



The ethical duty to preserve the quality of scientific information

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INTRODUCTION

The commitment to divulge the knowledge acquired during his/her studies and professional activity is certainly an ethical duty of every scientist. However the spreading of knowledge, in the Internet era, involves potential risks that a scientist should be aware of. The Internet may in fact contribute to spread information badly or even incorrectly presented. The final result could be an impediment to the diffusion of knowledge or, at least, a reduction of its effectiveness. Criteria aimed to recognize incorrect or inadequate information would be, therefore, extremely useful. A recent research, originally aimed to identify tools to improve the expressive abilities of near-graduates, has allowed to identify some criteria for the quality control of knowledge and scientific information. An example of its application in the field of engineering geology will be here provided.

THE HYPERONYM AS A DIDACTIC AND TRAINING TOOL

In linguistics, a hyponym is a word whose semantic field is included within that of another word, its hyperonym. For example, chair, table and closet are all hyponyms of furniture (their hyperonym). Hyperonyms and hyponyms are asymmetric. Hyponymy can in fact be tested by substituting X and Y in the sentence 'X is a kind of Y' to see if it makes sense. For example, 'A screwdriver is a kind of tool' makes sense but not 'A tool is a kind of screwdriver'.



Fig. 1 – One of the courses delivered at FOIT.

A recent research, originally aimed to identify tools to improve the expressive abilities of near-graduates and grant a good retransmission of knowledge on their part, has revealed that this linguistics concept possesses a particular didactic value. The didactic tools developed during our researches were in fact intensively tested through the delivery of courses funded and organized by the "Fondazione dell'Ordine degli Ingegneri di Torino (FOIT)", an Italian non-profit Organization located in Turin. The courses were part of the formative offer of the Foundation addressed both to professional engineers of the Provincia di Torino and also to unemployed people and other disadvantaged social categories to help them to more easily participate to social life.

Training a student to rapidly identify the hyperonyms of nouns has proved extremely useful to improve his abilities to express himself. The improvement occurs because it becomes clear, after some exercise, that the right choice of an hyperonym may help a person to be more easily understood. and to communicate with different types of audiences, according to their level of culture and understanding. An example may help to clarify the point.

A student of one of our courses, after some exercises about hyperonyms, found herself more able to communicate with her 4 years old daughter. One day this latter asked our student what was the origin of the smell that she was feeling in the entrance of their house. Our student answered that the smell was due to the fresh varnish on the portal. The little girl immediately asked what varnish were. Our student was able to chose immediately the best hyperonym for the circumstance: "it is the **color** that the portal has been painted with". Of course if she had to explain what varnish is to an adult she would have chosen a different hyperonym: "varnish is a **preparation** for coating surfaces". "Color" is the better hyperonym of varnish for a child, while "preparation" for an adult. The noun varnish has certainly also other hyperonyms, but the choice of the student was the best to make herself understood by her daughter: an ability learnt during the course.



Fig. 2 – "Color" is the best hyperonym to explain to a child what "varnish" is.

A CRITERIUM FOR A QUALITY CHECK OF ANY PIECE OF INFORMATION

Apart from its use as didactic/training tool, the hyperonym can be very useful also as a criterion to check the quality of any piece of scientific information. Is the information expressed with a correct choice of hyperonyms? The choice of the hyperonyms present in the text is correctly addressed to the audience that the information is delivered to?

A recent application of the hyperonym criterion in the field of engineering geology may show its usefulness in guaranteeing the quality of the scientific information spread over the Internet.

In one of our classes we used Wikipedia to explain our students the functioning of a septic tank. The Italian version of Wikipedia contained in fact a good description of a septic tank and its components parts. However the reading of this description caused some difficulties to the students and appeared unclear. A careful analysis of the text immediately revealed a wrong choice of some of the hyponyms used in the text.

A septic tank is a large tub that is usually divided in two compartments separated by a wall with a hole in the middle that allows water to flow from one compartment to the other. Wikipedia indicates the names given to these two compartments. In Italian, according to Wikipedia, they are named "setto verticale" and "divisorio". However both words, "setto" and "divisorio" are hyponyms of "wall" or "membrane". The translation of "setto" in English would be in fact "septum", which is a "dividing wall" or "membrane". Therefore "setto verticale" and "divisorio" are not appropriate names for labeling "compartments", which are "closed spaces" and not "walls" or "membranes".

