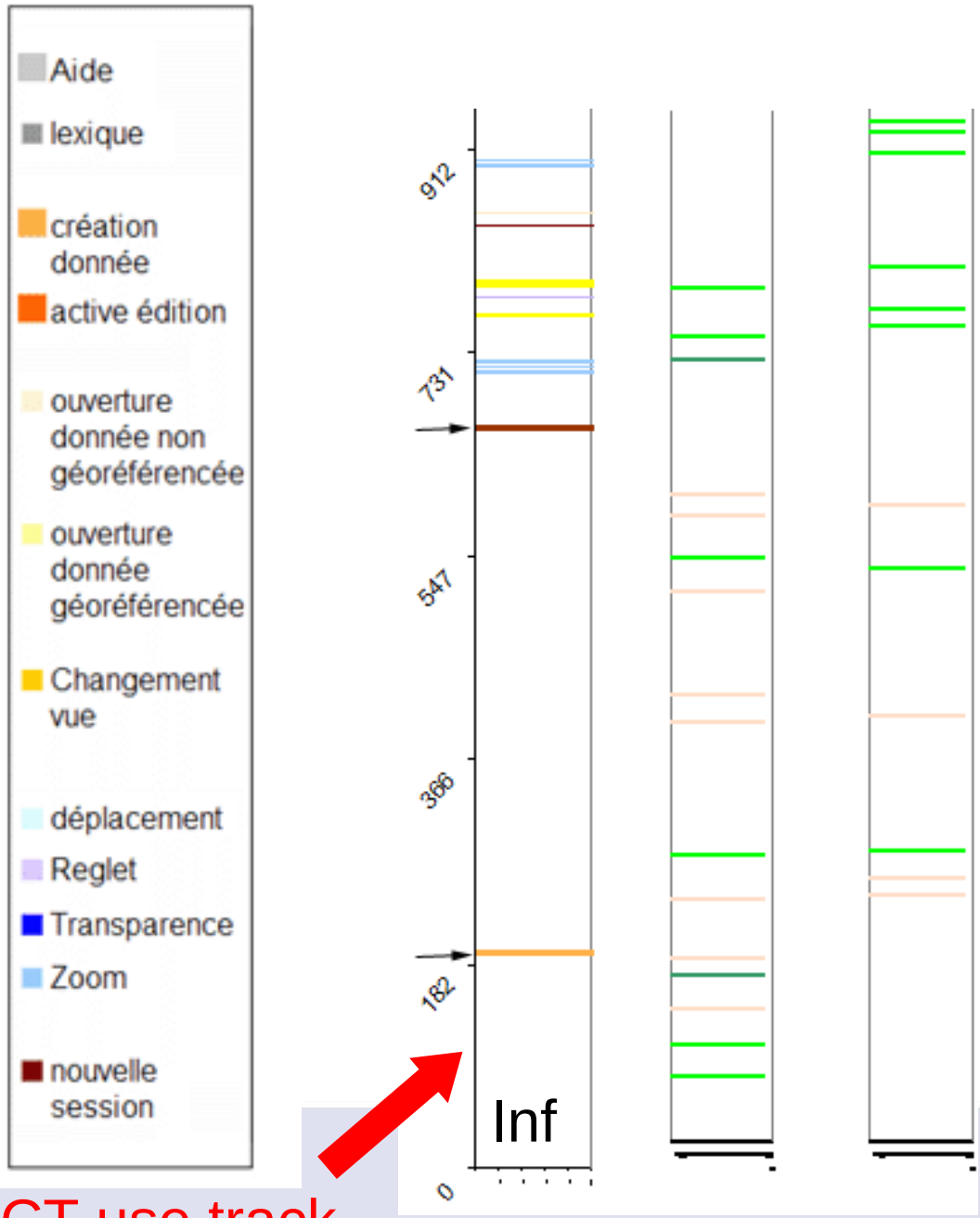
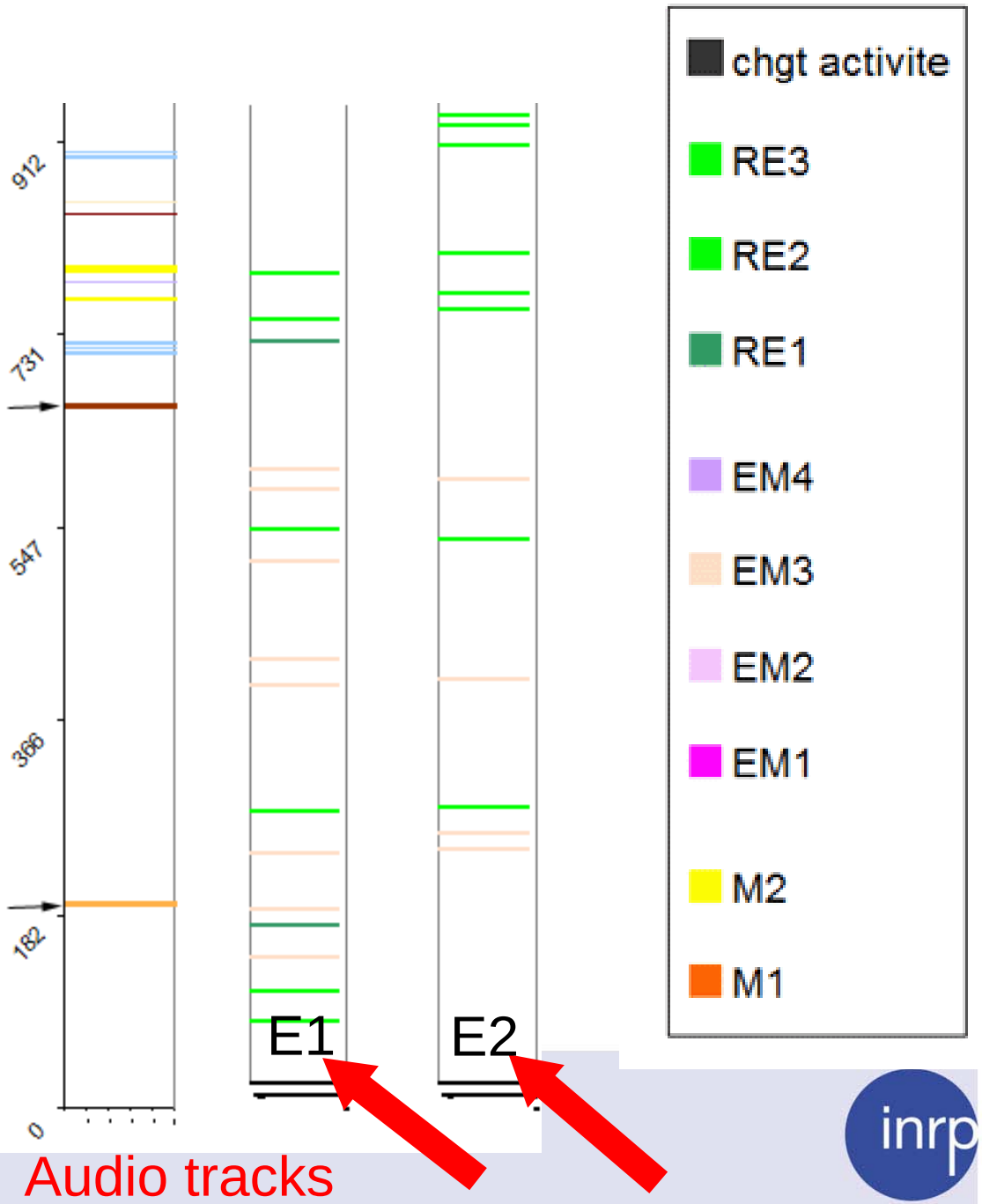
XMLfile

