KITCHENER'S SUNDIAL IN PALESTINE

TOMMER GROSSBERGER, AMIR FREUNDLICH and JOHN DAVIS

Horatio Herbert Kitchener (1850–1916) is very well-known to most people as the face on the famous First World War recruiting poster 'Your Country Needs You!'.[1] What is generally not known is that, long before he was a very senior British Army Officer, he was commissioned into the Royal Engineers and, when serving in Palestine, he presented a sundial which he had probably designed himself to his hosts. The sundial still exists and is currently being re-installed in its original location.

Fig. 1. Detail from 'The main street of the German colony' by Emily Cuthbert (1884) showing the Schumachers' house. Insert: close-up highlighting the sundial on its pillar.
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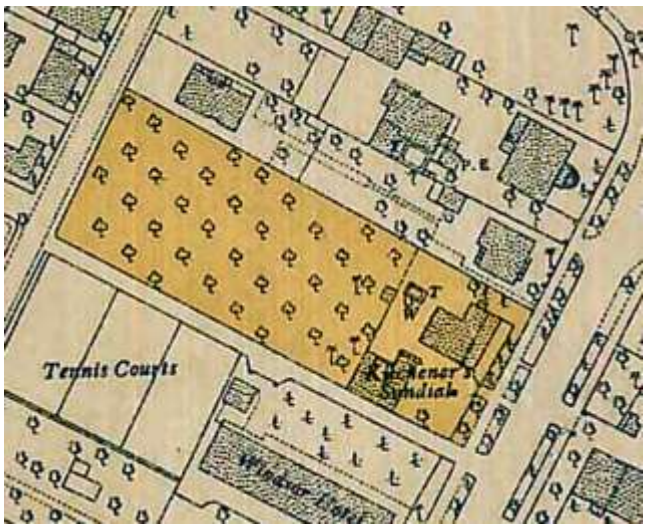

Fig. 2. Detail from a 1936 map of Haifa showing the location of "Kitchener's Sundial".

Background

In 1874, at the early age of 24, Kitchener was assigned by the Palestine Exploration Fund to a mapping survey of the Holy Land, later to be known as the Survey of Western Palestine. Owing to the death of the previous leader from malaria, Kitchener was made joint leader with another officer (Claude Conder[2]) and later they wrote the first three volumes of the eight-volume Survey report together.

During the Survey, Lieutenants Kitchener and Conder were hosted by Jacob Schumacher at his house in the Templar colony in Haifa (Figs 1 and 2). Schumacher, an architect and stonemason, was one of the founders and planners of the colony, and served as the U.S. consular agent in Haifa. Schumacher's son Gottlieb, later an eminent engineer, architect and archaeologist, was only 16 at the time. One can imagine the impact of the surveyors on the young man, soon to be one of Palestine's greatest surveyors and researchers in his own right. In 1875, before a brief return to England, Lieutenant Kitchener gave Schumacher an east–west sundial, made of a vertical brass plate with perpendicular end pieces, the top one with two small apertures, designed to let fine and accurate rays of light fall onto the bottom end piece, marked with the hours of the day and incorporating a split analemma designed to show the local mean time. The sundial was documented in words and painting, and appears on maps of Haifa, but was not photographed at that time.

Jacob Schumacher died in 1891. Gottlieb Schumacher, who joined the Ottoman army in the First World War as an

Fig. 3. Modern photograph of the marble plaque commemorating Kitchener, added in 1925.

Fig. 4. The sundial as it currently exists, viewed from the NE.

