

Human Evolution in Science Textbooks from Twelve Different Countries

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ABSTRACT: What kinds of images of human beings illustrate human evolution in school textbooks? A comparison between the textbooks of eighteen different countries (twelve European countries and six non-European countries) was attempted. In six countries (Algeria, Malta, Morocco, Mozambique, Portugal, and Tunisia), we did not find any chapter on the topic of human evolution in the textbooks consulted. When analysing all the images in the human evolution chapters in the 30 textbooks from the other twelve countries, we found that the great majority of these images show adult males, few images show females (one female for every four males), very few show children (one child for every nine adults), few images show ethnic diversity (one image with ethnic diversity for every eight images without ethnic diversity). When analyzing the images of timelines or trees depicting human evolution, we found in all the chapters on biological evolution the representation of *Homo sapiens*, who was found in 28 textbooks from twelve different countries. *Homo sapiens* is nearly always an archetype of a male with white skin, either naked or dressed in occidental clothing. Only in four cases, there was also a woman (and never a woman alone), such as in a Lithuanian textbook as well as in a French one, an Italian one, and a German one. This last German image is a unique one where ethnic diversity was illustrated by three people. These results show that scientific messages related to the origins of humankind are generally mixed with implicit values. It is important to identify these values, whilst teaching this topic, in order to favour the ability of students to develop a critical outlook for better citizenship.

KEYWORDS: Human evolution, images of humankind, science textbooks

Introduction

On the 21st of June 2006, the Inter Academy Panel (IAP), with sixty-eight member countries representing the world's national Science Academies, published a joint statement on the teaching of evolution:

We, the undersigned Academies of Sciences, have learned that in various parts of the world, within science courses taught in certain public systems of education, scientific evidence, data, and testable theories about the origins and evo-

lution of life on Earth are being concealed, denied, or confused with theories not testable by science. We urge decision makers, teachers, and parents to educate all children about the methods and discoveries of science, and to foster an understanding of the science of nature. Knowledge of the natural world in which they live empowers people to meet human needs and protect the planet” (p. 1).

This collective declaration shows the importance of evolution for the teaching of science and the clarification of the respective fields of scientific knowledge and values concerning this topic. Studies on the subject of the presentation of evolution in the curricula and textbooks have taken place in various countries, and often showed the great importance of social context with respect to the curricula and textbooks: on Spanish Biology curricula (Barberá, Beatriz, & Pérez-Pla, 1999), on Spanish textbooks (Jimenez Aleixandre, 1994), on Chinese, American and Soviet secondary school Biology textbooks (Swarts, Anderson, & Swetz, 1994) and on US textbooks (Skoog, 1984 and Rosenthal, 1985).

We focused our study on human evolution, in which the obstacles and the difficulties are exacerbated even more (Quessada & Clément, 2007). Skoog (2005) also studied the coverage of human evolution in 20th Century US high school Biology textbooks and in current science standards. He ascertained that, prior to 1960, human evolution was given little attention in Biology textbooks. In the following two decades, the situation with regard to human evolution worsened and the information about evolution was minimal but, in 1990, human evolution was unrestricted. By 2004, three states included the teaching of human evolution in the state science standards. A historical approach of the French syllabuses during the 19th and 20th centuries (Quessada & Clément 2007) showed a contrasting situation compared with Skoog’s work on the USA. For instance, after being taught at the end of 19th century and in the beginning of 20th century, human evolution was suppressed during the next 50 years, and then it was regularly taught. For any historical period, Quessada and Clément (2006a, 2006b, 2007) showed strong socio-cultural influences on the content of syllabuses and textbooks.

In Greece (Lakka & Vassilopoulou, 2004), human evolution is supposed to be taught, but is not always taught. Prinou, Halkia, and Skordoulis. (2007) specified that in Greece, from 1983 until 2000, “the evolution of humankind was only taught to a small percentage of pupils – those who were prospective candidates of medicine” (p. 8). Since 2000, human evolution is included in a chapter on theory of evolution, which is “omitted from the subject matter of courses in the upper secondary school, a practice that reveals at least the underestimation of its importance” (p. 9). This omission can also occur in other countries where the human evolution is supposed to be taught, but our work is limited to the analysis of the textbooks.

During recent years, our knowledge of the evolution of humankind has been significantly modified. Each new discovery has been immediately diffused in the media. The public is fascinated by queries concerning our origin, but, paradoxically, this topic is absent from the curricula of some countries. Thus, the goal of our work was to try to identify the potential socio-cultural influences on the current textbooks in the 18 countries of our sample. This work focused on questions relat-

ed to the presentation of the topic of human origin in the textbooks of the countries where this topic is taught.

