Critical inquiry, question asking and the structure of ignorance

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Critical inquiry and conscious ignorance

Critical inquiry requires awareness of what is not known or what is not understood, i.e. conscious ignorance

Critical inquiry involves

- Problem finding
- Curiosity
- Questioning

Problem finding

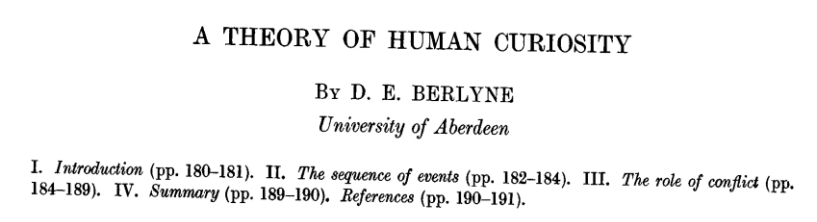
Problem finding: “the ability **to discover discrepancies** (problem sensitivity) and to render explicit a felt problem (problem formulation)” (Brugman, 1995).

> “The formulation of a problem is often more essential than its solution, which may be merely a matter of mathematical or experimental skill”
> Einstein and Infeld, *Evolution of Physics* (1938)

Curiosity

Few phenomena have been the subject of more protracted discussion than human knowledge. Yet …two important questions still confront us. The first question is why human beings devote so much time and effort to the acquisition of knowledge…

The second question… is why, out of the infinite range of knowable items in the universe, **certain pieces of knowledge are more ardently sought** and more readily retained than others (Berlyne, 1954, p.180)



A THEORY OF HUMAN CURIOSITY

By D. E. BERLYNE

University of Aberdeen

I. *Introduction* (pp. 180–181). II. *The sequence of events* (pp. 182–184). III. *The role of conflict* (pp. 184–189). IV. *Summary* (pp. 189–190). *References* (pp. 190–191).

Critical questioning
(Pedrosa de J., Moreira, Lopes and Watts, 2014)

Information seeking questions are generated when the questioner encounters

- an obstacle in a plan or problem,
- a contradiction,
- an unusual or anomalous event,
- an obvious gap in the questioner's knowledge base…

(Graesser and Person, 1994).

The study of conscious ignorance

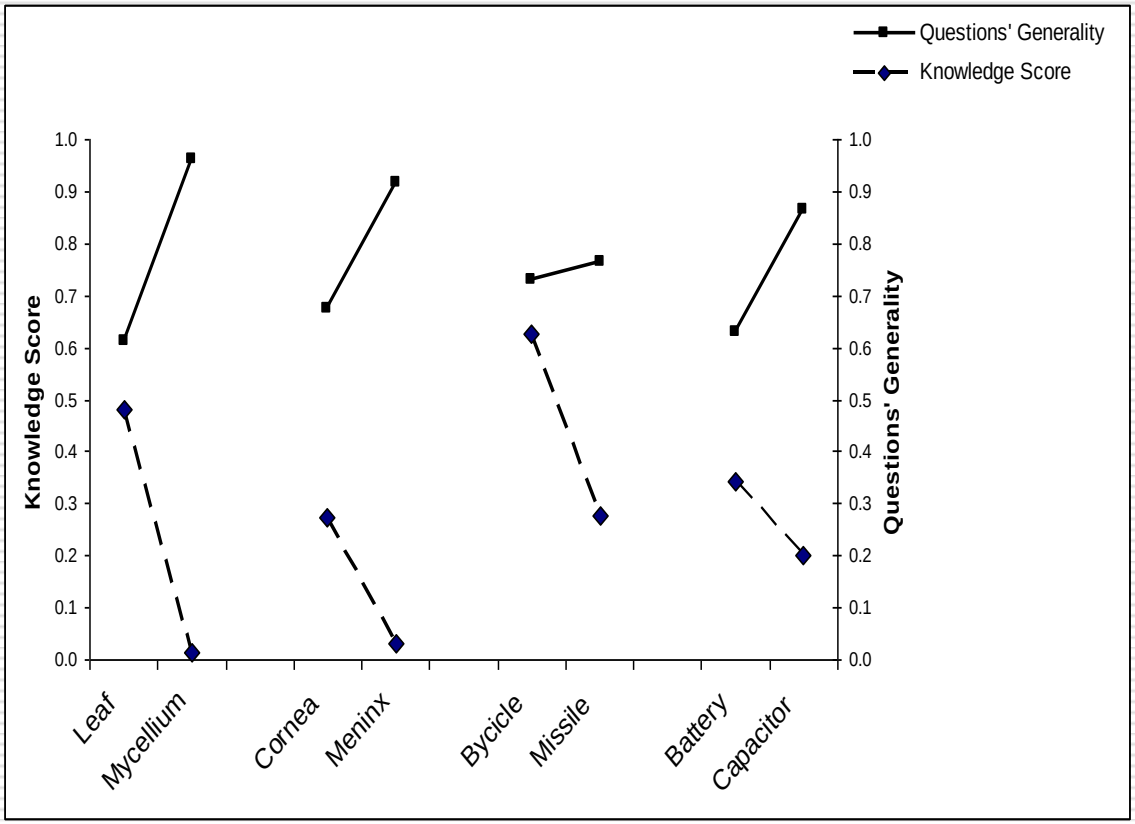
- Therefore a better understanding of critical thinking/critical questioning, involves a better understanding of the nature of conscious ignorance
- Many studies on the types and functions of questioning. (Chin and Osborne, 2008: 274 papers).
- Less analyses of the anomalies/ignorance causing questions
- Should conscious ignorance be considered as a void?

