

Chapter 35

Creating a Modern Hebrew Language for Mathematics

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The roots of the modern mathematical Hebrew lexicon are found in the Haskalah movement at the end of the 19th century. The next important stages are found in the context of the efforts of Eliezer Ben Yehuda and the institutions he developed for fostering modern Hebrew in general in Palestine. Of particular importance was the contribution of Avraham Baruch Rosenstein in Tel Aviv.

1. Introduction

The story of the teaching of mathematics in Israel, both before and after the creation of the State, cannot be told without telling the story of the development of a modern Hebrew lexicon for mathematics. In this chapter I indicate some of the main milestones in this intriguing story.^a

2. “Haskalah” and the Modern Scientific Hebrew Lexicon

One of the most important cultural phenomena in the Jewish world before the Zionist revival of the Hebrew language was the European Jewish Enlightenment, or “Haskalah,” beginning in the late 18th century. Inspired

^aA more detailed version of this story appears in Corry and Schappacher, (2010, pp. 449–457). I am indebted to Norbert Schappacher for our joint work in that article and for allowing me to use here the relevant parts, which I had written in the original version. I also thank Michael Fried for his help in preparing the final form of the current version.

by classical enlightenment values and motivated by the wish to achieve a fuller integration of Jews into European society, the Enlightened Jews, or “Maskilim,” promoted the study of secular topics among Jews (Feiner, 2004). They advocated a revival of the Hebrew language and of Hebrew literature.

The revival of Hebrew in the context of the “Haskalah” can be divided loosely into two stages. In the first stage, from about 1780 to 1855, the “Maskilim” aimed specifically at developing a language that would be as close as possible to the original, Biblical Hebrew. In the second stage, roughly between 1855 and 1880, the new Hebrew literature in Europe shifted to broader topics, including scientific topics, and with that came a freer use of post-Biblical Hebrew and neologisms.

Among the Maskilim who deserve particular attention in this story there stands out the remarkable figure of Chaim Selig Slonimski (1810–1904). He was a distinguished Talmudist proficient in several European languages as well as in Latin. He was well-versed in the science of his time and well-connected with the international community. Slonimski was among the first (if not the very first) to write books on science for a broad Jewish audience, focusing especially on astronomy, physics and mathematics. In 1862, he established in Warsaw the widely-read Hebrew journal, *Ha-Zefirah*, specializing in scientific topics. (Soffer, 2007).

Slonimski’s books illustrate the difficulties in creating an adequate modern mathematical lexicon in Hebrew, difficulties connected with appropriate terminology, symbols, and the right-to-left text direction of Hebrew. Indeed, in the introduction to his 1865 *Sefer Yesodei Hachkmat Hashiur* (ספר יסודי חכמת השיעור — “A Book of Basic Mathematics”), Slonimski discusses these issues explicitly and tells the reader how he often had to adopt foreign terms, that is, terms in “the language of the nations.” Nevertheless, like his fellow *Maskilim* writing other kinds of texts, Slonimski actually took great pains to use Hebrew words wherever possible in his mathematical book — sometimes modifying the accepted sense of terms — rather than transliterating foreign words. Only in a few cases did he follow the terminology used by “the learned of all nations”. Thus, for instance, while “arithmetic” appeared as “*hokhmat hashiur*” (השיעור חכמת — roughly: “the learning of ratios”), and “geometry” as “*medida*” (מדידה — “measurement”), “algebra” was simply transliterated. Sometimes,

Table 1. Slonimski’s suggestions for a mathematical lexicon.

Numerator (of a fraction)	מונה	“ <i>moneh</i> ”: counter (Slonimski adds in parentheses צעהלער, i.e., a transliteration of the German “Zähler”)
Denominator (of a fraction)	איכה	“ <i>eikhah</i> ”: an archaic Biblical term for “how” (Slonimski adds in parentheses נענער, i.e., “Nenner”)
Power (of a number)	מדרגה	“ <i>madregah</i> ”: stair
Exponent	רכס	“ <i>rechess</i> ”: crest
Edge (of a polyhedron)	צלע	“ <i>tzelah</i> ”: rib

he added a German translation. As in the case of “Differential-Rechnung”, for which he used “*heshbon pishionot*” (השבון פשייונות). “Heshbon” was and remains the accept term for calculus, while the Talmudic term “*pishion*” (פשייון) is completely out of use nowadays.

