SARTONIANA

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Sarton Chair of the History of Sciences
University of Ghent, Belgium

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Foreword

This second volume of *Sartoniana* bundles the texts of the Sarton memorial lectures given at the University of Ghent, Belgium, during the academic years 1987-88 and 1988-89.

F. Vandamme and M. Thiery acted as *guest editors* to Sartoniana II. They wish to thank the Heymans Foundation under the auspices of which this series was initiated in 1988.

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GEORGE SARTON CHAIR

of the

HISTORY OF SCIENCES

1987-89

Sarton Chair Lecture
1987-88

LAUDATIO J. VANDEWIELE

M. Thiery

Today we gather to honor Dr. Apr. Leo Vandewiele as laureate of the 1987-88 Sarton Memorial Chair. The members of the board elected Dr. Vandewiele because of his personal contribution to the history of pharmacy and in particular because of his epoch-making comments of medieval medicopharmaceutical manuscripts.

My dear Leo, we have known each other for more than 25 years and I remember vividly how I, a quarter of a century ago, for the first time entered your "antrum". You were then set up as a chemist at de Muide. Your spacious study deeply impressed me: piles of books - old and new - and the embryo of a collection of pharmaceutical memorabilia, which through the years would become a real museum. Since then our paths have crossed regularly, first at the meetings of the South-GeWiNa, more recently at those of the Sarton Committee. I have read with relish most of what you have written. I have listened with delight to the lectures that you as reader in the History of Medicine have given at the University of Ghent, and many private talks have infected me with your enthusiasm.

By your industry you have erected a pillar that is to remain. You initiated the historiography of pharmacy in this country from scratch and have kept it alive. It was self-evident that you would be selected as laureate of the Sarton Chair sooner or later and we are grateful that you were willing to accept this honor.

It looks as if you have always been fascinated by the historical background of your profession. I was told that it was Prof. Vincent Evrard who kindled the holy fire in 1935 - you were then still a student . During your "stage" the late Mr. Supply and his research on the "Past of Chemists from Kortrijk" showed you the track. Still later, it was Prof. Leon Elaut, editor of the journal Scientiarum Historia, in which you have collaborated, who has kept this interest alive. Finally, I wish to mention Dr. Brans from Rotterdam with whom you founded the Benelux Society for the History of Pharmacy, association of which you were to become the first secretary.

Stimulated by this variety of contacts you finally stood on your own feet, and in 1951 your published your first paper: "Inventory of chemist's pots on display in the 18th- Century officina of the Museum of Folklore of Ghent." Since then you have produced an unceasing flood of scientific publications: a hundred or two articles in Dutch, English, French and German and no fewer than 20 books, about an array of subjects, though mostly in connection with Medieval pharmaceutical botany.

Meanwhile you graduated at the University of Ghent as Doctor of Pharmaceutical Science, the first in our country to do so on a historical subject. The analogy with Elaut is obvious! You taught at our university in the History of Pharmacy and Medicine. You were Editor of the Belgian Pharmaceutical Journal; co-founder of and active in two scientific societies: the already mentioned Benelux Society for the History of Pharmacy and the South-GeWiNa or South Dutch Association for the History of Medicine, Mathematics and Natural Science; member of 10 other academic associatons and honorary member of as many others. And here I finish in order not to shame your modesty. You blush so easily.

And yet, I feel compelled to add a thing or two. Nobody will contradict me if I tell the audience that you are the expert on Middle-Dutch medico-pharmaceutical manuscripts. That you are also the fêted speaker on this subject you will prove to the listeners today and during the following lectures. Next - and here I really stop - in May 1975 you organised in Ghent the Jubilee Congress of the Benelux Society of the History of Pharmacy of which you were the co-founder in 1950 in Rotterdam. In this congress 140 members from all over Europe participated. The festive session that took place in this Aula, you adorned with a speech "The meaning of the pursuit of the History of Pharmacy", from which I would like to quote a paragraph. You said: " No scientific discipline has such an interesting history as pharmacy because pharmacy has so many interfaces with other disciplines. Think for instance of botany, that was studied exclusively for therapeutic purposes; zoology and mineralogy, from which medicines were drawn; chemistry, natural science, biology, medicine, toxicology, bromatology, pharmaceutics, microbiology, etc., without forgeting the rich scale of pharmaceutical practice, that on its turn contains unspeakable sources for folklore, that the pharmaco-historian in his turn can consult to find an explanation for many practices and interpretations of old chemists and for the popular belief and the magic that stick to many a medicine". This enumeration of interfaces you concluded with a quotation of George Sarton: "The history of science is not only the history of our increasing knowledge, it is also the history of the progress of tolerance and of freedom of thought". And here we have the interface between Sarton en Vandewiele. Identical ideas and insights mentioned in the year 1975, when at this university and in this town hardly a handful of men knew who George Sarton was and what he meant for the history of science.

THE ARABICS AND SCIENCE

Leo J. Vandewiele

Through his study of the history of science, George Sarton acquired a great respect for the Arabian period. While working on his "Introduction to the History of Science" he felt hampered by his lack of knowledge of Arabic. He therefore spent the academic year 1931-1932 in the Near-East to study classic as well modern Arabic. Sarton possessed the talent of languages : he spoke fluently Dutch, French, English, German, Italian, Swedish, Danish, Turkish and Spanish, was very knowledgeable in Latin and Greek and had fair notions of Hebrew, Chinese and Portuguese (1).

Nevertheless, he felt it a must to study Arabic, which on its own proves how important Arabs have been in the development of sciences. Sarton agreed with Kremer and Urdang (2) that "The light of science in the Middle Ages burned only gloomily, and it was oxygen of Arabian origin which made it bright again".

By Arabian period we mean the period from the 7th to the 12th century. Before this period, the Arabs were a nomadic people of the Arabic peninsula about whom little is known as a consequence of their lifestyle. Their way of life apparently did not prevent them from being happy, and ancient writers, such as Dioscorides, had the name of Arabia always preceded by the epithet 'happy", Arabia Felix, which is still the case in the 16th century when Dodonaeus wrote : "These varieties of cane can be found in India and in Happy Arabia".

In the early 7th century, the prophet Mohammed (570-632) appeared on the scene. Up to then the Arabs had not played an appreciable role in the history of the world. At that time, however, they founded a strong theocratic state and were to determine world destiny for three centuries. The "holy war", declared by the Prophet, made them stop their internal disputes and massacres and occupy, in less than a century, Syria, Asia Minor, a large part of Central Asia and the North-African coast. In the early 8th century they conquered Spain and Southern Europe. The northbound expansion was halted in 732 by the victory of Charles Martel on Adoer al Rahman. In the East, Byzantium prevented the advance of Islam, which made it possible for Charlemagne to found the Carolingean Empire, bringing later to an end the scientific monopoly of the Arabs.

The Prophet had promised that all who died with the sword in their hand would have their soul brought straight to Allah. The Arabs who, as all nomads, had a bad record, saw here the chance to secure eternal life and thus the disciples of the Prophet established in a short time a vast empire, stretching from Spain to the Indus. Although the Empire would become devided in various caliphates and included various races, they kept their unity by their religion, Islam, and by their written language, Arabic.

In the process of the founding of the Islamic Empire, which included victory over civilized nations, a rather unique fact in the history of mankind occurred : the conquerors did not destroy — as happens usually : Vae Victis ! — the conquered and their culture. The inhabilitants of the desert were staggered by the beauty they contemplated in Egypt, Greece, Italy and elsewhere. Instead of burning all they found, these simple people wanted to take part in the culture they happened to be confronted with for the first time. With their open mind, their clean and sound reasoning, their mathematical approach, these natural men tried to assimilate the spirit of the conquered civilized nations.

They soon started to translate and to order the many works they had laid their hands on. The essence of the whole Arabic resides in the fact that "they translated and ordered". These translations made Arabic the language of scholarship of that time. When the Arabic Empire faded away, everything will again be translated, from Arabic to Latin, the new language of scholars. Thus the West inherited from Hellas and Rome as well as from the Indian and Persian cultures by way of the Arabs.

The second merit of the Arabs resides in the fact that, using their mathematical approach, they ordered the widely scattered scientific works. They assimilated the existing sciences and gave them a clearer profile. They were not innovators buth conservators who, according to L. Elaut "constructed the showcase of the thinking of Antiquity in an Oriental magnificence' (3). They melted all existing knowledge in a stately clock with a beautiful sound.

To systematize Arabic sciences is very difficult since the representatives of some sciences are also found in others. Thus Avicenna, the coryphe of Arabic science, was as much physician as philosopher, astronomer, meteorologist, mathematician, lawyer, geologist, physicist as a poet and diplomat. Al-Kindi (ca 800-873), the oldest known Arabic philosopher, was also mathematician, physician, astrologist, and musician at the court of caliphe Al-Mamoen. According to the Fihrist al oeloēm (Index of Sciences), written by Mohammed Al-Nadim, a bibliographic work reporting the Muslim civilization up to 987 (4), he wrote 25 opera philosophica (inclusing works on Aristotle and Porphyrius), 11 treaties on mathematics, 8 on the sphere, 8 on musicial theory, 24 on astronomy, 27 on geometry, 21 on the orbit of heavenly bodies, 24 on medicine, among which his famous Aqrabadhin or Book on Composite Drugs, in which, by the ethymology of plant names in various languages, he proved to be an outstanding linguist, 9 works on astrology, 14 on the atmosphere and metereology, 10 on the calculation of distances, 5 on preconception and finally 36 on technology and chemistry.

Most Arabic scholars were encyclopedists *avant la lettre*, universal minds who sometimes wrote on the most various subjects. Their main concern was not to search for the new but to understand the old, to compare what was already found and to order and comment on the various theses.

From the 6th century BC a great explosion of the human mind occurred. The Greek natural philosophers built systems which were to become the basis of all sciences. Thus Thales of Milete claimed that water was the main principle, the archē, from with the whole world took its origin. Anaximenes of Milete thaught this to be air, whereas Herakleitos of Ephese favored the idea that it was fire.

Empedokles and Leukippos proposed as a compromise that there were 4 principles or elements : fire, air, water and earth. Demokritos, a pupil of Leukippos, specified that each element was made up of atoms and that these atoms (*a-tomos*), which cannot be split further) were typical for each of the 4 elements. Each of the 4 atoms possessed its own shape, size and weight, the fire atom being the smallest and lightest of the four.

When Hippocrates found that the data of the macrocosm were also applicable to the microcosm (man), he developed his theory of the 4 body liquids or humors : blood, slime, yellow bile and the hypothetical black bile, on which Aristotle was to apply later the stoïcheia or basic qualities discerned by our tactile sense : cold, humidity, heat and dryness. Thus originated the familiar correlation between elements, body liquids, temperaments, main organs, seasons, astrology and bloodletting.

The Arabs did not change anything in this natural philosophy of the Greek. Although Islam put its own accent on Mohammedan philosophy, the whole Arabic philosophy was a comment on the philosophy of the Greek. This is no sign of ignorance since later on, when the Arabic works were translated into Latin, the West also did not change anything in the natural philosophy of the Greek and the Arabs. Many centuries later revolutionary men will stand up and blow up all these theories : Paracelsus, Vesalius, Copernicus, Harvey, Galilei, Newton, Van Helmont and many more.

The Arabics brought no reformations. These were to occur in the West many centuries later. This does not mean that the Arabs did not add to the existing sciences. There certainly was an evolution and in each discipline of science Arabs did bring substantial complements, mostly comments, be it that essential reforms did not take place.

It should be emphasized that many scholars were brought under the denominator Arab who in fact were no genuine Arabs. Many Jewish and Christian scholars were active in the Mohammedan world and wrote in Arabic. Avicenna, Rhazes, Haly Abbas were Persians, Serapion, Avenzoar, Averroës and Albeithar were Spaniards. The cement that held there together was Islam. Their interest in science and their justification to study originated from the Coran. The Prophet had proclaimed : "Do teach science which maintains the feat of the Lord. Who communicates knowledge resembles the man who distributes alms. He who possesses knowledge is a subject of veneration and love. Science protects against error and sin, illuminates the path to heaven, assists through the burdens and joices of life. To our friends it is an ornament, to our enemies a shield. To study is as salvatory as to fast. The teaching of science is as precious as prayer".

The unity of thinking of the Arabs was much favoured by the pilgrimages to Mekka, the religious center of the whole Mohammedan world, where yearly a large diversity of people, ranging from Spain to India, mixed on the accasion of hadj, exchanging goods as well as ideas. The caravan trade in spices and aromates was of the greatest importance for pharmacy and expanded the arsenal of drugs as much as later the discovery of America.

Pharmacy itself is the only discipline which owes everything to the Arabs, its existence to start with. Greeks and Romans had so-called pharmacopoloi and pharmacopolae, respectively, but they were mere physician's servants. The physicians, who were not allowed, on the basis of their status, to perform handwork, usually had two servants at their service : one of them, usually a barber expert in handling the razor, was allowed to incise abscesses, to perform amputations and to cauterize the wound with a glowing iron; the other one collected herbs, pressed them out, cooked them etc... under the supervision and responibility of the physician. Both barbers and pharmacopolae, on the sly, exerted their practices independently. It is well known from the literature that every Roman could obtain a poison, a love or an abortion potion from the pharmacopolae. It were the Arabs who first realized that the simultaneous practices of medicine and pharmacy are incompatible and who decided that pharmacy ought to be practiced by independent and trained responsible persons. They founded schools and opened the first pharmacy in Bagdad in 770. Here also the influence of the Prophet Mohammed was decisive : "O servant of God, use medicines, as the Lord did not allow pain without a remedy against it".

Surgery as well obtained its civil rights from the Arabs. No longer had the barber to perform surgical interventions secretly as treaties were drafted at their intention, aiming at codifying their work. It is fair to mention here Aboel qāsim or Albucasis (936-1013) of Cordoba, the ingenious instrument builder who designed more than 200 instruments, in particular for tooth extractions (5). Aboel qāsim is also of importance in obstetrics. He did not invent the forceps but built a tong-like device to deliver the trapped fetal skull *per vias naturales* (6).

In the field of medicine the Arabs produced many clinicians without essentially modifying the current concepts. No fourth grand-master joined Hippocrates, Galen and Dioscorides. A great obstacle to progress was the fact that dissection was prohibited. On religious grounds the study of cadavers was not allowed and the descriptions by Galen had to suffice. This does not mean that the Arabs did not produce great physicians. A series of names are still respectfully cited, such as Rhazes (ca. 865-923), a great Persian scholar with a large experience acquired during daily contacts with patients in the Great Hospital in Bagdad, who wrote more than 200 treaties, half of them devoded to medical subjects; his main work, dedicated to the Persian Prince Mansoer and later translated as Liber Medicinalis Almansoris, was to become a much used handbook in the West. His second important work, Kitab-alhāwī, known in Europe as Liber continens, is a kind of encyclopedia of Greek medicine, enriched with results drawn from his own experience. He was a great clinician, observing that fever is not a disease but a symptom and describing the differences between smallpox and measles. He is still often cited in relation with ophtalmology.

Avicenna (980-1037), Ibn Sina, was born in Persia from Turkish parents, as shown by anthropologists in 1970 by craniological examination. The same also revealed that he died fairly young and that he had a particularly high I.Q. This is confirmed by his autobiography, which reads "When I was 10 I knew the whole Coran (78.000 words !) by heart, at 18 I was familiar with the entire philosophy, logic, physics, mathematics, geometry, arithmetics, astrology, music, theology, Arabic letters and many more study subjects. Never did I meet somebody who was superior to me in knowledge". A 30 m high tower, consisting of 12 columns, symbols of the 12 sciences in which Avicenna excelled, was erected on the mausoleum built in 1950 on his tomb in Hamadhan. He certainly was the greatest and most universal mind in the whole Arabic period, acquiring the name of Al-sjaich al-ra'is, i.e. Prince of scholars. His Qanoen fi't tibb, litterally Canon of canons, the rules of medicine, i.e. the principles and laws of medicine, was a standard work in the Arabic world and later in the Latin world, also with regard to its volume (more than a million words). It was to become, in the early phase of the art of printing, next to the Bible the most printed book. It was translated into Latin by Gerard of Cremona. Between 1470 and 1500, 16 prints were edited and again 20 between 1500 and 1660. Up to 1650 it was used as a textbook at the universities of Louvain and Montpellier. Sarton wrote about Avicenna : "His triumph was too complete, it discouraged original investigations and sterilized intellectual life" (7).

Ali Ibn al-Abbas or Haly Abbas (930-994) was court-physician of the Prince and director of the Great Hospital of Bagdad. He wrote a book on theoretical and practical medicine, Liber artis medicinae qui dicitur regalis, which was the first Arabic medical book to be translated into Latin.

Ibn Zuhr, Avenzoar Jr. (1091-1162) was an Arabic-Spanish physician, who discovered the food enema and Acarus scabiei.

Averroës (1126-1198), pupil and friend of Avenzoar, was a physician but is better known as a jurist and philosopher. Dante saw him in hell among the famous pagans : "I saw Averroës, who made the big comment" (IV, 143-144), referring to his comment on Aristotle.

Maimonides (1135-1204), spiritual son of Averroës, philosopher and theologist as well as court-psychician to Sultan Saladin, wrote a brilliant critic of Galen. He is very important in the history of dietetics.

Ibn Abi Oesaibiah (1203-1273) was the principal medical historian. He wrote bio-bibliographies of 400 Greek, Syrian, Persian, Indian and Arabic physicians. The work is most useful, not only for medecine but also for many other sciences, as many physicians were also mathematicians, astronomers, philosophers, physicists or all of these at the same time.

The most famous ophtalmologists were Rhazes, Aboel Kasim, Avicienna and particularly Ali ben Isa, who wrote a vademecum for the ophtalmic surgeon. He praised the use of both fluid and dry collyria and described 130 eye diseases and 143 medicines.

Arrazi is of importance for veterinary medicine. His book Kitāb almansūrī filbaytara (Veterinary medicine in Almansoer's book) deals with diseases of dogs, hunting panthers and lynxes. It is remarkable that, although Muslims were passionate horse lovers, before the 14th century no scientific or medical treatises on horses were available.

The Arabs also paid full credit to agriculture. "Who plants is giving alms heaven is taking into account" said the Prophet. Ibn Al-Awwan (end of the 12th century) wrote an important work on agriculture, Kitāb al-falāha, which contains much information on agriculture and horticulture, breeding, chicken- and bee-culture. The Arabs also paid attention to the culture of medicinal plants, the properties of which are described in herb tables. Albaitar from Malaga (1197-1248), whose name means "son of the veterinary doctor", was the most important pharmacogne. He was inspector of pharmacies and a very obliging man. His Liber Magnae Collectionis, also named Liber simplicium medicamentorum, gives a description of 145 simplicia of mineral origin, 130 of animal origin and 1800 of vegetable origin and was regarded by Sarton as "the greatest from the time of Dioscorides to the middle of the sixteenth century" (8).

A(l)benguefit (997-1068), one of the most important physicians of his time, born in Spain and living in Toledo, wrote a Herbal Book, based on the works of Dioscorides and Galen but much more surveyable and comprehensible for Western man. It was translated by Gerard of Cremona as Liber de medicamentis simplicibus. The same author also wrote an important book on balneotherapy.

In the field of astronomy the Arabs added little new altough many were interested in this science and were given much support by some caliphes. Thus caliph Al Mamoen, who ruled from 813 to 833, founded the school "House of Wisdom" in Bagdad, a precursor of the universities, including a real observatory. He also built an observatory in the Tadmor valley. The Arabic astronomers studied mainly the Almagest (Syntaxis mathematica) of Ptolomaeus to which they brought minor modifications as the latter was a summary of all the astronomics knowledge and insights of the Babylonians and the Greek. The best known Arabic astronomer is Al-Battānī (858-929), who, besides his contribution to trigonometry, defined a number of astronomic entities with the utmost accuracy. He also replaced the cumbersome Greek cord calculations by the sinus function and completed the introduction of the *umbra extensa* and *umbra versa* functions, corresponding to the present tangens and cotangens. His influence would last until Copernicus. Al-Zarqālī or Arzachel (Cordoba 1029 - Toledo ca. 1100) became famous as designer of the so-called Toledan planet tables, which were translated in the 12th century by Gerard of Cremona and later replaced by the astronomical tables or Tabulae Alphonsinae of the learned king Alphonsus al-Sabio of Castile. Al-Zarqālī is also famous for his astrolabium, the saphae Arzachelis.

Astrologers, sand readers, horoscope casters were present in all sultan courts and left many writings, the scientific character of which is debatable.

In the field of philosophy the Islamic philosophers faced the same problem Christian philosophers would be confronted with: their task was to bring pagan wisdom in agreement with the doctrines of their own faith. They were particularly inspired by aristotelism. Among the many Arabic philosophers two names should be emphasized to full advantage : Avicenna and Averroës (Cordoba 1126-Marrakesj ca. 1198).

Averroës was a fervent disciple and admirer of the doctrine of Aristotle, which he wanted to apply litterally, even if some principles were not in agreement with his own Islamic faith. His influence gave rise, in Paris in the middle of the 13th century to a philosophical trend, called averroïsm, i.e., aristotelism according to Averroës, the breaking-point of which was obligatory unity of material and form and the unity of intelligence of all men. This would lead, according to church authorities, to pantheïsm and provoked serious quarrels not only in Paris but even more so in Italy and England.

According to Avicenna "logic was a means to make the unknown intelligible by making use of the known. Knowledge which is not evaluated on the scale of logic is debatable and therefore no true knowledge". In his magisterial work Sjifa (Book of the cure of the soul), Avicenna provides the connection with natural sciences, which at the end were considered as part of philosophy, thus transforming Sjifa into an encyclopedia which, apart from the 4 philosophical summae (logic, physics, mathematics and metaphysics) included all exact sciences.

The founder of Islamic philosophy is without any doubt the philosopher and physicist Al-Fârâbî (870-950), who commented on a number of works of Aristotle as well as on the Almagest of Ptolomaeus. In one of his writings he compares the philosophy of Aristotle with that of Plato, paying more attention to agreements than to differences. Al-Fârâbî was also a musician. It is remarkable how philosophers-physicians were also theoreticians in the field of music : Razes, Al-Kindi and Avicenna, who defined music theory as "a mathematical science, where it imports whether the melody is in harmony or dysharmony". Ibn Butlan, a Christian physician who lived in Bagdad in the middle of the 11th century also thaught by making use of synoptic tables. In his book Taquim al-sihha, "The Health Tables" he deals with the properties of diet, sleep, purgatives, copulation, bathing, fumigation as well as music. Sarton wrote in his Introduction to the History of Science : "Music can be transferred by contact more easily than nearly any other activity and practical music is sooner or later followed by theoretical music. Thus it can be said that Mohammedan science permeated into Christianism partly on the wings of music".

Trade becomes an honorable profession, as also the Prophet did business. Trade gives birth to industry, paper and sugar refinery plants being the most important Arabic industries. Applied chemistry is by definition based on chemistry as a science. Before the Arabic period it is more appropriate to talk of alchemy rather than of chemistry. It has been erroneously claimed that the Arabs invented alchemy (*al-chemy*). According to others, chemistry is derived from the Egyptian word "Kimia", meaning black magic. Homer Dubs, professor of Chinese at Oxford University, suggests that alchemy, as well as elixir, notwithstanding the Arabic prefix al or el, is of Chinese origin.

Arabic alchemy is dominated by Ǵeber (Djâbir) or rather by the large number — nearly 3,000 — of writings attributed to him. According to Sarton "The most famous alchemist of Islam Jabir ibn Haiyan seems to have had a good experimental knowledge of a number of chemical facts; he was also an able theoretician, but it is impossible to appreciate his scientific merit with any finality until a comparative study of all the writings ascribed to him and to Geber has been completed" (9). Geber was probably born in Koefa on the Euphrate and died in 815. It is still unclear, however, what is due to Geber and what should be attributed to the Pseudo-Geber. In the 10th century the most important representative of alchemy is Rhazes, who wrote the Book of Mystery of Mysteries. Avicenna also practiced alchemy although he was doubtful about transmutation, i.e., the transformation of "sick" metal into precious metals. The goals of alchemy were not reached neither before or after the Arabs. In this respect the Arabic period was again a conservative one.

In the field of physics most attention should be given to Al-Haitham, better known as Alhazen or Alhazenus (965-1039) who by his work on optics (Kitâb al-manâzir or Opticae Thesaurus) strongly influenced European physics. He dared to criticize Ptolemaeus and Euclid and to oppose personal experiments against their theories on optics. He was not only a physicist but also an stronomer, mathematician and physician.

As to mathematics, the Arabs were not only the keepers of Greek, Babylonian, Indian and Hebrew mathematical and astronomical knowledge, but also made a contribution of their own to the development of this science. Of great importance were the Stoïcheia (Elements) of geometry and arithmetics of the Alexandrian mathematician Euclid, which form the basis of elementary arithmetics. There were at least three translations of Euclid's Stoïcheia in Arabic and a large number of summaries, among which one by Avicenna, published in his Sjifa on mathematics. Another mathematician, by the name of Alhazenus, commented on the difficulties of Euclid's book and refuted some of his theses such as one stating that all heavenly bodies get light from the sun.

The so-called Arabic ciphers are derived from the Indian decimal position system. Zero is called sifr (=empty) in Arabic, hence cipher, extended to the nine other symbols (10). These ciphers delivered us from the intricate manipulations of Roman ciphers. It should be noted that it would last until the 16th century before this simplification would be adopted in the West. As stressed by Sarton "Mountains and seas and even desert plains are smaller obstacles to the diffusion of ideas than the unreasonable obstinacy of man. The main barriers to overcome are not outside, but inside the brain".

Many names could be cited in relation with mathematics : Al-Kindi, Avicenna, Averroës, Maimonides and the Persians Al-Gazzāli (1050-1111) and Omar Khayyam (died ca. 1123) whose works Sarton regards as "one of the high peaks, perhaps the very highest of medieval mathematics"(12). The time of Omar Khayyam usher in the end of the golden century of Muslim science, the end of Muslim monopoly.

Mathematics is a science which fascinated scholars of all times : Babylonians, Egyptians and Greek. Archimedes, Diophantos, Euclid, Pythagoras and so many more are widely known names. Roman hegemony marked a halt. With the Arabs a resurgence of interest took place. Al-Khwārizmi of Bagdad (9th century) wrote the famous book Hisab al-dzjebr wal moeqābālah (The art of solving equations). Al-dzjebr, hence algebra, an Arabic name, not an Arabic invention.

For the Arabs, geography, geology and cartography were most important, given the vastness of their empire and the compulsory pilgrimages to Mecca over land and sea. Soon the works of Ptolemaeus were to be translated from the Syriac and Hebrew into Arabic. Tables with distances, roads and provinces were a must. The large world map of the great Moroccan Al-Idrīsī (born in Ceuta in 1099, died 1166), with 2500 names of cities, rivers, mountains and regions, is famous (13). Aboe 'l-Hassan al Masoedi of Bagdad (died in Cairo 957) produced a description of the whole empire in 30 volumes. He was initially very successful but his thesis that an evolution occurred from mineral to plant, from plant to animal, and from animal to man led him into disgrace.

There are also many historical works, such as The Chronicle of Nasrids, kings of Granada, by Ibn Al-Khātib (1313-1374), the last of the great Muslim historians; the World History of Assatibī (15th century), The Book of Pearls, divided according to the classical Arabic scheme : the world since creation untill the birth of the Prophet, the life of the Prophet, and the world history of Islam. Al-Biroeni (973-1050) is undoubtedly the most critical among the historians and is regarded as one of the greatest scholars in Mohammedan civilization history. Sarton praises his critical mind, without equal in the Middle Ages. He claimed that the fact that "Allah is omniscient" does not justify ignorance (14). His masterpiece is Tarkh al-Hind, the History of India : its religion, philosophy, literature, chronology, astronomy, laws and astrology before 1030. He also wrote dissertations on astronomy, arithmetics, cosmography, medicine and physics, being an exponent of the universal Arabic mind.

The Arabic period has been described by some as a scientific clique of scholars and interested caliphes. It should be emphasized, however, that they promoted the diffusion of science, as exemplified by a popular encyclopedic work, dealing with all scientific disciplines, published by the Brothers of Basra or Brothers of purity around 950.

This brings to an end this diagonal survey of the Arabic scientific period in world history. The many names cited are the most prominent ones but there were in fact many more. That so many were cited is felt to be justified by the saying of Sarton "Society can poison Socrates, crucify Jesus or behead Lavoisier, it cannot cause them to be born, it cannot dictate their task"(15).

Arabic culture has been the indispensable link in the development of human civilization. It took the Arabs two to three centuries to absorb and to put in order the sciences of Antiquity. In later centuries they developed their own research but did not achieve spectacular innovations.

In the writing of history one has been tempted to avoid the Arabic period on the excuse that sources are inaccessible and that one has to be satisfied with the Latin translations which were transmitted to us. Some changes did occur in recent years and Arabic manuscripts are more and more studied, although a large number is still awaiting publication. Here too the harvest is great and the workers few.

For us, Westerners, this period represents the transmission of science. We are seized with alarm when we come to think of a world in which the Arabic period would not have had its place. How much poorer would we, people of the Old World, have been ... We are indebted to the Arabs for not behaving, in times of conquest, like destroying barbarians, for keeping and transmitting the old cultures and, according to Sarton, for the following reason : "If there had been some ferocious eugenists among them, they might have suggested some means of breeding out all the Christians because of their hopeless inferiority"(16).

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THE ORIGIN OF PHARMACY

Leo J. Vandewiele[*]

The Arabic period, stretching from the 7th to the 12th century, can be regarded as the period of transmission of the cultural and scientific heritage of Antiquity and of the East to the West.

One science, however, owes everything, even its very existence, to the Arabs : pharmacy.

Pharmacy always existed, but not so for pharmacists. Originally medicine and pharmacy were not independent from one another. He who made the diagnosis also provided the medicine, be it in prayers, exorcisms, amulets, herbs or whatever. The physician was a man of authority, the magician a man without formal education but with much experience, an old man, a presbyteros, to be translated as "elder" or "priest".

When the physician could no longer cope with his work, he hired a servant who collected herbs for him and who made preparations under his supervision.

This servant set up, during the Roman period, a small occult shop in a little street where products could be obtained which should not be seen in daylight : a poison, an abortifacient, a love potion (philtrum or poculum amoris). These servants were called pharmacopolae, unguentarii, pigmentarii, aromatarii, serplasarii but they were no pharmacists.

It were the Arabs who, with their clear insight and mathematical

[*] Gent, 10 december 1987

approach, realized that this situation could not persist and that people dealing with the health of others ought to acquire a solid education, both professionaly and ethically. They also realized that the simultaneous exercices of medicine and pharmacy were incompatible. The mutual control between physician and pharmacist provides a much higher degree of safety, as is the case in the cooperation between architect and contractor but in a domain where people care most for their health and life.

The Arabs demanded that those who prepared medicines would do so in an independent profession, not in a side profession or as the servants of physicians.

Thus, for the first time in history, medicine and pharmacy were divided. The first pharmacy was opened in Bagdad in 770 under caliphe Al-Mansoer, who cared very much for science. The first pharmacists had much experience with medicines but did not possess the required education. This would change under caliphe Al-Mamoen, who ruled from 813 to 833 and founded in Bagdad "The House of Wisdom", a precursor of universities, where also pharmacists would acquire a solid education.

Up to now nothing is known about the curriculum and the first legal regulations, which explains why some historians set the founding year of pharmacy in 1231, when Frederic II von Hohenstaufen enacted his Constitutiones in relation to medecine, in which he devided medicine into 3 distinct groups : 1) dogmatic medicine, which makes diagnoses; 2) manual medicine, which performs surgical interventions; and 3) pharmaceutical medicine, which collects, mixes and conserves medicines. In fact, Frederic II fixed in legal norms a factual situation which had been established by the Arabs.

The profession of pharmacist was from the start an honorable one, and sons of pharmacists never omitted to mention their origin in their name : ibn al-attar, son of a pharmacist.

Pharmacists were often called sayadilah in Arabic works, Sandali in Latin, i.e., sellers of sandal-wood which was an expensive kind of wood from India from which they extracted a fragrant oil also used in medicine.

From the start government instituted the inspection of pharmacies : the Mutaşhib or head-inspector supervised the purchase and sale of poisonous substances; the Arifs or assistant-inspectors weekly inspected the pharmacies of their district as to identification, purity and prices of the medicines sold.

The name of one head-inspector has remained famous : Dhija ed-Din Aboe Mohammed Abdoellah Ben Ahmed el Malaki (from Malaga) el Andaloesi (from Andalousia) el Ashshab (the herbalist) Ibn (son of) al Baitar (the veterinarian), currently known as Albaitar. He was of Spanish descent and lived from 1197 to 1248. He was a much-travelled man and a distinguished pharmacognost. His book Djami el Moefridat, in Latin Liber Magnae Collectionis, also named Liber simplicium medicamentorum, contains the description of more than 2,000 simple medicines. Sarton regards this work as the greatest of its sort from Dioscorides until the 19th century.

Apart from the founding of pharmacy the Arabs have also the merit to have expanded the pharmaceutical armamentarium.

The vastness of the Arabic empire and the fact that Mohammedans from the farthest corners met each other on their pilgrimage to Mecca provided for the exchange of ideas as well as of goods between people from India and China as well as from Spain. Thus a lot of new medecines were introduced into medicine : accajou wood, amber, amomum, ammonia gum, areca, berberis, nux vomica, cassia fistula, cubeba, dragonblood, galenga, ginger, jasmin, jujubae, camphor, clove, manna, nutmeg, mace, musk, myrobalanes, oranges, rhubarb, sandal-wood, sarcocolla, senna leaves, refined sugar, tamarind, turbith, zedoaria, etc... This expansion was at least as interesting as the one which occurred after the discovery of America.

Another merit of the Arabs in the field of pharmacy was the development of a number of new drug delivery forms. As artists of life the Arabs succeeded in producing less drastic and less repulsive medicines by designing sirups (the Arabic sirab means potion), pellets, preserves, confections, marmalades. Studies were devoted to the lessening of the feared drastic action of some medicines. The availability of sugar was quite useful in the preparation of new and more pleasant preparations.

We owe detailed information on this topic from a Nord-Italian, probably a professor of Bologna or Padua, who under the pen-name of Mesues wrote a Grabadin or summary of Arabic pharmacy. He did so under the pen-name of Mesues because this was a prestigious name and this was often done at that time. A famous Mesues, Abū Zakarīya Yūhanna ibn Māsawaih, son of one of the first pharmacists in Jundishapur, had lived in the 9th century. He studied in Bagdad and died in Sāmarrā in 857. He was a Christian and wrote in Syriac and Arabic. He was preceptor of the crown-prince, later to become caliphe Abdallah el-Mamoen, the great promotor and protector of sciences. Mesues translated various Greek works e.g. of Galen and Aristotle into Syriac. Several works have been attributed to him but only his famous work on ophtalmology and his Aphorismi have been preserved.

There is a second Mesues, a certain Māsawaih Al-Mardīnī, who died in Egypt in 1015 and who is very often confused, even by Sarton, with the Pseudo-Mesues we are dealing with here and who has been rightly called "Pharmacopoeorum evangelista", the evangelist of pharmacists.

It is interesting to have a closer look at an Arabic prescription, such as the following one, taken from Al-Kindi's Aqrābādhīn : white eye medicine.

Sarcocol gum	1 dirham (ca. 3.3 g, slightly less than 1 dragm)
Opium	1 dirkham
Tragacanth gum	1 dirkham
Incense	1/2dirkham
White-lead	8 dirkham
Arabic gum	4 dirkham

Knead with white of egg, moisten with water of quince seed and knead all the ingredients. This medecine is very active, with God's help.

The Arabs ended each formula with the wish : with God's help and this is the origin of our Recipe. Many present-day prescribers think that the R which nowadays preceeds the prescription means : Recipe (take). In fact this is the interpretation of the last century. In earlier times the Jupiter sign ♃ was used, which was later hastily transformed into ♃ and still later became ℞. In older pharmaceutical formularies we always find ℞, with a bar through the shaft of R, never R alone. This R corresponded in fact to what the Arabs wrote in full : a prayer, a wish. As some Catholics start their letters or writings with †, one used in earlier times the sign of Jupiter, to invoke God's help. Accordingly, the R in the recipe is not Recipe but the wish that the recipe should not contain impurities and should benefit the patient.

Caution is required, however, when describing the merits of the Arabs in the field of pharmacy. The Arabs often stuck the article al or el to a foreign name derived from the cultural heritage of older civilizations. This does not transform, however, a doctrine or substance or apparatus into Arabic inventions.

Let us take a first example : alcohol. Many historians write that the Arabs invented alcohol. It sounds so Arabic ! Even a serious historian as Hermann Schelenz writes in his monumental Geschichte der Pharmazie that the Arabs invented alcohol and called it "brennendes Wasser". How could Schelenz and so many others have been misled ? Alcohol is indeed an Arabic word but it has nothing to do with our spiritus or C_2H_5OH. By alcohol the Arabs mean something extremly fine in solid form or something extremely light and mobile in liquid form. Thus Pseudo-Meseus writes : "Tritura trituratione ultima sicut alcohol", meaning "Rub it extremely fine, as fine as alcohol". Manlius de Bosco, a commentator of Pseudo-Mesues, added the following precision in his Luminare majus : "sicut alcohol id est sicut atomi solares", as sun atoms. At first sight this could be translated in "as fine and small as dust particles in sun rays",but Manlius de Bosco meant here "as fine as fire atoms", which were considered the smallest of atoms, i.e., the smallest particles in which the four elements (fire, water, air and earth) can be divided. Franck's Etymological Dictionnary, according to N. van Wijck, reads under the word alcohol : "Not yet in Kiliaen. International word. Via Spanish alcohol from Arabic al-kuhl, powder of leaf-sulfur, to spread over the eyelids". This is acceptable especially when knowing that powder to be spread over the eyelids should be extremely soft and fine, but the concept alcohol had a much broader and more general significance.