Designing Chronograms





ICT use track


chgt activite
RE3
RE2
RE1
EM4
EM3
EM2
EM1
M2
M1
912
731
547
366
182
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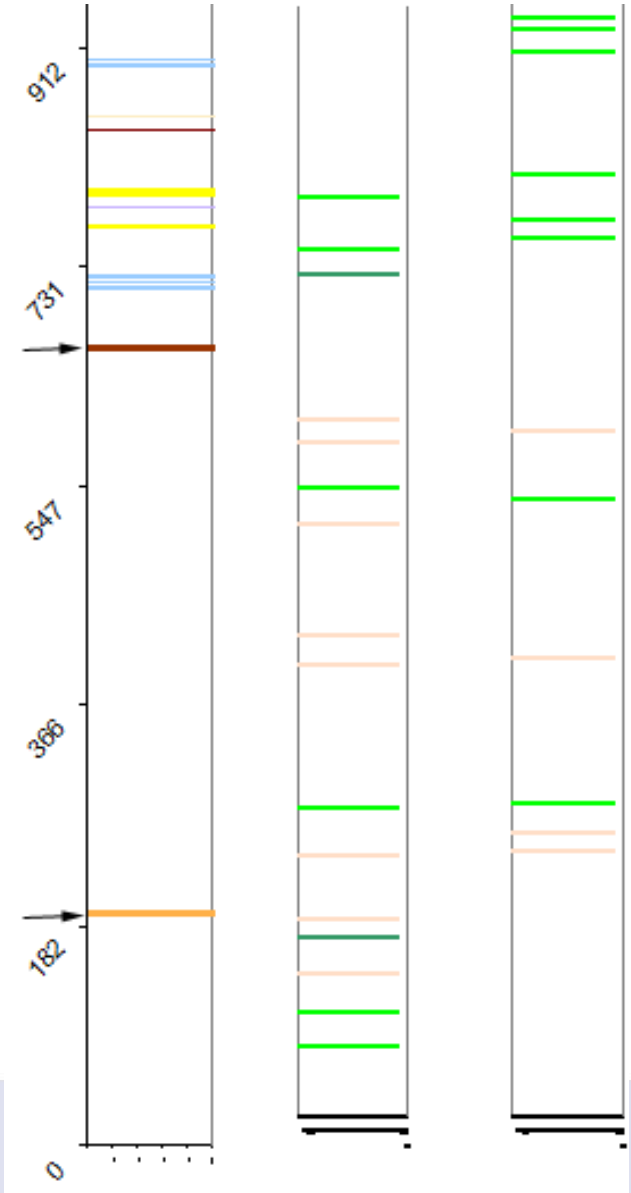
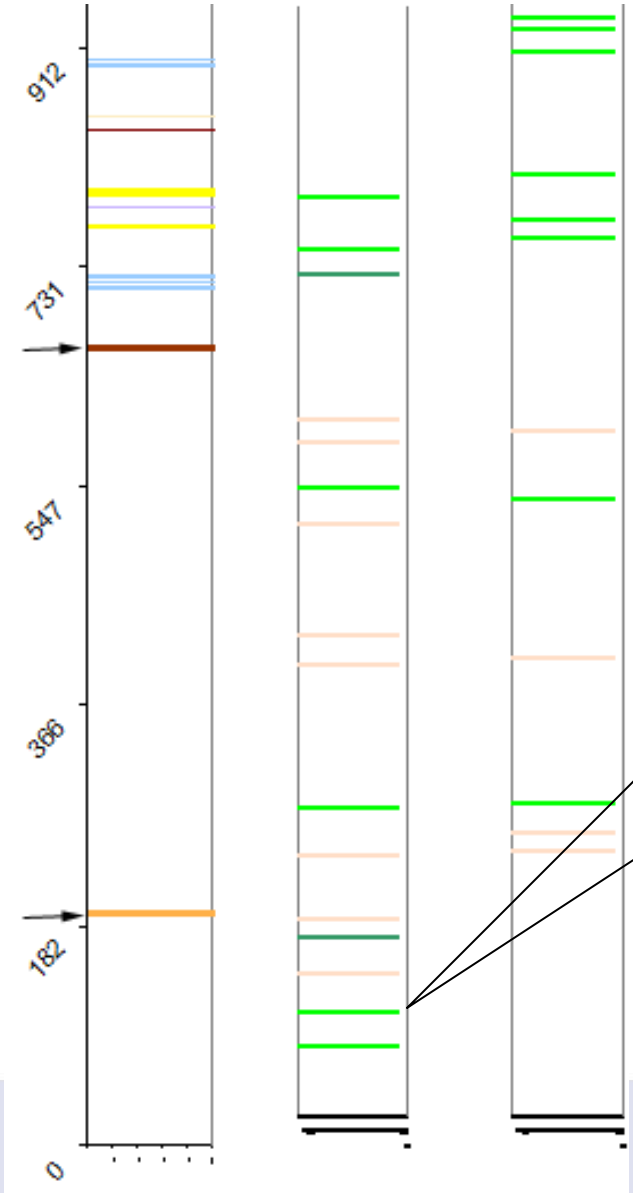
E1
E2
Audio tracks



