

UiO • InterMedia
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Mediation by Multiple (Re)presentations: a socio-cultural, semiotic approach.

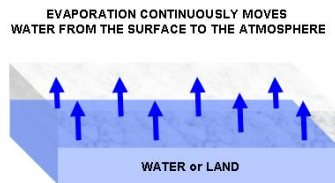


Multiple Representations...

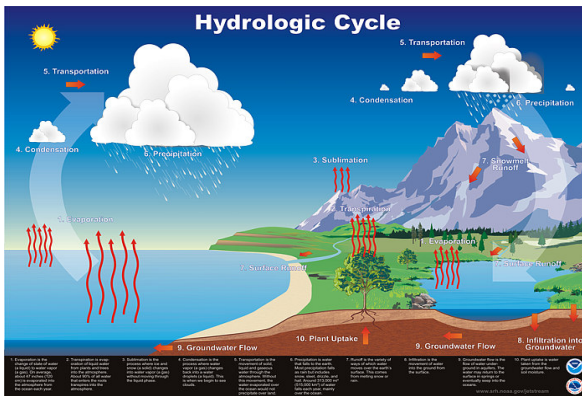
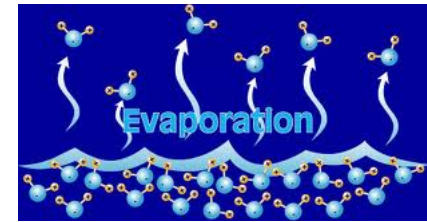
Multi-media vs. Multi-representational

- Media aspect:
 - Text, pictures, graphs, models, simulations...
 - Dynamic or static/ Interactive or non-interactive
- Representational aspect: the content as inscribed in the media.
 - Multiple media items to cover the same phenomenal aspect?...
 - Multiple media to cover different related aspects?

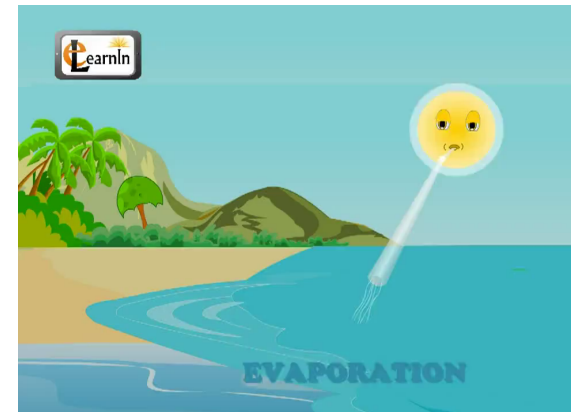
Multiple Representations...



“Same” media,
(not so) different
content aspects...



“Same” content,
different media



A Functional Taxonomy of MERs

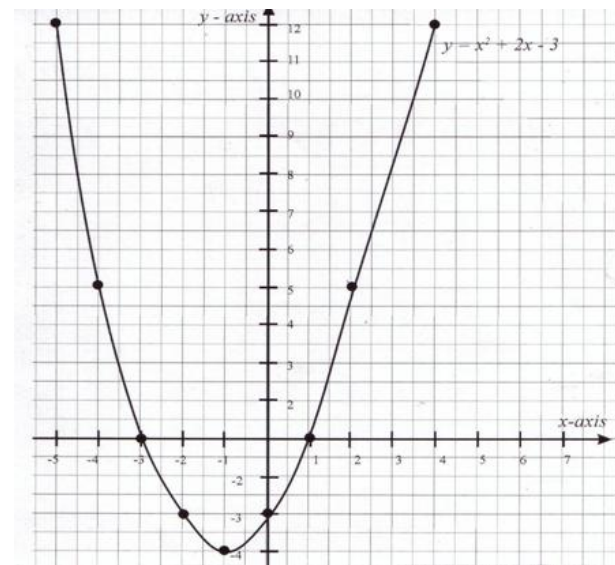
Ainsworth's (1999; 2006), 3 main functions:

- Complement each other
 - Representations support different *computational processes* (e.g. Larkin & Simon, 1987)
 - Representations “express” different information
- Constrain each other
 - Combine a familiar and an unfamiliar, or partially redundant representations.
- Support “knowledge construction”:
 - Support formation of more abstract “knowledge structures”
 - Support extension