What then is the origin of the confusion between the Arabic concept alcohol and our spiritus ? Schelenz probably did not thoroughly study the hundreds of works he referred to. He cites the title and provides a summary, which is already quite an achievement. When scanning the Arabic works he will have been struck by the often returning word alcohol, without knowing its precise meaning. From this he drew the erroneous conclusion that the Arabs did know alcohol. In claiming that the Arabs called alcohol aqua ardens or "brennendes Wasser" he is also mistaken, as Pseudo-Meseus wrote litterally : "aqua ardens id est aqua saponis". Ardere indeed means to burn as well as to shine, which is a characteristic of soap-suds. Only much later will the name aqua ardens or aqua vitae be used for alcohol.

Who then did discover alcohol ? The honor of the discovery belongs to Arnaldus de Villa Nova, born in the neighbourhood of Valencia ca. 1234-1250. He was a physician, astrologer, diplomat, translator of Arabic works into Latin, adviser of several popes and kings, professor in Salerno, but above all alchemist. He left around 80 works, several of which have been condemned by the Inquisition after his death. He died at sea in 1311. As all alchemists. Arnaldus was very active with the alambic or distillery apparatus. The alchemists litterally put everything they laid their hands on into the alambic. Some day, when distilling white and red wine, he was astonished to collect from both a very mobile liquid which in his excitement he called "Id est sicut alcohol", thus giving the liquid its name. The discovery of Arnaldus de Villa Nova was known in our countries as early as the 14th century. It was described in Middle-Dutch under the name Aqua vitae and was advocated as a panacee.

Another discovery, which has been erroneously attributed to the Arabs was the alambic, which there was no need to discover as it already existed. Old pictures show that the Greek and Egyptians made already use of distillery and used the alambic essentially to prepare perfumes. The Arabs did impose the cooling system, designing a precursor of the present serpentine on which a water stream was brought from superimposed water basins, the water being reused after cooling. It has been suggested by some that the name alambic is derived from the Greek word ambix (vessel, recipient) to which the Arabs stuck their label so that it was wrongly labelled an Arabic invention.

Another product, the discovery of which was wrongly attributed to the Arabs is sugar. Sugar is derived from saccharum, which is derived from the Arabic alzuchar, which in turn is derived from the Indian sakara.

Dioscorides (1st century A.D.) knew already sugar. In chapter 74 of the 2nd book of his De Medica Materia Libri Sex he writes: "Est et aliud concreti mellis genus, quod saccharon nominatur". "There is another kind of honey, named saccharon. It occurs in kinds of cane in India and in happy Arabia. It is compressed as salt. Drunk with water it is beneficial for intestines and stomach. It is remedy for disturbed bladder and kidneys and, when rubbed on the eyelids, dispels the darkness which obstructs sight".

Originally sugar was exclusively derived from sugar cane (Arundo saccharia L., Saccharum officinarum L.) which grew in China and India. The cane was compressed and the condensed sap called sakara. This sakara was a dirty, sweet and unrefined substance which the Romans called Sal Indicum. Dodonaeus writes in his Cruydt-Boeck : "Sal Indicum or Indian salt which is of a sweet taste and which is our actual sugar".

As also Galen and Plinius knew sugar, it were not the Arabs who introduced sugar into medicine. What they did was to realize that this substance could be quite useful for correcting the bad taste of many medicines. They did not want to use it in the dirty form which they had inherited. In order to obtain it in pure form they founded sugar cane refineries in Chuzistan and near Siraf and also laid out sugar cane plantations in Spain and the Mediterranean islands.

Sugar has long been an expensive product which was reserved for pharmacists. For this reason Saladinus of Asculo (15th century) wrote in his book Compendium aromatariorum on the ethic of pharmacy : "Ne praesumat syrupos qui debent esse de zuccharo de melle facere". "The pharmacist shall not prepare with honey sirups which ought to be made with sugar". Now the reverse is practised, honey being adulterated with sugar ! The reason for this is that sugar is no longer exclusively extracted from sugar cane but also, and much more so, from sugar-beets. This we owe to pharmacist Andreas Sigismund Marggraf (1709-1782) and especially to his disciple the pharmacist Carl Achard (1753-1821), who designed a technique for the preparation of sugar from sugar-beets and thus became the founder of the sugar-beet industry. Here again the role of the Arabs was restricted to the lay-out of sugar-beet plantations and the building of sugar refineries.

Alchemy has also been wrongly attributed to the Arabs. According to some the word is derived from the Egyptian kimia, which means something as black magic. Homer Dubs, professor of Chinese at Oxford University, suggests that alchemy, as well as elixir, notwithstanding the Arabic article al or el, is of Chinese origin. It is almost certain that the Chinese, who have a god of alchemy, Huien-Huien, are the discoverers of alchemy. The Arabs took this science over via the Indians, stuck as usual an Arabic label on it, as a consequence of which alchemy has been regarded as an Arabic science.

The most difficult chapter in the history of sciences is undoubtedly the chapter on alchemy.

When discussing alchemy one should immediately distinguish between true alchemists and charlatans, who, under the cloak of being capable to make gold, pulled a people's leg and deprived the concept alchemy of its philosophical-religious and mystic meaning and gave it its unfavourable connotation.

True alchemists were well-meaning and honest people who by their mostly absurd experiments rendered an invaluable service to mankind as they made chemistry possible.

The idea underlying alchemy is a philosophical one : the striving of the imperfect to the perfect. Man is mortal and thus imperfect. The principle of alchemy is to make man perfect, to immoralize him. Practical alchemy then corresponds with the striving to immortalization.

The alchemists were convinced that in the end an Elixir longaevitatis or Elixir of Life could be discovered which would bring to man long, even eternal life. Looked upon in this way, medicine actually still practices alchemy : we are still searching for a panacea to get rid of diseases as quickly as possible and for gerontological remedies to keep people young and to reach the age of 2000 years ! Alchemy is a phenomenon of all times.

To prepare this Elixir of Life the alchemists needed the Lapis Philosophicus, the Stone of the Wise, the Magnum Magisterium or Stone of Egypt. How then could one know whether one had found the Lapis Philosophicus ? When the stone or substance, added to base metals (lead, copper, tin, mercury, etc...) transformed these imperfect metals into noble ones (gold, silver) by a process called transmutation. This quite clearly shows that transmutation of base metals into gold was not a goal by itself but only a step in the preparation of the Elixir of Life.

The idea to make gold from worthless substances appealed of course too much to less noble characters to not adopt it. These then were the scum and not the pure idealistic alchemists, who indeed were also philosophers whith a special vision of life. They knew they were only then to obtain the Lapis Philosophicus when their conduct pleased the God (or God in later times). For this reason every alchemist laboratory also had an oratorium, a place of prayers, where they could reflect, meditate and pray. Laboratorium is derived from labor and oratorium. This also explains why so many monks also practised alchemy.

Up to now everything is clear : the alchemist searched for the catalyzer, which would transform metals into noble ones, by performing sensible as well as the most absurd experiments. They built all kinds of apparatus, each of them having its own name as an expression of their craving for mysteriousness. They thus were using the sphere, the spion, the tomb, the philosophical egg, the chickenhouse, the brides'room and the womb, or living beings e.g. the hydra, the twins, etc. Their oven was called athanor; they knew three kinds of heat : the moist fire or balneum mariae (the water bath, deformation of balneum maris), the supernatural fire which they obtained by adding oxygen, and the natural fire. Their sublimating apparatus was called aludel, but their apparatus par excellence was the alambic, the distillery apparatus.

The alchemists worked day and night, they thought and prayed, cooked, distilled, squandered time and money but were not enclined to inform all the world and his wife about their experience. For this reason they had designed a crytic language which was accessible to the adepts only, turning alchemy into an esoteric science, i.e., a science full of mysteries, destined to the intitiated only.

In the evolution of alchemy the Arabs played their usual role: to inherit and to transmit to the West. This does not mean that the Arabs did not practise alchemy. On the contrary, there were a great number of Arabic alchemists, which is best illustrated by the fact that 3000 works on alchemy have been attributed to Geber (Djabir). It is true, however, that alchemy, no more than alcohol, alambic and sugar, was an Arabic invention.

It is useful to fight against these heresies, for the merits of the Arabs, particularly in the field of pharmacy, is so great that it is unnecessary to exaggerate their importance.

Sarton Medal Lectures

LAUDATIO THOMAS FRANSEN

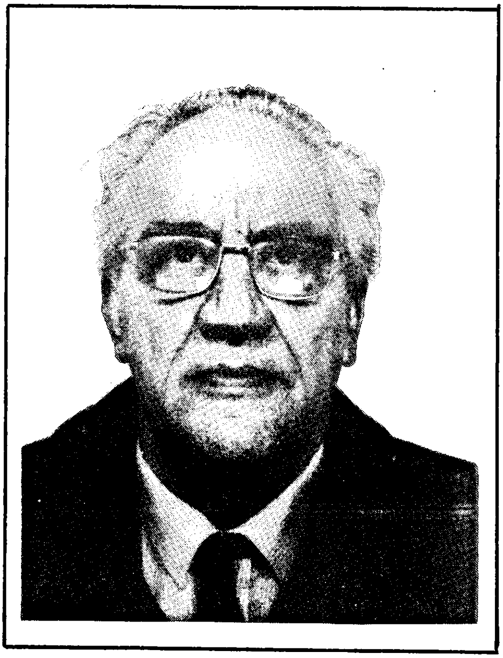
W. Wieme

Thomas Fransen graduated as a civil engineer at the University of Ghent in 1947. His career turned towards the textile industry, at that time still the main industry of the region. However, antiquated technology and lack of modern management would soon send this industry into near oblivion. Thomas Fransen has been working hard to prevent this happening. As Professor of the University of Ghent, teaching textile engineers, and as Director of the Laboratory for Textile Engineering we can say thát he has succeeded Now officially retired he continues teaching a number of specialized textile subjects, giving the engineering students the benefit of his extensive international experience.

The Sarton Chair is of course concerned with the history of science, so today we want to emphasize the merits of Professor Fransen in this respect. Although his professional interests have always been with the latest technological innovations, as it should be for an engineer, Professor Fransen was very much aware of the historical importance of the development of the textile industry. His personal interest was not limited to modern times and its technological and social problems, but he showed great appreciation for the art and craftsmanship of antique textiles. He became a member of the Centre d'Études des Textiles Anciens and Chairman of the Society for Industrial Archeology and Textile of Ghent. He was actively involved in rescuing some unique 19th century textile machinery from total oblivion or even destruction. Some ancient textilelooms have been painstakingly restored to working order. The famous Mule Jenny, smuggled out of England to the town of Ghent in 1789 to become the first continental loom, should one day become a show-piece in a Museum for Textile Products, a project to which Professor Fransen is giving all his support. If this project were to be realized, the town of Ghent, centre of world renown since the Middle Ages, will have a textile museum worthy of its reputation.

As a token of appreciation for his efforts in the field of textile archeology, and upon unanimous recommendation of the Faculty of Engineering of the University of Ghent, the Sarton Medal for 1988 has been awarded to Professor Fransen.

Ghent, March 24, 1988



INDUSTRIALIZATION CALLS FOR STANDARDIZATION

Thomas J.F. Fransen

Introduction

The subject of this contribution to the history of technical sciences is to illustrate how the development of industrialization and simultaneously the steady growing of the commercial relationships generate an increasing need to speak the same language. By the same language in the technics it is meant that the same concepts are handled in the translations, e.g. the same measures and weights are used. Therefore normalization work has to follow this increasing need and agreement upon specified features must be reached in order to set up general accepted standards.

The development of this theme is mainly restricted to the field of the textile technology. Three items are treated for which the standardization of measures has been the result of satisfying the need to univocal commerical transactions. Each one of these examples concerns measures used for the description or qualification of textile products. It is obvious that the acceptance of standard measures has favoured commercial relations or will do it in the future.

The items developed below are historically spread over a long period. Without knowing precisely the time limits, when they occurred, the first example is taken from the very distant past, the second item concerns an almost actual problem, although the final general consensus has not been reached yet and the third item may be a protection of development in the not so distant future.

Taking these three items in consideration it becomes clear that the growing communication facilities in the large sense of the term, promotes the commercial relations and also the industrialization, which in turn calls for progressive standardization. Reversely the increasing package of standards must favourably affect the technological evolution.

Parallel to this development it will also be clear that the so called standardization in the past, finds its application in rather restricted communities such as gildes, corporations or cities. Then, due to the growing industrialization, the field of application expanded within sections or subsections of the textile industry, but already outside the powerful city towns. The field of application becomes regions, which for certain items are transgressing the borderlines of nations, but remains almost within countries having the same communication language. It has to be expected that in a not so distant future standardization work has to be performed at a universal scale as it is already done in the different ISO-bodies. However it is to be feared that by the extreme slowness of reaching an international concensus the industry will take the lead. This is in itself not to be disapproved, when the industry would reach within their federations a general or large consensus. The latter is not a wishful dream, but a necessity of vital importance for each industrial activity and thus for the textile industry which in Flanders has been of old a prosperous industrial activity and still remains so.

The "ell" as length measure for textiles

This first item concerns a length measurement which has been used in the past mainly in textile communities.

It is obvious that in the pre-industrial ages by the lack of precise instruments the measurements of parts of the human body are used to express lengths, widths and thicknesses or heigths and depths with a figure. So the well known "fathom" may originally be defined as the distance between the finger tips by a horizontal stretched arm position. In England the half fathom becomes more in use and is called "yard". In addition the fathom measures such as foot, palm, and inch are also in use. The recognition of the extreme variability from man to man of the mentioned body parts, generates the need for standard measures such as rules. But these standard rules were different from quarter to quarter, from city to city and from region to region.

The following development was to find out a coherent measure system. So, for instance, for one of these systems it was agreed that 4 inches would be equal to one palm, three palms or 12 inches equal to one foot, three feet or 36 inches equal to one yard, and finally 2 yards or 72 inches equal to one fathom. It falls outside the objectives of this contribution to describe also the variability of each one of these measures. As already mentioned the length measure which is more specific for the measurements of textile products will be treated here. Such a measure, not yet mentioned, is the "ell" and this kind of measure was already in common use in the ancient civilisations in Babylon and Egypt practically exclusively for flexible materials such as fabrics, ribbons, cords and laces.

In the archives of the city of Ghent one may read that from 1760 to 1791, due to the success of the factory of Joos Clemens in Ghent and of all the printing works of the Southern Netherlands, the import of cotton sheets increased from 175.000 to circa 4.160.000 ell. How long this ell should be taken is not mentioned, but probably it concerns the ell used by the city of Ghent. For sure in the beginning people have used as many different ell measures as there were different merchants and dealers. In order to avoid fraud or disputes this situation was to be settled and this was done by regulations edicted by the local authorities or conventions within gildes, where a physical ell-standard was kept. Such a standard ell was then considered as the recognised length measure to be used by the gilde members or by the citizen of the city for the measuring of textile products.

In order to give an idea of the variability of the so called ell-standards a graph has been dressed. The data are taken from the "Dictionnaire Universel des Poids et Mesures" written by DOURSTHER. The graph represents the histogram of the ell-standards for about 550 cities spread allover the European continent. Fig. Higher peaks in this histogram are related to e.g. the "ell of Paris", which has been recognised and used by the majority of French towns and a number of towns in the Valais of Switzerland. An other peak is shown by the "ell of Brabant", which is applied by most Flemish cities. Shorter ells are used in German towns and in the german speaking part of Switzerland. Flemish towns who did not follow the ell of Brabant are given in a separate table.

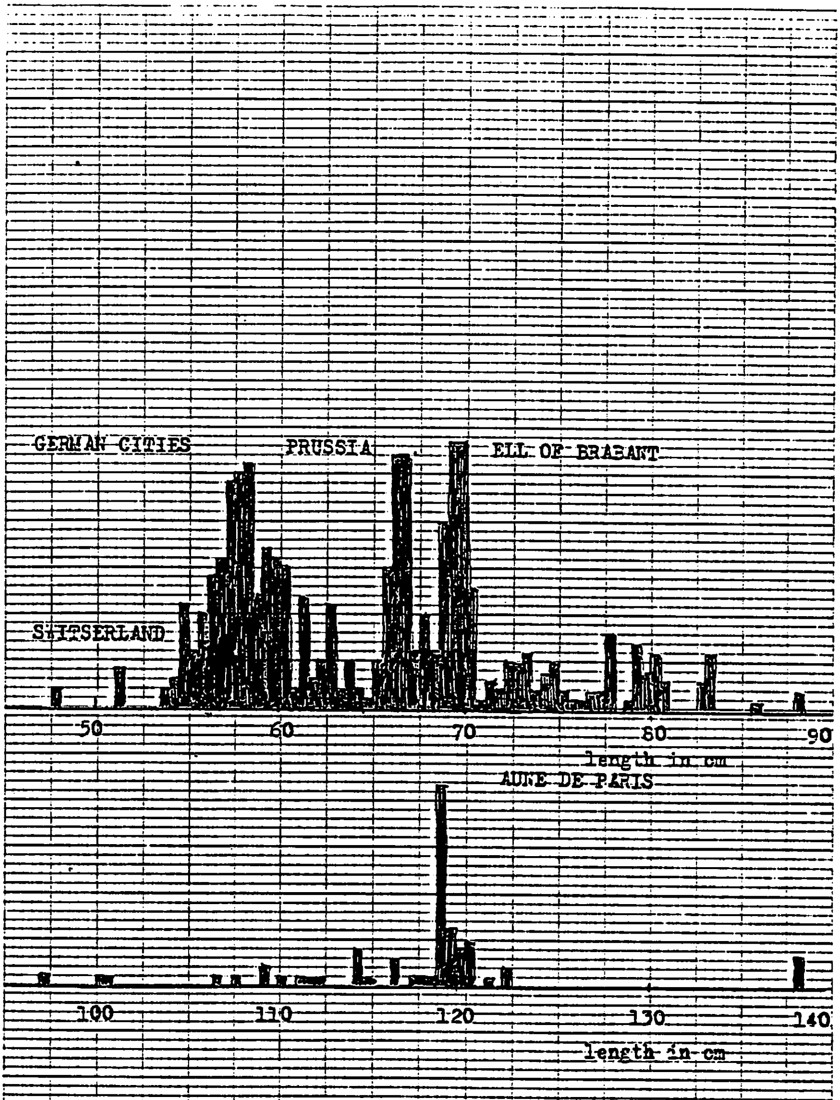


Fig. VARIABILITY OF "ELL" MEASURES

Table 1 — ELL MEASURES USED IN FLEMISCH CITIES

City	Subject of application	Length in cm
Aalst	Large ell Retail trade	71,9 cm 63,9
Antwerp	Ell of Brabant *	69,5
Dendermonde	Whole sale trade Retail trade	73,1 69,6
Ghent	Ecru cloth Bleached cloth Retail trade	76,5 72,8 69,8
Herenthals		68,6
Ypres		69,7
Courtrai	Ecru cloth Bleached cloth Retail trade	73,7 69,1 71,0
Louvain		68,0
Lier and Malines		68,9
Menen	Lace Table cloth	71,3 69,3
Oudenaarde	Ecru cloth Whole sale trade Retail trade	76,8 73,4 70,3

* in application by most of the Flemish Cities

In this table one can observe that the city of Ghent has standardised three different ell lengths. The longer one is used on the "Freiday market" in order to measure linnen offered to sell by the farmers in lengths of 40 ells. The longer ell was also used in the so called "cloth measuring houses" where the length of the pieces of cloth are mesured or controlled by officials.

The shorter ell is used for the measuring of milled cloth in the wet state. Both ell standards are kept by the governing body of the city of Ghent from 1546 until 1786.

In 1790 a decree of the constitution in France charged the Academy of Science to set up a coherent, unique and decimal unit system in order to replace the multiple existent measuring systems. At that time the ell was subdivided in 16 talies and was therefore not decimal. After having measured the distance between Dunckerque and Barcelona and estimated the 10,000th part of the total length of the meridian the Academy of Science has defined this part as being the new unit called "meter". By a decree of 2 November 1801 the meter becomes a universal and legal unit for measuring the length. Shortly thereafter the metric system, which was decimal, was built up and the use of that system obligatory since 1 January 1840. In the Netherlands the new meter unit was adopted in 1816 under the name of the "ell of the Netherlands". In Belgium the new unit has been introduced since 18 June 1836.

The meter standard in platina is kept at 0° C in the "Pavillon de Breteuil" in Sèvres. Later on the same standard has been redefined, taking as a base the wave length of the specific red line in the spectrum of cadmium or, such as it has been done by the National Bureau of Standards, on the base of the wave length of the specific green line of the spectrum of the mercury isotope 198.

Only the Anglo-saxon countries have pursued the use of yards, feet and inches. This fact is not without significance for our countries, because there are close relations between England and the low countries by the sea of the continent.

In the fourteenth century Flemish weavers settled in England and gave to the existing textile activities a marked impulse. At that time England made a kind of an industrial revolution by the increasing growth of cloth preparation technics and the application of waterpower for milling operations.

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The export of English cloth to Brabant and Flanders has made an end to the traditional textile industry in these countries. By this situation the Flemish weavers imported Spanish wool and wove new lighter and cheaper cloths, which they exported in turn to England. This alternation of success and crisis situation in England and in the low countries by the sea repeats itself during centuries. Remember the industrialist *Lieven Bauwens*, who set up in 1800 cotton spinning mills in Flanders. This made it possible to produce cotton fabrics, called calicaot's, which is a degenerated form of Calcutta, the city in India from where these fabrics originally were imported. These historical facts explain why a prolonged use of english measure systems could be observed in our textile mills. For sure the "ell" is not used anymore as a measuring unit. Some idiomatic expressions are still remainings of the past situation.

The count as a measure for the fineness of textile strands

By the growing complexity of the industrial and commercial activities the need for normalizing systems in general and specific systems for the textile industry in particular. Such a need has broken through in the textile industry, where the use of synthetic fibres and the growing importance of products composed with fibre mixes, has been the stimulating factor in setting up a logic system for the designation of the fineness of products as fibres, single and plied yarns and filaments.

In the textile industry a large number of systems have been in use for expressing the fineness of these products, depending as well upon the material used as upon the region and industrial sector taken into consideration. Direct or weight numbering and indirect or length numbering have been in use. In the length number system the count expresses the amount of length units which are in a specified weight unit. The units which are involved differ markedly from one material to the other. This differentiation may be explained by technological reasons, since the common presentation of the material under the form of leas is different for each kind of material and for each different textile community.

Table 2 — INDIRECT COUNT SYSTEMS

Name	Symbol	Length unit	Mass unit	Application
Metric count	Nm	1000 m	1000 g	General except silk and filament
French count	Nf	1000 m	500 g	Cotton
English count	Nec	840 yard	1 lbs	Cotton, silk waste
English linnen	Nel	300 "	1 "	Wet spun flax
English wool	New	360 "	1 "	Combed wool
English wool	New	256 "	1 "	Woollen yarn
Typp	Nt	1000 "	1 lbs	"
Allooi	Na	11520 "	1 lbs	"
Galashielt	Ng	200 "	1 lbs	"
Hawick	Nh	320 "	1 lbs	"
American wool	NaW	1600 "	1 lbs	"
Dewsbury	Nd	16 "	1 lbs	"
American asbest	NaA	100 "	1 lbs	Asbestos and glas
British asbest	NbA	50 "	1 lbs	Asbestos
Catalonia	NcC	500 canas	1 lbs	Cotton
Espania.	Np	1320 meter	1 lbs	
Irish wool	NiW	64 yard	1 lbs	Woollen yarn
Cardado coreil.	NpW	1 meter	5 gram	Woollen yarn

Table 3 — DIRECT COUNTS SYSTEMS

Name	Symbol	Mass unit	Length unit	Application
Legal denier	Td	50 mg	450 m	Silk and Synthetics
		1 g	9000 m	
Scottish	Ts	1 lbs	14400 yard	ry spun flax, jute
Aberdeen	Ta	1 lbs	14400 yard	Woollen yarn
Poumar	Tp	1 lbs	1000000 yard	
Silk	Tsi	1 dram	1000 yard	Silk
American count	TaG	1 grain	20 yard	Woollen yarn
Spanish	To	1/4 ounce	500 canvas	"
Catalonia	TcW	1 g	504 m	"
Grex	Tg	1 g	10000 m	
TEX	Tt	1 g	1000 m	UNIVERSAL

A typical example is the expression of the fineness of textile materials composed from silk in "denier" units. This unit was originally used for the measurement of the fineness of silk, later on also in use for manmade fibres or filaments. The term itself is deduced from "denarius", which is an old roman coin and has the value of ten "as". The same term was used by the romans as a weight equal to the 84th part of a pound. In France the "denier" is also known either as an old french coin equal to the twelfth part of a "sou" or as a weight, known as a "dernier tournois", which is equal to 45 mg. Furthermore the term "denier" is also, such as carat for gold, an expression for the parts of silver 12 being pure silver. In the textile world the term "denier is used to express the weight of silk. Until 1850 in Lyon, the centre of the silk industry, the weight count of silk filaments was based upon leas of 475 m and expressed in Montpellier grains weighing 45 mg. The length of 475 m represents the average workable length of silk filaments, which could been withdrawn from a cocoon. The Conference of Paris reduced this length in 1900 to 450 m and rounded the basic weight unit to 50 mg. By reeling off 20 cocoons at the time, which is a current procedure, the definition of a denier may formulated as being the weight of 9000 m, expressed in gram.

So far the origin of "denier" used for expressing in the past the fineness of silk filaments. Analogue explanations may be given for the other count and numbering systems, but this falls outside the aim of this paper.

It is clear that such a variability in expressing the fineness of textile strands may not be beneficial to the industry and to commercial transactions. Not so long ago lessons given in technical schools spent more than one semester in explaining the different count systems and in resolving problems of converting one count into one from an other system.

The fineness unit expressed as the mass per unit length and more particularly the expression in gram per kilometer has already been suggested in 1873 during a Conference in Vienna. The tex system, such as it is called nowadays, was not really a new idea when in 1956 in Southport at an ISO-meeting of technical Committee 38 unanimously the adoption of that count system was recommended. A committee adhoc, which met in 1957 in the Hague, was charged to activate the use of that universal count system by National and International Textile Federations and Associations. It may be said that especially commercial bodies, presumably by love of ease, did not accept this recommendation with enthusiasm and even today some merchants and dealers keep aloof from the recommended tex system. In technical sciences the use of the tex system is unquestionably a tremendous simplification. The system is not only a metric system, such as the metric count system, but is at the same time a decimal system, so that multiples and fractions may be used and designated by the prefixes "kilo" "deci" and "millitex". Such a facility does not exist with the metric count system. It is sometimes discouraging to state that actually, 30 years after the decision taken in Southport, locally still out of date or archaic count systems are in use.

The introduction of the tex system on the side and the legalisation of the International and coherent Unit system on the other side, has next to the fineness expression also interfered with other textile expressions commonly in use. So the designation of yarns, the lea and single thread strength the twist factor and cover factor to be revised. As an example one of these revisions is given below.

The breaking length as a measure for the yarn strength

It is common practice in the textile industry of the continent to express the strength of yarn by the breaking length, which may be defined as the length of yarn having a mass of which the earth attraction power is equal to the average tensile force. As long as the fineness is defined as a weight per unit length it was sufficient to divide the tensile strength by the count to obtain a length dimension. The length, so obtained, is commonly expressed in kilometer. By the introduction of the coherent international system of units in which the kilogram force has to be banned, and by the definition of the count in tex, being a mass per unit length, an expression of the specific tensile strength is obtained by dividing the tensile force in Newton by the fineness in tex. The numerical value of this specific strength, expressed in centiNewton per tex has to be divided by the factor 0, in order to obtain the commonly used breaking length in kilometer.

So far the problem of expressing the fineness by counts and the inference upon other expressions used in textiles.

Classification systems of carpeting

By this we have reached the third item of this paper, a theme which is more a projection for the future. It concerns the classification of carpets and the way of classifying a carpet in the system. It is surely not a surprise to state that also in this field a variation of classification systems are already in use. The application of these systems is not so strongly depending upon the used textile materials as it was in the past by the count systems. The classification systems already in use are transgressing the border lines of nations and cover larger fields in the European community. The german classification system is largely adopted by Germany Austria and German Switserland. The Scandinavian system is largely applied in Sweden, Norway, Finland and Denmark. The ICCO-system is adopted in France, Belgium and for some time ago also in Great Brittain. Another classification system found its application in national and European Institutes Housing. Finally there is also an international IWS-system which has an international application but reserved only for wool carpetings.

Taken into account that Belgium is the largest producer of carpets in Europe and therefore also the largest exporter it becomes of prime importance for the producer and for the commercial transactions to reach a universal recognised carpet classification system. Therefore is it interesting to describe very shortly the essentials of the ICCO-classification system and to show how it is established.

In the first place in compliance with Iso-recommendations a kind of interrelation is adopted between the rooms on the one side and the wear conditions on the other side. This interrelation has been set up as well for domestic use as for public use of the carpet. Are excluded from this classification system the luxurous carpets and the carpets for decoration.

Tabel 4 — REVIEW OF THE IMPORTANT SPECIFICATIONS IN THE ICCO-CLASSIFICATION SYSTEM

Class	Change of Appearance	Static Compression	Minimum requirements for all classes
T2	1	2,0 mm	Fastness to light pale shades 3-4 middle " 4-5 dark " 5-6
T3	2	1,5 mm	Fastness to rubbing 4
T4	3	1,0 mm	Castor chair test 5 kilocycles 3 25 " 1
T5	3 - 4	0,8 mm	5 kilocycles 3 25 " 1

The classes for domestic use are partly overlapping the classes for industrial use so that in total maximum four classes are taken into consideration. These classes are numbered from 2 to 5.

Next to this subdivision in classes minimum requirements are specified valid for all classes. These requirements are given in table.

Furthermore reference tables are established for carpets with pile composed of wool, acrylic, texturised or spun polyamide, spun polypropylene and for a number of commonly used mixes of acrylic and polyamide or wool and polyamide.

In addition to these minimum resuirements valid for all carpets and restricted to descriptive characteristics of carpets, there are also requirements in the field of the wear conditions of the carpet. The durability of a carpet is assessed by a drum test where after a treatement during 22,000 cycles by a heavy rolling hammer the change of appearance is determined. This change may not be less than the limits given in Table 4.

For the evaluation of the change of appearance the ISO subcommittee in charge established different types of reference scales each of which is composed by physical carpet samples and represents five stages of heaviness of attrition numbered from 1 to 5. These reference scales are pretended to be useful in assessing the durability after all different kinds of use conditions.

Finally a last specific characteristic of a carpet is the compression under seat or table legs. A special instrumentation measures the remanent compression after a recuperation time of 60 minutes. The maximum compression in function of the classification steps are given in table 4.

Carpets for classification step T-4 and T-5 have to be tested supplementary by the castor chair test.

Sofar the ICCO system for the classification of pile carpets.

Conclusion

So far three themes taken from the textile world in order to sustain the thesis that the development of the commercial transactions and parallel to this development the progress of the technologic evolution, if not revolution, and the increasing industrialization has generated the need to use standard measuring systems and to use these systems for the creation of universal accepted classification systems for commercial products. At the same time we have shown that in the old ages these standards are recognised in very restricted communities such as gildes, cities or local markets. With the time and the further development of industrial communities some of these standards are spread within a particular industrial activity such as the linnen, wool, cotton or silk industry. The use of man made fibres and mixes has created the need to accept one and the same fineness standard for all textile products.

Finally it is to predict that by the creation of the new open market in the European countries new needs will rize for standardization such as it will be the case for the international classification of carpets. It is hoped that such a classification system will be realised in a not so distant future.

This is really what is meant by the title "Industrialization calls for standardization".

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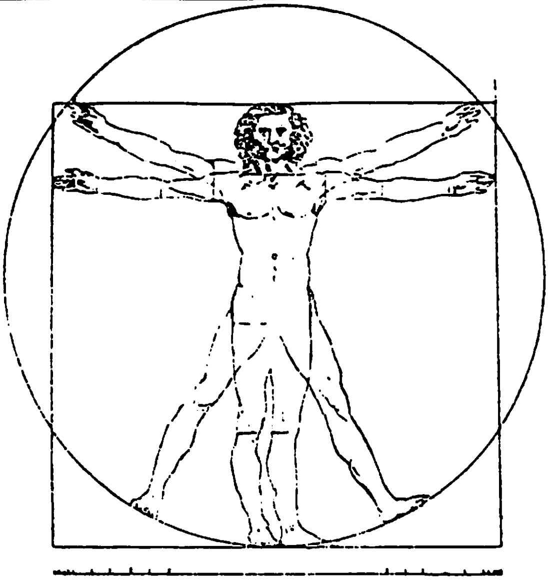

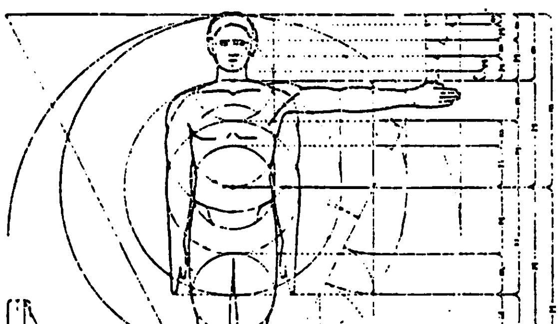

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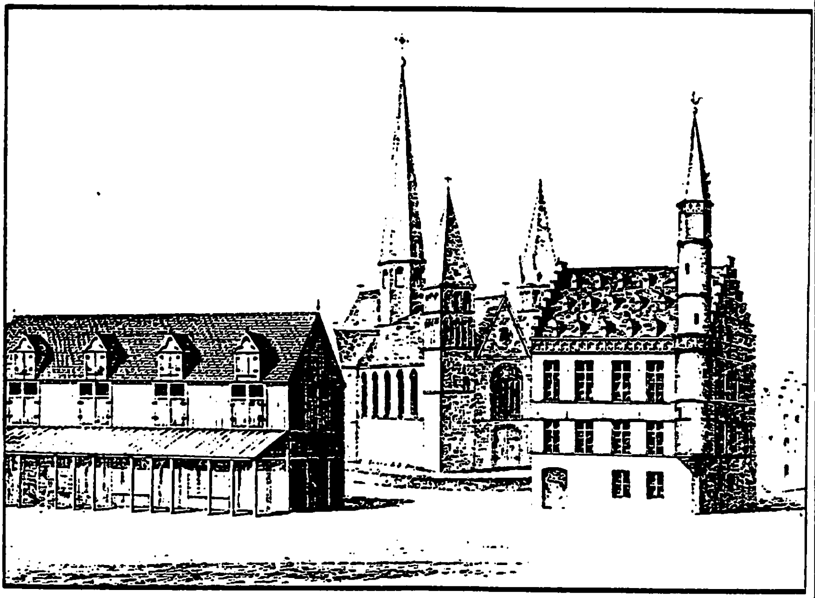


VIAT

Metershuis 1666

8

VIAT

Metershuis 1772

9

VIAT

COCON AFWIKKELEN

1 2

KLASSERING DER LOKALEN EN DER GEBRUIKSVOORWAARDEN

KLASSE	HUISHOUDELIJK GEBRUIK	PROFESSIONEEL GEBRUIK
T2	Licht gebruik bv. slaapkamers	
T3	Normaal gebruik bv. woonkamer	Matig gebruik bv. Privé-kantoor
T4	Zwaar gebruik bv. alle woonkamers	Normaal gebruik bv. vergaderzalen
T5	Intensief gebruik	Zwaar gebruik bv. openbare plaatsen winkels en dergelije
TD	Decoratieve of luxe-tapijten	TL

VIAT	KLASSERING	13

LAUDATIO ADRIAAN VERHULST

*Marcel De Boodt**

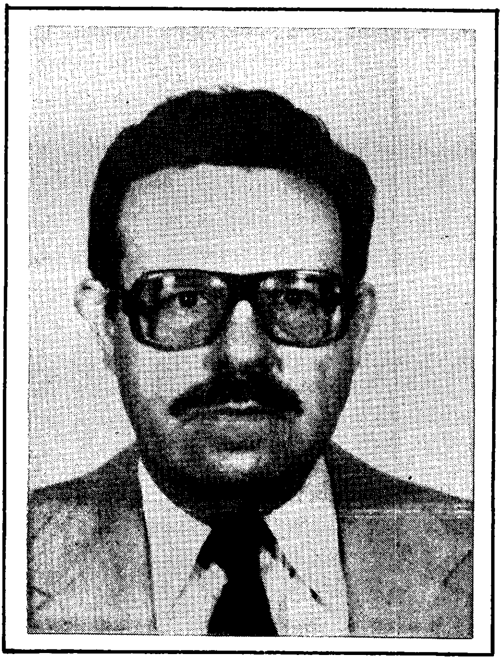
Born in Ghent on 9 november 1929, Verhulst studied history at the state University specialising in the "Flemish Medieval social and economical past". He obtained his PhD in 1956 with a thesis on the S[t].Bavon Abbey and its properties during the Middle-Ages. The promotor was the wellknown historian Prof. F.L. Ganshof

When nominated Professor at his Alma Mater in 1966, Verhulst was and still is in charge of the social and economical history in the Middle Ages and of historical geography. He also was appointed as part-time docent in 1983 at the Free University Brussels in charge of the "Economical history of the Middle Ages". His scientific and honorary activities are important. To cite only a few; director of the Royal Commission for history of Belgium; corresponding member of the Royal academy for science, letters and fine art of Belgium; and president and honorary president of the "Willems foundation" president of the board of trustees of the Belgian Radio and Television (BRT).

Numerous are the books he wrote reflecting his main fields of interest. Five are written in his mother tongue dealing with specific aspects of social and agrarian history in Flanders or in Belgium as a whole. Two are written in French-dealing with the financial institutions during the Middle Ages in Flanders and one is written in English on medieval Finance.

Prof. A. Verhulst is not only a well known authority on the financial, social and agrarian history of our country, but also abroad. His engagement in the cultural activities of his region and in Brussels are highly appreciated. No better authority could be found to lecture and occupy the Sarton chair to speak about : The agrarian revolution, a myth or reality ?