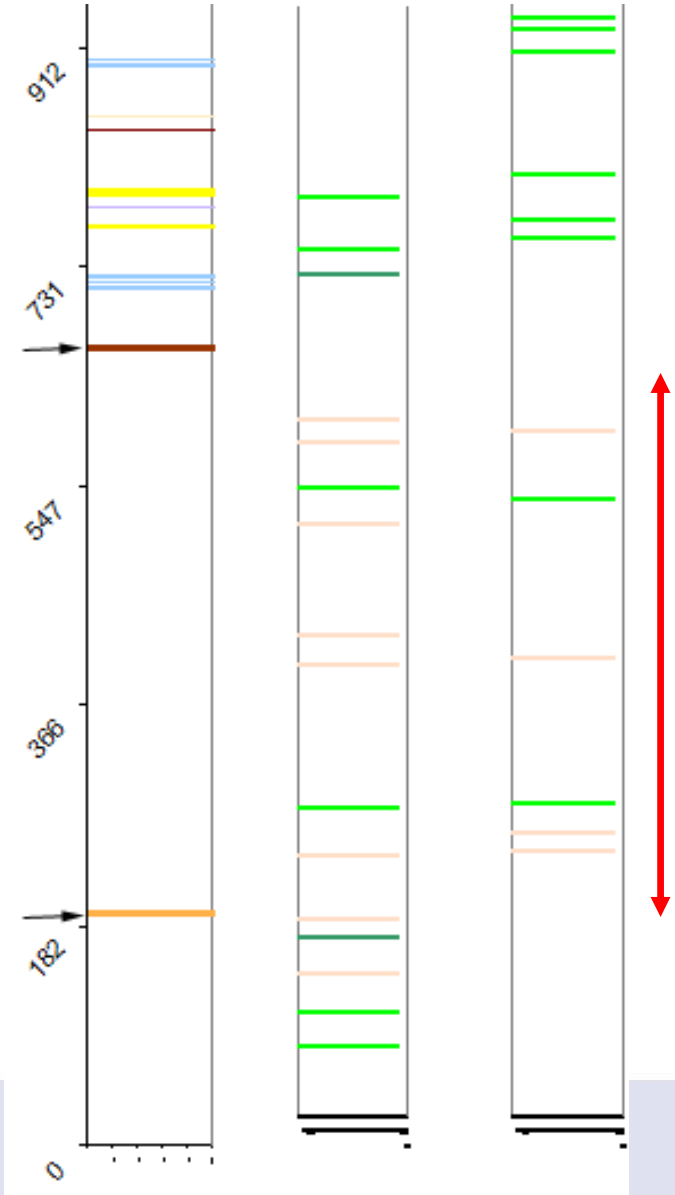
Picture selection

SM ⟷ EE

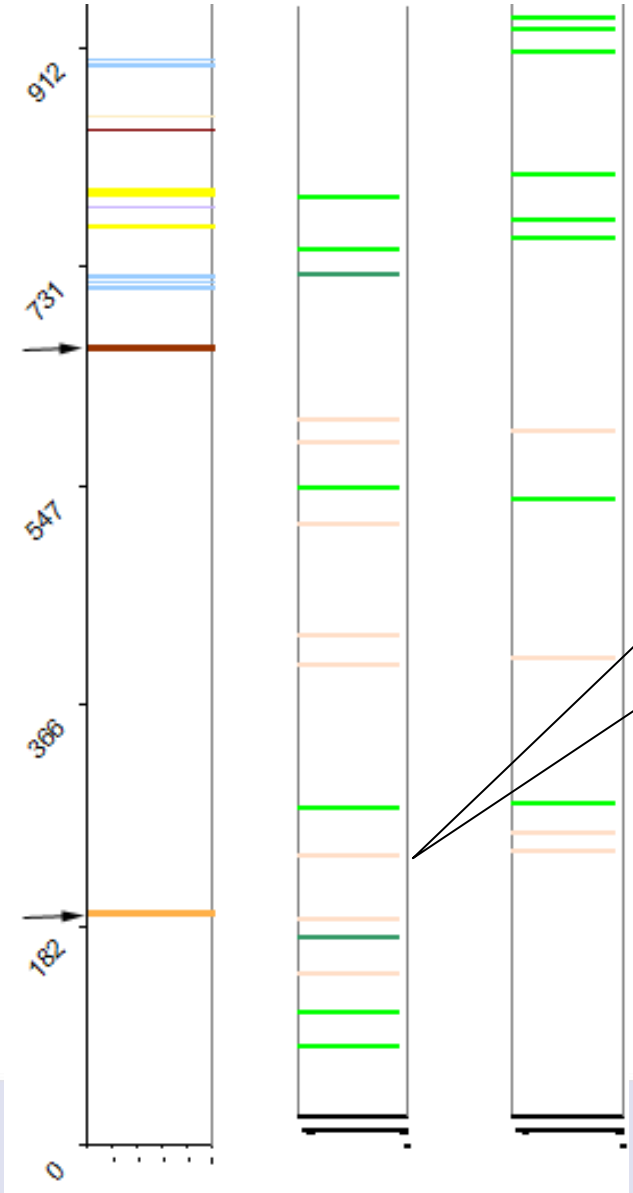


E1 : Great! Here you can see the big blocks…

Picture selection



Writting of a commentary for the picture

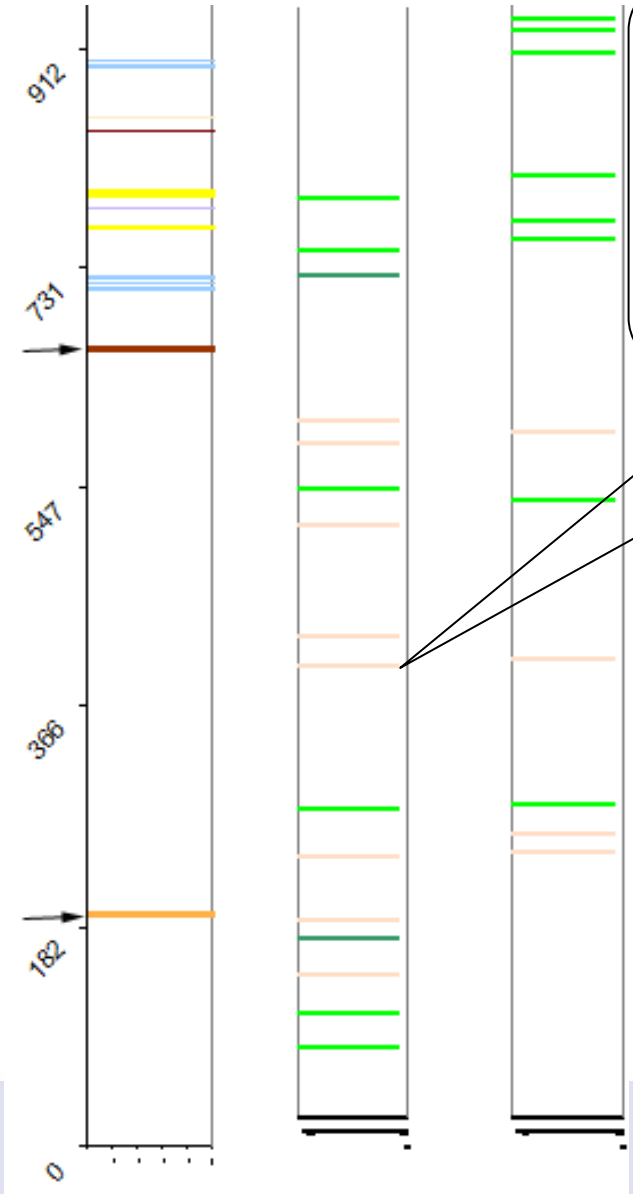


