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Universitat de Girona

Using Language to Teach Science: Researching Classroom communication and Developing Dialogical Approaches

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Practical information about the course

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To succesfully complete the course it is necessary to:

1. Attend, at least, 80% of the sessions
   (7, 8, 9, 12 and 13 August 2013)

2. Submit and pass the final assessment
   Analysis of a classroom episode (to be completed in groups of 4 students), deadline to be decided.

What characterises teaching and learning?

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- What is the activity taking place in these three videos?
- What makes this activity recognisible?

Outline of the course

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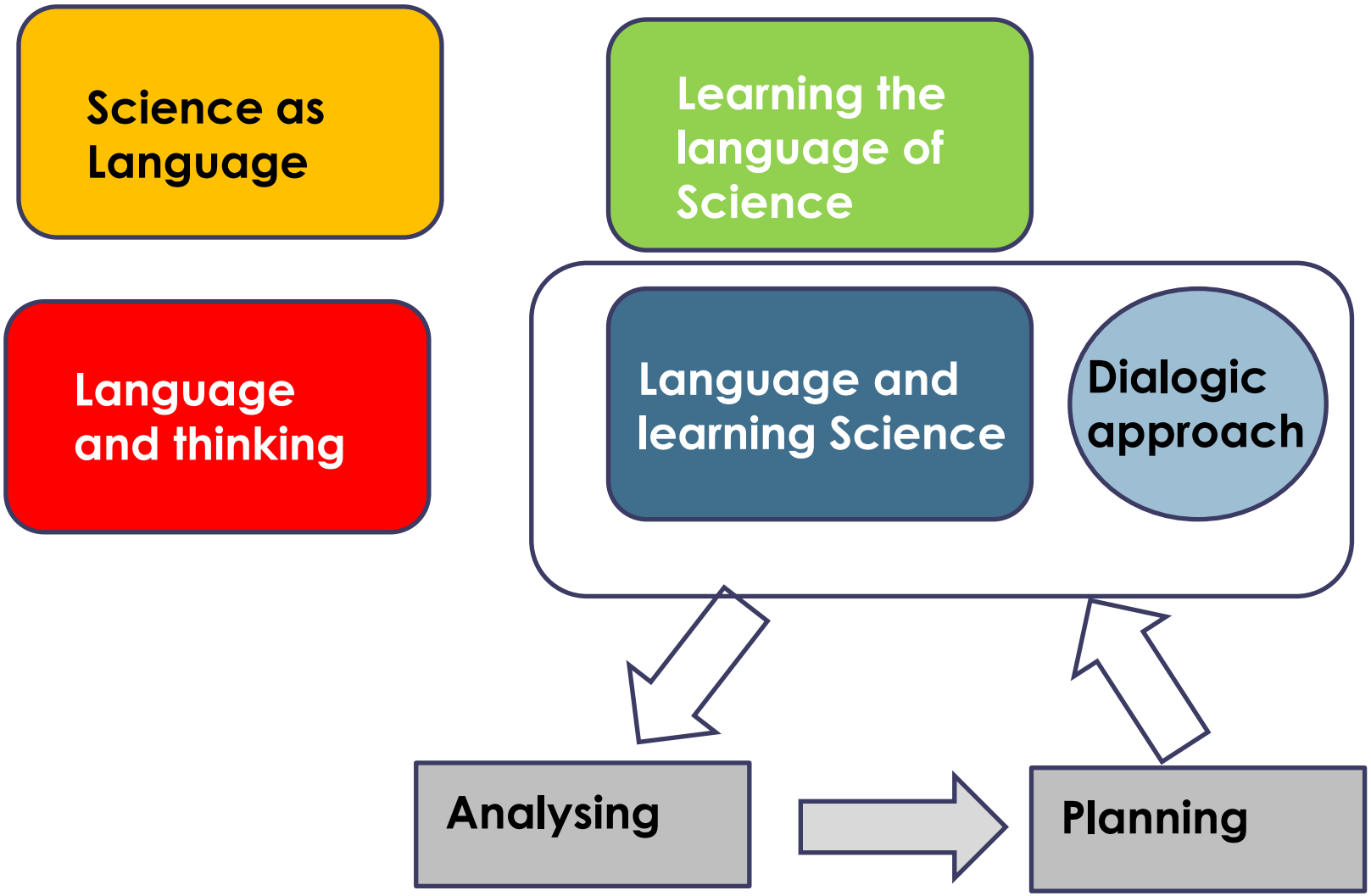

