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# You'd Think They Could Get Their Facts Right

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**Felix Pirani**'s typology of mistakes in non-fiction/reference titles.

All information books for children must bear a particular responsibility to be accurate but what kinds of mistakes are made in non-fiction and reference publishing on scientific topics? And how deleterious is the impact of such errors on young readers? developing understanding? **Professor Felix Pirani** gives examples of the kinds of mistakes to be found and categorises them in groups, suggesting some of the principles which should underlie both the production and the critical assessment of non-fiction/reference titles for the young. <!--break-->

When is a leap year? A young person who wants to know which years are leap years must choose his/her reference book carefully. I have at hand five such books which discuss leap year. All five are inadequate. One of them is written as if Pope Gregory XIII had never existed [**1** , p 245]; three of the others are imprecise about the Gregorian rule [**2** , p 82;**3** , pp 13, 143, 148;**4** , p 397] and the fifth states it wrongly [**5** , p 19]: the rule is that a century year is a leap year if and only if it is divisible by 400. The confusion is generally compounded by assertions about the length of the year, which render the Gregorian rule incomprehensible because *they use the wrong year*: The length generally asserted is that of the sidereal year or the anomalistic year, both longer than the tropical year, which is the relevant one in this case (**6** ).

**A typology of mistakes**

I attempt in this article to construct a crude typology of mistakes:

**1. Nuisance mistakes**

Errors such as those cited above in relation to leap year are nuisances, but not appalling. Knowing the wrong rule for leap years may lead one to lose a mark or two for an essay, but is perhaps not very likely to lead one to make many false inferences about other matters.

**2. Mistakes which invite generalisation**

In six years of reviewing science books for **BfK** I have found some mistakes which I think worse, because they invite generalisation. A few examples:

?The Moon has a mass roughly one-sixth that of the Earth, so its gravity is one-sixth as strong.? [**7** , p 72]

Both the premise and the rule for inference are wrong, and would be almost bound to lead to wrong inferences about the gravity of other astronomical bodies. In fact the Moon has a mass roughly one-eightieth the mass of the Earth, while its diameter is a little more than one quarter the equatorial diameter of the Earth, from which one may by Newton?s law of gravitation infer that its gravity is about one-sixth as strong. Surface gravity is determined by the shape and size of a body, as well as the mass.

??uranium 235 has 235 more neutrons than protons.? [**8** , p 16]

The implied rule for labelling elements is wrong, and would *always* lead to false inferences. Here 235 is the ?mass number?, which is the total number of neutrons plus protons, not the difference between these numbers.

?Two identical light bulbs connected in series (a) and in parallel (b) [with a diagram displaying (a) and (b)]. The bulbs in series glow brighter?? [**4** , p 63]

Didn?t the authors ever try it? This false statement would lead to false, and possibly dangerous, inferences about other electric circuits.

**3. Factual mistakes which mislead**

Then there are factual mistakes which mislead but are less likely to be generalised:

?Matter is created in exploding stars called supernovas.? [**4** , p 238]

The case is that some elements are produced from others by nuclear reactions in supernovae, but to say that ?Matter is created ?? is wrong.

?? a gyroscope [is] a fast-spinning wheel that you can?t tilt, however hard you try.? [**9** , p 62]

The injuries that might be sustained by believing this (skateboard + portable gyroscope?) could be severe.

More about the calendar:

?To keep our calendars in step with the Sun, leap seconds are sometimes added to a year.? [**4** , p 397]

This is totally misleading. The leap second is a clock correction to allow for the varying speed of rotation of the Earth, now that (since 1967) the second is defined by an atomic transition. To keep our calendars in step with the Sun we introduce leap years with extra days, as discussed above.

Describing the evolution of the Universe correctly is difficult. This is a fairly typical example of a flawed description:

?Space itself is getting bigger, so the galaxies are moving further apart. Working back in time, it means that the Universe was once much smaller.? [**4** , p 406]

This may seem intuitively right, but on present data, the spatial extent of the Universe is, and has been since shortly after the Big Bang, if there was one, infinite. Galaxies are moving further apart, but it is imprecise to say that the Universe ?is getting bigger? or was ?once much smaller? [**10** ].

**4. Caveat mistakes**

Even more widespread are what I call ?caveat mistakes?:

?The planets do not move around the Sun in circular paths, but in ellipses. [**1** , p 78].

Anyone who believes this will find accounts of the discovery of the planet Neptune, which relied on calculations concerning the departure from ellipticity, unintelligible. Had the author written ?approximately in ellipses?, it would do.

There is a similar problem for planetary satellites.

?All water molecules are the same ?? [**7** , p 28]

What would a reader who accepts this make of statements about ?heavy water?? A caveat about isotopes is needed here.

?The boiling point of a substance is always the same; it does not vary.? [**7** , p 17]

A caveat about pressure is needed here. Otherwise pressure cookers and the awfulness of tea brewed on the top of a mountain are incomprehensible. So is the design of a nuclear power station.

?Mercury is a liquid metal?? and on the same page ?Although liquids change their shape when moved from one container to another, their volume always stays the same.? [**7** , p 14]

A caveat about temperature is needed here. What can one make, otherwise, of an explanation of the mercury thermometer?