E1 : First of all we consider the accretionary prism

SM ⟷ EE

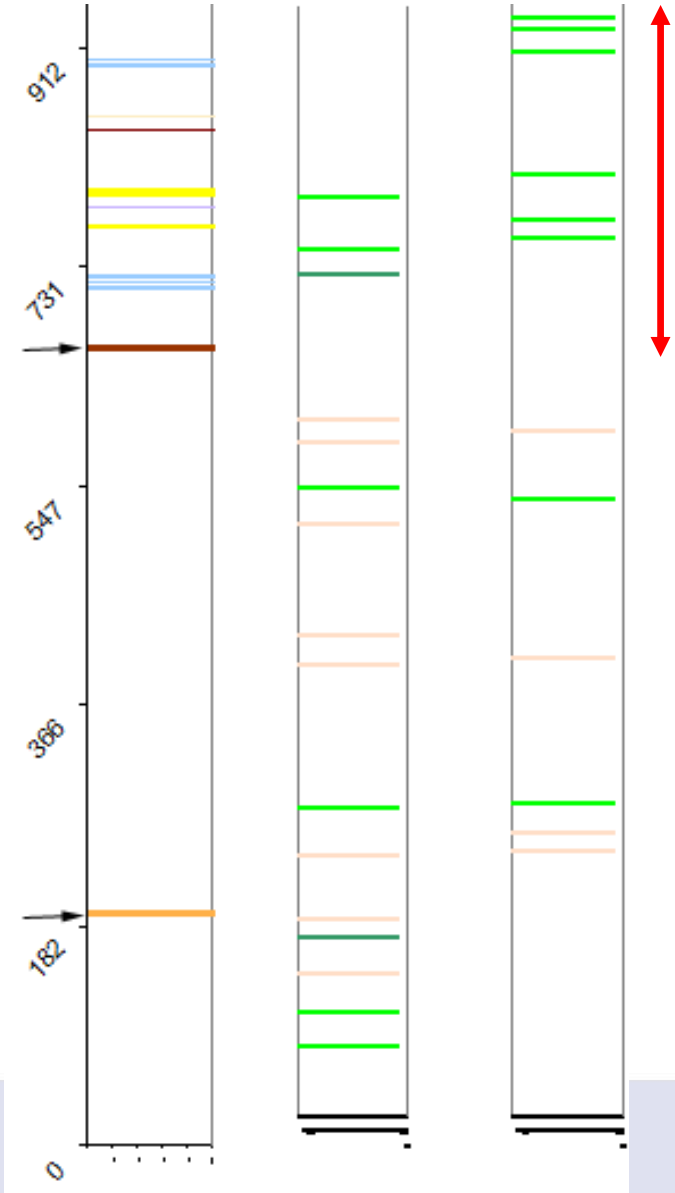
Picture selection

SM ⟷ EE

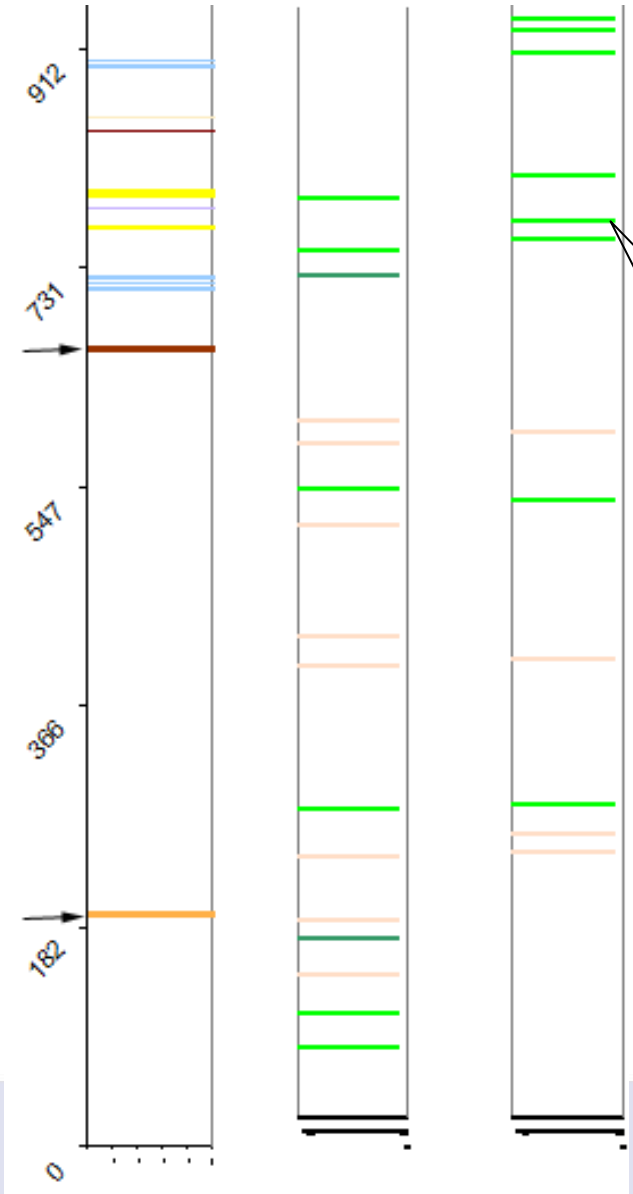


E1 : … *présentant des plis en S. témoin d'un raccourcissement et d'un phénomène de subduction.*

