



D'var Torah Pinchas – July 8, 2023

By Morry Safer

Shabbat Shalom.

My name is Morry Safer and I am a Torah and Math geek.

While I may have quickly gained a reputation at Minyan Ma'or as a loud-voiced amateur musicologist, my true passion in Jewish learning is in employing my engineering training in the study of Torah, Talmud, and other sacred texts. As an example, this past March, I enthusiastically attended evening minyan in the Gann Chapel on Pi Day, and came home eager – perhaps overly eager, to Rachel's dismay – to share my new learnings and mathematical insights.

I feel I come by my mathematical interest in Torah study quite naturally. My last name - Safer - has been connected through family lore to *sofrut* - likely a relative who was a scribe in the Old Country. The Hebrew root *Samech-Peh-Reish* is the source of the word *sefer* for “book”, but also the verb *lispor*, meaning “to count”. Historically, we know that the alphabetic writing invented by the Phoenicians was required for keeping inventory of their seafaring commercial interests. In English as well as Hebrew, there is an easy etymological path to trace from “counting” the inventory, to required bookkeeping “accounting”, to the “accounting” of a story. The Talmud takes this common root a bit further in explaining the *Sofer* was thus named because he was responsible for counting all the letters in the Torah.

So, fully embracing my *yichus*, I'd like to spend a few minutes sharing some mathematical insights inspired by this week's parasha - Parashat Pinchas. For those who were “told

there would be no math” this morning, I hope you’ll try to follow along and stick around for the very non-mathematical conclusion. For my fellow Judaic numberphiles, please sharpen your shabbat-friendly #2 pencils, take out your shabbat-friendly calculators, and let’s get started.

The most interesting meta-mathematical fact about Parashat Pinchas is how often it is read. As one of 54 parshiyot hashavua, Pinchas can be read up to 3 times during the week at Shacharit. Of course, this past Thursday was an overriding exception for the Shivah Asar b'Tammuz fast day, so it was only read twice this week. However, because of the descriptions of all of the special sacrifices found at the end of the parashah, Pinchas is a common addition, included as a special reading for Rosh Hashanah, Yom Kippur, Sukkot, Pesach, Shavuot and Rosh Chodesh.

Factoring in the additional non-Pinchas readings added for Purim, Chanukkah, and fast days, as well as the nuances of the variability of the calendar, I postulate the following: If you walk into a random shacharit service and see a Torah being taken from the ark, there is a greater than 15% chance you are about to hear part of Parashat Pinchas read! (34/206) While still a minority of all Torah readings, reading from Parashat Pinchas is not-at-all a rare event!

Mathematically, we talk about the probabilities of events occurring and the expected value of such outcomes. Sometimes, this gives a confusing practical result. The expected value of the roll of a 6 sided die is 3.5 - the average of all 6 equally likely outcomes. This is mathematically true even while it is impossible to actually roll a “3.5” in a single roll of the die. Similarly confusing, as part of Jewish mourning practices we speak of Shiva and Shloshim – literally periods of 7 and 30 days for observing specific mourning rituals. But the expected value of the number of days spent observing Shiva is actually less than 7. There are no halachic circumstances under which Shiva is extended beyond 7 days, but the observance of Shiva does conclude early due to Rosh Hashanah, Yom Kippur, or Festivals.

Practically, that means that Shiva will be observed less than 7 days for a period of approximately 4 weeks around Tishrei, a week around Pesach, and a week around Shavuot - more than 10% of the calendar year. Shloshim has the same interruptions, and thus is observed for less than 30 days about 30% of the time. While shortened periods

of Shiva and Shloshim are exceptions, they are certainly not rare or unexpected occurrences.

There are also examples of this kind of expected value calculation being used in the formation of Jewish law. In Masechet Pesachim, a baraita describes a community with nine kosher butchers and a single additional non-kosher butcher. In the case where an otherwise unmarked steak is found in the public domain – the kashrut determination follows the most likely case, and since there is a 90 percent chance the steak came from a kosher butcher, the steak is deemed kosher.

Those familiar with the laws of kashrut will be familiar with the concept of “*batel bashishim*” that accidental combinations of unkosher with kosher are negated in amounts less than 1/60th. But, in this case, there is a much greater uncertainty. Further, we know that “*batel bashishim*” does not apply to *chametz* and the rabbi take a zero-tolerance stand for accidentally consuming *chametz* during Pesach, yet the talmud continues with another highly-implausible yet mathematically interesting scenario: during Pesach cleaning, nine piles of *pesadik* Tasty-O’s are placed outside near a single pile of collected *chametzdik* Cheerios. A single cereal ring from an unknown pile is seen separated where it is picked up by a mouse and carried into an otherwise clean-for-Pesach kitchen. By similar logic to the kosher steak, the rabbis declare the most-probable situation to hold and the kitchen is still *pesadik* (though you now have an unwanted mouse-visitor at your *seder*!)

Returning to this week’s parashah, I’d like to use this concept of probable vs. improbable outcomes to re-evaluate a famous story from Parashat Pinchas.

Early in the parashah, a census is completed to count the number of men in the community - totaling 601,730 – among whom the Land of Israel will be apportioned.