Theoretical background

School textbooks can be analyzed in the context of the didactic transposition. The concept of didactic transposition, as proposed by Verret (1975) and then by Chevallard (1985), is used to analyse the way some scientific knowledge is chosen and then transformed in order to be taught. Typically, it consists of three levels of transposition, namely, the reference knowledge, the knowledge to be taught, and, finally, the taught knowledge. Clément and Hovart (2000) proposed more than three levels and one of them relates directly to school textbooks. For each level, they took into consideration the interactions between scientific knowledge (K), values (V), and social practices (P), and termed this process the KVP model (Clément, 2004, 2006). Several scientists and philosophers analyzed the interactions between scientific content and socio-cultural context, particularly for the evolution of humankind (Gould, 1981; Cohen, 1999). Quessada and Clément (2007) also introduced the concept of Didactic Transposition Delay, (DTD). DTD relates to the time delay between the date on which a scientific publication appears and the date on which its content is introduced into a syllabus or into a school textbook.

Analyzing the history of French science textbooks, Quessada and Clément (2006a, 2006b) observed a different DTD for the syllabuses and for the school textbooks. The DTD for the syllabuses can be either shorter or longer than that for the textbooks. The length of these DTD are correlated to different parameters of socio-cultural context, such as, the importance of the subject matter and the popularisation of the specific topic, as well as the existing dominant values (ideologies, beliefs, moral or philosophical positions). Social pressure is particularly important with respect to teaching the origins of humankind.

These earlier results, relating to current and past French socio-cultural context (Quessada & Clément 2007), have led to the development of a larger comparative approach involving several countries which contrast in terms of their geographical, political, social, cultural, and historical contexts, allowing the prospect of identifying interactions between the social practices, the current values, and the scientific knowledge that is taught in each country.

Research Question

Which implicit values can be identified in the images of human beings and other *Homo* species in the chapters dealing with human evolution in school textbooks? Can we find the same images, the same implicit values, in textbooks of countries that contrast in their historical, geographical, economic, political, cultural, and religious contexts? We claim that the images presenting the genus *Homo* do not only express scientific knowledge, but perhaps also some implicit values.

1. "Biology, Health and Environmental Education for better Citizenship", project coordinated by G. Carvalho (Portugal), P. Clément (France) and F. Bogner (Germany).

Methodology

Our work was part of the European project “BIOHEAD-Citizen”¹ on six topics. Participants from 18 countries worked on the topic of the origin of humankind. The countries had been chosen based on their socio-cultural, geographical, and historical differences in order to test precise hypotheses regarding the comparison between European and non-European countries, the comparison among religions (based on countries which are mostly Catholic, Protestant, Orthodox, or Muslim, and having various levels of atheism or agnosticism) and, within Europe, analysing differences between North and South Europe, East and West Europe, etc.

In a first step, we examined whether the specific topic of human evolution was present in the textbooks of the eighteen countries. The second step focused on two complementary sets of data, that is, the images of the different species of the genus *Homo* in the chapters devoted to human evolution, and the images of *Homo sapiens* in evolutionary trees or timelines in all the chapters of the textbooks. The textbooks have been analysed using the same grid for each country. The grid was developed collectively, during the first year of the BIOHEAD-Citizen project (2004–2005), and tested on samples of textbooks in several countries for verification and improvement. The data used in the present analysis came from only two small parts of the grid.

The Images of the Different Species of the Genus Homo

During the first part of our work, we analyzed 30 textbooks from the 12 countries where a specific chapter of the textbook was devoted to human origin, namely, Cyprus (4 textbooks), Estonia (2), Finland (2), France (4), Germany (3), Hungary (3), Italy (6), Lebanon (1), Lithuania (2), Poland (1), Romania (1) and Senegal (1). All the textbooks that were analyzed are science textbooks, with the exception of one history textbook (Cyprus). The textbooks cover a large age range of students (from 7 to 19 years old). The number of textbooks analyzed from each country is related to two different parameters, that is, the number of school level(s) dealing with human evolution, and the existence of only one official publisher or of several private publishers (in this case, the textbook that was mostly used was selected).

The data used in our first analysis relate to the type and number of images representing past or present individuals of the genus *Homo*. Each image was characterised by specific indicators concerning the gender, the age, the ethnicity, and the presentation of each human being (nude, dressed, or skeleton, and whole body or only one part, such as, the head or the skull).

The Images of Homo sapiens in Evolutionary Trees or Timelines

The second part of our work analyzed 62 images containing representations of *Homo sapiens* in a tree or timeline of Evolution in all the chapters of the textbooks. These images were collected from 28 textbooks from twelve countries (Cyprus, Estonia, France, Germany, Italy, Lebanon, Lithuania, Mozambique, Portugal, Romania, Senegal, and Tunisia). These 12 countries are not exactly the same as for the first part of our work, because in three countries where human evolution was present in a specific chapter (Finland, Hungary, and Poland), there was no timeline or tree of evolution with a representation of *Homo sapiens*, but, in three other countries, namely, Mozambique, Portugal and Tunisia, there was no specific chapter devoted to human evolution, but some timeline or tree of evolution with a rep-

resentation of *Homo sapiens* in other chapters. These images of *Homo sapiens* have been grouped in several categories, such as, nude man without beard, nude man with beard, dressed man with suit, dressed man (other than suit), couple, small group of people, shadow of unidentifiable gender, brain, and skull.