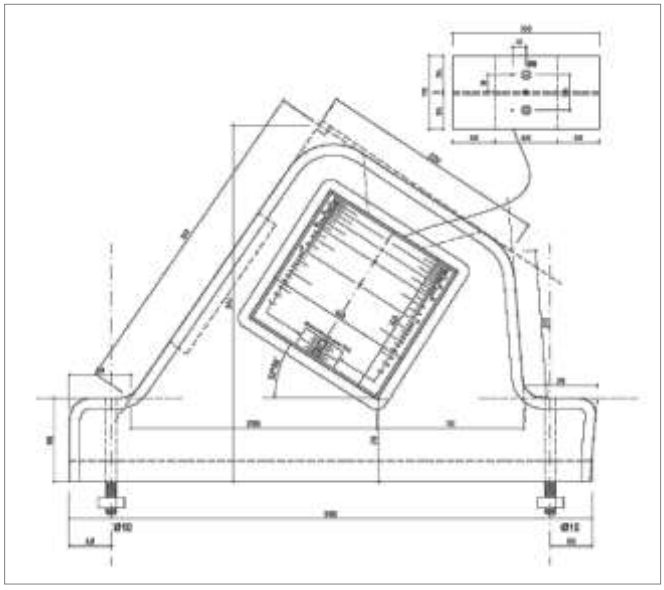

Fig. 5. Engineering side view of the complete structure.

engineering officer, was refused permission to return to Palestine after the war and stayed in Germany. During that period, the sundial was knocked down. In 1924 the British government finally agreed to let Schumacher return to Palestine, but he was in bad health and he died in 1925. In that year the sundial was 'restored' and put back in its place, now carrying a marble plate commemorating Lord Kitchener on its rebuilt structure (Fig. 3).

In 1948, after most of the Templars left or were deported from Israel, the house was leased to the Grossberger family, who kept the sundial but never inquired about its use or the way it operates.

In 2015, during a documentation process of the Schumacher house, the sundial was studied in detail and its features drawn, as described below.

There is good evidence that the sundial was actually used as a regulator of the local clocks. Gottlieb Schumacher's seventh daughter, Nelly (1896–1991), who stayed in Israel long after the Templars had left the country, wrote a biography[3] in which she described the sundial in detail:

"In our yard stood a tall pole. Every Sunday my brothers would raise the stars and stripes flag on it. Next to the pole stood our famous sundial, a present from Lord Kitchener to my father. The sundial was surrounded by a green wooden fence. It was made of a small, round marble panel, placed on a stone pedestal, on which two parallel metal plates were positioned with a slant. Once a ray of light entered a slot in the plate, illuminating a certain spot, we knew it was exactly 12:00 o'clock. Prior to that time, Grandfather Lange would come from the community house across the street with a whistle in his pocket. His granddaughter Theodora would stand by the bell rope in the great community house. Once grandfather blew the whistle, Theodora would pull on the rope. The clear sound of the bell would echo over the colony houses, and everybody would hurry and set their clocks. Thus, our time keeping was no less accurate than today's radio signals."

The Sundial Design

An overall view of the existing sundial is shown in the photograph of Fig. 4 and the engineering drawing of Fig. 5. It is believed that the physical casing of cast concrete which supports the internal plates was added when the dial was restored in 1925: the marble plaque of Fig. 3 is embedded in its northern face. It is unclear what the original appearance of the dial would have been – the plates may simply have stood on an angled marble disc. The existing concrete structure not only supports the (original) brass plates but also provides a dark interior allowing maximum contrast for the bright sun-spot. The rectangular openings have heavily chamfered edges to allow the sun to enter at a slightly oblique angle and to facilitate viewing. Although the concrete casing provides a very secure structure for the dial, it severely restricts its operation, reducing it from a dawn-to-dusk dial to a meridian line. One reason why it may have been considered acceptable to reduce the functionality of the dial in this way is that the site became overshadowed by trees, as can be seen in an early (1917) aerial photograph taken by the Australian Flying Corps, so that the dial functioned only when the sun was high in the sky.

The original and key part of the design is a double-sided brass plate approximately 3 or 4 mm thick with a top and bottom plate to form an 'I' shape, as can be seen in the 3D drawings of Fig. 6. The main upright of this structure lies in the meridian plane and the 'I' is slanted at an angle of around 32½° so that the tops and bottoms of the plates lie in the polar plane (the latitude of Haifa is actually 32.82° N). Small circular apertures in the top plate are thus positioned to be perpendicular to the sun at noon on the equinoxes. These apertures are countersunk to allow angled rays to enter.