* woensdag 27 januari 1988, 15.00 uur. Landbouwfaculteit.



AGRARIAN REVOLUTIONS : MYTH OR REALITY?

Adriaan Verhulst

The contribution of an agrarian historian to the memory of the famous historian and philosopher of science George Sarton has to discuss, if only by way of introduction, the fundamental problem of the historical relation between science and practice, in this case the relation between agronomy and agricultural technique. According to the well known philosopher of science John Ziman, the interrelation of theory and practice cannot be caught within a simple theoretical model. (1) In his opinion a technique sometimes precedes science, in other cases some aspects of technical knowledge find their origin in close relation to parallel evolutions in pure science. Practice and theory, as the examples related to biology and genetics cited by Zimanprove, can lead separate lives until one day they happen to meet with goods results.

The historian of agriculture can contribute to this debate and formulate new hypotheses concerning the relation between agronomy and agricultural techniques. We will try to prove that, before the nineteenth and twentieth centuries, so-called agrarian revolutions not only did not result from the science of agronomy but that they never even existed, not in the Middle Ages, nor in the eighteenth century.

I

The first part of our thesis, namely that agronomic literature had little or no influence on the common practice of farming and on agricultural technique in general, is usually admitted, at least as far as the period before the origin of agronomy as a science is concerned. This is before the middle of the eighteenth century when problems of agronomy were first discussed in the academies of different countries. It is possible that the presence of important Latin agricultural treatises like those of Cato Senior, Varro and especially of Columella in several monastic libraries during the early Middle Ages led on some large estates or in the garden next to the monastery to experiments which at that moment had no further influence or application. The French historian Duby however, whose views on agricultural revolution in the Middle Ages will be treated below, is less sceptical about the influence of these Latin works on agricultural practice in general (2). He ventures to suppose that the study of these texts by some monastic administrators in Carolingian times can have been one of the impulses to medieval agrarian expansion. Thinking along these lines, Duby considers the appearance of original treatises on estate management and agricultural technique at the time of the important agrarian expansion of the twelfth and thirteenth centuries, particularly in England and Italy after 1250, as highly significant (3). One of the earliest of such treatises was written between circa 1276 and circa 1290 in the Norman-French vernacular by a certain Walter of Henley (4). Its purpose was the instruction of both secular and ecclesiastical bailiffs on large manors. Therefore it contains more information concerning the administration and organization of such manors than it provides agricultural advice. The same is true of the few other works from England in the same period, which were also mostly written in French (5). The work of the patrician and landowner Pier de 'Crescenzi(Petrus de Crescentiis) of Bologna entitled "Ruralium commodorum libri XII", had a far larger audience. This was mainly the consequence of the fact that it was printed in 1471 at Augsburg, more than one and a half century after it had been written. It was written between 1300 and 1309 in Latin but shortly afterwards translated into Italian (6). de 'Crescenzi abundantly cited classic agronomists, especially Columella, whose quotations however he knew only indirectly through Palladius, who in the fourth century using Columella's material (7) composed a manual in the form of a calendar. de 'Crescenzi's work also contains some agronomic advice based on his own experience. This work (translated into German even before the end of the fifteenth century) and still more so that of Columella (many manuscripts of which were found in fifteenth century monastic and lay libraries and which was used as a basis for the first German agronomic discourse written in Latin by Konrad Heresbach in 1570 (8)), had great success in humanistic circles during the late fifteenth and sixteenth centuries. Therefore one can wonder, as Duby quite rightly did this time (9), whether these works really were practical manuals used as such. As long as they have not been thoroughly studied, in order to separate practical experience from compilation as their components and to compare that experience with the techniques actually used in the Middle Ages, we will remain very sceptical about their influence on the agricultural activities of the average contemporary landowner or peasant.

This scepticism is also based on an a fortiori line of argument starting from the agronomic literature of the eighteenth century. It is well known that in this period many more works than before were written on the subject and that most of them were printed. They found their way to a larger public of much less illiterate persons than ever before. Moreover, these agronomic works were published in the second half of the eighteenth century and the beginning of the nineteenth century, the period in which an agricultural revolution is said to have taken place. Although this coinciding in time of both phenomena suggests a causal relation between agronomy and the agricultural revolution, this relation never existed, not only because the agricultural revolution of the eighteenth century is now considered to be a myth, but also, as will be argued below, because the eighteenth and nineteenth century agronomists had very little influence on agricultural practice, if ever they had any. As Michel Morineau formulated it : "<les agronomes> n'ont pas fait la "révolution agricole" mais ils l'ont proclamée; d'où la double confusion qu'elle ait eu lieu et qu'ils en soient les auteurs" (10). The same view is held by the well-known Dutch historian of agriculture Slicher van Bath (11) and it is also the conclusion of André Bourde in his important tripartite standard work on agronomy and agronomists in eighteenth century France. We will continue to refer to the latter work because the subject-matter is too elaborate and the authors are too numerous (12). Bourde argues (13) that the agronomic literature of the eighteenth century, describing the prototypes of the so-called "Modem Husbandry" serving as models and propaganda, was in many cases the product of laboratory experiments. This does not exclude that data based on experience were incorporated.

The effect on agricultural practice according to Bourde was slight. Only later on, in the nineteenth century, did the agronomic movement of the eighteenth century really influence agriculture as a result of admiration and praise by early nineteenth century agronomists. One of them was Nicolas François, named de Neufchateau, who in 1804 procured a new edition of Olivier de Serres' *Théatre d'Agriculture* which dated back to the sixteenth century. In his introduction to this new edition, de Neufchateau prophetically pointed out the course along which agronomy could make its influence felt on agricultural practice when he wrote : "La chimie, qui promet beaucoup et qui tiendra parole, n'avait pas encore soumis à l'analyse les principes reproductifs des engrais naturels et artificiels" and "la mécanique, qui associe les forces de la nature à celle de l'homme, était encore loin de la perfection vers laquelle elle marche" (14).

How this scientific and technological progress, especially during the second half of the nineteenth century, found its way to the peasantry has been described in an excellent manner by J. Craeybeckx (15). According to him its success was caused by the rapidly expanding agricultural instruction as well as by the frequently attended evening courses and lectures organized by the official agricultural committees ("comices") and especially by free agricultural societies.

II

Because in the eighteenth century agronomy was still very abstract, hardly scientific and impractical, the above mentioned conditions for its vulgarization were not yet fulfilled. For this reason it is impossible to suppose that agronomic works of that period were at the basis of the progressive agricultural techniques used in some regions of Western Europe. These techniques, noticed, described and praised by some intellectual of the eighteenth century, were wrongly labelled as the manifestation of the agricultural revolution of the eighteenth century by later economists and historians.

The expression "agricultural revolution" was first used more than a hundred years ago (16) to indicate the fundamental changes in the English countryside during the eighteenth and the beginning of the nineteenth centuries. These changes mainly consisted of the disappearance of the openfield system as a consequence of the abolition of collective servitudes weighing on it (especially the grazing of the fallow). They completed the enclosure movement which had already started in the late Middle Ages and gave the English landscape its typical character (17). To indicate the important alteration of proprietary rights and land use caused by this process, Karl Marx was one of the first to use the term "Agrarian (not "Agricultural") Revolution" (18). He probably did so on the analogy of the expression "Industrial Revolution", with which the former was connected in a causal and chronological way. On the other hand, according to Marx and other earlier authors, the "agrarian revolution" coincided with the introduction of new farming techniques imported to England from Flanders. Among the latter the disappearance of the fallow by the sowing of fodder-plants, such as turnips and clover, was the most spectacular (19).

Ever since most historical studies on the evolution of agriculture have been more interested in the introduction and spread of new agricultural methods than in the consequences of these technical innovations, such as the increase of the agricultural output and productivity (20).

For the historian it is indeed easier to trace in the sources the appearance of agricultural innovations than to study their often slow spread and generalization in time and space and to measure their effect on agricultural output and productivity on a quantitative basis (21). Agricultural revolutions can only be labelled as such by paying close attention to technical innovations, but doing so the interval between their first mention and their generalization is often neglected. If one looks at the problem from an economic point of view one is even less inclined to speak of "revolutions" because the increase of the output was not always, and sometimes not in the first place, consequence of technical innovations. For both reasons it is dangerous and confusing to speak of "agricultural revolutions". In our opinion, they are rather myths than reality.

This point of view will be explained below by summarizing the modern opinions about the so-called revolutions that are said to have taken place since the introduction of agriculture about 6000 years ago, especially during the Middle Ages and the eighteenth century. We will of course not take into consideration the only true agricultural revolution which according to modern insights is deserving that name, i.e. the one taking place at an accelerated pace since the middle of the nineteenth century and which is still going on now. It is characterized by an enormous progress in biology (use of chemical fertilizers, introduction of insecticides and herbicides, selection methods) and by the mechanization of the production process (22).

III

The so-called "agricultural revolution" in eighteenth century England pointed out by Marx and others after him, is the earliest one mentioned in historiography. But for a long time it was accepted that in the eighteenth century an agricultural revolution also took place in France and especially in the Southern Netherlands. Moreover a relation was seen in this repect between these three countries. The interest of foreign experts was above all excited by the "New Husbandry" of the Southern Netherlands, which was infact limited to the territory of the present-day East and West Flanders and the neighbouring areas in modern Northern France (French Flanders and the surroundings of Lille) and in Hainault (23) where the so-called Flemish agriculture was in use.

Already in 1650 the work of Sir Richard Weston, "A Discours of Husbandrie used in Brabant and Flanders" was published by Samuel Hartlieb (24). Crop rotation systems and manuring methods used in the Land van Waas, in the north-east of Eastern Flanders, are its main topics. It was however only during the late eighteenth and the beginning of the nineteenth century that the whole of Western Europe became acquainted with the Flemish "New Husbandry" by the writings of travellers, scientists and agronomists, such as I. Thys(1788), abbé Mann (1735-1809), Nicholas François de Neufchateau (1804), J.N. Schwerz (1807-1811), John Sinclair (1815), Thomas Radcliff (1819) a.o. (25). They drew attention to the abolition of the winter fallow, the introduction of new crop rotation systems in which the potato took an increasingly important place, the cultivation of so-called double-crops on the short fallow ("cultures dérobées") and especially to the introduction of fodder-plants such as turnips, clover and spurry in the crop rotation which made stable-feeding possible and increased manure production. In recent years Chris Vandenbroeke of Ghent University disproved that these innovations could have provoked an agricultural revolution causing an important increase in agricultural output and productivity (26). He did not only show that the distribution of the potato in the Southern Netherlands was a very slow process which took place from the west to the east (the potato first appeared in the extreme West of Western Flanders at the end of the seventeenth century, to reach Limburg only around the year 1770). He also stressed that the cultivation of potatoes was a "culture de misère" proving the incapability of agricultural techniques to increase corn production in proportion to the growth of the population (the so-called "Irish development"). Proving this thesis with statistic material Vandenbroeke for the period 1776-1785 only accepts a maximal increase of the corn output of 30 to 35 percent compared to the middle of the seventeenth century. If one considers the yield ratios only there even was no increase of agricultural productivity at all. The level of productivity had remained almost stable during the four centuries preceding the middle of the nineteenth century. It is therefore out of question that an agricultural revolution took place before that date. On the other hand some innovations which already during the seventeenth century but especially towards the end of the eighteenth century were considered by the above mentioned agronomists to be of recent origin, in reality date back to well before the end of the Middle Ages. Most of these medieval innovations, as will be shown below, concern the reduction of the short and the winter fallow through the cultivation of fodder-plants and plants grown for commercial purposes. In the second half of the seventeenth century, and perhaps even earlier, in the last decades of the sixteenth century, they were introduced in England (27). It is here that Karl Marx made an "agrarian revolution" precede an industrial revolution to account for the rise of an industrial proletariat in the eighteenth century. The classic work of Lord Ernle on English agriculture (1912) is mainly responsible for the first and longest accepted picture of this so-called agricultural revolution (28). According to Ernle, the introduction of new agricultural techniques was impossible as long as the *openfield* with its common grazing after the harvest (the so-called "common land") prevailed. When Parliament did away with the "common field system" and replaced it by "enclosures", progressive landowners and tenant-farmers, especially in Norfolk, introduced according Ernle new farming techniques like the cultivation of turnips during the fallow period and of clover and other fodder-plants which were incorporated in the well-known four-yearly crop rotation system of Norfolk. This phenomenon would have caused important changes in English agriculture between 1760 and 1815.

In the sixties of our century the version of Lord Ernle was gradually abandoned. To deal with all new theories in detail would take us too far, but we will mention the thesis of Eric Kerridge which fundamentally changed the picture painted by Ernle by dating these innovations much earlier, namely at the end of the sixteenth century (29). Other historians of agriculture, like H.E. Hallam, traced some ofthe symptoms of intensive agricultural techniques in Eastern England back to the thirteenth century (30), a conclusion we are inclined to support with respect to the Southern Netherlands. In the light of these views it is necessary to examine whether the thesis can be maintained that the so-called innovations in English agriculture were introduced from Flanders during the second half of the seventeenth century.

This classic thesis was also defended by the famous French historian and specialist in rural history Le Roy Ladurie in the standard work *"Histoire de la France rurale"*, edited by G. Duby and A. Wallon. Relativizing an agricultural revolution in France during the eighteenth century (31), he points to the introduction of intensive agricultural techniques from Flanders especially from the region of Lille into the northern part of France about 1690. The cultivation of vegetables and fodder-plants, stable-feeding, an efficient production of manure and the gradual decline and disappearance of the fallow were at that moment typical of Flemish agriculture. We agree with Le Roy Ladurie in thinking that these agricultural methods had their origin in medieval Flanders (32).
In 1717-18, this "système flamand-lillois", as Le Roy Ladurie calls it, crossed the Somme river and was introduced southwards on the

large openfields of the Paris Basin, where it was put into practice on the large farms typical of that region. The increase of corn production with forty percent between 1715 and 1787, which Le Roy Ladurie sees as a result of these innovations and indeed no longer as a result of a real "revolution", was however strongly contested by historians such as Michel Morineau and Chris Vandenbroeke, as we already mentioned above (33).

IV

We referred repeatedly to the Middle Ages and the important agricultural changes which are said to have taken place during that period. A lot of historians, such as Duby in 1954, even used the expression "agricultural revolution" to indicate these changes (34). At that time Duby dated it between 950 and 1050, but later on he became less precise (35). The American historian Lynn White even dated this medieval agricultural revolution back to the early Middle Ages, somewhere between the sixth and the ninth century (36). Although there is a chronological gap of several centuries between both theories, Duby and White nevertheless agree with each other that the fundamental changes in agricultural technique took place *before* the late Middle Ages. They consider them as one of the main causes of the population growth and the clearance movement of the eleventh, twelfth and thirteenth century. This view differs widely from the opinion advocated by Slicher van Bath, who set the important changes in agricultural technique in the last two centuries of the Middle Ages, *after* the important agrarian expansion of the eleventh to thirteenth century (37). According to Slicher van Bath, the technical progess in agriculture was the consequence of the late-medieval crisis, when prices of corn fell, labour became scarce and cattle-breeding became more important than the growing of corn. In his view, these changes were the beginning of the "New Husbandry" of the Modern Times (38).In one of our first articles, about thirty years ago, we thought the thesis of Slicher van Bath to be true and we even added new evidence to it (39). In later years however we gradually abandoned this view and after the publication of studies by Derville, Van Uytven, Mertens and Irsigler to which we could add our own research of new source material (40), we realized that the most important changes in agricultural technique do not have to be looked for in the early Middle Ages nor in the late Middle Ages, but probably in the late twelfth and thirteenth century when the agrarian expansion had reached its height.

At present, we intend to make this view acceptable on the one hand by summarizing criticism on the classical thesis of Duby and White, according to which the indisputable agricultural expansion between the eleventh and thirteenth century was unthinkable without an important progress in agricultural technique (41). On the other hand we will tone down the theory of Slicher van Bath about the improvement of agricultural technique during the late Middle Ages, not only using the already mentioned recent studies on the growth of an intensive husbandry during the thirteenth century (42), but also by appealing to a recent economical explanation proposed by our collaborator E. Thoen, which differs widely from the explanation of the economic "depression" theory of Slicher van Bath. One of the technical innovations of medieval agriculture both Duby and White pointed out is related to the use of the horse, especially as draught animal for cart and plough. The in their view limited possibilities in Antiquity of the harnessing of horses were the result of a flexible yoke pressing on the horse's veins and trachea when pulling great-weights (43). The use of a wooden yoke, resting on the horse's shoulders, together with the general use of the horseshoe, greatly favoured the replacement in many regions of the ox by the horse from the eleventh-twelfth century onwards. Although the pulling power of the horse is not greater than that of the ox, the horse moved faster, it was more mobile and it had more endurance. These qualities must have prevailed over its higher cost, its greater sensibility to diseases, and above all its more expensive feed, which in a large measure had to consist of oats. Moreover, according to these authors, there is a connection between the use of the horse in agriculture and two other innovations of early medieval farming technique, the generalization of the use of the heavy plough with mouldboard and the adoption of the three-course cultivation system. While the light plough tilled the soil only superficially, the heavy plough, with its metal ploughshare, coulter and mouldboard, fitted with a cart and two wheels, cut deeper furrows in the soil (mostly to the right) turning it up so that the soil was more crumbled and exposed to the air while weeds were more thoroughly destroyed. On account of the slight effect of the light plough on the soil, cross-ploughing was necessary, creating small square fields (the so-called "Celtic fields") or block fields, instead of the long and narrow strips that would have been created by the heavy plough with fixed mouldboard. This implement indeed could not be used for simple up-and-down ploughing, because its fixed mouldboard turned the soil always to the same side, thus preventing the formation of a regular pattern of ridges and furrows. More complicated plough-schemes therefore had to be adopted. In addition, difficult turns of the plough-team at the end of the fields had to be avoided as much as possible. Taking these turns was easier when the plough was drawn by horses than by oxen. In this way, according to Lynn White, the heavy plough contributed to the origin, from Carolingian times onwards, of the typical long strips of arable land of the openfield landscape that was gradually built up from that moment onwards. Such strips could easily be grouped in more or less square bundles of parcels all running in the same direction, known as "furlongs" ("Gewanne" in German). They were generally three or a multiple of three, in order to facilitate the three-course system, which is believed to have been introduced at the same time. The furlongs provided the topographical basis for the three-course system and determined its compulsory character, because all the strips of one furlong had to be sown with one and the same plant and consequently had to be tilled at the same time in the same way. This explains the connection that existed, particularly in the classical view as exposed by White and Slicher van Bath, with the plough-type and field-shape on the one hand, and the introduction of the three-course system as a new crop rotation technique, necessary for the new field-organization, on the other hand (44).

White, who has insisted more strongly than anybody else on the interdependence of all these innovations and who dated them back to an earlier period, moreover believed that the three-course system not only favoured the growing of oats which made the increasing use of horses possible, but also the harvesting of leguminous crops. These crops being rich in proteins improved human nutrition which according to White could explain the population growth from the tenth-eleventh century onwards. The main reason for White, and indeed also for Duby and all other authors to put an agricultural revolution before the thirteenth century first and foremost, is to explain the great population explosion that can be proved for some regions from the tenth century onwards and almost everywhere in Europe during the eleventh century.

It is well known that this population growth not only made the rise of great cities in Western Europe possible, but also occasioned a great movement of land reclamation with the result that in the European landscape cultivated land became much more important than woodland.

All this was, according to the classical view which was best represented by Duby and White and which we explained above, considered impossible without far-reaching changes in agricultural practice. Moreover, the important increase in soil productivity was not only seen as a consequence of all these agricultural innovations but as an aspect of the agricultural revolution itself. In their opinion, indeed, productivity must have been extremely low in Carolingian times, so low that in most years half and in some exceptional years even the whole of the harvest had to be put aside for seed. In the thirteenth century, on the contrary, harvests probably yielded on an average four times the volume of seed used for them. In round figures this would mean a rise of yield-seed ratio's from 1,5 : 1 and 2 : 1 in Carolingian times to 4 : 1 in the thirteenth century. The very low productivity figures from the Carolingian period put forward by Duby (45), provoked a controversy soon after their publication, that was in inverse proportion to the available documentation (46). This controversy started off the criticism on other aspects of the so-called early-medieval agricultural revolution. First of all, Duby's calculations of soil-productivity were contested because they resulted in the very low figures quoted above and because they do not tally with other figures discovered and calculated since (47). These recent figures result in yield-seed ratio's of 2 or 3 : 1 for the ninth and tenth centuries, and of 3 to maximum 4 : 1 on average for the twelfth and thirteenth centuries. This would mean that a general and continuous rise of soil productivity from the ninth to the thirteenth century is almost out of the question. At most, there was a limited and moderate increase, certainly not sufficient to keep up with the growing demand, that had to be met mainly by extensive reclamation of new land. Although these newly produced figures can be accepted as an average for most European regions, a few very densely populated and highly urbanized regions in North-West Europe, such as the above quoted very fertile loamy region around Lille, show much higher yield-seed ratio's for the end of the thirteenth and the beginning of the fourteenth century (48). In our opinion, these figures however are exceptional (49) and must be interpreted as the result of an intensification of Flemish agriculture, the origin of which must certainly not be dated long before the beginning of the thirteenth century, as we will see further down.

The extensive character of land reclamation from the tenth to the thirteenth century and the very moderate rise in soil productivity during this same period, give way to the idea that there has been no great qualitative progress in agricultural technique before the thirteenth century, let alone an agricultural revolution.
A recent thorough examination of illustrations and texts from the second and third centuries A.D. concerning the harnessing of horses in Northern Gallia has shown that the old way of harnessing horses was not as harmful as was impressed upon us on account of the studies of Lefebvre des Noëttes (50). The same study proved that in the second and third centuries A.D. the prosperous farmers of Northern Gallia had used horses more frequently and for heavier loads than was hitherto believed with respect to North-West Europe- on the basis of evidence concerning the Mediterranean world where indeed asses and mules were preferably used in agriculture. The progressive use of horses in West-European agriculture from the eleventh-twelfth century onwards was not only limited to some regions, it was also determined by other than pure technical considerations, like the size of the farms, the development of estates etc. This explains why in many regions of Western Europe, particularly in traditional corn growing regions, the ox continued to be used as draught animal until the nineteenth or twentieth century (51).
The distribution of the heavy plough was not a linear and general consequence of a single invention either (52). Although it was rare before the eleventh century, this type of implement was not unknown in late Antiquity and was used by the Slaves and the East-Frisians during the early Middle Ages. Moreover, during the last

three centuries of the Middle Ages different types of heavy ploughs were used. A new type of plough with mouldboard but without wheels was used in England and on the Continent from the thirteenth century onwards until well after the Middle Ages (53). Therefore one is forced to take into account, as one had to do in the case of the horse, the part played by more complex factors, mainly of social and economic nature, in the distribution of plough-types and also to disconnect the problem from the origin of field-forms (54).

From the more differentiated conclusions of recent research concerning the use of the horse and the heavy plough in medieval agriculture, one may infer rightly that their connection with the spread of the three-course system is not as direct as some historians and geographers have supposed. Recent research proves beyond doubt that a kind of three-course system was applied on some fields of several large domains in Northern France during the Carolingian period. Topographically these fields formed vast units, called *culturae*, very often grouped in a multiple of three (55). This situation however was exceptional. It was indeed not until the eleventh-twelfth century that in many regions of North-West Europe the rather small and isolated fields of a village were joined together to form one vast openfield complex, named also "cultura", "kouter" or "couture" (< lat. cultura) (56). More northwards, in the eastern parts of the Netherlands and in North-West Germany, these fields were called "es(ch)" or "enk" (57). At the same time of the creation of the one vast "cultura" or shortly afterwards, at the latest during the twelfth or early thirteenth century, more and similar "culturae", won by the reclamation of new land, were added, as far as geographical conditions were favourable. Together with the original and oldest "cultura" they formed a unit of three fields nearly equal in size, that occupied the main and best part of the arable of the village (58). In some regions, though certainly not in all (59), a compulsory three-course system probably replaced a possibly already pre-existing but voluntary three-course crop rotation. This may have happened as a result of pressure exerted by large landowners or because of a kind of forced land redistribution (60). Elsewhere, the three-cousec rop rotation continued to exist but was increasingly infringed upon. The same was true for some regions in the course of the thirteenth century where the three-field system was used. Leguminous crops like peas, beans and vetches rapidly followed by plants grown for commercial purposes like plants used for dying such as woad and madder, were indeed cultivated during the second half of the thirteenth century not only on fields normally yielding summer-corn (mostly oats) in a compulsary or voluntary three-course system, but even on the fallow during the year-of-rest (61). These innovations were often the initiative of small peasants and were resisted without much success by large landowners because amongst other things they feared soil-exhaustion. These cultivation methods were clearly manifestations of intensive husbandry. On the one hand they were stimulated by urban economy, especially by the needs of the textile industry in fertile regions such as South Flanders (region of Lille), the Hesbaye region and the Kölner Bucht. On the other hand cattle-raising which was clearly extended from the late twelfth century onwards played an important part in the same regions. Cattle-raising was stimulated by the towns, particularly through investments by way of so-called livestock leases (*baux à cheptel*), which became more and more common (62). Technically the extension of cattle-raising was made possible through the cultivation of fodderplants which enabled stable-feeding on a far larger scale than before. The more efficient production of manure maintained soil fertility despite the reduction of the fallow and of common services linked to the three-field-system such as common grazing.

If one were to use the expression "agricultural revolution" it would only be justifiied to do so with respect to the thirteenth century, and only in the highly urbanized regions of North-West Europe. The fundamental changes in agriculture subsumed under this expression were not so much the cause as the consequence of the demographic explosion of the eleventh, twelfth and thirteenth centuries. For the latter phenomenon other explanations than an agricultural revolution before the end of the twelfth century, which has been proved to be very improbable, will have to be found.

This conclusion is confirmed by our collaborator Erik Thoen in his recent doctoral thesis. This study treats the agrarian economy of the Flemish countryside in an extensive region south of Ghent during the late Middle Ages. He confirms that all kinds of new farming techniques, which were considered a.o. by Slicher van Bath as expressions of agricultural intensification from the fourteenth and fifteenth century, in fact already existed before the fourteenth century (63). This applies to the use of labour-intensive agricultural implements such as the typical Flemish harvest implement called *pik*, which replaced the sickle, and to the cultivation of arable land during the year-of rest.

From an economic point of view this means that these innovations did not take place in a period of economic contraction such as the late Middle Ages but on the contrary in a period of economic growth. In Thoen's opinion, this phenomenon is caused by the fact that in the county of Flanders, early urbanized, the possibilities to invest in agriculture were more real than in non-urbanized regions. The tendency towards decreasing labour productivity which is typical for periods of economic growth, thus could partly be avoided. According to Thoen, because of the concentration of urban markets, even the remotest land in Flanders had a surplus value. In urbanized areas the surplus value rises faster than in city-less areas. If it were the peasants themselves who could profit from this rise in value as a consequence of different phenomena such as the tendency towards nominal stability of feudal obligations, then investments created agrarian progress. His conclusion is that the presence of towns in itself does not explain the agricultural progress in thirteenth century Flanders, if it is not seen in combination with feudal structures. At the same time, and once more, this explanation emphasizes the strong relation between urban and agrarian economy. Moreover the mentioned study reveals the complex mechanism that could cause and explain the agricultural intensification especially by way of technical innovations.

Our final conclusion is that this mechanism can not be described either as an "agricultural revolution".

NOTES

(1) J. Ziman, The Force of Knowledge. The Scientific Dimension of Society, Cambridge, 1987, p. 35.

(2) G. Duby, L'économie rurale et la vie des campagnes dans l'Occident médiéval, I, Paris, [2]1977, p. 88. For the agronomic literature in Latin, see the review in L.I.M. Columella, De Re rustica, W. Richter, ed., München-Zürich, 1983 (Sammlung Tusculum), III, p. 569 f.f. (with bibliography).

(3) Duby, Economie rurale, I, pp. 176-177.

(4) D. Ochinsky, Walter of Henley and other Treatises on Estate Management and Accounting, Oxford, 1971; concerning the date see p. 144.

(5) Ibidem. Also in the book written in Latin called *Fleta* about English law (ca. 1290) (see R. Van Caenegem, v° Fleta, in: Lexikon des Mittelalters, München-Zürich, 1987, vol. IV, kol. 546-547) similar data can be found.

(6) W. Richter, Die Überlieferung der "Ruralia commoda" des Petrus de Crescentiis im 14. Jahrhundert, in: Mittellateinisches Jahrbuch 16 (1981), pp. 223-275; see also G. Sarton, Introduction to the History of Science, III, 1947, p. 811 f.f.

(7) See Richter (ed.), Columella, pp. 651-652 (see above our note 2).

(8) W. Abel (ed.) - H. Dreitzel (transl.), Konrad Heresbach, Vier Bücher über Landwirtschaft, Meisenheim, 1970 (contains both the original edition in Latin from 1570 and the German translation).

(9) See also S. von Frauendorfer, Ideengeschichte der Agrarwirtschaft und Agrarpolitik im deutschen Sprachgebiet, München, 1957, vol. I, pp. 118-120.

(10) Duby, Economie rurale, I, pp. 177-178.

(11) M. Morineau, Révolution agricole, révolution alimentaire, révolution démographique, in: Annales de Démographie historique, 1974, reprinted in: id., Pour une histoire économique vraie, Lille, 1985, p. 259.

(12) B.H. Slicher van Bath, The Agrarian History of Western Europe A.D. 500-1850, Utrecht-Antwerp, 1960, p. 262.

(13) A.J. Bourde, Agronomie et agronomes en France au XVIIIe siècle, Paris, 1967, 3 vols.

(14) See for example part I, pp. 18-29.

(15) O. De Serres, Le Théâtre d'Agriculture et Mesnage des Champs, N.-L. François de Neufchateau ed., Paris, 1804, I, p. LXXXV, cited by M.-J. Tits-Dieuaide, Les campagnes flamandes du XIIIe au XVIIIe siècle ou le succès d'une agriculture traditionelle, in: Annales. E.S.C., 1984, p. 590.

(16) J. Craeybeckx, The Depression of the Late Nineteenth Century and the Recovery Before 1914, in: A. Verhulst G. Bublot (eds.), Agriculture in Belgium. Yesterday and Today, Mercatorfonds/ Cultura, Brussels, 1980, pp. 41-43.

(17) A survey of the use of the expressions "agrarian" and "agricultural revolution" in: D. Grigg, The Dynamics of Agricultural Change, London, 1982, pp. 177-192.

(18) W.G.Hoskins, The Making of the English Landscape, Harmondsworth, 1970, pp. 142-210.

(19) K. Marx, Das Kapital, vol. 1, Berlin, 1961 (reprint of the edition Moscow 1932), pp. 755-789.

(20) About these innovations see: B.H. Slicher van Bath, The Agrarian History of Western Europe A.D. 500-1850, pp. 262-340; Bourde, Agronomie, I, pp. 277-309. See also note (20) below.

(21) Besides the above mentioned standard work of Slicher van Bath, see also his article, The Rise of intensive Husbandry in the Low Countries, in: Britain and the Netherlands, J.S. Bromley - E.H. Kossmann (eds.), London 1960, pp. 130-153 (partly reprinted in: Ch. K. Warner (ed.), Agrarian Conditions in Modern European History, New York, 1966, pp. 24-42). See also the standard work of P. Lindemans, Geschiedenis van de Landbouw in België, 2 vols. Antwerp, 1952; M.-J. Tits-Dieuaide, L'évolution des techniques agricoles en Flandre et en Brabant du XIVe au XVIe siècle, in: Annales E.S.C., XXXVI, 1981, pp. 362-381; Id., Les campagnes flamandes (see above note (14)), pp. 590-610.

(22) Grigg, Dynamics of Agricultural Change, pp. 164-176.

(23) About the "agricultural revolution" of the nineteenth and twentieth centuries in Belgium: Verhulst-Bublot (eds.), Agriculture in Belgium, pp. 42-47, 87-93.

(24) See above note (20).

(25) R. Weston, A Discours of Husbandrie used in Brabant and Flanders, first edition. S. Hartlieb, London, 1650; transl. in Dutch by P. Lindemans, Sir Richard Weston, Verhandeling over de landbouw in Vlaanderen en Brabant, 1644-1645, Bruges, 1950. Concerning this work: Lindemans, Geschiedenis van de Landbouw, I, p. 14 and shortly a study and new edition by M.J. Tits-Dieuaide.

(26) A profound, critical and surveyable study of this literature is still missing. A lot of these works are unedited, often in answer to prizes offered by Academies. Provisionally see J. David, Ouvrages concernant l'agriculture belge parus avant 1850, Louvain, 1975 (Centre Belge d'Histoire Rurale, publication nr. 47) and a compendious list in Lindemans, op. cit., I, pp. 14-15.

(27) C. Vandenbroeke - W. Vanderpijpen, The Problem of the Agricultural Revolution in Flanders and Belgium: Myth or Reality ? in: H. Van der Wee - E. Van Cauwenberghe (eds.),

Productivity of Land and Agricultural Innovation in the Low Countries (1250-1800), Louvain, 1978 (Centre Belge d'Histoire Rurale, publication Nr. 55), pp. 163-170; A. Verhulst - C. Vandenbroeke (eds.), Agricultural productivity in Flanders and Brabant 14th-18th century, Ghent, 1979 (Centre Belge d'Histoire Rurale, publication Nr. 56), esp. pp. I-X (introduction written by A. Verhulst and C. Vandenbroeke) and pp. 379-405 : C. Vandenbroeke, Graanopbrengsten en oogstschommelingen in Zuid-Vlaanderen (17e - begin 19e eeuw); C. Vandenbroeke, Landbouw in de Zuidelijke Nederlanden 1650-1815, in : Algemene Geschiedenis der Nederlanden, 8, Haarlem, 1979, pp. 73-101.

(28) In addition to the studies of Slicher van Bath cited in notes (19) en (20), see especially: G.E. Fussell, Low Countries Influence on English Farming, in: English Historical Review, 74, 1959, pp. 611-622.

(29) Lord Emle (R.E. Prothero), English Farming. Past and Present, London, 1912 (6th ed. 1961).

(30) E. Kerridge, The Agricultural Revolution, London, 1967; Id., The Agricultural Revolution Reconsidered, in: Agricultural History, 43, 1970, pp. 463-475; G. Mingay, The Agricultural Revolution in English History: a Reconsideration, in: Agricultural History 37, 1963, pp. 123-133; Id., The Agricultural Revolution : Changes in Agriculture 1650-1880, London, 1977.

(31) H.E. Hallem, Rural England 1066-1348, Glasgow, 1981, pp. 13-15, 55-62.

(32) E. Le Roy Ladurie, La croissance agricole, in: G. Duby-A. Wallon (eds.), Histoire de la France rurale, 4 vols., II, Paris, 1975, p. 417.

(33) To compare with A. Derville, Le grenier des Pays-Bas médiévaux, in: Revue du Nord 69, 1987, pp. 267-280.

(34) M. Morineau, Y a-t-il une révolution agricole en France au XVIIIe siècle, in: Revue Historique, 239, 1968, pp. 299-326; Id., Les faux-semblants d'un démarrage économique: agriculture et démographie en France au XVIIIe siècle, Paris, 1971 (Cahiers des Annales 30); Id., Révolution agricole, révolution alimentaire (see above note 10). For the most important studies of C. Vandenbroeke concerning this subject, see above note (26).

(35) G. Duby, La révolution agricole médiévale, in: Revue de géographie de Lyon 29, 1954, pp. 361-366.

(36) Namely in his later general works, in which he not only avoided more and more the expression "revolution", but in which he also dated back the phenomenon to the period between 1000 and 1200 and even to the thirteenth and fourteenth century: Duby, Economie rurale, I, pp. 176-208; Id., Medieval agriculture 900-1500, in: C. Cipolla (ed.), The Fontana Economic history of Europe, I, The Middle Ages, London, [2]1973, pp. 175-220. In his work Guerriers et Paysans, VIIe-XIIe siècle, Paris, 1973, pp. 211-225, Duby didn't even use the expression "revolution" any more and he toned down the technical progress which he dated back to between 1000 and 1200. In the same work technical progress is not so much seen as a consequence of agricultural technique stricto sensu (the so-called "pratiques agraires", like field-systems, manuring), but more as a consequence of better agricultural implements, such as the plough, of the use of the draught-horse and of the better tillage which was the consequence of these improvements.

(37) Lynn White, Medieval Technology and Social Change, Oxford, 1962; Id., The Expansion of Technology, in: Cipolla, Fontana Economic History of Europe, I, pp. 143-175. In: La révolution industrielle du Moyen Age, Paris, 1975 (coll. Points, éd. Seuil, pp.49-78), J. Gimpel devoted a chapter to "La révolution agricole", based mainly on the writings of Duby and White, in which he explains the demographic explosion of the eleventh-thirteenth centuries by the technical progress in agriculture.

(38) Slicher van Bath, The Agrarian History, pp. 197-209.

(39) See above notes 19 and 20.

(40) A. Verhulst, Het probleem van de verdwijning van de braak in de Vlaamse landbouw (XIIIe-XVIIIe eeuw), in: Natuurwetenschappelijk Tijdschrift, 38, 1956, pp. 213-219.

(41) A. Verhulst, L'intensification et la commercialisation de l'agriculture dans les Pays-Bas Méridionaux au XIIIe siècle, in: La Belgique rurale. Mélanges J.J. Hoebanx, Brussel, 1985, pp. 89-100 including references to the studies of the authors mentioned.

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(43) Verhulst, Intensification et commercialisation, including the studies mentioned in it by Derville, Van Uytven, Mertens, Irsigler.

(44) This classical view is based on the well-known work of R. Lefebvre des Noëttes, L'attelage, le cheval de selle à travers les âges, 2 vols., Paris, 1931.

(45) Slicher van Bath, Agrarian History, pp. 71-72.