Results

In Six Countries of Our Sample, There Was no Chapter on Human Origins.

In the sample of countries represented in our research project, there was nothing related to Evolution in Algeria and Morocco, and there was no specific chapter on human origin in Malta, Mozambique, Portugal, and Tunisia, where Evolution was nevertheless taught. In some of these countries, this precise topic was present but disappeared in the most recent syllabuses (Morocco, Tunisia, and Portugal: personal communication of our colleagues). In Lebanon, it was present in the syllabus (Harfouch & Clément, 2001), but it was no longer compulsory (Harfouch 2008). We do not discuss here the possible causes of this absence, but we only present data related to the presentation of the topic “human origin” in the textbooks of the twelve countries where this topic is taught.

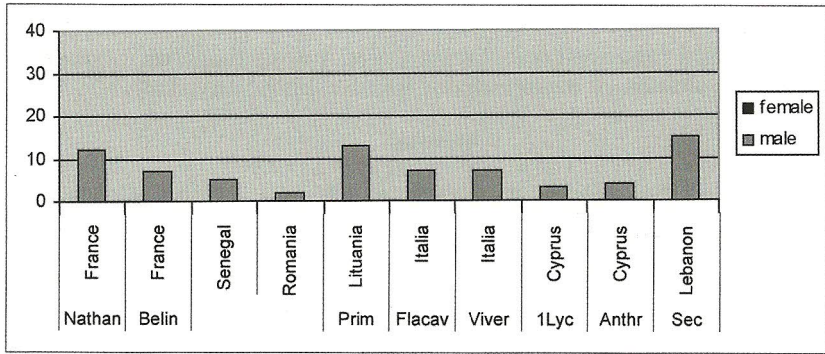
Images of the Genus *Homo*

In the twelve other countries of our sample, we first added up the occurrences of all the images of human beings, taking into account all the species of the genus *Homo*. There were 606 representations of *Homo* within 203 images (203 figures in the 30 analysed textbooks). For 45% of these 606 representations of the genus *Homo*, the gender was not identifiable, because the images showed skulls or skeletons, without any indication of their gender. Images of human males added up to 44% and only 11% of the images were identified as human females.

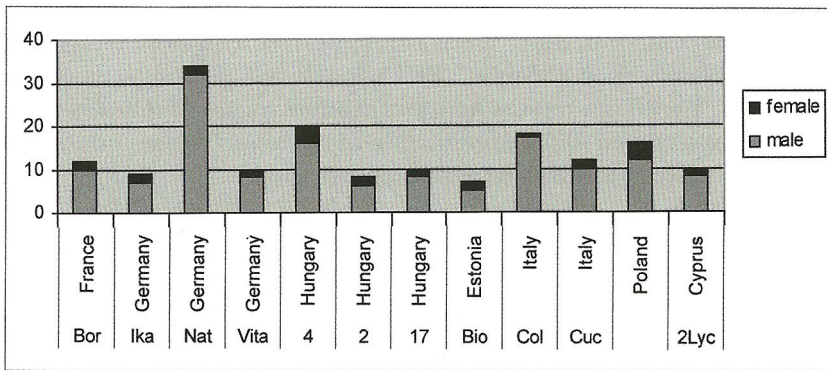
There were three categories of textbooks. Textbooks with only males (Figure 1a), textbooks where both genders were present, but very few females (< 30%) (Figure 1b), and textbooks including more than 30% females (Figure 1c).

Figure 1 shows also four types of countries. Only in Finland, there was a balanced amount of the two genders (half male - half female in the three analyzed textbooks). In contrast, there was not a single woman in the textbooks analyzed from three other countries (Senegal, Romania, and Lebanon). The situation was intermediary in four other countries, where all the analyzed textbooks had just a small number of women (Germany, Hungary, Poland, and Estonia). In the other four countries, the presence of women strongly varied among the publishers (Figure 1).

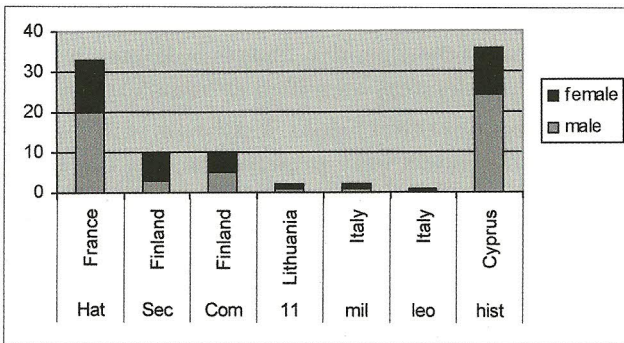
In all the cases, the female Lucy was present but she was an *Australopithecus*, not a *Homo*. We found an interesting association of Lucy with an actual woman (Figure 2a), which showed the actual woman as a morphological comparison with Lucy. The representation of a prehistoric woman, as in the Italian image (Figure 2b), was the most frequent female image. Exceptionally, we found an image of women represented in a scientific context, in a Finnish textbook, where there were two female ethnologists working with a chimpanzee.