Writting of a commentary for the picture



Picture geolocalisation

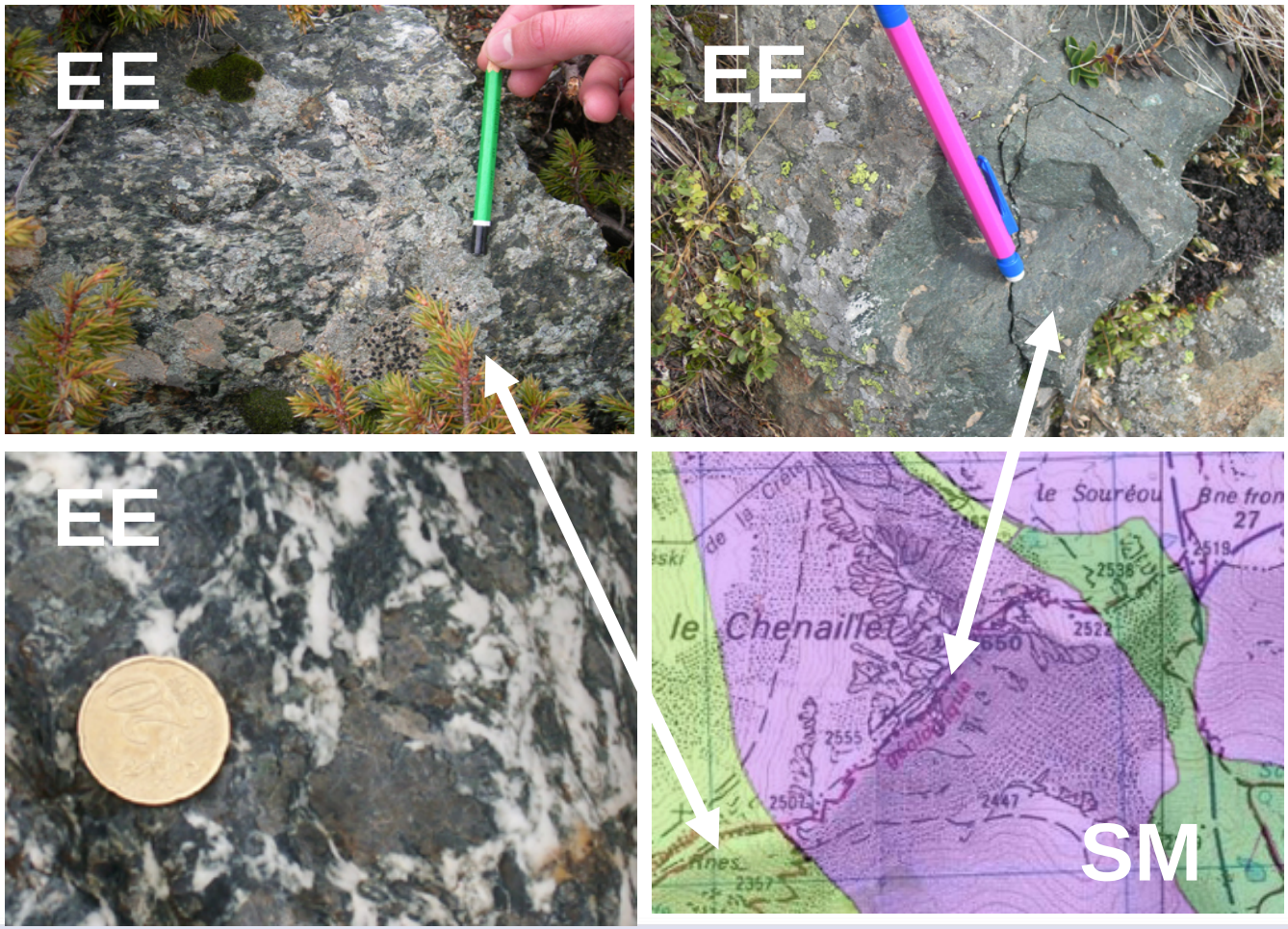


Picture geolocalisation

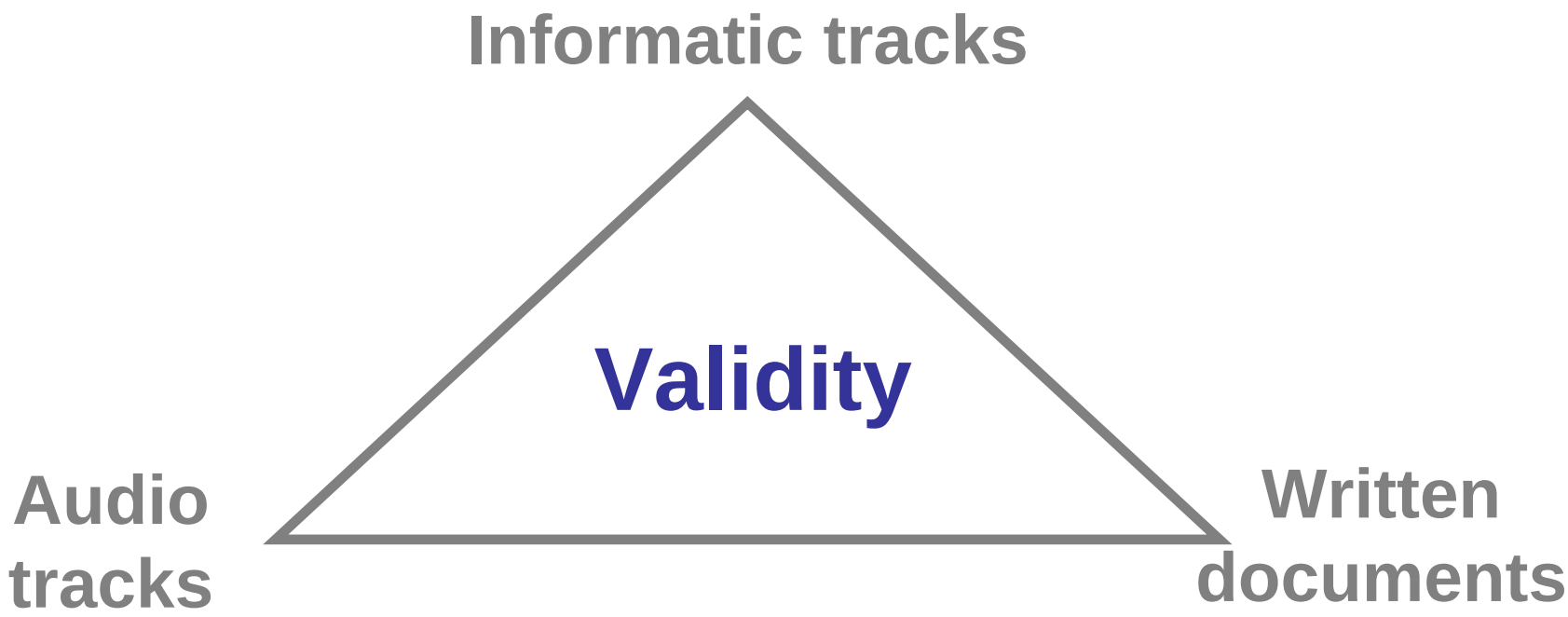
E2 : No, you cannot see the roads. It should be there.