A Functional Taxonomy of MERs

- Example of representations supporting different “perceptual” processes in “informationally equivalent” representations:

$$Y = x^2 + ax + b$$



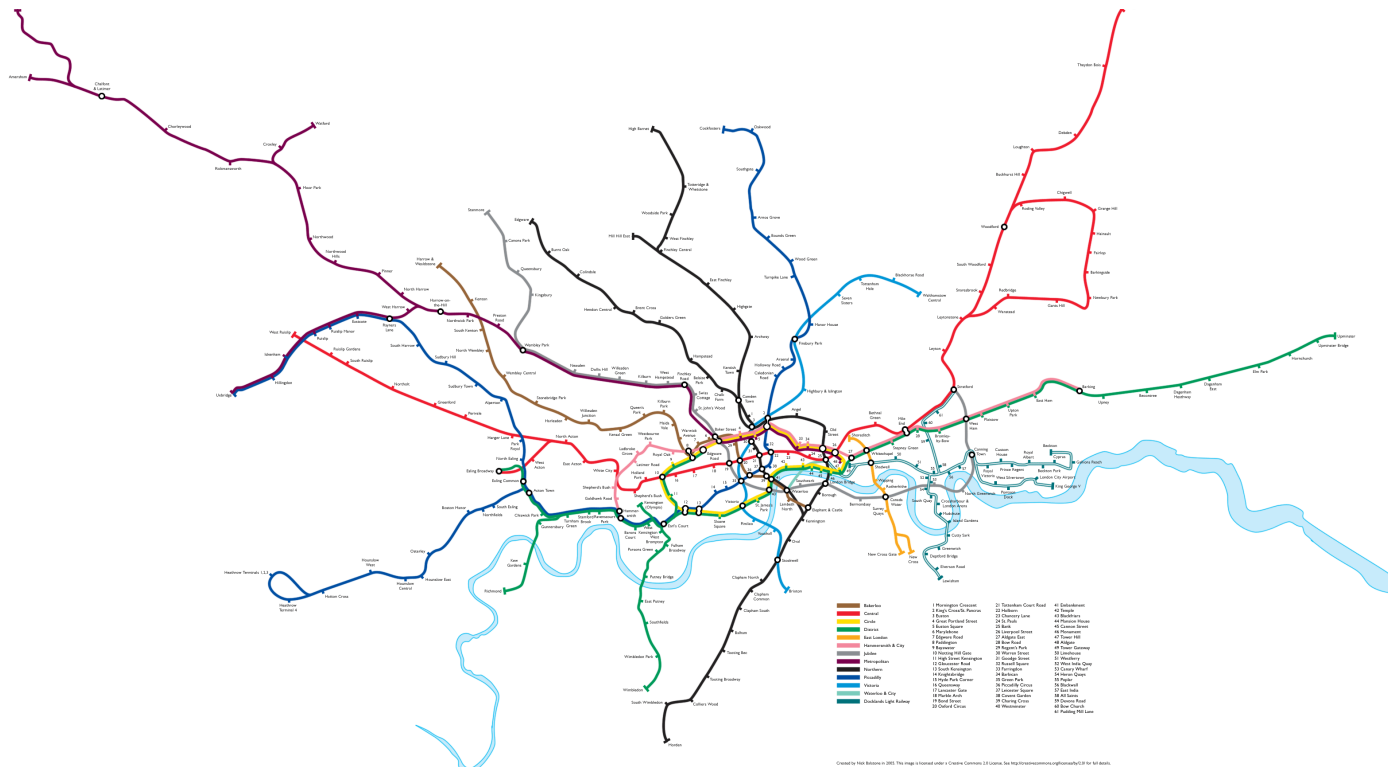
A Functional Taxonomy of MERs

London Underground map as an example of constraining representations



A Functional Taxonomy of MERs

London Underground map as an example of constraining representations



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A Functional Taxonomy of MERs

London Underground map as an example of constraining representations



A Functional Taxonomy of MR

- In sum, Ainsworth suggests that we must approach the relation between
 - Representations' features,
 - Learners' features
 - Tasks' situations

...

However, empirical evidence shows that a direct, straightforward relationship between the three does not seem to be found.

The Problem

Steps as involved in learning with MERs (Van der Meij & de Jong, 2006)

- Understand the syntax of each representation.
- Understand which parts of the domain are represented.
- Relate representations to each other.
- Translate between representations (interpreting similarities and differences of corresponding features of two or more representations).

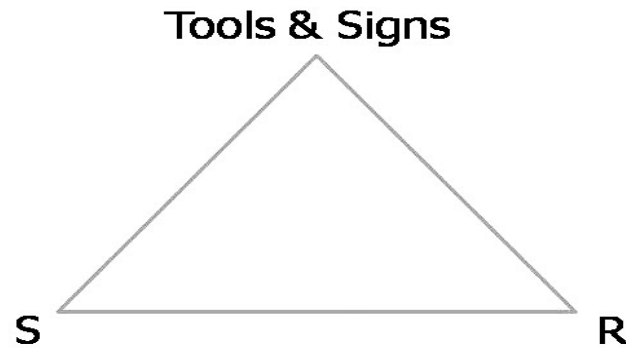
The Problem

- Both Ainsworth (1999) and van der Meij & de Jong (2006) review literature showing that learners face two main difficulties:
 - Relating different representations.
 - Translating between representations.
- Van der Meij & de Jong (2006), for example, explore two means to support these processes:
- Integrating
 - Dynamic linking

Two approaches to the problem

Do you remember this?