a



b

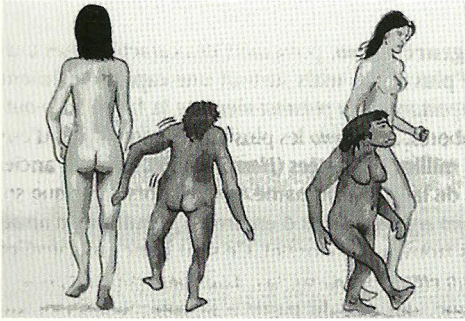


c

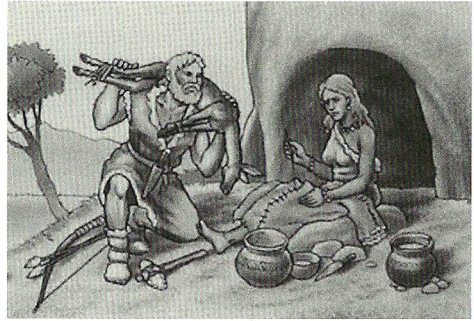
Figure 1. Number of Male and Female Representations of the Genus Homo (different species; total $n = 606$) in the 30 analysed textbooks. The images with an unidentifiable gender are not included in this graph. Each bar represents one textbook.)

The proportion of adults versus children in the representations of the genus *Homo* found in all the textbooks analyzed is very low. The age cannot be identified in 12% of the images, and only 9% of the images showed children. So, in the textbooks, the archetype of the genus *Homo* was not only a male, but also an adult male.

In the next step, the ethnic diversity in 223 figures, showing representations of *Homo*, was analyzed. The ethnic type cannot be identified in 58% of the figures (sil-



(a) Comparison of the Australopithecus Lucy and an actual woman (France, Hatier, 2002, p. 55)



(b) A prehistoric family (Italy, Juvenilia, 2005, p. 15)

Figure 2. Examples of Images Showing Females.

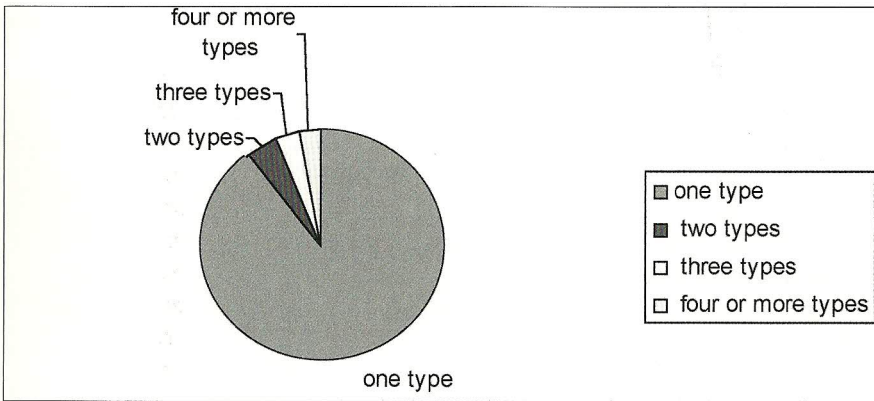


Figure 3. Ethnic Diversity of the images of Genus Homo (N = 223) in the Figures Included in the Chapters Devoted to Human Evolution.

houettes, shadows, skeletons, and skulls). From the remaining representations (Figure 3), 90% of the images showed only one ethnic type. This was generally a white man, but some exceptions were found. For example, in Finland one black-skinned woman and one Saharan girl were shown. In 4% of the figures, there were two ethnic types, generally juxtaposing people with white and black skin. In 3% of the figures, there were three ethnic types (one Polish and two German textbooks), and in the final 3%, four or more types were shown (one in France, one in Germany, and one in Hungary). Thus, in most of the textbooks, the genus *Homo* was represented not only as an adult male, but also as a white adult male.

Images of *Homo sapiens* in Human Evolutionary Trees or Timelines.

A total of 62 figures, which showed human evolutionary trees or timelines (sequences) containing at least one illustration of *Homo sapiens*, emerged from the 28 textbooks that were analyzed. In these 62 figures, 67 humans were shown. These images have been classified into 9 categories, as indicated in Figure 4.

