

HISTORICAL ANALYSIS OF ILLUSTRATIONS OF SCIENTIFIC INSTRUMENTS IN GREEK PRIMARY SCHOOL TEXTBOOKS (1878 -1950)

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ABSTRACT.

Greek Science Textbooks analysis is part of a wider research project on studying the History of Science Education in Greece. Results of science textbook analysis on History of Science that preceded revealed that illustrations in general and scientific instruments illustrations especially play a certain role on the “image of science” that they create. In this research we investigate how scientific instruments are illustrated in Greek primary science textbook from 1878-1950, the “image of science” they implicitly present. Results suggest that earlier in 20th century scientific instruments illustrations impose/present an absolute (truthful) science.

Key-words: scientific instruments, illustration, primary school textbooks, Greece.

1. Introduction

This research is part of a wider multilevel effort to study the history of science education in Greece in general and the history of Greek science textbooks in particular. In our previous studies on science textbooks we focused on a) history of (science) textbooks and (scientific) illustration (Drakopoulou et al 2002), b) Introductory structural analysis of 20th c. Greek primary school science textbooks (Drakopoulou 2003), c) elements of History of Science primary school science textbooks (Drakopoulou et al 2004a; 2005), d) elements of History of Science secondary school science textbooks (Drakopoulou et al 2004)

Analysis of illustrations in science school textbooks revealed that illustrations of scientific instruments play an important role on the “image of science” that they present to learners. In previous study (Drakopoulou et al 2005) the criteria of data classification and content elaboration which included pictures showed that *Materials* used to present historical information are usually *scientific illustrations of apparatus and instruments* (B2, B4, see Table 1).

Recent research (Parkosidis et al 2006) on the existing knowledge and attitudes of Greek 6th grade primary school pupils towards Scientific Instruments and their History showed so far that pupils are not aware of the basic operation principles of well known scientific

instruments, yet they pronounce a positive judgment for the framework of their use in everyday life. The contribution of the History of Scientific Instruments to the teaching and learning of Science has been proposed (Holland, 1999) and has not been adequately investigated.

2. Objectives and methodology

It has been shown that images, simulations, metaphors, models and every kind of effort to bring the functions of an ‘unseen’ world closer to our experience are often factors hindering the transformation of scientific knowledge into school knowledge (Halkia 2001).

In this research we investigate how scientific instruments are illustrated in Greek primary science textbook from 1878-1950.

Thus our scope was to investigate the way the Greek textbook writers choose and use the pictures they feel that more effectively express their educational objective. The aims were to trace and categorize scientific instruments pictures used, fill in the puzzle of the “image of science” they implicitly or explicitly present.

3. Research

3.1 –The sample

In this study we focused on the 1st half of the timeline we are working on, that is the 20th century (getting a glimpse of the end of 19th century). We managed to find and study the following textbooks as there are a lot of historical and practical obstacles in tracing this kind of historical material in Greece (eg destroys, wars).

1.	1878	5 th &6 th grade	Mikra Fysiki, by M.Daskalakis, (French translation)
2.	1920	5 th &6 th grade Vol.1	Science experimentals (Vol.1), by E.Gontzes
3.	1935	6 th grade	Science experimentals, by A. Monokrousos
4.	1935	5 th &6 th grade	Science experimentals, by E.Gontzes
5.	1936	6 th grade	Science & CHEMISTRY, by L.Liokis, D.Papaioannou
6.	1946	6 th grade	Science experimentals, by A.Aloisos
7.	1947	5 th grade	Science experimentals & Chemistry, by D.Doukas, E.Karagianopoulos, S.Mallis
8.	1949	6 th grade	Science experimentals, by L.Liokis, D.Karnavos

3.2-Analysis criteria

All of these textbooks referred to the same curriculum content, the most of which was firstly introduced from central European counties (through foreign textbooks translations).

The textbooks’ content was classified in five (5) thematic units:

- 1) matter- force-motion,
- 2) magnetism-electrism-electromagnetism,
- 3) optics,
- 4) acoustics,
- 5) themodynamics, meteorology.

