Nissan, E. "Double-Mode Clock, Arabic Pocket Watch, Jewish Time, and the Canonical Hours: On the Modern Legacy of the Roman Market Hours", Australian Journal of Jewish Studies XXXIII (2020): 217-277

# Double-Mode Clock, Arabic Pocket Watch, Jewish Time, and the Canonical Hours: On the Modern Legacy of the Roman Market Hours

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### 1. Introduction

The sociology of time and the cultural anthropology of time are the subject of Bergmann (1992) in the inaugural issue of the journal *Time & Society*, of Munn (1992), and of Zerubavel (1982). The present study contributes to those fields through a case study in the ethnography of Baghdadi Jews. It is concerned with circadian time. I consider how timepieces<sup>1</sup> manufactured in Europe were so adapted as to subserve the religious needs of both Muslims and Jews in Muslim-majority countries. That the Jewish minority was not "drowned" in the majority, when it came to attention allocated by manufacturers, is suggested by the presence of some Jew as a representative of a particular brand.

The early rabbinic subdivision of the day into hours was based on the standard introduced by the Romans for the operation of city markets. That standard also found its way into the Canonical Hours of the Church, and into Islam. Rabbinic day subdivisions were still a concrete experience of Jewish families in traditional communities until recent generations. Even clocks and watches with special features subserved that culture-bound way of measuring time. This article provides an example from Jewish life in Baghdad, in the first half of the twentieth century. For diachronic contextualisation, I relegate to an appendix a sketch of the history of the spread of mechanical watches in the Near East.

Both Jews and Muslims in the Ottoman Empire had similar requirements of timekeeping, because their religio-cultural traditions require them to divide daylight time into hours, and therefore the length of hours varies seasonally, unlike the 24 constant-length hours of the day and the night according to the now globalised modern Western practice. "The unification of clock times and social times was a vexed, contested, and long-winded story" (Ogle 2013, p. 1377). "Ultimately, over the course of several decades, the process of time unification touched on localities all over the globe, as mean times were introduced, locally specific ways of keeping time slowly disappeared, and social times lost some though by no means all of their flexibility" (*ibid.*). Nevertheless, the religious needs of Jews and Muslims have not gone away. In this article, we are going to consider actions taken and devices used by Jews in Baghdad in order to cope with changing, globalised timekeeping.

To how important, for self-perceived religious identity, being particular about the mode of timekeeping can be, the two initial paragraphs of a short story by Rinaldo De Benedetti (1903–1996) bear witness. De Benedetti (a relative of the late historian Sir Arnaldo Momigliano and of the Jewish studies scholar Alberto Cavaglion) was a prominent science reporter in Italy, and a promoter of secularist causes. Nissan (2018–2019) discussed his biography and autobiographical or literary or nonfiction popularisation texts he wrote which are relevant to his Jewishness.

The following is quoted (in my translation from Italian) from his short story "Il ritorno" ("Homecoming": De Benedetti 2020, p. 27). The narrated time is at the end of the First World War, and the setting is in a fictional hamlet in the Alps of western Piedmont (De Benedetti was a Piedmontese from Cuneo). In 1848, Piedmont evolved from a clerical, politically conservative absolute monarchy (the Kingdom of Sardinia, but Sardinia in practice was its colony) into a liberal, Italian nationalist constitutional kingdom, still under a king from the House of Savoy, seeking the unification of Italy, obtained in 1859-1860 (Rome was conquered from the Pope in 1870). Already in 1848, the archbishop of Turin, the capital, was imprisoned and then exiled, because he denied the assistance of a priest and the comfort of religion to a dving government minister (excommunicated because of a clerical asset confiscation law the government was promoting). It was only in 1929, that the Church and (then Fascist) Italy became reconciled. The two paragraphs translated here describe how the town hall, with its own clock, shows an hour different from the belfry's clock in front, because the Church had not accepted (yet) the reform introducing international time zones, so the belfry's clock was showing noon at the actual, astronomical midday (as we are going to see in Sec. 3, also in the late Ottoman Empire the acceptance of mean time — i.e., the annual average of the seasonally non-uniform rotation rate of the earth — was a lengthy process, and opposition not infrequently came from religious circles).<sup>2</sup> This was yet another aspect of political and religious animosity:

In Piedicastello, the belfry of the church and the tower of the town hall stood in front of each other as two enemies watching each other. The belfry was taller, narrow and pointed towards the sky, whereas the tower was square, embattled [like some castle of old], squat, built there by decree of the town council to symbolise as though the Ghibelline [anti-clerical] idea at the times when the antagonism of the Church and the State was at its most acute.

The two towers had never been in agreement. When one of them launched into the air of the valley its joyous peals,<sup>3</sup> the other one remained silent, stubborn and rabid. When the shorter tower raised the flag, and when the taller tower was ornamented with red cloth and paper flowers to honour the Saint, that tower was faced with the silent hostility of its rival tower. Even the dials of the clocks showed a different time: the one of the town council showed the time according to Central Europe's time Double-Mode Clock, Arabic Pocket Watch, Jewish Time, and the Canonical Hours

zone, whereas the one of the church showed the local time, which thirty-five minutes separated from the time zone's time. That way, Piedicastello had the advantage of hearing twice the peals of noon and of each hour of the day.

In contrast, in the present ethnographic study, my great-grandfather in Baghdad was setting the time on his pocket watch according to the time shown by a clock in a square in Baghdad, subserving the need for seasonally variable-length hours that devout Muslims (and devout Jews) had (and still have). The technology and its use were subserving those religious needs. My interest in the interplay of religio-cultural factors and technology is partly akin to the subject of the article "The Social History of the Sewing Machine in the Middle East" by Uri Kupferschmidt (2004). In the present case, however, I am concerned with how the particular mode of using particular technological devices was directly of use to the practice of Judaism.

I summarise the introduction of time zones by quoting from Wishnitzer (2010a, pp. 52–53):

Before the age of the railway and telegraph, every community kept its own hour, which was derived from the meridian where it was located, and the slowness of transport and communication made synchronization of these local hours both impossible and unnecessary. Telegraph systems, which were becoming global by the end of nineteenth century, wove remote localities into a huge network, capable of transmitting information almost instantaneously. Once connected in this network, the multitude of times was increasingly perceived as a problem. The huge number of local times created great difficulties in the operation of railway systems too.

Such problems were the main motive<sup>4</sup> for convening the Prime Meridian Conference in Washington, D.C., in 1884. The conference, which was attended by representatives of twenty-five countries, including the Ottoman Empire, made several important decisions. Most relevant to our discussion here [concerning timekeeping in the Ottoman Empire], the conference defined the longitude of the Greenwich Observatory as the Prime Meridian from which longitudes were to be counted [whereas French delegates would have preferred retaining the initial meridian at Madera]; it set the beginning of the Universal Day at midnight GMT, and decided that counting the hours of the day would run from zero to twenty-four.

Although adopted almost unanimously, the decisions of the conference were implemented slowly by the respective

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governments. Japan applied the system in 1888, Italy and Germany in 1893, Spain in 1901, and France only in 1911. Things were even more complicated for the Ottomans, since the unification of time in their empire was not merely the adoption of a new standard time, but rather, the replacement of the gurubî hours [according to real solar time] with a completely different, mean time-based system. In 1884 this was not on the agenda. While still in Washington, the Ottoman delegate stated that regardless of the recommendations of the Prime Meridian Conference, in the Ottoman state there would always be two times, l'heure à la franque and l'heure à la turque. [This is to be borne in mind, as arguably being the model of the difference, in Baghdadi Judaeo-Arabic, between "English hour" and the seasonally variable "Arab hour" used for Jewish religious purposes.]

Concurrent use of both hour systems indeed continued throughout the Hamidian era until the 1908 Young Turk Revolution opened the way to reform. [It also introduced general conscription for Jews, and opened to Jews the Military Academy of Istanbul.] According to Ekmeleddin İhsanoğlu and Feza Günergun, a committee was formed in the spring of 1913 to examine the benefits of adopting Greenwich Mean Time for all official matters. In fact, a similar committee had already been formed by the Ministry of Treasury in late 1908 or early 1909, not long after the Revolution. In order to allow better handling of official affairs, that committee had recommended reforming the mali calendar and adopting mean time instead of the Ottoman hour system.

At any rate, Wishnizer points out (2010a, pp. 65–66): "The 'Islamist' Sultan and his administration obviously did not think that mean time was inherently anti-Islamic, as long as it did not replace the indigenous system. In fact, the sultan even erected a clock tower that showed both mean and *alaturka* [real solar time] time right next to the mosque that bore his name, in the compound of the Yıldız palace. The double-faced public clocks were visible expressions of the validity and relevance of both hour systems. But the attacks of mean time advocates against this ambivalence dialectically created their opposition". Still: "It is important to note once again how the *alaturka* system was bound with religious practice and feelings, creating a time that was distinctly 'ours'" (*ibid.*, p. 68). "In the face of a tremendous cultural shift, the *alaturka* system represented for many Ottomans a way of life, a set of values and beliefs, and an identity they sought to preserve.<sup>5</sup> It is clear, then, that the cultural load attached to both hour systems [...] actually guided the political choices made by some of the contemporaries and kept

the *alaturka* system alive until the radically different political and cultural climate of the early Republican era facilitated its elimination" (*ibid*.).

This was not only a matter that concerned Muslims in the Ottoman Empire. Real solar time is essential also for keeping some Jewish precepts, such as the time of beginning and exit of the Sabbath, the major festivals, and fasts, as well as the daily times of prayer. It is an important contribution of the present study that it shows how, against the backdrop of these cultural and material changes in how timekeeping was publicly done in their host societies in a Sunni Muslim-ruled country, some devout Jews in 20thcentury Baghdad made use of technological devices and manners of using them, so that their religious timekeeping needs be met.

My present article is concerned with explaining the background of a culture-bound practice of time-measurement that was still in use in the family of the mother of the present author when they were still living in Baghdad. To the best of my knowledge, this is the first time Iraqi Jewish timekeeping practices are discussed, so a survey of earlier literature on this specific topic (unlike about timekeeping practices in the late Ottoman Empire) cannot be fulfilled. It is possible instead to provide some bibliography concerning that community in modern times.

For example, Nissan (2018 [2019]) offers a discussion of patterns of life in the domestic space, with an appendix about the pogrom of June 1941. Nissan (2019a, 2019b), a shorter and a longer version of the same study, were concerned with the consumption of fish by the same community. As for the urban use of gazelles among Iraqi Jews, consider "Captive Gazelles in Iraqi Jewry in Modern Times in Relation to Cultural Practices and Vernacular Housing" (Amar and Nissan 2009), a paper complemented by Nissan and Amar (2012) in this journal. Humorous tales of the same community were discussed in Nissan (2011) from the perspective of folktale studies. The history of Iraqi Jews is the subject of Ben-Jacob (1979), Meir (1989), Kazzaz (1991, 1997), Gat (1997, 1998), Darvish (1987), Kedourie (1971, 1974, 1989), Moreh e Yehuda (1992), Rejwan (1985, 2004), Shamash (2008/2010), Meir (1995), Meir-Glitzenstein (2009, 1981), and Malinovich (2019).

The present study deliberately mixes *microhistory* (stressing the ethnography: an oral history of a Jewish Baghdadi elite family and its use of watches and clocks in relation to its devotion orthopraxy combined with openness to modernity), and *macrohistory*. Namely, the latter here comprises in the body of the paper the culture of keeping time in relation to religious needs in the Ottoman Empire, and pocket watches with Ottoman numerals intended for the markets of the Ottoman Empire; and in appendices, firstly, a history of conceptual subdivision of time across denomination, that has led to the particular custom of keeping time as ethnographically recorded in this study, and secondly, a brief history of mechanical horology in the East in relation to western models, something

relevant for the kind of instruments whose use by a Jewish family I describe.

There is no custom without cultural background. Keeping time in relation to Jewish customs and ritual requirements — and I am talking here about keeping circadian time (all day long), not about calendrical time<sup>6</sup> — results from considerable ideational sophistication which rabbinic culture was already sharing with surrounding cultures in the Roman period. Jewish religious requirements dictated how such concepts would be blended into the way devout Jews would live their lives.

An important contribution of this paper is in providing context. Firstly, it gives a context for the Jewish practice of keeping time as described, which is rooted in the Roman market hours, hence important parallels with Islamic time keeping (something that, as I will show, was quite significant for making it feasible for Jews engaged in the time-keeping customs described to adopt given instruments and a given *modus operandi*). Secondly, it gives a context for situating these particular practices as performed by a given family, based on their station in life, religious attitudes, and integration in their human, artefactual, and built environment.

# 2. Pocket watches with Ottoman numerals intended for the markets of the Ottoman Empire: Already during the long eighteenth century

Artemis Yagou has stated: "During the long eighteenth century, English and continental firms produced large numbers of pocket watches with Ottoman numerals intended for the markets of the Ottoman Empire. These products, both technical novelties and fashionable accessories, were highly popular among the local multiethnic populations" (Yagou 2018/2019, p. 78). "The clocks and watches for the Ottoman market were differentiated through the use on the dial of 'Ottoman numerals', i.e. numerals used with the Arabic script, which offer a direct way to visually identify horological products intended for the Ottoman market. These products covered a wide range: from highly elaborate table-top clocks and pocket watches of extreme luxury used as gifts among rulers and diplomats, to simpler and cheaper pocket watches which constituted a mass market" (ibid.). Yagou avoided calling the numerals on the dial Arabic: "It would be confusing to call these numerals 'Arabic', as we use that designation nowadays for our own numbers, which are derived from the Islamic ones" (ibid., fn. 2).

"[T]he pocket watch, a product incorporating both fashionability and technical innovation, offers an appropriate starting point for exploring novel, technology-related expressions of consumption and luxury in the Ottoman Empire during the long eighteenth century. Such aspects of material culture and their impact on local communities have received limited attention, with few exceptions. The current study aims to examine and test the hypothesis that the imported pocket watch with Ottoman numerals is an example of the emergence of popular luxury in the Ottoman Empire" (Yagou 2018/2019, p. 80). Such earlier pocket watches with Arabic numerals can be found at museums Yagou enumerated: "For the purposes of this paper. I have based my study on late eighteenth- to early nineteenthcentury medium- to low-cost pocket watches from the Clocks and Watches Collection of the National Historical Museum (NHM) in Athens, the Silversmithing Museum of Ioannina (Greece), the Deutsches Museum in Munich, the Worshipful Company of Clockmakers Collection at the Science Museum in London, the V&A Museum in London, the Uhrenmuseum in Vienna and the Nicolae Simache Clock Museum (NSCM) in Ploiesti (Romania)" (ibid., p. 81). Yagou was even able to identify a pocket watch such that the brand of the market leader was forged: "The silver-plated dial of the watch is labelled "George Charle London" and bears Ottoman numerals. The back plate of the watch bears the inscription "George Charle London 13110"; the latter is the serial number, from which it would be possible to date the watch. As 'the numbering of the movements and silver cases of watches was demanded by [English] law', the absence of numbering is a strong indication of forgery. 'George Charles' was a label used by the English watchmaker George Prior (1735-1814), the market leader for pocket watches in the Ottoman market in the second half of the eighteenth century. Apart from making and marketing high-end watches, Prior also 'had a large trade in lower quality watches that he signed with the name George Charles'. The misspelling of the name ('Charle') suggests that this item might also be a forgery" (Yagou 2018/2019, pp. 84-85, her brackets).