(46) G. Duby, Le problème des techniques agricoles, in: Agricoltura e Mondo rurale in Occidente nell'alto Medioevo, Spoleto, 1966, pp. 167-183 (Settimane di Studio 13).

(47) See the article of B.H. Slicher van Bath, Le climat et les récoltes au haut moyen âge. This article is published in the proceedings of the Spoleto conference mentioned in note (45), pp. 399-425. See also the discussion between Duby and Slicher in Spoleto published pp. 443-447.

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(59) See the case-study by L. Van Durme, Toponymie van Velzeke-Ruddershove en Bochoute, I, Ghent, 1986, pp. 256-265.

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Sarton Chair Lecture 1988-89

LAUDATIO ANTONIE M. LUYENDIJK-ELSHOUT

M. Thiery

Dear Professor Luyendijk,

Let me, in my turn, welcome you to this temple of science, where you must feel at home because of the historical ties linking our two universities. As you know, our university was a gift from King Guillaume I during the happy years when your country and mine were still a single nation. In this room, the historical bonds between your medical faculty and ours are symbolized by the row of medaillions from which three of your Leiden professors look down at you, benevolently I trust : Rembert Dodoens, who taught *materia medica*; your great Herman Boerhaave, European citizen *avant la lettre* and *communi Europeae praeceptor*, as von Haller liked to call him; and, finally, Pieter Camper, a native of your city in which he took his degree and, after a hectic life, found eternal rest in the Pieterskerk.

But even more personal ties unite our medical faculties. I myself have had the privilege of working in Leiden, and it is with gratitude and affection that I remember the superb hospitality offered to me by the then Director of the Institute of Pathology, Prof. Th. van Rijssel. Gratitude is the right word for what I feel toward your university, because my stay in Leiden, so close to the place where you were then working, was to be such an important turning-point in my scientific career.

Dear Colleague. Since I happen to be your *collega proximus*, it is my privilege to introduce you and your work to this audience today. You were born in the town of Gorinchem. The date I shall not mention, because it would not become me to do so and because this detail is superfluous : both your strong personality and your lively spirit render you ageless. Having passed through the *gymnasium* you studied medicine from 1941 to 1950, first at the University of Amsterdam, later at the University of Leiden, and it is the latter institution that you have been connected with from 1943 to the present.

You started your medical career as a morphologist but from the beginning you made it clear that your special interest was the historical background of your field. During the very first year of your prosectorate you published a paper, the first of a long series, on the restoration of nineteenth-century anatomical specimens preserved in the Institute of Anatomy. This paper was the first step toward the thesis entitled *The Leiden Cabinet of Anatomy* you were to defend in 1952. By adding a subtitle, "*Cultural* and historical importance of a scientific collection" (italics mine) you wished to stress the importance of cultural factors in medical historiography, a notion you were to go on defending and developing in the following years. As indicated once more by the title of your acceptance speech today, concept and culture are two words you cherish and in fact introduced in this context. I wish to briefly define the scope of these words and the importance you gave them in your philosophical approach to this subject.

As you indicated in your farewell lecture in 1987, it is your view that medical historiography should no longer be restricted to the study of what you like to call the accumulation of "knowledge" and that this science must pay more attention to the cultural climate in which new medical advances occurred. The two notions "increase of knowledge" and "culture" are complementary and synonymous with your words "concept" and "culture", respectively.

Although *concepts* (i.e., the insight into disease states giving rise to prophylactic and therapeutic measures, in fewer words : medical discoveries) are and should continue to be the backbone of medical historiography, our vision of disease and the human organism has always been very significantly influenced by factors that are not purely scientific, even to the point that in many areas the impact of these "other" factors (e.g. cultural, social, economic, ideologic, and ethical), which you group under the term cultural, has been conclusive of the final result. *In concreto* : because discoveries in medicine tend to reach the recipient in a haphazard way, their impact on the condition of life of the population at large has been utterly inconsistent. It is your contention that medical historiographers have not paid enough attention to the interdependence of concept and culture and, by overemphasizing the contribution of the great pioneers and overelaborating "the gospel according to the hagiographers" (Richardson 1985), have distorted the course of history. By the emphasis it has put on the interdependence of concept and culture and its concentration on these neglected aspects of the history of science, your work has reached the Sartonian dimension.

Having obtained your medical degree, you spent a year in the USA qualifying in the morphologic sciences at the Institute of Anatomy of New York University, the Carnegie Institute for Embryology in Baltimore, Maryland, and the Jackson Memorial Laboratory in Bar Harbor, Maine. You resumed your work at the Leiden Laboratory of Anatomy and Embryology in September 1953, took leave in 1955, and nine years later took up your connection with the Laboratory again, as part-time scientific staff member. During that period one of the things you studied was the historical evolution of our knowledge of the sympathic system, with special attention to Frederik Ruysch (1638-1731). Ruysch, who first described the valves of the lymph vessels (Jan Swammerdam was to challenge the priority of this invention), was also an accomplished male-midwife and the man who shared with Roonhuysen the notorious secret instrument, the obstretic vectis. Your investigations led you to re-edit Ruysch's 1665 *opus princeps*, his famous *Dilucidatio Valvularum.* When Ruysch's cabinet was later sold to Czar Peter the Great, the rare anatomical specimens it contained were packed by Herman Boerhaave with his own hands. Through the years, this renowned cabinet has been a source of inspiration, and the allegorical meaning you gave to one of the specimens, the weeping fetus (Luyendijk-Elshout, 1987), has permeated all of your subsequent literary-medical writings.

In 1967, you became secretary to the Organizing Committee which prepared the Commemoration of Boerhaave's birth in 1668.

At the symposium *Boerhaave and his Time*, to which several distinguished scholars were invited, you presented a paper on the anatomical illustrations in Boerhaave's *Institutiones Medicae.* The commemoration festivities also included an exhibition on Boerhaave in the National Museum for the History of Science at Leiden. The then-Director of the Museum, Dr. Maria Rooseboom, and your then-Chief Prof. Johan Dankmeyer, advised you to accept a temporary position at the Museum to become better acquainted with museology. You were appointed as a part-time, Conservator for the medical section between 1970 and 1972. During this period you took part in the activities of the Museum Staff but you also continued your publications, e.g. your study on Vesalius, which prompted an analysis of the changing pattern of sixteenth-century medicine in the Low Countries.

Until 1976, your main task had been the presentation and exhibition of anatomical collections, teaching the history of anatomy and embryology, and preparing medical-historical exhibitions, both within and outside your university. The exhibitions absorbed the greater part of your time and energy, and between 1972 and 1975 you were responsible for five such events. One of the latter characterizes your interest in cooperating with colleagues from other disciplines : the exhibition on the Evolution of Cystoscopy at the 16th International Congress of Urology in Amsterdam 1973.

In 1976, your dream came true and from then on you were able to devote yourself entirely to the teaching of and research on the history of medicine. The scope of your endeavors was broad indeed, as you managed to instruct medical students, social workers, and nurses; provide courses for medical historians at the Free University of Amsterdam; add introductory lectures to the Boerhaave courses; and teach students of the Subfaculty of History. An excellent example of the multidisciplinary and multisided approach you wished the science of medical history to take.

Finally, in 1977, the Leiden University appointed you *Professor extraordinarius* of the History of Medecine in recognition of your special approach to teaching and research. Automatically, this appointment enabled you to form and head a team of physicians, historians, and literary men and woman, and at the same time to realize an old dream of yours : to demonstrate the complementarity of concept and culture concretely.

The activities of the Luyendijk team were threefold : teaching of men and women belonging to different disciplines, research, and assistance. Your research essentially remained directed toward the evolution of the Medical Faculty of Leiden University in the eighteenth and nineteenth centuries, a task for which the young professor had been eminently prepared. Over the years, scanning of the international relationships of Dutch medicine became an important and original topic of your group. Focus was put mainly on the historical ties between Japan and The Netherlands, and in this area, too, your team did pioneer work. This line of your interest dates back to 1973, when the Japanese Academy of Sciences based in Nagasaki, invited you to discuss the transfer of "Dutch" science to Japanese physicians in the nineteenth century. The title of your lecture was *The introduction of Western Anatomy into Japanese Textbooks* and your source of inspiration was the *Kaitai Shinsho*, a Western textbook on anatomy translated from the Dutch in 1772 by the Japanese physician Sugati Genpaku. The contacts you made in that year were to be of a permanent nature and they led to the bilateral exchange of Leiden and Japanese investigators. But your project had an ethical dimension as well. It was intended to settle a debt of honor owed by The Netherlands to a group of brave and capable men who managed to Westernize medicine and public health in that far-away country in the nineteenth century. You continually quoted the names of von Sieboldt, Pompe van Meerdervoort, and Gratama, three pioneers who, although well known abroad, had hitherto been almost totally ignored by their own countrymen.

Giving concrete answers to the historical aspects of a variety of medical queries was to be the second task of your group, a task for which her background had prepared its chief well.

Although you no longer took an active part in the realization of medical exhibitions after 1976, you went on collaborating with the Boerhaave Museum on the collection of documents concerning the Leiden Medical Faculty. You continued to supervize the museum of the Anatomy Laboratory until 1985, and on a temporary basis acted as *Professor regius* in the field of physical anthropology. Having reached the age of retirement in 1987, you became *Professor emeritus*. Although this event put a stop to an important part of your scientific career, you kept on working. In ending your farewell lecture you quoted Winston Churchill ("I hope I have still some services to render"), but let me paraphrase Sir Winston and say that "You still render invaluable services". Indeed, you continue to advise the team you once headed so remarkably and to serve as the editor-in-chief of the journal *Clio Medica*, as president of the Consilium Medico-Historicum , and co-editor of the Dutch *Journal of the History of Medecine*. You are still active on the board of the Einthoven Foundation, you are President of the Thijssen-Schoute Fund and a member of the Leeuwenhoek Committee. Your stream of publications continues to flow, and you still keep yourself busy lecturing. What more could an emeritus professor do ?

Ladies and Gentlemen,

I trust I have not bored you and have refrained from hagiography, but I sincerely hope that I have shown you who Professor Luyendijk is and what part she has played in contemporary medical historiography. On the grounds of her immeasurable personal contributions to and her original vision of this field — a vision which is perfectly in line with that of George Sarton — the members of the *ad hoc* Committee have decided unanimously to award the G. Sarton Memorial Chair 1988-89 to Professor Antonie Maria Luyendijk-Elshout.

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CONCEPT AND CULTURE IN THE MEDICINE OF THE NINETEENTH CENTURY

A.M. Luyendijk-Elshout

A book entitled *Medicine and culture : Varieties of treatment in the United States, England, West Germany, and France* (1) was recently published by the New York journalist Lynn Payer. The reviewer who discussed this book in the Saturday Supplement of the *NRC-Handelsblad* in The Netherlands on November 5, 1988 came to the following conclusion : French doctors are Cartesian thinkers, German physicians are authoritarian romanticists, their British colleagues are friendly and paternalistic, and American medicine is reputed to be 'aggressive'.

The author gives a witty description of the variations in the interpretation of the concept disease as well as the equally numerous corresponding recommendations concerning treatment. The unsuspecting reader may be shocked to realize that there is no internationally accepted canon. Its existence is suggested, but here it seems to me that Lynn Payer has gone too far in drawing a conclusion. There are certainly standards which are applied throughout the world in conventional international medicine, but this does not mean that the concept culture does not play a role — one which cannot be overestimated — in the practice of medicine or in the concept of disease accepted not only by physicians but also by laymen. There can be no doubt that this has long been recognized and described by historians. For example, in his book *Het medisch denken* (Medical Concepts), which appeared in 1952, L. Elaut, professor in Ghent, pointed to the philosophical and metaphysical aspects of the concept disease and its strong dependence on the culture of the period (2). F.A. Sondervorst, emeritus professor of the History of Medicine of the University of Louvain, wrote a book called *De geschiedenis van de geneeskunde in België* (The history of medicine in Belgium)

(1981) in which he discussed, among other subjects, political and social considerations, the problems associated with professionalization, and the legal and moral quandaries with which medicine had been confronted in the course of time (3).

The title of my discourse refers to the notions concept and culture in medicine, and I have restricted myself to the nineteenth century. This period is currently enjoying considerable interest on the part of almost all scholars dealing with various areas of history — even art historians, who until recently considered at least the early decades of the century beneath their interest. The social historians were of course the pioneers in all this, but researchers in the fields of economic history and historical epidemiology have also turned to the nineteenth century. I shall venture to select from the very broad concept culture a few aspects with importance for my subject, i.e., the drum-roll of the military, the concepts of *natural philosophy*, the rise of materialism, and, lastly, the increase of the influence of medical thinking and practice on governments. You will undoubtedly have noticed that this list does not include the rise of the natural sciences which in all periods have been considered responsible for the concept 'progress' in the history of medicine. It would be impossible to ignore the natural sciences in a period in which the hope of mankind was set on the new paths opened by the Enlightenment to reach a better understanding of Nature and a salutary insight into health and sickness. Nevertheless, in my present context I shall not give precedence to either the natural sciences or technology.

Around 1800, Europe was caught up in the Napoleonic wars, and the influence of the waging of war was to be felt in medical care for a long time. The closure of an appreciable number of universities had dealt a severe blow to medical training. The least affected were military personnel, since the army had need of 'surgeons' (medical officers). One well-known institution was the military teaching hospital in Val de Grâce, which was opened in 1796, but training centers were also established in Berlin, Vienna, and other places on the Continent. The Low Countries followed later : in 1817 the military hospitals in Leiden and Louvain were elevated to *Grote Rijks Hospitalen ter Instructie* (large national teaching hospitals), whose main function was to train medical staff. In the still disrupted organization of health care, this group was of great importance for the maintenance of medical knowledge and skills. Unlike the situation in the universities, where the main accent was on theoretical medicine and the students were still taught according to a traditional pattern, the young recruits were immediately exposed to teaching at the bedside, following the French model to which the Enlightenment had contributed greatly by the value assigned to observation and understanding in the art of medicine (4) (Foucault 1963). In addition, these students were given a respectable basis in the natural sciences and as graduates they were not handicapped by the age-old distinction between *doctores medicinae* and surgeons (Kerkhoff 1987) (5). Furthermore, a military hospital had the advantage that poverty was not the sole criterion for admission, as was still the case in many municipal and civilian hospitals. In the military hospital medical indications took precedence over considerations of charity and social circumstances.

In 1822, the schools of Louvain and Leiden merged to form the *Rijkskweekschool voor Militaire Geneeskundigen te Utrecht* (National Training School for Army Surgeons at Utrecht). The students were subjected to military discipline as in all army institutions. Attention was given in the first place to building the military character, because 'being an army surgeon is not simply a matter of being a doctor and wearing the uniform' (Haneveld 1987)(6). But did the teaching differ essentially from that in the universities and, if so, what guildelines and concepts were applied ?

The first principle of the military approach was *basic knowledge but not even the semblance of erudition.* For achievement of this goal, teaching had to be apodictic and dogmatic and be based on rational empiricism. No doubts, no divergent precepts. The handbooks produced for this purpose were written according to these principles. In 1851, Johannes Fredericus Kerst, surgeon-major of the Utrecht hospital, published a handbook of impressive proportions that was divided -military style- into sections covering six main subjects and twenty-one subsidiary subjects. Latin terminology was scrupulously avoided : the 692 pages are in the mother tongue and some of the terminology could only have originated from military strategy. For example, hysteria is defined as 'a change of direction of the uterus", and therapeutic procedures are stated as a series of commands, an often-cited example being the prescription of the first army surgeon, F.S. Alexander, a faithful follower of the French army surgeon F.J.V. Broussais. He directed hospital orderlies to use 'a half or a whole squadron' of leeches on his patients (7). But this did not mean that new discoveries and medicines were not included in the curriculum. Quite the opposite : during the symposium on this medical school held in 1987 in Nijmegen under the title *'s-Rijkskweekschool voor Militair Geneeskundigen te Utrecht* (1822-1865), from which I have borrowed most of the present information, it was clearly shown that new methods such as Wunderlich's thermometry were soon routinely applied in the hospital.

Thus, the 'drum-roll of the military' guaranteed 'no-nonsense' concepts in medicine, and partially in a period that was later to be rejected by the positivists because of the speculative thinking associated with natural philosophy. It was also the period of romantic ideas about the *levenskracht*, the life force, that irrational notion still preserved in the homeopathy introduced by Samuël Hahnemann in 1833. According to this view, disease is a phenomenon based on an immaterial principle that can be affected by external influences. However, the ideas of the vitalists should not be rejected simply as irreconcilable with rational empirical thinking in medicine. The idea of unity expressed in natural philosophy, the belief in the maintenance of an equilibrium between the life processes — as defined by Christoph Wilhelm Hufeland (1762-1836) in his biodynamic concept of medicine — strongly determined the daily practice of the physicians of that period (8). Ultimately, the physicians in the middle of the last century found themselves just as impotent in the face of sickness and death as their predecessors had been a century earlier. What benefit was provided by the advances made in the natural sciences when it came to controlling tuberculosis, and how did the discovery of the cholera bacillus help when an epidemic started ? *'Pasteur of Koch, zij sterven toch'* (Pasteur or Koch, they still die) was a frequently heard saying in those days.

As an example of the vitalist school in which the unity of Nature played an important part, I should like to mention here the physician Joseph Guislain (1797-1860) of Ghent. In his work, concept and culture are harmoniously merged. Guislain is known best for the founding of the mental hospital in Ghent, which was opened in 1857. The building itself, which was designed and furnished on the basis of his ideas about insanity and its treatment, bore no trace of the madhouse concept of the preceding centuries (the less light the better) but instead offered quietness and light as well as air and nature in the surrounding gardens. The natural-philosophy aspect of Guislain's thinking can be found in a text he wrote for his students after he was appointed professor of physiology at the University of Ghent in 1835 (9) (Van Staeyen 1988). This volume was intended as a basis for lectures on the history of medicine, a subject added to his teaching assignment in 1837. The book bore the title *La nature considérée comme force des organes* and appeared in 1846. It was not by chance that it was dedicated to his great predecessor Jean Baptiste van Helmont. This work contains most of the medical-philosophical principle on which Guislain based his concept of the genesis, the nature, and the treatment of mental diseases. Like van Helmont, Guislain accepted primary forces as subtle intelligences in the organs, i.e., the germinal force, excitability, instinct, and spirit. He did not have to resort to van Helmont's Archeus concept, but instead gave preference to the Montpellier school represented by Paul Joseph Barthez and the modish system of the Scottish physician John Brown. This was vitalism in its most extreme form, based on non-materialistic principles but nevertheless introduced and applied so systematically in the diagnosis and treatment of mental illness that it became extremely important for the improvement of the 'unhappy fate of the insane', a theme which was discussed during a workshop held in Santpoort (The Netherlands) in November 1986.

There is no need to fear opening the Pandora's box filled by the Romantics. It is true that an endless flutter of speculations will be released, including the ontological view of disease so reviled as *kakodaimon* by the scientists of the positivistic school (Schrant 1868) (10), and metempsychosis, theme of horror stories, Frankenstein's monster invented by Mary Wollstonecraft Shelley : "t' is the tempestuous loveliness of terror", according to her husband (Praz 1979) (11). As consolation for romantic medicine, the bottom of the box offers water, which like van Helmont's *humor primigenium* received new attention from biodynamic medicine. The beneficial spas of Europe were rediscovered and were to attract sufferers from the most dissimilar diseases throughout the nineteenth century. Here it must be kept in mind that the salutary effect of the water was utilized not only by physicians but also by lay adherents of natural medicine such as Vincent Priesznitz (1799-1851) and Father Sebastian Kneipp (1821-1897), who contributed substantially to the culture of hydrotherapy (12).

Air, water, movement, and diet formed part of the routine recommendations of the nineteenth-century general practitioners, as exemplified by the great Hufeland. In his *Camera obscura*, Nicolaas Beets describes the bust of Hufeland as the principal ornament of the consulting room of the established general practitioner. Although the practitioners of natural medicine and Hufeland's followers all worshipped 'unspoiled' nature in similar ways and as the source of all life and health, Rothschuh (1978) (13) pointed out that the two movements diverged to some degree. Both groups were inspired by the writings of Jean-Jacques Rousseau (1712-1778), but the idea of 'back to nature' was taken much more literally by the adherents of natural medicine than by the physicians. With the former it was more an emotional glorification of nature, full of pantheism, nature worship, and enmity for conventional medicine, including the diet of Western countries. Many of them were vegetarians and totally opposed to medicaments. This certainly did not hold for the doctors, although they too were against intemperance, excessive indulgence, alcohol, and effeminacy. Both groups believed in hardening of the body and exercise in the open air, the breastfeeding of one's own child, and the entire salernitarian program which had been revived in the eighteenth century. In the last decades of the nineteenth century natural medicine was enriched by the inclusion of gymnastics, air-baths, light treatment, and the prescription of raw food. Furthermore, the natural-medicine movement expanded into areas offering a more general reformation of life. The rule was now : only what is natural is admirable and good. Reformed clothing, nudism, vegetarianism, the protection of nature and animals, are all cultural phenomena that attracted attention in this period (14). We can follow them into our own time and find them in alternative medicine, the movement to protect the environment, and the politics of the 'green' parties.

Thus, the biodynamic concept of disease and the work of the worshippers of water, light, and air continued to lead a life of their own, even into the present. But those who, impressed by this veneration of nature, would like to assign Ludwig Büchner's book *Kraft und Stoff*, which appeared in 1855, to this category, are in for a surprise. This book seen as the bible of materialism represents a very different concept of nature and the way to solve its secrets. Scientific materialism contributed appreciably to a new concept of disease that is still considered valid today. The originator was the German physician Karl Vogt (1817-1895), who was followed by Jacob Moleschott (1822-1893) of The Netherlands and another German, Ludwig Büchner (1824-1899). These three scientists saw it as their duty to undermine belief in authority, whether in science, religion, or politics. They were strongly influenced by the work of Ludwig Feuerbach (1804-1872), who had published a powerful attack on theism in his book *Das Wesen des Christentums* dating from 1841. All of them attempted, each in his own way, to collect arguments, supplied by the natural sciences and their own medical knowledge, in support of Feuerbach's philosophy. It is known that this brought them into conflict with Karl Marx, who characterized this materialism as vulgar and therefore called his own ideology dialectic materialism (Gregory 1977) (15). The primary aim of these physicians was to educate their people by spreading scientific knowledge as well as by refuting artificial and illusory idealism in ideas about Nature. They published by preference in popular magazines like the *Algemeine Zeitung* in which Karl Vogt placed a series of articles between 1845 and 1847 entitled *Physiologische Briefe für Gebildete aller Stände*, which was intended to serve as a popularization of physiology. The Dutch magazine *Album der Natuur* founded in 1852 was also intended as a vehicle for 'the dissemination of information about nature among cultured readers belonging to all social strata'.

The first attack on the scientific materialists was aimed at the life force, which was described by Karl Vogt in one of the first letters on physiology as 'the refuge of lazy minds ... which refuse to look more closely at what they do not understand but are willingly deceived by this apparent miracle' (16). The practising physicians were also attacked on the grounds that their maintenance of the concept like force led them to assign rheumatic as well as psychic diseases such as hysteria and hypochondria to the lumber-room of medicine reserved for everything about which no exact information is available. The materialists considered themselves the true apostles of progress. In his inaugural address delivered in Giessen in 1847, Karl Vogt declared that 'each acquisition in commerce, industry, and agriculture is the fruit of intellectual progress,the steady perfectioning of the free spirit of the natural sciences'.

Vogt was unquestionably the most radical of the scientific materialists. Both political and scientific progress could in his eyes only be achieved by revolution. The failure of the revolution of 1848 was a heavy blow for Vogt and his followers, but it inspired them to propagate their ideas more widely. In Heidelberg in 1850, Jacob Moleschott published *Die Lehre der Nahrungsmittel für das Volk*, a book full of practical hints about nutrition, giving balanced diets that could also be maintained on a small income. He even dealt with the diet of expectant mothers. His book was read throughout Europe in the original and in translation, and was reviewed with great enthusiasm by Ludwig Feuerbach, who wrote : This book by Molenschott illustrates the ethical and political importance of education for the common people. Food becomes blood, blood becomes heart and brain, (and materializes into) ideas and moral values. If you want to improve mankind, give them better food instead of sermons against sin. ... Man is what he eats." (17)

Moleschott saw the future in terms of socialism assisted by men of science. The latter would hold in their hands the keys to the distribution of 'energy and mattter' over the peoples of the world. His polemic book called *Der Kreislauf des Lebens* appeared in 1852. Büchner drew heavily, and with success, on the ideas Moleschott put forward in this book. Büchner's *Kraft und Stoff* was read everywhere in the world. In his memoires, the Russian immunologist and Nobel prize winner Elie Metchnikoff recounts how this volume was taught surreptitiously in the *lycea* in Russia and how ecstatically the young Russians welcomed the natural sciences as a liberation. They linked the positivism of August Comte, Stuart Mill, and Herbert Spencer with the 'energy and matter, light and life' of Büchner and Moleschott (Gaissinovitch 1921) (18). After 1861, when the censorship was tightened and the few Russian universities could only offer these young people hopelessly antiquated knowledge, the young Russian intelligentia set out for the German universities where they were taught the new diagnostics of Frerich and Traube and the modern basic sciences of Kölliker and Helmholtz. Here I must mention the Russian girl students who in the last years of the Belle Epoque travelled to Zürich and Geneva to study medicine at the progressive Swiss universities. Among them was Lina Stern (1878-1968), who became the first professor of physiological chemistry at the University of Geneva, and had been taught in the tradition of Karl Vogt (19).

The last point I shall discuss here is the influence of medical thinking and practice on governments and its effect on health-care policies. This subject has received considerable attention from many disciplines in recent years. Policies related to health were strongly influenced by the Hygienist movement; this influence was felt first in France and later in England under the leadership of the Utilitarian, Jeremy Bentham (1748-1832) (ten Have 1983) (20). Under the influence of liberalism and the more radical among the democratic movements, their example was followed by Germany, The Netherlands, and Belgium in the 1850s. One of the most remarkable advocates was Rudolph Virchow (1821-1902), the founder of cellular pathology but also the pugnacious liberal who was at the Berlin barricades in 1848 (21).

The population growth and marked urbanization which accompanied the Industrial Revolution brought with them an increase of infectious diseases, particularly typhus, tuberculosis, and diseases of childhood such as diphteria. Furthermore, filth accumulated rapidly in the cities and a town like London gave off such a strong stench compounded of urine, horse dung, and other rotting material that it could be smelled from far off. Cities has been recognized as an infective factor as early as the eighteenth century by British physicians such as George Cheyne (1691-1743), but all their efforts to improve the urban environment failed to reduce the high mortality rate of the inhabitants of cities in Europe with their recurrent epidemics (22). As Vogt pointed out, the urbanization due to industrialization was seen as a potential for progress, 'at least if guided by a positive social science based on facts', according to the Hygienists. They attempted to establish facts with the assistance of statistics as developed by L.A.J. Quetelet (1796-1874). The medical description of localities, according to the Hippocratic tradition with attention to air, site, and water, had to yield to maps, graphs, and long series of figures on mortality and morbidity. The dreaded cholera epidemics supplied impressive figures; sanitation measures such as the building of sewers, a piping system for drinking water, the institution of standards for foodstuffs, and regulations in the area of public hygiene, awaited government action (23). In 1841, the *Académie de Médecine* (Academy of Medicine) was founded in Brussels to provide the authorities with information about all aspects of public health, forensic medicine, and veterinary medicine. Such institutions formed an indispensable support for the work of the Hygienists. The first chairman of the Academy, J.F. Vleminckx (1808-1876), was also Inspector General of the Army Medical Service. In the final decades of the nineteenth century, military medicine made an appreciable contribution to the improvement of hygiene, which of course benefitted the entire population. At the same time, the various branches of medicine became professionalized, which led in 1835 and 1853 to the passage of laws pertaining to the practice of medecine in Belgium (24). This was extremely important for the maintenance of quality in medical practice and health care. The need for control was made urgent by technological advances utilized by the specialists, particularly in the fields of surgery and obstetrics. But this line of development can only be properly followed in the twentieth century.

The four facets of the very elastic concept culture dealt with here — namely the military influence, natural philosophy, the new materialistic physiology, and positivistic thinking in an industrialized society — have of course only been touched on briefly, but I have attempted with this short review to make it clear that a concept of medical thinking and practice is not reached solely via science and experience; rather, the society — in its widest sense — of any epoch determines what the physician, and the layman as well, thinks about sickness and health. The patient too has a conception of his own disease that is equally determined by culture and period. Even the present brief glance at natural medicine was sufficient to show that the sick do not always resort to the medical profession but, especially in a period when society is undergoing radical changes, tend to turn to healers who have not had an education recognized by that society. In the nineteenth century all this was enhanced by the conflicting effects of the benefits and afflictions of the Industrial Revolution. From Biedermeier to Belle Epoque the pattern persists: on the one hand the astonishing discoveries made by our scientific heroes and joyously welcomed by the rebellious materialists, and on the other hand the complaints of physicians and laymen the 'unbalanced development of human nature' which cannot mature properly in a society that has departed from the laws of natural biology. This balance was taken into consideration in the formulation of the list of wishes submitted to the politicians : better living and working conditions, better educational facilities to train nurses and doctors, and greater social security in sickness and in health. In the final years of the Belle Epoque many of these wishes became the objectives of politicians and associations, which led to the building of hospitals and the establishment of clinics for tuberculosis, child care, and birth control. This too reflects the culture of a society, in the same sense as the strict discipline of the military unquestionably contributed to advances in medicine and hygiene.

Let us return to Lynn Payer, the author of *Medecine and Culture. Varieties of treatment in the United States, England, West Germany, and France.* After travelling through these countries she modified to some extent her original impression that in the past European medicine was determined mainly by folklore. She was very surprised to find that certain treatments used in Europe but not in favor in the United States, such as mud-baths and hydrotherapy, apparently gave good results. Some alternative medical methods are forbidden in America but may be applied in Europe, and vice versa. She attempted to gain more insight into the differences in accepted indications and the use of surgical procedures in various countries, and gave the highest marks to French surgery because of the "subtlety" of the operations. Her countrymen are considered to wield the surgical knife the most energetically. In her view, science generates data but the culture determines how those data will be used. Up to a certain point we can accept this view, but it does not mean that the standards now applied by the informed layman to evaluate the practice of medecine are not equally culture-bound. In our time we often have need of historical awareness, insight into a still recent period when everyone was regularly confronted with diseases and multilations bearing witness to chronic suffering and permanent disability. Europe and the United States are parts of the world where these street sights have become relatively rare, thanks to the efforts and achievements of earlier societies. From Biedermeier to Belle Epoque the healers gave precedence to the attainment of equilibrium, unity, and harmony with man's environment. This will continue to be the case in our time, too, no matter what concepts of health and sickness are developed within the changing culture.

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SOME HIGHLIGHTS OF THE TRANSFER OF DUTCH MEDICAL LEARNING TO JAPAN UNTIL 1870

A glimpse of a white horse, cantering past a slit in the wall...

*Antonie M. Luyendijk-Elshout**

"The Netherlands has contributed to new developments in Japan by the influence of her *navy*. This should be known better in the Netherlands and abroad ! The Netherlands has proved by its navy, that it intended to assist Japan truly and faithfully in the area of teaching and development, to bring the country to a higher level. It wanted to *persuade* the Japanese to drop their antiquated system of government by assisting them wherever possible in the spread of knowledge; to enable them to recognize their government".

Thus writes Jhr J.L.C. Pompe van Meerdervoort in his memories : *Vijf Jaren in Japan (1854-1859)* (1). Indeed, the Dutch contributions to the spread of knowledge in Japan culminated in the period 1855-1885, first by the foundation of the naval college at Nagasaki in November 1855 by the first detachment under command of G.C.C. Pels van der Rycken, later by the introduction of medical teachers from the Military Medical Training College at Utrecht (2).

The first naval officer to arrive with a medical training was Johannes Lidius Catharinus Pompe van Meerdervoort. Born in 1829 in Brugge, Belgium from an aristocratic family he entered the *Mili-*

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tary Medical Training College in Utrecht in 1845, where he graduated as a medical naval officer in 1849. In 1852 he was promoted to a naval officer second class and sent with the second detachment to Japan in 1857.

Pompe van Meerdervoort introduces his memories by giving a broad survey of the history of Japan, an impressive study in which he explains the organisation of the government, the religious and worldly authorities. Furthermore, he pays ample attention to the relations with European countries, with the Netherlands in particular. Finally he gives an ethnological description of Japan, data on its geography, agriculture, hunting and fishing, its industry, mining, language and teaching.

His view upon the relations with the Netherlands mainly concerns the political and trade connections. He describes the factory of the Dutch on Deshima, after the closure of Japan in 1640 at the beginning of the *Tokugawa* Period, which would last until 1868, when the *Meiji Restoration* began. In this period, the *Rangaku*, the Dutch learning, was introduced into Japan. Since this mainly concerned medical and scientific knowledge I would like to pay some attention to the early spread of *Rangaku*, by briefly mentioning the highlights, beginning with the magnificent work of Genpaku Sugita (1733-1817) and Ryotaku Maeno (1723-1803) published in 1774. They overcame in a heroic way the language problems, with their efforts to translate the *Ontleedkundige Tafelen*, an anatomy book which was published in 1734 by Johan Adam Kulmus (1689-1745) and translated by a Dutch surgeon, Gerard Dicten (3). This *Kaitai Shinsho* is the first landmark of the reception of Dutch knowledge; it would be followed by many more books from Dutch scholars, which were translated into the Japanese language. We must bear in mind that officially no Western books were allowed to be introduced into Japan and therefore, great care was essential regarding the spread of Dutch learning. The factory at Deshima in the harbour of Nagasaki offered the opportunity of some contacts, but there was more chance to exchange knowledge during the "Court-Journey", when the captain of the Dutch factory had to be replaced. The so called "opperhoofd" was obliged to travel to Edo to greet the Shogun, and the Dutch surgeon was expected to accompany him on this court-journey. Some

Shoguns were less strict on the rules regarding Western books, especially when the Dutch learning was dealing with important knowledge such as instruments for navigation or scientific instruments, useful for other purposes. Around 1720, under Shogun Yoshimune (1716-1745) the introduction of Dutch books on medicine, botany and astronomy was officially permitted (4). Moreover, various books were expected to be offered to the authorities as gifts, such as Dodoens' *Cruydtboek*, Heisters *Chirurgie* (5) or even dictionaries, which were of great importance for the translators, mostly interpreters at Deshima.

The surgeons who stayed at Deshima were contracted by the V.O.C., the United East India Company, which looked after the trade-interest in the Dutch East Indies. In 1799 this institute was closed down by the new rulers of the Batavian Republic, which was installed under pressure of the French revolutionary movement after 1789.

Especially during the period 1803-1813, the trading post at Deshima had to face serious problems, since the English were hostile towards the Dutch, because they considered them to be allies of the French. Hendrik Doeff (1777-1835), the "opperhoofd" of the trading post, was isolated from both the Dutch Indies (now Indonesia) and the Netherlands. During this period the Dutch were allowed to leave the island and to walk around the city of Nagasaki. The Japanese authorities even took care of their needs, since no import of necessary goods was possible. When Pompe van Meerdervoort asked the Japanese authorities why they had been so liberal and human towards his compatriots only during that period, and not thereafter, they answered him :

> "This was impossible. The Dutch always want to smuggle as soon they have the opportunity to exchange merchandise. Doeff had nothing, so he could not do any harm."

But Doeff had something, he had a Dutch-French dictionary published by Francois Halma in 1710 translated into a Dutch-Japanese dictionary, *Doyaku (or Zufu) Haruma*, with the help of the Deshima interpreters in 1816 (7). This dictionary was of great importance to the translators of Dutch medical textbooks. Actually, Inamura Sampaku (1759-1811) had already compiled a Dutch-Japanese dictionary, the *Edo Halma* in 1796, also based on Halma's book. Therefore, "Haruma" (Halma) became the generic name for Dutch-Japanese dictionaries (8).

After 1813, when King William I of the Netherlands managed to restore the trading contacts with Japan, the diffusion of Dutch medical learning spread more rapidly. Before 1824, when Philipp Franz von Siebold (1796-1866) came to Nagasaki, there were only five schools of Dutch medical learning. In 1855, when Pompe van Meerdervoort started his teaching in the Nagasaki Hospital, there were already more than fifteen (9). These schools were private, they were organised by the feudal clans, which were eager to start a modern school for their territory. By 1871, there were 272 feudal clans in Japan, of which 95 had medical education facilities (10). The first school was founded in 1786, by Gentaku Otsuki at Edo. From this school various wellknown graduates founded other schools, for instance at Osaka, in 1798, and even two at Kyoto, in 1800 and 1801 (11). We must admire the achievements of these schools. The students were confronted with often difficult medical writings, such as Boerhaave's *Medical Institutions* and *Aphorisms* (12), Johannes de Gorter's textbook of internal diseases (13) and various anatomical treatises, which were popular for naval surgeons during the eigteenth century, but not easily accessible for the Japanese scholars, who had traditionally a different concept of the structure of the human body (14). It was for this reason that Genpaku reflects upon the problems he had to face during his lifetime. "Time flew like a white horse cantering past a slit in the wall ... (15), three or four years passed all too quickly".

The *Kaitai Shinsho* and the medical schools for Dutch learning of the feudal clans represent the *first* higlight of Japanese-Dutch medical relations. The second highlight came forth from the stay of von Siebold. Much honour has been paid by Japanese scholars to his commemoration, his botanical garden at the Narutaki district in Nagasaki has been well preserved and his statue can be found there. Furthermore, the Hosei University publishes the Siebold Kenkyu since 1982. Various new materials on von Siebold have been published by members of the von Siebold Society. In 1988, a commemoration exhibition "Von Siebold and Japan" was held in the national musea of Tokyo and Kyoto, including also the Nagoya City Museum. An impressive catalogue with beautiful illustrations was published for the occasion.