The term ‘**scientific instrument**’ is a convenient handle for describing a variety of technical artifacts used in various scientific and technical practices. According to Holland(1999) there

are three (3) categories of instruments and devices used for the demonstration of scientific principles in an educational context:

- 1) Instruments that they may have long antecedents in science teaching going back to the popular scientific lecturers of the eighteenth century or earlier,
- 2) Instruments that they may represent simplified versions of precision instruments,
- 3) A third category of scientific instruments represents instruments used in various technical practices, such as navigation and surveying.

In our research we classify the illustrations of scientific instruments that existed in the textbooks according to the five (5) thematic units existing in the textbooks and the three (3) categories proposed by Holland. In this way we can identify if there is any dynamic between key scientific concepts and their (re)presentation in the textbooks.

5. Results

The following tables show in a quantitative way some of our results.

Table 2.

In Table 2 we present pictures distribution within the textbooks.

	n/PAGES per textbook	n/PICTURES in the textbook	Textbook coverage by pictures %
1878	103	28	27
1920	78	33	42
1935 1	62	102	164
1935 2	94	53	56
1936	62	60	96
1946	57	96	168
1947	54	44	81
1949	47	60	96

Table 3.

In the following table we present quantitatively not only the number of pictures of scientific instruments in every textbook but their classification according to Holland's three (3) categories of Scientific Instruments.

	HOLLAND 1	HOLLAND2	HOLLAND3	Total n/ sci. instrum. pictures	Percentage of sci. instruments pictures towards the n/PICTURES in the textbook
1878	14	2	4	20	71,4 %
1920	8	7	5	20	60,6%
1935 1	8	12	28	48	47%
1935 2	7	13	9	29	54,7%
1936	5	10	14	29	48,3%
1946	4	7	12	23	23,9%
1947	4	9	0	13	29,5%
1949	5	7	12	24	40%

Table 4

This table shows the classification of scientific instruments pictures according to each of the five (5) thematic units.

	Matter- Force- Motion	Thermodynamics- Meteorology	Magnetism- Electrism- E/M	Optics	Acoustics	SUM
1878	8	2	9	1	0	20
1920	6	4	7	2	1	20
1935 1	0	0	20	26	2	48
1935 2	12	2	8	5	2	29
1936	0	0	18	10	1	29
1946	0	0	12	10	1	23
1947	9	4	0	0	0	13
1949	0	0	14	9	1	24
	35	12	88	63	8	206
						TOTAL SUM

6. Conclusions

If we read Table 2 and Table 3, we notice that there are a lot of the textbook pictures that don't follow Holland's categories, and therefore they could not be included in Table 3.

In the tables above we expose our first indicative quantitative results. There are differentiations between the three Holland's categories as Table 3 shows. Table 3 also give us a clear view on the textbook coverage by pictures of scientific instruments specifically. 1878 and 1920 textbooks contain comparatively more scientific instruments pictures than later textbooks.

Magnetism, electrism and e/m is the thematic unit with the most representatives of scientific instruments pictures in the textbooks (88 out of 206) (Table 4). Second in line comes optics (63 out of 206), and third matter, force, motion (35 out of 206). The zero number (0) most of the times means that there is not such a unit in the textbook.

The differentiations which appear in the tables are discussed in terms of quality criteria and historical terms, and examples from the textbooks themselves in the full paper.

Qualitative analysis of the textbook pictures showed that writers (or translators), when it comes to what is called scientific instrument, try to find **that** image which is closer to what is called formal/official science in order to convince for its truth and respect.

Results suggest that earlier in 20th century scientific instruments illustrations try to present an absolute and always truthful science (e.g. Table 4)