Yagou concluded her paper by indicating a desideratum — how individuals experienced those pocket watches — which my present paper satisfies, relating and elaborating about the recollections of a particular Jewish family, but in the first half of the 20th century, instead of in the late 18th and early 19th: "It is argued that the case-study of the pocket watch enables us to expand the popular luxury discourse beyond England, France, and the Netherlands to the Ottoman Empire, and especially to its south-eastern European provinces. Pocket watches in the early modern Ottoman Balkans clearly satisfy the criteria for being classified as popular luxury; nevertheless, the actual conditions of usage and appropriation of these objects incorporating new technology, as well as the associated mentalities by a range of users, require further clarification. Future research would aim to elaborate on the reception and use of the pocket watch, focusing on the experiences of individuals" (Yagou 2018/2019, p. 103).

# 3. The context within a particular family

One of the cultural practices grounded in specific instruments from material culture, that my mother's family did not carry over into its new environment (in Israel, Italy, and England, and for a while for some members, Japan and Canada), is making use of *a Jewish clock and a Jewish watch* — yes, such

tools used to exist — in order to determine sacred time. We still observe the hours for the beginning and the end of Shabbat and the festivals, but this is done (like other practising Jews do, in Western countries) by only relying on the times as published in print (or perhaps, in Israel, also over the broadcasted media).

The end of that cultural practice can be considered to have occurred in the early 1960s, at the demise of the paternal grandfather of my mother. (I use the first person on purpose, because of methodological criteria anthropologists would readily recognise, and which I set out following this paragraph.) His pocket watch became a keepsake: soon after his demise, my maternal grandmother and her youngest child moved to Milan, and much remained behind, even photographs of previous generations. Most of the family's silverware was donated to neighbours, so that the Iraqi state would not obtain them. This step became much more dramatic when just a few years later, but by then under the Baath regime, my maternal uncle fled Iraq; a close associate of his, also in his thirties, had been tortured and killed by the police because he was a Jew.

Whereas the pocket watch of my great-grandfather belongs to me, I am in London and it is somewhere in Israel, reflecting how the family became dispersed. Concerning pocket watches as keepsakes, consider how, in a thematic issue of *Shofar* about Jewish children from Axis lands who came to England with the *Kindertransporte*, one can read: "Others [...] tell of losing their keepsake in the train, [...] She had, for instance, left on the train her mother's silver bracelet, [...] her grandmother's pocket watch, and a case. She later commented: 'I felt I had lost the last tangible bits of my parents'" (Körte and Axelrod 2004, p. 113).

The official Jewish name of my mother's paternal grandfather was Joseph ben Nissim ben Ezra, but to the local authorities, he was Yousef Nessim (Yousef stressed on the first syllable, in the Arabic standard way for this name). To family members he was Baba Yuséf (note the place of the stress: this suggests that in the Baghdadi Judaeo-Arabic vernacular,<sup>7</sup> the Hebrew name Yosef was made to match the same diminutive Arabic derivational pattern as, e.g., *Husayn*).<sup>8</sup> This was a devout Jewish family, whose affluence depended on its roots in the merchant class.<sup>9</sup> Baba Yuséf was a rentier, and an administrator directed the operations at a tannery he owned. The family attempted a transition from the merchant class into the state bourgeoisie, by sending their eldest surviving son to the military academy, a short time after Jews were permitted (in 1908) to do so in the Ottoman Empire. It was that son, an officer and director of the Baghdad Royal Arsenal (after being forced to resign in the late 1930s from the army, after a false accusation he refuted), a merchant-banker with many commercial or industrial initiatives, who was the great doer in the family, and prevalently shaped the memories and ethos of the family in the next generation.<sup>10</sup>

#### 4. Time-measurement practices of the family

# 4.1. Arabic hour" (of Jewish liturgy) versus "English hour" (of lay modern living)

It is important to understand that Shabbat times (for the beginning and the end of Shabbat) are shown in current calendars giving the Western hour. By contrast, according to the "Arabic" time, Shabbat always starts at the same hour. This is why the pocket watch and the clock as working in "Arabic" mode needed adjustment.

It is remarkable that Jewish sacred time (at the timescales of hours and minutes) was referred to as "the Arabic hour", vs. "the English hour" (such were the expressions in the Baghdadi Judaeo-Arabic vernacular). It reflects the fact that traditional Jewish society shared that kind of time reckoning with the hosting Muslim society.

Arguably, the model for those two descriptors were other two descriptors, in use in the Ottoman Empire in the several years leading to the First World War and afterwards. The root was at "the Prime Meridian Conference in Washington, D.C., in 1884 [...] attended by representatives of twenty-five countries, including the Ottoman Empire" (Wishnitzer 2010a, p. 52). "While still in Washington, the Ottoman delegate stated that regardless of the recommendations of the Prime Meridian Conference, in the Ottoman state there would always be two times, *l'heure* à *la franque* and *l'heure* à *la turque*" (*ibid.*, p. 53). Avner Wishnitzer pointed out (2010a, p. 58):

The use of the terms alaturka and alafranga reminds us that the two hour systems were never culturally neutral. Just as the dividing line between gurubi [real solar time] and zevali [mean time] signified the different positions of the sun that the two systems used as a baseline, and the term ezani alluded to the religious baggage that the Ottoman system carried, the terms alaturka / alafranga expressed the significance that the two systems had in the construction of collective identities. The terms alafranga and alaturka, best translated as "European style" and "Ottoman style", became widely used during the second half of the nineteenth century as European commodities, tastes and fashions were disseminated through Ottoman urban centers on an unprecedented scale. By the end of the nineteenth century the term alafranga could denote anything, from "European style" house furniture, through clothing and haircuts, and on to table manners and etiquette.<sup>11</sup>

As we have seen in the introduction, even in Western Europe, where traditionally belfries and tower clocks set both church and secular time, national standard time (an average, rather than pointwise locally dependent on daylight) was only introduced with the expansion of the railway system, in the late nineteenth century. Every town used to have its own time. In a socio-historical study of the standardisation of time, Eviatar Zerubavel (1982), discussing the introduction of standard time, also remarked about opposition to its introduction (*ibid.*, p. 18):

Some of the opposition toward its introduction came on purely practical grounds, mainly from communities whose local times differed materially from the standards they were to adopt. Note that, in communities located as far as 7½ degrees of longitude away from the meridian that controls their time zone, standard time might differ by as much as 30 minutes from actual solar time. This involves considerable shifts in the clock times at which the sun rises, and, consequently, at which people must get up in the morning (an issue that has also been central to the entire debate concerning the introduction of daylight-saving time).

However, the controversy has also had some purely extrapractical, symbolic overtones. The introduction of standard time — like that of daylight-saving time — has been viewed as a blasphemous interference with the divine natural order. Even today, despite the fact that most Moslem countries, for example, have officially adopted international standard time, they still schedule such events as prayers in accordance with solar time (Meziane 1976, p. 221; Worldmark Encyclopaedia 1976, passim).

Then on the next page Zerubavel (1982) related about Khomeini (Zerubavel's brackets, my braces):

While resisting the international time-reckoning system may be viewed in some cases as mere indifference to it, there are at least some other cases where it clearly cannot be seen as anything other than a symbolic act of actual defiance. Note, for example, the defiant tenor of the following statement made by the Ayatollah Khomeini: "The heads of our [Muslim] countries are so influenced by the West that they have set their clocks according to European time. It's a nightmare" ("The Khomeini Enigma" {in Newsweek (December 31)}, 1979, p. 28). Such an attitude is clearly indicative of a quest to defy standardization and universalism and preserve particularistic sentiments by maintaining uniquely distinct sociotemporal arrangements.

4.2. Jewish calendars kept at home, tabulating sunset

At my mother's family's home in Baghdad (whose architecture and cultural use I described elsewhere),<sup>12</sup> there used to be several calendars, of the kind

showing the time at which Shabbat and the festivals start. Such Jewish calendars were called (and are still called) by my family ' $\partial bb\bar{u}r$ , i.e., 'Ibbur — properly the technical name for the process of inserting a thirteenth month, every few years. (This kind of calendars, as published by the Jewish community of Milan since the late 1940s, is called *lunario*.) Etymologically, Hebrew '*ibbur* means 'pregnancy', but *sod ha-'ibbur* (literally, 'the secret of 'Ibbur', 'the secret of intercalation [or: pregnancy]') refers to the calendrical calculations for determining, e.g., leap years according to the Hebrew calendar.<sup>13</sup>

Such Jewish calendars in Baghdad used to indicate the time of dawn and sunset. Also newspapers used to provide such information. (It is important information not only for Jews, but also for Muslims.) Such a calendar even appears at the end of a prayer book, that my uncle Həyyāwī (Albert) in Ramat-Gan, Israel, still has, and which he used in Baghdad, stating the times for the given city over many years.

Such information was useful not only in order to know the times, during the day, of Shabbat and the festivals according to the standard watches and clocks, but also in order to set the Jewish watch and clock accordingly. In the northern hemisphere, between the summer solstice (21 or 22 June) and the winter solstice (21 or 22 December), the beginning of the Sabbath gets earlier from week to week, whereas between the winter solstice and the summer solstice the beginning of the Sabbath gets later from week to week, so the "Arabic" hour on the pocket watch would be adjusted accordingly.

Apart from the times of the beginning and end of the Sabbath, as found in yearly calendars in use in Israel and in particular countries in the Diaspora, with the times indicated per city, one also comes across, at the end of prayer books, practical information about the calendar (and astronomic times) of several years following the year of publication of the prayer book itself (facing pages are shown in a scan we reproduce here, as Figure 1, from a prayer book printed in Israel decades ago).

## 4.3. Public clock, to pocket watch, to clock at home: The modus operandi

My late uncle Həyyāwī (Albert) explained more, concerning the "Arabic" hour. Dawn was at one o'clock, according to the "Arabic" hour. Minhah (the afternoon prayer) was at six o'clock. 'Arbith (this is how the Ma'ariv prayer is called among Iraqi Jews) was around ten or eleven o'clock, again according to the "Arabic" hour. Every [week]day, Baba Yuséf would move the "Arabic" hour forth about two minutes, on his pocket watch. Once every week, my uncle Həyyāwī would accompany Baba Yuséf on a walk to the town centre, and at the Ṣarāy (a large square being the courtyard of an important palace), Baba Yuséf would adjust the "Arabic" hour on his pocket watch to agree with the public clock displayed on the square.<sup>14</sup> Baba Yuséf used to set the "Arabic" hour on the clock at home (to do so, he would

mount on a chair), according to his pocket watch, once every week. My late uncle Edward (Adwar, whose Hebrew name is Nissim) said that it was on Fridays that Baba Yuséf used go on a stroll and adjust his watch according to the clock at the Sarāy.



Figure 1. Calendrical data for 1980–1981, from a prayer book, Siddur Tefillat Yesharim hashalem, printed in Jerusalem by Saleh J. Mansour, undated.

The pocket watch (with five hands: see below) was the connection that would allow taking home the "Arabic" hour from the tower in the public square, so that the clock at home (which had four hands) could be set accordingly. The clock was moved to the other houses where my mother' family lived, after leaving the house in Church Street in Baghdad in late 1947 or early 1948.

By the way, note how Baba Yuséf was relying upon an authoritative clock, when adjusting his pocket watch. Setting one's pocket watch by checking the time at some authoritative clock used to be the practice of watchmakers, but also, of course, of owners of watches. They relied on a public clock, somehow related to officialdom (or to religious authorities). This is akin to how I rely upon BBC Radio 4 to announce the time, and I check the discrepancy from my watch as well as from my radio clock.<sup>15</sup>

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In Baghdad, the time of the exit of Shabbat was checked directly by staring at the sky, in order to see whether the stars were already visible. This was feasible in Baghdad, but the stars are not practically visible from the semi-detached house in London where I live, because of the illumination neighbours have in their back gardens, apart from street illumination and light from the houses. My mother (who passed away on 8 July 2020) said that in order to ascertain whether Shabbat had ended, one used to check not parts of the sky far from the moon, but as a precaution, one would preferably check the sky visible near the position of the moon. If stars were visible notwithstanding the moonshine, then this was clear proof that Shabbat was over. Yet, the rule was that it is enough for three stars in the sky to be visible.

Concerning the public clock displayed on the square, consider what Avner Wishnitzer has to say (2010a, pp. 64–65) concerning late Ottoman attitudes towards clock towers:

The reservation toward mean time was not limited to the virtual sphere of cartoons [which in post-1908 satirical publications, lampooned<sup>16</sup> the confusion caused by the competing use of the imported mean time and, real solar time in timekeeping]; it was inscribed onto the physical space of the city in the shape of clock towers. In his recent work, Mehmet Bengüh Uluengin [(2010)] shows that Ottoman clock towers carried "complex and seemingly contradictory layering of meanings". The cultural meaning associated with clock towers were fluid, Uluengin concludes, and it was the context that determined the way these buildings were interpreted. The hours shown by the clock towers add an additional level of complexity. Those built before the second half of the nineteenth century all displayed alaturka time [i.e., real solar time], a clear expression of the obviousness of the indigenous, of its cultural monopoly. At that time, there was no need to distinguish between alaturka and alafranga [i.e., mean time] simply because the latter did not exist as a valid cultural option. However, as the use of mean time spread, more and more public clocks began to show mean time, often alongside the old alaturka hours.

Ottoman clock towers were discussed by Acun (2000), Kreiser (2006), Uluengin (2010), Wishnitzer (2010b), Çelik (2008, pp. 146–151), and Birol (2005, pp. 50–57).

4.4. Jewish hands and regular hands on the quadrant of the domestic clock Concerning the clock, my mother described it as "a balance-wheel pendulum-clock" (verbatim in English). Baba Yuséf either had it since his wedding, or otherwise it was bought in Turkey by Baba Yamen. My mother was unsure which was what, but suggested that the former was much likelier, namely, that it was a present the couple got at the wedding, perhaps from the father of the bride, Nana Serah. The external cabinet (box) of the clock apparently was of mahogany. The cabinet of the clock, containing the pendulum, was hanging from the wall, and did not reach down to the floor. The pendulum was gold-coloured. The estimates concerning size, as provided by my mother, are as follows. The width of the cabinet (including the frame) was c. 40 cm. Its depth was c. 20 cm. Its height was about one metre, and this comprises the rectangular opening for the pendulum beneath the quadrant, which itself was a circle inside a square. Their proportion was about two thirds of the height for the opening of the pendulum, and one third for the quadrant. When one would wind or set the clock, one would stop the pendulum during that operation. The height as given excludes the top: the quadrant was surmounted by a triangular roof, a wooden triangle, which was part of the frame. The back of the cabinet was where the cabinet was hanged. The quadrant and the opening of the pendulum were covered by a glass door, closed on the right by a hook.

One more twist to the matter is that on the clock, the numbers were given in Roman numbers. These Roman numbers on the quadrant served both functions of the clock, as the latter had two separate engines, one giving the hour as usual in the West, and one giving the Islamic and Jewish hour. It was these two modes, and two times, that in my family's Baghdadi Judaeo-Arabic vernacular used to be respectively referred to as sa'a 'arabáyyi and sa'a anglezáyyi, i.e., "Arab/Arabic hour" and "English hour". (Interestingly, on a Sunday morning Zoom session hosted by Chabad in London on 31 May 2020, in response to an originally Swiss rabbi being introduced with a passing mention of the importance of time for the Swiss, I very briefly related that my great-grandfather had a pocket watch made by Longines, which had five hands, with the two added hands representing Jewish time with seasonally variable hours. The rabbi hosting the session smiled, and reworded this as Jewish time vs. Yekesche time, thus rendering 'non-Jewish' with an adjective originally reserved for non-Jewish Germans.)