SM ⟷ EE

Other Data



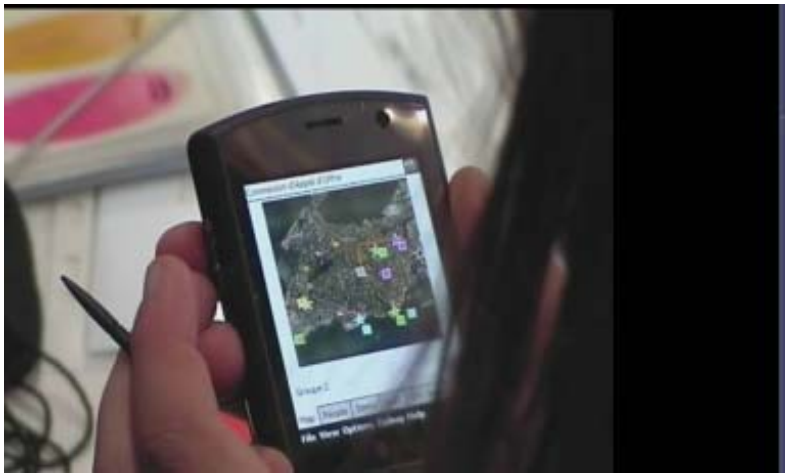
Triangulation of Data

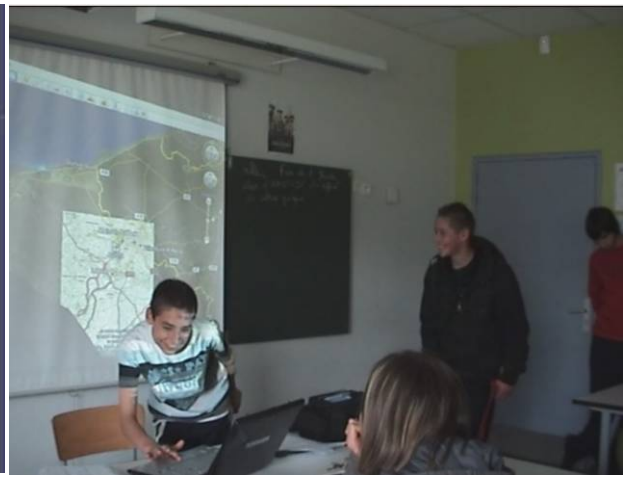


Designing Serious Games with Geotechnologies

(Sanchez & Jouneau-Sion 2009, Sanchez et al. forthcoming)

How to implement « green » energy in Sète?





The Game's Scenario

The mayor of Sète presents the trend

Each company presents the project to the tender committee

During two weeks each company prepare a proposal

During two more weeks the companies finalize their project

Research Questions

- How to design a pretend game with geotechnologies?
- What elements should be taken into account to design the learning situation?

Researchers and Practitionners: a Collaborative Work

Researcher ⟷ **Practitionner**

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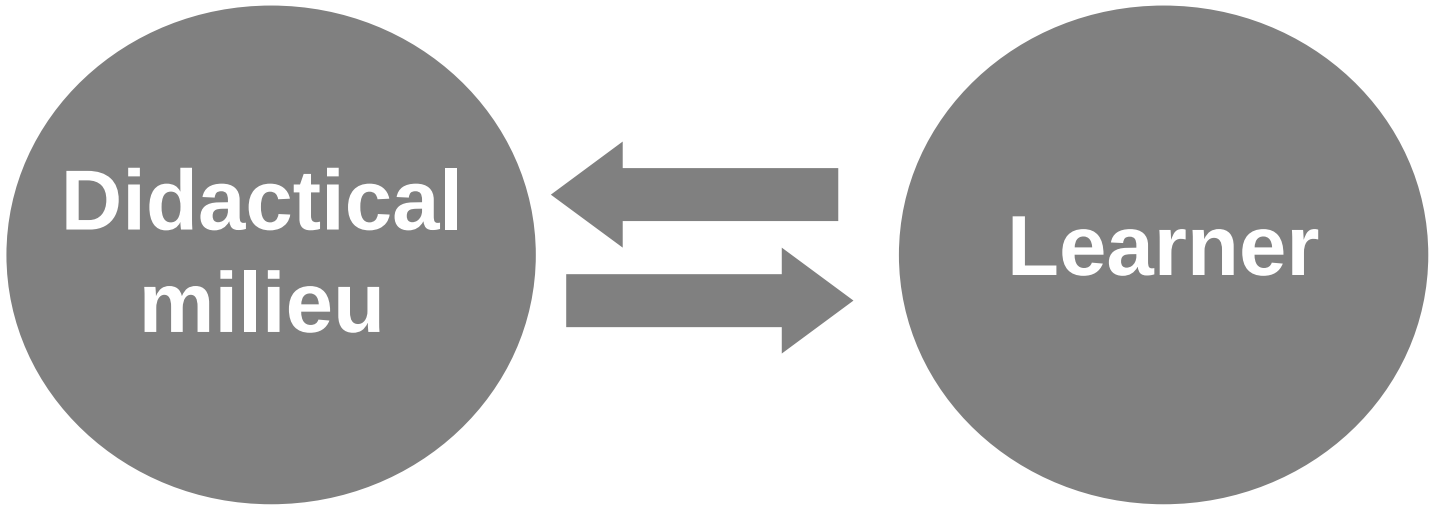
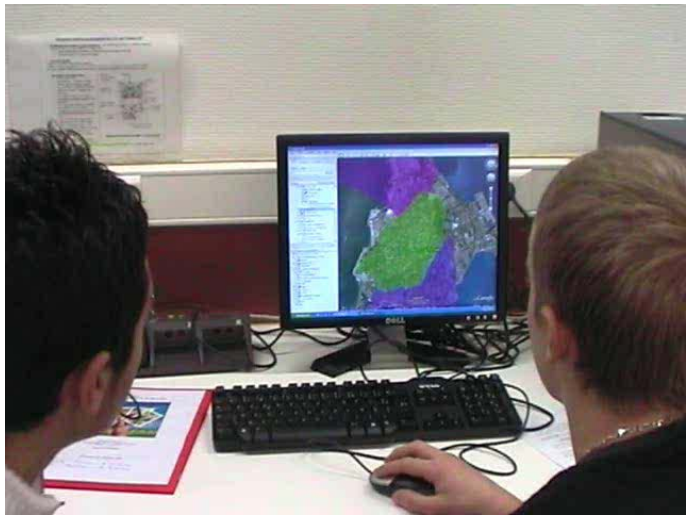
Researcher → **Practitionner**