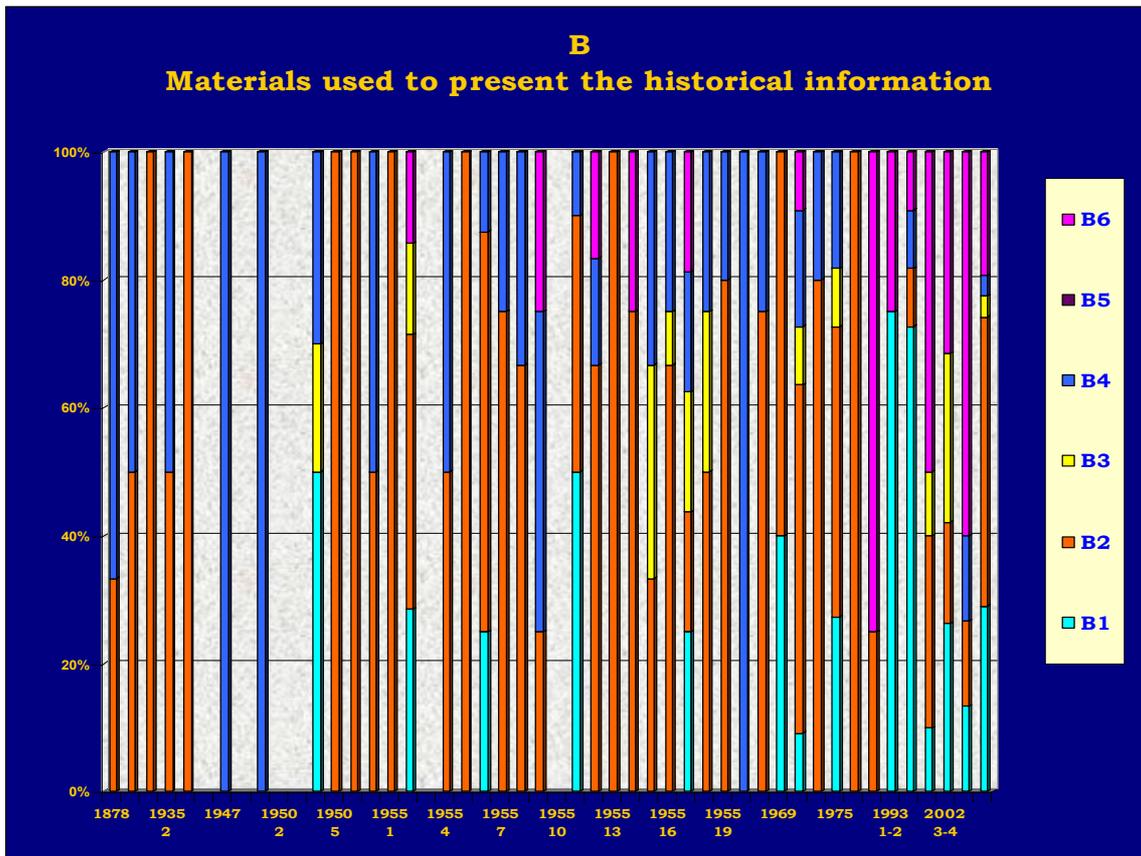
Some of the factors that affect textbook pictures as described by Theodoridis & Halkia (2001) seem to apply in our research sample, eg; a) the Economy in the use and selection of textbook images, b) the Moderation in the selection of the elements that constitute an image, c) the Reasoning consistency, d) the Ideological consistency, e) the Visual effectiveness and f) the Dialogue with the receiver (pupil) .

He hope that by filling up our research sample through the rest of the 20th c we will be able to contribute to one of the major aims (last 20 years) of sociology, history, and philosophy of science; to investigate and to understand natural sciences as practical work: a work of minds, of hands and as a social process.

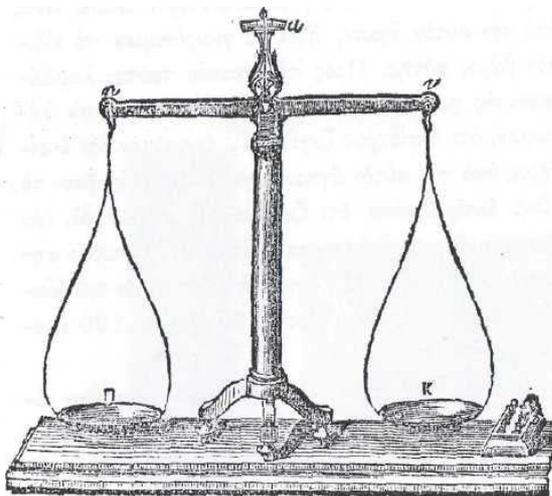
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Table 1. Materials used to present historical information.

