

Hebrew natural science publications from the 15th to the 18th centuries: cultural and social aspects / Ester Kandelshein

Abstract

The scientific revolution began with the end of the Renaissance. This period saw the emergence of entirely new assumptions about geography and the natural sciences: from a "closed" world to a limitless universe where man has the ability to control his surroundings. This revolution, carrying with it changes more forceful than any other intellectual event in the history of mankind, began in the 16th century with Copernicus, who dared to position the sun in the center of the universe. It concluded with the publication of Newton's studies and laws, which laid the foundations of the scientific research of the 18th century.

What characterizes the period from the 16th to the 18th centuries in Jewish history is the proliferation of ties between disparate Jewish congregations. The expulsion of the Jews of Spain and Portugal led to the scattering of educated and professionally trained Jews throughout Western Europe and up to Turkey; and this migration built links between different communities. Improvements in transportation and growing economic ties between European countries during this period benefited the Jews too. Emissaries sent to encourage foreign Jews to support Jewish settlements in the Land of Israel also served to bridge distant Jewish communities. And, even though the Jews always saw themselves as a minority – because they lived in ghettos separated from their Christian surroundings and because of their distinct language and dress – they enjoyed lively interaction with their neighbors in trade and day-to-day activities. This created curiosity as to what was happening in the world of science.

Throughout the ages, Jews have been active in science. In addition to being Rabbis, they were also doctors, astronomers and mathematicians, as the manuscripts attest. Since the printing press became the main technology for the dissemination of new ideas, the bond between science and printing is crucial. The first to understand the significance of this new invention, and the first to make use of it, were the Jews. The press enabled mass distribution of Jewish intellectual religious writings, in copies that were precise, identical and at low in cost.

Statistical bibliographic analysis of the printed scientific texts enables us to learn about the extent of Jewish integration with and openness to the scientific movements sweeping the world during this period. It also enables us to sketch a scientific-social-cultural profile of the Jews, both within the Christian community and outside it. The questions that arise are. Were the Jews aware of the scientific developments in the world? To what extent did they draw on the studies of the (non-Jewish) culture? What part, if any, did they play in the scientific revolution? Within the Jewish society: How did the scientific revolution influence Jewish beliefs, opinions, ways of studying, and particularly the spiritual and social life of the Jews within their communities? Were the scientific stings intended only for the highly educated classes, or were efforts made to reach ordinary Jews as well? Were there centers of

scientific activity on a certain topic, in a specific place? Answers to these questions can clarify for us to what extent the Jews were integrated into their non-Jewish communities, in socio-cultural terms, and to what extent they were influenced by it.

The researchers of the "book and society" school of thought were the first to draw attention to the political, social and cultural importance of the book. These researchers developed a number of methods to analyze and understand cultural, social and historical processes in societies of the past. Their research is based on quantifiable data and statistical methods, as is common in the social and exact sciences. The main methods rely on statistical analysis of bibliographic sources, such as bibliographies, codependence, official documents of the religious and civil authorities, colophons and stock-lists of printers, publishers, booksellers, among other things.

There is a strong similarity between the methods of "book and society" and bibliometric study in information sciences. Using quantifiable analysis of written matter, bibliometrics attempts to make a classify diferent types of publications, according to subject matter and by defining. basic principles, or by delineating patterns, even attempting to foresee future processes. This is a theoretical field with analytical aspects, which focuses on external formal characteristics, while also taking into consideration the content of the text.

The study of Jewish culture has also been aided in recent years by the methods of "book and society" and bibliometric research. Therefore, an important source of information both for all kinds of bibliographies are texts written by Jews in Hebrew, and printed by Hebrew printers. A bibliometric analysis of these bibliographies will shed light on socio-cultural processes and changes, and help us understand how Jewish culture was integrated into the non-Jewish culture of its period.

Drawing from bibliographic sources, this study concerns texts which deal with scientific subjects; and which were published in Hebrew type, from the invention of the printing press until the 18th century. This period includes 150 years of scientific revolution and The fields of science during this period were: astronomy, medicine, mathematics, nature, astrology, geography and nature studies (in general). The present study discusses only the Judeo-Hebraic aspects, and not the general Jewish aspects; therefore, it does not address the issue of whether there was openness to non-Jewish literature outside the realm of science.

Hebrew type is a parameter that ascertains whether a given text was targeted for the Jewish reading public. In addition to Hebrew, other languages included in this category are Ladino, Yiddish, Tatar, and Hebrew transcription of foreign languages. Language is an element that differentiates between cultures, and in Jewish society two cultures emerged simultaneously the culture of the educated and mass culture. The language of the educated culture is that of holy studies, Hebrew. Mass culture had the day-to-day languages: Yiddish, Ladino and the local (non-Jewish) languages. On the assumption that economic factors influenced printers in their choice of "product", the very printing of scientific texts in Hebrew attests to a certain demand for Hebrew books Limiting this study to publications in Hebrew type means including only

a small number of texts. On the other hand, it provides a clear definition of the target readership, enabling us to learn about its general trends and reading preferences.

From the invention of the press and until the 18th century, 753 titles dealing with the natural sciences were published in various editions, representing 1,094 texts in Hebrew type. There were seven specific disciplines: chronometry (565 texts), geography (186 texts), medicine (171 texts), astrology (70 texts), mathematics (37 texts), astronomy (35 texts), nature (14 texts) and an additional general subject dealing with all these areas: natural sciences (16 texts).