The roles of language in teaching and learning Science

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Language is a fundamental part of the activity of teaching and learning (to many the most important element).

Language plays four main roles in this activity:

a) It provides a lexico-grammatical realisation of the meaning being constructed
b) It provides a series of scientific genres
c) It shapes the interactions among participants (general)
d) It shapes the process of learning science

- **a and b** refer to **what** is being taught-learnt

- **c and d** refer to **how** it is being taught-learnt

Science and Language

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Science, as any other meaning constructed by humans, is expressed through language. Doing science is, partly, developing/creating this language.

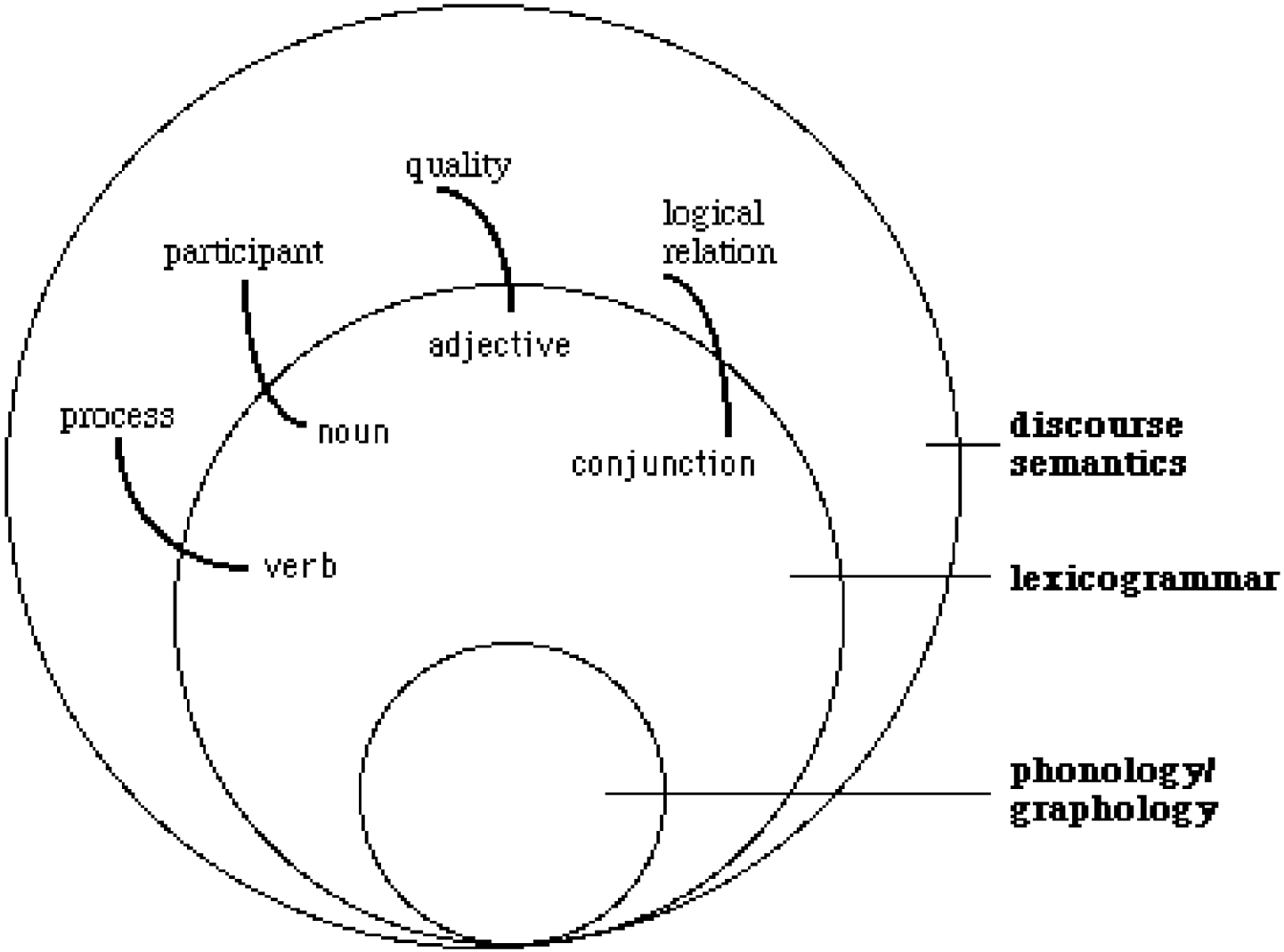
The language used to "do" and to "talk" science has characteristics that make it unique:

- There are particular structures that are used to create valid claims:

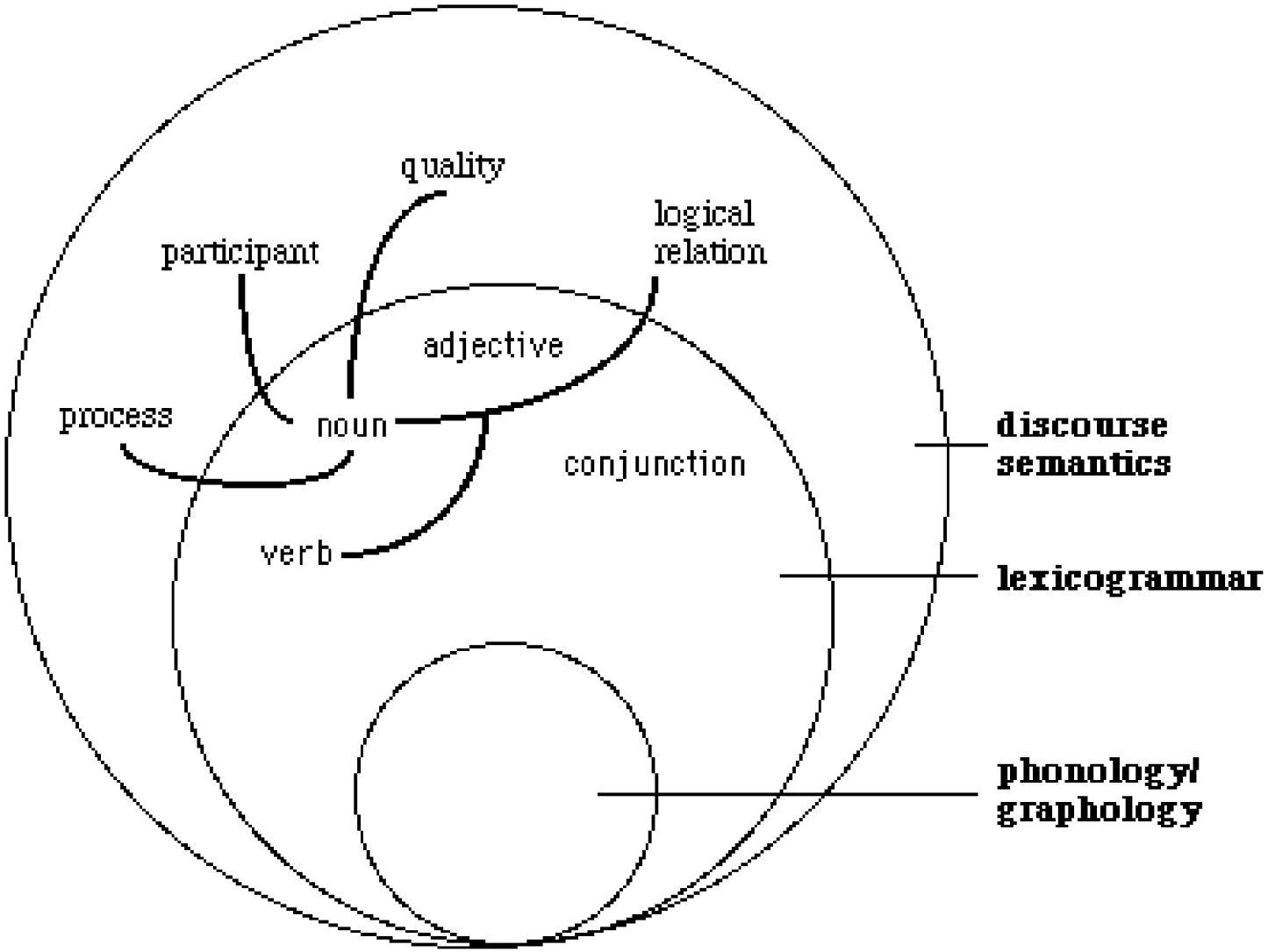
  (...) the core of a scientific text is the development of a chain of reasoning (...) in which each step leads on to the next. But in order to lead on to the next step it is necessary to be able to repeat what has gone before and is now being used as the springboard for the next move. (Halliday, 1993)