The category “woman” did not exist, because *Homo sapiens* was never repre-

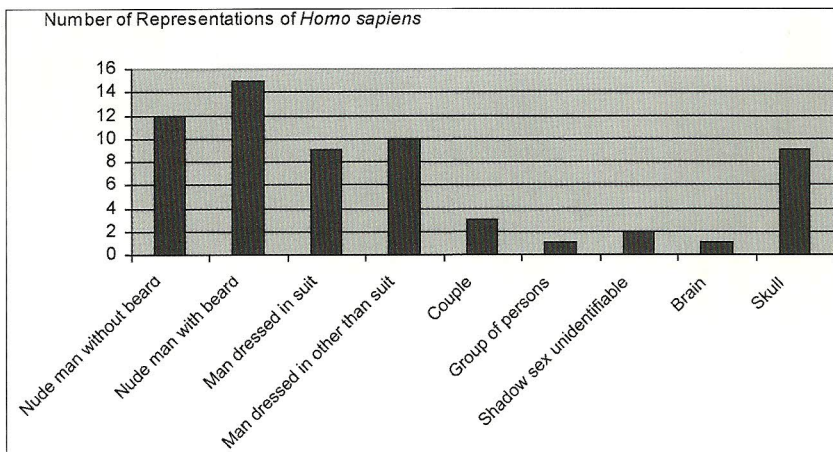


Figure 4. The Different Categories of Representations of *Homo Sapiens* in the Trees or Timelines Depicting Human Evolution.

sented solely by a woman. *Homo sapiens* was represented three times by a couple (an example is shown in Figure 5), and, in another case, by a small group with two men and one woman (Figure 11). In total, only 6% of human beings presented in this context were females (Figure 6). In the great majority of the analysed textbooks, biological evolution ended with a male *Homo sapiens*.

More than half of the male *Homo sapiens* (59%) were nude, while half of this percentage had a beard, and half did not. The others were dressed, 18% appeared to wearing a suit and 23% were shown with other occidental dress (sweat suit, sweater, shirt, etc.).

The majority of textbooks illustrated human biological evolution as linear and finalised, projecting an

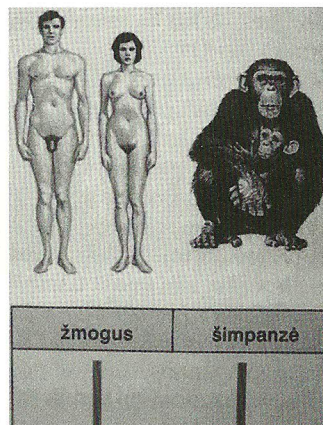


Figure 5. A Couple (in *Biologija*, S. S. Mader, Vilnius, Lithuania, 1999, p. 134)

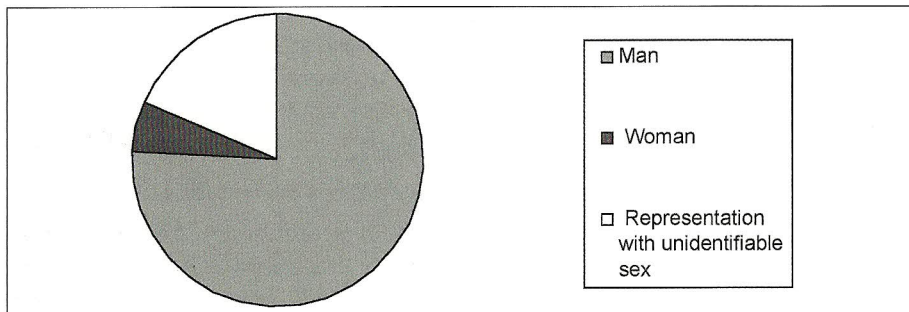


Figure 6. Gender in the representations of *Homo Sapiens* in Human Evolutionary Trees or Timelines.

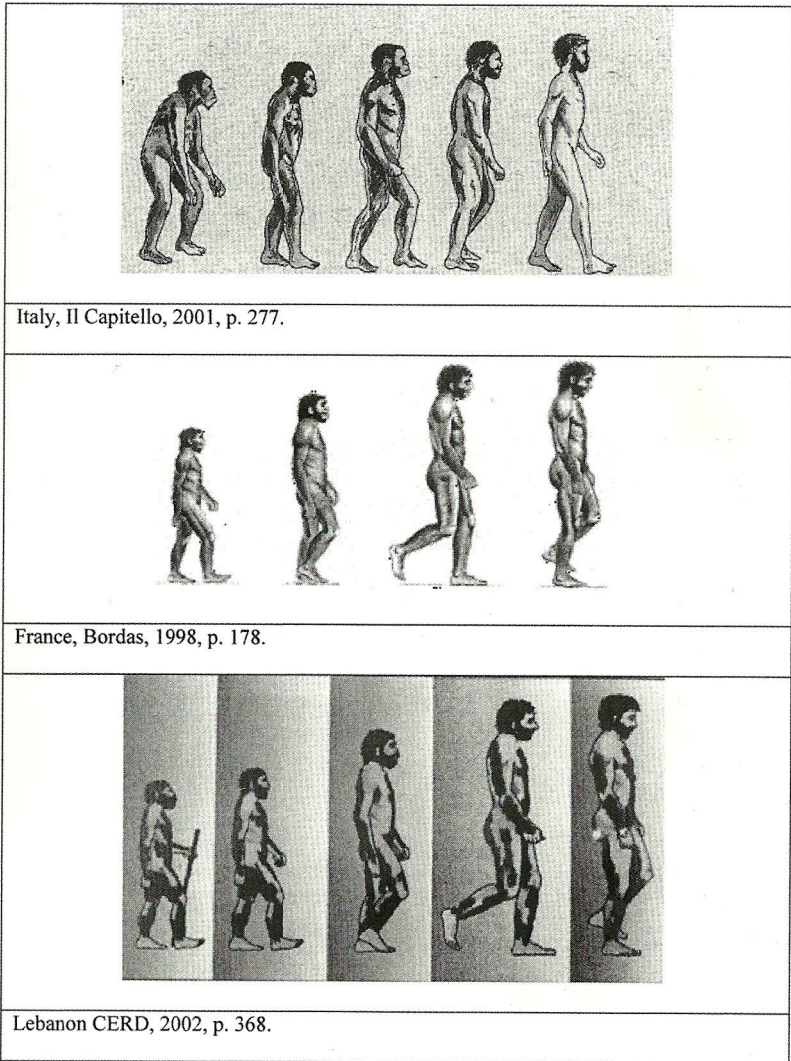
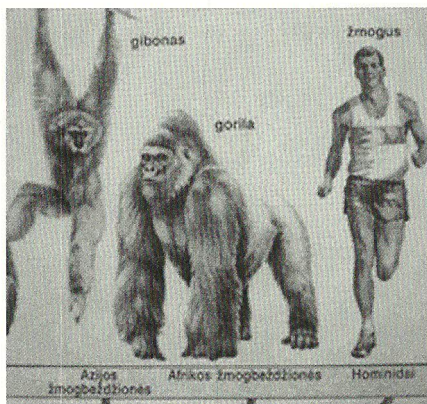