Von Siebold started his medical teaching at Deshima. This had been arranged by the "opperhoofd" Jan Cock Blomhoff (1779-1853). Officially ordinary Japanese doctors were not allowed to enter this island. But they could sneak in — disguised as servants to the Deshima officials, or even as an interpreter (16). Soon von Siebold was allowed to see patients and teach medicine at the private school run by Narabayashi Soken (died 1852) and Yoshio Kosai (1788-1866), descendants of famous interpreters families. By June 1824, a boarding school was built in the Narutaki section of Nagasaki which he visited once a week for clinical instruction and treatment (17). This was the first time in the history of Dutch/Japanese relations that a physician who was stationed at Deshima, was directly teaching medical knowledge to Japanese students.

We shall not go into the medical activities of von Siebold, neither into his excellent qualities as a collector and ethnograph. During his first stay in Japan from 1824-1829, he did many discoveries in the field of natural history. He studied Japanese literature and he brought together an important ethnographical collection on Japan (18). The description of this can be found in his work : *Nippon, an archive for the description of Japan*, which was published in a succession of 20 volumes from 1832-1858. As mentioned before, his *Flora Japonica* and *Fauna Japonica* are studies of a most delicate beauty (19).

The arrival of Pompe van Meerdervoort meant in more than one way a change in Japanese/Dutch relations. We should realize that the Japanese Government asked the Dutch government for a medical naval officer *directly*, by Mr H.J. Donker Curtius, the "opperhoofd" at Deshima. When Pompe van Meerdervoort started his medical teaching in 1857, he had to render an account to the Japanese government by the Nagasaki governor. Moreover, contrary to the feudal clan schools where the *rangaku* was taught by Japanese doctors, the Nagasaki school offered the direct transfer of European medical knowledge from a Dutch physician to Japanese pupils. Von Siebold had done the same, but more as a private enterprise. Moreover, after 1853, Japan was open to other countries. The Government could decide from which country they wanted to import medical knowledge. Until the time of Pompe van Meerdervoort it had been the *rangaku*, the Dutch Learning, which was accepted in Japan. After Pompe van Meerdervoort, *rangaku* would become *ranpo* medicine, Western medicine. The Shogun could decide from which country this *ranpo* medicine could be imported.

On the other hand, also feudal clans were allowed to contract foreign physicians independently. Generally speaking, we may say that the prevalence of both the Japanese Government and the daimyo's of the feudal clans for Dutch medical doctors continued until 1869, when the Meiji Restoration opened new ways for education. In that year, the Government decided to adopt the German system of medical education. In 1876 the Government passed a regulation requiring all physicians to study Western medicine. This does not mean that the feudal clans could no longer contract Dutch physicians ! For instance, the Okayama clan contracted Franciscus Johannes Antonius de Ruyter (1841-1886) who worked at the Okayama Medical School from 23 June 1870 - 7 July 1871 (20).

The third highlight of Japanese/Dutch relations in the transfer of knowledge is without any doubt the contribution of Jhr J.L.C. Pompe van Meerdervoort, who organized *structured* medical education on a Western base (21). This was continued by his successor Anthonius Franciscus Bauduin (1820-1885), who had been a teacher at the Utrecht Military Medical College during twelve years until 1862. It may be desirable at this point to pay some attention to the medical knowledge, which was actually transfered to Japan in this period. Before going into this matter, a bird's eye view upon the Netherlands, its medical schools and its sanitary problems, should be considered.

At the beginning of the nineteenth century, Europe had been suffering under Napoleonic wars. In 1813, the Netherlands was in the same condition as poor Hendrik Doeff at Deshima : poverty, an enormous national debt and a complete isolation of the sources of its riches : the Dutch colonies. In the field of medicine, the Dutch had been scourged by epidemics, smallpox and diphtheria. Within seventeen years, cholera would be added to this squadron of Death ! Therefore, priorities in medical care should have been prevention and sanitary decrees to improve Public Health. Only the vaccination against smallpox was realised, already in 1799. It would be advocated in this country by prominent physicians and become gradually a general practice during the nineteenth century (22).

It would take much more time before an effective prevention against cholera could be established. Hygienists, engineers and politicians were unable to take the necessary measures, especially the installation of a drinking-water system and a proper sewage system until ± 1870. So in this respect, the Dutch could offer little help to the Japanese, when cholera epidemics were inflicted upon the population, for instance in the year 1858-1859, when an American ship "Missisippi" brought the cholera to Nagasaki, and even Pompe van Meerdervoort fell ill (23). But effective vaccination against smallpox could be realized. The main problem was the conservation of the vaccine, which had to be imported from Europe or the Dutch East Indies. In spite of these problems Otto Gottlieb Johann Mohnike (1814-1887) made great efforts in 1848 to vaccinate children in Nagasaki (24). Pompe van Meerdervoort also promoted vaccination in Nagasaki. Many leading Japanese physicians contributed much to the encouragement of vaccination. The daimyo's ordered some physicians like Narabayashi Soken at Nagasaki, to consult the Chief of the Deshima trading center about the import of vaccine from Batavia. In 1850, Narabayashi Soken was able to vaccinate the son of the daimyo Nabeshima Kanso, who launched a campaign to promote vaccination. The active vaccine was passaged arm-to-arm and finally reached Edo. A vaccination office was founded there in 1858, ten years after Mohnike began its action in Nagasaki. Out of this vaccination office at Edo finally grew the Medical Faculty of Tokyo University in 1871 (25).

Besides epidemics, the Dutch were confronted with an accelerated development of medical knowledge during the nineteenth century. Around 1850, the Universities were backward in both research and teaching. The clinical schools and especially the Military Medical Training College at Utrecht were more receptive to innovations. Laennec's stethoscope, Wunderlich's thermometer, improved microscopes and the so-called "Kunstlijk" from Auzoux, a skillfully constructed replica of the anatomy of the human body, were in daily use for care of patient and teaching (26). Various teachers of surgery at the Military Medical Training College contributed to the "veldtoestel", an instrument-case with a set of surgical instruments which could be transported on horseback (27). These instruments came from different countries, such as French tourniquets and scalpels, English bone-pinchers and German amputation knives.

This instrument-case was symbolic for the reception of the new trends in medicine in Europe by the teachers of the Military Medical Training College. They composed several textbooks for the students written in Dutch in a concise, matter-of-fact way. They avoided sophisticated theories and tried to educate the trainees as universal practical medical officers. In one of their reports the teachers declare :

> The medical officer should excel in his universal practical knowledge. In his person, physician and surgeon should be fully united. Furthermore, he should be his own pharmacist. He is the first man present in the hospital where he is responsable for the care of the sick and the wounded. On campaign, but especially in the navy and out-stations in the East, he has to be an all-round medical man ... (28).

This universal knowledge was taught on a scientific basis. In the book : *Handleiding tot de natuurkunde van den gezonden mensch* (Guide to the Physics of the healthy man),published by F.C. Donders and A.F. Bauduin in 1851, the authors refer to modern research in physiology, published by scientists as Dutrochet, Brücke, Vierordt, Liebig and Lehmann (29).

But besides this practical no-nonsense training, the military aspect of the college also forced the students ("élèves", as they were called) to follow a rigorous training program, with both physical and mental exercises. The pattern of the school was definitely French, like the *Ecole Militaire* at Val de Grâce, with strict schedules and an emphasis on clinical observations and autopsies (30). The examinations were competitive, like the French "concours". Thus the graduates of this college were well-trained, vigorous young men, like Pompe van Meerdervoort, who structured the curriculum of his students in Nagasaki on the same pattern as the Military Medical Training College at Utrecht. He was greatly indebted to Matsumoto Ryojun, a gifted young shogunate physician from Edo (31), who assisted him by being "the medium for communication between Pompe van Meerdervoort and the students" (32). We should realize that Pompe van Meerdervoort had to give all the courses alone, from basic medical science, chemistry, anatomy to clinical teaching. He soon recognized that the students were especially attracted by practical exercises; he introduced a dissection course and also a practice in bandaging. He was succeeded by Bauduin, who introduced the ophtalmoscope in Japan. After Bauduin, more specialized trainees of the Military Medical Training College came to Japan, like Koenraad Wolter Gratama (1831-1888) who taught chemistry and physics at the Medical School in Nagasaki from 1866-1868. After the Meiji Restoration he moved to Osaka, where he got a Laboratory for chemistry at his disposal in 1869 (33). The last pupil, who was contracted for medical teaching was Tjarko Wiebenga Beukema (1838-1925) who taught at Nagasaki, Tokyo and Yokohama from 1871-1888 (34).

The Military Medical Training College at Utrecht was closed down in 1880, after a period of gradual decline, beginning in 1865. An interesting source of medical knowledge for Japan had come to an end.

Conclusion

In this paper, three higlights on the history of Japanese/Dutch medical relations until 1870 were discussed briefly. Another century has passed by, and I am inclined to repeat the poetical words of Genpaku Sugita once more : 'Time flew like a white horse, cantering past a slit in the wall ...' to which I would like to add three or four *centuries* passed all too quickly ! With great respect we remember the Japanese doctors who mastered the Dutch language and became experts in the Dutch Learning, the *Rangakusha.* We also admire the *exchange of learning* between Japanese interpreters and von Siebold, the outstanding natural scientist. But most of all we should honour Pompe van Meerdervoort, "The unsung hero of the development of Western medicine in Japan" (35) and his successors, who managed to teach their eager pupils the achievements of Western science in sometimes very difficult or nearly impossible circumstances. I would like to finish this paper by quoting Pompe van Meerdervoort once more :

> " How could we compete with the powerful European countries which could afford to send an impressive fleet to Japan while we now and then showed our flag on a small brig or steamer ? We were only able to maintain our influence in Japan because we could assist the Japanese in developing their Empire along the pathway of knowledge, and we should continue to do so: the Dutch naval detachments, the ship-engineering by Mr Hardes (36), the medical teaching. All this should have been supported by the Dutch Government, it would have given us a more influential position than all diplomatic relations together"(37).

The white horse has passed by. The Netherlands are a small part of the coming Europe of 1992. Japan is a dynamic modern country between the other nations around the Pacific. In both countries regular, international medicine is practised and there is an international exchange of learning. Medical research of high quality is done by Japanese scientists, and various innovating techniques have been introduced by Japanese surgeons. The Netherlands are playing their part in the medical world as well, but we could never, as Pompe suggested, continue to transfer knowledge to Japan exclusively on the basis of mutual understanding and tradition. We are growing into one big world. Let us continue to be friends and colleagues, to bring the best of medical knowledge to all nations, especially to those which are in urgent need for medical assistance.

NOTES

1. Jhr. J.L.C. Pompe van Meerdervoort, *Vijf Jaren in Japan (1857-1863). Bijdragen tot de kennis van het Japansche Keizerrijk en zijne bevolking.* Leiden, Firma van den Heuvel en van Santen,

1867. Vol. II, p.161. An English edition of this study was published in 1979 by Sophia University, Tokyo. It was translated and annotated by Elisabeth P. Wittermans and John Z. Bowers.

2. Military Medical Training Center, or Training College for Military Surgeons.

3. A.M. Luyendijk-Elshout, "Anatomia Reformata. The Dutch handbook of anatomy from the bároque period; the contents and presentation". *Nihon Ishigaku Zasshi* (1974) 20, p.104-91.

4. C.R. Boxer, *Jan Compagnie in Japan (1600-1817).* An essay on the cultural, artistic and scientific influences exercised by the Hollanders in Japan from the seventeenth to the nineteenth century. Oxford University Press, London/New York 1968, p.54. See also : Grant K. Goodman, *Japan : The Dutch Experience.* The Athlone Press, London and Dover, New Hampshire, 1986, p.49-65.

5. Rembert Dodoens' *Cruydt-boek* etc. was printed in Antwerp in 1554. There were many reprints, also one in Leyden in 1618. It is a national herbarium, devoted to species indigenous to the Flemish provinces. Lorenz Heisters treatises on surgery were published and reprinted may times between 1718 and 1769. They were translated from German into Dutch in 1741, as *Heelkundige Onderwijzingen,* by Hendrik Ulhoorn.

6. Pompe van Meerdervoort, "Vijf Jaren ." *o.c.* : Vol.I, p.115.

7. W.J. Boot, "Japanese Studies in the Netherlands". In : *Japanese Studies in Europe.* Directory Series VII, The Japan Foundation, 1985, p.326.

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9. Ishida Sumio, "The Age of Rangaku (Dutch Learning) : Medical Education in Japan during the 19th Century". In : *History of Medical Education.* Proceedings of the 6th International Symposium on the Comparative History of Medicine — East and West. Ed. by Teizo Ogawa. The Ianiguchi Foundation, published by Saikon Publ. Co. Ltd. Tokyo, 1983, p.151-179.

10. *Ibidem*, p.155.

11. *Ibidem*, p.156.

12. Probably the Dutch editions. See Achiwa Goro, *Herman Boerhaave 1668-1738. His Life, Thought and Influence upon Japanese medicine in the period of Dutch Learning.* Introduction by G.A. Lindeboom, Tokyo, 1969.

13. Joh. de Gorter, *Gezuiverde geneeskonst, of kort onderwijs der meeste inwendige ziekten.* Amsterdam, Isaak Tirian, 1744. This book was especially written as a manual for surgeons at sea or on a military campaign. Common diseases are well described and many recipees are given in the text.

14. A.M. Luyendij-Elshout; "Anatomia Reformata", *o.c.*

15. Genpaku Sugia, *Dawn of Western Science in Japan : Rangaku Kotohajima.* Kokuseido Tokyo, 1969, p.44.

16. Tadashi Yoshida, "Von Siebold as a Station Doctor". In : *Franz Philipp von Siebold, a Contribution to the Study of the Historical Relations between Japan and the Netherlands.* The Netherlands Association for Japanese Studies, 1978, p.29-38.

17. *Ibidem.*

18. W.R. van Gulik, "Von Siebold and his Collection". In : *Franz Philipp von Siebold* etc. (note 16) p.19-28. From the same author : "Brief History of the National Museum of Ethnology. In : Von Siebold and Japan. Catalogue of the exhibition, held in Japan from March 29-July 31, 1988. Tokyo, 1988.

19. See on von Siebold : John Z. Bowers, *Western Medical Pioneers in Feudal Japan.* The Johns Hopkins Press, Baltimore, Maryland, 1970, Chapter IV, p.92-137.

20. Ishida Sumio, "The Age of Rangaku", *o.c.*, p.169.

21. A. Querido, "Dutch Transfer of Knowledge through Deshima. The Role of the Dutch in Japan's Scientific and Technological Development during the Edo Period". *Transactions of the Asiatic Society of Japan.* Third Series, Vol.XVIII, Tokyo, 1983, p.17-37.

22. K.J. van der Korst, *Om lijf en leven.* Health care and medical care in the Netherlands between 1200-1960. Utrecht, Bohn/Scheltema/Hoek, 1988, p.217-218.

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24. John Z. Bowers, *When the Twain meet. The Rise of Western Medicine in Japan.* The Johns Hopkins University Press. Baltimore/London, 1980, p.10-26. See also : Masao Soakawa, "Propaganda Bills for Vaccination distributed during the Kaei Period in Japan". *Nihon Ishigaku Zasshi* (1984), 30, p.62-85.

25. Matsuki Akitomo, "A brief history of Jennerian Vaccination in Japan". *Medical History* (1970) 14, p.199-201.

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29. F.N. Grousta, "Het preklinisch onderwijs in zijn natuurwetenschappelijke aspecten". In : *'s Rijkskweekschool voor Militair Geneeskundigen te Utrecht* (note 26), p.49-65.

30. A.H.M. Kerkhoff, "De militair-geneeskundige dienst en de medische hervormingen in de negentiende eeuw". In : *'s Rijkskweekschool voor Militaire Geneeskundigen te Utrecht* (note 26), p.3-16.

31. John Z. Bowers, *Western Medical Pioneers in Feudal Japan.* The Johns Hopkins Press, Baltimore, Maryland, 1970. See the chapter on J.L.C. Pompe van Meerdervoort, p.176-201.

32. Querido, "Dutch Transfer..." *o.c.*, p. 31.

33. H. Beukers, L. Blussé, R. Eggink, *Leraar onder de Japanners. Brieven van Dr K.W. Gratama betreffende zijn verblijf in Japan.* Amsterdam, de Bataafse Leeuw, 1987, p.12.

34. D. de Moulin, "Abituriënten van 's Rijkskweekschool voor Militaire Geneeskundigen werkzaam in Japan". In : *'s Rijkskweekschool voor Militaire Geneeskundigen te Utrecht* ... (note 26), p.111-117.

35. John Bower, "Western Medical Pioneers", *o.c.* p.176.

36. Thomas Hardes was an outstanding engineer, who belonged to the second naval detachment. As Pompe remarks : "In three years he turned a swamp into a factory for steam engineering whose development has no equal east of the Cape of Good Hope ... See "Vijf jaren in Japan", *o.c.* Vol. II, p.173.

37. "Vijf Jaren in Japan", *o.c.* Vol. II, p.240.

Sarton Medal Lectures

LAUDATIO OTTO GEKELER

*Frans LOX**, Director

Today it is a special day for you, I know, but be sure we also are very proud and feel honoured with your selection as G. Sarton medal holder and with your presence in this Institute of Science and Technology where we try to discover the thread of Ariadne in the labyrint of pathways which mankind settled up in the past.

Looking back to your very extended and extra-ordinary curriculum vitae, I have the truly conviction that your sixth sense has helped you to overcome a lot of difficulties, but has guided you into a direction where the pathways of great men from the past as Johann Beckmann, and so many others, emerge by extrapolation to one big cross-point you just reached at the moment you went retiring some years ago. At that moment you really discovered the beauty of synergetic effects of multidisciplinarity; and even yesterday you told me that the most enjoyable moments of your life were those when you achieved to bring together people, representing the most different disciplines.

Your way-life, running likely as a Brownian movement all over the surface of the earth, from Germany, to Brasil, again to Germany, to Russia, France and the United States, made your mind full of experiences, and since I met you in 1971, I discovered — and I may stress this before this audience — one of your greatest and unexhaustible qualities : you were and still are very generous with your richness of thoughts. Indeed, dealing and speaking about your experiences, you forget yourself and at the same time you are enlighting and encouraging others. It is known that you speak a lot of languages as Portugese, English, French and Spanish, so you are surrounded now by a lot of friends, how can it be otherwise, and

* February 16th, 1989

this is proved by the presence of those who made efforts for travelling hundreds of kilometers to be here as a grateful duty.

Our Rector will make efforts to come at the end of the ceremony to hand over your Sarton. Many others as the Governor of east flanders, the vice-rector, the representative of the Government and faculty members from our University, Prof. Quintyn, the foregoing director, and different members of the University of Brussels, really apologize to be maintained by professional duties. I also received these last weeks a lot of letters sent from the most extreme corners of Germany, Japan, China, Denmark, Seoul, Poland, Italy and Austria : all are congratulating you and send you their best regards.

Dear friend Gekeler, I know that your happiness of today should be much more intensive by the presence of your wife : be sure that we also deeply regret her unvoluntary absence at this ceremony.

Dear audience. Mr. Gekeler graduated in economic sciences at the University of Tübingen, and made his way in the well-known firm AEG-Telefunken. He worked in the field of statistics, organisatory systems and methods for classifying goods and their numbering for electronic handling of information. A lot of high-level scientific publications came from his hand. This work lay on the base of the "real" work he started nearly at the moment he retired from AEG.

So he was founding member of the DGWT "German Association of Commodity Science and Technology", became president, and was one of the leading figures in establishing and editing the international journal "Forum Ware".

In 1976 he was the most encouraging member for founding the IGWI, "International Association of Commodity Sciences and Technology", and since, five two-yearly high standard symposia have yet been succesfully organised in Europe and in Japan. During the past ten years, Mr. Gekeler went more directly to the roots of the knowledge of Commodity Science and Technology and discovered the figure of Johann Beckmann. In 1987 he founded the "Johann Beckmann Gesellschaft" and due to his unexhaustible enthusiasm, festivities were organized in Göttingen and at the birth-place Hoya, commemorating Johann Beckmann. This name was also dedicated to a street; exhibitions have been organized and so on. Especially for this historical work we are here together.

Before giving the floor to you, I would like to try to walk into your way of thinking : don't look at one aspect but try the "gesamt-bild", a word which can't be translated. So I would like to hang up the following picture of the Beckmann period nearly 200 years ago : Beethoven playing one of his beautiful piano sonates, probably the pathetic; the stresses of the period of the French Revolution; the period of 1780, when the steam-engine was built, which forms the starting point of the industrial revolution, twenty years before the discovery of the voltaic cell. At that time Lavoisier also opened the area of modern chemistry. It seems that at any moment science, technique, arts, phylosophy and politics are fertilizing. George Sarton and Johann Beckmann do have treated the matters of science and technology from different view-points — historical and technological — but with that common objective of "Ganz heitlichkeit" from ressources of goods-production to the social implications. Due to your work much attention has been paid in our institute to the founder of technology, Professor Dr. Johann Beckmann.

Dear Mr. Gekeler, you were born on the first day of Spring and I'm sure that your health and youth will produce still many Springs in the future, and today we feel excited to hear the voice from the bottom of your heart.

JOHANN BECKMANN AND THE "CONSIDERATION OF COMMODITIES AND TECHNOLOGY IN THEIR ENTIRETY"

Otto Gekeler

1. Introduction

It shall be stressed at the beginning of this paper that both Johann Beckmann and George Sarton have had a same fundamental aim in their view : i.e. "science and humanity".

The theme to treat concerns the past and the presence : the *past* in so far as Johann Beckmann could understand and treat the knowledge of science and the practise of real things and achievements at this time, the *presence* in so far as we can consider today the commodity science and technology in their entirety.

It is a fact that nowadays goods cannot be treated under the angle of economic and technical elements only, but that also cultural, social, historical, linguistic and political aspects must come into consideration and, last but not least, must be seen with their ecological and/or environmental implications, which became actually of highest importance. This conscious appreciation of *all possible implications* of technology, and commodities encountered at all stages of their existence (from production over usage and/or consumption to waste management), will be called the "ganzheitliche Betrachtung" which can be described in English as "contemplation in entirety".

It is clear that this "principle of completeness" reckon with the multidisciplinarity of things; this is in clear contradistinction with the "economic principle", where partial and sectorial objectives are of most importance. Johann Beckmann held the view of multi disciplinarity.

Johann Beckmann was a man who believed in universal education. He practised and promoted sciences which lead to concrete applications in the real daily life; he put "sciences" into practise for "people", in so far he was able to combine science and techniques in the perspective of entirety.

By observing Beckmann throughout his subsequent works we discover the ever new aspects and accents he considered to reach his goal of completeness.

In this perspective, the museum of science and technology of the state university of Ghent where I'm presenting Beckmann's and our ideas, receives under the directory of Prof. Dr. Lox a symbolic value : it aims also at demonstrating the synergetic effects of scientific disciplines and different techniques into the subsequent evolutive processes of sciences and technologies. This museum forms a real theatre human achievements : on one side comes Sarton's monumental work as a root in connection with the history of sciences, and otherwise Beckmann's work forms the pillar for the history of technology and all what has been realised. Both persons are represented together with their work at the entrance, symbolising the bridging completion of thoughts aiming at the representation of humanistic entirety.

The knowledge of natural products and resources was a fundamental conception of Beckmann : how products are harvested (agriculture), treated (technology) to become commodities (the economics of transport and trade) and the "industrial management" were considered by him under a common denominator as *one* "science for people".

Troitzsch argued in 1963 : "The rigid separation of natural and humanitarian sciences as it went systematically since the 19th century, in so far that nowadays it is common to speak about the two "cultures", was not yet in force in Beckmann's time. We are now tending to consider the interdependency of sciences. Too less attention has been paid up to now upon the fact that the main works of Johann Beckmann are written not only following a common systematic frame, but also with the fundamental idea of an overarching treatise of the usage of products which are offered by nature".

It is my aim to treat Johann Beckmann under two aspects : the description of his work and how it was influenced, how he lived, which requirements he had, and what has been set to work on by him. Secondly, I will try to recognise Beckmann's importance today, to discover how his creative activity progresses in modern technology.

2. Curriculum vitae of Johann Beckmann

Beckmann is a transcription of "Mann an der Beeke" which means "man at the brook". Johann Beckmann was born in 1793; his father was a tax collector and a postman in Hoya at the Weser (Northern West Germany). At the age of 20, he went to study theology at Göttingen, but started quickly to follow physics, fiscal sciences, classic and new languages. In 1762 he went for a study tour to the Duchy of Braunschweig and subsequently to the Netherlands. In Braunschweig he visited several manufacturings, mines and people.

Most interesting is the meeting with the renowned learned theologian Jerusalem in Braunschweig. It was Jerusalem who advised Beckmann to travel to the Netherlands, where he stayed "only" 44 days. A lot of interesting ideas and impressions were noticed in his diary; what luck that it was translated into Dutch in 1912. Later Beckmann became teacher at the lutherian College in St. Petersburg (1763-65) and afterwards studied for one year in Sweden under the direction of the wellknown Prof. Dr. Carl Linnaeus. In St. Petersburg. Beckmann taught mathematics, physics and natural sciences. He also met his Göttingen fellowstudent Schlözer, who became one of the most known critical historians and political publicists of the german "Enlightenment". Beckmann continuously stayed in correspondency with his friend Schlözer, but most important were the impressions from Linneus : they are found to have governed his way of thinking, working and scientific practise. The influence of Linnaeus lies on the base of Beckmann's life purpose : science for the benefit of people.

Johann Beckmann was nominated in 1766 "professor in philosophy" at the University of Göttingen and in 1770 "professor in economics". At that time the courses in economics were agriculturally oriented. Beckmann died in Göttingen at the age of 72 (1811). The scientific and creative works of Johann Beckmann are astonishing :

- he was the founder of the subject technology, pioneer of agricultural sciences and of the commodity science, and critial historian of social and technical discoveries.
- he learned mineralogy, accountancy, paleontology and fiscal administration.
- he wrote, besides the main subjects concerning commodity science and technology, works about Linnaeus and about personalities from remote ages, and also made compilation of the main regulations and made thousands of bookreviews.

Most astonishing is the fact that this work of over 30.000 pages was written under candle light with feather and in the period where personal transport was realised with the hoursecouch ! It is clear that Beckmann searched into the original works : he was fluent in following languages : Latin, Greek, English, French; he translated Swedish and Italian and had a good knowledge of Russian (See table of activities).

Table of activities : Subjects treated by Johann Beckmann

Topic	Main fields	Minor fields
Objects from nature		- natural sciences - natural history of antiquity - mineralogy - botanics - comparative anatomy
Techniques Administration Economics	- Technology - Commodity Science (Warenkunde) - Agronomics	- Business science - small housekeeping - Cameralism, public adminstration - Poor's relief - Code-collections
History of social affairs and techniques	- History of social and of technical origins, discoveries and inventions	- history of natural sciences - literature of travel descriptions - etymology - terminology

3. Johan Beckmann as human

If we summarize what contemporaries have told about Beckmann we come to this personal characterisation : he had a robust health, a great creativity, was a hard worker with a special sense of order and had a high working efficiency. He was not a revolutionist or atheist; it is difficult to recognise his religious thoughts. He was not a politician; was most reserved in his utterings.

He was kind to the poor and his house personnel; he was member of a lot of national and international academical associations and had in this way an extended correspondency all over the "world".

His financial affairs were extremely well managed : expenditures and revenues were noticed, following the principle of double book-keeping. His private current-account was object for a book "Anweisung die Rechnungen kleiner Haushaltungen zu führen".

Some private documents were recently offered to the International Johann Beckmann Association (I.J.B.G.-founded in 1987) by descendants living in Germany, Brasil and U.S.A. : interesting are his handwritten household book with expenditures, revenues and balances over the period 1803-1807 as shown in figure 1.

Beckmann also used his housekeeping books for memorising personal events. So here he noticed at the left side below : "on the 6th (of this month) I had a pleasure of accepting the visit of my former accurate auditor, the famous traveller von Humboldt (Alexander) after his return from America".

Handed to his birth-place Hoya/Weser was also his handwritten testimony : it has been translated into twelve languages ! This remarkable document projects some very personal qualities of character : "I wish to be buried without luxus and sensation... That my bones may become unrecognisable as quick as possible by mixing them with those from others...". The word "God" is not used in the text but he advised his survivors "to live honorably and as a christian...". Beckmann also expressed the wish that this personal

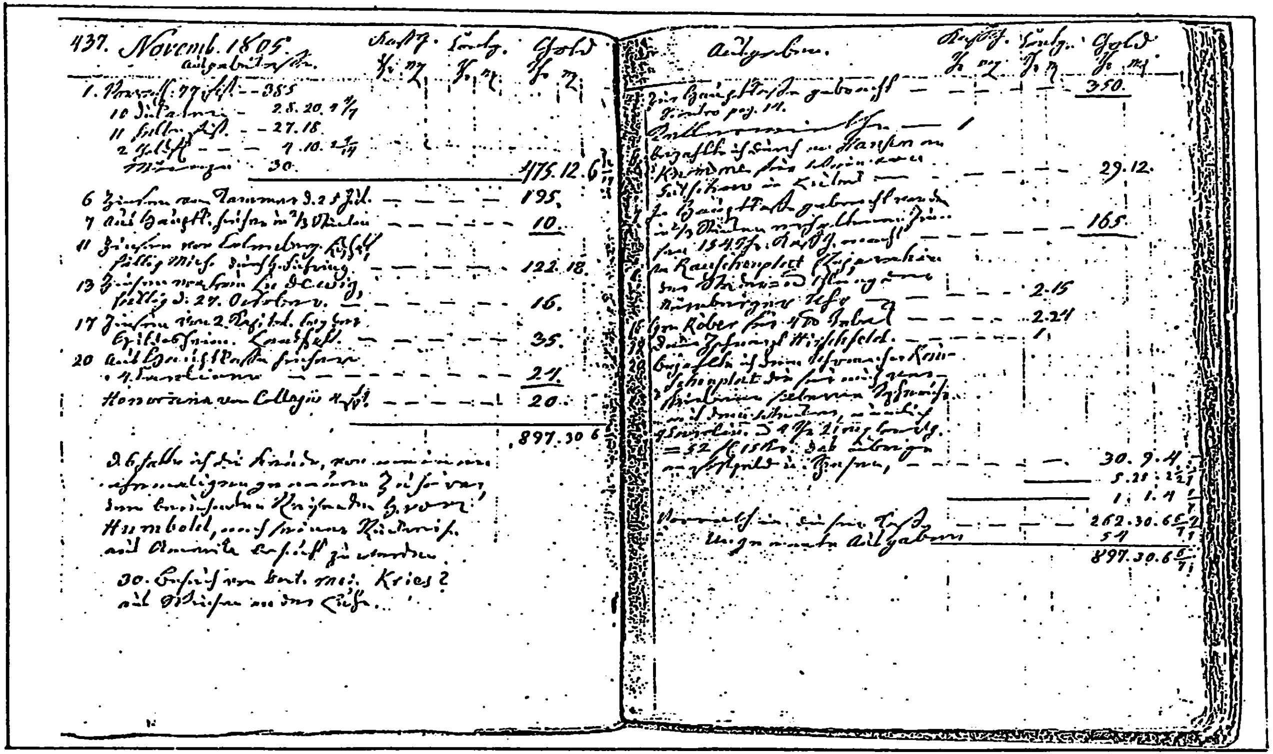

Figure 1 : Johann Beekmann's household book : copy of page 437 November 1805
The picture shows two pages in Beckmann's own handwriting
Left side : cash in hand, income (interest, lecture fees a.s.o.)
Right side : expenses, cash in balance.

bible should remain in the family during some years, "in love from my parents". This wish has been fulfilled up to now : the Bible is still in hands of Beckmanns, living in Brasil.

4. Influences and spirit of the ages

Beckmann lived in a period where two fundamental movements were in course : Humanism and Enlightenment. Both revolutionary ideologies have in common the aim to liberate humans from their spiritual, associative and material fetters. It is a fact that physical sciences seem to lose the bindings with dogmatics and philosophy : at each time it is demonstrated in different graduations and accentuations that only one significant discovery can be more useful than an ivory tower. Closely allied with the spirit of "enlightenment" is the "cameralism", the German alternative of mercantilism. This movement aimed basically at improving the state and the general prosperity by the promotion of sciences, education and industry. In these tendencies we discover the fundamental need to bridge theory and practise. It is our conviction that Beckmann and also the french representatives of the enlightenment undergo this guiding influence.

5. Johann Beckmann, founder of Technology

As stated before, Beckmann was nominated as professor in philosophy in 1766 at the University Göttingen with the aim to found a professional chair of economy. Things evolved very quickly: after one year he presented his ideas about the economic (equal to the actual) agriculture and organized an "economic garden" with most important plants and even weeds !

So, he published in 1769 the "Grundsätze der teutschen Landwirtschaftslehre" (Fundamentals of the German Agriculture) which received six reprints : the book was one of the most-read textbooks of the time : it treated arable farming, plant-culture, cattle-raising, the processing of farm-products and also the administration and planning of farms. It is of extremely importance to notice that a professor of *economy* (or agriculture) became the founder of *technol-*

ogy : it is our conviction that both sciences, "economy" and "technology", deal with natural products : on the one hand the culture of plants (agriculture) and on the other hand their *processing*. In this point of view it seems to us that technology forms a logic extrapolation of the agricultural science. It may be recalled here that Beckmann taught at the age of 26 in St. Petersburg about "natural products" !

6. Johann Beckmann and his book "History of Inventions"

Johann Beckmann published from 1780 to 1790 one of his most famous works under the title : "Geschichte der Erfindungen" (History of Inventions, Discoveries and Origins) : It appeared in five subsequent volumes. The English translation appeared in 1846 and had four reprints in England. The english version contains an additional chapter entitled "Steam engine". Beckmann describes a lot of technical inventions, recipies and discoveries placed in the timely *social context* : this treatise is based upon the historical facts and documents and shows in this way an interesting evolution of applications of scientific discoveries and technical inventions in daily life, together with their social implications. One of the most interesting chapters concerns the "ribbon loom" : This machine is considered by Beckmann as one of those inventions by which more can be produced than necessary; he also mentioned the social implications in so far that qualified persons can become unemployed or fortemporily oppressed. He writes : "The municipality of Danzig is said to have pushed aside the inventor of the "ribbon mill" by drowning or suffocation". Karl Marx has also treated this story of the ribbon loom : he wrote litterally "this machine, who caused so many difficulties, was preceding the spinning machine and moving machinery and also of the industrial revolution". Recently the books "History of Inventions" and "Project of General Technology" (Entwurf der Allgemeinen Technologie - 1806) have been translated from the original German version into Japanese (published in 1982) by a group of 45 people from the Japanese Patent Office. The aim was "to understand to judge in a better way the transfer of technological knowledge from Europe to Japan." (Tomita).

The 250th anniversary of J. Beckmann formed an interesting opportunity to edit a stamp, and this was realized by a studygroup from the Technical College of Madgeburg (G.D.R.) in 1989.

Figure 2 : Copy of the stamp dedicated to Johann Beckmann, edited in 1989 on occasion of the 250th anniversary of his birthday.

7. Johann Beckmann, professor in Commodity Science

Johann Beckmann was the first real professor in lecturing commodity science : nevertheless there are indications that already before him commodities were described demonstrating the importance of a good knowledge about the objects of trade. Ali-ad-Dimisqi (1174 Damaskus) treated this aspect in his book entitled "The book with indications about the beauty of trade and about the knowledge of good and bad products and their adult-relations". Francesco Baduci Pergolotti (Italy 1440) also treated in his "Prattica della mercature" (practise of commodities) the characteristics of different commodities. N. Lemery (France, 1645-1715, chemist and doctor in medicine) published a material lexicon, and Paul Jacob Marperger (German cameralist, 1656-1730) argued that a course should be learned at all higher commercial schools by which "the products of trade could be treated in extenso". Ludovici (Leipzig, 1707-1778) founded in Leipzig the concept of a university-course about commodities. Beckmann entitled his text-book "Introduction to the Commodity Science or the Acquaintance of Important Foreign Products", most different from Ludovici's work entitled as "General and Special Commodity Science". Professor Grundke (G.D.R.) justly notifies that Beckmann's commodity book must be considered as the "birth-charter" of the commodity science. Indeed, all goods are treated with their properties, their manufacturing, their quality control and giving directions for use and trades; Beckmann systematically makes clear the terminology of words upon historical information. Ecological aspects could yet be found : e.g. under chapter "Ivory" he indicates aesthetic elements of goods and the irrationality of values especially for cases where humans exhaust animal life. "The birds learn the superiority of people : they fly to other places to avoid persecution. The man disturbed in this way the company of the beaver, the walrus and probably many other species". In this way it may be said that the commodity science is oriented by Beckmann towards "entirety". The influence of J. Beckmann was important : at different German universities the course "commodity science" has been lectured since. We may stress that Beckmann's ideas are still of use today : we find up to now commodity sciences taught at the economic faculties in Italy, Japan, Poland, Austria and others. In the Anglo-Saxon countries, commodity-science is not presented as such on the university programmes. Probably because the german word "Warenkunde" can't be translated by one word into the Anglo-Saxon languages. Nevertheless, since the international association was founded in 1976, several international Congresses were subsequently organised in Vienna, Gent, Krakow, Bari, St. Gallen, Tokyo and Seoul, all under the terminology of "Commodity Science", a term which by now has been adopted by the scientific community.

8. Johann Beckmann and Technology

The most widely known achievement of Johann Beckmann is the foundation of the science called "Technology". At the age of 33 (1772), Beckmann used for the first time the word "Technology" to describe "the science of manufacturing and the history of arts". In 1777 he published his famous book entitled "Anleitung Zur Technology" (Introduction to Technology).

Herein the word "technology" has been defined as "the science describing the processing of natural products or the knowledge of their manufacture". So we consider Beckmann not only as the promotor of the *word* "Technology" but also as the person who created the *object* (or thing) and its *form*. After this publication many "chairs of technology" were introduced at several universities and "technological" literature appeared very quickly. It is out of doubt that the actual presence of technology in the wide range of realisations depends directly upon the publication of this technological standard book, wherein, for the first time, several products such as paper, beer, porcelain are treated and classified in the way how they can be produced.

