Session 3: The Great Circle Route to Jerusalem

1. I Kings 8:44-45

If Your people go out to battle against their enemy, by whatever way You shall send them, and they pray to the LORD toward the city which You have chosen, and toward the house which I have built for Your name, then may You in heaven hear their prayer and their supplication, and maintain their cause. If they sin against You — for there is no one who does not sin — and You become angry with them and deliver them to the enemy, so that they carry them away captive to the enemy’s land, far off or near; yet if they shall repent in the land where they are captive, and turn back, and make supplication to You in the land of them that carried them captive, and turn back, and make supplication to You in the land of them that carried them captive, and pray to You toward their land, which You gave to their fathers, the city which You have chosen, and the house which I have built for Your name; then hear their prayer and their supplication in heaven Your dwelling-place, and maintain their cause.

2. Daniel 6:11

And when Daniel knew that the edict was signed, he went into his house — now his windows in his upper chamber opened toward Jerusalem — and he kneeled upon his knees three times a day, and prayed, and gave thanks before his God, as he had done previously.
3. **Mishnah Berachot 4:5**

If one is riding on a donkey, he gets down [to pray]. If he cannot get down, he turns his face. If he cannot turn his face, he directs his heart toward the Holy of Holies.

4. **Babylonian Talmud, Berachot 30a**

Our sages taught: A blind person and one who cannot determine the directions directs his heart toward his Father in heaven, as it is written (I Kings 8:44): “And they pray to the LORD.” One who is outside of Israel directs one’s heart toward the land of Israel, as it is written (I Kings 8:48): “And they shall pray to You, toward their land.” One who is in the land of Israel directs one’s heart toward Jerusalem, as it is written (I Kings 8:44): “And they shall pray toward the city that You have chosen.” One who is in Jerusalem directs one’s heart toward the Temple, as it is written (II Chronicles 6:32): “And they shall pray toward this house.” One who is in the Temple directs one’s heart toward the Holy of Holies, as it is written (I Kings 8:44): “And they shall pray toward this place.” One who is standing in the Holy of Holies directs one’s heart toward the *beit hakaporet*. One who is standing behind the *kaporet* views oneself as if one were in front of the *kaporet*. Thus, one who is in the east faces west, one who is in the west faces east, one who is in the south faces north, and one who is in the north faces south. We find all of Israel directing their hearts to a single place. R. Avin (some say, R. Avina) says: What verse supports this? (Song of Songs 4:4) “Your neck is like the tower of David, built with shields (talpiyot)” — a hill (tel) to which all mouths (piyot) turn.
5. **Babylonian Talmud, Bava Batra 25a-b**

R. Akiva says: [A tannery] may be set on any side at a distance of fifty cubits, save on the west side, where it must not be placed at all, because it is a constant abode. Said Raba to R. Nahman: A constant abode of what? … It is the constant abode of the Shechinah. For so said R. Joshua b. Levi: Let us be grateful to our ancestors for showing us the place of prayer, as it is written (Nehemiah 9:6): “And the host of heaven worships You.” R. Aha bar Jacob strongly objected to this [interpretation]: Perhaps [the sun and moon bow down to the east], like a servant who has received a gratuity from his master and retires backwards, bowing as he goes! This is a difficulty. … R. Shesheth [who was blind] also held that the Shechinah is in all places, because [when desiring to pray] he used to say to his attendant: “Set me facing any way except the east.” This is a difficulty. … R. Shesheth [who was blind] also held that the Shechinah is in all places, because [when desiring to pray] he used to say to his attendant: “Set me facing any way except the east.” This is a difficulty. …

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R. Isaac said: One who wishes become wise should turn to the south, and one who wishes to become rich should turn to the north. The mnemonic is that the table [in the Tabernacle] was to the north of the altar and the candlestick to the south. R. Joshua b. Levi, however, said that he should always turn to the south, because through obtaining wisdom he will obtain wealth, as it says (Proverbs 3:16): “Length of days are in her [wisdom’s] right hand, in her left hand are riches and honor.” But was it not R. Joshua b. Levi who said that the Shechinah is in the west? — [He means that] one should turn partly to the south. R. Hanina said to R. Ashi: Those like you who live to the north of Eretz Yisrael should turn to the south. How do we know that Babylon is to the north of Eretz Yisrael? — From the scriptural verse, (Jeremiah 1:14) “Out of the north evil shall break forth upon all the inhabitants of the land.”
6.  Tur, Orach Chaim 94 (R. Jacob ben Asher, 1269–1343, Cologne, Germany)

We hold by this ruling [Berachot 30a] and not by that of Bava Batra, where some Amoraim say that the Shechinah is in the east and one must face east, and some say that the Shechinah is in the west and one must face west. We face east because we live west of Israel, and when we face east, we thus pray toward Jerusalem.