Should conscious ignorance be considered as a void?

13 year-old students were told to ask about objects:

- Less well known Mycellium, Meninx, Missile,Capacitor

- Better known: Leaf, Cornea, Bicycle, Battery



(Otero & Gallástegui, 2015)

Plan of the presentation

Components of conscious ignorance and the variables that influence it

1. Lack of knowledge about an object. Influence of domain knowledge and ontological category.
2. (Incomprehension of a science text. Influence of task.)

1. Lack of knowledge about an object

- Participants

  89 7th grade students; 40 12th grade students

- Procedure
  - Context: design of an encyclopedia of science and technology
  - Instructions to state unknowns ("what you do not know") by asking questions about 8 natural objects, such as Cornea or Glacier, and 8 artifacts, such as Battery or Radar

(Vaz-Rebelo, Fernandes, Morgado, Monteiro, Otero, 2014)

1.Lack of knowledge about an object

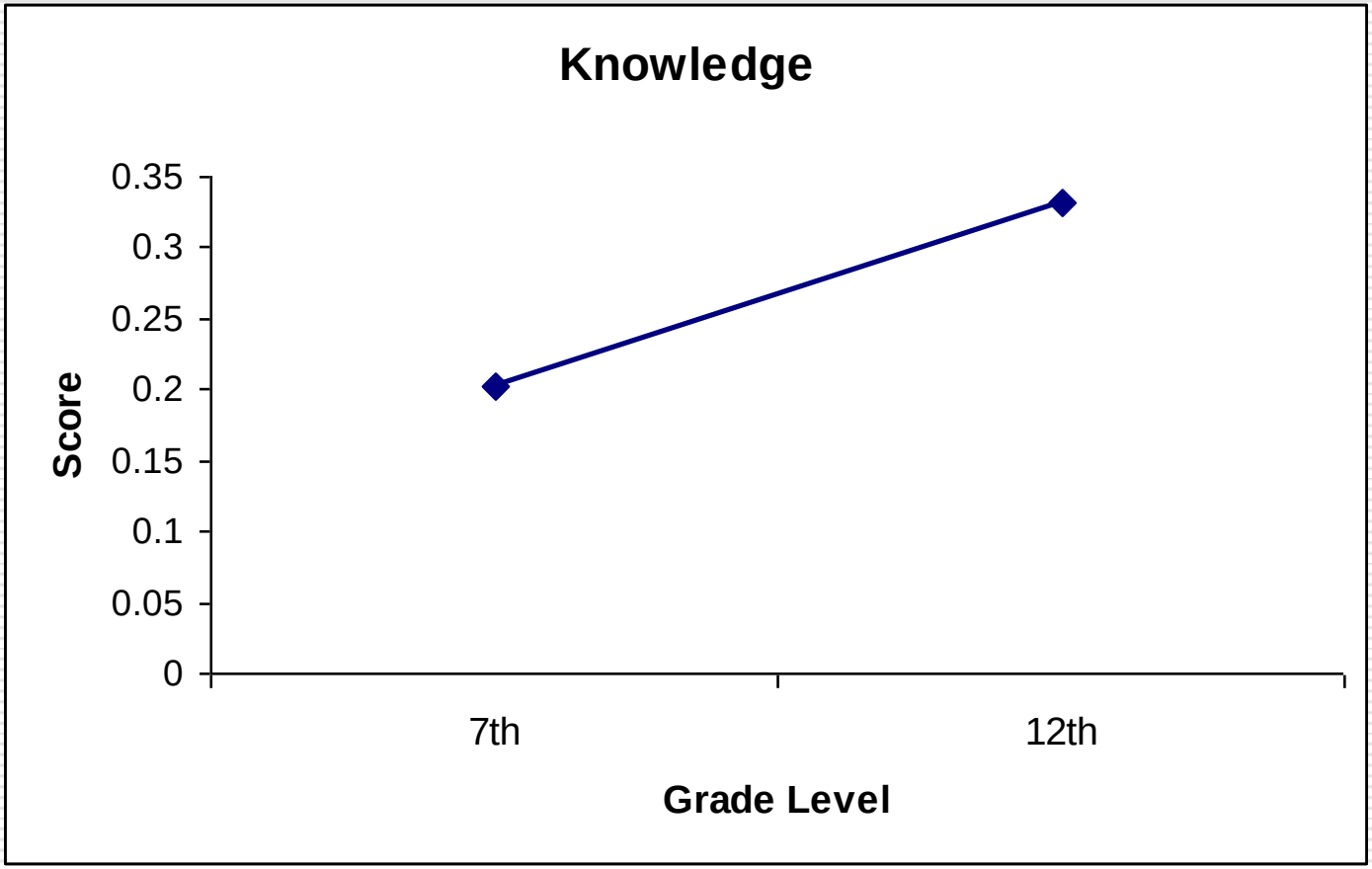
A basic hypothesis: ignorance is built upon knowledge