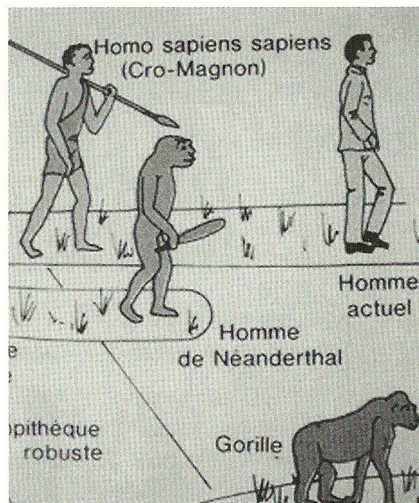
Figure 7. Linear Conception of Human Evolution, Ending With A White-Skinned And Bearded Man.

image of a light-skinned male *Homo sapiens*. Figure 7 illustrates the most frequent type of drawing of this linear human evolution, where *Homo sapiens* appeared as a naked white-skinned man, resembling the prototypical image of Adam.

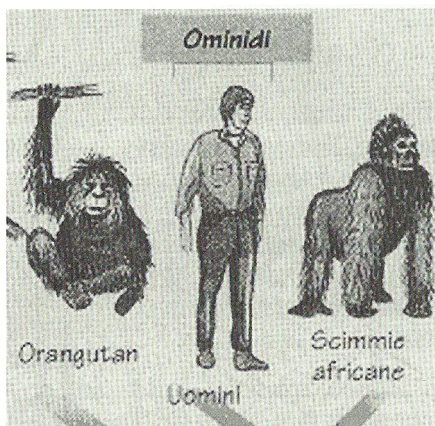
Another frequent representation of *Homo sapiens* was a male human, with characteristics of occidental society (white-skinned, occidental clothing, and/or tools and accessories). The images in Figure 8 show a jogger from a Lithuanian book, a white man with a suit from a Senegalese book, a man wearing modern blue dress in an Italian book, and a boy in a German book.



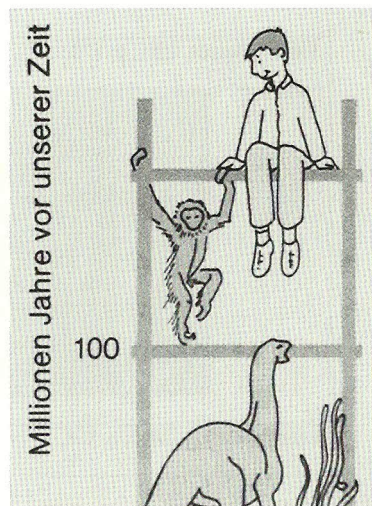
Lithuania, Alma Littera, 1999, p. 350.



Senegal, Armand Colin, 1983, p. 314.



Italy, Mondadori, 1998, p. 208.

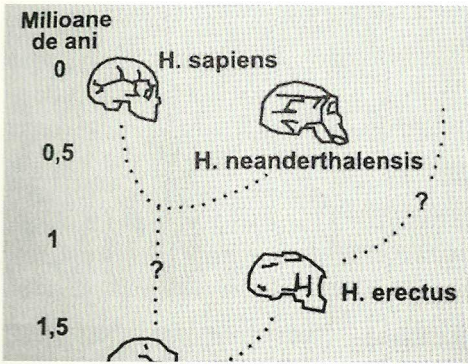


Germany, Ernst Klett Schulbuchverlag GmbH, 2005, p. 74.