The general concept of the *1777 book* was described by Beckmann himself as follows :

a. The handicrafts should be ordered not only following the used materials and the produced objects, but also following the common parts and analogies during their processing and the principles upon which these are based.
b. the knowledge of handicraft, fabrics and manifactures is undispensable : what has been made, ordered, qualified handled, gained, used and performed should at least be known and understood".
c. "when the basic knowledge fails, so shall the craftman be left upon his own or will he receive plans which cannot be performed".

The principes of ordering the treated subjects are shown in Fig. 6.

Anleitung
zur
Technologie,
oder
zur Kentniß
der
Handwerke, Fabriken und
Manufacturen,
vornehmlich derer, die mit der
Landwirthschaft, Polizey und
Cameralwissenschaft
in nächster Verbindung stehn.

Nebst
Beyträgen
zur
Kunstgeschichte.

Von
Johann Beckmann
ordentlichem Professor der Oekonomie in Göttingen.

Mit einer Kupfertafel.

Göttingen,
im Verlag der Wittwe Vandenhoeck. 1777.

Figure 3 : Front page of Johann Beckmann's book "Introduction to technology" Published in 1777.

die also ganz abgegangen sind, ist nicht ohne Nutzen. Nach Erfindung der Glasspiegel gieng die Kunst Metallspiegel zu machen, verlohren, die man in neuern Zeiten, nach Erfindung der Spiegelteleskope, mühsam wieder suchen muste.

§. 14.

Natürliche Ordnungen der Handwerke und Künste.

Nulla ars non alterius artis aut mater aut propinqua est.
Tertull. de idololat. c. 8.

I.

1. Handwerk der Schlächter, Fleischer, Metzger, Knochenhauer.
2. Kochkunst.

2.

3. Bereitung der Käse, Butter.
4. Oehlschlägerey. Baumöhl, Rüböhl, u. s. w.
5. Thransiederey.
6. Bereitung des Wallrats.
7. Bereitung der Hausenblasen, Hausenleims.
8. Leimkocherey.
9. Seifensiederey.
10. Lichtzieherey.

3.

11. Bereitung der Nudeln.
12. Oblatenbäckerey.
13. Bäckerkunst, Grobbäcker, Weisbäcker, Losbäcker, Fastbäcker.
14. Honigkuchenbäckerey. Pfefferkuchen, Lebkuchen.
15. Bereitung der Chocolate.
16. Zuckerbäckerey, Conditerey.

4.

17. Bereitung der Weine.
18. Bierbrauerey.
19. Essigbrauerey. Wein- und Bier-Essig.
20. Brantweinbrennerey. Franz- und Korn-Brantewein.
21. Bereitung der Liqueurs, Olitäten.
22. Scheidewasserbrennerey.
23. Vitriolöhlbrennerey und die übrigen Säuren.
24. Apothekerkunst.

5.

25. Boraxraffinerie.
26. Potaschsiederey.
27. Salpetersiederey.
28. Kochsalzsiederey.
29. Alaunsiederey.
30. Vitriolsiederey.

Figure 4 : Reprint of the contents of the "Introduction to technology" : §14 : Natural arrangements of handicrafts and hand-arts (continued in figure 5)

19.

114. Weben der Haarsiebe.
115. Leinenweberey.
116. Zwillichweberey, Drellweberey.
117. Leinendamasweberey.
118. Batist, Kammertuch u. s. w.

20.

119. Tuch= und Zeugweberey.
120. Bandwirkerey, Bortenwirkerey.
121. Tapetenwirkerey.

21.

122. Kattunweberey.
123. Sitz, Parchent, Kanefas.
124. Nesseltuchweberey.

22.

125. Seidenweberey. Halbseidenzeuge.
126. Glatte, ganzseidene Zeuge: Taffent, Gros de Tour.
127. Façonirte Zeuge, Atlas.
128. Gezogene Zeuge, Damast.
129. Brochirte Zeuge: Batavia, Stoffe, Drap d'or, Drap d'argent.
130. Sammet, Plüsche, Welpel, Manchester, Welverets.
131. Seidenbortenwirker.

23.

132. Walkerkunst.
133. Filzmacher.
134. Wattenmacherkunst.
135. Hutmacherkunst.

24.

136. Papiermacherkunst.
137. Bereitung der Sachen aus Pappe.
138. Dockenmacher, Puppen, Masken.
139. Bereitung der Uhrgehäuse, Futterale, Scheidenmacher.
140. Bereitung der Sachen aus Papier maché.
141. Fechtelmacher.
142. Buchbinder.

25.

143. Bereitung der Bleystifte.
144. — des Siegellacks.
145. — der Gypsbilder.
146. — der Pasten in Schwefel u. d.
147. — der Bilder von Hausenblasen.
148. — der künstlichen Blumen.
149. — der unächten Perlen.
150. Wachspoussirkunst.

Figure 5 : Reprint of the contents of the "Introduction to technology"

"Examplcs" 1777 ↓

Method \ Goods	Cement	Bakery	Beer-brewing	Paper
heating	revolving oven	baker's oven	drying oven	-
grinding & breaking up	breaking device	mill	grinding	tearing
water	+	+	+	+
mash	concrete	paste	mash	mash

---------------------->
"Principles" 1777
(and Examples 1806)

Figure 6 : Beckmann's principles of ordening the treatise of goods in the 1777 book.

In 1806 Beckmann published a second technological standard work entitled "Entwurf der allgemeinen Technologie" (Project of a General Technology). In this work he tried to summarize the different aims and methodologies of goods. It may be stated that Beckmann's viewpoints are trivial and universal at the same time :

- one object can be made following different systems;
- one system can be used for different objects.

Both technical works must also be considered as *complementary to each other* because the 1777-edition treats also important general techniques and the 1806-edition contains (in contradistinction to the title) the description of a lot of separate handicrafts, each based upon a different "know-how" and/or "technology". We can demonstrate the systematic way Johann Beckmann followed to treat and to describe the general technology by following example.

Let us consider the life-cycle of the Commodity "bread" : First stage is the transformation of *grain* to *flour* by the miller; the work to make *bread* from it is done by the baker. The following phases as shown under *transport, storage* and preparing the bread will bring us to the final purpose "consumption for feeding".

The Beckmann consideration of general technology finishes in the stage of making flour; without doubt the next stages can be deduced from the basic concept of Johann Beckmann, because at several occasions he treats about the use people make of things. Prof. Hölz (Wien) recognises the following categories of the "purposes" in the description of general technology : a technical purpose, a techno-economic purpose and a techno-ecological purpose. It is also interesting to consider the ideas of the technic-philosopher Ropohl about Johan Beckmann. They are part of the following figure 9.

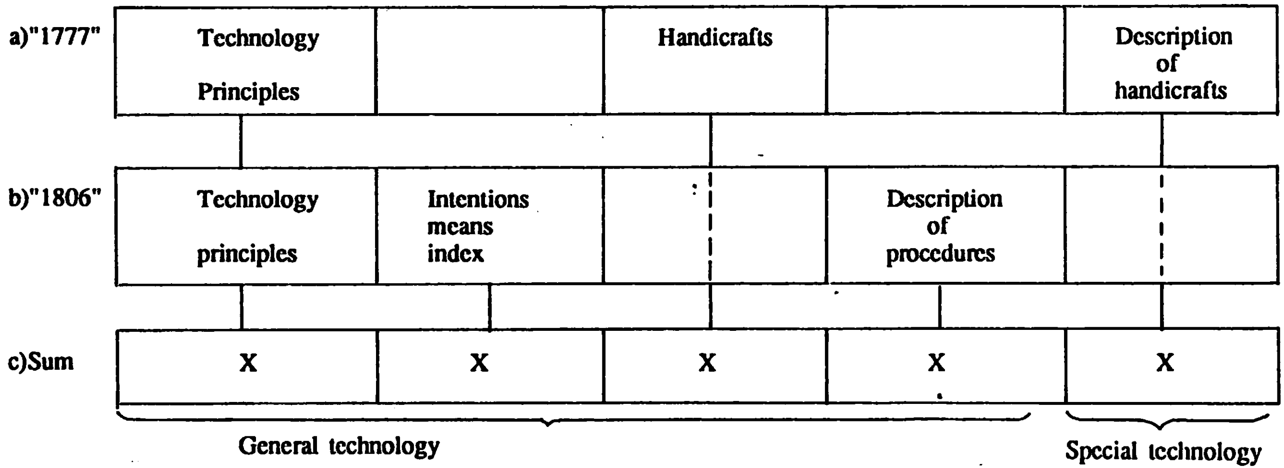

Figure 7 :Rearrangement of the two technological oriented works of Johann Beckmann : (edited in 1777 and in 1806)
1777 : "Anleitung zur Technologie"
1806 : "Entwurf der allgemeinen Technologie".

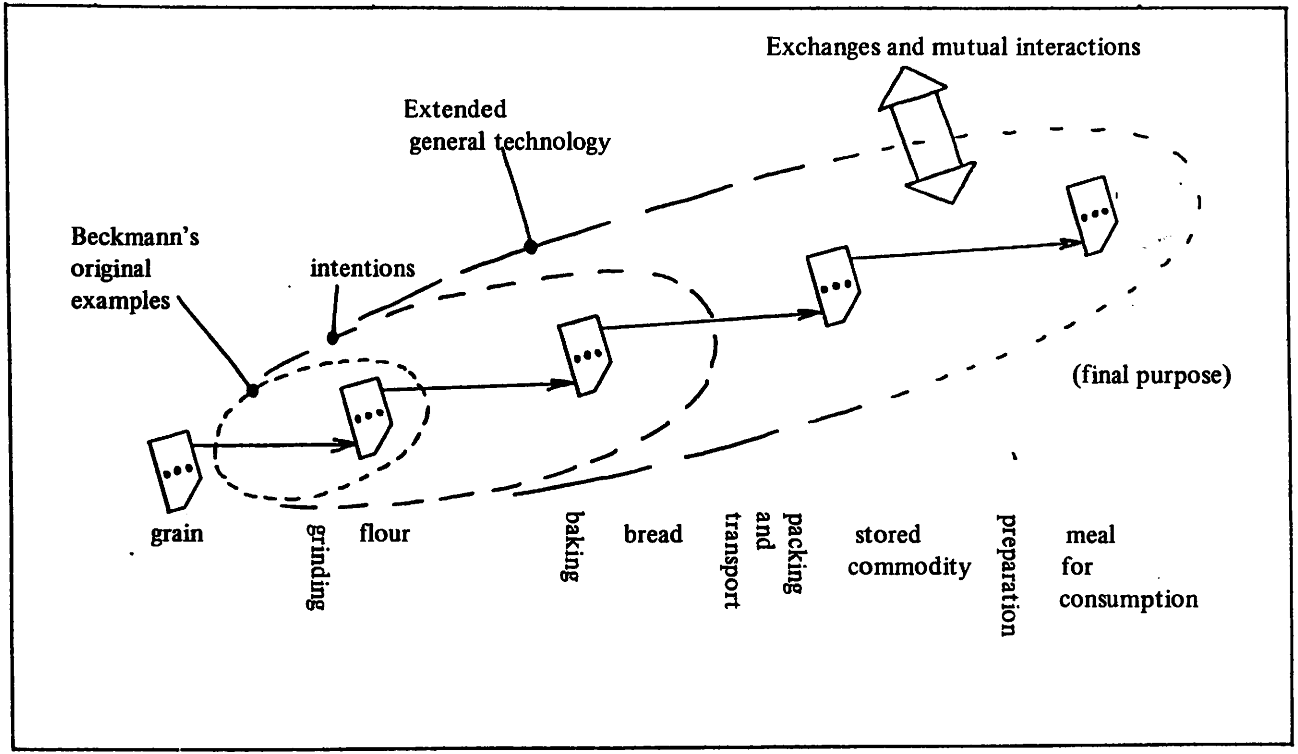

Figure 8-1 : The intention - mean chain following Johann Beckmann.

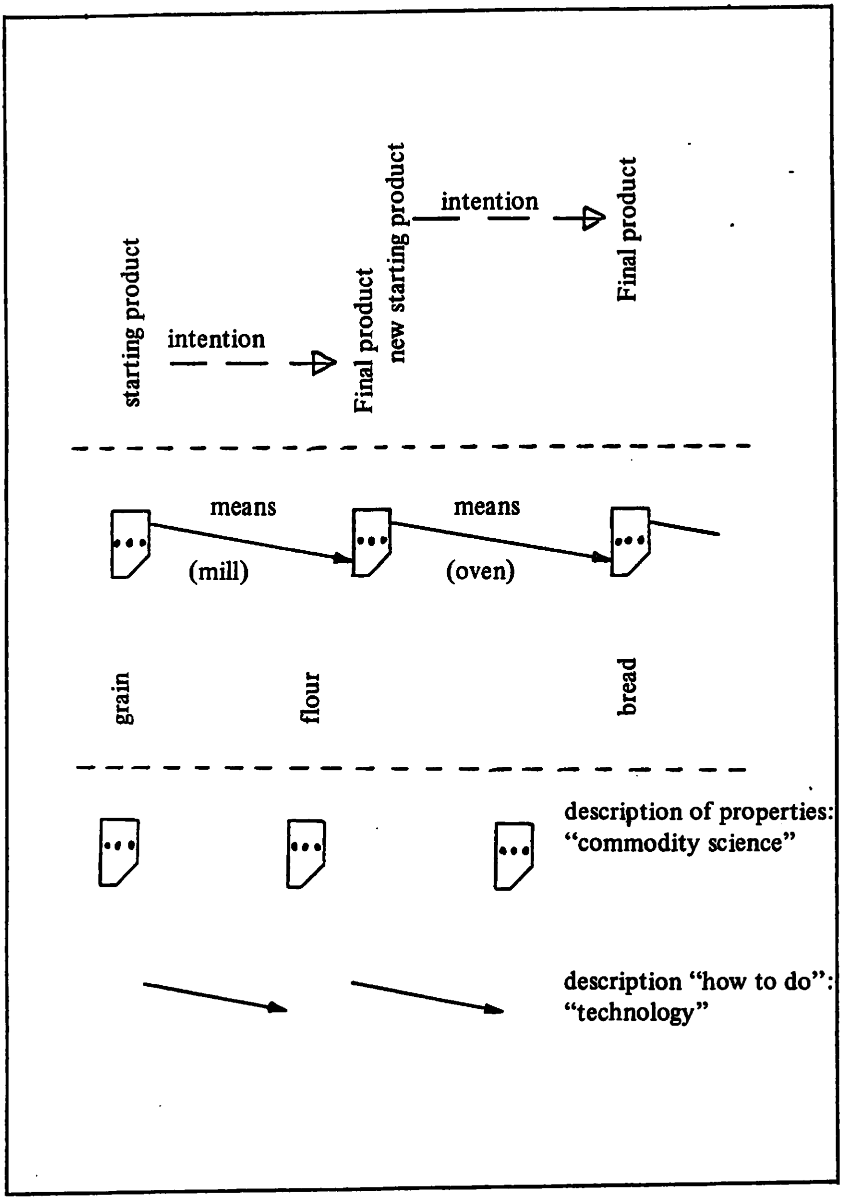

Figure 8-2 : Technology and commodity science as seen by Johann Beckmann.

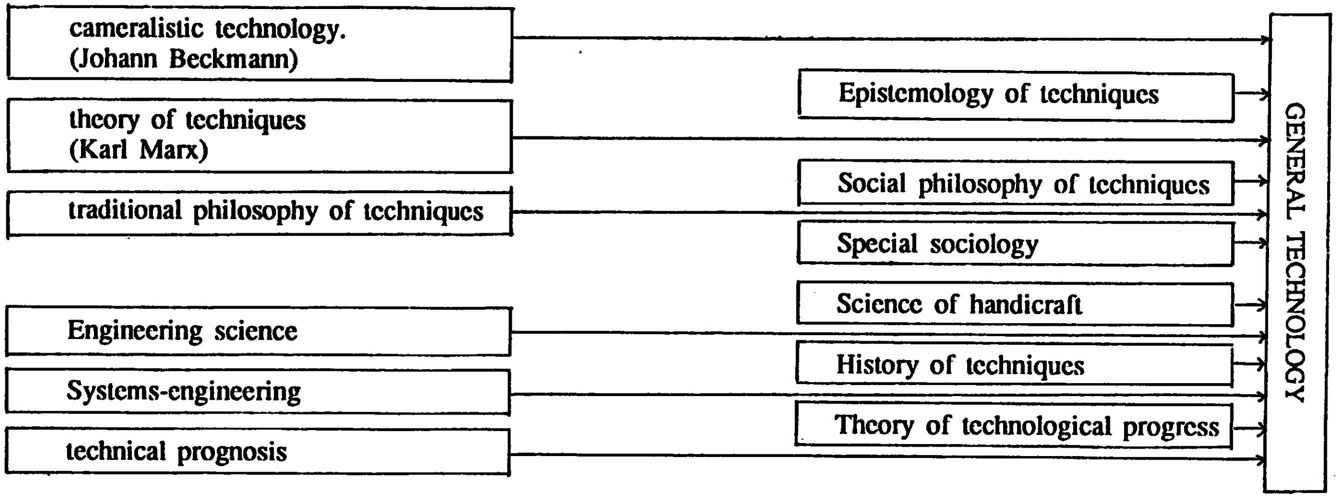

Figure 9 : Johann Beckmann's ideas concerning the concept of general technology following Ropohl.

The cameralistic technology (it is the technology as seen by Johann Beckmann) is shown at the left side. It is a part of the general technology as it is considered today. Ropohl argues that Johann Beckmann nevertheless gave directions to found a new model of general technology with the actual technical problems and theoretical knowledge : "The generalistic and in approach systematic character of Beckmann's work has induced us to propose "general technology" as a programmatic attestation for that comprehensive research and teaching of techniques to which this (Ropohl's) work will contribute" (Ropohl, 1983).

9. Technology, Engineering and commodities

Up to now the word "technology" was used in the meaning of "science of technics" : but technology stays also for the entire and complex reality of engineering.

The real meaning of the word technology is unfortunately not clearly defined : it is mostly used as synonym for engineering. If we summarise the viewpoints of Johann Beckmann about general and special technology and those of Ropohl concerning the real meaning of general technology, we come to the following consideration as shown in figure 10.

Engineering or technical sciences includes a "for what purpose", namely *for what* do we need know-how, what can we reach with our knowledge. Engineering implicates also a "butt" "a toreach goal". The question is "*what* is the purpose and *to which* purpose will it lead" (hierarchy of purposes). Unfortunately, reality shows that "purpose" and possible further achievements of higher order or value remain forgotten. G. Sarton indicates this as "technical frivolities" and C.F. von Weizäcker argued in 1988 "The opinion that all what can be made should be really made, is a wish-dream reserved for childhood, it is like the misuse of the drug "power". Engineering means matured accuracy". Von Weizäcker clearly wants to express that engineering describes the "means for purposes". In my personal opinion and following a consideration in entirety includes an ethic evaluation of "availability" and of "usage". Thus : "Techniques is

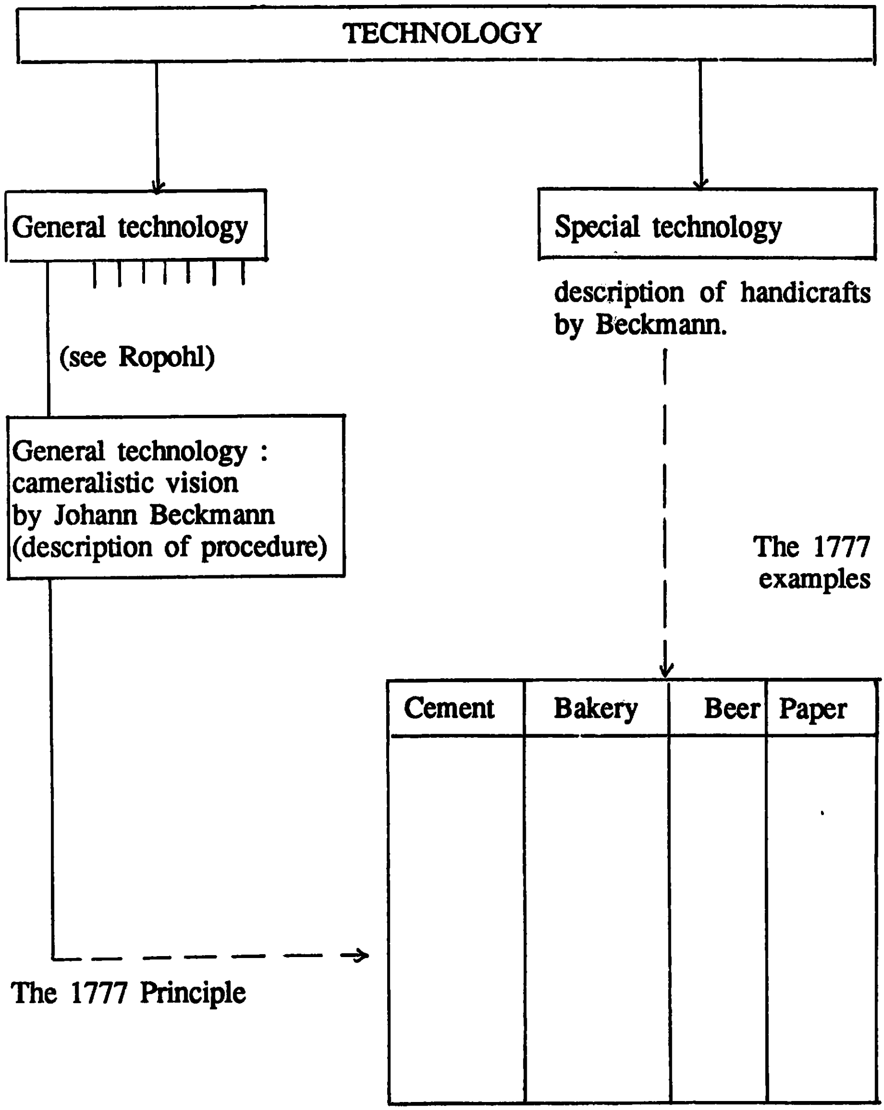

Figure 10 : The concept of "overall" technology with regard to the viewpoints of Johann Beckmann.

making means available for purposes". And as *we* see this : Techniques is giving at hand and application of means for

- Production
- Maintenance of Use-Value
- Waste Handling

of Artefacts (Products).
What is true for the notion engineering is also true for commodities : The description of goods in function of the means to fulfill human requirements can't be perfect and complete : it makes abstraction of a lot of interactions with nature and society. Consequently the definition of commodities in considering the principle of entirety could be : Commodity is a requirement-fulfilling thing; its social, ecological, economic, ethical and other implications must be considered as well. In conclusion we may state that "commodity science" is the "science of implications of commodities".

10. To present the problem under consideration in entirety

What follows are some notes on how problems should be seen in their entirety. As already mentioned, there is a need *to consider all relevant factors* — all implications of technology and commodity — of the artefact — that means all the influences of man and nature on the object and also the effect on themselves. Just as a highlight : let us look to all the problems concerning the *car*, we must not only consider its uses and costs but also its social, ethical, ecological and all its other consequences as for instance : the change of lifestyle, the construction of tanker fleets, petrol stations, road and signal devices, accidents, influence on psychological moods, health and environment. Yet another question is what will the consequence of the car be on the following generations ?

Here is another example : what does it mean when, for each other coffee-drinker "so and so" many coffee plants in monoculkture must be taken care of ? — and in order to do this jungle must be destroyed. What does it mean, when in the third world arable land is usurped to produce food for European beef cattle ? — valuable biomass which the people there lack as a source of their own food production !

The consideration in entirety" does not only involve itself with the problem of needs and costs but takes all relevant factors together and tries to divide them into "useful" and "hamful", in order to obtain a sound value judgement with the help of a "commodity-scale" or a "commodity-balance". This is the main idea of the *entirety-principle.*

This "entirety-principle" is the overcoming of the pure consideration of use and costs — the "economic principle" which better should be called "ecónomic principle".

Let us now single out some urgent problems of our time and try to examine them through the glasses of the entirety-principle. This is above all to demonstrate how universal the entirety-principle can become. Up until now the way of thinking about these problems has been more sectoral so that the view is in fact more-or-less obstructed, and important factors are cut out.

Only to mention very briefly : production, responsibility, trends, survival-catalogue, growth in economy, social discrepancies, awareness, orientation of life.

11. Analysis of the present time

The idea that everything which is produced by man and put on the market is *useful* and *sensible* is deeply rooted in our minds. It is already obvious in the language when products are described with the particularly positive expression "Good/Goods". It was a common view :

"More production equals Satisfaction of more needs".

Nowadays, we know that this satisfaction of needs has to be paid for with ecological and social damage, that we could use this equation only for as long as the human being was unable to endanger the whole world through his machinery. Beckmann was probably convinced of this fact, just as of the fact that the use of commodity production will surpass the damage. Nowadays development does not only have a supporting but a more and more destructing effect. So,

Das „ganzheitliche Prinzip“	The "Ganzheit Principle"[1]
als Aufwandsminimierung:	*with regard to minimising effort:*
Es gilt,	We must
den materiellen und immateriellen	obtain
Nutzen der Ware	the material and immaterial
mit einer in ihrem Lebensweg	benefit from the commodity
insgesamt	with a minimum of
kleinstmöglichen Menge an	nature and human substance
Natur und menschlicher Substanz	throughout
zu erzielen –	the commodity life –
dies unter Beachtung	with due regard to
gesundheitlicher, politischer,	health, political,
ethischer und anderer	ethical and other
relevanter Belange.	relevant aspects.

[1] The English words totality, entirety, wholeness, integrity do not meet the meaning of "Ganzheit" completely. In philosophy "Ganzheitslehre" has been translated into "Holismus", but according to the authors' feeling this term and the adjective "holistic" are not common in English. So we here follow the practice in psychology where "Ganzheit" has been adopted into the English vocabulary.

Figure 11 :The principle of entirety.

the equation concerning goods production versus satisfaction must now be written (following the entiretyprinciple as :

> "More production equals satisfaction and inauguration of more needs, together with more damaging of nature and society".

The final balance of this "entire viewpoint" can be formulated as :

> "Satisfaction of needs *minus* the encountered damages equals *life-quality* today and/or tomorrow".

All this shows that the formerly quite harmless ambivalence of sciences, technology and economy has become highly critical.

Today we have to consider this all as

- a horn, offering in never ending supply, the most beautiful sought-after things
- Pandora's box, a never drying source, out of which come dreadful things pouring over the Earth. Unfortunately it seems as if the negative factors are increasing more than the positive factors. This we demonstrated already in 1981 (Fig. 12) :

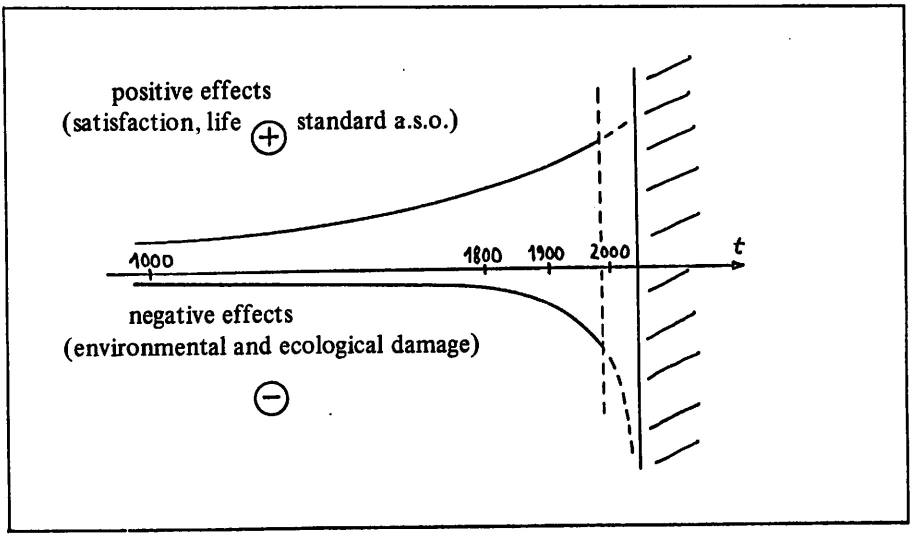

Figure 12 : How will things move ahead ? Or : will the balance of satisfactions and damages evolve in a positive or a negative way ?

12. Trends

The picture shown above fortunately does not completely correspond to reality, because in the past years a change in the forecasted trend has obviously begun, in so far as the public and politics have gradually become alarmed about the ecological damages. Therefore many smaller and larger measures have been initiated to counteract the development which threatens existence.

Let us consider only a few examples :

- Politics is hardly possible without the environmental aspects.
- Increasingly, the media informs on environmental damages and consequences.
- Nuclear energy is seen more and more critically.
- Next to the "polluter pays" jurisdiction increasingly acknowledges the principle of "precaution".
- A more modest way of life in alternative groups has been highlighted.
- A change in consciousness towards collective responsibility, also for the sake of posterity, has emerged.

Numerous measures and considerations which appeared to be out of the question five or ten years ago are, taken for granted. It seems that people are prepared to accept necessary but unpopular measures. The realisation is growing in dealing with commodity and technology, not only short-sighted consideration of their usage counts, but also ecological, social and ethical matters are now of importance — for us and for the sake of our progeny !

13. What is to be done ?

The main thing is that we get an impression of the character, of the dimension or the direction of our reactions. We have to distinguish between four different areas of action.

A) Techno-economy C) Politics
B) Ecology D) Consciousness

The synergism of these four areas of activities towards the future is shown in picture 13.

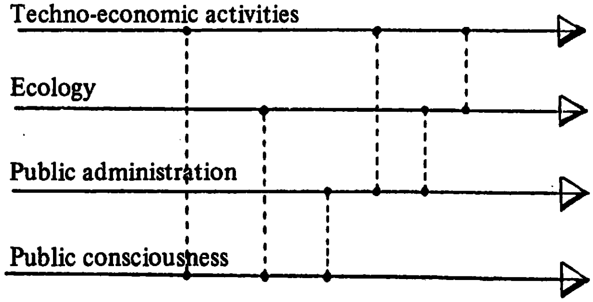

Figure 13 :The interactions between the different areas of action.

The change can only be successful if all four groups interact. Emphasis to this idea follows.
1. The turning away from the dominance of the economic system. A turn towards integral thinking and judgement. Economy has to integrate higher, non-economic factors in its objectives. The "economic principle" must be replaced by the "entirety-principle".
2. Another consequence is the turning away from the economic growth, from the dogma that a lack of economic growth, zero growth or even negative growth would necessarily lead to collapse, unemployment and social riots. But up to what point do we want to grow ? Obviously nobody realizes the parallels to capital investment with compound interest. We should think about more often where this with 3% interest to in the next 30 or 50 years. In 25 years this is 200% compared to the first year : this might have been allowed from 1945 to 1970.

But what can zero growth, which many people long for, accomplish ? Zero growth means that in a given year exactly the same amount is produced as in the previous year.

- If 1000 km of new road are built one year, another 1000 km will be built during the following year — that makes 2000 km of new road — since the first 1000 km will not dissapear or be destructed !
- If one million new cars are built in one year, another million will be built the following year. That means : even with zero growth, the accumulation of means of production and of consumer goods continues. In fact, the volume grows with zero growth quite considerably. Reckon : if a child grows 5 cm this year and another 5 cm the following year, none would call this zero growth. Only the economic perspective can do this trick ! These examples of economic growth clearly show the way in which limited, non-entire-thinking can lead to confusion.

14. Social discrepancies

In many industrialized countries we see a growing number of destitute-enclosed people : the discrepancy between possessing and non-possessing grows and grows (the so-called "New poverty").

So critical social discrepancies appear where people are starving and at the same time where a thin upper strata of society lives in luxury. On closer examination we will see that these are surprisingly the so-called "industrial nations" and the "developing world". We will hardly find reason for famine and extreme poverty in natural and geographical conditions but in social-political- and ideological conditions. The reference to the way of existence as "being" as an alternative to "having" (according to Erich Fromm) is no help to the starving and exclosed people. In which social and cultural values of the commodity wonderworld should these people believe ? In the self-controlling power of supply and demand ? — in the economic growth with use of more and more machinery instead of people ? — in the hope of more export or relief from debts on the part of creditorcountries ? These possibilities are of no importance to them because they are far away from realisation : - these people may be indifferent towards the ozone-problem, greenhouse-effect, pollution of the ocean, because they do not carry any guilt. On the whole, ideas and creativity are demanded; but above all, the will to change ! It is necessary that the "rich and the powerful" permit this before it is too late, and that the "poor" summon up the necessary hope, determination and energy. The age of the *commodity-consumption* must be relieved by the age of *reciprocal help.*

15. Consciousness and life-orientation

What value the theme of consciousness and orientation in life has, is implicated in the fact that even the authors of both reports of the Club of Rome have realized "that a radical psychological change in "man" represents the only alternative to economic catastrophy. Mesearovic and Pestel demand a new world-awareness... a new ethic in the use of material-treasures... a feeling of identification with the next generations... not to do everything what can be done !

Erich Fromm distinguishes between two fundamentally different ways of existence : the one "of having" and the other of "being". Consumption is a form of having, may be the most important one in today's superfluous society. Consumption is ambivalent : it reduces our fears since the consumed goods cannot be taken away from us any more, but it also makes us consume more and more, because the goods, once consumed, no more satisfy us. I *am* what I *have*. and what I *consume* is the actual consciousness.

The "being-way" of living is almost unknown to many of us compared to the "having-way", since "having" is the dominant way of thinking in our society. Someone who lives the "being-way" does not have to be afraid of the question : who *am* I, if I am what I *have*, and then *lose* everything I *have* ? If I *am* what I *am*, and not what I *have*, nobody can rob me of my possession, nobody can threaten my sense of identity. "You do not lose what you give" - you lose what you hold on to" ! Being goes together with the will to give, to share and to sacrifice. It is an undeniable fact, that human beings are determined for the "being" just as well as our biological survival instinct favours the "having" way of living. It is a sad comment on civilisation, that war and suffering mobilize more willingness to sacrifice than peaceful life, and that in times of peace only egoism seem to flourish.

16. The New Responsibility

In the modem highly, specialised world, the individual is not operating for himself and in his immediate social surroundings, but in *collectives*. Everybody is a beneficiary and at the same time a victim of techno-economic activity.
Consequently, the individual does not have immediate responsibility for the artefact anymore but only an indirect responsibility : The responsibility has presumably been transfered to the collectives or societies (factories, authorities, etc.) which are operating for themselves and cooperating with one another. The responsibility as a whole is lost where the individual or the organisators become an insignificant fraction of it. Where the responsibility is atomised there is *non-responsibility* or a real *irresponsibility*.

In view of these facts *responsibility obtains the rank of pure survival strategy* ! (Banse, Buttlzer, Hörz, 1989). Without a new responsibility in conformity with the approaching dangerous challenges the rising risks can never be mastered.

Genuine responsibility is duty to all living, is "respect of life" (Albert Schweitzer). G. Banse (Berlin, G.D.R.) understands responsibility as *"obligation to the promotion of humanity"*. So the new responsibility means exactly what the so often misunderstood Kantian Categorian Imperative expresses : "Act (always) in such a way, that the maximum of your will could always and at any time serve as principle for a general legislation". This imperative is an extreme *moral demand* — but *never* permission for acting, without regard to other human beings and to creature.

If then responsibility is not only a matter for securing real technical and scientific progress, but much more is "conditio sine qua non" for securing existence and future of global life, then the question is : Is mankind at all able to master such a gigantic step ? Our answer is yes — the French Revolution, the Russian October Revolution, the Independence Wars in the U.S.A. and last but not least the dramatic events of nowadays in the Eastern Block — all this demonstrates that decisive changes can succeed very quickly when the pressure or sufferings has become unbearable.

Carrying through the "new responsibility" starts with the *willing* to recognize the dangers ! Opposed to this in the human tendency to steady repressing and diminishing, a way of thinking and of consciousness which is favoured, moreover, by the opinion that making obvious the dangers might imperil the "progress".

To summarize : Mankind *can* win the epochal changeover — if they *want* this ! The profit of removing the dangers is gigantic, and compared to this the corresponding expense is inevitable ! Thus, investing into the *"new consciousness"* is the utmost profitable enterprise. All the new high-technologies, excursions into space and military pseudo-securities lose colour against these investments into the real assurance of human future !

These thoughts surely lie in the thinking-line of Beckmann and Sarton. Sarton was convinced : "I believe that I am only a fragment of humanity, yet that I must try to look at things from the point of view of the *whole*, and not of the fragment". That is indeed entirety-thinking ! Beckmann could still trust in the mission of technology to lighten the lot and happiness of mankind. This hope is evident in all his creation : science and technology are useful for the benefit of mankind — in a material and a spiritual sense. Sarton experienced the terror of two world wars and the consequences of excessive rationalisation and mechanisation. This is the reason he warned : This machine-age must go !
What Beckmann could not foresee and Sarton experience, is the fact that technology and science gave mankind the power over the earth not only to lighten its lot, but also the power to give rise to the mondial holocaust.

But Sarton said : "When one reads such a book as Gibbon's "Decline and Fall", one cannot help shuddering half of the time, and wondering how on earth did the "good people", the forwardlooking ones, the "dreamers" ever triumph over the unprincipled barbarians, over the ruffians, gangsters and murderers, who in every level of society, from top to bottom, were weakening the Empire, and undermining like termites the whole fabric of civilization ? ... *And yet they* (the good people) *did*".

