



C. S. E.

CENTRO STUDI ETOLOGICI

impronte

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This is the third issue of your newsletter!

A collection of information and curiosities on the most varied nature subjects

The "perché, perché, perché" (why, why, why) section" is always ready to answer your weirdest questions. This time we will tell you all about the sun and how fish use their olfactory system to "smell" in the underwater world!

Remember to address your questions to:

The Editor, Impronte,
Centro Studi Etologici, Convento dell'Osservanza 53030 Radicondoli (Si)
or email us at
impronte@centrostudietologici.org

Don't forget to write your name, age and where you are writing from.

In this issue "The woodsman" will tell us all about place-names (toponymy), read on to find out more about this fascinating subject.

Discover the optical illusions in our "Incredible!" section.

A warm greeting from the Editorial board

photograph: a male Black redstart (*Phoenicurus ochruros*)



perché, perché, perché?

readers ask the questions

Why and how the process of hydrogen fusion warms the sun's core?

Francesco Arduini (Roma)

Before answering this question let's take a look at a simple everyday example of combustion. First we need a piece of plastic which we will weigh on a precise weighing scale: the plastic weighs 10 grams (you need 1000 to make a kilogram). Then we put the plastic next to a flame, the plastic will start burning and will slowly turn into a heap of plastic, nothing like its original form (different in colour, consistency etc.). Now let's weigh the burnt plastic; it will weigh 8 grams, two less than the original weight. What happened to the other two grams? What has happened is that thanks to a process of combustion part of the plastic (mass) has been transformed into gas (a very smelly gas!) and energy (the heat emitted). - **This experiment must not be attempted at home, never without the supervision of an adult and never near other inflammable objects** -. If we hadn't let the gas evaporate, i.e. if the experiment had taken place under a glass dome, we would have found that the weight of the gas held in the dome would have been exactly the two grams that went missing from the plastic after having burnt it!

The same kind of phenomenon happens in the engine of a car; firstly the tank is filled with petrol (40 litres weigh about 30 kilograms) and after having driven for a while the petrol tank is empty; the petrol (mass) is transformed into: thermic energy (the engine is hot); mechanic energy (cars carry us and our luggage a long way, without cars our poor legs would have to work terribly hard) plus "leftover gas" a lot of which causes pollution. The first thing to do is start a process of combustion (the spark of the candle of the engine); the next step is converting "material" into other products and into energy. The material is called combustible, which means it can be burnt. It is interesting to notice that the final product of the combustion process cannot be used as fuel again. Therefore we could say that we have converted "useful" products into less "good" products, but we have obtained energy.

Now let's get back to our sun. We could say that a similar transformation takes place. In this case though the material is neither plastic or petrol; we are talking about hydrogen; this atom is the lightest existing in nature and is one of the most diffused in our universe. The temperature inside the sun can reach thousands of degrees. Hydrogen nuclei are very close to each other and the high temperature of the sun makes the hydrogen nuclei collide together hundreds of times. When four nuclei collide each other with a very strong force they fuse together. This fusion produces helium nuclei (in ancient Greek the word elio

perché, perché, perché? our readers' questions continued

means sun). If we were to weigh the helium nuclei we would find that one nucleus weighs less than four hydrogen nuclei; this is because during the process of fusion the nuclei release energy. This energy heats the sun's core and the sun therefore is able to warm the universe and produce light.

This process is called nuclear fusion and it can in a certain way be compared to the transformation of the plastic that changes once burnt. Hydrogen is transformed in 2

products: helium and energy. The difference from the plastic piece is that a portion of the mass of



the hydrogen nuclei is directly transformed into energy. A Hydrogen nucleus weighs thousands of times less than our piece of plastic (you need about 6×10^{21} followed by 21 zeros, six thousand millions of millions to reach the weight of 10 grams).

Sounds scary, doesn't it? On the other hand the force that joins the four hydrogen atoms to make the helium nucleus is far more intense compared to the force necessary to burn the piece of plastic (a bit like ants, these creatures are tiny compared to man, but can carry loads equal to a man's body weight). So a severe quantity of fusions of hydrogen nuclei produce an extremely large amount of energy, much more energy than would be produced by burning a piece of plastic with the same mass of that of the fused hydrogen atoms! When will this process end? Eventually all the hydrogen in the sun will run out, that is to say when all the hydrogen nuclei will have joined to form helium nuclei then there will not be sufficient heat around the sun to keep the gas atoms speeding up and colliding with each other, then the sun will eventually cool down like a dying fire! This is not something we will be around to witness so I wouldn't worry too much about it because this disaster will not take place for billions of years to come.