Table 1 presents examples for translations suggested by Slonimski for elementary mathematical concepts:

As for the thorny issue of mathematical symbolism for Hebrew texts, Slonimski’s own choice was *not* the one that was eventually adopted. In Slonimski’s approach, the quadratic formula would appear as follows (read from right to left, of course):

$$. \left(b^2 \frac{1}{4} - a \frac{1}{2} \right) \sqrt{\pm a \frac{1}{2}} = q$$

3. Mathematical Lexicons in the Land of Israel

The most important figure associated with the revival of the spoken Hebrew language in Palestine, Eliezer ben-Yehuda (1858–1922), emerged from the same kind of *Haskalah* background as Slonimski. He was born in the town of Luzhky, near Vilna, and moved to Jerusalem in 1881. Almost immediately, he started working towards establishing Hebrew as the everyday means of communication for Jews coming to Palestine from all regions of the world. He regarded this common language as the key ingredient for the national revival of the Jewish people. At the turn of the 20th century he established the *Vaad Halashon Haivry* (ועד הלשון העברי — Committee for the Hebrew Language), which would become the most prominent vehicle for

Table 2. The *Vaad*'s suggestions for a mathematical lexicon.

Numerator (of a fraction)	כמה	“ <i>kamah</i> ”: literally “how many”, also “quantifier”
Denominator (of a fraction)	מנה	“ <i>manah</i> ”: portion or ratio, but also related with “counting” (למנות)
Power (of a number)	מדרגה	“ <i>madregah</i> ”: stair
Exponent	רכס	“ <i>reches</i> ”: crest
Edge (of a polyhedron)	חוד/פה	“ <i>peh</i> ”: mouth; or “ <i>khod</i> ”: cusp

the realization of his plans. In 1953 the *Vaad* became the National Academy of the Hebrew Language.

The *Vaad* was directed by Hebrew teachers intent on “adapting the Hebrew language for use as a spoken language in all aspects of life: at home, at school, in the public sphere, in commerce, in industry, in art, and in science.” As part of their efforts, they periodically published lists of new terms to be used variously. In 1913, they published one such list containing mathematical terms as shown in Table 2.

Besides the *Vaad*, various primary and secondary schoolteachers’ unions took upon themselves the task of turning Hebrew into the main and only teaching language in schools of the *Yishuv* (the term used to refer to the Jewish residents of Palestine before the establishment of the State of Israel). The question as to who was better qualified to develop Hebrew lexicons occasionally gave rise to fierce theoretical discussions, as well as open power struggles, between these teachers’ associations and the *Vaad* (Efrati, 2004, pp. 49–80).

4. Language Wars in Palestine

The story of the establishment of a modern Hebrew lexicon cannot be told without mentioning the so-called *Language War* in Palestine which broke out in 1913. Jewish educational institutions had been established since the end of the 19th century not only by Zionist initiatives, but also as part of the efforts of European Jewish philanthropic organizations such as the French *Alliance Israélite Universelle* and the German *Hilfsverein der Deutschen Juden* (עזרה).

In 1907, the director of the *Hilfsverein*, Paul Nathan (1857–1927), initiated the establishment of an institution of higher learning for engineering in Haifa, the *Technikum* — which eventually became the *Technion* — as well as a *Realgymnasium* working close to it — which eventually became the Hebrew Reali High School of Haifa. Against the background of a technological gap increasingly felt at the time in the Ottoman Empire, Nathan assumed that the Jewish population of Palestine, if properly trained in the German technological tradition, would be a welcomed contribution to the development plans then encouraged by the Ottoman government, which, in turn, would encourage Jewish immigration into Palestine.

Nathan's initiative was welcomed at the *Yishuv*, but in 1913, just as the first buildings were being constructed, the Board of Governors of the *Hilfsverein* in Berlin passed a decision to the effect that all teaching in the *Technikum* would be in German. The decision was based on the assumption that no adequate Hebrew books existed for advanced technological teaching so that German books would be used anyway. The decision, however, triggered furious opposition from the local Jewish population. Teachers of the Jerusalem Teacher's Seminar (created and supported by the *Hilfsverein*) renounced their posts, while students went on strike. This debate sparked intense emotions. In an open letter signed by Ben-Yehuda and some representatives of the teachers' associations, the decision was described as "...an open attack against the soul of the Hebrew nation and we consider it to be a national disaster," and the position that Hebrew must be the language of all schools in the Land of Israel was reasserted trenchantly (Efrati, 2004, p. 147).