The engraving on the plates is shown in Fig. 7. The operation of the original dial (without the concrete casing)

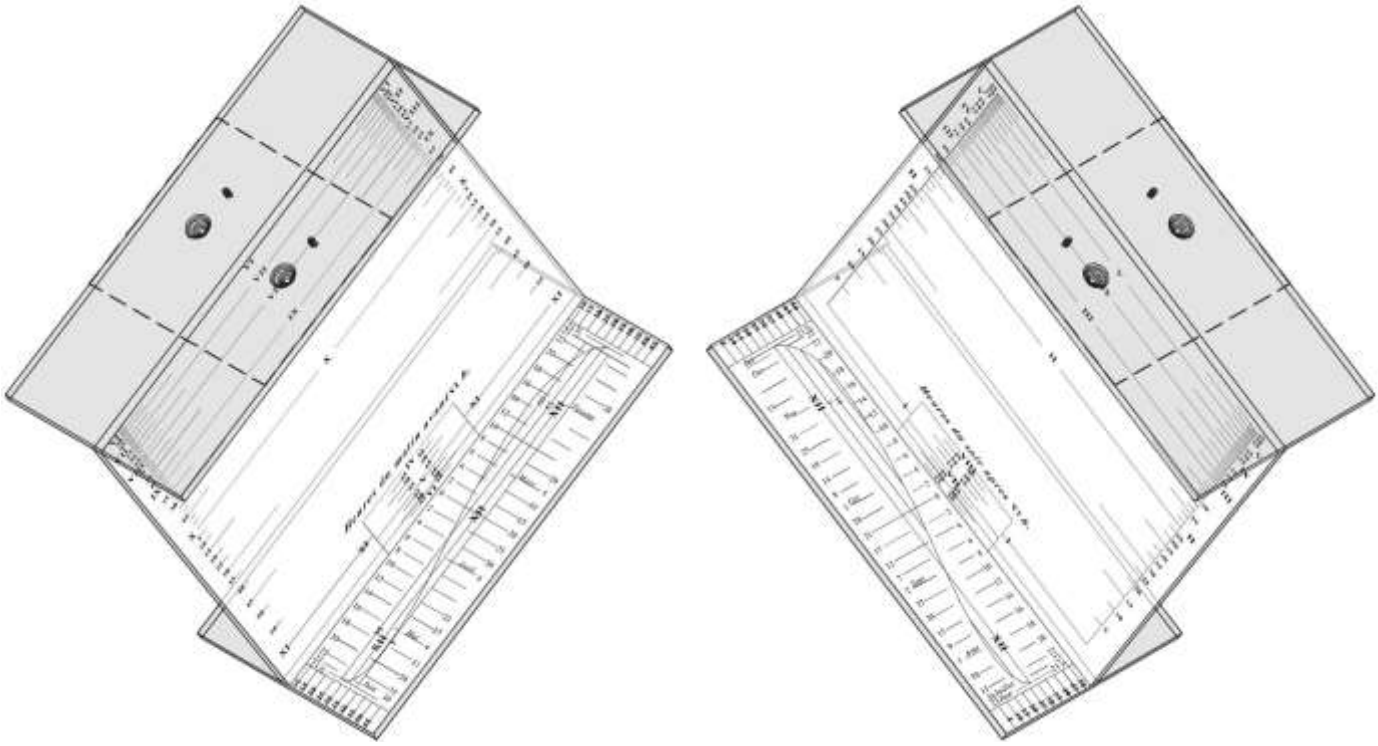

Fig. 6. Two 3D drawings of the plates showing the overall 'I' structure.

can be understood as follows. At 6 am, the shadow of the eastern edge of the top plate will lie along the eastern side of the upright plate. During the morning, it will travel down the plate, always lying parallel to the top plate and indicating the time on the engraved scales. At about 11:10 am, this shadow will pass onto the bottom plate and the minutes past 11 am will continue to be indicated by the numbers nearest the edges of the plate. At the same time, two small sun-rays coming through the apertures in the top plate will produce spots of light on the east and west sides of the bottom plate, now conveniently in shadow. The analemma has the time of solar noon marked as XII and a