One would wind the clock by means of a metal key, which was introduced in one of two holes of the quadrant. These holes were, say, near the signs for 4 and 8 (in Roman numerals: IV and VIII), but internally to the quadrant. Each such hole was for winding the clock according to one of the two systems: the Western hour, or the traditional ("Arab") hour. Baba Yuséf used to wind the clock according to both systems, at the same time as he was at it. There were four hands ( $my\bar{a}l$ , the singular being  $m\bar{l}l$ ) on the quadrant. These were two pairs, differently coloured. Each pair comprised a short hand for pointing to the hours, and a long hand for the minutes. One pair indicated the "English hour", and the other pair, the "Arab hour".

#### 4.5. A Jewish and Muslim pocket watch with five hands

As mentioned earlier, not only there was a Jewish clock; there also was a Jewish pocket watch. Baba Yuséf had a large pocket watch (it still survives), with a chain, as usual for a pocket watch. What was unusual, by Western standards, was that the hours on the quadrant indicated by numerals as currently written in Arabic (not the "Arabic" numerals that are the digits as commonly known in the West).

This pocket watch is still in the possession of my family: in recent years we found it is still working.<sup>17</sup> It has two hands for the "Arabic" hours and minutes, two more hands for the usual, "English" hour, and also has a fifth hand, for the seconds. All five hands move clockwise. Note that when the watch is set properly, the two hands for the hours (the "English", and the "Arabic") and the two hands for the minutes tend to be near each other, especially the hands for the hour, because the "Arabic" hour is just a bit shorter (in winter) or longer (in summer).

My great-grandfather used to carry this pocket watch in a pocket of his waistcoat, and my mother recalled that this was usual for men of his generation, in the same environment. Clearly, this is a Westernised trait, even though pocket watches became widespread in the Near east during the nineteenth century among quite traditional people as well.

Based on the inscriptions on this pocket watch, the manufacturer was Longines (thus, in Switzerland),<sup>18</sup> and the concessionary agent in Constantinople had an Armenian name. One of my uncles recalls that under the Iraqi monarchy, the agents for Longines in Baghdad were the Abdu family, a Jewish family. Watchmaking as being a profession did occur among Iraqi Jews, and this affected onomastics, in the case of the Saatchi family, that rose to Saatchi & Saatchi fame in the advertisement sector in Britain in the 1980s. The name *Saatchi, sá'ačī*, literally means 'watchmaker'.

For comparison, consider that watchmaking had a conspicuous role in British Jewish history outside London in the nineteenth century. Consider the following statements, concerning watchmaking among Jews in Britain: "The end of the 1830s saw an important change begin in the geographical distribution of Jews outside London. Originally they were country pedlars, progressing to shopkeeping or watchmaking in the county towns, or occupations associated with the navy or shipping in the ports; the coming of the railways and changes in the structure of retail distribution, helped to bring about a re-deployment to the growing industrial areas; the small communities in market or port towns declined and the Jews built new communities of merchants and manufacturers in the Victorian cities" (Lipman 1986 = 1998, p. xii).

#### 4.6. Further considerations about the family's time-keeping

Traditional Jewish Baghdadi religious culture shared with the hosting Muslim culture the manner of referring to the hours. This was also part of a much wider Jewish and Gentile tradition, or set of traditions of how to compute the time within the day and the night. My mother recalled that Baba Yuséf would refer to the hour for prayer by the traditional time. This was a way to reaffirm one's Jewishness, yet paradoxically this was referred to as the "Arab/Arabic hour".

Of course, there also were watches of the usual, Western kind, used by the family. (Everybody had his or her own conventional watch, and Mama Baliha, my maternal grandmother, had already one when she was a little child.) This was also the case of a different clock, which was of the Western kind. In the room of Mama Baliha's room on the first floor of the multi-floor house in Church Street in Baghdad (a house organised around an internal courtyard),<sup>19</sup> between the two windows on the alley, there used to be a beige clock. It had been sent from Switzerland, having been won at a lottery of Nestlé, whose chocolate was much consumed at home. (This is an illustration of how an aspect of modernity became globalised.)

On the opposite side of the house, namely, from the tarar — the ground-floor corridor adjacent to the cellars and open on the courtyard — the children could see the hour on that clock in their mother's room on the first floor, when it was time to go to school. That clock was visible through the window of that room on the courtyard, whereas the clock itself was hanging on the wall separating the room from the alley.

# 5. More about time-keeping in a late Ottoman or Persia's late Qajar context

In Persia in the second half of the 19th century and early 20th century, watches spread more widely than clocks (Floor 2011 [1992]):

The market for pocket watches in Persia, though small, was clearly growing. At the end of the century, according to the British consul H.W. MacLean, there was "a small trade in cheap watches of Continental make" [...] By 1328 [from Hegira] / 1910 about 50 percent of the watches sold in Persia came from Switzerland, the remainder from Great Britain and France. Annual sales ranged from 35,000 to 70,000 tomans. The price of a silver watch was DM 20-80, of a thinly plated gold one somewhat higher [...] In such provincial towns as Yazd only the European watches cheapest were sold, though local watchmakers were considered indifferent workmen (Diplomatic and Consular Reports [London, HMSO], 4838, 1911, p. 29). As of 1850 Swiss musical boxes became very popular and sold well in Persia [...]

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Although watches were no longer a novelty and were seldom mentioned in the later literature, clocks were still regarded as curiosities. In the royal museum at the Golestān palace there was a substantial collection that had been developed over the years. E. A. Powell, who visited the museum in 1341/1922, reported "clocks of every size, model, and material, from gilt-and-glass extravagances incrusted with jewels to those atrocities in the form of a Swiss chalet, which indicate the hour by the door's suddenly flying open and a little wooden bird's squawking 'Cuckoo! Cuckoo! Cuckoo!'" [...]

Having mentioned a royal museum in Iran, consider the collection of clocks and watches, discussed by Fanny Davis (1984), of the Topkapı Palace Museum in Istanbul. Concerning the Ottoman Empire, it is necessary to mention the books *European Clocks and Watches in the Near East* by Otto Kurz (1975), and *Ottoman Clocks and Watches* by Kemal Özdemir (1993). Bear in mind that already in the 16th and 17th centuries, there was some local manufacture of clocks in the Ottoman Empire (Özdemir 1993, pp. 111–125; Kurz 1975, pp. 55–60; Göçek 1987, pp. 104–107). "Ottoman sources too suggest the proliferation of clocks and watches in the eighteenth century, both in İstanbul and in the provinces" (Wishnitzer 2010a, p. 49, fn. 7, citing Göçek 1996, pp. 103–106; Tanyeli 2003, pp. 314–315). By Uğur Tanyeli, also note an article of 1998, "The Emergence of Modern Time-Consciousness in the Islamic World and the Problematics of Spatial Perception".

In the "Introduction", I pointed out how in Italy before the First World War, the Savoy monarchy had accepted the introduction of international time zones, but since 1848, the state was in conflict with the Church (which e.g. instructed the faithful to boycott parliamentary elections though not municipal elections), and peals from the clock of a belfry would be according to the actual local time of the town, whereas clocks of the town council adopted Central Europe's time zone instead.

In a study entitled "'Our Time': On the Durability of the *Alaturka* [i.e., Italian *alla turca*]<sup>20</sup> Hour System in the Late Ottoman Empire", Avner Wishnitzer (2010a) stated what follows at the beginning:

Over the last two hundred years, the use of mean time [i.e., the annual average of the seasonally non-uniform rotation rate of the earth] has become so widespread that it is largely taken for granted, as if part of the natural order of things. This was hardly the way the Ottoman elites of the early twentieth century saw it. In fact, the adoption of mean time and its implications became the object of a debate that was to continue into the Republican era. This debate is at the center of the current study. Nissan, E. – Australian Journal of Jewish Studies XXXIII (2020): 217-277

Mean time entered the Ottoman Empire around the middle of the nineteenth century and was increasingly used in various governmental agencies alongside the indigenous hour system, commonly known as gurubi or alaturka saat. The use of mean time widened considerably following the 1908 Young Turk Revolution, but it did not fully supersede the Ottoman system down to the fall of the Empire. It was only in the beginning of 1926 that the old hour system was finally abolished and universally replaced by mean time in the newly established Republic of Turkey.

In Ottoman Islam, like in Judaism, "sunset marked the beginning of a new calendar day and the beginning of a new cycle of religious ritual" (Wishnitzer 2010a, p. 49), and this is the background of the resistance to the introduction of mean time in the Ottoman Empire. And yet, it is important to understand that the *alla turca* system of Ottoman official use, sticking to local time rather than mean time, used equal-length hours; "by the nineteenth century it predominated over seasonal hours, at least in official use" (*ibid.*, p. 50). "Mean time began to spread in the Ottoman Empire around the middle of the nineteenth century and came to be known as *zevali* (from *zeval*, noon), *vasati* (from *vasat*, mean [an adapted Arabic word]), or *alafranga saat*" (*ibid.*, p. 51).

In his article, Wishnitzer "ask[s] how the *alaturka* system survived *in* spite of the efforts to replace it" (2010a, p. 48). "The marginalization of the *alaturka* hour system, and the world of values with which it was connected, dialectically generated a defensive response among sectors and individuals who felt threatened by the emerging temporal order. The durability of the *alaturka* system will thus be explained by the role it was assigned in the consolidation of a 'nativist' Ottoman-Muslim identity" (*ibid.*). Already in the 15th century, Ottoman astronomers were aware of the timekeeping system with hours of equal length — "Equinoctial hours were already known in antiquity and were used in tables of prayer time before the Ottoman era. The Ottoman innovation was the counting of equal hours from sunset" (*ibid.*, p. 48, fn. 4) — but for practical purposes, seasonally variable hours were still in use in the early 20th century (*ibid.*, pp. 48–49):

The Ottoman hour system traced its origins to the ancient scheme of "seasonal" or "temporal" hours, according to which the day and the night were each divided into a set of twelve equal units. Daytime hours were counted from sunrise to sunset and nighttime hours, from sunset to sunrise. As the length of daytime and nighttime changed throughout the year, the seasonal hours varied in length accordingly. While the use of seasonal hours continued down to the twentieth century, the Ottoman tradition of astronomical timekeeping relied first and Double-Mode Clock, Arabic Pocket Watch, Jewish Time, and the Canonical Hours

foremost on equinoctial hours (al-mustawiya), which by definition, were of equal length. According to the system devised by Ottoman astronomers in the fifteenth century, if not earlier, two cycles of twelve equal hours were counted from sunset, reckoned as twelve o'clock.

The spread of this system in subsequent centuries was most probably connected to the widening use of mechanical clocks. The first mechanical clocks had reached the Ottoman court already in the late fifteenth century, and during the sixteenth they were sold in ever growing numbers, gradually spreading beyond palace circles. It seems safe to assume that by the second half of the eighteenth century, thousands of timepieces were marketed throughout the Ottoman domains every year. Seasonal hours were ill suited for the new devices, as their length equaled the standard hours of the clock only on the two equinoxes. Equinoctial hours, by contrast, were fully compatible with the uniform hours of the mechanical clock except that the need to adjust all clocks and watches to show 12 at sunset wore down their mechanisms. Since sunset (gurub) was the baseline of this unique Ottoman arrangement, just as it was in the system of seasonal hours, the names gurubi (and ezani) saat remained in use and were in fact at least as common in official correspondence as the now better-known term alaturka saat.

Thus, the evidence I have provided earlier is important in that it shows how at the very least Longines in Switzerland tried to accommodate the needs of such Ottoman customers who required seasonally variable hours in a religious context, and therefore added two hands to be reset on a weekly basis, and this in addition to the digits on the dial being according to how the Arabic alphabet writes numbers.

Concerning the *alla turca* system of timekeeping — I must say that in Italian in current use, you would more typically apply *alla turca* to the manner of squatting when reliving oneself on a rudimentary toilet being a hole in the ground (something not unknown in some Baghdadi houses in the first half of the 20th century: see Nissan 2010) — Wishnitzer explained (2010a, p. 50): "In theory, it could be just as precise as the mean time system, but the need to set all clocks and watches on a daily basis created discrepancies. Gaps between different timepieces widened quickly if they were not set on time for a few days. The resulting level of unpunctuality did not present serious difficulties before the nineteenth century as most governmental and commercial structures remained relatively simple and could rely on the daily prayer cycle for temporal orientation. Even if hours were fixed, they were usually understood with relatively wide margins".

author and educator Dino Provenzal (Livorno, 1877 – Voghera, 1972), in an entry in a book of his (1966) explaining idiomatic phrases or sentences, mentioned that in Florence, answering the question: "Come va il tuo orologio?" ("How does your watch go?", rather than the now usual "Che ore sono?", i.e., "Would you tell me the time, please?"), there used to be a punning answer: "Va con Prato" — "It goes with Prato" (a town also in Tuscany: "It follows the local time of Prato") — actually intending "Va comprato", i.e., "It ought to be bought (I don't wear any)". Wishnitzer continues (2010a, pp. 50–51):

But times were changing. The reign of Sultan Selim III (1789– 1807) inaugurated a long period of nearly constant reform aimed at creating a more centralized and effective state apparatus to cope with internal challenges and a rapidly changing outside world. Early in this reform process, different organs of the Ottoman state began experimenting with new techniques of time organization. In an attempt to attain better surveillance capabilities and higher levels of regularity, efficiency, and predictability, these organs developed elaborate "temporal constructs" in which clocks played an increasingly important role. The term "temporal constructs" here denotes the comprehensive ensembles of time-related practices and procedures that govern the work routines in complex organizations. In the nineteenth-century Ottoman Empire, the emergence of such constructs became most evident in the administrative system, in the post-1826 army, and later in the educational system. Similar constructs were devised for various systems of transportation and communication that were run by the state.

Until the end of the nineteenth century, almost all the temporal constructs within the state apparatus relied on the alaturka system. Daily routines in governmental bureaus and military compounds, schedules of schools and ferries all featured the Ottoman hours. As the length of night and day shifted throughout the year, however, the length of workdays in bureaus varied greatly between winter and summer, and office hours had to be redefined every few months. The same problem arose in school schedules and in public transportation timetables, and creative solutions were found in order to solve it. For example, shortly after the Young Turk Revolution [of 1908], official workdays were redefined in terms of hours before and after noontime (rather than in terms of alaturka saat) probably because noontime changed at a slower rate between days. Officials were now instructed to arrive three hours before noon, to take a one-hour break at noontime,<sup>21</sup> and then continue to

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work until four and a half hours after noon. The same arrangement was apparently tried in the educational system as well.

In establishing noontime as baseline, this arrangement was reminiscent of the hour system that developed in Europe, which originally counted hours from high noon to high noon. [...]

## 6. Concluding remarks

In the present study, I have grounded a Jewish custom which I record from Baghdad in the second quarter of the 20th century, in the history of rabbinic division of the day, in the history of how that kind of time measurement came to be shared by Judaism and other religious denominations, and in the early modern history of horology in the Middle East.