The subject that concerned the authors of these texts more than any other is chronometry, which accounts for a full 565 (53%) of the 1,094 texts. Of chronometry texts, 87% are calendars and 13% are texts dealing with various topics related to chronometry principles and directives for making calendars, Maimonides's directives on performing the ceremony of sanctification of the month, etc. Some of the texts not centrally concerned with chronometry included a calendar nevertheless. Of the texts on this subject, 72% were in Hebrew, and the remaining was in everyday languages: 157 texts in Yiddish, and 2 in Ladino. During the 18th century one can note that this field loses its "scientific" standing, and a growing number of chronometry texts are published in everyday languages. In the 18th century a full 28% of these texts were in everyday languages, while in the 17th century, only one out of 39 was in Yiddish, and in the 16th century only two out of 64. Thus, fluctuations in the language chosen for publication of texts can attest to the popularization of a given field of study.

Astrology is another subject which was transformed from a professional field to a non-scientific popularized subject. At the beginning of the scientific revolution, practical astrology was the field to which everyone wanted to contribute, but during the 18th century, astrology lost its stature worldwide and its scientific basis was already in question. The same process took place in the Hebrew press. There was demand from the public, but no supply from new authors, so printers published new editions of old texts again and again. Thus, with a lack of new studies, the subject ceased being a field of research and became a popularized non-scientific subject area.

Geography originally tended to be a popular subject, mainly concerning the land of Israel, the Jews and the ten tribes. In the 16th century, 94% of the texts were of the popular kind, and in the 17th century 96%. In the 18th century, the ratio drops to 84%, from the total number of texts, and there is a leaning towards making the field a "scientific" subject. The reason for this is that during this period there was an increase in the number of authors who wrote about topical geographical subjects of general interest, not necessarily about the Land of Israel.

Medicine, mathematics, astronomy, nature and natural sciences are all research subjects of great relevance during the time of the scientific revolution and the period following it. The number of authors during this time span was large. From the total number of authors during the 18th century, only 12 are not contemporaries of the period. There was an increase in the number of mathematics textbooks. From a single textbook in the 17th century to 7

textbooks (28%) in the 18th century, all of which were authored by contemporary writers. The increase in medical texts during the period was less dramatic. While there is an increase in the total number of medical texts published during the period, a large, and growing, majority of these texts were popular books. During the 18th century the publication of popular medical texts accelerated. From the total number of medical texts published during this century, 71% were in popular medicine, and only 29% were in professional medicine. There was an increase in books about astronomy, and the name of Copernicus comes to the forefront of scientific discourse among Jewish authors, even in texts considered non-scientific. In nature and natural sciences, the growth is impressive: the 18th century accounts for a full 86% of all the texts published in the field of nature, as well as 81% of all the published texts concerning natural sciences.

It is possible to identify centers of Hebrew printing during all the periods, and these centers were also the sites where scientific texts were published. The development of a publishing center resulted mostly from political factors, which permitted Jews to settle in a specific place and to receive work permits from the authorities. The center of Hebrew printing during the 15th century was the Iberian Peninsula, but following the expulsion of Jews from Spain and Portugal printing there ceased entirely, and Italy became the center of Hebrew printing. Printing continued to migrate eastwards, to Kushta, Salonika and Cario. During the 16th century, Hebrew printing centers thrived in Prague, Cracow, Basel and of course Venice. At the end of the Thirty Years War in the middle of the 17th century, Amsterdam became an international commercial center. The new political conditions and its geographical position turned the city into a publishing center as well. Conditions permitted Jews to open publishing houses there, and Amsterdam became a Jewish printing center. Where there was Hebrew publishing there was also scientific publishing, and about 15% of all scientific texts of this period, were published in Amsterdam (161 texts). Mantua should also be mentioned, as a locus of uninterrupted scientific publishing from the 15th century (3 texts) up to the end of the 18th century.

In fact, Jews were sharply aware of developments in the world of science. They were informed and active in all the fields of science of their time. Drawing from the general non-Jewish research, they attempted to disseminate their knowledge within their own people, to bring them closer to science. There is a positive relationship between the language of composition and the scientific discipline addressed in the text; that is, if the language of composition is a popular language, it can be assumed that the subject is popularized. This connection, which becomes increasingly stronger, shows us the efforts made by the authors and publishers to disseminate science among the people, and to awaken their curiosity

The production of texts grew from 13 texts in the 15th century to 957 in the 18th century, bringing with it increasing popular interest in scientific subjects. This also led to scientific cooperation between Jews and Christians, and socio-cultural integration between them and their neighbors. As a given topic of inquiry gained momentum in the general (non-Jewish) research, it became more important in Hebrew writing as well; as interest faded in the world at

large, so did popularity within the Jewish readership. Science was transformed from an exclusive field to one accessible to a greater number of people. We are witnesses to various transformations: ancient subjects undergoing fundamental changes (astronomy); new fields becoming accessible to the masses (nature); fields which were exclusively for the educated adopting a more popular bent (chronometry); subjects which developed rapidly (mathematics); and fields which gradually lost their "scientific" stature (astrology).

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