7.  Shulchan Aruch, Orach Chayim 94:1-3 (R. Joseph Caro, 1488–1575, Tzefat, Israel)

When getting up to pray, one standing outside of Israel faces toward Israel and also directs toward Jerusalem, the Temple, and the Holy of Holies. One standing in Israel faces toward Jerusalem and directs toward the Temple and the Holy of Holies. One standing in Jerusalem turns toward the Temple and directs toward the Holy of Holies. One standing behind the kaporet turns toward the kaporet.

If one is praying in a different direction, one turns one’s face toward Israel (if outside Israel), toward Jerusalem (if in Israel), toward the Temple (if in Jerusalem).

Rema (R. Moses Isserles, 1520–1572, Krakow, Poland): We face east because we live west of Israel, and when we face east, we thus pray toward Jerusalem. We do not build the ark and the side for prayer facing due east, for that is the way of the heretics, but rather turn slightly to the south. And even one who wishes to fulfill the expression, “To be wealthy, turn north; to be wise, turn south,” should nevertheless turn his face to the east.”

One who does not know how to determine the direction should turn one’s heart to his Father in heaven.
8. Levush, Orach Chayim 94 (R. Mordecai ben Avraham Yoffe, 1530-1612, Prague; Venice; Poland)

And we, who turn to the east, should not face due east; on the contrary, one who does this is completely wrong, for that is the practice of the heretics who pray to the location of sunrise, and their intention is to bow to the sun and make it a god, chas v’shalom. Rather, because we live west of Israel, when we turn to the east, we find ourselves facing toward Israel, Jerusalem, the Temple, and the Holy of Holies. Note that the lands where we are scattered are all to the northwest of Israel, not directly west of Israel, and [knowledge of] the length of days and nights will make this clear to anyone who knows about the shape of the earth. Therefore, I believe it is proper that when building a synagogue, that the eastern wall in which the ark is built and towards which we pray should be turned slightly to the southeast. Thus, we will stand facing Israel, Jerusalem, the Temple, and the Holy of Holies, and we will not imitate the heretics who claim that we face the sun like them.

But setting up the synagogue in these places requires some consideration. In summary, by studying the globe, it is clear to me that we should set it up as follows. On the day of the equinox (plus or minus six or seven days), when the sun rises in the morning and enters the window in the middle of the eastern wall of the synagogue and the beam strikes the western wall, the beam starts at a point far south of the middle and reaches the middle of the wall after half an hour or an hour. A synagogue built like this,
in these places, truly faces Jerusalem and the Temple according to the globe [approx. 5-10° south of east]. But if we set it up such that on the aforementioned days, the beam strikes the middle of the western wall immediately at sunrise, then it is facing due east, and that is the practice of the heretics. If we were to do this, we would be copying the heretics and not bowing toward Jerusalem and the Temple, and thus we should not build a synagogue in this manner. And if we build it so that the sunbeam strikes the western wall north of the middle, even though this synagogue does not imitate the heretics, it is nevertheless not built in accordance with the verse “They shall pray … toward their land,” for it does not face Jerusalem or the Holy of Holies, but rather turns away from them, and this is the third figure that I drew. And even though the Sages say, “To become rich, turn north; to become wise, turn south,” nevertheless one should always face toward Jerusalem, because the Bible says “Pray toward their land,” and according to the first picture that I drew, everyone on earth will come to the right conclusion, I believe.