- Cognitive approach to the relation learner - world:
 - Stimulus – (information processing) – Response
- Socio-cultural to the relation learner – world:
 - Stimulus – (social mediation) – Internalization of social relations.



Mediation (Vygotsky, 1978/1933)

Information Processing (IP) Approach to the Problem

- Two main assumptions:
 - Relation between “Internal” and “External” representations.
 - Search and Recognition (Larkin & Simon, 1987), Computational load (e.g. Mayer & Moreno, 2003)
- Methods:
 - statistical studies relating visualizations’ features, instructional treatments, personal traits and performance (van der Meij & de Jong are an excellent example of this approach).
 - Testing hypotheses to build models of cognitive processing (e.g. Schnotz & Bannert, 2003).

What remains unexplained? I

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What remains unexplained? I

How does syntax and the system of references (what different elements “stand for” in relation to the world and to each other) emerge in the first place?

How can students search for or recognize something that is not yet known?

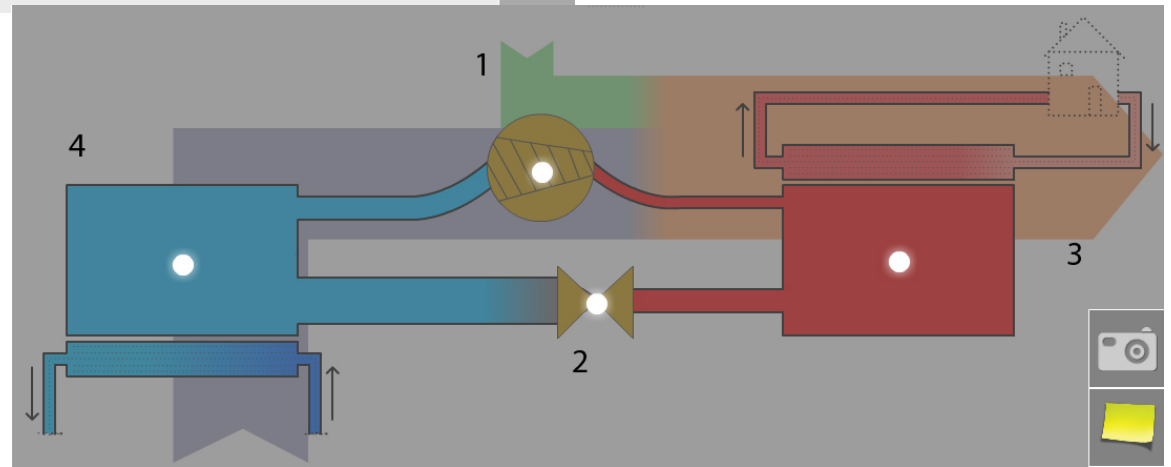
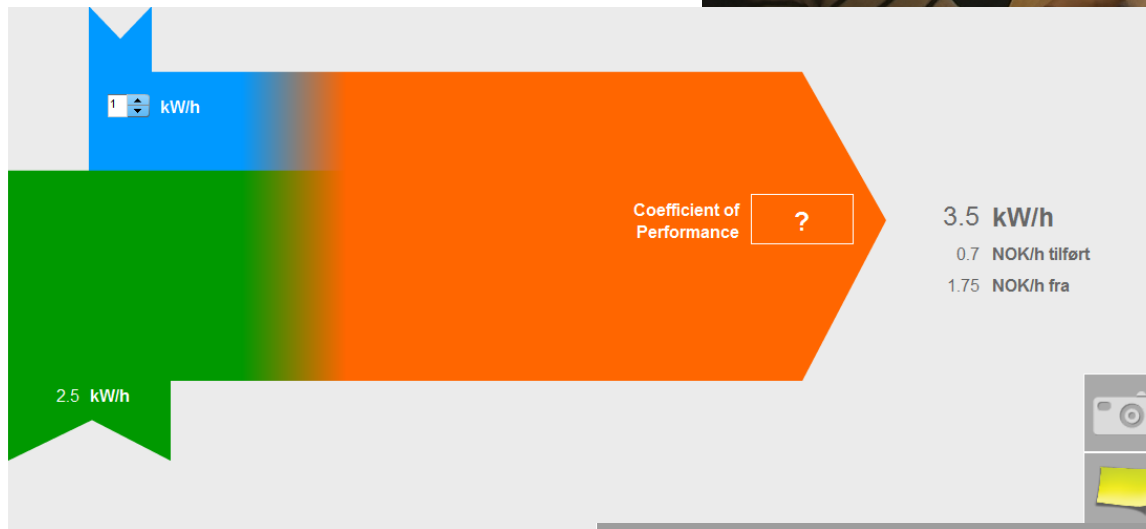
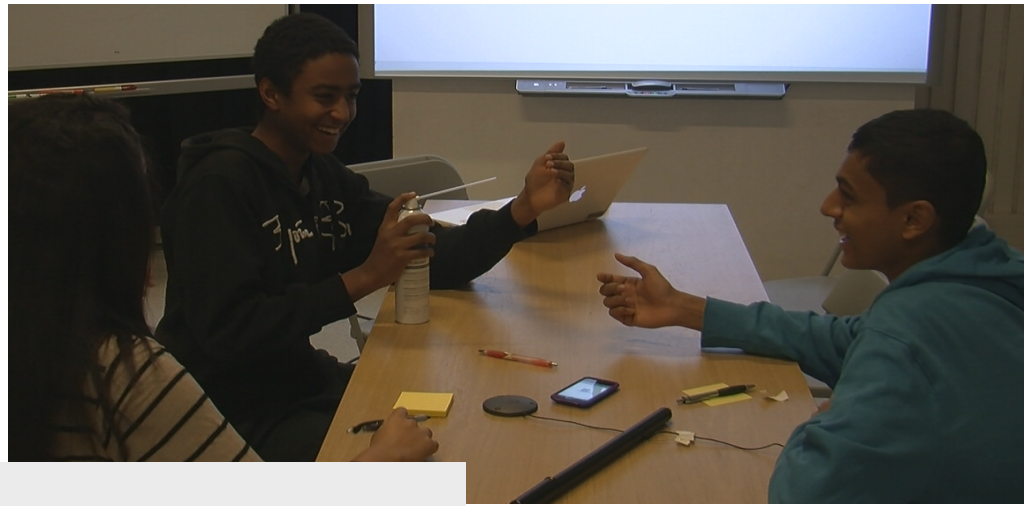
For Information to be processed, there must be information first.