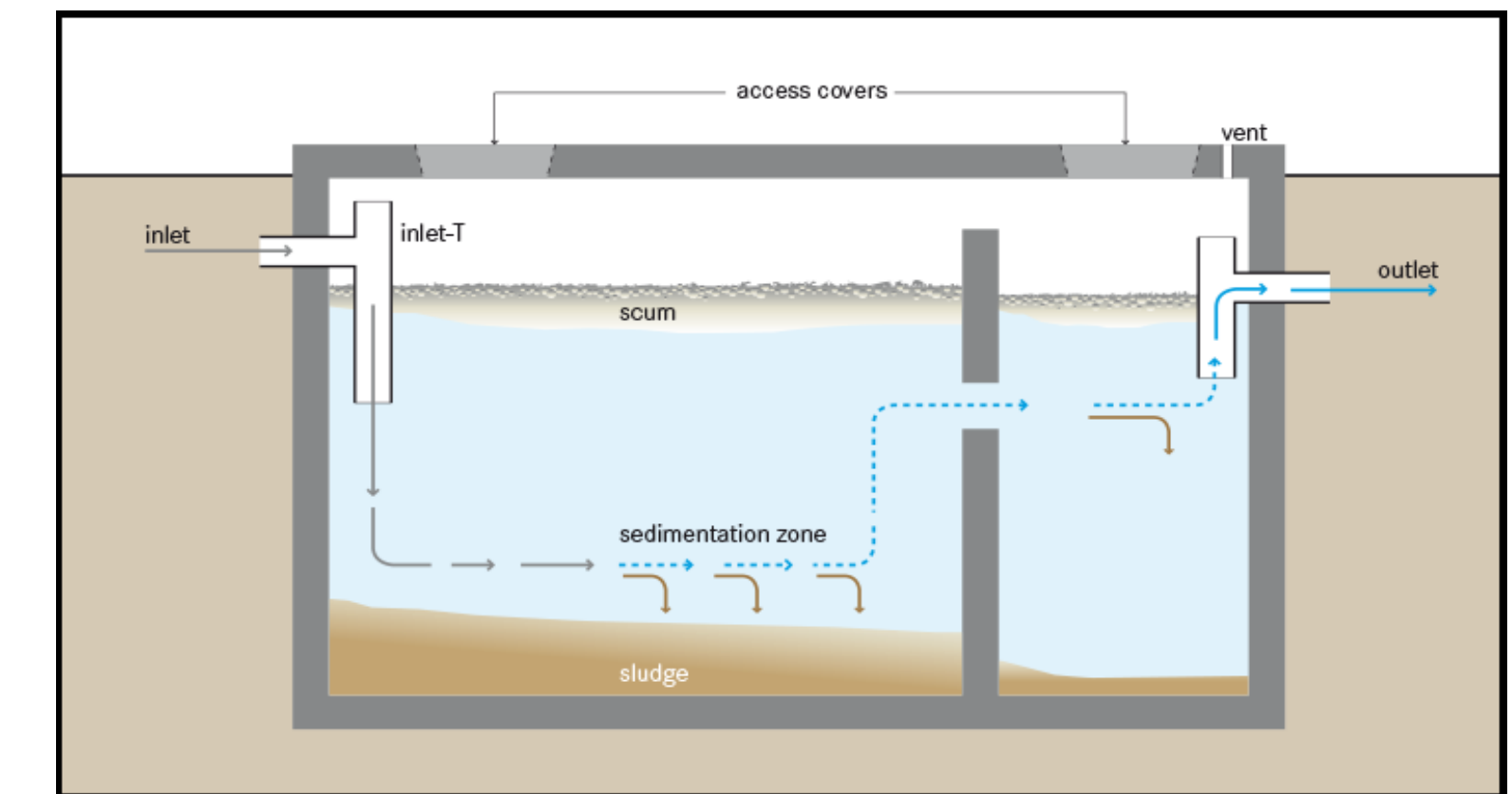


Fig. 3 - Schematic of a septic tank [1]



Fig. 4 – The Italian version of Wikipedia. The red circles shows the wrong hyponyms chosen to label the two compartments of a septic tank.

Such a wrong attribution of names, made with a wrong choice of hyponyms, deteriorates the quality of the information and was actually responsible of the difficulties of understanding met by the students of our class.

Once the wrong choice of names was spotted, the students did not meet any further difficulty of understanding.

COPY AND PASTE OF BAD INFORMATION OVER THE WEB

In a paper titled "Information versus knowledge and understanding" (1995), the Nobel Prize Murray Gell-Mann has emphasized the need of a quality control for the information available on the net. Such a control is of paramount importance to grant the spreading of understandable information and avoid confusion and misunderstanding due to bad information. The criterion here proposed might contribute to this end, particularly if it were taught in schools, to train student to better express themselves, spread good information, and recognize examples of bad information.

A rapid check has allowed to verify that the wrong information present in the definition of septic tank on Wikipedia has been copied in several other sites, contributing to spread bad and misleading information. The use of the criterion here proposed might contribute to mitigate similar effects by both helping to correct eventual mistakes and/or guiding readers to recognize them.

A NEW SUBJECT TO BE TAUGHT IN SCHOOL

The preservation of the quality of the scientific information available is an important issue that should be addressed with adequate tools and criteria. We all share the responsibility of efficiently passing the acquired knowledge to the new generations in order to grant the sustainability of our culture. Therefore every effort spent in this direction should be adequately appreciated. A possible criterion for a quality check of any kind of information has been here proposed with an example of its possible application. It hopefully might be the first step to introduce an important new subject to be taught in school: "preservation of the quality of information and knowledge".



Fig. 5 – M. Gell-Mann.

[1] Tilley, E., Ulrich, L., Lüthi, C., Reymond, P., Zurbrügg, C. - *Compendium of Sanitation Systems and Technologies* (2nd ed.). Duebendorf, Switzerland: Swiss Federal Institute of Aquatic Science and Technology (Eawag). ISBN 978-3-906484-57-0.