- Intrinsic unknowns: *What are the components of a battery?*

- Extrinsic unknowns: *Do batteries harm the environment?*

- Function unknowns: *How are batteries used in satellites?*

1. Lack of knowledge about an object



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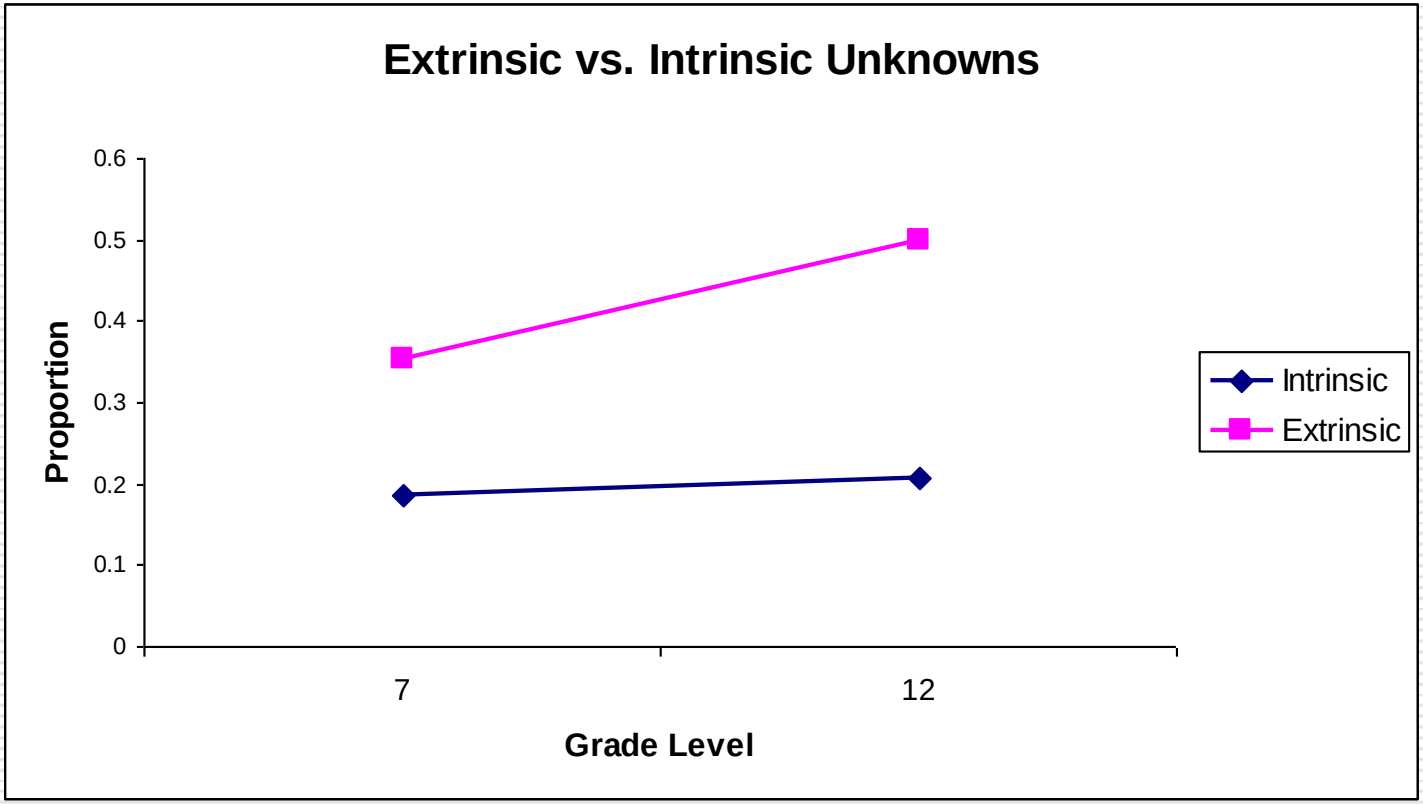

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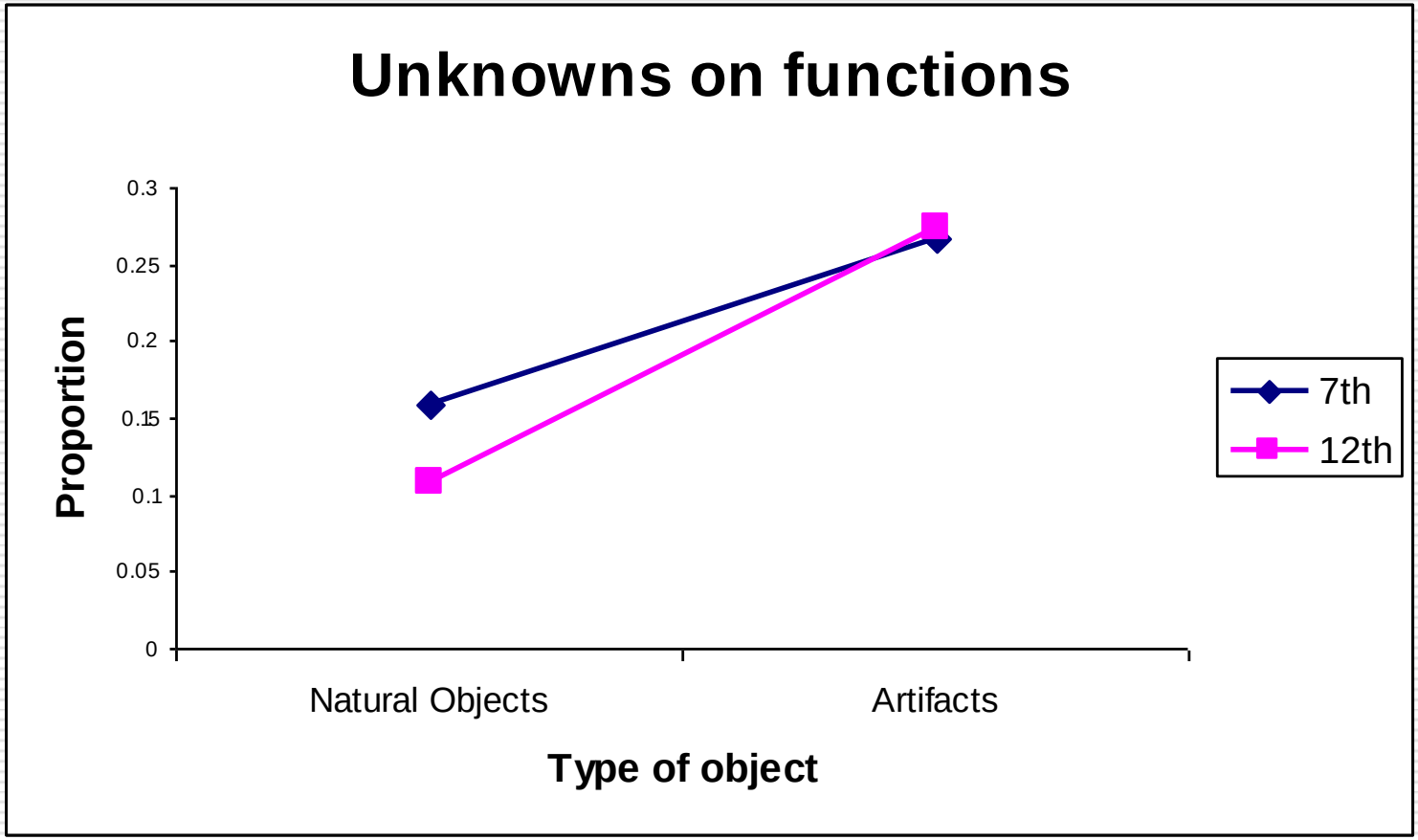