The "war" ended victoriously for the Hebrew camp in February 1914. The *Hilfsverein* agreed that teaching at the *Technikum* would be in Hebrew, and that all teachers not yet fluent in Hebrew will be compelled to learn the language within four years. By the time the first courses were taught there in 1924, the British Mandate had passed a decision (in 1922) recognizing Hebrew as one of its official languages, alongside English and Arabic, consummating the victory in the "language war."

5. Rosenstein

If we need to single out the person whose influence was the most decisive in establishing the Hebrew mathematical lexicon in use up to this day, that

person would be Avraham Baruch Rosenstein (1881–1950), a renowned mathematics teacher at the emblematic Gymnasia Herzliya in Tel Aviv (Razi-Stein, 1991). The Gymnasia was established in 1905 as the first high school to conduct its teaching entirely in the Hebrew language.

Rosenstein joined the staff of the Gymnasia in 1911 shortly after completing a dissertation in mathematics in Vienna. He immediately undertook the task of creating an appropriate lexicon for his teaching, and, more importantly, of writing the necessary textbooks in all fields of high school mathematics and physics. Over the years, he authored or co-authored twenty-five books that continued to be used across the country until the 1950s. As an enthusiastic former student put it, thanks to the efforts of Rosenstein, high school students at Gymnasia Herzliya “spoke algebra, geometry, trigonometry, logarithms and differential calculus as if these disciplines had been created and initially taught in Hebrew” (Ben Yehuda and Ofek, 1971, pp. 83–84).

In his quest for a modern mathematical lexicon, Rosenstein went back to ancient Hebrew sources, including Avraham Bar Hiyya (1070–1136) and Levi ben Gerson (1288–1344), both of whom wrote treatises on arithmetic and geometry. He also consulted more recent Hebrew scientific authors such as Slonimski. As early as 1912, he was teaching summer seminars on the Hebrew mathematical lexicon to teachers from all around the *Yishuv*. The participants of his seminars decided to write to the *Vaad* demanding that they define their mathematical lexicon based on the suggestions of the teachers’ union (which were actually Rosenstein’s) (Efrati, 2004, p. 71). The list published by the *Vaad* in 1913 from which we quoted above shows that this demand was not met. Some examples of Rosenstein’s Lexicon are shown in Table 3.

It is important to stress that, while rejecting the specific mathematical choices of the *Vaad*, the neologisms introduced by Rosenstein did often follow some new kinds of general declensions, introduced into Hebrew by the *Vaad* with the explicit aim of allowing the consistent production of a broad range of neologisms based on existing roots. Thus, for instance, Rosenstein’s “chezkah” was an adaptation of the root (כִּזְקַח) to one such new type of declension.

No less important than the lexicon itself in shaping the new Hebrew mathematical language was Rosenstein’s decision to use Latin characters for

Table 3. Rosenstein's suggestions for a mathematical lexicon.

Numerator (of a fraction)	מונה	" <i>moneh</i> ": counter, like Slonimski
Denominator (of a fraction)	מכנה	" <i>mekhaneh</i> ": namer
Power (of a number)	חזקה	" <i>chezkah</i> ": a neologism derived from the root חזק (strong or powerful)
Exponent	מעריך	" <i>ma'arikh</i> ": a neologism derived from the root ערך (value)
Edge (of a polyhedron)	מקצוע	" <i>miktzoah</i> ": a forgotten Biblical term, whose original meaning was "corner"

all mathematical and physical equations and formulae, rather than Hebrew ones as Slonimski had done previously. Rosenstein wrote them from left to right, as in any European text, and this is the way that equations continue to be written in Hebrew scientific texts.

Rosenstein's influence was also decisive concerning the way in which the modern Hebrew mathematical lexicon of advanced academic research took its shape. This was mainly through the mediation of two Gymnasia alumni, Jacob Levitzky (1904–1956) and Binyamin Amira (1896–1968). Both were among the young faculty of the Institute of Mathematics at the Hebrew University in its early days. Both earned their Ph.D. in Göttingen, where they met Edmund Landau (1877–1938), who was to become the first Professor of Mathematics in Jerusalem in 1927–1928. Landau's teaching in Jerusalem and several texts that he wrote at the time adopted Rosenstein's lexicon and style, and so did all other faculty members at the time.

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