

Dates and date conversion in the Hebrew Calendar

Benjamin Schnabel schnabel@hdm-stuttgart.de

Abstract

Background: [The Hebrew Calendar system](#)

This article shows how to work with different calendar systems in Knowledge Graphs. In this case the Hebrew Calendar is used in the Knowledge Graph JudaicaLink. The article discusses the why the Hebrew Calendar system is used how data is stored and converted.

The Hebrew Calendar is one of the oldest calendar systems, which is still in use today. It is a luni-solar calendar, which is different to the Gregorian Calendar. The calculation of days and years are based on the solar circle, the months however are based on the lunar cycle. Thus the Hebrew Calendar does not have a leap day, but a whole leap month every three years. The Hebrew New Year begins in September/October.¹

The Hebrew Calendar uses a complicated numerical system based on all the letters of the Hebrew Alphabet. The system is already used in the early rabbinic Literature, such as the Talmud and all later rabbinical literature.²

The monthly and yearly cycle was developed in biblical times, but was changed during the Babylonian Exile. In the biblical era years were counted relative to important historic events, such the reign of kings or wars.³ This relative system was used in Europe until the 12th century and in later rabbinical exegetical commentaries. Two rabbinical exegetical works, the Seder Olam Rabba and the later addition to it, the Seder Olam Zuta, took the effort to calculate all the relative years beginning from the creation of the earth (anno mundi) and converting them to an absolute year.⁴

In Israel the Gregorian Calendar used as the civic calendar alongside with the traditional Hebrew calendar. The traditional calendar is used for all religious purposes, like religious holidays, birth, death and marriage dates and death anniversaries and agricultural purposes.

Kommentiert [BS1]: Siehe Epidat

¹ David M. Russinoff, "Understanding the Hebrew Calendar."

² Ludwig Basnizki, *Der JüDische Kalender. Entstehung Und Aufbau*, 1. Aufl. ed. (Frankfurt am Main: Jüdischer Verlag, 1998)..

³ Roger T. Beckwith, *Calendar, Chronology, and Worship - Studies in Ancient Judaism and Early Christianity*, ed. Martin Hengel, et al., *Arbeiten Zur Geschichte Des Antiken Judentums Und Des Urchristentums* (Leiden (u.a.): Brill, 2005)..

⁴ Chaim Milikowsky, *Seder Olam. Wissenschaftliche Ausgabe, Auslegung Und Einleitung (Hebräisch)*, 2 vols., vol. Teil 2 (Jerusalem: Yad Itzḥak Ben Zvi, 2013)..

Methods and data

JudaicaLink Graph

JudaicaLink is a Knowledge Graph for Jewish studies by the University Library J.C. Senckenberg in Frankfurt a.M. It contains about 2,671,550 entities in 18 datasets. The Graph contains Gregorian and Hebrew dates in the triples.

Compact Memory

One dataset is Compact Memory which contains the extracted entities from full texts of about 500 Jewish Journals between 1771-1958, mostly from Germany and Austria. These journals were written in German, Hebrew and Yiddish and other languages. Especially in religious articles Hebrew dates are commonly used.

Epidat

One very important dataset is Epidat which holds about 41,000 entities from Jewish epigraphs. The Hebrew Calendar is used in these epigraphs. The epigraphs have been digitized and the dates converted. The entities for person dates have been extracted and imported to JudaicaLink as dataset.

Findings

1. Best datatype for dates

The datatypes for dates in the Graph vary, depending on the sources. Some datatypes are literals (strings), some are dates and some are datetimes and the data is country specific. Therefore the data cannot be searched or filtered. Sometimes in the data there is no distinction between BC and AC. Wrong data needs to be fixed first, either with scripts or manually. The best standard to use dates in the Graph is the "xsd:date"-datatype in numerical form in most-to-least-significant order.⁵

2. Conversion of dates

The Hebrew Calendar dates are not searchable in the web interface or machine readable and do not allow the enrichment of other Graphs or authority files. Hebrew dates should be stored as literal or string and then converted to the Gregorian date and additionally saved in the Graph. The conversion between the calendars is complex and needs to be done with a script or an external API. Russinoff shows how to convert the Hebrew to the Gregorian date and vice-versa.⁶

In cases where the conversion is not possible either when the date is not correct or incomplete or relative, the data should be stored as literal. Time ranges can be split and relative dates can be annotated with RDF-Star in the meta level.

3. Extracting dates in full texts

In full texts from Compact Memory or in epigraphs from Epidat dates are extracted using Natural Language Processing with Named Entity Recognition. The task in German texts is simple, whereas in Hebrew articles is much more difficult. Additionally regex patterns, training data and the stop words are used to extract dates from the texts.

⁵ xsd:date, according to ISO 8601.

⁶ David M. Russinoff, "Properties of the Hebrew Calendar," (2022), <https://ui.adsabs.harvard.edu/abs/2022arXiv220513345R..>

Literature

- Basnizki, Ludwig. *Der JüDische Kalender. Entstehung Und Aufbau*. [in ger] 1. Aufl. ed. Frankfurt am Main: Jüdischer Verlag, 1998.
- Beckwith, Roger T. *Calendar, Chronology, and Worship - Studies in Ancient Judaism and Early Christianity*. [in eng] Arbeiten Zur Geschichte Des Antiken Judentums Und Des Urchristentums. Edited by Martin Hengel, Pieter W. Van der Horst, Martin Goodman, Daniël R. Schwartz, Cilliers Breytenbach, Friedrich Avemarie and Seth Schwartz. Leiden (u.a.): Brill, 2005.
- Milikowsky, Chaim. *Seder Olam. Wissenschaftliche Ausgabe, Auslegung Und Einleitung (Hebräisch)*. [in heb] 2 vols. Vol. Teil 2, Jerusalem: Yad Itzhak Ben Zvi, 2013.
- Russinoff, David M. "Properties of the Hebrew Calendar." (2022): arXiv:2205.13345. doi:10.48550/arXiv.2205.13345, <https://ui.adsabs.harvard.edu/abs/2022arXiv220513345R>.
- . "Understanding the Hebrew Calendar."