Conceptions of time in the history of ideas are a tantalizing subject.<sup>22</sup> The socio-history of time in relation to the unfolding of modernity is an important area of research.<sup>23</sup> Moreover, in the socio-history of technology in the modern Middle East, timepieces have been conspicuous and influential, but scholarship has also investigated a similar role for the sewing machine — in a region with a long tradition of textile manufacturing.<sup>24</sup> How people on an individual basis but as a socio-cultural phenomenon cope with personal technologies such as timepieces is a subject that has also received attention in scholarship (Corn 2011).<sup>25</sup> In Nissan (2010), I discussed how the changing material culture of sanitary appliances affected religious Baghdadi Jews, how modern and traditional appliances co-existed, and how traditional sanitary appliances within local realities were reflected in norms set by a local Jewish ritualist (Ben Ish Hay).

A standard for the subdivision of the day as of the night<sup>26</sup> spread as early as the Roman Empire, and also finds expression not only in the Mishnah, thus from within the borders of imperial Rome, but also in the Babylonian Talmud, thus from the Sasanian Empire. This standard is shared by the three main monotheistic faith communities, notably in the Church's Canonical Hours, but also in Islamic cultures.

This latter feature explains the paradox by which, among traditional Baghdadi Jews in the first half of the twentieth century, the traditional Jewish hour was referred to as being "the Arabic hour" (as opposed to "the English hour", i.e., the modern Western time as being subdivided into 24 hours of equal length, whatever the season). Jewish liturgical time used as a reference a clock in a public place, subserving Islamic as well as Jewish needs in Baghdad. A pocket watch with five hands, two of which were catering to the liturgical hours with seasonal variation of length, was set according to the public clock, and at home, a clock with four hands (itself not leaving the house) was set according to the pocket watch. Such a pocket watch or clock was quite useful to Jews, yet were not manufactured with primarily Jewish customers in mind. A pocket watch with four hands in the possession of this author's family has a quadrant with the digits written in the current Arabic script (not the Western "Arab" numbers), was used for liturgical as well as lay purposes by this author's grand-grandfather (d. 1960/1), but was produced in Switzerland by Longines, and imported to Constantinople by an Armenian concessionary.

In this article, I described how the given family set or used its clock or pocket watch. Then, I turned to a discussion of the Canonical Hours as shared with the Church, and to tracing this kind of subdivision of the day and of the night in the rabbinic literature. I also provided a sketch of how, from early modern times, mechanical clocks and watches spread in the Near East: both in the Ottoman Empire, and in Persia, i.e., two polities who played major roles in the history of Iraq since the early modern period, to the early 20th century.

## Appendix A: Concerning the history of watchmaking in the Near East: Horology advances, cultural contacts, and trade

I have mentioned that my great-grandfather's pocket watch I have described was manufactured in Switzerland, and imported through an Armenian concessionary in Constantinople, on the evidence of the inscription on the watch itself. It would be just raw data if I was only to provide the ethnographic description without contextualising it within the history of trade and the history of horology in the region. Let me say something on the history of Western clocks, watches, and related techniques in the Near East. Bruton (2002) is a history of clocks and watches. What is the history of Western techniques of watchmaking in the Near East? (as opposed to Near Eastern medieval water clocks).

In the early Middle Ages, the Baghdad Caliphate has something to teach Europe in horology, too. An elaborate water clock was sent by the Caliph Hārūn al-Rashīd to Charlemagne, through a Jewish emissary, Isaac, who also took with him an elephant, Abūl-'Abbās, that was to become famous in the West, and is even featured (in a dream) in S.Y. Agnon's autobiographical fiction.<sup>27</sup> "In the 13th century, clock construction and engineering entered a new phase with the advancements made by Al-Jazari, a Muslim engineer from Diyar-Bakr in South East Turkey, who is thought to be behind the birth to the concept of automatic machines. While working for Artuqid king of Diyar-Bakr, Nasir al-Din, al-Jazari made numerous clocks of all shapes and sizes. In 1206 he was ordered by the king to document his inventions leading to the publication of an outstanding book on engineering called 'The Book of Knowledge of Ingenious Mechanical Devices'".<sup>28</sup>

The development of early mechanical clocks in Europe had an incentive in the liturgical needs of the Church.<sup>29</sup> For example, Carey Fleiner began an article about early clocks by stating (2006, p. 183):

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The use of cord, cable, hemp, or string interchangeably to repair clocks is noted in the earliest records of mechanical clocks in the thirteenth century. However, for about thirty years in the seventeenth century, the churchwardens' records of London's Allhallows parish in Lombard Street show that a clocksmith called William Edwards was keen specifically to use 'lutestrings' to keep the church clocks in his care in good working order.

Churchwardens kept financial records of all the money spent by their parish church on the upkeep of the church and its property. Parish records note whenever money was spent on clock repair, the amount spent, and the nature of the repair or maintenance. Most often it was the year's purchase of oil to keep the iron parts of the clock moving smoothly, and of different types of cord, gut, or wire to suspend the various weights.

Later on, in the early modern and modern periods, one finds the Muslim clergy involved in modes of timekeeping. See a 2015 article by Daniel Stolz, ""Positioning the Watch Hand: 'Ulama' and the Practice of Mechanical Timekeeping in Cairo, 1737–1874".<sup>30</sup> Timekeeping in modern Egypt is the subject of a 2013 book by On Barak, *On Time: Technology and Temporality in Modern Egypt*.

In an article about import and export in the Ottoman Empire, especially from and toward Europe, in early modern times, Suraya Faroqhi (2000) included a section entitled "Tributary Clocks" (pp. 442–443). She points out (*ibid.*, p. 442, fn. 28) that "[t]he standard work on our subject is Otto KURZ, *European Clocks and Watches in the Near East*" (i.e., Kurz 1975). Again Faroqhi writes:

It has long been common knowledge that at the close of the sixteenth century, clocks from Europe were in demand at the Ottoman palace. While in the seventeenth and eighteenth centuries, these were imported from France and England, in earlier periods, there were other sources as well. Around 1600, Augsburg was a major centre of European clock and watchmaking. Moreover while Augsburg clock- and watchmakers lost their leading position to their French and English competitors in the second half of the seventeenth century, the town continued to be an important centre of gold- and silversmiths for at least a century longer. Ottoman dignitaries, the Sultan not excluded, were so interested in these artefacts combining the skills of clockmakers and silversmiths that the latter came to make up a significant part of Habsburg tribute payments [the "Turkish Tribute" (Türkenverehrung)], due for the small strip of Hungarian territory remaining in the hands of the "king of Vienna". And after changes

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in the seventeenth-century balance of power had led to the abandonment of tribute payments, the clocks of Augsburg were still in demand as diplomatic gifts. [...]

For example, in 1573 a Habsburg ambassador received a request from Ahmed Paşa,<sup>31</sup> who:

wanted two timepieces whose sketches he included, and which have survived in the Viennese archives, complete with Ottoman explanations and their translations into German. Such exact specifications could cause problems; at one point, an order was delayed because no one in Augsburg could make sense of the Ottoman text.

Ahmed Paşa wanted only vegetal ornaments, and specifically excluded images of human beings and relief work. This was also [at the same time in 1573] the demand of [Mehmed] Sokollu, who had a German-speaking watchmaker in his service, so that the explanations belonging to the sketches did not need translations. Other recipients were less particular where imagery was concerned. Thus in 1569, depictions of birds and animals suitable for the chase were deemed appropriate for Sultan Selim II, while Murad III, in preparation for the 1582 circumcision of his son, even demanded figures of animals and human beings moved by clockwork; they were presumably intended as table decorations. [...]

Let me turn to Persia.<sup>32</sup> Willem Floor (1992 [2011]) states that "There is little available information on the existence and use of clocks in Persia itself before the Il-Khanid period (654–736/1256–1336)" (under Mongol rule), yet it is known that a water clock was built at a religious establishment in Yazd in 725/1324. "The mechanical clock, in which a weight-driven device moves a counting mechanism at regular intervals, appears to have been invented in Europe about 1300 C.E. (Baillie [1981]). Watches, which are portable clocks, became common after 1500, when the German Peter Henlein probably invented the mainspring. Both clocks and watches were introduced into Persia at about that time (Baillie)" (*ibid.*). There is mention, from the first half of the sixteenth century, of "what may have been the first clock brought from Europe, which he [Moḥammed Ḥafeẓ Eṣfahani, the author of the work reporting this] saw in Herat" (now in northeastern Afghanistan).

The Ottoman sultan (probably Bāyazīd II, 886–918/1481–1512) and the king of Persia (probably the Aq Qoyunlū [dynasty member] Ya'qūb, who ruled at Tabrīz in 883–96/1478–90) sought to have it copied as it passed through their lands, so that the art of making clocks would not remain the monopoly of nonDouble-Mode Clock, Arabic Pocket Watch, Jewish Time, and the Canonical Hours

Muslims. Besides, it was a necessary tool for determining the correct times for prayer. They were unsuccessful, however, and Esfahānī himself was the first to grasp its workings and make a copy; he confessed himself amazed at the intricacy of the design. In addition to the instrument that he made at Herat, he built another at Samarqand for the Timurid prince Soltān-Aḥmad Gūrkānī (873–99/1469–94; [...]) [...]

"By 949/1542 there was a clock in Tabrīz, housed in a separate pavilion in the  $b\bar{a}z\bar{a}r$ " (Floor, *ibid.*). That clock was described by an Italian traveller, and contained animated characters (horsemen, buffoons, a dragon, a cat, a snake). Moreover, by inserting a coin, one could obtain a piece of paper foretelling the future. "Despite these early examples, however, the art of making clocks was soon lost in Persia" (Floor, *ibid.*). In the 1590s, there were a few watchmakers from Western Europe in Persia. Two European clockmakers who worked in Persia in the first half of the seventeenth century, were executed for murder on separate occasions.

Around 1709, a Shah of Persia wrote to Louis XIV of France, asking for some clockmakers to be sent to him. In the first half of the eighteenth century, kings of Persia "also employed watchmakers, some of them natives" (Floor, *ibid.*). "Clocks and watches became more common in Persia during the 13th/19th century" (*ibid.*). "Persians often showed their watches to Europeans in order to learn their prices, on the assumption that the latter would know, just as they knew the prices of horses and shawls. English products were preferred, especially the hunting watch, [...], because glass, if it were broken, was difficult to replace" (*ibid.*). In a pocket watch with a hunter case, the glass is protected by a metal cover that can be opened.

"The craft of watchmaking had become well established in Persia by the mid-13th/19 century" (*ibid.*). "In such provincial towns as Yazd only the cheapest European watches were sold, though local watchmakers were considered indifferent workmen (*Diplomatic and Consular Reports* [London, HMSO], 4838, 1911, p. 29). As of 1850 Swiss musical boxes became very popular and sold well in Persia" (*ibid.*). In "1924 there were only seventeen master watchmakers in Isfahan [...]. At about the same time there were 48 watchmaking shops in Tehran, operated by fifty-six masters (*ostād* ['boss': a term used also in Iraq]), twenty-three journeymen (*kārgar*), and twelve footboys" (*ibid.*).

Reviewing Agius and Hitchcock's edited volume *The Arab Influence in Medieval Europe* (1994), Maya Shatzmiller made this comment about a chapter concerning horology (Shatzmiller 1997, p. 118):

Donald Hill [(1994)] writes about the uniqueness of the few Arab treatises on fine technology and their possible role in the development of mechanical clocks in Europe. He begins with a Nissan, E. – Australian Journal of Jewish Studies XXXIII (2020): 217-277

concise introduction to the Arabic treatises (which he has studied and published); explains their relationship to Greek precedents, Philo and Hero; then indicates the Arabic innovations. He examines the elements described in the Arabic works and, although he cannot substantiate exactly how they reached Europe, he concludes that the mechanical components of early European clocks already existed in Islamic models made several centuries earlier, suggesting some sort of borrowing. He also suggests that the monastery of Ripoll [in Catalonia] was the most likely avenue for the transmission of this technology to Europe.

Elman (2010) pointed out that in China during the seventeenth and eighteenth centuries, the Jesuits "remained as court clockmasters and geometers, and a Jesuit, usually Swiss, was always in charge of the imperial clock collection in the eighteenth century" (*ibid.*, pp. 348–349). To better appreciate this remark, note that in 1723, a new emperor exiled a Chinese scholar prince, and denied his favour to the Jesuits who had collaborated with that prince, because in the strife for succession the prince and the Jesuits had not supported him (*ibid.*, p. 349). Jami (2008) discussed a Portuguese clockmaker at the Chinese court in the last quarter of the 17th century. Chinese clockmackers from a later generation acquired the ability to manufacture Western-type timekeeping instrumentation: "By 1800, with only a few ex-Jesuits remaining, Chinese artisans were proficient enough to make mechanical clocks themselves" (Elman 2010, p. 348). Early modern clocks in Japan, and the history of punctuality in modern Japan, are the subject of Skeel (1892) and Hashimoto (2008).

#### **Appendix B: Time-keeping in Jewish sources**

# B.1. The rabbinic background

# B.1.1. Hours for prayer, divisions of the day and night,

## and the Roman legacy

Elisheva Carlebach (2011) has discussed Jewish timekeeping at the calendrical level, in her book *Palaces of Time: Jewish Calendar and Culture in Early Modern Europe.* In the present study, we have concerned ourselves not with the calendar, but with Jewish timekeeping at the circadian level (roughly speaking, from sunset to sunset, or a bit later when it comes to the exit of Shabbat).

Church terminology in Europe still retains some references to the old day subdivision with seasonally variable hours, even though there references were eventually recast into the new system with constant hours. Such relics are found in the names of some of the Canonical Hours. Consider the Nones, as they are called in English. This is the daily office that was originally said at the ninth hour, corresponding to 3 pm, but now often earlier. Latin nona stood for the third quarter of the day. The hours of the day and of the night depended upon daylight, and thus upon the season.

Consider in the following Table 1, "The Little Hours" and the evening hours, these being part of the Canonical Hours from Catholic liturgy. This sample of the Canonic Hours is useful in order to realise similarities and differences with respect to the rabbinic subdivision of the day:

Time of Day	Names of canonical Hours used by Traditional Orders	Names of the Canonical Hours used by Novus Ordo
6:00 AM (the "first hour")	Prime	~Abolished~
9:00 AM (the "third hour")	Terce	Called collectively "The Little Hours" or "Prayer through the Day", they are still called individually "terce", "sext", and "none". Only one of these short offices is obligatory [].
noon (the "sixth hour")	Sext	
3:00 PM (the "ninth hour")	None	
Sunset	Vespers	Vespers or "Evening Prayer" or "Evensong"
After sunset, before bed	Compline	Compline or "Night Prayer".

Table I. The Little Hours.

"The Canonical Hours"<sup>33</sup> shows a fuller table for the canonical hours as fixed in the current system by Novus Ordo.

*None* (rhyming with *bone*) corresponds to the Jewish Minhah prayer (which however has an earliest time and a latest time permissible), Vespers corresponds to the Jewish Arvit/Ma'ariv, whereas Compline corresponds to Keri'at Shema' 'al ha-mittah (i.e., Shema' ["Hear, o Israel"] before bed: a statement of belief in monotheism and commitment to Jewish orthopraxy). More precisely, the Vespers correspond to the Jewish *Minhah* prayer, whose proper time is at sunset, but which can be permissibly anticipated to as soon as the early afternoon, in which case it is called "the small Minhah" in Hebrew, with its time corresponding to that of the Catholic None. Once one can see the stars (but permissibly it is enough that it be after sunset), according to the Jewish liturgy one has to say the evening prayer (Arvit/Ma'ariv), and therefore it also corresponds to the Vespers.