Francesco's question was kindly answered by Fabio Finocchi, Physicist. He lives and works in Paris at "*Groupe de Physique des Solides*" of the CNRS.

perché, perché, perché? our readers' questions continued

Can fish smell?

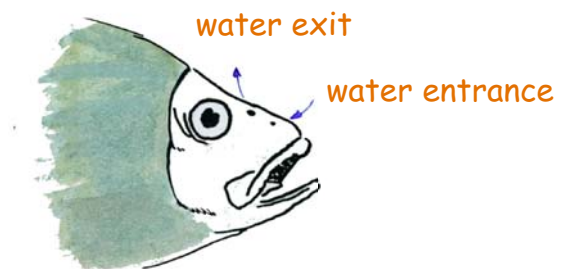
Tondo Barducci (Radicondoli)

The answer is yes. The olfactory organs are very ancient and date back to animals that existed on earth much earlier on. The olfactory system in fish is made up of two little tubes which are usually found between the eyes and mouth area, one on each side (a bit like our nose).



Premnas biaculeatus

These tubes allow the water to flow in and out freely. The inside of these tubes are lined with a mucous membrane which is made up of olfactory cells; these cells are nervous cells and are connected to the olfactory bulb, that is the part of the brain that elaborates and sends appropriate signals. The fish olfactory cells are very sensitive to certain chemicals present in the water (just as animals are sensitive to chemicals present in the air). The smell of these molecules are then "classified". According to some researchers this molecular mechanism is made of interactions between the olfactory cells and the odorous substances. In fact researchers have found that in the olfactory mucous of fish there are different kinds of receptors (certain areas of the cellular surface that can transform the signals received into nervous transmissions), each of which are sensitive to a certain kind of smell and with which the odorous substance can or cannot interact according to their chemical characteristic. It is almost like putting together the pieces of a puzzle, for each molecule there is a right piece, and each little piece corresponds to a certain odour. Similar smells trigger off the same receptors. Its like a chain reaction: the olfactory cells of the part in contact with the chemical substance is stimulated by that same substance to transmit that certain smell to the olfactory bulb. It is thanks to this complicated and sensitive system that fish are able to detect areas where venephic substances are present and therefore avoid danger. It may sound strange, but fish are also able to communicate with each other and coordinate mating activities, they do this by letting out a special class of chemicals called pheromones.



Tondo's question was kindly answered by Roberto Cozzolino;
photo by Giovanni Smorti; picture by Annette Tillmann

The woodsman

Plants and places

The vegetation that grows in a certain area, being that of a single plant or that of a group of plants has often contributed to the name of the place where it grows spontaneously; mountains, valleys, settlements, etc.,