What remains unexplained? II

- What happens with the social context?
 - Pairs of students perform better (Schwartz, 1995)
 - Collaborative inquiry and sense-making (Roschelle, 1992, 1996).
 - Students' interpretation of representations as a function of social interactions (White & Pea, 2011; Furberg, Kluge & Ludvigsen, 2013).

A socio-cultural approach

- Jorner & Roth (2013):
 - A Vygotskyan approach:
 - Non-representationalist
 - Semiotic (as opposed to a “computational”) approach to the question of syntax and reference.



A socio-cultural approach

Non-representationalist...

- Multiple Presentational Forms vs Representation:
 - Trying to understand representations as first-time encounters where the unknown becomes known.
 - Expanding the “presentational” question to artifacts other than “representations”.
 - Re-presentation is distributed across participants’ and setting. Re-presentation takes place in and as language/ communication.

A socio-cultural approach

...semiotic approach:

- Emergence of the structure as emergence of signs.
- The research question becomes “how do elements in the different representations become signs in and through learners’ communication?”

A socio-cultural approach

- **Methods:**

- Shift from the quantitative to the qualitative: the problem of meaning.
- Interaction Analysis (Jordan & Henderson, 1995): meaning as made available in interaction.
- Mixed Methods: though in our study we don't use it, it is possible to combine traditional quantitative methods with interaction data.

A socio-cultural approach (Findings)

- Two processes were analyzed:
 - Structuring work.
 - Relational work.

The term “work” is used to highlight the material nature of the processes that are involved. These are not just mental, but also and at the same time, interactional.

A socio-cultural approach (Findings)

- Structure emerged during object-oriented action, and changed as action changed, even when presentations remained constant in the material continuum.
- Structures are salient, remain or become “lost of sight” as a function of the interactional focuses.
- Objects shift from familiar to unfamiliar, or uncertain, as a function of the context within which they are presented.

A socio-cultural approach (Findings)

- Structure becomes re-presented...
 - First throughout deictic and iconic gestures
 - Only after throughout language.
 - Structure changes as language changes.
- Relations between structures:
 - The only evidence for connections comes from their gestures and talk suggesting similarities or analogies.
 - However, the specific nature of these connections between objects of the material continuum relies fully in the discursive practices.
 - Throughout the episodes, there is no articulation of how formal aspects one presentational form are related to formal aspects of another.

Experimenting in a multiple representations environment

Go to:

<http://phet.colorado.edu/en/simulation/states-of-matter>

and download the Java application “states of matter”.

Play the simulation in groups of 2 to 3.

Experimenting in a multiple representations environment

- Reflect on the processes by which you yourself attend to and interpret the different aspects in the simulations.
- Reflect on the ways in which your interaction with others affect the ways in which you attend to and interpret the different aspects in the simulations.