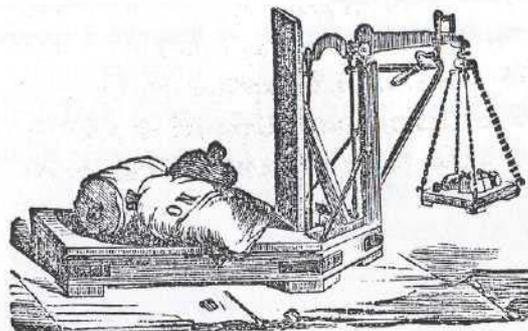


Appentix : Textbooks' illustration samples



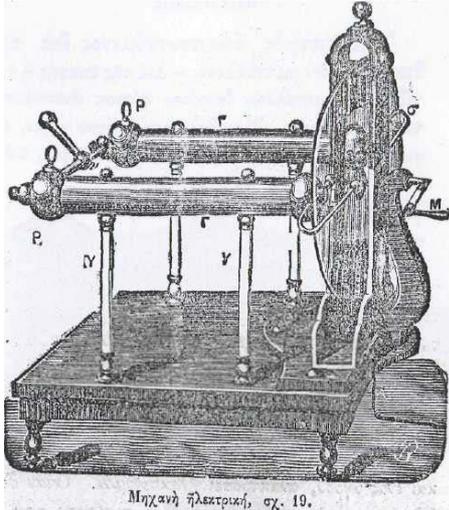
Κοινή τροχιάνη, σχ. 7.

1. 1878 balance p.30 (Holland 1)



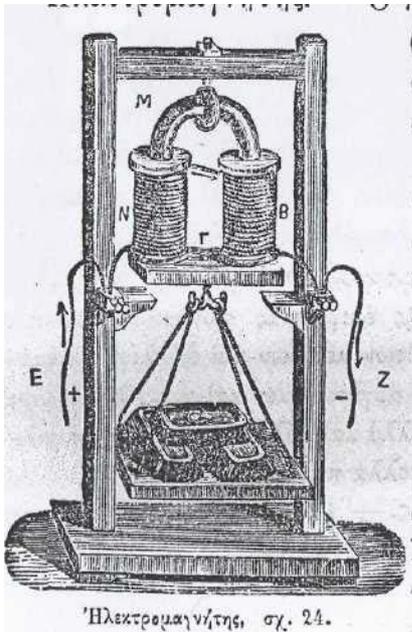
Κύλων, σχ. 9.

2. 1878 balance p.32 (Holland2)



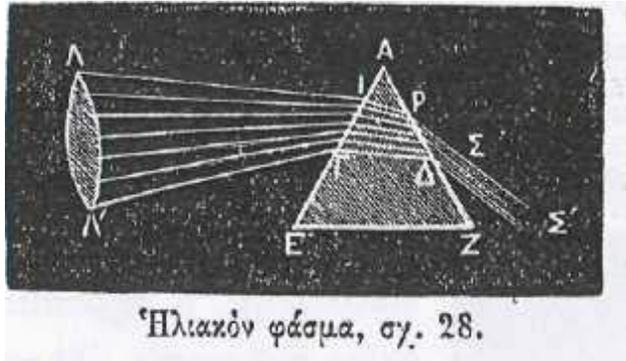
Μηχανή ηλεκτρική, σχ. 19.

3. 1878 electrical machine p.78 (Holland 1)



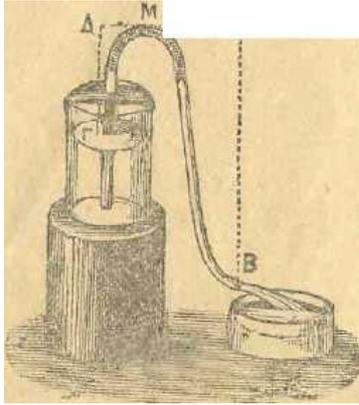
Ἐλεκτρομαγνήτης, σχ. 24.

4. 1878 electromagnet p.84 (Holland 1)

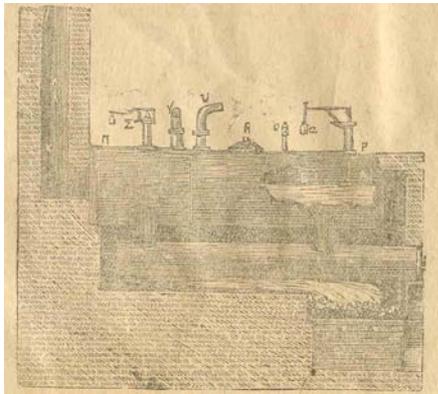


Ἡλιακὸν φάσμα, σχ. 28.