2. Incomprehension of a science text

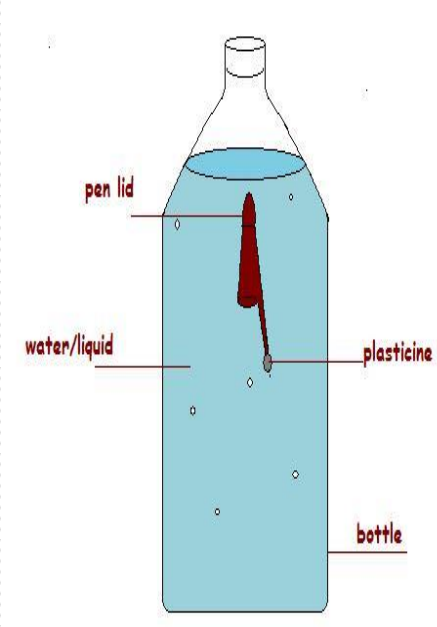
- What students do not understand from a text may be defined in terms of what they may understand from a text: a situation model
- A situation model is built from information provided by a text and knowledge elements from a reader’s memory, i.e., inferences

2. Incomprehension of a science text

These inferences may be of three types

- Associations: information about features, properties, and, in general,descriptive detail
- Explanations provide reasons as to why something occurs.
- Predictions are forward oriented and include consequences and anticipate ocurrences

2. Incomprehension of a science text



The Cartesian Diver

Submarines explore the ocean depths, both by floating and diving down to the ocean bed To understand how they work, a toy invented by Descartes, the *Cartesian Diver*, may be used. It can be made with a plastic pen cap and a piece of plasticine. The Cartesian Diver is put into a plastic bottle filled almost to the top with water, so that it can float with the top of the cap above the water. Care must be taken to ensure the cap does not have a hole in it and the amount of plasticine needed to make the Cartesian Diver float must be tested in a glass of water. If the bottle is corked well, when the sides are pressed the Cartesian Diver will dive to the bottom. To make it come up again, the pressure on the bottle simply has to be released