- Extensive use of non-verbal elements (with particular modalities)

Science and Language - Structures



Science and Language - Structures



Science and Language - Structures

According to Halliday (2004, 2006)

Nominalisation (and derivation in general) is **a resource for extending the lexical resources** of a language.

*So when Billig writes that **their argument is made through the use of nominalisation**, he realises semantic processes of 'arguing', 'using' and 'nominalising' as nouns (instead of verbs), and the logical connection between them through a preposition (instead of a conjunction).*

Grammatical metaphor on the other hand is **a resource for scrambling, within limits, the realisation relationship between semantics and grammar and so indefinitely extending a language's meaning potential**. This is much more than a vocabulary building exercise. It allows writers, and people who learn to speak writing, to mean more than one thing at once.

Science and Language - Structures

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- Magnetic materials are materials attracted by magnets. **Magnetism** has many uses.
- Water **evaporates** from a puddle. **Evaporation** occurs more quickly in hot weather.
- When light hits a mirror, it bounces off it or is **reflected.** **Reflection** of light is very useful.
- A seed will start to grow or **germinate** when it has warmth, air and water. **Germination** is when seeds start to grow.
- **The Moon orbits the Earth**. The **Moon's orbit** around the Earth takes about one month.
- The air **resists** the movement of the sky-diver. This **resistance** is larger when he opens his parachute.

Science and Language - Structures

Metaphors are also used in science to build:

- **Definitions**: Thus **sound** is a **compression wave** that can be heard.
- **Classifications**: As far as the **ability** to carry electricity is concerned, (b) we can place most substances into one of two groups.
- **Explanations**: Establishing temporal and causal relations