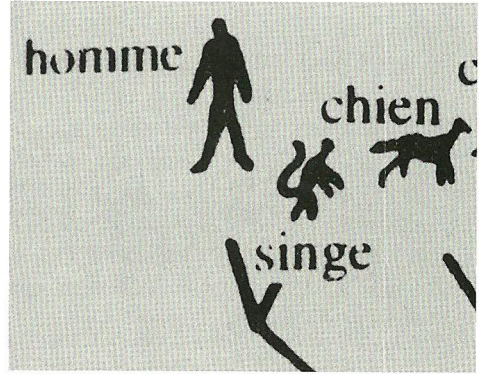
Figure 8. Different Representations of an Occidental Male in Images of *Homo sapiens*.

In some representations, neither the gender nor the ethnic type could be identified, as indicated in Figure 9. Such representations were images of skulls (14.5%), shadows (3.2%), and brains (1.6%). Other images of *Homo sapiens* showed males with some symbolic characteristics, such as, for instance, a silhouette of a man dressed with a suit and an attached case as a symbol of modernity, or a nude white

man paradoxically bearing a modern tool in his hand as a symbol of humanity, as indicated in Figure 10.

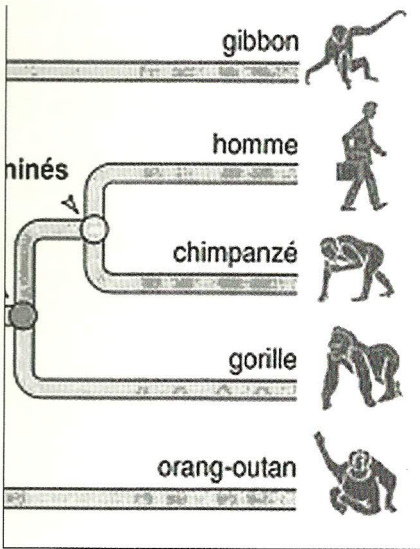


Romania, Alma Littera, 2002, p. 94.

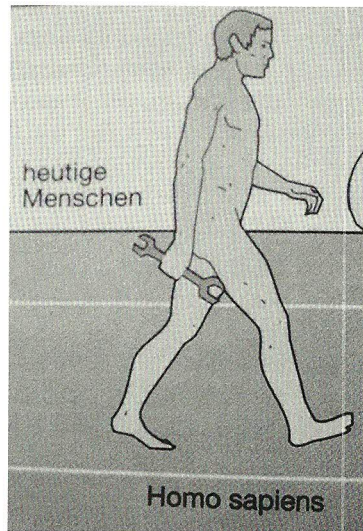


Tunisia, CNPOI, 2005, p. 135.

Figure 9. Unspecified Representations of Homo Sapiens.



France, Bordas, p. 39.



Germany, Ernst Klett Schulbuchverlag GmbH, 2005, p. 82.

Figure 10. Additional and Different Representations of Homo sapiens.

Finally, we found only one image showing ethnic diversity in humankind with a sketch of three persons from three different ethnic origins (Figure 11). Among the 67 human illustrations included in human evolutionary trees or timelines, which were found in the 28 textbooks that were analysed, only two of these illustrations could be identified without ambiguity as being non-occidental (African and Asian), accounting for only 3% of all the representations of *Homo sapiens* that were found.

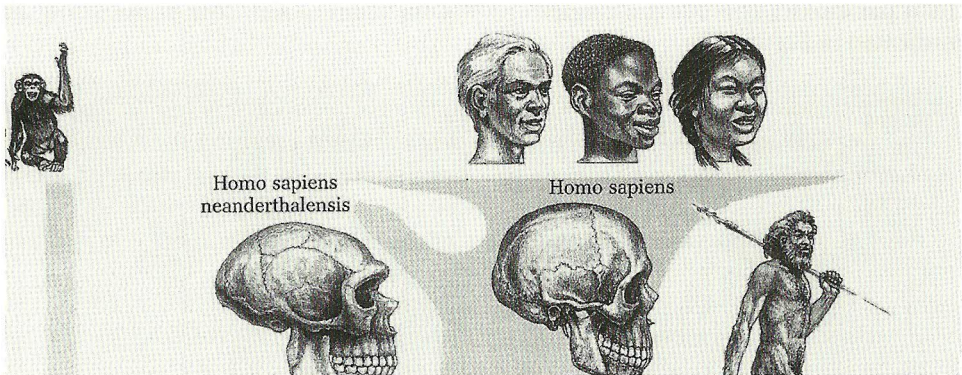


Figure 11. Diversity of *Homo sapiens* (Illustration by Koehler (2005) from Ikarus, Natur und Technik, p.185, Germany).