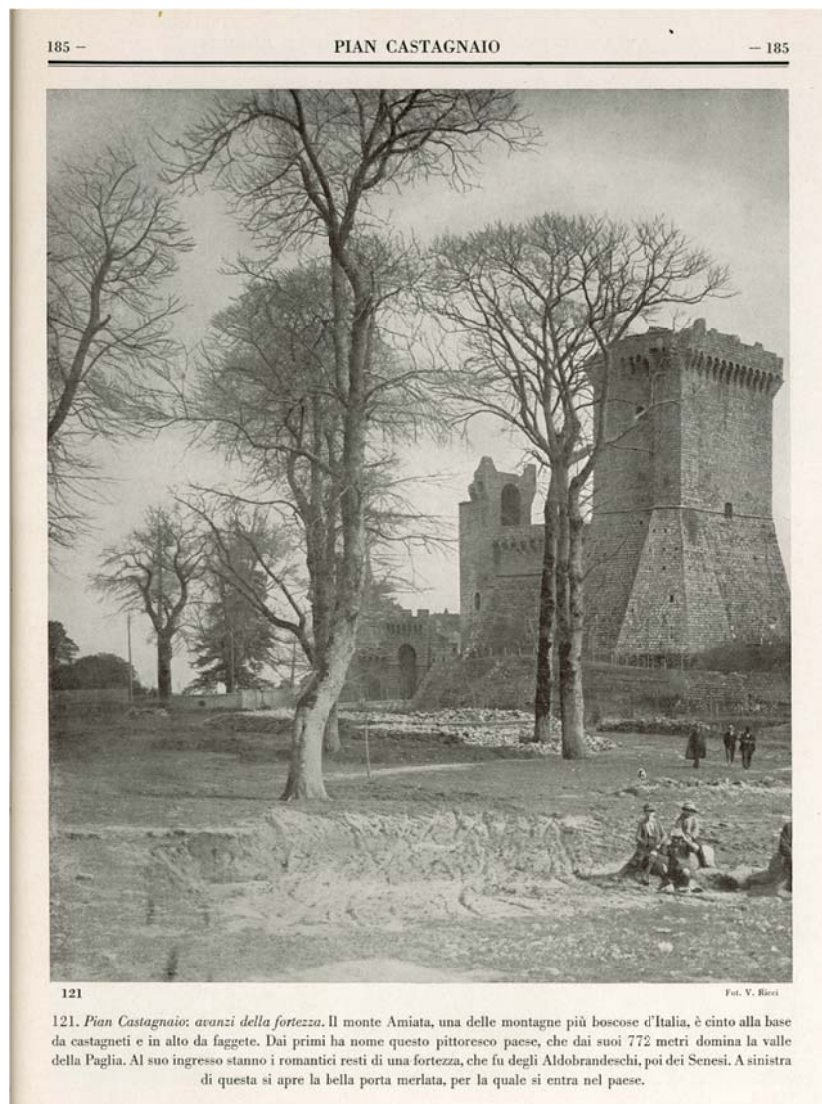
The technical term for the study of place names is **Toponymy**. The toponymy can be habitative, therefore defining a settlement, or topographical, describing landscape or geographical features. These name types suggest to us what the landscape looked like, how much it may or may not have changed over the years and what kind of nature and animals inhabited the area.

Here you will find a few examples of woods in the Tuscan region whose names derive from the vegetation that has grown in that area: Castagneto Carducci (Carducci Chestnut wood), Cerreto Guidi (Guidi Oak wood),

The following are examples of place-names that derive from the growth of one single plant in the area:

Quercegrossa (Large oak), Elci (from elce=leccio - holm oak), Poggio a Gattero (gattero=popular tree), Poggio Cerretino, (Oaktree hilltop), Buca ai Faggi (Beech hole), Fosso dei Lecci (holm-tree ditch), Fosso dei Tre Cerri (Ditch of the three Oaks), il Castagno (The Chestnut), Casa al Pero (House at the Pear Tree).

In certain cases the toponymy can help us trace the origin of certain woodland areas or of single species of vegetation where there have been events that have modified the original conditions of a certain area and therefore



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Fot. V. Ricci

121. Pian Castagnaio: avanzi della fortezza. Il monte Amiata, una delle montagne più boschive d'Italia, è cinto alla base da castagneti e in alto da faggete. Dai primi ha nome questo pittoresco paese, che dai suoi 772 metri domina la valle della Paglia. Al suo ingresso stanno i romantici resti di una fortezza, che fu degli Aldobrandeschi, poi dei Senesi. A sinistra di questa si apre la bella porta merlata, per la quale si entra nel paese.

The woodsman (continued)

the woods or species which were once present no longer exist in that area. We can also collate place-names that contain words such as woods, forests or even a spot: La Selva (The Forest), Boscotondo (Round Wood), Casalbosco (Farmhouse Wood), Macchialunga



bosco di Monteluco (Monteluco wood)

(Longspot), Maccchiolaie (Woodsmen Spot).

Place-names that have the word "selva" (forest) probably have the most ancient origins and it is likely that they date back to the Roman age. Whereas those place-names with the word "bosco" (woods) originate from the Latin Middle Ages.

Caggio derives from the Longobard expression "gahagi" meaning a fenced woodland area, whereas the meaning of the place name Monte Luco indicates an area on a hilltop where the woods have been devoted to the Gods (from the Latin "lucus").