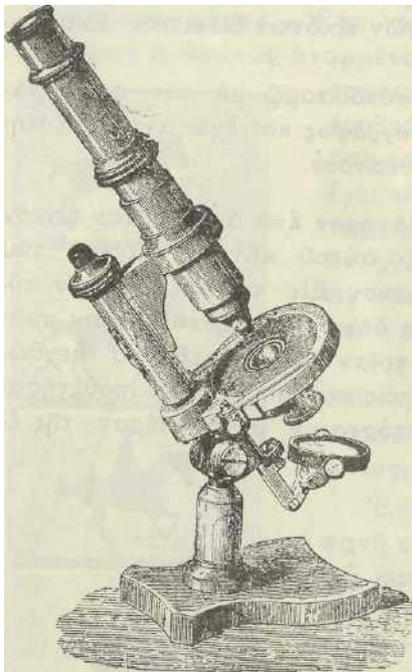
5. 1878 optics, Light spectrum p.93 (Holland 3)



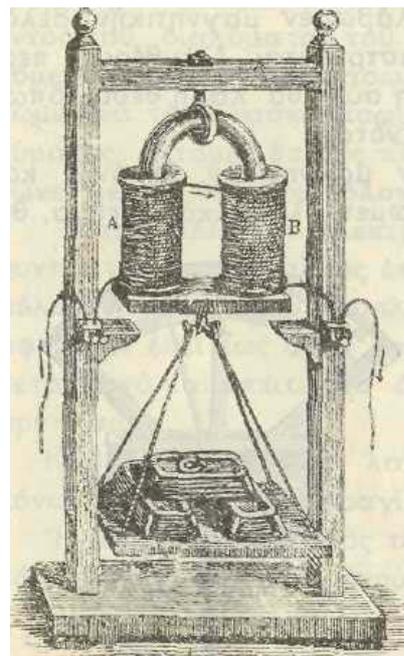
6. 1920 siphon p.50 (Holland 3)



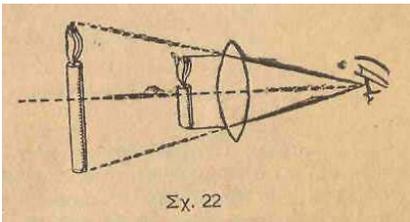
7. 1920 steamengine p.20 (Holland 1)



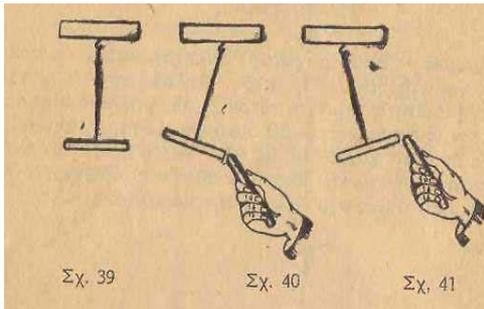
8. 1936 telescope p.34 (Holland 1)



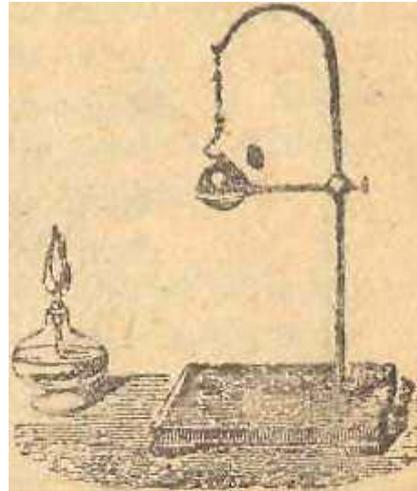
9. 1936 electromagnet p.60 (Holland 1)



10. 1946 optics, lenses p.27 (Holland 3)



11. 1946 electric pendulum p.44 (Holland 2)



12. 1947 Thermodynamics p.5 (Holland 1)



13. 1949 Acoustics -bell p. 4 (Holland 2)