9. Emunat Chachamim (R. Aviad Sar Shalom Basilea, 1680–1749, Mantua, Italy)

   In Germany and Poland, and also in Italy, the Levush is correct that the wall should face a bit to the south. But the Levush’s reasoning is incorrect, with all due respect. There are places that satisfy the same conditions that the Levush mentioned [i.e., their latitude is greater than that of Israel], yet one who wants to face toward Israel precisely should turn slightly to the north. The idea is not to look at north in the world and south in the world, measured with respect to the equator, but rather north and south of the city. The most important great circle that passes through the city, known in their language as verticale primario, is what you need to know if you want to determine whether to turn to the north or the south in order to face Israel. It is impossible to understand this if you don’t know trigonometry, so I have skipped the details here. In the end of the book, I will explain all of this in a foreign tongue [Italian] so those who are familiar with this subject can know what direction a person should pray, although we really don’t need such precision. I have illustrated this with the example of Lisbon, the capital of the kingdom of Portugal, which is 39.5° north of the equator, whereas Jerusalem is only 32° north. Thus, according to the Levush, someone in Lisbon should turn slightly south in prayer, but in fact it’s the opposite: the eastern wall should face slightly north.

10. Netzach Yisrael (R. Israel ben Moses Segal of Zamość, c. 1700–1772, Poland)

   With all due respect to His Honor [the Levush], I will show that he has made a big mistake in his ruling that it those who are northwest of Israel (i.e., whose latitude is greater than that of Israel), should face southeast. This is completely incorrect. After a brief introduction to the study of hagrofia (the measurement of the earth and its geometry), we will show that those who live due west of Israel should turn slightly north. And as for those who live northwest of Israel, we shall find an exception to the rule given by the Levush, who thinks that the only factor that matters is latitude. Indeed, the answer also depends on how far west one’s country is relative to Israel…
To figure out which way the ark should face, we need to know our latitude from the equator and our longitude from the west. [The prime meridian here is what we would call 31° W, dividing between the Old and New Worlds.] Subtract the longitude from 66° [the longitude of Jerusalem], and look up its cosine. Also look up the tangent of 32° [the latitude of Jerusalem] and the tangent of our latitude. If the cosine of the longitude difference times the tangent of the latitude is greater than the tangent of 32°, then we should turn a bit south when we face east. If this number is equal to the tangent of 32°, we should face due east. And if it’s less than the tangent of 32°, we see clearly that we should turn a bit north when we face east. And all of these things are completely clear, without a doubt, and impossible to refute.

the distance of our country from the western sea [i.e., its longitude], and its difference in longitude from the navel of the world [Jerusalem]. This computation is easy for those who know spherical trigonometry.

12. Rabbi Howard Cohen, personal e-mail, 2010 (Congregation Or HaTzafon, Fairbanks, Alaska)

Hi Adam,

Interesting question you ask. It falls under the category of questions like how does one truly observe Shabbat up here when the sun doesn't set or because three stars can't be seen for weeks and weeks on end. Since facing east is purely a symbolic gesture it is not necessary to determine in any literal or astronomically sense whether or not we are actually turned towards Jerusalem. In other words, we symbolically face east like most Jews everywhere who locate themselves west of Jerusalem.

However, were this community more traditional I could imagine some people arguing for facing more towards Jerusalem. If I were to imagine walking from here to Jerusalem in as straight a line as possible I would think I would walk in a southeasterly direction toward some point on the east coast and then just continue heading east, southeast.

So although the math might suggest one of the two directions you mention intuition (rightly or wrongly) suggests one face southeasterly.

L'shalom,

Howard
Let \((\theta_1, \phi_1)\) be your latitude and longitude, respectively, and let \((\theta_2, \phi_2)\) be the latitude and longitude of Jerusalem. Consider the spherical triangle formed by your location, Jerusalem, and the North Pole:

![Spherical Triangle Diagram]

We have \(b = 90^\circ - \theta_1\) and \(c = 90^\circ - \theta_2\), and \(\alpha = \phi_2 - \phi_1\). Thus \(\cos b = \sin \theta_1\), \(\sin b = \cos \theta_1\), \(\cos c = \sin \theta_2\), and \(\sin c = \cos \theta_2\). Our goal is to compute the angle \(\gamma\).