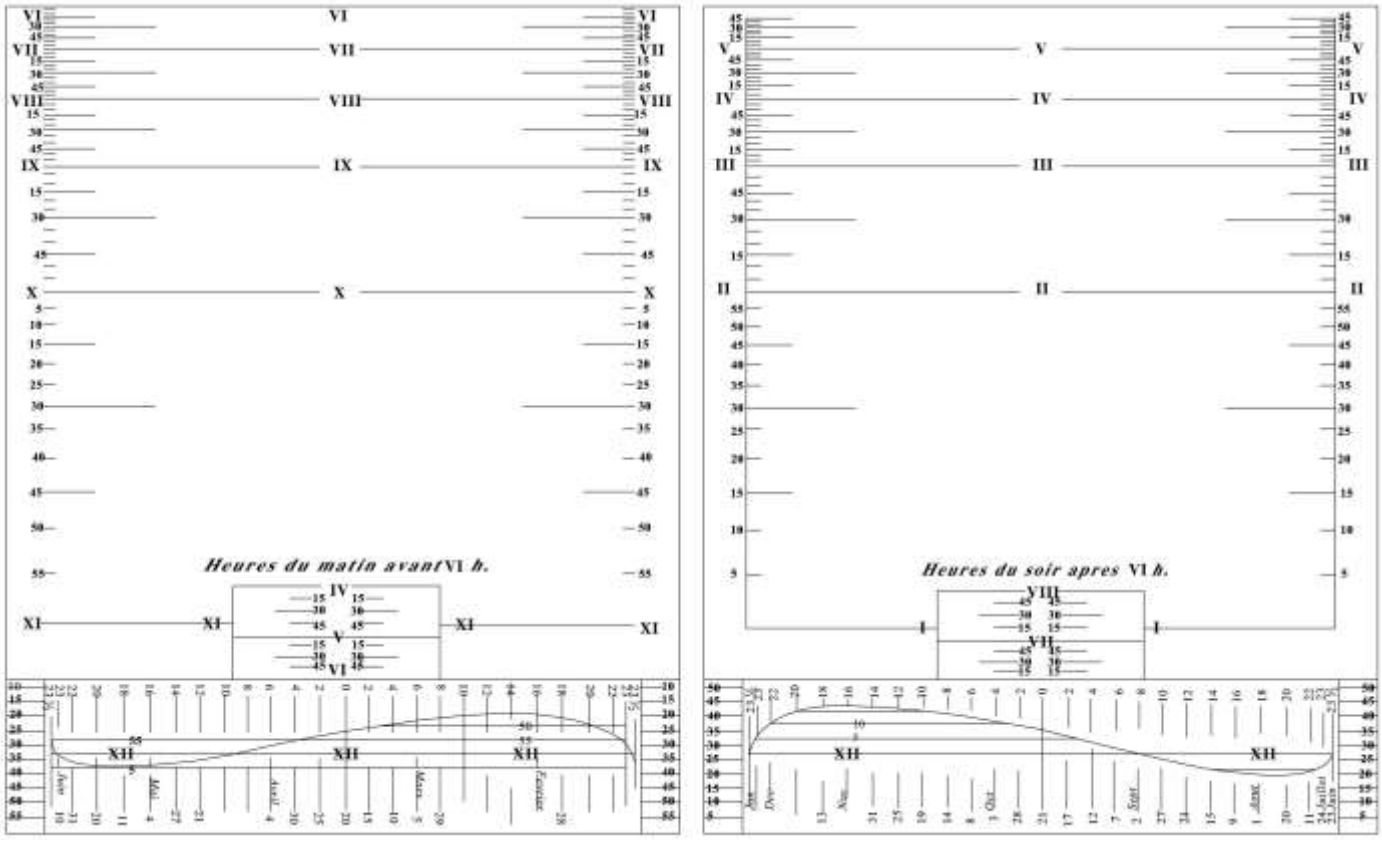

Fig. 7. Drawing of the engravings on the east (left) and west (right) plates. Note that the analemma sections at the bottom are actually at 90° to the plane of the drawing.

few minutes either side of that are numbered in Arabic numerals. Solar noon will be indicated simultaneously on both half-analemmas. The analemma scales also show the sun's declinations in degrees and the corresponding dates, with the period from the winter solstice to the summer solstice on the eastern part and the other half-year on the western one. Knowing the date, the appropriate half can be selected to give the correct time of (mean) 12 o'clock.