Science and Language - Structures

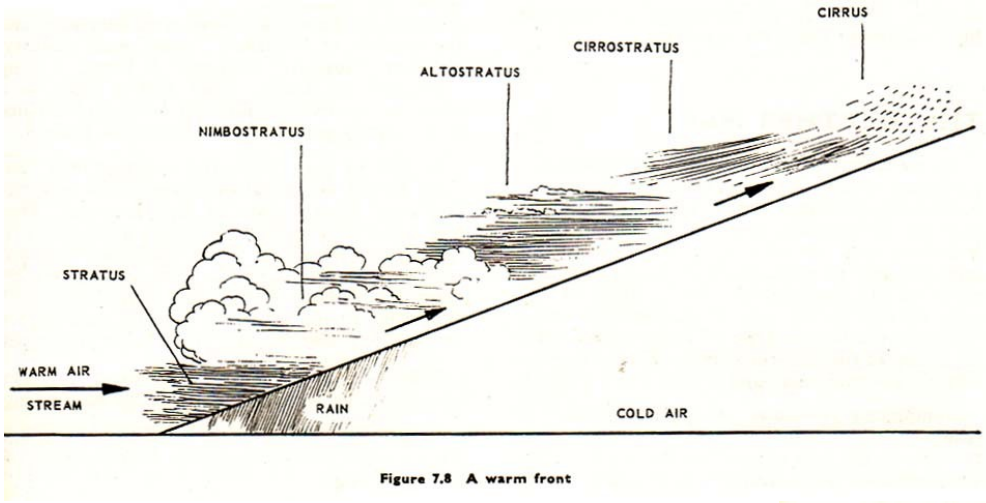

Figure 7.8 A warm front

as sequential explanation

as causal explanation

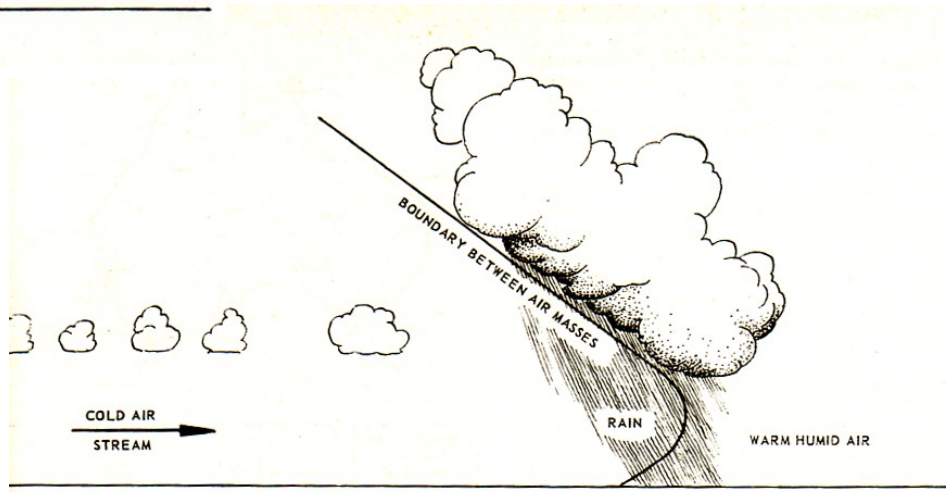

Figure 7.7 A cold front

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Science is not done, is not communicated, through verbal language alone. It *cannot* be. The "concepts" of science are not verbal concepts, though they have verbal components. They are semiotic *hybrids*, simultaneously and essentially verbal-typological and mathematical-graphical-operational-topological. The actional, conversational, and written textual genres of science are historically and presently, fundamentally and irreducibly *multimedia genres*. To do science, to talk science, to read and write science it is necessary to juggle and combine in canonical ways verbal discourse, mathematical expression, graphical-visual representation, and motor operations in the "natural" (including human-as-natural) world.

Lemke, J. (1998)

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Science and Language -multimodality

By multimodality we understand the use of different modes of communication to create/convey meaning

A mode of communication is any culturally determined system of meaning creation (for instance traffic signals)

Multimedia often refers to the use of different material substrates culturally converted into socially organised tools of representation, i.e., converted into modes of communication (for instance, sound and moving photography converted into cinematographic language)

Teaching and learning are multimodal activities. The school is embedded in a multimodal and multimedia environment.

Science and Language -multimodality

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The language that articulates scientific knowledge has a multimodal nature

- In terms of content (vectors represent forces)
- In terms of an specific tool to think about this knowledge
- Each mode has different affordances in terms of presenting different kinds of information.

Learning the language of science -multimodality

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Multimodal language to construct knowledge:

- **Vectorial concept of force (making use of dif. affordances)**
- **Scientific perspective of physical phenomena (superposition of representations)**

Multimodal language to mediate the teaching/learning process

- *Co-occurrence of different ideas (limited to two), fostering Interactive Dialogic discourse in a plenary*

Multimodal language as a pedagogical tool

- *External representations of ideas, facilitating personal explanations*
- *Visual reasoning*