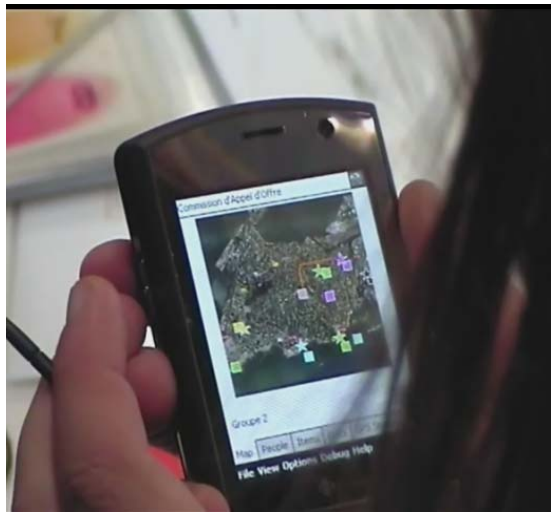
A common background



Learning results from interactions (Piaget, Brousseau)

Researcher ⟷ Practitionner

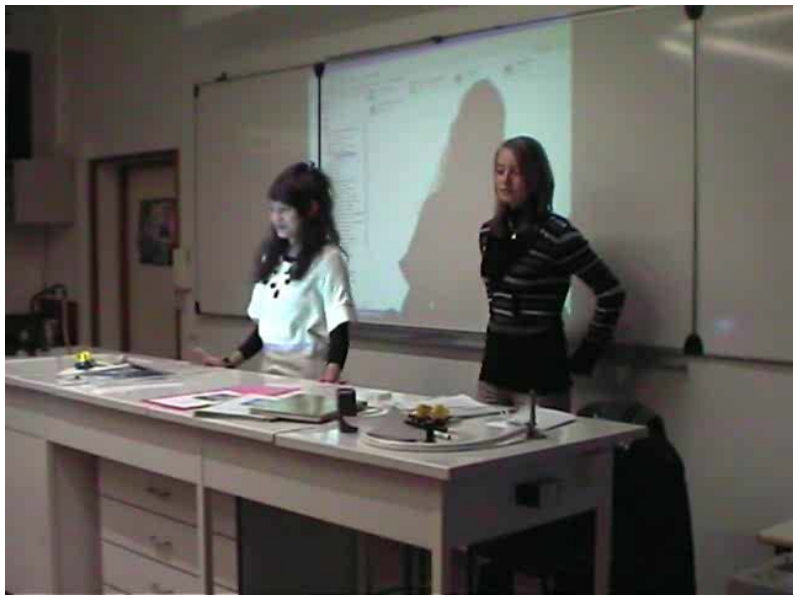




Design of the learning situation

(by implementing theoretical ideas)

Practitionner → Researcher



data gathering (audiotapes, videotapes, written documents…)

Researcher ⟷ Practitionner

Data interpretation (during meetings, focus group, seminars…)

The Impact of the use of Geotechnologies on VSWM

Hypothesis "*the use of geotechnologies has a positive impact on the visuospatial working memory (VSWM) development* but *there are differences related to genders*"

Methodology (control)

Two groups of subjects (control of internal variables)

*** Group of subjects involved into geotechnologies activities**

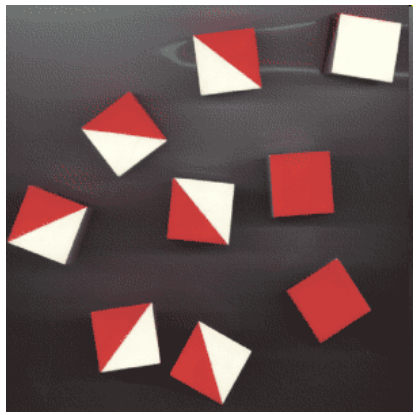
*** Control group (matched on all important characteristics): age, gender, students levels, etc.**

Anticipation of variables that have to be controlled

Methodology (data)

Tests into performances on VSWM tasks (examples)

- Task of memory (Della Sala *et al.* 1999)
- Task of locations (Loisy & Roulin, 2003)



Data Analysis

$$T = \frac{\hat{\beta}_k}{\sqrt{\widehat{Var}(\hat{\beta}_k)}}$$

T-test if there are two groups of subjects

Analysis of variance (ANOVA) if there are more than two groups of subjects

But

- difficulty to meet the requirements for experimental validity

- impossibility to have a randomly selected population

Design-Based Research

From DE to DBR

- Ingénierie didactique (Didactical Engineering)

Artigue, 1988

- Design Experiment

Brown, 1992

- Design-Based Research

Design-Based Research Collective. (2003)

Design-Based Research

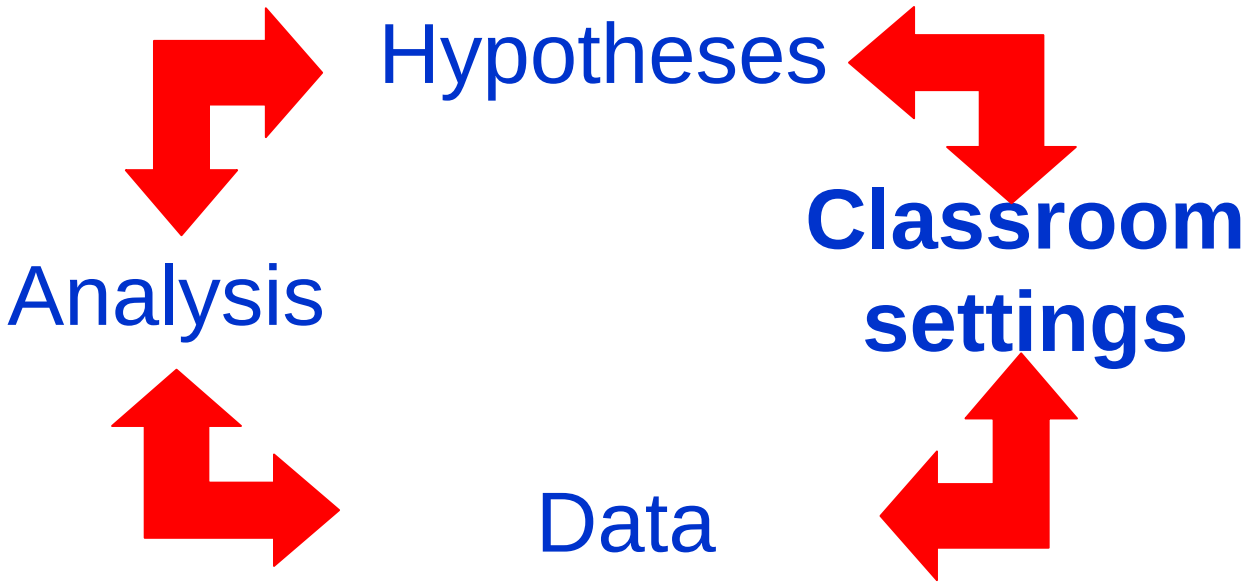
"A systematic but flexible methodology aimed to improve educational practices through iterative analysis, design, development, and implementation, based on collaboration among researchers and practitioners in real-world settings, and leading to contextually-sensitive design principles and theories"

(Wang and Hannafin, 2005).