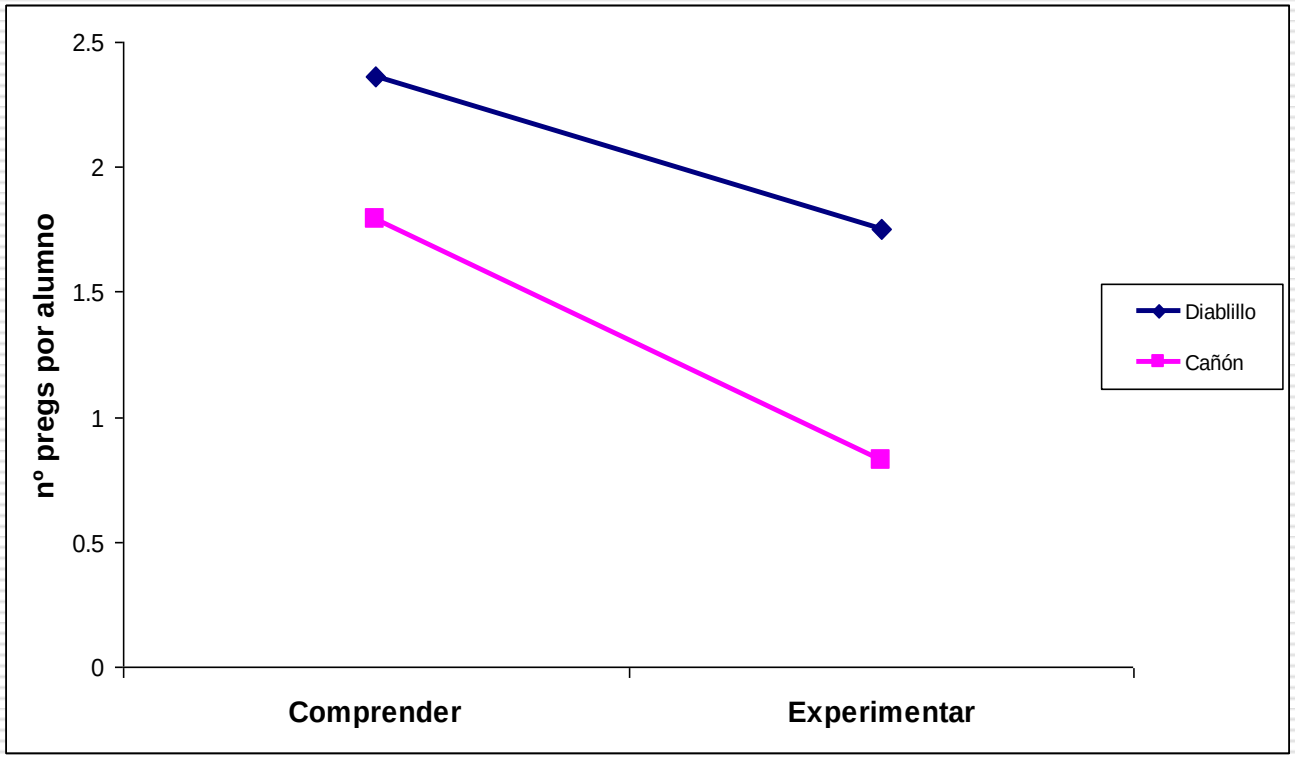
(Morgado, Otero, Vaz-Rebelo, Sanjosé, Caldeira, 2014).

2. Incomprehension of a science text

- **Explanations**: *Why does buoyancy increase when the bottle is no longer squeezed? Por que é que a impulsão aumenta quando deixa de se apertar a garrafa?*

2. Incomprehension of a science text

Explanation Questions



Conclusions

- Conscious lack of knowledge should not be considered as an undifferentiated void
- Both conscious lack of knowledge and conscious incomprehension have certain components

Conclusions

- Awareness of knowledge gaps about an object depends at least on knowledge and ontological category
  - Less knowledgeable students focus on general knowledge gaps
  - Older students focus on unknowns about relations with other entities more frequently than younger students
  - Lack of knowledge about functions comes more easily to students' minds when thinking about artifacts than when thinking about natural objects

Conclusions

- Awareness of obstacles when understanding a simple text describing a natural phenomenon depends at least on task
  - More explanatory obstacles are found when reading for understanding than when reading to prepare a demonstration

Conclusions

- In sum, several components can be distinguished in conscious ignorance that results in questioning.
- Understanding these components, and the variables that influence them, could contribute to the improvement of question asking and consequently critical inquiry

Obrigado