It is especially nightly divisions from Christian liturgy — "Already well-established by the ninth century, these canonical offices consisted of eight daily prayer events and three (or four) nightly divisions (called 'nocturns', 'watches', or 'vigils')"<sup>34</sup> — that have a precise equivalent in the Talmud.

By the time of the Roman Empire, the Jews (and eventually early Christians) began to follow the Roman system of conducting the business day in scheduling their times for prayer. In Roman cities, the bell in the forum rang the beginning of the business day at about six o'clock in the morning (Prime, the "first hour"), noted the day's progress by striking again at about nine o'clock in the morning (Terce, the "third hour"), tolled for the lunch break at noon (Sext, the "sixth hour"), called the people back to work again at about three o'clock in the afternoon (None, the "ninth hour"), and rang the close of the business day at about six o'clock in the evening (the time for evening prayer).<sup>35</sup>

The following explanation about Islamic practice is brief, but quite informative for our purposes:<sup>36</sup> "Muslims still use a modified definition of canonical hours when they pray five times a day. Their prayer (salah) times are Salat al-Fajr (Laudes), Salat al-Zuhr (Sext), Salat al-Asr (Nones), Salat al-Maghrib (Vespers) and Salat al-Isha (Compline)."

#### B.1.2. Seasonally variable hours from rabbinic sources

Unlike the Churches, the Jewish and Moslem system of subdivision of the day maintained the seasonally variable hours. This much clarifies the situation, by which Jewish sacred time as subdivided within the day was referred to by Baghdad Jews as the "Arab/Arabic hour". Judaism and Jewry (both in Europe and in Islamic lands) used to refer to the hours of the day in a manner closely related to how we have described the "Arabic" hour (the way it was explained to me by my uncle Həyyāwī). Bear in mind that as late as early modern and modern times, rabbinic literature has maintained the system documented as early as the Mishnah and the Talmud. In the Mishnah, at *Kelim*, 12:4, the stone-dial is called *even ha-sha'ot*, "the stone of the hours". In the Babylonian Talmud, *Berakhot*, 3a, one finds the time referred to as *'ad arba' sha'ot*, which means "to four hours (the fourth hour of the night)" (Jastrow 1903, p. 1609, s.v. *sha'a*).

The morning *Shema* ' (affirmation of monotheism) prayer must be recited by the third hour, the '*Amidah* (standing prayer) by the fourth hour, the supplementary morning prayer (*Musaf*) before the seventh hour, the

afternoon prayer (*Minḥah*) between shortly after the sixth hour and shortly after sunset, and the *Shema* ' as being part of the evening prayer — before midnight.

In the Mishnah, *Sanhedrin*, 5:3, one finds: *eḥad omer bishtei sha'ot*, that is to say (Jastrow, *ibid*.): "if one witness testifies that the act under consideration was committed at the second hour of the day", i.e., since dawn. That passage from *Sanhedrin* reads as follows (my translation from Hebrew):

One says: "at two hours" [i.e., at the second hour of the day], and one says: "at three hours", their testimony [of each one] stands. One says: "at three" (be-shalosh), and one says: "at five" (be-hamesh), their testimony is invalid. Rabbi Judah says: "It stands". One says: "at five", and one says: "at seven" (be-sheva'), their testimony is invalid, as at five the sun is in the east, and at seven the sun is in the west".

Hanokh Albeck's Hebrew commentary (1959) to that passage of the Mishnah explains: "Because before noon, the sun is in the east, and in the afternoon the sun is in the west". In H. Albeck's introduction to tractate *Pesa him* of the Mishnah explains (on p. 139 of *Seder Mo'ed*):

This is the place to remark that the hours mentioned here and concerning the prohibition of hametz (ch. 1: 4–5), and elsewhere in the Mishnah, are sha'ot zemanniyyot [seasonally variable hours, literally: 'temporal / provisional hours'] that subdivide the day, from dawn until the stars are visible [well after sunset], into twelve parts, and these are the hours (sha'ot). According to this division, the hours in summer are longer than the hours in winter. In the middle of [the month of] Nissan, when the length of the day in the Land of Israel is between 12 and 13 hours [i.e., fixed-length hours as per modern Western usage], there isn't a big difference between the sha'ot zemanniyyot [seasonally variable hours] and the hours of constant duration (ha-sha'ot ha-shavot) that are in use among us. Another difference between us and them [the early rabbis] is that we count the hours from midnight and from noon, and at the time of the Mishnah they used to count them from the morning — from dawn (me-'alot ha-shahar), but some say from the first appearance of the sun (me-hanetz ha-hamma) — until the evening, that is until the stars are out ('ad tzet ha-kokhavim); but some maintain: until the end of sunset ('ad sof sheki'at ha-hamma).

The rabbinic authorities cited by Albeck (*ibid.*, fn. 5) include Maimonides' commentary to the Mishnah at *Berakhot*, ch. 1, to folio 9b; and then *Shenot Eliyahu* and *Lehem Shamayim* by Ya'betz *ad loc.*; as well as *Shulhan* '*Arukh*, §443:1.

#### B.1.3. Time-Keeping in Relation to Passover Rites

In the Mishnah, *Pesahim*, 5:1, one finds, concerning the hour of the *tamid*, i.e., of the perpetual sacrifice, made every day at twilight:

The tamid is slaughtered at half past eight, and is offered at half past nine; on the eve of [the first night of] Passover, [as it was necessary to make the Paschal sacrifice after the tamid, the tamid] is slaughtered at half past seven and is offered at half past eight, whether it is in a weekday or on the Sabbath. If the even of Passover happens to be on the eve of the Sabbath, [as it is necessary to roast the Paschal lambs before the beginning of the Sabbath, the tamid] is slaughtered at half past six and is offered at half past seven, and the Paschal sacrifice after it.

Chametz (i.e., leavened food), according to Mishnaic law, in principle must not be eaten starting from noon, i.e., starting at the beginning of the seventh hour, on the 14th of the month of Nissan (the eve of Passover). As a precaution (lest one errs and confuses the sixth hour for the seventh), Mishnaic law stipulated that chametz should be burnt one hour earlier. In the Mishnah, *Pesahim*, 1:4, one finds, concerning at which time in the day, one must cease eating or using chametz on the 14th of Nissan: "Rabbi Meir says: They eat [the chametz permissibly] all the fifth hour long, and they burn [the chametz] at the beginning of the sixth hour. Whereas Rabbi Judah says: They eat all the fourth hour long, and they suspend all the fifth hour long, and they burn [the chametz] at the beginning of the sixth hour". By 'suspension' (tolin, "they suspend"), it is meant (according to rabbi Judah) that because of some doubt concerning the exact time, all the fifth hour long there is an intermediate interval, during which the chametz is no longer eaten by Jews and not yet burnt, but it is permissible to use the chametz, such as by feeding it to one's chattel.

Consider that in the canonical hours of the Church, the Nones are c. 3 pm, thus corresponding to the ancient Roman ninth hour. In the Jewish halakhic literature, e.g., in the *Shulhan 'Arukh* at §471 (which concerns the eve of Passover), there is mention of "the tenth hour", which corresponds to c. 4 pm around the time of Passover, in Mediterranean countries.

## B.1.4. Rabbinic divisions of the night:

# Modern practice and talmudic mythologisation

Concerning the subdivision of the night, the very popular Even-Shoshan dictionary of Hebrew, s.v. *ashmura, ashmóret,* defines: "Part of the night (usually one third)", related this to the nightly watches, and goes on to state: "The first *ashmoret* is approximately until ten o'clock; the second — until two past midnight; the third — until the sun shines (*zeriħat ha-shemesh*).

There are those who divide the night into four *ashmorot*, each one of four hours".

The medieval exegete Rashi, in his gloss to *ashmoret habboker*, "in the *ashmoret* of the morning" (*Exodus* 14:24), remarked: "The three parts of the night are called *ashmorot*, and the one before morning, [Scripture] calls it *ashmoret habboker*. I say that it is because the night is subdivided into watches of song (*mishměrot shir*) of the Angels of the Service, one group succeeding the other, there being three parts, that it is called *ashmoret*, and this is why Onqelos translated [into Aramaic with] *mațțĕrat*" (*bemațțĕrat tsafra*, literally "in the watch of the morning").

My mother commented that in her family's everyday life back in Baghdad, the traditional way of subdividing the day and the night was accepted naturally, not as something outstanding. When I mentioned to her that even in fairly recent generations, Hebrew literature steeped in the tradition would refer, for example, to the end of the first nightly watch (*ha-ashmoret ha-rishona*), she retorted that she was aware in Baghdad of the three nightly watches, and volunteered their times: "before twelve, then at three, and at six". I pointed out in response that this way, the three watches only comprise three hours each, and she remarked that it is approximately three to four hours (evidently, she was referring to our conventional hours, constant the year round, whereas nights are shorter or longer depending on the season.) She also said she thinks that also the Moslems have some subdivision like that.

Actually, the standard explanation of the Jewish subdivision into nightly watches is provided in the Babylonian Talmud, *Berakhot*, 3a. I quote from Maurice Simon's translation in the Soncino Press edition (ed. Epstein) from the 1930s (the square brackets are Maurice Simon's own; I interpolate his footnote in curly braces):

UNTIL THE END OF THE FIRST WATCH. What opinion does R. Eliezer hold? If he holds that the night has three watches, let him say: Till four hours [in the night]. And if he holds that the night has four watches, let him say: Till three hours? — He holds indeed, that the night has three watches, but he wants to teach us that there are watches in heaven {Among the ministering angels} as well as on earth.

This is followed by a midrashic interpretation of *Jeremiah*, 25:30, where divine metaphorical roaring is referred to by three occurrences of forms of the Hebrew verb for 'to roar' (*sha'ag*). Supposedly, there are three such roars per night, one at each watch. Then, the Gemara continues, listing event patterns associated with each watch:

And the sign of the thing is: In the first watch, the ass brays; in the second, the dogs bark; in the third, this child sucks from the breast of his mother, and the woman talks with her husband. What does

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*R.* Eliezer understand [by the word watch]? Does he mean the beginning of the watches? The beginning of the first watch needs no sign, it is the twilight! Does he mean the end of the watches? The end of the last watch needs no sign, it is the dawn of the day! He, therefore, must think of the end of the first watch, of the beginning of the last watch, and of the midst of the middle watch.

And so forth. This Talmudic passage states what appear to be folkloric beliefs associated with homiletics. Perhaps some elements from the *realia* of the Roman-ruled Land of Israel were transferred, in the different social context of Mesopotamia, to corresponding heavenly events.

## B.2. The biblical precedent of the sundial hours of variable length

The sundial is already mentioned in the period of the pre-exilic monarchy and of the Prophets. This is in the episode when Isaiah foretells King Hezekiah (r. c. 727 - c. 698 B.C.E.) that he shall recover from his illness, and Hezekiah requests that a specific sign that this will happen be given to him: namely, that the shadow of the sundial (itself called "the degrees/steps of Ahaz", after Hezekiah's father and predecessor, who had it made) would go back by ten degrees (2 Kings 20:9–11). That episode is retold in the Babylonian Talmud, tractate Sanhedrín, 96a).

Among the medieval Jewish commentators, Gersonides (Levi ben Ghershom, also known as Leo Hebraeus, or Maestre Leo de Bagnols), a Provençal rabbi (1288–1344) who also was an astronomer (Freudenthal 1992, Freudenthal e Mancha 2005) and a mathematician (he was the founder of trigonometry), in his gloss to 2 *Kings* 20:10, as could be expected expressed surprise. He concluded that the miracle was circumscribed to the shadow of the sundial, with no effect on the sun's trajectory. Gersonides proposed that the clouds deflected the sun rays, and that Hezekieh had dared request that miracle because he was aware that an optic phenomenon was possible: it was windy, and he had noticed "vapours" in the sky. Therefore, the miracle he requested would consist of a suitable movement of the clouds.

Joseph Kara, a French rabbi from the first half of the 12th century, explained in his gloss to 2 *Kings* 20:9 that this was about "degrees/steps made for the hours of the day (daylight)", and that those degrees/steps were "like *orlogin* that artisans make in order to check the hours of the day (daylight)". In his gloss to v. 11, Joseph Kara explained "Ahaz had [had] twelve degrees/steps made, in order to check there the hours".

The same episode also appears in *Isaia* 38:8, and Rashi (Troyes, Champagne, 1040 - Worms, 1105), Judaism's most famous biblical and talmudic commentator, explained *sél hamma'alót* ("the shadow of the degrees/steps") as follows: "a kind of steps/degrees (*madregót*), made in front of the sun, in order to check there the hours of the day, like *orlogin* 

that the Christians make". Another medieval commentator, Eliezer of Beaugency (Belgançi),<sup>37</sup> in his gloss to *Isaiah* 38:8, claimed that the degrees whose receding Hezekiah requested were the degrees on the east, because after noon the shadow proceeds eastwards, whereas from the morning until noon the shadow proceeds westwards. He claimed that all in all, there were 24 degrees, each one corresponding to half an hour, and that there were 12 degrees to the east, from the sixth hour on. He maintained that the episode took place in the month of Tammuz (about July), and he says that much based on a rabbinic source no longer identifiable. He explains that it was almost sunset, and that this resembles Hezekiah's life which, because of his illness, appeared to be nearing its end, and that the sundial shadow receded by ten degrees remaining in the eastern ones (the afternoon hours). That gloss is accompanied, in the manuscript, by a drawing of the sundial degrees. Cohen (1996), who has that gloss on p. 247, reproduced that drawing on p. 406. Eliezer of Beaugency, in his gloss to vv. 1-5, tried to reconcile astrology to the vivifying effects of prayer, which can deflect considerably fate as depending upon the constellations.

A gloss by Isaiah of Trani to *Isaiah* 38:8, claims that it was almost evening, and that as the sundial shadow had receded by ten degrees, it looked as though it was morning. Thus, he clearly considered the sundial to have had 12 hourly degrees, not 24 degrees of half an hour each.

# *B.3. Jewish references to time-keeping from early modern records B.3.1. Verona, 1610*

In the minutes book of the Jewish community of Verona, in an entry of 1610 (on p. 242 in ed. Boksenboim 1990), one finds: 'ad shekkishkesh sha 'ah k"d "until [the city bell] rings the 24th hour" (i.e., midnight); and 'ad 'X sha 'ah ballaylah "until the first hour of the night" (i.e., 1 am). This reflects not the traditional liturgical hours, but the usual quadrant with 24 hours.