Main Characteristics

- **Pragmatic**: solving current real-world problems
- **Grounded in both theory and the real-world** context
- The process is **interactive, iterative and flexible**
- **Integrative:** a variety of research methods and approaches (both qualitative and quantitative)

DBR as an Iterative Process



Traps to Avoid by Researchers

Research *vs* Assessment

- **Research**: a systematic investigation to establish facts and knowledge

- **Assessment:** a process for making judgment that lead to take decisions

Research *vs* Innovation

- **Research**: a systematic investigation to establish facts and knowledge

- **Innovation:** a change that leads to create something new

The Hawthorne Effect

Subjects improve or modify an aspect of their behavior being experimentally measured simply in response to the fact that they are being studied

The Risk of Illusions

The Triangle of Bermuda of Data

How to survive with a such amount of data?

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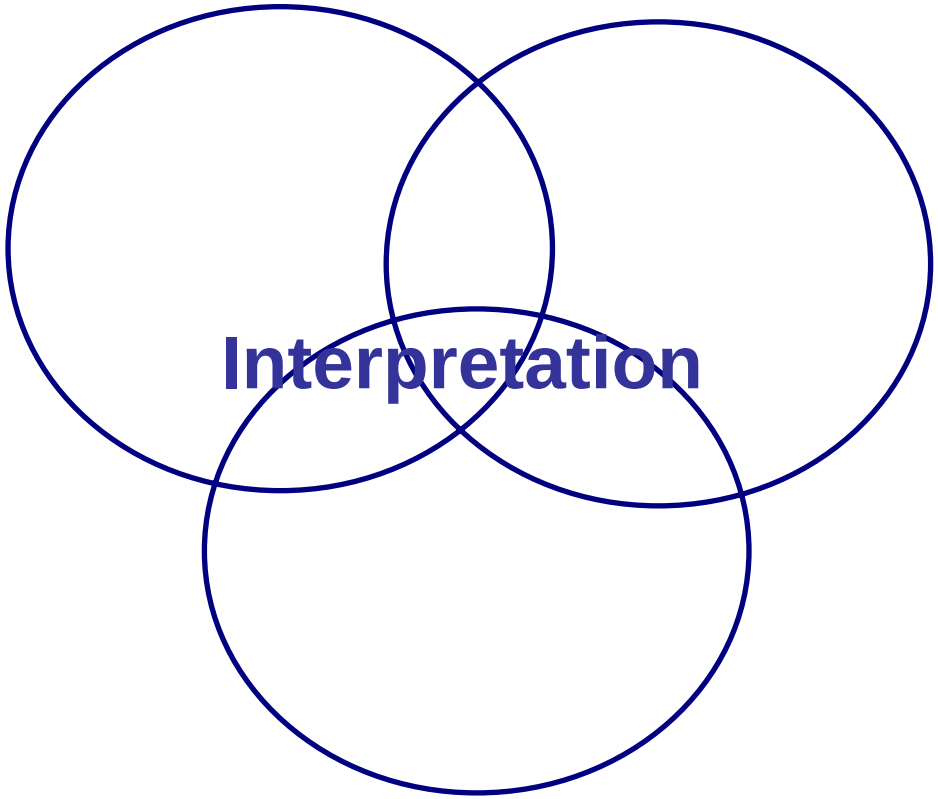
Performing Core into Data

Designing Categories

Data Triangulation



Conclusion

Important Questions to Address

What is the Nature of the Phenomena that I Want to Investigate?

- School, classroom?
- Teachers, students?
- Professionnal identity?
- Knowledge, skills, competencies?
- Actions, interactions, behaviours?
- Artefacts, technologies?

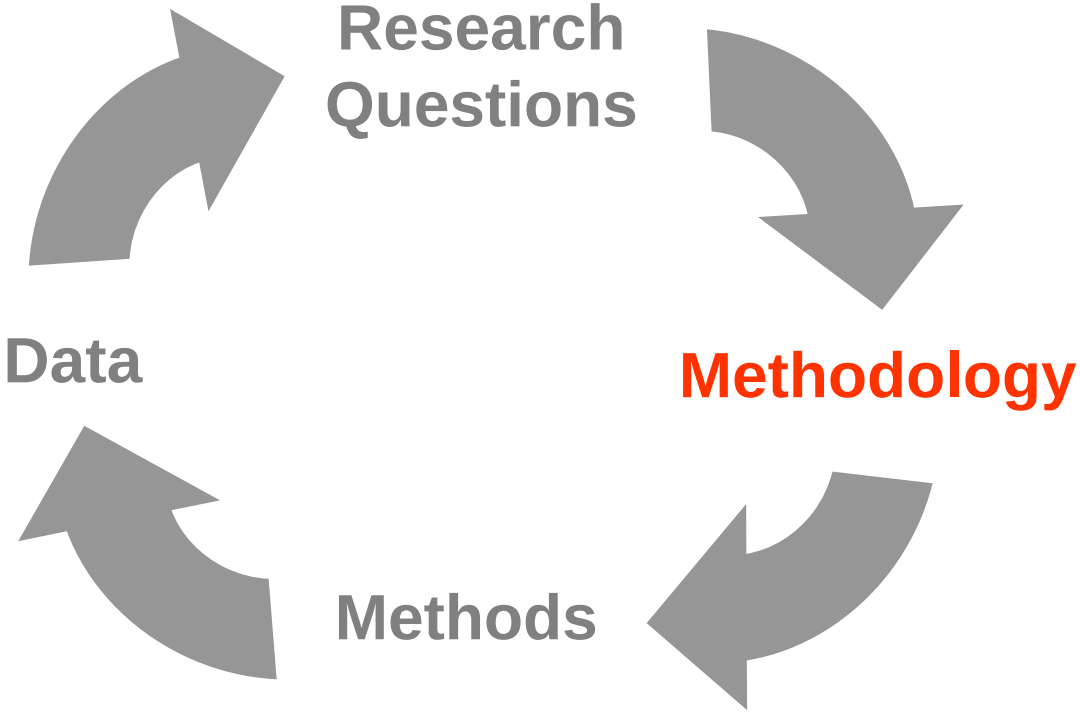
… alternative ontological perspectives might tell a different story

What Might Represent Evidence of the Entities which I want to investigate?

- The need to determine indicators in order to collect data
- « Conceptual lenses »

… an epistemological question

Do I Have a Coherent Research Strategy?



… understanding of the methodological implications

Is my Inquiry Ethical?

… impact on students? Personnal gains? Social implications?

How Can I Demonstrate that my Methodology is Reliable and Accurate?

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