I am greatly indebted to many personalities :

- First of all to Prof. Frans Lox for having taken the initiative, that our thoughts could be presented at the State University of Ghent, as well as for so many arduous hours of transforming the original (extensive) paper and the short speech-manuscript into *one* concise compromise and of translating it into excellent English.
- Further gratitude to Mr. W. Spitzberg and so many authors, whose papers and works gave me inspirations for my thinking over the matter, authors which maybe have not been mentioned in this text.
- Special thanks are due to Prof. J. Hölz (Vienna) and Prof. G. Grundke (Leipzig), who, many years ago, gave first stimulations to deal with commodity science and technology and with Beckmann and Sarton.
- I owe much encouragement to Japanese scientists, to scientist and Friends of the international Johann Beckmann Society (Hoya/Weser) and especially to Prof. U. Troitsch (Hamburg) during pacing my way.
- Last but not least, from the bottom of my heart I thank Mrs. Marie Gekeler, who for so many years showed much understanding and made so many sacrifices for my intense dealing with the whole of the matter.

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Text translated by F. Lox, I. Mielewski and H. Lox.
Figures translated by W. Spitzberg, O. Gekeler and adapted by F. Lox.

LAUDATIO MAURITS DE VROEDE

*K. De Clerck**

In June 1943 Maurits De Vroede (who was only just 21) obtained an M.A. in history at the State University of Ghent. Being successively employed as a teacher at several secondary schools and at a teachers' training college for a considerable time, he nevertheless continued to do scholarly research. The results regularly appeared in journals and in book form. In 1957 De Vroede got his Ph.D. and in 1970 he gained the degree of "geaggregeerde voor het hoger onderwijs". From 1972 onwards he held a chair at the Catholic University of Louvain, where he was given emeritus status in 1987.

Generally spoken, the work of Maurits De Vroede can be devided into three parts :

1. the history of the Flemish movement and the relations between Belgium and the Netherlands;
2. the history of the press;
3. the history of education, which became, since the 1960s, his favorite field of research.

As far as parts one and two are concerned, De Vroede did a considerable amount of pioneering work by studying new records. In view of the history of education he published in 1970, as the result of an intensive study, an important book on teacher training in Belgium and Luxemburg mainly during the first half of the XIXth century. This work shows, at least embryonically, a clear preference for the social approach in the history of education. Later on his conception of socio-historical research in education was given concrete form in numerous and often international publications. One of the most significant contributions to the Belgian educational

* Ghent, March 3, 1989

historiography is undoubtedly the publication of an impressive inventory and characterization of the educational press in Belgium from 1817 onwards — a project under the editorship of De Vroede that started in 1970 and was completed in 1987. It was the result of a close cooperation of many years' standing between the departments of history of education of Louvain and Ghent.

De Vroede has always been in close contact with researchers from all over the world. In order to stimulate the international dialogue, he has founded the "Belgisch-Nederlandse Vereniging voor de Geschiedenis van Opvoeding en Onderwijs" and the "International Standing Conference for the History of Education".

We are pleased to present Maurits De Vroede with the SARTON MEDAL as a token of our recognition.

DE LA PEDAGOGIE AUX SCIENCES DE L'EDUCATION.

L'évolution en Belgique au cours de l'entre-deux-guerres

Maurtis De Vroede

L'objet de cette communication se situe sur le terrain de l'histoire des sciences de l'éducation. J'essaierai de répondre à deux questions : 1° au cours de l'entre-deux-guerres, la pédagogie se présentait-elle comme une discipline autonome, ou était-elle en train de se constituer comme elle ?; 2° comment était-elle considérée, par rapport à d'autres sciences ? Je me limiterai cette fois-ci à la Belgique, en renvoyant à une étude en préparation sur l'évolution internationale de la recherche expérimentale en éducation (1).

En 1920, Jean Demoor et Tobie Jonckheere, professeurs à l'Université Libre de Bruxelles (2), publièrent un livre sur *La science de l'éducation*. En dépit de son titre, il contient la phrase suivante : "La science pédagogique n'est pas encore définitivement constituée en discipline particulière et est rarement envisagée dans son ensemble" (3). La rédaction de ce livre déjà achevée en 1915, le témoignage se rapporte à la situation d'avant-guerre.

Au cours des deux dernières décennies avant la première guerre mondiale, une nouvelle science s'était développée sur le plan international et non le moins en Belgique : la pédologie, étude scientifique et intégrale de l'enfant (4). A ce caractère intégral, les pédologues y prétendaient du fait que, d'un côté, ils voulaient étudier l'enfant individuel sous tous ses aspects et pendant toutes les phases de son développement et que, de l'autre côté, ils voulaient englober dans leurs recherches tous genres d'enfants, les déficients aussi bien que les normaux. Ces recherches se voulaient scientifiques grâce à l'emploi de méthodes d'investigation dont les sciences physiques fournissaient le modèle, en d'autres termes grâce à l'observation systématique et à l'expérimentation. De cette façon la pédologie prétendait se substituer à la pédagogie traditionelle, à laquelle elle reprochait de n'être qu'empirique, de se trouver enlacée dans la métaphysique et la philosophie spiritualiste et de partir d'idées préconçues, de sorte que ses dires manquaient tout fondement solide. D'après le mot bien connu de Binet, datant de 1898, ce n'était guère plus que du verbiage (5). Par contre, à une pédagogie moderne l'avenirserait assuré si elle suivait le chemin des sciences exactes. Cela lui permettrait de prendre place à côté de la chimie, de la physique et d'autres sciences respectables (6). Seule une pédagogie scientifique — pour autant qu'on voulait encore maintenir le terme "pédagogie" — pourrait servir de fondement à une pratique éducative rationnelle.

Les recherches pédologiques des années 1890 et 1900 étaient multidisciplinaires. Elles étaient l'affaire de psychologues, de docteurs en médecine, de psychologues et de pédagogues. Elles se situaient surtout sur les terrains de la psychologie psychologique et de la psychologie pédagogique. Toutefois, les résultats ne correspondaient pas à l'attente. Ils souffraient du fait que les méthodes d'investigation restaient souvent déficientes et ne présentaient guère d'homogénéité. On était à même d'éclairer certains aspects de l'objet — l'enfant pris comme phénomène naturel —, mais on ne réussissait pas à le reconstruire dans sa complexité indivisible de sujet vivant. En 1909, Binet parlait déjà d'une manière tout autre que onze ans plus tôt. Tandis qu'il comparait la pédagogie traditionnelle à une vieille carriole qui grinçait et avançait bien lentement, mais qui enfin marchait, comment lui paraissait la nouvelle ? "La pédologie a l'aspect d'une machine de précision, d'une locomotive mystérieuse, brillante, compliquée et qui au premier aspect frappe d'admiration; mais les pièces semblent ne pas tenir les unes aux autres et la machine a un défaut, elle ne marche pas..." (7). En Belgique même, le bilan dressé tout de suite après la première guerre mondiale, était négatif. La pédologie en était encore à ses débuts. Si elle avait produit déjà quelques résultats, ceux-ci n'étaient que provisoires. D'après des pédagogues renommés comme le professeur François Collard, de Louvain, ou l'inspecteur Jules Renault, ils apportaient peu de nouveau et n'étaient certainement pas de nature à détrôner la pédagogie classique (8).

La pédagogie scientifique, en effet, n'avait pas encore atteint le stade de la maturité. Basée sur l'expérience personnelle et la sagesse accumulée au cours des siècles, la pédagogie traditionnelle continuait à déterminer la pratique éducative. Après 1918 la pédagogie scientifique était non seulement regardée avec méfiance, mais elle répugnait même certains esprits, qui s'obstinaient à préférer l'empirisme. En Flandre, un représentant notoire de cette tendance était Edouard Peeters, polygraphe et rédacteur influent, depuis 1920, de la revue *Het Schoolblad voor Vlaanderen.* Dans cette revue (9), ainsi que dans d'autres publications (10), il ne laissait subsister aucun doute sur l'opinion qu'il s'était faite sur les thèses, élaborées par des docteurs très savants dans leurs chambres d'étude et leurs laboratoires. Pour lui, le fait que des savants, "de grands esprits, de puissants génies", s'occupaient de l'enseignement, était très grave. Envers et contre tout, ils se lançaient dans des généralisations indues, tandis qu'ils n'avaient aucune notion du champ pratique. La pratique éducative n'était guère une question de théorie pédagogique, de didactique ou de psychologie. L'expérience et l'intuition suffisaient. L'art d'éduquer était inné. La connaissance de l'enfant s'obtenait par l'analyse introspective et les souvenirs personnels d'enfance. Au contraire, c'est avec la plus grande prudence qu'il fallait accueillir ce que les épreuves de laboratoires avaient produit.

Peeters n'était pas le seul a émettre une telle opinion. Prenons un autre exemple. En 1923, le professeur d'école normale Léon Breckx, qui serait promu docteur en Sciences de l'Education en 1931 et, quatre ans plus tard, deviendrait président de la Fédération du personnel des écoles normales de l'Etat, avançait que la psychologie de l'enfant était surestimée et que, pour connaître l'enfant, la connaissance de soi-même, sur laquelle se basait l'ancienne pédagogie, resterait le facteur essentiel. D'après lui aussi, les enseignants devaient s'en tenir à l'empirisme (11). Des manuels comme ceux d'Albéric Decoene (12) et d'Alphonse Staelens (13), ou de l'inspecteurs Guillaume Siméons (14), datant de 1921 et 1922, ne sortaient pas des lignes traditionnelles. A de tels produits pouvait s'aplliquer ce que Raymond Buyse (15), un promoteur de la pédagogie scientifique dont nous parlerons plus amplement, écrit en 1935 : "Pour nous résumer, nous dirons qu'en pédagogie empirique tout a été dit, fort agréablement redit, très subtilement contredit..., mais que rien, ou prou, n'a été prouvé. C'est bien le pays des aveugles où les borgnes sont rois !" (16). Plus tard encore, on a pu déplorer que trop de pédagogues continuaient à édifier tout l'art d'enseigner sur leur expérience personnelle et à baser leurs méthodes sur des opinions et non sur des faits (17).

A côté de l'intuition et de l'expérience personnelle, il y avait l'héritage d'anciens pédagogues, comme par exemple un Quintilien ou un Bossuet. Ceux qui y puisaient n'étaient pas non plus en faveur chez un homme comme Buyse. Il caractérisait les "historiens" de la pédagogie comme étant avant tout "des érudits, qui, très fiers de leurs connaissances livresques, s'ingèrent d'interpréter, avec pédanterie le plus souvent, la pratique actuelle des écoles en termes de doctrines anciennes" (18). D'un point de vue contemporain on peut affirmer, en effet, qu'à l'époque, l'histoire de l'éducation, hormis l'histoire scolaire dans le sens strict, ne représentait guère plus qu'une analyse a-historique d'idées et de systèmes pédagogiques. Durant l'entre-deux-guerres, elle a gardé ce caractère.

En second lieu il y avait une pédagogie qui, quoique gardant en honneur les classiques, présentait des tendances de réforme et s'inspirait des réalisations du mouvement des écoles nouvelles ainsi que de données, plutôt discutables d'ailleurs, fournies par la biologie, la psychologie ou la sociologie. C'était ce que Buyse appelait "une pédagogie expériencée (prise au sens bergsonien du mot, et aussi dans l'acceptation de James)". Elle avait beau se déclarer discipline scientifique, elle ne l'était pas. Elle négligeait l'évaluation expérimentale de ses initiatives pédagogiques. Ses représentants, comme un Jan Ligthart ou un Léon Tolstoï, étaient des personnes généreuses, entièrement vouées à l'oeuvre sociale de l'éducation, mais leur pédagogie était "une pédagogie d'artistes, s'élaborant sous le signe d'un impressionnisme exacerbé" (19). Il faut toutefois remarquer que cette nouvelle pédagogie n'excluait pas la recherche expérimentale, et vice versa. Elle a également activé l'attention portée aux problèmes de l'éducation.

Cette attention s'est nettement renforcée sous l'effet de la première guerre mondiale. Vu la baisse de la moralité, la nécessité d'une bonne éducation morale et civique était accentuée de maint côtés. La guerre avait illustré l'importance de la force de résistance physique. La santé nationale demandait donc toute la sollicitude possible, les effets de l'hygiène et de l'éducation physique étant soulignés. En 1919 fut fondée l'Oeuvre Nationale de l'Enfance, institution publique qui fut chargée de promouvoir la protection et les oeuvres de l'enfance (20). Beaucoup de médecins ont prêté leur concours aux activités de cette institution, ce qui était, en fait, la continuation des initiatives prises déjà avant la guerre. Dès la fin du siècle, en effet, les médecins s'étaient engagés dans la lutte contre la mortalité infantile, dans la campagne pour améliorer la nutrition et les soins à donner aux nourrissons, campagne menée entre autres par la Ligue nationale belge pour la protection de l'enfance du premier âge, fondée en 1904 (21), et par la Fédération générale des sages-femmes de Belgique, datant de 1913 (22). Après la guerre, cette action s'est élargie. C'est dans ce cadre que se sont développées la puériculture et la pédiatrie (la Société belge de pédiatrie fut fondée en 1923) (23). C'est dans ce cadre également que le mouvement hygiéniste a pris de l'envergure, englobant tout aussi bien l'hygiène mentale que corporelle. Ce fut un médecin, le docteur Auguste Ley (24), qui, en 1922, fonda la Ligue nationale belge d'hygiène mentale. Avant la guerre, des médecins avaient aussi agi en faveur de l'hygiène scolaire. Après la mise en place de l'inspection médicale scolaire — la loi fut votée en 1914, l'arrêté d'exécution date de 1921 — ils en étaient chargés partout, au moins dans les villes et communes qui ne négligeaient point l'organisation de cette inspection.

Quoique la préoccupation des médecins se soit portée principalement vers les soins corporels et la croissance biologique, ils ne se sont pas désintéressés d'autres questions qui avaient rapport à l'éducation. D'après le docteur Ley, les médecins devaient même jouer un rôle *pédagogique* important (25). C'était une opinion qu'on saisit en constatant que les soins hygiéniques étaient assimilés à l'éducation (26). Par rapport à l'éducation, un bon nombre de médecins semblaient avoir des idées biologistes, partagées d'ailleurs par certains hommes d'école. On affirmait même que la biologie était le fondement de la pédagogie (27), une conviction qu'on recontre par exemple, après tout aussi bien qu'avant la guerre, au sein de l4association médico-pédagogique liégeoise (28). Plus encore, Demoor et Jonckheere — le premier physiologue, docteur dès sciences et en Médecine, le second homme d'école —, dans le livre cité au début, parlaient de "la pédagogie, branche de la biologie" (30). Néanmoins, pris dans son ensemble, le livre même fait croire que se qui vient d'être cité était une erreur. En effet, aux première et deuxième parties, consacrées respectivement aux bases biologiques et au système nerveux, succédait une troisième dans laquelle quelques données de psychologie expérimentale étaient présentées et, enfin, Jonckheere y ajoutait une quatrième partie sur "l'évolution de l'école", qui n'avait guère de rapport avec les trois premières. Dans l'introduction il était dit d'ailleurs, que la connaissance de l'enfant ne pouvait résulter que des recherches expérimentales physiologiques *et* psychologiques (31).

Les programmes des écoles universitaires de pédagogie (32) des années vingt et trente incluaient la biologie et la physiologie. Dans les nouveaux manuels on retrouve également ces disciplines (33). Apparamment, il était devenu évident que les sciences de l'éducation devaient englober ces disciplines, mais en même temps qu'elles ne pouvaient prétendre à en être les seuls éléments constitutifs (34).

En fait, il y avait aussi, après comme avant 1914, l'apport de la psychologie. Au cours de l'entre-deux-guerres, son importance pour la pédagogie ne s'est certainement pas amoindrie. Seulement, quelle psychologie ?

Il n'est pas aisé de se retrouver dans les différents courants psychologiques de l'entre-deux-guerres (35), ni de savoir ce qu'ils valaient aux yeux des pédagogues. En vue des questions posées au début de cet article, nous voudrions quand même relever quelques phénomènes.

Si en physique l'idée d'une opposition entre une approche rationnelle et une approche expérimentale était abandonnée depuis longtemps, en psychologie les deux tendances continuaient à s'affirmer. La psychologie expérimentale étudiait et expliquait le déroulement des phénomènes physiques, tandis que la psychologie rationnelle, ou philosophique, tâchait d'approfondir l'essence de l'âme; elle recherchait les derniers fondements de l'homme et formulait une réponse aux questions de son origine, de sa nature et de sa destinée. Confronté avec cette dualité, le milieu pédagogique se trouvait divisé.

Selon l'opinion catholique (36), la psychologie expérimentale apportait des données qu'on ne pouvait pas nier, mais cela n'était guère suffisant : elle restait muette sur les problèmes fondamentaux de la vie humaine et ne pouvait donc définir le but de l'éducation ni poser les fondements de sytèmes ou de normes pédagogiques. Il fallait donc la compléter par la psychologie philosophique (ou métaphysique). C'est ici qu'on rencontre le rejet d'une science strictement positive, une "science de l'âme sans âme", émanant d'une conception positiviste de l'homme et de la science. Inutile de dire que pour les catholiques leur vision était la seule valable. Frans De Hovre (37), qui en Flandre donnait le ton sur le terrain de la théorie pédagogique, résumait la conviction catholique dans la formule suivante : toute pédagogie se fonde sur une conception de la vie, une pédagogie véritable se fonde sur une conception totale de la vie, la vraie pédagogie se fonde sur la vraie conception de la vie. Seule la pédagogie catholique avait en vue la formation totale de l'homme.

Du côté non catholique (38), on répliquait que la conception de la vie, et donc les buts transcendentaux de l'éducation relevaient d'un choix personnel. Les buts à poursuivre et le procédés techniques ne devaient pas se confondre. Il fallait faire la distinction entre éducation et enseignement, entre formation et instruction. Reconnaître la primauté du premier élément ne pouvait empêcher que le second reçoive l'attention nécessaire. En tout cas, seule la recherche *scientifique* pouvait expliquer la nature de l'enfant et déterminer les méthodes adéquates pour développer ses dons naturels et lui faire apprendre certaines connaissances ou certaines techniques. Il était donc parfaitement possible de travailler — et même de collaborer comme le faisaient, par exemple, Decroly et Buyse — en dehors des convictions philosophiques.

On ne peut nier qu'à ses débuts la psychologie expérimentale était d'inspiration naturaliste. Elle partegeait la foi dans les possibilités infinies de la science. Tandis que la physique dévoilerait tous les secrets de la nature, la psychologie nouvelle, débarrassée des liens théologiques ou philosophiques, allait élucider les énigmes du sphinx humain. Dans un premier temps, la psychologie strictement scientifique tendait à devenir une science naturelle. L'associationnisme répondait à cet idéal : on tâcherait de découvrir les éléments de la vie psychique et les lois de leurs combinaisons, donc d'analyser et de décrire ce qui s'y déroule. Toutefois, dans l'entre-deux-guerres, on pouvait constater qu'au cours de son existence relativement courte, la psychologie expérimentale avait déjà subi des changements profonds — nous y reviendrons dans un instant —, mais aussi qu'elle n'avait pas réussi à résoudre ni à chasser les vieux problèmes philosophiques (39). Il nous semble qu'en dehors du milieu catholique aussi, on s'en est rendu compte. Bien caractéristique nous paraît à cet égard l'allocution de Léopold Levaux, président de l'Institut supérieur de Pédagogie de Liège, lors de la célébration du dixième anniversaire de cet institut, en 1939. C'était très beau ce que Cattell, Binet, Rossolimo, Decroly, Montessori, Claparède, Dewey et Piaget avaient fait, mais "ils n'ont pas rompu pour autant l'enchaînement vital qui relie l'éducation à la nature et à la portée philosophiques de l'homme, ils n'ont pas supprimé la question primordiale de *l'homme*. Cette question, c'est la question même du but. Or, en toutes choses, c'est le but, c'est la *fin* qui prime" (40). Quoique cela dépasse notre cadre chronologique, nous aimerions relever que dans le milieu universitaire liégeois cette opinion n'a pas disparu. En 1953, lors de la célébration du vingt-cinquième anniversaire de l'Institut, son président, Arnould Clausse, en se livrant à une sorte d'examen de conscience, reconnut que la recherche scientifique avait produit des résultats remarquables, mais il ne manqua pas de se demander si l'on n'avait pas perdu de vue la finalité de l'éducation. La pédagogie, restant toujours une science normative, ne vaudrait jamais que comme instrument au service des objectifs qu'il fallait réaliser. Or, ces objectifs restaient à degager clairement. Les instituts pédagogiques devaient donc s'intéresser à une philosophie de l'éducation. Et Clausse de s'expliquer : "J'entends par là qu'il est indispensable que, par-delà ou en-deça (sic) d'une métaphysique et d'un fidéisme subjectif où chacun apporte la noblesse de ses aspirations, nous nous demandions ce qu'est l'homme d'aujourd'hui, sous quelles formes il se présente à nous, quelles sont ses exigences particulières et ses besoins. Bref, il nous faut savoir dans quel sens doit s'orienter notre action pour que l'homme, quelle que soit la destinée ultérieure que nous lui assignons, remplisse dans notre société, en évolution constante et rapide, sa mission d'homme" (41).

D'un autre côté, dans le milieu catholique, l'attention ne s'est pas seulement portée vers la psychologie rationnelle, mais aussi vers l'approche expérimentale. La critique des méthodes de recherche n'est pas restée absente, et quant aux résultats il fut encore dit, au début des années vingt, qu'ils ne faisaient que confirmer ce que l'ancienne scolastique avait déjà avancé (42). N'empêche que les catholiques ont de plus en plus fait appel à la psychologie expérimentale, qu'ils considéraient comme indispensable pour mieux connaître l'enfant et comme utile pour le traitement de problèmes concrets, posés par la pratique de l'éducation et de l'instruction. Les progrès de la science ne pouvaient pas laisser indifférents les pédagogues catholiques. Si l'on parcourt les volumes des deux revues pédagogiques catholiques qui donnaient le ton, le *Vlaamsch Opvoedkundig Tijdschrift* et la *Revue belge de pédagogie* (43), on constate qu'elles ont consacré beaucoup de pages à la psychologie expérimentale. Dans la dernière revue, cet intérêt fut nourri surtout par le professeur louvaniste Arthur Fauville; dans la première, par différents collaborateurs, parmi lesquels le professeur gantois Frans Fransen et, au cours des années trente, l'inspecteur Victor D'Espallier (44). Il est frappant de constater que les rédacteurs de la revue flamande, Frans De Hovre et Albéric Decoene, continuaient à accentuer la force de la vision catholique et l'excellence d'une formation spirituelle chrétienne, mais en même temps ils informaient leur public sur les personnalités controversielles. Quoique sceptiques à l'égard de l'orientation vers les sciences exactes, comme ils la trouvaient par exemple chez Decroly (45), ils ne faisaient pas le silence. C'est surtout à la psychologie pédagogique que la revue attachait beaucoup d'importance, mais au cours des années trente, elle informait également ses lecteurs sur les nouveaux courants psychologiques. En 1936, D'Espallier, qui était nettement gagné pour la recherche scientifique (46), devint corédacteur et secrétaire de la rédaction. La *Revue belge de pédagogie*, sans mépriser la tradition, ne s'est pas moins occupée des recherches modernes en psychologie, ainsi qu'en pédagogie. Quoique formulant des critiques à certains égards, elle croyait pouvoir en attendre des résultats positifs (47).

Quelles données de la psychologie trouvait-on importantes du point de vue pédagogique ?

En ce qui concerne la psychologie générale, on était d'avis que la psychologie associationniste avait été de peu d'unitlité. Elle avait rassemblé beaucoup de matériaux et produit une meilleure compréhension de la nature de la vie psychique, mais à la pratique éducative elle n'avait offert que peu de points de contact. La dissection de l'âme s'était d'ailleurs avérée beaucoup plus difficile que celle du corps. Toutefois, dans les années vingt et trente, les temps où l'on pouvait comparer les psychologues aux anatomistes, étaient révolus. Déjà avant 1914 on avait pris de nouvelles directions. L'associationnisme pur avait fait son temps. On évoluait progressivement d'une psychologie des éléménts vers une psychologie de la totalité, on cherchait de plus en plus à pénétrer dans le noyau du phénomène physique, le moi qui anime toute vie consciente (48). On aspirait à faire des synthèses, à reconstruire des totalités. Avec cela se développait toute une série de psychologies. Les théories, les écoles et les courants devenaient presque aussi nombreux et divers que les psychologues mêmes. La psychologie des Formes, la psychologie de la structure, le personnalisme, l'eidétisme, la réflexologie, le behaviorisme, la psychanalyse, la psychologie individuelle, la psychologie analytique, la caractérologie, la typologie... que pouvaient en extraire les pédagogues, que pouvaient-ils en faire ? Cette diversité renfermait-elle quelque part le fondement de la pédagogie ?

La psychologie de la structure et les psychologies differentielle et génétique, pour autant qu'elles étaient relatives à l'enfant, apportaient des notions précieuses :

- l'enfant n'est pas un petit adulte; il n'a ni plus ni moins de capacité intellectuelle, il travaille d'une autre façon;
- l'évolution de l'enfant ne suit pas une ligne droite, elle présente des rythmes différents;
- son développement intellectuel est aussi influencé par le milieu et par son intérêt; il faut donc faire appel à ses intérêts croissants et changeants, ainsi qu'à l'enfant tout entier, parce que c'est toute sa personnalité qui réagit;
- la motorique joue un rôle important, puisque les difficultés que rencontre l'action se répètent sur le terrain de la pensée;
- la gangage et la pensée font un;

- les enfants, de même que les adultes, présentent des différences individuelles très prononcées.

De telles données avaient être utiles pour les pédagogues. Il faut toutefois faire remarquer que le secret des mécanismes de l'activité psychique des enfants n'avait pas été découvert et que la psychologie de l'enfant et de l'adolescent restait encore fragmentaire. On était à même de donner un large aperçu de leur développement, en se basant sur des résultats scientifiques (49), mais la psychologie de l'enfant — pensons entre autres à Charlotte Bühler et aux ouvrages de Jean Piaget datant des années vingt — étudiant principalement le jeune enfant, avant l'âge scolaire. Or, en vue de l'enseignement, ce dernier était le plus important. Cela n'empêche pas que la psychologie de l'enfant était d'une grande utilité pour connaître l'enfant jusqu'à la crise pubertaire (50).

Dans le domaine de la psychologie pédagogique, se rapportant à la psychologie de l'enfant en train d'apprendre, des résultats durables étaient également acquis, quoiqu'ils fussent encore fragmentaires. Les études sur les processus d'instruction mettaient beaucoup de choses au clair et étaient de nature à contribuer puissamment à l'élaboration de la didactique, mais cet espoir devait encore se réaliser. En psychologie pédagogique la manière de poser les problèmes manquait d'ailleurs d'unité (51).

Pour un éducateur la caractérologie pouvait avoir de l'intérêt, puisqu'il avait besoin de connaître un sujet concret. Dans les années trente, cette branche cadette de la psychologie attirait beaucoup de chercheurs, tant en Belgique que sur le plan international. L'accent mis sur la nécessité de la formation du caractère dans le cadre de l'éducation morale n'était pas étranger à ce phénomène. Le caractère, qui avait échappé le plus longtemps à la recherche expérimentale, était pourtant difficile à comprendre. Sur l'essence de la caractérologie, ses éléments et ses méthodes un consensus ne s'était pas encore dégagé (52).

Les typologies, les classifications des caractères sur la base d'observations, étaient extrêmement variées. Parmi la multitude de typologies proposées, de nature psychologique, psychocosmique ou psychophysique, pas une n'était à même de satisfaire tout le monde. Des choses amusantes ne manquaient d'ailleurs pas de se produire. Ainsi, par exemple, une lecture divertissante est offerte par un livre que les frères Paul et Camille Bouts, le premier ancien professeur d'école normale, le second licencié en Philosophie et docteur en Médecine, publièrent en 1931 sous le titre *La psychognomie. Lecture méthodique et pratique du caractère et des apitudes, base de la pédagogie individuelle.* La psychognomie, terme derivé de "psychè" et de "gnomè", y fut présentée comme une science neuve qui, quoiqu'elle dût encore créer pour une bonne part son vocabulaire technique, prétendait pouvoir diagnostiquer la personnalité individuelle en se basant sur des données externes : le crâne, le visage, l'écriture. Dans ce livre, qui a connu plusieurs éditions (53), on peut trouver entre autres une reconstitution de l'identité psychologique de Jules César, ou des conseils sur la manière de traiter les types triangulaires et ovoïdes.

Sur l'utilité des typologies, l'opinion était divisée. René Nihard, qui pendant vingt ans fut l'âme de l'Institut de pédagogie à Liège, n'y croyait pas beaucoup (54), tandis que D'Espallier y voyait un peu plus (55). Bien que même une typologie idéale ne pût saisir toute la personnalité humaine, la typologie fournissait, d'après lui, un schéma dont on pouvait se servir comme instrument pour atteindre le niveau individuel. Embarrassant restait pourtant le fait que les typologies, notamment les typologies de la personnalité, étaient normalement élaborées en fonction des adultes. Pouvait-on les appliquer aux enfants ? Y avait-il moyen de trouver chez des enfants, non encore arrivés au terme de la croissance, la structure essentielle de l'une ou l'autre typologie et d'en tirer au besoin des mesures pédagogiques ? La typologie n'était point une panacée qui d'un coup éliminerait toutes les difficultés à connaître l'homme, non plus qu'un fondement pour une théorie pédagogique.

La même chose était valable pour la psychanalyse. Sur le terrain de la psychologie les mérites de Freud furent pourtant reconnus. Il est vrai qu'en 1937, un chargé de cours à l'Université Libre de Bruxelles croyait encore devoir le défendre contre "certains représentants de la science officielle" qui se permettaient "de dénigrer, de déformer ou de mépriser en bloc la psychanalyse" (56), mais dès

1924, le renommé psychologue Albert Michotte Vandenberck, professeur à Louvain, avait fait entendre un autre son de cloche : le développement ultérieur de la psychologie serait considérablement influencé par le fait que Freud avait mis pleinement le rôle essentiel de la vie affective, de l'émotivité et des instincts; qu'il eût attiré l'attention sur l'unité de la vie psychique, n'était pas de moindre importance (57). Des cathalogiques, comme Frans De Hovre et Albert Kriekemans, reconnaissaient également les mérites de Freud sur le plan psychologique, mais il va de soi qu'ils condamnaient sa conception de l'homme et de la vie (58). Celle-ci représentait, selon l'opinion catholique, une des forces destructives les plus dangereuses de la société. Quant à l'éducation, la psychanalyse s'avérait inutilisable. La pratiquer sur des enfants ou des adolescent, était au moins un péché éducatif (59). De Hovre et Decoene partageaient d'ailleurs l'avis du théologien catholique de Fribourg, Linus Bopp, qui avançait qu'on ne pouvait guère parler d'une véritable pédagogie psychanalytique. La psychanalyse n'était pas en mesure de proposer un idéal pédagogique utilisable (60). La *Revue belge de pédagogie* et *L'Education familiale* étaient également de cet avis (61). De son côté, Fransen fit appel aux psychiatres et aux pédagogues afin qu'ils combattent certains systèmes de pédagogie psychiatrique ou de psychiatrie pédagogique, comme celui de Freud, qui relevant plutôt de la charlatanerie que de la science (62). Roger Piret, de Liège, dans le temps aspirant auprès du Fonds National de la Recherche Scientifique, parla dans le même sens, quoi-qu'il reconnût que, sous certains aspects, la doctrine freudienne avoit apporté une contribution intéressante à la psychologie de l'enfant (63). Il se peut que certaines sources nous aient échappé, mais dans la littérature belge des années vingt et trente, nous n'avons trouvé qu'un seul ouvrage écrit dans un autre ton : le livre que l'inspecteur cantonal Hilaire Deman, licencié en Sciences de l'Education, publia en 1934 sous le titre *Het kind en de adolescent in de psychoanalyse*. Un certain nombre de problèmes éducatifs difficiles et actuels y étaient traités à la lumière de la psychanalyse, laquelle, d'après Deman, était de nature à les éclairer d'un jour particulier. Il nota néanmoins qu'une pédagogie psychanalytique complète faisait défaut. A ce qu'on dit, le silence s'est fait sur son livre (64).

Reprenant maintenant la question de savoir si la psychologie moderne pouvait servir de base à la pédagogie, nous devons y répondre par la négative. C'était déjà impossible parce qu'on ne pouvait se passer d'autres disciplines, notamment de la philosophie de l'éducation, de la biologie et de la psychologie, mais même à part cela, les pédagogues ne pouvaient s'en remettre à la psychologie pour poser les fondements d'une pédagogie strictement scientifique. En effet, c'est une discipline propre qu'ils voulaient créer, non psychologique mais pédagogique et reconnaissable comme telle; une pédagogie scientifique, à distinguer des sciences apparentées et qui occuperait une place à elle dans le champ éducatif. Une telle discipline ne pouvait se réduire à une psychologie appliquée. Plus personne ne doutait que la psychologie expérimentale procurait des données utiles, mais elles n'étaient pas de nature à résoudre des problèmes essentiellement pédagogiques, notamment ceux que posait l'activité à l'école (65).

Alors, de quelle manière croyait-on pouvoir construire une telle science pédagogique ? Cette question impose la distinction entre contenu et méthode.

La science pédagogique devait s'appliquer à l'étude de problèmes spécifiques d'éducation et d'enseignement, comme par exemple : quelles sont les conditions (méthodes) les plus favorables au développement des potentialités naturelles de l'élève, ou à l'acquisition de connaissances théoriques ou de techniques ? "Quelle est la meilleure méthode pour enseigner telle branche donnée ? Quel est le niveau moyen atteint par les élèves de même âge, d'un même milieu ? Comment obtenir le rendement désirable avec le minimum d'efforts et de temps ? Quelle est la meilleure marche à suivre pour l'entraînement ? etc." (66). Il va de soi que ce champ de recherche n'était pas étranger à la psychologie pédagogique, mais de celle-ci il fallait distinguer une autre discipline : la didactique, ou l'étude des aspects techniques de l'enseignement. A ce qu'on disait, les lois psychologiques ne pouvaient pas se traduire en règles didactiques et les psychologues n'étaient pas qualifiés pour résoudre des problèmes de didactique (67). C'est aux pédagogues qu'il incombait de développer celle-ci, comme la subdivision de la pédagogie qui élaborerait les normes de la pratique concrète de l'enseignement, de sorte que l'art d'instruire évoluerait vers une technique à base scientifique. C'est surtout Raymond Buyse, auquel, dès 1926-1927, un cours de didactique expérimentale était confié à Louvain, qui s'est empressé de réclamer une place pour cette discipline, à côté de la psychologie pédagogique (68). Des deux réunies naîtrait la pédagogie scientifique, une science autonome englobant la psychopédagogie, au lieu d'une pédagogie se réduisant à une psychologie appliquée.

La création de la pédagogie scientifique, ayant comme objet des questions psychopédagogiques sinon proprement pédagogiques, y inclus les problèmes didactiques, posait comme condition sine qua non que les méthodes d'investigation fussent scientifiques, c'est-à-dire conformes au modèle généralement admis en science expérimentale. Plutôt que comme système, la pédagogie scientifique se présentait comme un mode d'étudier des problèmes pédagogiques. Sa méthodologie, notamment en vue de la recherche en didactique, fut largement exposée dans le livre que Buyse publia en 1935, sous le titre *L'Expérimentation en pédagogie*, selon D'Espallier le premier essai de ce genre en Europe (69). Dans la troisième partie, Buyse donnait aussi une série d'exemples de recherches didactiques expérimentales, pour démontrer les résultats féconds qu'elles pouvaient produire en vue de la pratique, ainsi que pour illustrer la méthode d'investigation.

L'étude expérimentale de problèmes pédagogiques se heurtait à de nombreuses difficultés spécifiques, notamment en ce qui concerne la didactique (70). Ici l'école et la classe servaient de laboratoire. La collaboration des praticiens y était nécessaire, et ceux-ci, on peut le dire, ne se distinguaient pas précisement par un esprit scientifique. Néanmoins, il fallait considérer la méthode expérimentale comme ce que Tobie Jonckheere appelait "la sauvegarde de la pédagogie" (71). Contrairement à ce que les pédologues avaient affirmé, il n'était point nécessaire de rejeter en bloc l'ancienne pédagogie, mais on devait la débarrasser d'une manière systématique des spéculations et des hypothèses qui trop longtemps avaient entravé son essor (72). "L'éducateur sera un observateur, ou il ne sera pas" (73). Cela ne revenait pas nécessairement à dire que le praticien, de par sa profession, devait entreprendre des recherches expérimentales, quoiqu'il ne lui fût pas défendu d'y aider. Il fallait néanmoins qu'il pût se rendre compte de ce qui était fait dans ce domaine.

Les efforts y déployés au cours de l'entre-deux-guerres, relevaient dans une large mesure du mouvement des test, dont l'essor était remarquable. L'impulsion venait du monde anglo-saxon, principalement des Etats Unis. En 1923, Decroly et Buyse attirèrent l'attention sur *Les applications américaines de la psychologie à l'organisation humaine et à l'éducation.* Ils rendirent compte de ce qu'ils avaient appris au cours d'un voyage d'étude, entrepris en 1922 grâce à la "Commission for Relief in Belgium, Educational Foundation". Cinq ans plus tard, afin de démontrer les avantages du recours à des tests, ils publièrent un gros volume sur *La pratique des tests mentaux.* En 1929 suivit leur *Introduction à la pédagogie quantitative. Eléments de statistique appliqués aux problèmes pédagogiques.* Cette publication se proposait de donner aux professionnels de l'enseignement les éléments nécessaires pour comprendre la méthode suivie dans une recherche pédagogique quantitative, et pour organiser un test, en calculer les données et en interpréter les résultats. Un peu plus tard, René Nihard publia un bon aperçu, *La méthode des tests pour initier les éducateurs.* Dans son livre de 1935, Buyse s'arrêta évidemment au traitement de données statistiques (75). De la main de Tobie Jonckheere et d'Albert Van Waeyenberghe suivit encore, en 1937, *Le problème des tests d'instruction. Essai de mise au point.*

Le nombre de tests dont on pouvait prendre connaissance était impressionnant. Il y en avait de toutes sortes : des tests individuels et collectifs, verbaux et non verbaux, ou, d'après leur objet, des tests d'intelligence, d'apitude, de caractère, de performance. Au début, toute une série d'objections furent formulées contre leur usage (76). Il était dit que beaucoup d'aspects de l'homme, et même l'intelligence, ne se prêtaient pas à être mesurés. Des tests pour mesurer les aptitudes diverses ou les fonctions intellectuelles ne pouvaient avoir qu'une valeur relative. Un examen à un moment statique était insuffisant pour évaluer les capacités mentales d'un individu. Si un test informait quelque peu sur le degré d'intelligence, il n'en donnait point une vue claire. Il n'y avait pas encore de tests d'aptitude qui avaient fait leur preuve comme l'échelle métrique de Binet-Simon et ses revisions.Du point de vue technique, les tests de caractère n'étaient pas aussi perfectionnés que les tests d'intelligence; pour l'examen des traits de caractère, la méthode des tests semblait donc encore de peu de secours. Quant aux test de connaissances scolaires, ils étaient de valeur inégale en rapport aux diverses disciplines et, pour la Belgique, on devait encore les mettre au point en grande partie. En effet, la difficulté la plus grande que posaient les tests, résultait de leur origine étrangère. Il n'était pas suffisant de les traduire en français ou en néerlandais. Il fallait un étalonnage nouveau, des moyennes pour le propre pays ainsi que des séries parallèles, mais les moyennes calculées restaient peu nombreuses et les parallèles faisaient encore défaut.