## B.3.2. Mantua, 1563

Clocks occur in Hebrew texts from the early modern period even when the purpose was not to indicate the time. The purpose was to indicate the space instead, in the colophon of an edition (described in Spagnoletto 2007, p. 28) from Mantua, of 1563, of Isaac Aboab's *Sefer Menorat ha-Ma'or* (*The Candelabrum for Illumination*), a treatise in religious ethics in seven parts, each one called a lamp, hence the candelabrum metaphor. The colophon, also in Hebrew, states: "At the printhouse that is inside the tower (*migdal 'oz*) of hours of the brothers Messer Filoterpse and Clidano Filipono". The word for 'tower' should have been just *migdal*, whereas the text has *migdal 'oz*, i.e., literally, 'tower of strength', i.e., a fortified tower. This was because of the occurrence of the noun phrase in *Proverbs* 18:10 and *Psalms* 61:4. Another feature of the colophon is a double occurrence of a syntactic

Italianism, consisting of the preposition 'of' being expressed by means of the Hebrew preposition for 'from'. The Hebrew text has:

> בדפוס שהוא בתוך המגדל עז מהשעות מהאחים מיסי׳ פילוטארסי וקלידאנו פיליפוני

Spagnoletto translates: "nella stamperia della torre dell'orologio dei fratelli Filoterpse e Clidano Filipono". In present-day Hebrew, a clock tower is called *migdal ha-sha'ot*, i.e., literally, 'the tower of the hours'. In the colophon considered, one has instead the literal sense "the tower of strength from the hours from the brothers" and so forth.

# *B.4. The biblical Teraphim: Two medieval interpretations B.4.1. The interpretation of the Teraphim as*

#### horologic devices used for divination

The Teraphim of Laban, stolen by Rachel (*Genesis* 31:19) have been traditionally associated with idolatrous practices as well as with divination. In that respect, it has been problematic that the biblical David had Teraphim at home: Michal, his wife and King Saul's daughter, enabled him to escape assassination by having him flee and placing the Teraphim in his bed (*Judges* 18:2), something that supported the view, among medieval rabbinic commentators, that they shaped like a human being.

Moses Naḥmanides (Ramban) was born in Gerona in 1194 or 1195, mostly lived there or in Barcelona, was known in Catalan by the names *Bonastrug da Porta* and *Messer Mossé de Girona*, and was an intellectual leader of Spanish Jewry. In old age, after he had to take part in the famous Barcelona disputation of 1263 into which the Jews were forced. He moved to the Land of Israel, attempted reconstruction of local Jewish communities after the ravages of the Mongol invasion, and died there around 1270.

Naḥmanides, in his gloss to *Genesis* 31:19, claimed: "And the most likely [interpretive option is] what they say, that they are instruments for receiving [i.e., sensing and indicating] the hours, and they perform magic by their means in order to know future things".

The Provençal exegete and grammarian Rabbi David Ķimhi (or Radaķ, b. 1160?, d. 1235?) is one the main Jewish medieval biblical exegetes; Christian Hebraists or apologists, too, published sometimes his biblical commentaries. The gloss to *Genesis* 31:19 by Rabbi David Ķimhi states: "And the Teraphim are the copper instrument in which [people] see the hours of the day, and they see [i.e., divine in] it future things, and oftentimes it misleads [...], and it is called in the plural because it is made as several plates".

Abraham Ibn Ezra, in his gloss to *Genesis* 31:19, averred: "There are those who say that it is a copper instrument made in order to know the parts of the hours [...] and for me, it is likely that the Teraphim are in the shape

of human beings". For the latter interpretation, Radak related it by referring explicitly to Abraham Ibn Ezra. A Hebrew poet, grammarian, Biblical commentator, philosopher, translator, astronomer and physician, Abraham Ibn Ezra was born in Tudela in Islamic Spain, in 1089. He lived in Spain and North Africa until he was nearly fifty. Then, from 1140 onwards, he wandered in Western Europe, especially in Italy (e.g., he was active in Lucca) and France, and died circa 1164, apparently in London.

Radak, in his commentary to *Judges*, at 18:4–5 (where the Danites, moving north, consult the Levite hired by Micah to officiate at his private shrine and its graven image, which they then proceed to confiscate for their own use), quotes concerning the Teraphim what Abraham Ibn Ezra wrote at *Genesis* 31:19, but without naming him.

## B.4.2. Another interpretation of the Teraphim, and an Armenian parallel

Sperber (1995) and Nissan (2008) discussed the medieval claim that Laban's Teraphim were red pickled men. David Mescheloff summarized Sperber's paper in English as follows (1995, p. xiv): "Rabbinic and medieval Jewish sources describe the Teraphim of Genesis 31, 19 as pickled red men who were capable of foretelling the future. In 'Teraphim', Daniel Sperber traces the various elements which make up this strange legend to a variety of disparate sources, demonstrating how this motif evolved". Sperber showed that as the legendary interpretation of Laban's Teraphim evolved from the version given in Pirgé deRabbí 'Eli'ézer (a Jewish homiletic work from Palestine, ca. eighth century), the nature of the Teraphim was described differently. Originally, it was claimed that these were magical implements, which pagans obtained by severing the head of a firstborn male person, preserving it with salt and balsam, and placing it on a golden tray on which a magical formula was inscribed (Sperber, *ibid.*, p. 372). The same is also related in the pseudo-Jonathan Jewish Aramaic translation (and elaboration) of Genesis (Sperber, ibid.).

In later versions — in the pericope *Vayyetse* in *Séfer haRoqéah* by Rabbi Eliezer of Worms (b. Mainz, 1160, d. Worms, 1237), while commenting on *Genesis*, 39:19, as well as in the commentary *ad loc*. by Rabbi Menahem Tsiyyoni (Worms, 15th century) — it is stated that the person so sacrificed had to be an '*adam* '*adom*, "a red person". Sperber (1995, p. 373) rejects the hypothesis that this version arose from a wrong repetition, and proposes instead that it existed in the earlier sources as well, from which it was deleted by emendation (as some copyist must have thought it was a wrong repetition). According to Sperber, the description of the sacrifice was originally applied to the Phoenicians (who used to sacrifice their firstborn children indeed, a practice associated with the *tophet* of Phoenician and Carthaginian colonies throughout the Mediterranean). The very name of the Phoenicians, in Greek, was derived from  $\varphi olvi\xi$  for 'red'. (Sperber adopts the etymology according to which the ethnic name was given because of the involvement of the Phoenicians in the production of purple dye.)

The social anthropologist Sir James George Frazer (1854–1941), in his classic *The Golden Bough* (Pt. 4, vol. 2, p. 97), stated: "With regard to the ancient Egyptians we have it on the authority of Manetho that they used to burn red-haired men and scatter their ashes with winnowing fans". That Egyptian rite was intended to ensure fertility for the earth. Frazer listed examples, drawn from various cultures, of human sacrifices intended to make the ground fertile, and Adi Zemach (1998, pp. 44–45) mentions this in relation to agriculturalist Cain slaying the shepherd Abel.

I am now able to signal an anti-Jewish medieval Armenian occurrence of the motif. An Armenian chronicle from which we have been quoting earlier — *History of the Nation of the Archers* (i.e., the Mongols) by Grigor of Akanc'in Cilicia, who wrote a manuscript in 1271 — while describing in Chapter 10 atrocities perpetrated against Christians by the Mongols, joins into the opprobrium a Jewish physician who supposedly convinces the Mongols to kill children for medical purposes (thus, instantiating the widespread Christian libel against Jews represented as killers of Christian children). The following is quoted from Blake and Frye (1949, pp. 327, 329, 331, a translation facing the Armenian text; my added boldface):

[p. 327: ...] After this, when the year 706 (1251) of the Armenian era had come, there arrived from the east, where the great Khan was, seven sons of the khan's, each with a duman of cavalry, and a duman is thirty thousand. [But Central Asian tümen, hence in Islamic languages tūmān, denotes 10,000.] They were named as follows: The first and greatest of them was Hulawu (J 36), who was a brother of Manku  $\Gamma$ an. The second, Xul, called himself the brother of God and was not ashamed. The third was Balaxe, the fourth Tut'ar, the fifth T'agudar, the sixth Jratayan, and the seventh Bawrayan. They were in disagreement among themselves but were very fearless and eaters of men. On their journey they all came and traveled about in wagons, while they leveled the mountains and hills of the eastern country to facilitate the movement of their wagons and carts.

Then that chieftain, who called himself the brother of God, came into the interior of the country and mercilessly fell upon the miserable Christians. They burned all the wooden crosses wherever they found them erected on the roads and mountains. But nothing whatever satisfied them. Wherever they found monasteries in the land they plundered and oppressed, eating and drinking. They trussed up the venerable priests and flogged them mercilessly.

#### Double-Mode Clock, Arabic Pocket Watch, Jewish Time, and the Canonical Hours

A chieftain of the horsemen of Xul came to a cloister which was called Geret'i, and the head of the cloister was a greybeard and very old, outstanding (V 24), holy and accomplished in all of his ways, performing good deeds, Step 'annos by name. When he beheld the [p. 329:] chieftain of the Tat'ars, who was coming towards him to the cloister, he took a jar of wine and went towards the Tat'ar and brought salt as is the custom of the Tat'ars. Then (J 37) afterwards he led them to the cloister and had him sit down with the other horsemen who were following their chief. He slaughtered a sheep and opened other wine and gave them all their fill in eating and drinking so that they could hardly remain on their horses. In the evening drunk, they returned to their camp (lit., houses), which was near the cloister, that is, the camp of the Tat'ars. When they arrived at their quarters they slept through the night. In the morning, on waking, they beheld their chieftain very sick. When they asked him, "What is the cause of thy sickness?" the chieftain said, "The priest poisoned me last evening". The priest was innocent, but it was because of their evil and insatiable <eating> and drinking it so happened. They at once set out and brought in bonds the splendid ancient, father Step 'annos. [...] Then they lit a fire under him and burned and roasted his entire body till the marvelous ancient Step 'annos gave up the ghost. They clearly saw a portent and a pillar of light over the blessed (V 25) father Step'annos, who thus, innocent and in vain, underwent his passion, and was crowned along with the sacred martyrs.

Then that foul and pitiless chieftain, apart from the sickness which he had, was smitten by a demon so that in his madness (J 38) he ate his own unclean body, and perished in much suffering and bitter affliction. So likewise the entire camp fell ill of the evil disease and many of them died of it. Although it happened thus, they did not fear God but ever persisted in doing deeds of rue and bitter tears. Their [p. 331:] great chieftain Xul, the one who in pride called himself like to, and the brother of, God, fell ill with the gout. By reason of this sickness he committed an unmentionable, evil, and lamentable act. They went and found an infidel Jewish doctor and brought him to Xul. When he saw his sickness, this impious and deceitful leech prescribed as a remedy for the sickness that a red-haired boy's **belly be slit open while alive** and Xul's foot put in the belly of the boy. They at once sent horsemen out into the country. They entered suddenly into the villages of the Christians and seized the children on the streets and fled like wolves. The parents of the children went after them raising screams and wails, with

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bitter and sorrowful tears. But they were unable to tear them away, rather turned back and went with sorrowful heart to their homes. If they, opposing resistance, did tear away the children, then they (the Tat'ars) shot arrows at the parents of the children. Thus this woeful matter came to pass through the infidel (V 26) Jew. The children whom they disemboweled reached thirty in number, but he did not recover. Rather, when the impious Xul realized how much evil he had done, and it had not availed him, then (J 39) he became angry because of the harm done to the children. He ordered the Jewish doctor brought before him and disemboweled, and his entrails thrown to the dogs. They carried out his command at once, but Xul himself afterwards died an evil death, and his son, Miyan by name, ascended his throne in his place.

Consider how the Mongol chief is partly exonerated owing to his ignorance and his being misled by a Jewish physician, who in this tale is the worst villain. Cf. Yuval (2002, p. 100), about both Pharaoh and (in the fourthcentury legend of Sylvester) Constantine being prescribed a bath in children's blood as a cure for leprosy.

## Acknowledgements

I wish to that the journal's editors, and the anonymous referees. One of the referees has been very helpful, and signalled to me part of the literature about Ottoman timekeeping that I used in this study

## Endnotes

1 W.S. Eichelberger of the U.S. Naval Observatory began a speech at the American Association for the Advancement of Science (he was retiring as vice-president of its Section A), by stating (1907, p. 441): "To those who have never had an opportunity to acquaint themselves with the history of the development of the modern clock, I wish to say that no attempt will be made to trace out that development. Time will not permit, as those familiar with the subject well know". 2 In a paper concerned with the shift from a locally defined time to an official regional standard, Sauter points out: "Scholars have long known that people were once very possessive of their local time and often resisted relinquishing it in favour of an externally imposed standard. The literature on the history of time discipline usually interprets this reluctance as a remnant of the old ways, a bump on the road to modern time discipline, and there is reason to ascribe this resistance to parochial stodginess. However, the reluctance to give up one's local time can also be understood as a product of the same forces that shaped early modern Europe's many public spheres. Put simply, people resisted giving up 'their' time because it was based on knowledge and discipline that they enacted in their particular place. In the eighteenth century, time sense was closely linked to a sense for 'place'" (Sauter 2007, p. 701).

3 Steven Weintraub pointed out (1995, p. 310): "The English word 'clock' derives from the Latin word 'clocca', which means bell. (Compare the German word for bell, Glocke.) This etymology, surprising at first, is actually quite logical. The first mechanical clocks were so-called 'tower clocks', mounted in church towers and the towers of other tall buildings. While the very first clocks solely kept time, as soon as striking clocks were invented, sounding the hours (by ringing a bell) became the main function of clocks. To see why this is so, let us put ourselves in medieval Europe. For peasant farmers, there is little need to tell time. Their lives are governed by the position of the sun in the sky. Only with the development of trade did this become important. Consider two merchants. In order to transact business, they must arrange a time (and place) to meet. If they agree to meet at 10:00, say, they must know when 10:00 is. To find the time they consult the town clock, and in order to do so, they must be within its range. To maximize the range, the clock is located in a tower, but the range is still limited. However, once a chiming mechanism is installed, the range is vastly increased, for, as we all know, a clock can be heard to strike the hours over a much wider area than it can be seen from. Thus we can see that, originally, it was more important for clocks to announce the time than to keep it. Indeed, it is more accurate to think of early clocks as defining time rather than measuring it, and medieval clockmakers made much greater progress in developing striking trains, the mechanism that chimes the hours, than in developing going trains, the mechanism that keeps the time. (Subsequently, clockmaking became a race to develop more and more accurate going trains.)"

4 In Vanessa Ogle's words: "Euro-American scientists and railway entrepreneurs declared uniform time rational, neutral, free from politics or other petty questions of identity, and hence universally applicable across societies. 'Time reform', as contemporaries termed it in typical nineteenth-century idiom, targeted different aspects of time, from clock times to calendars to social time. The most well-known movement formed to unify time was that advocating the introduction of time zones. In 1884, scientists and diplomats at the Washington Prime Meridian Conference promoted the introduction of a global system of time zones based on the meridian at Greenwich, England, as well as the adoption of a universal day beginning at midnight rather than at noon or, as in some non-Western societies, at sunset or sunrise" (Ogle 2013, p. 1381). Eviatar Zerubavel (1982) discussed sociohistorical aspects of the standardisation of time. The campaigns for uniform time are the subject of a book by Ian Bartky (2007), whereas Bartky (2000) is about timekeeping in the United States in the 19th century. Also see Ogle's 2015 book The Global Transformation of Time: 1870-1950. Its provisional title had been Contexting Time: The Global Struggle for Uniformity and Its Unintended Consequences. That book combines sociological aspects of time, with the history of time systems and standards.