At approximately 12:05, the shadow of the western edge of the top plate will appear on outside edge of the western bottom plate and will move towards the upright plate, passing onto it at around 12:55, as indicated by the scales outside the (separate) analemma. It will continue upwards during the afternoon, until 6 pm.

One feature which is rarely seen on east–west dials is the two small subsidiary timescales, operating over the summer half of the year and positioned near the centre of the analemma. That on the east plate is labelled "*Heures du matin avant* VI *h*" (morning hours before 6 o'clock) and on the west plate "*Heures du soir apres* VI *h*" (evening hours after 6 o'clock). These scales give an extra 4 hours of time range when the sun can be found above the horizon to the north of the E–W line: this is rather more than is actually required at this latitude. Only parts of the bottom plate would cast a shadow on these scales.

The dates of the equinoxes shown by the analemma, when the declination is zero, are 20 March and 21 September. These are very close to the current, Gregorian, dates. The extremes of the EoT are difficult to interpolate accurately from the scales but are clearly in excess of –16 minutes in early November and around 14m 30s in February (the actual values for 1875 were –16m 19s and 14m 30s respectively[4]). It is not known where Kitchener obtained the data for the analemma but a copy of the Nautical Almanac is highly likely. Note that the analemma makes no allowance for a longitude offset: the times are all local ones. The dial was made some nine years before the 1884 International Meridian Conference in Washington D.C. when the Greenwich Meridian was formally adopted as the origin for the world's longitudes, and the 15°/1hr time zones were set.

Fig. 8. Photograph of the eastern side of a model of the dial, indicating 8:35 am local solar time. © Arch Amir Freundlich 2015.

It is initially a puzzle why the labels, and the months on the analemma, are written in French. The most logical of languages would have been English or German. However, although the French community in Palestine at that time was small, the use of French for official documents was still quite standard. Kitchener was very pro-French, having been to school in Montreux (his parents were living in Switzerland) and having joined the French field ambulance service in the Franco–Prussian War. It seems unlikely that there was a French mathematical instrument maker in Palestine that Kitchener could have used to make the dial – a Royal Engineers workshop seems a more likely choice.

Study of the Kitchener sundial continues and an accurate replica of the plates has recently been made with the intention of experimenting with it *in situ* (see Fig. 8). It remains a fascinating example of what at the time would have been one of the most sophisticated and accurate dials in existence.

ACKNOWLEDGEMENTS

We are grateful to Frank King for fruitful discussions on the functioning of the dial.

REFERENCES and NOTES

1. Kitchener (later Field Marshal and the 1st Earl Kitchener) has an extensive biography in the *Dictionary of National Biography* (OUP) and briefer details of his life can be found on Wikipedia.
2. Claude Reigner Conder (1848–1910) was a great-great-grandson of Louis-François Roubiliac and had met Kitchener at school.
3. Nelly Marcinkowski-Schumacher: *Rain from Clear Skies, my life with Wladimir Ph. Marcinkowski* (1994). Originally published in German in 1978 (Wuppertal: R. Brockhaus).
4. Edward Dent, table in the instructions for a dipleidoscope.

Tommer Grossberger is a neuropsychologist and works in rehabilitation of the mentally and socially challenged. Tommer's family have lived in the Schumacher House in Haifa since 1948 but never enquired about Kitchener's sundial inside it until recently, when a conservation project of the building took place. Tommer lives in Binyamina and can be contacted at *tommergros@gmail.com*.

Amir Freundlich, B.Arch. Cum Laude (2001) from the Technion – Israel institute of technology – specializing in Conservation of historical and archaeological sites. He documented Schumacher's House in the Templar Colony in Haifa (July 2015) by request of the Grossberger family (contact: *amfreundlich@gmail.com*).