Malgré tout cela, des chercheurs belges se sont occupés de traduire des tests et d'en examiner la praticabilité. Cela fut le cas des tests pour jeunes enfants de Charlotte Bühler et de Hildegarde Hetzer (77), du test Binet-Simon et de la revision de Stanford (78), du test de groupe de Ballard (79), du test de lecture de Haggerty (80) et de quelques autres. On essayait de mettre au point des échelles appropriées pour la mesure de certaines connaissances ou techniques (81). Pour sa part, le docteur G. Vermeulen, qui allait devenir professeur à l'Université Libre de Bruxelles, essaya, en partant de Rossolimo mais à Propos d'enfant belges, d'obtenir un profil psychologique, comme une vue d'ensemble de la physionomie mentale d'un sujet. Toutefois, comme méthode d'analyse psychologique, son procédé ne pouvait résister à la critique (82).

Tous ces efforts nous montrent en tout cas qu'on croyait à l'utilité du nouvel instrument de recherche, quoiqu'il rendît moins de services pour le genre de recherches que la psychologie moderne était en train de développer. A condition que l'emploi en fût judicieux (83), on y vouyait beaucoup de possibilités. Elles se trouvaient, bien sûr, dans les domaines de la médico-pédagogie et de l'orientation professionnelle, mais aussi en dehors. Les tests d'intelligence rendraient plus facile et plus sûr le "dépistage" des enfants anormaux ou des mieux doués. En principe, ils permettaient aussi de former des groupes d'élèves qualitativement homogènes. Grâce aux tests de rendement scolaire on pouvait apprécier le niveau atteint pour un ordre donné de connaissances théoriques ou pratiques, faire le diagnostic des points faibles chez l'élève, contrôler le rendement d'une manière moins subjective que celle du système usuel d'examens, juger la valeur de diverses méthodes d'enseignement et perfectionner les techniques scolaires. Au fond, ce dernier aspect était le plus important des tests scolaires. La vérification expérimentale des procédés didactiques et le contrôle scientifique scolaire s'imposaient. Les appréciations qualitatives étant subjectives et peu précises, la mesure d'un rendement ne pouvait vraiment s'exprimer qu'en termes quantitatifs (84).

L'appel à l'usage des tests et à la statistique témoigne d'une nette tendance vers un esprit plus scientifique, une tendance qu'on ne constate pas seulement sur le terrain pédagogique. Citons par exemple, en guise de comparaison, l'ergologie, la science du travail, qui s'est développée pendant l'entre-deux-guerres. En Belgique, ce développement fut stimulé par le Centre belge d'études ergologiques, dont les débuts datent de 1922, et qui, dès 1927, comprenait un laboratoire et une école d'ergologie (85). Tandis que le taylorisme s'occupait seulement du côté technique du travail, en vue de la production, l'ergologie voulait également étudier le facteur humain dans le travail, ainsi que les facteurs sociaux, économiques, politiques, juridiques et éthiques. L'étude du facteur humain était l'affaire de la psychotechnique, basée sur la physiologie et la psychologie. En substance, les psychotechniciens voulaient reconnaître si un homme est propre au travail qu'on lui destine, découvrir les causes succeptibles de l'influencer et de faire varier son rendement et, en conséquence, le mettre à la place qui lui convient le mieux, et établir les conditions de travail les plus favorables à son efficience; bref, adapter l'homme au travail et le travail à l'homme (86). Parmi tous les genres de travail à l'étude, aucun n'étant d'ailleurs excepté, choisissons, pour nous y attarder un instant, le travail ménager, puisqu'il peut être mis en rapport avec l'éducation.

En effet, au sein de la Ligue de l'éducation familiale, fondée en 1900 (87), on se demandait si l'organisation scientifique du travail n'était pas applicable aussi à l'éducation familiale. Si les parents pouvaient se débarrasser de certaines tâches et gangner ainsi du temps et de l'énergie, n'arriveraient-ils pas à une éducation plus efficace de leurs enfants (88) ? Le pionnier de la Ligue, l'ingénieur Dr. Paul De Vuyst, haut fonctionnaire du ministère de l'Agriculture et promoteur de l'enseignement ménager, prit l'initiative de la création d'un Centre national d'études d'économie ménagère (89), initiative à laquelle José Drabs, professeur à l'Université Libre de

Bruxelles et codirecteur du Laboratoire d'ergologie, apporta son aide. Le Centre commença ses activités par un congrès organisé en août 1931 (90). Des personnalités en vue y prirent la parole et le ministre de l'Industrie, du Travail et de la Prévoyance Sociale, Henri Heyman, y participa. Le docteur Paul Sollier, fondateur du Centre belge d'études ergologiques, fit une conférence dont le résumé fut publié par après. Nous aimerions en citer ce qui suit :

"M. Sollier compara ensuite un ménage à une usine, à une manufacture, à un hôtel-restaurant, à un laboratoire et à un lieu de réunion. Aussi la ménagère doit-elle adopter dans une certaine mesure, les meilleures méthodes employées dans ces divers endroits.

Il est primordial qu'un horaire soit établi et observé. Non seulement chaque tâche sera chronométrée mais encore chacune des phases du même travail. La première obligation du psychotechnicien sera donc d'analyser et de chronométrer les diverses phases des travaux ménagers.

L'attitude que prend une femme lorsqu'elle accomplit une de ses obligations domestiques doit être également notée. Certaines positions sont plus exténuantes que d'autres. La fatigue sera mesurée par la quantité d'oxygène consommée pour effectuer un travail donné.

Enfin, le psychotechnicien proscrira tous les mouvements inutiles, superflus ou trop prolongés. Il déterminera ainsi le temps pour effectuer chacun d'eux afin d'obtenir le rendement optimum avec la moindre fatigue possible. Le standard de l'opération sera alors trouvé" (91). Etcétera.

Ajoutons encore que le congrès tint une de ses séances d'après-midi au Laboratoire d'ergologie. Au moyen de projections, Sollier y montra les attitudes rationnelles à prendre au cours des travaux ménagers, tandis que Drabs fit trois sortes de démonstrations — au laboratoire se trouvaient un bon nombre d'appareils — pour mesurer la force, la résistance, la dextérité et la mobilité qu'il fallait rencontrer chez une ménagère.

Le sens de l'efficience, la recherche du rendement maximal, telle était bien une des tendances principales de l'après-guerre (92). Comme dans la production et le ménage, le rendement fut aussi recherché dans l'enseignement. D'après le mot de Buyse : "Tayloriser l'instruction pour valoriser l'éducation" (93). Dans le domaine de l'éducation et de l'enseignement, la nouvelle pédagogie déclencherait une révolution pacifique, analogue à celle qui avait rendu possible les prodigieuses performances humaines sur le terrain de la technique (94). L'organisation méthodiques du travail, aussi bien intellectuel que manuel, était d'ailleurs considerée comme une garantie pour la paix sociale (95).

Reprenons maintenant, afin de conclure, la question de savoir ce que représentait la pédagogie au cours de l'entre-deux-guerres. C'était un mélange d'ancien et de nouveau, tout aussi bien quant au contenu que quant à la méthode. Cela se constate également lorsqu'on prend connaissance de la littérature pédagogique du temps. Elle était très hétérogène, formée de contributions de nature religieuse, morale, philosophique, historique, médicale, psychologique, didactique ou méthodologique. Le terme "pédagogie" ne couvrait pas une science simple, autonome, mais un conglomérat de disciplines diverses qui, de par leur objet, étaient liées au phénomène de l'éducation. Parmi elles, les disciplines nouvelles, expérimentales réclamaient pour elles seules le prédicat de "scientifiques". La philosophie de l'éducation se voyait exclue du terrain de la science pédagogique. Ce terrain fut réservé à la biologie, la psychologie et la didactique.

C'est ici que se constate la différence d'avec le paradigme péodologique d'avant 1914. D'après les pédologues, l'évolution de l'enfant dépendait de trois groupes de facteurs : biologiques, psychologiques et sociaux. La science de l'enfant devait donc se construire en partant de la biologie, de la psychologie et de la sociologie. La science pédagogique de l'entre-deux-guerres a retenu les deux premières et y a ajouté la didactique, en négligeant pour la plus grande partie la sociologie. Il est vrai que l'on retrouve l'idée (96) que, l'enfant étant un être social, son éducation doit aussi se baser sur des lois sociologiques et que, par conséquent, la sociologie pédagogique faisait partie de la pédagogie scientifique, ainsi que l'histoire de l'éducation. Pourtant, en Belgique, ce que l'on pourrait nommer une sociologie pédagogique ne s'est guère développé, ce qui est quand même surprenant pour une époque qui aimait à ressasser le slogan "L'école pour la vie, par la vie". On savait bien que le milieu aussi détermine l'évolution de l'enfant, on se préoccupait de la famille, considerée comme le noyau de la société, mais les rapports entre l'enseignement et la scoiété ne furent pas approfondis et reçurent relativement peu d'attention.

Au cours de l'entre-deux-guerres, la pédagogie a évolué vers une constellation de science de l'éducation, qu'il fallait concevoir comme complémentaires. C'est ainsi que Sylvain De Coster a pu nommer la pédagogie la "discipline de la complémentaire" (97). Cette évolution est bien caractérisée par le changement de nom que les instituts pédagogiques de Gand et de Liège ont subi en 1947. D'*écoles de pédagogie*, ce qu'ils étaient depuis leur fondation en 1927, ils furent rebaptisés en *instituts des sciences de l'éducation*. Et encore n'obtinrent-ils pas ce qu'ils désiraient (98), c'est-à-dire un changement comme il s'était produit à l'univeristé catholique de Louvain : en 1944, l'*Ecole de pédagogie et de psychologie appliquée à l'éducation*, comme elle s'appelait depuis sa fondation en 1923, changea son nom en celui d'*Institut de psychologie appliquée et de pédagogie*. Que n'y a-t-il pas dans un nom (99) ? En fait, pendant l'entre-deux-guerres, la psychologie était la discipline la plus importante, tandis que la didactique expérimentale se frayait lentement son chemin. En 1954 encore, Joseph Emile Verheyen, professeur à l'Université de Gand, crut devoir mettre en garde contre ce qu'il appelait l'exagération et l'erreur de considérer la pédagogie comme de la psychologie appliquée, ce que certains psychologues avaient fait les dernières années (100).

Au point de vue institutionnel, la pédagogie moderne de l'entre-deux-guerres se voyait soutenue par tout un réseau : des associations, des laboratoires, des instituts universitaires ou non universitaires, des périodiques. Elle fut incorporée dans les programmes universitaires, ce qui n'était pas le cas dans beaucoup de pays européens. Pourtant, est-ce à dire que sa place à côté d'autres sciences était reconnue ? Au cours de l'été de 1935, alors que l'Ecole de pédagogie louvaniste avait déjà douze ans, une réunion d'anciens étudiants de toutes les facultés eut lieu dans la ville universitaire. A des étudiants qui faisaient fonction de commissaires, Victor D'Espallier demanda, mine de rien, ce qu'était donc cette pédagogie mentionnée au programme des fêtes. L'un deux, un étudiant de dernière année, lui répondit en toute sérénité : "Un pédagogue, c'est quelque chose dans le genre d'un vétérinaire". D'Espallier, prenant la chose au sérieux, rendit compte de l'incident et ne manqua pas d'ajouter que ce n'était pas un cas unique, au contraire, que de sa propre expérience il pouvait en citer plusieurs (101). A nous-même il n'a pas été difficile de retrouver de nombreuses plaintes du même genre, émanant de pédagogues de Gand, de Liège et de Bruxelles, et se situant avant ou peu après la seconde guerre mondiale (102). Malgré le courant expérimental, les milieux académiques étaient encore loin de considérer la pédagogie comme une vraie discipline scientifique, tandis que ses représentants n'échappaient pas à un complexe d'infériorité. Dans l'enseignement moyen, la situation n'était guère différente. Les professeurs d'athénée et de collège pouvaient fort bien s'en passer. La pédagogie, c'était bon pour les primaires, mais pour eux ? Un professeur d'humanités à qui on parlait de pédagogie — s'en occupait-il quelque peu ? — ne manquait généralement pas de fixer son interlocuteur d'un regard étrange, qui exprimait sa commisération et la conscience de sa supériorité (103).

A tort ou à raison, on pouvait attendre qu'un changement de mentalité se produirait, entre autres, grâce aux premiers contingents de licenciés et de docteurs, diplômes par les divers instituts. C'est là, en effet, qu'on devait former ce que Buyse appelait des ingénieurs scolaires, des gens capables *et* de faire des recherches *et* de réaliser des choses pratiques (104). La question se pose donc de savoir, ce qu'en fait les sciences de l'éducation ont représenté pour les praticiens. Il nous est impossible d'y répondre ici. Formulons simplement l'hypothèse que la réponse, très nuancée, serait formulée plutôt dans un ton mineur.

NOTES

(1) M. Depaepe, A comparative history of paidology and experimental pedagogy in Western Europe and the United States, 1890-1940.

(2) Voir les références dans M. De Vroede, J. Lory & F. Simon, *Bibliographie de l'histoire de l'enseignement préscolaire, primaire, normal et spécial en Belgique 1774-1986* (Louvain, 1988) 90 et 93.

(3) J. Demoor & T. Jonckheere, *La science de l'éducation* (Bruxelles, 1920) 364.

(4) Cf. M. De Vroede, Die Anfänge der wissenschaftlichen Pädagogik (Pädologie) in Belgien von etwa 1895 bis 1914, *Zeitschrift für Pädagogik*, 14. Beiheft (1977) 159-174; M. Depaepe, Science, technology and paedology. The concept of science at the Faculté internationale de pédologie in Brussels (1912-1914), *Scientia Paedagogica Experimentalis*, XXII (1985) 14-29; ID., Le premier (et dernier) congrès international de pédologie à Bruxelles en 1911, *Le Binet Simon*, LXXXVII, 612 - III (1987) 28-54; ID., Social and personal factors in the inception of experimental research in education (1890-1914) : An exploratory study, *History of Education*, XVI (1987) 275-298.

(5) A. Binet & V. Henri, *La fatigue intellectuelle* (Paris, 1898) 1.

(6) M.C. Schuyten, Voorwoord, *Paedologisch Jaarboek*, I (1900) VII-VIII.

(7) Cité par R. Buyse, Etude critique sur les origines de la pédagogie moderne, in : *Questions actuelles de pédagogie* (Juvisy, s.d. [1931]) 177-178.

(8) F. Collard, *Histoire de la pédagogie* (Bruxelles, 1920) 616; J. Herbé (= J. Renault), Pédagogie et pédologie, *Revue de l'éducation familiale*, XVIII (1921) 168-173.

(9) Cf. M. De Vroede e.a. *Bijdragen tot de geschiedenis van het pedagogisch leven in België in de 19de en 20ste eeuw*, vol. IV, 1 (Louvain, 1987) 536-538.

(10) E. Peeters, *De opvoeding van den opvoeder* (Bruxelles, s.d.); ID., *Vrije uitingen van een schoolmeester* (Nimègue - Bois-le-Duc -

Anvers, 1920) 7-8 et 90-100.

(11) L. Breckx, Over introspectie of zelfdoorvorsching, *Vlaamsch Opvoedkundig Tijdschrift*, V (1923-1924) 284-289.

(12) Voir sur lui la littérature reprise dans De Vroede, Lory & Simon, *o.c.*, 81-83.

(13) A. Decoene & A. Staelens, *Inleiding tot de opvoedkunde* (Gand-Louvain-Leyde, 1921).

(14) G. Siméons, *Cours de pédagogie théorique et pratique à l'usage des élèves des écoles normales primaires et moyennes et des membres du personnel enseignant* (Tamines, 1922).

(15) Voir A. Bonboir e.a., *L'oeuvre pédagogique de Raymond Buyse* (Louvain-Bruxelles, 1969).

(16) R. Buyse, *L'expérimentation en pédagogie* (Bruxelles, 1935) 48.

(17) *Cahiers de pédagogie*, III, 1 (juillet 1937) 4.

(18) Buyse, *Expérimentation*, 124-125.

(19) Cf. *ibid.*, 49-52.

(20) Cf. De Vroede e.a., *o.c.*, 396-444 et 734-756; K. Vermeylen, Moeder- en kinderzorg in het Nationaal Werk voor Kinderwelzijn (1919-1940), in J.J.H. Dekker e.a. (réd.), *Pedagogisch werk in de samenleving. De ontwikkeling van professionele opvoeding in Nederland en België in de 19de en 20ste eeuw* (Louvain, 1987) 39-46.

(21) Cf. De Vroede e.a., *o.c.*, vol. III, 1 (Gand-Louvain, 1976) 943-947.

(22) Cf. *ibid*, vol. III, 2 (Gand-Louvain, 1978) 1758-1761.

(23) Citons, parmi d'autres, les ouvrages des médecins E. Cordier,

Vademecum de puériculture à l'usage des futures mères, des mères et des personnes chargées de les conseiller (Bruxelles, 1918); P. Dascotte, *Puériculture, hygiène scolaire et professionnelle, premiers soins aux malades et aux blessés* (Mons, 1915), P. De Sagher, *Cours de puériculture. Hygiène de la première enfance* (Liège, 1922), A. Delsemmes, *Ce que toute jeune mère doit savoir. Hygiène de la première et de la seconde enfance* (Liège, 1923), L. Ga rot, *Méthodes actuelles de puériculture* (Liège, 1934). Ces ouvrages ont connu plusieurs édition.
Il y avait aussi des revues de vulgarisation, comme *Maman* et *Voor moeder en kind*; cf. De Vroede e.a., *o.c.*, vol. IV, 2, 1088-1090 et 1219-1221.

(24) 1873-1956. Médecin en chef du sanatorium Fort-Jaco, à Uccle, professeur à l'Université Libre de Bruxelles.

(25) B. wartelé, *Auguste Ley. Zijn bijdrage tot de gehandicaptenzorg* (mémoire de licence inédit, K.U. Leuven, Fac. de Psychologie et des Sciences de L'Education, 1979) 100-104.

(26) De Vroede e.a., *o.c.*, vol. III, 2, 1451. Voir aussi la critique de Maurice Rouvroy, S.O.S. de maman, *L'education familiale*, XXXI (1934) 395.

(27) Voir la contribution de Fernand Marquebreucq dans la *Revue mensuelle [de l'] Oeuvre Nationale de l'Enfance*, II (1920-1921) 1089-1090.
Marquebreucq était professeur d'éducation physique à Bruxelles et l'auteur de *Recherches sur la croissance, les exercices et les jeux des enfants en âge d'école (de six à dix-sept ans). Applications pratiques* (Bruxelles, 1921).

(28) Cf. De Vroede e.a., *o.c.*, vol. III, 2, 1552-1565; A. Tengrootenhuysen, *De "Association médico-péda gogique liégeoise" (1911-1939)*, (Mémoire de licence inédit, K.U. Leuven, Fac. de Psychologie et des Sciences de l'Education, 1982).

(29) Demoor & Jonckheere, *o.c.*, 7.

(30) Voir sur lui : *Manifestation en l'honneur de Monsieur Jean Demoor, professeur à l'Université de Bruxelles, memebre titulaire de l'Académie royale de Médecine de Belgique, à l'occasion de son élévation à l'honorariat, 1899-1937* (Bruxelles, 1937), ainsi que les ouvrages repris dans De Vroede, Lory & Simon, *o.c.*, 90.

(31) Demoor & Jonckheere, *o.c.*, 6.

(32) Sur Bruxelles : Le XXVième anniversaire de l'cole de Pédagogie de l'Université de Bruxelles. Séance académique du 13 décembre 1946, *Revue des sciences pédagogique*, VIII, 36 (déc. 1946) 97-124; T. Jonckheere, Ecole de pédagogie, in *l'Université de Bruxelles 1909-1934* (Bruxelles, 1934) 169-179; sur Gand : J.E. Verheyen, *Het Hoger Instituur voor Opvoedkundige Wetenschappen te Gent. Terugblik en toekomstperspectieven* (Gand, 1954); L. Druwe, *Zestig jaar pedagogiek aan de rijksuniversiteit te Gent* (mémoire de licence inédit, Univ. de Gand, Fac. de Psychologie et des Sciences de l'Education, 1987); sur Liège : XXVe anniversaire de l'Institut Supérieur de Sciences pédagogiques de l'Université de Liège (21 et 22 novembre 1953), *Cahiers de pédagogie et d'orientation professionnelle*, XIII, 1 (mars 1954); sur Louvain : Nuttin, *l'Institut de Psychologie et de Pédagogie à l'Université de Louvain. Avec un aperçu historique sur l'Ecole de Pédagogie* (Louvain, 1945).

(33) Comme, par exemple, les *Notions de psychologie appliquée à l'éducation à l'usage des écoles normales, par une Soeur de Notre-Dame de Namur*, dont une édition revue par les Soeurs de Notre-Dame parut à Namur en 1935-1936, ou les manuels de L. Detaille, *Psychologie appliquée à l'éducation* (Liège, s.d.) et *La pédagogie contemporaine. Ses bases, ses méthodes, son histoire*, t. I, *Pédologie expérimentale. Fondements physio-psychologiques de l'éducation* (Bruxelles, 1932). A comparer avec le manuel vieux jeu d'A. Decoene & A. Staelens, *Paedagogische zielkunde* (Gand-Louvain-Leyde, 1920).

(34) Buyse, *Etude*, 182-183.

(35) Cf. A. Clausse, *Les principales tendances de la psychologie expérimentale* (Liège, 1936); N. Braunshausen, *Au seuil de la psychologie expérimentale. Histoire, méthodes, sciencezs auxiliaires : psychologie animale, infa ntiel, pathologique* (Bruxelles, 1931, Documents pédotechniques, X, 1).

(36) Représentée notamment par les deux périodiques pédagogiques les plus influents : la *Revue belge de pédagogie* et le *Vlaamsch Opvoedkundig Tijdschrift.* Parmi les articles d'Albéric Decoene et de Frans de Hovre, rédacteurs de ce dernier périodique, citons : I (1919-1920) 294; II (1920-1921) 56-57; IV (1922-1923) 49-51; XI (1929-1930) 432.

(37) La littér ature lui consacré est reprise dans De Vroede, Lory & Simon, *o.c.*, 88-89.

(38) Voir, par exemple : O. Decroly & R. Buyse, *Introduction à la pédagogie quantitative. Eléments de statistique appliqués aux problèmes pédagogiques* (Bruxelles, 1929) 11-12; R. Halconruy, A bâtons rompus, à travers les conceptions nouvelles, *Cahiers de pédagogie,* I, 4 (mars 1936) 14-17; II, 1 (juilllet 1936) 15-18; II, 3 (déc. 1936) 83-89.

(39) L. De Raeymaeker, Psychologie en wijsbegeerte, *Vlaamsch Opvoedkundig Tijdschrift,* XVII (1935-1936) 71-79 et 133-139.

(40) *Cahiers de pédagogie,* V, 1 (juin 1939) 12.

(41) *Cahiers de pédagogie et d'orientation professionnelle,* XIII, 1 (mars 1954) 10-11.

(42) A. Decoene, Eenheid in onze opvoedkundige studie, *Vlaamsch Opvoedkundig Tijdschrift,* I (1919-1920) 294.

(43) L'analyse de ces périodiques se trouve dans De Vroede e.a., *o.c.*, vol. IV, 1, 299-335 et 445-524.

(44) Nommé plus tard professeur à l'université de Louvain; voir les publications reprises dans De Vroede, Lory & Simon, *o.c.*,90-91.

(45) Cf. *Vlaamsch Opvoedkundig Tijdschrift*, XIII (1931-1932) 57-58; XIV (1932-1933) 4-5.

(46) V. D'espalliern Wat hebben we practisch aan de typologie ?, *Vlaamsch Opvoedkundig Tijdschrift*, XV (1933-1934) 97.

(47) Cf. De Vroede e.a., *o.c.*, vol. IV, 1, 317-321.

(48) De Raeymaeker, *o.c.*, 79.

(49) Comme, par exemple : G. Vermeylen, *La psychologie de l'enfant et de l'adolescent* (Bruxelles, 1926); F. Van Hoof, *De psychischestadia van het schoolkind* (Anvers, 1931); R. Adriaensen, *Schommelingen in de psyche gedurende de puberteitsjaren* (Anvers, 1932); E. De Greeff, *Nos enfants et nous*, Bruxelles, 1939).

(50) V. D'Espallier, Onderwijzer tegen psycholooog ?, *Vlaamsch Opvoedkundig Tijdschrift*, X (1928-1929) 155; ID., Psychologie en lager onderwijs, *ibid.*, XIX (1937-1938) 23.

(51) D'Espallier, Psychologie en lager onderwijs, *ibid.*, XIX (1937-1938) 33.

(52) A. Kriekemans, *Inleiding tot de karkaterkunde* (Anvers-Bruxelles-Gand-Louvain, s.d. [1936]); N. Braunhausen, *L'étude expérimentale du caractère. Méthodes et résultats* (Uccle, 1937); A. Boutinaud, La caractérologie et le problème des éducations difficiles, *Revue belge de pédagogie*, XIX, 1 (oct. 1937) 10-13; M. Rouvroy, Bricolages, *L'Education familiale*, XXXII (1935) 10, 149 et 198.

(53) La sixième date de 1950.

(54) R. Nihard, *Cours de pédagogie psychologique et expérimentale* (Liège, s.d.) 108.

(55) V. D'Espallier, Wat hebben we practisch aan de typologie ?, *Vlaamsch Opvoedkundig Tijdschrift*, XV (1933-1934) 92-101;

ID., *Menschenkennisq en typologie* (Tilburg, 1935).

(56) J. De Busscher, La psychanalyse. Son importance en psychologie normale et pathologique, *Revue de pédagogie*, IV, 21 (1937) 25-41.

(57) Avant-propos d'A. Michotte pour la traduction néerlandaise, par Fernand Van Goethem, du livre de L. Bopp, *Psycho-analyse en kath. opvoedkunde* (Louvain-Gand-Malines, 1924) VII-X.

(58) A. Kriekemans, Bij het afsterven van S. Freud, *Vlaamsch Opvoedkundig Tijdschrift*, XXI (1939-1940) 65-69; F. De Hovre, Aantekeningen betreffende verdiensten en dwalingen van Freud, *ibid.*, 114-122.

(59) A. Decoene, Over psycho-analysis, *ibid.*, II (1920-1921) 337-342.

(60) Bopp, *o.c.*, 69-86.

(61) Fr. Anselmus, La Théorie psychoanalytique de Freud, *Revue belge de pédagogie*, XII, 6 (févr. 1931) 346-357; XII, 7 (mars 1931) 407-419; A. Fauville, Freud et la psychanalyse, *ibid.*, XXI, 2 (nov. 1939) 67-69; P. Halflants, Le Freudisme, *L'Education familiale*, XXXIII (1936) 452-456 et 524-527.

(62) F. Fransen, Psychiatrie en opvoeding, *Vlaamsch Opvoedkundig Tijdschrift*, III (1921-1922) 343-348 et 385-394.

(63) R. Piret, Education et psychanalyse, *Cahiers de pédagogie*, V, 1 (juin 1939) 34-39.

(64) J. Van Buggenhout, *Enkele aspecten van de pedagogiek in verband met de Vlaamse openbare lagere school, periode 1919-1940* (Gand, 1961) 135.

(65) Buyse, *Expérimentation*, 55-56; ID., *Etude*, 182-183; R. Nihard, Qu'est-ce que la pédagogie expérimentale ?, *Cahiers de pédagogie*, I, 1 (juin 1935) 6.

(66) Decroly & Buyse, *o.c.*, 15; Nihard, o.c., *Cahiers de pédagogie*, I, 1 (juin 1935) 7.

(67) Buyse, *Expérimentation*, 55 et 281.

(68) Voir surtout *ibid.*, 58-88.

(69) *Vlaamsch Opvoedkundig Tijdschrift*, XVI (1934-1935) 622.

(70) Cf. Buyse, *Expérimentation*, 108-120; ID., Limites de l'expérimentation en pédagogie, *Cahiers de pédagogie*, V, 3 (déc. 1939) 115-119; V. D'Espallier, Grenzen van het experiment in de opvoedkunde, *Vlaamsch Opvoedkundig Tijdschrift*, XXI (1939-1940) 208-212.

(71) T. Jonckheere, *La méthode scientifique et la pédagogie* (Bruxelles, 1933) 7.

(72) *Ibid.*; Buyse, *Expérimentation*, 54.

(73) Demoor & Jonckheere, *o.c.*, 365.

(74) V. D'Espallier, Experimenteele didaktiek, *Vlaamsch Opvoedkundig Tijdschrift*, IX (1927-1928) 403.

(75) Buyse, *Expérimentation*, 238-274.

(76) Pour ce qui suit, cf. Fr. Maximin, L'école sur mesure, *Revue belge de pédagogie*, III, 9 (juin 1922) 580; ID., Si les catholiques acceptent le contrôle scolaire, *ibid.*, VIII, 7 (avril 1927) 424; M. Rouvroy, A ceux qui étudient les enfants, *ibid.*, VI, 4 (jan. 1925) 226-228; ID., Les "tests" à l'école ordinaire, *ibid.*, VI, 5 (févr. 1925) 300-306; ID., La conférence pédagogique sur les "tests", *ibid.*, VI, 6 (mars 1925) 357-366; ID., Et après les "tests" ?, *ibid.*, VI, 9 (juin 1925) 579-584; ID., Moisson de tests, *ibid.*, VI, 10 (juillet 1925) 630-637; ID., La psychologie et les "psychologies", *ibid.*, XI, 1 (sept. 1929) 19; ID., L'enseignement spécial, *ibid.*, XVII, 1 (oct. 1935) 15-16; *Over het vraagstuk der tests. Lichamelijk en psychisch onderozke der leerlingen op de*

lagere school (s.l., s.d.; V.O.V., Studiekring Brussel); Van Hoof, *o.c.*, 85-87; Nihard, *Méthode*; V. D'Espallier, *Methoden voor verstandsonderzoek* (Bruxelles, 1935; Katholieke Hogeschooluitbreiding, XXXIV, 7-8); Jonckheere & Van Waeyenberghe, *o.c.*

(77) E. Moritz , Les premières années de la vie (s.l., 1932); E.Z. Annonciaden van Huldeberg, De kleinkindertests van Ch. Bühler - H. Hetzer, *Vlaamsch Opvoedkundig Tijdschrift*, XIV (1937-1938) 257-273; ID., Toepassing der methode Bühler-Hetzer op Vlaamsche kinderen, *ibid.*, 334-345.

(78) E. Monchamps & E. Moritz, *Les étapes mentales de l'observation des images* (Bruxelles, 1927); A. Delvaux, *Contrôle de la Stanford révision de Terman (échelle Binet-Simon) sur des enfants de milieux sociaux différents* (Bruxelles, 1932, Documents Pédotechniques, XI, 2); H. Deman & A. De Saeger, *De waarde van de tests Binet-Simon voor de Vlaamse buitenkinderen* (Anvers, s.d.; Brochurenreeks V.O.V.); *Intelligentieschaal voor Vlaamse kinderen* (Anvers, 1931; Brochurenreels V.O.V.); J. Frickx, *Deuxième contribution à l'étude de la méthode des tests* (Bruxelles, 1930; Documents pédotechniques, IX, 1).

(79) O. Decroly & J.E. Segers, *Essais d'application du test de Ballard* (Bruxelles, 1932, Documents pédotechniques, XI, 1); E. Moritz, *Etudes expérimentales et critiques sur les tests mentaux. Adaptation belge du test de groupe de Ballard* (s.l., 1934).

(80) E. Monchamps, *Examen de lecture de Haggerty traduit et adapté avec autorisation de l'auteur* (Bruxelles, s.d.).

(81) Comme, par exemple, R. Piscart, Echelle objective d'écriture pour écoliers belges, *Revue belge de pédagogie*, XIX (1937-1938) 345-351, 415-1, 465-471, 536-540 et 601-603; F. Dubois, Echelle d'orthographe française, *ibid.*, XXI (1939-1940) 88-94, 150-155, 221-224, 287-292, 348-353, 404-407 et 457-461.

(82) G. Vermeulen,, *L'examen psychographique de l'intelligence* (2 vol., Anvers, s.d.); voir D'Espallier, *Methoden*, 24-28, Nihard, o.c., *Cahiers de pédagogie*, I, 1 (juin 1935) 5, et J. Frickx,

Contribution à l'étude de la méthode des tests (Bruxelles, 1928, Documents pédotechniques, VII, 2).

(83) Voir, par exemple, les remarques critiques de L. Decortis, Les tests "clandestins", *Cahiers de pédagogie*, II, 3 (déc. 1936) 90-91, et de Jonckheere & Van Wayenberghe, *o.c.*, 8.

(84) Decroly & Buyse, *Introduction*, 9-12, ainsi que le chapitre II.

(85) Cf. A. Despy-Demeyer & P. Goffin (réd.), *Liber memoralis de l'Institut des hautes études de Belgique fondé en 1894* (Bruxelles, 1976) XCVI-CIV; De Vroede e.a., *o.c.*, vol. IV, 2, 1479-1480.

(86) Cf. P. Sollier & J. Drabs, *La psychotechnique. Introduction à une technique du facteur humain dans le travail* (Bruxelles-Paris, s.d. [1935[); . Drabs, Le facteur humain et l'agencement de l'habitation, *L'intérieur*, II, 1 (1937) 10-15.

(87) Cf. De Vroede e.a., *o.c.*, vol. III, 1, 372-413.

(88) *L'Education familiale*, XXVI (1929) 260; *ibid.*, XXVIII (1931) 479.

(89) Cf. J. Lindemans, Le Centre national d'études d'économie ménagère, *Bulletin ergologique*, II, 3 (15 mars 1932) 39-42; De Vroede e.a., *o.c.*, vol. IV, 2, 1485-1489.

(90) Cf. L. Charles, Congrès d'éducation ménagère, *L'Education familiale*, XXVIII (1931) 604-609; XXIX (1932) 26-33 et 95-98.

(91) *Ibid.*, 28.

(92) Decroly & Buyse, *Introduction*, 10.

(93) Decroly & Buyse, *Les applications*, 56.

(94) Braunshausen, *Au seuil*, .

(95) R. Ledent & L. Wellens, *Précis de biométrie à l'usage des médécins et des éducateurs* (Liège, 1923) 20.

(96) Par exemple chez F. Marquebreucq, o.c., *Revue mensuelle [de l'] Oeuvre Nationale de l'Enfance*, II, (1920-1921) 1090.

(97) S. De Coster, La pédagogie discipline de la complémentarité, *Revue des sciences pédagogiques*, XI, 45 (mars 1949) 5-20.

(98) R. Piret, Rapport moral, *Cahiers de pédagogie et d'orientation professionnelle*, XIII, 1 (mars 1954) 15.

(99) Les raisons du changement sont expliquées par Nuttin, *o.c.*, 126-132.

(100) Verheyen, *o.c.*, 52.

(101) *Vlaamsch Opvoedkundig Tijdschrift*, XVI (1934-1935) 619.

(102) Jonckheere, *La méthode* (1933) 69-70; R. Jadot, Ad augusta per augusta, *Archives belges des sciences de l'education*, I, 1 (juillet 1935) 4; M. Grypdonck, De hervorming van het onderwijswezen, *Vlaamsch Opvoedkundig Tijdschrift*, XX (1938-1939) 401; De Greeff, *o.c.* (1939) 32-33; C. Lurquin, ainsi que Jonckheere lui-même, Hommage au Professeur Tobie Jonckheere. Séance académique du 25 mai 1948, *Revue des sciences pédagogiques*, X, n° spécial (1948) 7 et 13; F. Macours, L'éducateur devant la pédagogie scientifique, *Cahiers de pédagogie et d'orientation professionnelle*, X, 1-2 (août 1950) 8. Fin 1926, consulté sur le projet d'organiser des cours supérieurs de pédagogie, accessibles aux régents et aux instituteurs, le doyen de la Faculté de Philosophie et Lettres fit savoir au recteur de l'Université de Gand que dans l'opinion de la Faculté de tels cours seraient mieux organisés en dehors de l'université, puisqu'ils ne pourraient jamais prendre le caractère d'un véritable enseignement universitaire : Druwe, *o.c.*, 7. D'après A. Michotte "l'introduction de la pédagogie dans l'enseignement supérieur était, à l'époque, une innovation audacieuse" : *Revue des sciences pédagogiques*, VIII, 36

(1946) 112.

(103) A. Decoene, Opvoedkunde voor iedereen, *Vlaamsch Opvoedkundig Tijdschrift*, IX (1927-1928) 472; XI (1929-1930) 265.

(104) Buyse, *Expérimentation*, 56-57.