5 Sauter (2007), whose focus is on Berlin, is concerned with the shift from a locally defined time to an official regional standard. Vanessa Ogle (2013, pp. 1376–1377) relates that in 1905, an anonymous journalist in India "had written about time. His article criticized the introduction of standard time (Greenwich Mean Time) to the city of Bombay, where the citizens insisted on keeping local Bombay time. According to the journalist, standard time had no legitimacy. It was

British time, tied to specific circumstances of British rule over much of India. The British traders and bureaucrats who advocated it were not representative of Bombay or of India as a whole. In consequence, after widespread protests, a pluralistic landscape of times was not just maintained but enhanced throughout British India as cities such as Bombay (and to a lesser degree Calcutta) followed local time on most public clocks except for a few government offices until 1950". Ogle also points out: "While Germans adjusted train schedules, the denizens of Bombay harbored their own assumptions about trains and time. In the second half of the nineteenth century, Indians made time the topic of conversations, novels, and journalistic reporting. Intellectuals reflected on the compression of time and space that railways brought. Colonial subjects integrated the rhythms of timetables and trains into their everyday life but did not refrain from complaining about the inconveniences of certain scheduling arrangements. Moreover, Hindu and other religious reformers were enthusiastic followers of the principle of self-help and saw time discipline and time management as central to their efforts at selfstrengthening. When the colonial administration first considered the idea of reforming timekeeping, Indians were therefore no strangers to Euro-American and other times. Between 1881 and 1905-1906, the West Indian city of Bombay became the stage for protests against the abolition of local time and the introduction of the new so-called Indian Standard Time, which was set in accordance with the Greenwich system. Bombay's citizens were infused with a sense of local urban pride and identity, fueled not least by the recent economic upswing the city had witnessed during the American Civil War, when cotton production came to a halt in the South, and mill owners in Lancashire and elsewhere turned to other outlets. In 1881, the British governor of Bombay, James Fergusson, had failed to calculate his way through the thicket of simultaneously existing different times and schedules applied by railway lines, telegraph bureaus, and local town hall buildings across British India. The governor missed a train. Out of this mishap an idea was born, and later that year the governor moved to introduce Madras time to Bombay. The time of the southern Indian city and its observatory was the standard that had been widely adopted by most Indian telegraph bureaus and railways since the 1860s. Bombay denizens, both Indian and British, were quick to reject Madras time as confusing, and above all as imposing the time of a rival city upon the proud denizens of Bombay, who confidently claimed for the city the status of Urbs Prima in India [the foremost city in India]. Meanwhile, a handful of government offices had adopted Madras time, as had the clock at St. Thomas Cathedral, whereas private offices, schools, and even the High Court ran on local Bombay time. [...] Such diversity created an environment of multiple times that required knowledge not only of which time was kept where, but also of who would follow which time" (ibid., pp. 1383-1384). While discussing how Greenwich Mean Time was formally introduced to Beirut in 1917, with the arrival of French troops, actual application being much slower, Ogle on p. 1392 mentions multiple calendars, including the Jewish calendar used by the relatively small Jewish community in the city. Also see "A History of Time in Mount Lebanon, 1860–1914", by Akram Khater (1999).

6 Calendrical time is a much more complex subject in the history of science and in the history of how ideas such as the Metonic cycle were incorporated in Jewish calendrical norms. See Reingold and Dershowitz (2001a).

7 On Baghdadi Judaeo-Arabic, see, e.g., Mansour (1991) and Blanc, Haim (1964a, 1964b), as well as, on a literary variant of the same vernacular, Nissan (2001).

8 There apparently is only one instance of that nominal derivation pattern in Hebrew: the early rabbinical term *bodeda* ( $\langle bwdydh \rangle$  or  $\langle bdydh \rangle$ ) for 'small olive press', as opposed to *bad* 'olive press'. It is as though an Arabic *XuXayXa* pattern was applied, with *ay* being replaced in Hebrew by a long *e*. More generally, the Arabic diminutive *y* infix finds an equivalent also in the plural adjective *amelalim* 'miserable' (instead of the standard *umlalim*), by which the gentile foes of the Jewish returnees from the Babylonian Exile are referred to (*Nehemiah* 3:34).

9 See Nissan (2020). The following information is important, as (which is not an infrequent case in the bourgeoisie across cultures and societies), this was a family shaped by a member who was a great doer. Baba Yuséf's eldest surviving son, and main earner in the (multiple) patriarchal family living under the same roof, was my maternal grandfather, Yamin [ben] Joseph (officially Yamen Yousef, but in the family: Baba Yamen) was professionally trained at the Military Academy in Constantinople and at the Baghdad Military College, and while an officer in the Iragi army, in the 1930s he was director of the Baghdad Royal Arsenal, being in practice forced to resign in the late 1930s after a false accusation by far rightists, related to his Jewish identity, even though he was able to refute that charge, after a search by the military police yielded no results. (Still, the highest ranking Jew in the Iragi army, a colonel of artillery, Salem Saleh, remained in active service throughout the Second World War.) He thereafter was a merchant banker, until his untimely death in 1942, aged 44. His case is instructive, in that it instantiates the phenomenon (also known from Europe) when Jews welcomed the opportunity to integrate in state-building and tried to move from the merchant class into the state bourgeoisie. In the case at hand, a Jew was allowed that transition, only to be pushed back into the merchant class when the ruling elite either felt that the contribution of Jews was no longer acutely needed, or was deterred (which was the case of this particular person) because the far right clamoured for the removal of those persons in authority who had allowed a Jew to occupy the post he was holding.

10 A methodological caveat is in order. One or more anonymous referees recommended (along with other, wise advice I eagerly adopted) the following, whereas another referee adopted opposite stance: an "The author should edit the tone so the anecdotes are 'a family' rather than 'my family', making it a macrohistory rather than an anecdote. They could add a footnote regarding the family's history and his own connection, but throughout ensure that although it is a historical autoethnography (of sorts) it is still scholarly rather than merely anecdotal." However: "Many of the anecdotal details are unnecessary and overwhelm the core scholarly contribution of the article. The author should edit to avoid instances where anecdotal sources are emphasised as

the source of facts [...]. The author should remove anecdotes reflecting on their own current positioning as they are unrelated to the historical context being provided/explored. The author should remove anecdotal details that are unrelated to the topic at hand specifically."

Arguably (or at any rate, I argue so), this mixes up scholarly gravitas or decorum, something which itself is a cultural practice of the scholarly profession, with the crucial needs of a usable ethnography. Woe to the ethnographer who would eliminate the mere "anecdotes" (these supposedly not being aseptic enough for presentation in a scholarly context), as anthropologists reading in future the resulting sanitised text would stamp their feet in anger at how the author destroyed the opportunity to record the cultural context faithfully. Mind you: we are at a stage, in generational turnover, when this information stands to be lost forever. The responsibility that comes from decades being a scholarly author forces me to be discerning, when it comes to accepting peers' advice, even as a long experience as journal editor makes me acutely aware of the gratitude owed experienced referees for their selfless and indispensable efforts.

11 Vanessa Ogle began an article (2013), "Whose Time Is It? The Pluralization of Time and the Global Condition, 1870s–1940s", by relating this anecdote: "After what must have been a hot day in August 1909, a journalist for a Beirut newspaper felt inclined to take an evening stroll. Jubran Massuh decided that he would 'pretend to be European', and that meant donning a tie and other European apparel [this is termed 'to dress *fránjī*', and in fact, Massuh used the verb *tafárnaja*] and adopting European behavior. But suddenly it occurred to him that it was entirely un-European to walk around aimlessly 'wasting time'; after all, as Europeans said, 'Time is money'. Young Jubran therefore turned on his heels to get back behind his desk and spend his time studying something useful. The time-conscious European was one of several temporal identities that Jubran Massuh was juggling".

12 Nissan (2016; 2010), and in a nearly completed book of mine.

13 Lunisolar calendars such as the Jewish calendar are based on the intercalation of a thirteenth month, based on a cycle of 19 years named after Meton, an Athenian astronomer who published the Metonic cycle (with 12 years of 13 months, and 7 leap years of 13 months) in 432 B.C.E., but that cycle was already known in Mesopotamia and China. The Islamic liturgical calendar discarded the lunisolar model, as Muḥammad rejected the very notion of a thirteenth month (*Qur'ān* 9:36– 37). "The Metonic cycle is currently accurate to within 6.5 minutes a year" (Reingold and Dershowitz 2011b, p. 11). According to a formula from Reingold and Dershowitz (2001a, p. 97), let y be the given Jewish year. Year y is a leap year (in Hebrew, a *shaná me'ubbéret*, "a pregnant year"), and therefore has 13 months, if and only if by multiplying y by 7, then adding 1, and dividing that sum by 19, the remainder of the division is smaller than 7. The Hebrew collocation *sod ha-'ibbùr* (literally, "the secret of intercalation") denotes detailed calendrical calculations within the Jewish calendar.

14 Setting one's pocket watch by checking the time at some authoritative clock used to be the practice of watchmakers; for example, Sauter (2007, p. 708, Fig. 7)

is a 19th-century engraving of Parisian clockmakers checking the time at the Paris Observatory ("Les horlogers de Paris prenant l'heure au régulateur de l'Observatoire"), from the Collection Musée du Temps, Besançon, also available in Mayaud (1994, p. 83).

15 Michael Sauter remarks (2007, p. 706-707) that "the public's expressed desire for better time implicates it in the modern subjection to clocks, in addition to exposing a less than emancipatory aspect of the eighteenth-century public sphere. The particular significance of this development for Prussia (and later Germany) lies in Berlin's status as a political and scientific centre. When in the nineteenth century the new time was exported to other cities and towns — most of which would have had at least one public clock, as well as a host of clockwatchers — it made sense for locals to follow this standard carefully, because powerful political and scientific authorities stood behind it. In the end, Prussia's factories and trains functioned with a discipline that had been created by daily life in the streets of the capital city. Berliners became subject to modern time discipline only after the state ratified astronomy's new temporal standard. The roots of this change extended back over a century and were spread widely. Berliners had been accumulating experience with clocks of all types since the second half of the seventeenth century. To this was added the diffusion of the pocket watch, the growing complexity of city life including the construction of new urban spaces — the rise of institutional science, and the maturation of a critical public sphere. The key change within this fluid context came, however, with the installation of the Academy clock, because it focused the many aspects of the local time regime into a coherent set of practices" (Sauter 2007, p. 707).

16 Poking fun at modes of timekeeping is something one still comes across in Turkish literature. Namely, one finds that much (but very poetic) in one of the chapters of the 2015 novel Istanbul, Istanbul, by Burhan Sönmez. His biosketch claims: "The recipient of a number of literary prizes, he was seriously injured following an assault by Turkish police. With the assistance of the Freedom from Torture foundation, he spent five years in the U.K. undergoing rehabilitation". The novel has a frame story, and nested plots which begin the chapters. The English translation was published by Or Books, appreciated by the U.S. radical left. The publisher's blurb states: "Below the ancient streets of Istanbul, four prisoners ----Demirtay the student, the doctor, Kamo the barber, and Uncle Küheylan - sit, awaiting their turn at the hands of their wardens. When they are not subject to unimaginable violence, the condemned tell one another stories about the city, shaded with love and humour, to pass the time. Quiet laughter is the prisoners' balm, delivered through parables and riddles. Gradually, the underground narrative turns into a narrative of the above-ground. Initially centred around people, the book comes to focus on the city itself". The website of Sönmez claims Boccaccio's Decameron as a model for the organisation with a frame story: "It is the story of four prisoners in the underground cells of a centre for torture in Istanbul. When they are not being subjected to torture, the four tell one another stories about Istanbul to pass the time. The underground narrative gradually turns into the narrative of the above ground. Initially centred around persons, the novel comes to focus on the city of Istanbul. There is as much suffering or hope in the Istanbul

above ground as there is in the cells underground. Like the Decameron tales, the novel is comprised of ten chapters. Each chapter is narrated by one of the occupants of the cell respectively". The website of the novel's author claims: "It is being published in different languages: Gallimard (France), OrBooks (USA), btb Random House (Germany), Turbine (Denmark), Nottetempo (Italy), Polirom (Romania), Klimaty (Poland), Dituria (Albania), Antares (Armenia), Thaqafa (Arabic), Opus (Croatia), Hohe (Ethiopia), Joshua Könyvek (Hungary), Jumhoori (Pakistan), Nepko (Mongolia)". All chapters of this novel as per the Or Books edition are accessible through links at a webpage at the JSTOR database, at https://www.jstor.org/stable/j.ctt207g8gw

In the Or Books edition (the translation from Turkish is by Ümit Hussein), the chapter (on pp. 147-172) of the 7th Day, "The Pocket Watch", is told by the student Demirtay. That chapter begins as follows (the double quotes are in the original), describing a library director feeding animals (a bit like Noah in the Ark): "When the director of Beyazit Library, Serafat Bey, arrived at work that morning, he realized that there was no one waiting at the door. Every morning there were always a couple of bibliophiles there, but this morning he was alone. Walking toward the lateral wall of the building that had been converted from a mosque stable into a library, he opened the parcel of liver he was carrying. He crouched down and placed the finely chopped pieces of liver onto the cobblestones. He watched the cats gather, then turned his attention to the pigeons under the plane tree. He took a paper bag filled with wheat out of his briefcase and scattered a handful around the tree. Here the cats and the pigeons got on well together, they didn't bother one another. As the director stood up and was walking toward the door, he saw the two early-bird bibliophiles approaching. He wished them good morning and reminded them that they were ten minutes late that day. The two bibliophiles consulted their wristwatches and said they were on time. The director took his pocket watch out of his waistcoat pocket. He compared it with that of the bibliophiles. Theirs was slow. The director gave them an indulgent smile, but when, throughout the day, he saw that they were not the only ones, that everyone's watches, inside and outside the library, were ten minutes out, he realized that there was something going on. Time's gracious hand was changing in Istanbul. School bells, cinema performances, and boat trips were all ten minutes out, and no one was aware of the discrepancy. The children selling newspapers in the mornings at the tops of their voices announced no such news. Every day the director opened the library according to his own watch, and asked himself the same question: Why were all the clocks suddenly slow? It's actually a long story but I'll be brief. In one part of the world a war was ending, while in another a new one was brewing. Despite the smell of spring, the air in Istanbul was oppressive. Mariners set out to sea with a serene expression, women forgot their washing on the line for days. The director, Serafat Bey, couldn't bear the fact that everyone's watches were slow and that his regulars were arriving late, and resolved that he had to do something. Once he had fed the cats and the pigeons in the mornings and worked in the library until midday, he started to delegate tasks to his assistants and spend the rest of the day visiting the other libraries in the city. Whispers circulated around the reading rooms. The presenter on the state radio read the news and the muezzin in the mosque called the faithful to prayer ten minutes late. While the time in Istanbul was undergoing a complete change, now the only watch that appeared to be wrong was his. He didn't know that he was in danger, that he was being watched by men with black rosettes. He couldn't even estimate the consequences of the tardy radio and calls to prayer. I should at least save the libraries, he thought. He told the librarians the correct time and the truth that only he seemed able to perceive. [...] As long as his pocket watch continued to work nonstop, as long as someone wound it up every day and made it go, time was on their side. He believed that sincerely. One morning, completely by chance, Serafat Bey dodged a car that was coming straight for him; at lunchtime at the last moment he returned the poisoned sherbet that a street vendor held out to him on the grounds that the glass was dirty, but when he arrived home in the evening and was entering the garden, he could not evade the knife that someone aimed at his back in the darkness The neighbours rushed over upon hearing his wife's screams, they called a doctor. Realizing he had reached the end of the road, Serafat Bey took his watch out of his pocket and handed it to his wife for safekeeping. His wife looked at the pocket watch with the red ruby encrusted cover and said sadly: What can be the meaning of yours being the only watch that's right when everyone's else is wrong? Şerafat Bey gazed at his wife tenderly and motioned to her to draw near. As she bent over, under the curious scrutiny of the neighbours, he whispered something in her ear, then he closed his eyes, never to open them again. The next day they washed his slight body and, following the funeral prayers, performed ten minutes late, bore him to the graveyard. [...]".