?Nothing can travel faster than light.? [**7** , p 110]

This is widely stated, but true only in a vacuum. A young reader who fixes this in his/her mind and later learns about the Cherenkov detector for energetic particles will find the description unintelligible: the operation of this detector entails the observation of particles travelling faster than light in a chosen medium.

**5. Historical mistakes**

Then there are historical mistakes:

?? Maurice Wilkins and his assistant, Rosalind Franklin, were using X-rays on DNA?.? [**2** , p 217]

Rosalind Franklin was never Maurice Wilkins?s assistant, which is a major issue for historians of the double helix, intensely disputing who acquired what X-ray photographs where and when and how and from whom.

?However, in 1932, Otto Hahn and Fritz Straussman [sic; misspelled] managed to split a special type of uranium atom into two bits and showed that energy was released.? [**11** , p 66]

It was 1939, not 1932. If nuclear fission had been discovered in 1932, World War 2 might have been shorter, but would certainly have been very different. In the context of the author?s other work [**9** , p 56] it appears that this is not merely a typo.

In fact nuclear weapons are something of a hang-up for many writers. One book claims that

?Little Boy [the Hiroshima bomb] was a plutonium bomb and Fat Man [the Nagasaki bomb] was a uranium bomb.? [**2** , p 208]

Actually it was the other way round, and this claim, together with the accompanying illustration, taken in conjunction with a description of how the bombs worked, would lead to total confusion.

**6. Unjustified omissions**

Another book [**12** , p. 93] describes the uranium bomb only, and gives no indication that the bombs have ever been used.

**7. Editing mistakes**

Then there are editing mistakes:

One book gives the number of moons of Jupiter as 16 in a data box and as 28 in the main text [**4** , pp 209 & 210]. Another gives the speed of particles in the largest cyclotrons an absurdly low value, and adds further confusion by giving the speed in mph inconsistently with that in kph. [**7** , p 23] Perhaps kps (kilometres per second), not kph (kilometres per hour) was meant, although that would not resolve the inconsistency. But a separate category of ?typographical mistakes? is perhaps needed.

**Responsibility to be accurate**

In my view, information books for children have a very high responsibility to be accurate, so that their readers do not have later on to waste time and energy on unlearning and relearning. Do not infer that I consider information books for adults to bear a lighter responsibility. The challenge to the authors and editors of encyclopedias is not well met, as should be apparent from these examples. The frequency of mistakes is excessive ? I have found more than those here mentioned. What is to be done?

It is often beyond my competence merely to identify mistakes in books I am reviewing ? for one encyclopedia I shared this task with a medical daughter-in-law; I covered the physics and astronomy, while she dealt with the life sciences. No doubt editors have similar problems, but that?s their job, innit? Specialist help is needed. Caveat mistakes could often be avoided by incorporating the caveat, thus making articles slightly longer, which requires that one should not overextend oneself in the available space. Often the needed space could be retrieved by being slightly less grandiose with illustrations.

Now that linking information books to websites is becoming more common, a means of dealing with mistakes suggests itself: besides guiding young readers to ?safe? web locations, the publisher?s website could include a file, perhaps tactfully titled ?updates and other developments? or something of the kind, and announced on the book?s dust jacket, where mistakes could be corrected. An email address could also be included, for readers who find mistakes to send news of them.

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**1. The DK Space Encyclopedia** , Heather Couper and Nigel Henbest, Dorling Kindersley 1999, 0 7513 5413 9, £20.00 hbk

**2. 1000 Inventions and Discoveries** , Roger Bridgman, Dorling Kindersley 2002, 0 7513 3928 8, £14.99 hbk

**3. The Usborne Encyclopedia of Planet Earth** , Anna Claybourne, Gillian Doherty and Rebecca Treays, Usborne 1999, 0 7460 3405 9, o/p

**4. The Young Oxford Encyclopedia of Science** , OUP 2001, 0 19 910711 4, £20.00 hbk

**5. How to? Build a Time Machine** , Hazel Richardson, OUP 1999, 0 19 910590 1, £3.99 pbk

**6.** For the details, see **Mapping Time: The Calendar and its History** , E G Richards, OUP 1998, 0 19 286205 7, £12.99 pbk

**7. e.encyclopedia science** , Dorling Kindersley 2004, 1 4053 0304 2, £25.00 hbk

**8. Hiroshima: The story of the first atom bomb** , Clive A Lawton, Franklin Watts 2004, 0 7496 5132 6, £12.99 hbk

**9. How to? Build a Rocket** , Hazel Richardson, OUP 1999, 0 19 910591 X, o/p

**10.** For a non-technical elaboration of this see, for example, Chapter 5 of **The First Three Minutes** , Steven Weinberg, Flamingo 1983, 0 00 654024 4, o/p

**11. How to? Split the Atom** , Hazel Richardson, OUP 1999, 0 19 910592 8, o/p

**12. The Usborne Illustrated Dictionary of Science** , Corinne Stockley, Chris Oxlade and Jane Wertheim, Usborne 1999, 0 7460 3485 7, £14.99 pbk

**Links:**
[1] http://typo3.booksforkeeps.co.uk/member/felix-pirani
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