In the example that follows we can see how places also got their names from the activities which took place there in the ancient days, Cetinarei, Cetinelle, Le Cetine all derive from the Latin word "caedere" meaning to cut.

Here are a few more examples of place-names from around the world:

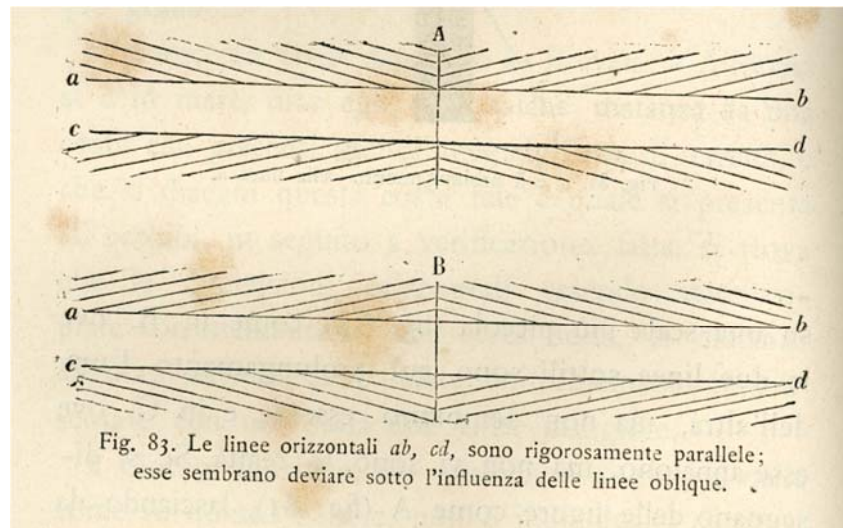
Acol in Kent, the name goes back to the Old English, ac for oak and holt for wood. The name indicates a wood of oak-trees. Birchington, also in Kent also comes from the Old English bircen "birch-tree" and tun "farmstead or village, so that the underlying sense is of a farmstead where birch-trees grow.

Erlenbach is a village in Switzerland whose name means brook lined by alders.

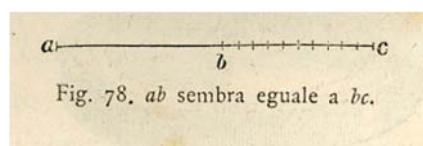
Alessandro Ceppatelli is the woodsman, the photograph of Pian Castagnaio was taken from "Attraverso l'Italia - illustrazione delle regioni italiane" Vol.6, 1935, Touring Club Italiano; the photo of bosco di Monteluco was downloaded from the website <http://www.spoletointica.it>

Incredibile! But could it be true?

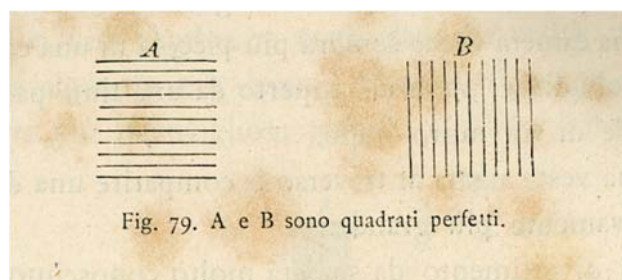
OPTICAL ILLUSIONS



If you observe this diagram, it looks as if the lines converge towards the oblique lines whereas they are perfectly parallel.



ab looks the same length as *bc* doesn't it? If you look closer you will see that *bc* is shorter than *ab*; in fact the lines drawn in the second half make it look the same as the section *ab*.



A and B are two perfect squares, but what do you notice if you look at them; your eyesight is tricked into seeing two rectangles instead.

Drawings taken from *le Ricreazioni scientifiche* (Scientific recreations) by Gastone Tissandier
Published by F.lli Treves Editori, Milano 1882.

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(*footprints*)

free electronic newsletter for children

contributors for this issue :

Alessandro Ceppatelli, Roberto Cozzolino, Fabio Finocchi,
Giovanni Smorti, Alexandra Gelpke, Annette Tillmann

English version: Isabella Colopi

CENTRO STUDI ETOLOGICI cultural association

Convento dell'Osservanza

53030 Radicondoli (Siena) Italy

<http://www.centrostudietologici.it>

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