The first person narrator (the Student) says: "I was as lonely as the librarian Serafat Bey, who, despite what every other clock said, believed his was the only watch in Istanbul with the right time". The Doctor tells the student: "You told me that story before, but the ending was different". The student retorts: "Just as you can't bathe in the same river twice, neither can you tell the same story twice in Istanbul". Another character, Uncle Küheylan, joins in and says: "That pocket watch is one of the things about Istanbul that fascinates me. According to my father, the rubies on its cover shone like stars in the dark. Anyone who looked at it once searched the sky for nights on end, and only believed the pocket watch was right once they had found the stars that looked like rubies". The Doctor reminisces that when he was a child, there was indeed a library where "the clock was always ten minutes fast". He adds: "In those days there were a lot of stories about the ruby encrusted watch, but they all ended differently. Just like Demirtay changes all his stories, the watch stories changed too. I didn't give it much thought when I was a child, but now I'm beginning to wonder about that pocket watch too". The Student then relates about a dead woman he saw in the interrogation room on the previous day.

17 A photographer in Israel, approached by the same uncle of mine in early April 2008, found it overly difficult to photograph the quadrant of the clock, because the details are minute, and the covering glass is an obstacle.

18 The very fact that such technology catering to cultural needs in the Ottoman Empire could be produced by Longines, calls for considerations on available skills of the technical labour force in the Swiss watchmaking industry in the relevant period. Cf. Pasquier (2005). Vanessa Ogle (2013) mentions the spread of timepieces in Beirut in fin-de-siècle (late 19th-century) Beirut, as states (*ibid.*, p. 1394): "Watch merchants routinely placed advertisements in newspapers and other widely circulating publications. One such seller functioned as the representative for Swiss Longines watches in Syria and promoted timepieces from

'the biggest factories in Europe'. Another merchant boasted that he had spent five years in Australia working as a representative for the most famous watches from London as well as Waltham watches, a well-known American brand". Incidentally, note that the Antiquarian Horological Society in Sussex has published a book by Ian White, English Clocks for the Eastern Markets (2012). "As early as 1708, an apprentice watchmaker in Geneva could, as part of his basic training, be required to learn how to make 'watches in the English style' (montres à l'angloise)" (Smith 2004, p. 125). Already by the Napoleonic period, timepieces from Geneva — a luxury trade — were being sold in the Levant. By the 1790s, Genevan watchmakers were claiming an ability to "imitate English manufacture to the point of exporting annually around eight thousand watches, to be sold in Northern Germany, Russia, the Middle East and even in England itself These watches were perfect copies [of English watches] with regard to the movement, the form of the case and even to the colour of the gold, even though it was only of 18 carats rather than the 22 which was the legal standard in England" (quoted in translation in Smith, *ibid*.). The Napoleonic authorities tried to require French hallmaking. "Not surprisingly, the Genevan makers were concerned that the imposition of French hallmarking by the French authorities now controlling the city would have a disastrous effect on this export trade" (Smith, *ibid*.). Indeed, they complained: "It is obvious that a French hallmark, applied to an English-style case, would immediately reveal the true origin of the watch and would soon lead to a drop in the considerable sale of such items now being made" (Smith, ibid.). Roger Smith (2004, p. 137, n. 9) quotes in French from "a lengthy memoir on the watch and jewellery trade from the municipal authorities of Geneva to the French resident, Desportes, on 7 July 1798. See E. Chapuisat, 'Le Commerce et l'industrie à Genève pendant la domination française (1798-1813)', Société d'histoire et d'archéologie de Genève - Mémoires et Documents, t. XXVIII, Nouv. série VIII (1902-08): '[L]es Genevois sont parvenus depuis peu à imiter la fabrication anglaise au point d'exporter annuellement environ huit mille montres, qui se vendent dans le nord de l'Allemagne, en Russie, dans le Levant et même en Angleterre. Ces montres sont parfaitement imitées quant au mouvement, à la forme de la boîte et même quant à la couleur de l'or, quoiqu'il ne soit qu'à 18 karats au lieu d'être à 22 qui est le titre légal de l'Angleterre' (p. 661); 'Enfin, avec cette police de poinçons, il faudrait renoncer à la concurrence que Genève fait aux Anglais. Il est évident qu'un poinçon français, appliqué sur une boîte de forme anglaise, décèlerait du premier coup la véritable origine de la montre et ferait tomber sans retard le débit considérable qui s'en fait' (p. 667)."

19 Concerning this kind of Oriental houses, see, e.g., Al-Azzawi (1984, 1988).

20 Wishnitzer is also the author of a 2015 book, *Reading Clocks, Alla Turca: Time and Society in the Late Ottoman Empire.* Also consider an edited book by François Georgeon and Frédéric Hitzel (2012), *Les Ottomans et le temps.* 

21 Also in Baghdad (I was told by my mother), it was usual at offices for staff to take a break at noontime, and to resume work in the afternoon. One of the factors was that the hottest hours of the day were avoided. Incidentally, consider the Puritans in early America. Marshall Davidson explained (1944, p. 105): "In 1786 it

was proposed that the Salem schools should start at one in the afternoon. Not only did that prevent the children from going swimming when they were 'too much crammed with animal food', but at that hour public notice of the time was given throughout the town. So few families owned clocks and watches, it was explained, that there was no other certain time for collecting the children. Undoubtedly there were more timepieces in early American households than such a statement seems to indicate, but they were not commonplace or, as life was organized, particularly necessary".

22 A "thesis about the changing shapes of time [was] elaborated by historians such as Reinhart Koselleck, is instinctively appealing. Koselleck located this epistemological shift — what he called the "temporalization of history" — somewhere in the three hundred years between the sixteenth-century painter Albrecht Altdorfer and the nineteenth-century philosopher Friedrich Schlegel, between the Reformation and the French Revolution" (Varwig 2012, p. 156, citing Koselleck 1985, pp. 9–10 and 37, and considering application to how musicians reconceived time).

23 The subject of a book by Thomas Allen (2008) is temporality and social imagination in 19th-century America. An essay (McCrossen 2010) "about pocket watches and time consciousness in the nineteenth-century United States, suggests that the increasing volume of pocket watches in circulation throughout the United States after the 1830s prodded a wide cross section of Americans into more than just simple awareness of mechanical time. The evidence, some of which is drawn from accounts relaying details about repairs to watches, shows that watches augmented, rather than replaced, already complex temporal sensibilities" (ibid., p. 1). For example: "As if part of Elgin's marketing plan (though it was not), in 1874, the women's right activist Grace Greenwood insisted that along with the ballot and a sewing machine, every American woman needed a watch. If portraiture is any guide to practices, she had been carrying a watch since 1850, at least, as the chain around her neck in a daguerreotype of that year indicates" (ibid., p. 15). "Although the 'Lawes and Libertyes' of 1648 that made it a punishable offense to waste time [...] are no longer on the books, the time once saved in the name of Christian virtue is now saved in the name of practical efficiency" (Davidson 1944, p. 109). "No longer primarily the beverage of spiritual contemplation, commerce, or leisure, coffee became the alarm clock that marked industrial time. North Americans' coffee imports swelled almost ninety-fold in the nineteenth century" (Topik 2009, p. 98).

24 In a study about the social history of sewing machines in the Middle East, Uri Kupferschmidt remarked (2004, p. 201) that sewing machines "were advertised in Beirut as early as 1860, [but] it took apparently some time to enter public consciousness: the influential journal *al-Muqtataf*, for instance, on the verge of moving from Beirut to Cairo in the 1880s, published two articles on the new invention. Singer embarked on a long running advertising campaign in the local press addressed both at the workshop owner and the private consumer."

25 The focus of Corn (2011) is on the 19th and 20th centuries.

26 Incidentally, Caldini Montanari (2007) discusses how the ancient Romans, since Republican times, had been using the constellation of the Great Bear as a night clock.

27 See Sec. 2.7. ("The Elephant and Charlemagne in a Novel by Agnon, and Agnon's Humour") in Nissan (2013, pp. 141–142).

28 http://en.wikipedia.org/wiki/Clock

29 The famous monumental clock of the Strasbourg Cathedral "was rebuilt and modernized by Jean-Baptiste Schwilgué in the mid-nineteenth century. The first Strasbourg clock of 1354, a great medieval astronomical artifact, was principally a 'mechanical model to represent the motions of the heavens', and was complete with an automated astrolabe, calendar, carillon, and automatons, including the famous mechanical crowing cock. As magnificent as the medieval clock was, however, the second clock finished under the direction of Conrad Dasypodius in 1574 represented 'the pinnacle in the development of [the] monumental astronomical clocks", in the words of Lisa Zeitz and Peter Thoms (1991, p. 496). "Like the first cathedral clock, the second represented an imitation of the structure of the world within a religious context. Natural history, astronomy, the monarchies of the ancient world, the three fates, the four ages of human life, the sacramental history of Creation, Resurrection, and the Last Judgment - all (and more) were represented through automatons (or 'puppetry'), models, and paintings on the twenty-five-foot by sixty-foot structure. Timekeeping was almost an afterthought compared with the clock's great symbolic significance as a microcosm of the world" (ibid., pp. 496-497).

30 The abstract of Stolz (2015) states: "This article explores the role of the 'ulama' in shaping the use of mechanical timepieces in Cairo in the 18th and 19th centuries. Ottoman interest in new technologies in this period is often understood in relation to the emergence of modernization projects and new scientifically trained actors, with a corresponding decline in the status of the 'ulama'. However, the vogue of mechanical timepieces in Cairo allowed 'ulama' trained in the very old tradition of *mīqāt* (astronomical timekeeping) to make their knowledge speak in new ways to new audiences. Based on several manuals and tables that such scholars wrote 'on the position of the watch hand', this article shows how 'ulama' not only facilitated distinctively Ottoman timekeeping conventions, but also furthered an understanding of watches as instruments of precision. The article builds on a growing literature on Ottoman temporality, while expanding our historical view of 'ulama' and their authority, of the material culture of Cairo, and of science and technology in an Islamic context". Please note that the spelling 'ulama' is not enclosed by single quotes. Rather, that Arabic word begins by the Arabic letter 'avn (corresponding the the 'avin of Hebrew), is stressed on the last syllable, and ends by what in Hebrew would be an *aleph* with a schwa. On Islamic practices and religious laws concerning timekeeping for religious purposes ( $m\bar{t}q\bar{a}t$ ), see Brentjes and Morrison (2011), King (2004), and the entry "Mīkāt" by A.J. Wensinck and D.A. King in the Encyclopaedia of Islam, Second Edition.

31 This is obviously not the same Ahmed Pasa (Ahmad Pāsha), the general whose killing by Sultan Bayezit (Bāyazīd) II (b. 1448, r. 1481-1512) was related by both the Hebrew chronicler Elijah Cápsali of Candia — who did it in 1523 in a florid style recycling wording used by King Ahasuerus when asking a question of Haman ("What should be made to a man who..."), with the general answering: "He shall die, he shall not live; 'he shall die' in this world, 'he shall not live' in the hereafter", thus adapting more biblical wording with the respective homily; the Sultan then kills him (for Capsali's Ottoman chronicle, see Shmuelevitz 1978 and Jacobs 2005, and the full Hebrew text in Capsali [1517-1523] 1975-1983) — and Niccolò Machiavelli, who mentioned that episode in his poem Dell'Ingratitudine, addressed to Giovanni Folchi: "Acomatto bascià, non dopo molto / ch'egli ebbe dato il regno a Baiasitte, / morì col laccio intorno al collo avvolto." ("Ahmed Paşa, not a long time after he gave Bayezit the kingdom, died with a noose surrounding his neck.") That episode is also mentioned in The Anatomy of Melancholy by Richard Burton ("Democritus Junior"), of 1621 (my underlining; pagination as "Printed & to be sold by Hen. Crips & Lodo Lloyd at their shop in Popes-head Alley. 1652"): "Old friends become bitter enemies on a sudden for toys and small offences, and they that erst were willing to do all mutual offices of love and kindness, now revile and persecute one another to death, with more than Vatinian hatred, and will not be reconciled. So long as they are behoveful, they love, or may bestead each other, but when there is no more good to be expected, as they do by an old dog, hang him up or cashier him: which [355] Cato counts a great indecorum, to use men like old shoes or broken glasses, which are flung to the dunghill; he could not find in his heart to sell an old ox, much less to turn away an old servant: but they instead of recompense, revile him, and when they have made him an instrument of their villainy, as [356] Bajazet the second Emperor of the Turks did by Acomethes Bassa, make him away, or instead of [357] reward, hate him to death, as Silius was served by Tiberius. In a word, every man for his own ends." I am trying to finish a book, provisionally entitled Turks as Seen in the Renaissance: Western Perceptions of Ottoman Power and Religious Otherness, and the Attitude of Elijah Capsali, a Cretan Rabbi and Venetian Subject, in his History of the Ottomans.

32 Nourbakhsh (2008) is concerned with Iran's early encounter, in the early modern period, with three late medieval or early modern European inventions: the mechanical clock, the printing press, and firearms.

#### 33 From http://www.fisheaters.com/hours.html

34 Quoted from http://en.wikipedia.org/wiki/Canonical\_hours — last modified on 22 January 2008 when accessed). Another website I found useful ("The Canonical Hours", http://www.fisheaters.com/hours.html) explains, concerning the Vigils: "This office originally consisted of four 'watches', or vigils': 6 PM–9 PM, 9 PM– Midnight, Midnight–3 AM, and 3 AM–6 AM. Later it consisted of three 'nocturnes', 9–Midnight, Midnight–3 AM, 3 AM–6 AM." The Wikipedia page "Canonical hours" (http://en.wikipedia.org/wiki/Canonical\_hours) explains in detail "the Catholic usage, the Anglican usage, and the Orthodox usage" (actually

also including Coptic and Armenian usages, with the addition of a Section 6: "Muslim prayers".

35 From http://en.wikipedia.org/wiki/Canonical\_hours — in particular, the quotation is from a section entitled "Judaism and the Early Church".

36 From http://en.wikipedia.org/wiki/Canonical\_hours

37 Rabbi Eliezer of Beaugency (*blgn5*), now usually pronounced *belgántsi* when that exegete is mentioned by scholars in Israel) belonged to the second generation of the Tosaphists (glossators of the *Babylonian Talmud*), whose own first generation was the one after Rashi. The French adjective *beau* 'cute' derives from an older form *bel*. Rather than being a Tosaphist himself, R. Eliezer of Beaugency is only known as a commentator on the Bible, not the Talmud. Only his commentaries to *Isaiah*, *Ezekiel*, and the *Twelve Minor Prophets* are extant, and this in only one manuscript (Oxford Bodleyan 1465, Opp. 625). See on pp. [v] and ['] in Cohen (1996). Concerning Eliezer of Beaugency, see Berger (2008), Harris (2007).

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