By the spherical law of cosines, we have:

\[
\cos c = \cos a \cos b + \sin a \sin b \cos \gamma
\]

\[
\sin \theta_2 = \cos a \sin \theta_1 + \sin a \cos \theta_1 \cos \gamma.
\]

By the spherical law of sines,

\[
\frac{\sin a}{\sin \alpha} = \frac{\sin b}{\sin \beta} = \frac{\sin c}{\sin \gamma},
\]

so

\[
\sin a = \frac{\sin c \sin \alpha}{\sin \gamma} = \frac{\cos \theta_2 \sin(\phi_2 - \phi_1)}{\sin \gamma}.
\]

Thus,

\[
\sin \theta_2 = \cos a \sin \theta_1 + \frac{\cos \theta_2 \sin(\phi_2 - \phi_1) \cos \theta_1 \cos \gamma}{\sin \gamma},
\]

which can be rearranged to give

\[
\tan \gamma = \frac{\cos \theta_1 \cos \theta_2 \sin(\phi_2 - \phi_1)}{\sin \theta_2 - \cos a \sin \theta_1}.
\]

Using the spherical law of cosines again,

\[
\cos a = \cos b \cos c + \sin b \sin c \cos \alpha
\]

\[
= \sin \theta_1 \sin \theta_2 + \cos \theta_1 \cos \theta_2 \cos(\phi_2 - \phi_1).
\]

Therefore,

\[
\tan \gamma = \frac{\cos \theta_1 \cos \theta_2 \sin(\phi_2 - \phi_1)}{\sin \theta_2 - \sin^2 \theta_1 \sin \theta_2 - \sin \theta_1 \cos \theta_1 \cos \theta_2 \cos(\phi_2 - \phi_1)}
\]

\[
= \frac{\cos \theta_1 \cos \theta_2 \sin(\phi_2 - \phi_1)}{\cos \theta_1 \sin \theta_2 - \sin \theta_1 \cos \theta_1 \cos \theta_2 \cos(\phi_2 - \phi_1)}
\]

\[
= \frac{\sin(\phi_2 - \phi_1)}{\cos \theta_1 \tan \theta_2 - \sin \theta_1 \cos(\phi_2 - \phi_1)}
\]

Thus,

\[
\gamma = \arctan \left( \frac{\sin(\phi_2 - \phi_1)}{\cos \theta_1 \tan \theta_2 - \sin \theta_1 \cos(\phi_2 - \phi_1)} \right).
\]
RITROVARE

Se una Regione sia Settentrionale, o Meridionale, ripeto ad altra Regione, data la longitudine, e latitudine d'ambidue, e che questa sia Settentrionale.

Dico data quella Regione dove si trova l'Osservatore, e rivolta quella, di cui si ricerca la situazione, e l'abitudine.

Negli Orizzonti obliqui il verticale primario distingue la parte Settentrionale dalla Meridionale, e lega il Meridiano ad angoli retti; e l'Orizzonte nel punto della sezione dell'Equatore.

Quando le due Regioni fanno fronte uno al Meridiano, e la rivolta avrà maggiore latitudine ha Settentrionale; e minore Meridionale.

Il lato maggiore e d gr. 58.
Il minore a e gr. 50. 23.

La differenza di lati gr. 7. 38.
La differenza gr. 3. 49.
log. 2. 599970

Angolo verticale gr. 54. 20.
Angolo di fis. gr. 27. 10.

Semiomnima degli Angoli alla base gr. 73. 56. MeF. 1052172

Semiomnima de'lati gr. 54. 11. tom. 1009104
Semiomnima de' medesimi gr. 3. 49. log. 883274
Semiomnima verticale gr. 27. 10. MeF. 1052173

Semiomnima degli Argoeli alla base gr. 50. 12. MeF. 1054200

Nel triangolo a d e è nato l'Arco a d e compimento dell'elevazione Polare di Lisbona gr. 50. 22., e arco d e compimento di quella di Gerusalemme gr. 58. 0., e l'angolo d e a distanza de'Meridiani gr. 34. 20.
_Clear the path for women craters.

A firm believer in the power of women, she marched forward, undeterred by obstacles.

With determination and courage, she paved the way for others to follow.

In her footsteps, the landscape changed, and the path became more accessible.

Her vision was clear, her goals were unwavering.

Together, they moved forward, conquering one obstacle after another.

Their journey was not easy, but their determination was stronger.

And so, the path for women craters was cleared, opening up new possibilities and opportunities.

For them, it was a victory, but for all, it was a step forward in the fight for equality.
ג'ירס

נולם אָדוֹן

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ירנו אָדוֹן קָּנְבַּר דִּיקָל וּֽגְּרֶנֶס

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