Discussion

The present results clearly indicate that, behind the apparent objectivity of the familiar scientific images related to human evolution, there are some implicit values. In most of the textbooks from different countries that were analysed, representations in human evolutionary trees or timelines showed almost exclusively adult occidental men. In other more general images illustrating the genus *Homo*, some women were present, but usually in a smaller number than men, and in 30% of the textbooks women did not appear at all. A considerable ethnic disequilibrium appeared as well beyond this gender disequilibrium.

Why the image of *Homo sapiens* as a white occidental adult man is still largely dominant in textbooks to-day? One possible explanation might be a strategy of the textbook publishers to choose illustrations representing the most numerous types of human beings in their country. Images of occidental human beings could be considered as normal in occidental countries. Nevertheless, in this case, several questions arise. Why mainly men and not women, and why mainly adults and not children did appear in the representations? Furthermore, why have occidental men appeared up until now in the evolutionary trees in the textbooks of African countries such as Senegal? One answer is that some African countries still use or reproduce European textbooks. However, there is another alternative explanation that can be offered based on an epistemological approach.

The historical study of the construction of scientific knowledge about human evolution indicated that the main epistemological obstacles are ideological, as shown by Quessada and Clément (2007). These authors demonstrated seven epistemological obstacles that have been hindering the development of scientific understanding about the origins of humankind since Linnaeus (1707–1778), such as, separation between animals and humans, biblical timing, refusal of common origins with monkeys, belief in the superior nobility of man, racism, finalism (e.g., considering that the emergence of *Homo sapiens* would be the goal of evolution) and over-simplification.

Quessada and Clément (2007) made it clear that, by the end of the 19th cen-

tury and during the first part of the 20th century, the belief in the superiority of occidental man was very present inside the European scientific community. There was a large confusion between the concept of biological evolution and the concept of cultural development. In the mind of the researchers of this period, the conception of biological evolution was linear and finalized meaning that the goal of evolution would be an occidental man in accordance with their ethnocentric and sexist ideas. Their representation of evolution was similar to that which we found in a lot of recent textbooks during this research (Figure 7). Two complementary hypotheses can be proposed: (1) The dominance of white males in the textbooks resulted from the inertia of the diffusion of scientific knowledge, i.e., we still go on using the same unrepresentative images of human beings for reasons of unquestioned tradition. (2) The obstacle of occidental ethnocentrism is still an issue. Until now it has been difficult to think of images of human evolution that do not lead to a white male.

The phenomenon can be also analysed in terms of social representation. The implicit choices embedded in the representations of human origin are common to a wide social group. They are acquired from the previous generation and they are systematically transmitted when nobody questions them. Many years ago, Lévy-Bruhl (1910) distinguished between the collective representations of “civilised” and “primitive” men. These representations are still common and could paradoxically be a root of the images of *Homo sapiens* found today in the phylogenetic trees or lines in the analysed textbooks.

Cohen (1999) showed that, through the history of science until today, there is a link between scientific knowledge about human evolution and the occidental culture about the origins of humankind. Our results can also be interpreted in this way. The great number of “nude white men” illustrations in the textbooks is probably linked to the representation of Adam in art.

As a consequence of this present work, several points emerge: (1) Implicit values may play a concealed and important role in the choice and the form of the presentation of scientific contents related to human evolution in school textbooks. (2) These implicit values were present in most of the countries under study, with just some exceptions. For instance, there was a gender and ethnic balance in the Finnish textbooks, where images of women were not restricted to traditional feminine roles. There were also images of female scientists. That is probably linked to non dominant sexist social values in Finland. In other Northern European countries, such as, Germany, Hungary, Poland, and Estonia, the proportion of females was relatively high in the illustrations of the genus *Homo*. The German publishers were particularly inventive in illustrating the present *Homo sapiens*. It was the only example we found with ethnic diversity, and, furthermore, in another image of the Evolutionary tree, a photograph of Charles Darwin was used as the symbol of the present-day *Homo sapiens*. In some countries (France, Italy, Cyprus, and Lithuania), we identified important differences from one publisher to another. More generally, there were no important differences between the countries, with the exception of more feminine images in the Northern European countries. (3) These implicit values related to human evolutionary images were not exclusive to school textbooks. Similar images can be found in the media. For example, the images repro-

duced in Figure 7 are very popular. (4) This question related to non-European countries has also its own peculiarities, because they often use (or partly reproduce) the textbooks produced in European countries for economic reasons.

In conclusion, this work concerning the topic of human origin in textbooks shows that scientific data are often mixed with implicit values. It is important to identify these values, in order to favour the ability of students to develop a critical outlook and to separate the different fields of thought. It was recommended in 2006 by the Inter Academy Panel (IAP):

Human understanding of value and purpose are outside of natural science's scope. However, a number of components – scientific, social, philosophical, religious, cultural and political – contribute to it. These different fields owe each other mutual consideration, while being fully aware of their own areas of action and their limitations (IAP, 2006, pp.1–2).

Therefore, we recommend an introduction of epistemological reflection into teachers' training and a historical approach to science in curricula, including particular reference to the topic of human origins.

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