Later in the Torah reading, we learn of the 5 daughters of Tzelophchad - orphans with no brothers, who would like to become heir to their father’s portion of the land contrary to the patrimonial estate system. Famously, B’not Tzelopchad are feminist icons, getting a divine decree in their favor, overturning an injustice originally included in the inheritance laws.

The mathematical question I'd like to ask is: would a family of 5 sisters without any brothers be expected in a community counting over 600,000 men? If such a family would not be expected, then it is certainly fair to see the story of B'not Tzelophchad as an evolution in Jewish law – updating an existing law for a new, unconsidered case. However, if B'not Tzelophchad just serve as representative plaintiffs for a common and expected family demographic, this traditional interpretation must be reconsidered.

While getting to any precise mathematical solution for this problem is quite complicated, there are many steps we can consider toward an answer. First, while families with 5 children are uncommon in our community, the Torah gives many examples of families with 5 or more children in its many genealogies. As Yair taught over Shavuot in his early-morning analysis of *p'ru ur'vu*, fertility rates between 4.5 and 7 were common for most of human history until modern times. Assuming equal probability of sons and daughters, for randomly selected families of 5 children, we would expect 1 in 32 (or about 3%) to be families of only 5 daughters.

The mishnah, in Yevamot, describes two different interpretations of *p'ru ur'vu* useful for calculating family probabilities. Beit Hillel says the mitzvah is fulfilled by families with one son and one daughter. In contrast, Beit Shammai requires two sons. Despite the difference in phrasing (and the more misogynistic-sounding formulation from Shammai), we can show mathematically that both directives average families that are 50% male and 50% female. Therefore, we would expect a Torah family of 5 children to have, on average, 3.5 males - a father and 50% male children. Making the oversimplifying assumption that all families are families of exactly 5 children – true in the specific case of B'not Tzlophchad and a reasonable average size given our additional knowledge, the census count would suggest more than 170,000 such families, of which, more than 5000 would have no sons! Families having all daughters would be a minority, but not at all rare.

A couple of additional caveats to consider. First, in a society that values patrilineal inheritance, there may be an incentive for parents of only daughters to “try for a son”. We note, however, that for all the families adding a child, half will continue to have only daughters. Second, Dr Jonathan Rosenberg, Professor of Mathematics at the University of Maryland College Park, comments on this 50% probability assumption, noting that while male and female are equally likely in the general population, families who have lots

of sons (citing the patriarch Jacob's family) are probabilistically more likely to produce sons. In contrast, he cites B'not Tzelophchad as an example of a family whose probability skews to daughters.

Mathematically, this is best represented by a more-complicated beta-binomial distribution, which is very interesting, but beyond the scope of this morning's *d'var torah*. Regardless, I find the math convincing that there is nothing particularly unexpected about the demographics of B'not Tzlophchad. The idea that a divine Torah from an omnipotent deity would not have predicted the necessity of an inheritance law which considers the probabilistically-likely situation of families with no male heir is unconscionable to me, and empowered by my proving calculations, I find a different, more satisfying interpretation of the story.

When the daughters of Tzelophchad raise their challenge, Moses petitions G!d on their behalf, and G!d responds "The plea of the daughters of Tzelophchad is just!" The kabbalist, Or HaChaim, points out that, looking closely, we see that it is Moses who originally shares the inheritance laws. In Masechet Bava Batra, Rabbi Shimon HaShikmoni teaches that even before turning to G!d for guidance, Moses knew that the daughters of Tzelophechad were legal inheritors. That is, while on Mt Sinai, Moses had learned more about the inheritance laws than he had chosen to share with B'nei Yisrael. Thus, the laws received in the Torah are those through Moses's own filter and not the original version.

Perhaps Moses' oversight was unintentional. Perhaps Moses knew they were rightful inheritors, but was uncertain how to precisely divide the portion of the firstborn without an available eldest-son. Perhaps through his own family of only sons, Moses was unconsciously biased against considering the concerns of the other. Or perhaps Moses had some other, unknown ulterior motive. In any case, the result is a misguided unfair law unaligned with Divine will. Regardless, it is clear that B'not Tzlophchad are protesting, not the original law, but Moses's interpretation.

In the midrashic text of Sifrei Bemidbar, the discussions of B'not Tzlophchad are recorded prior to their petition. They said, "G!d's mercy and compassion is not like the compassion of mankind. Mankind favors men over women. G!d is not like that. His compassion extends to men and women alike..."

Through this interpretation, B'not Tzlophchad are not asking for a change in the divine law, rather they are petitioning for a divine correction in the way Moses has chosen to interpret it. In addition to being consistent with the math presented in the parasha, I find this to be a powerful reframing of the changemaker legacy of B'not Tzlophchad. They are not challenging the will of Hashem, but rather are partnering with G!d to correct injustices.

Thus, Mahlah, Noah, Hoglah, Milcah, and Tirzah are role-models for a modern path for progressive Halacha to reconsider the original divine mitzvot independent of human mis-interpretation. Through this lens, may those who have historically been in the silent countable minorities of our community, like B'not Tzlophchad, find recognition and realization of their own Expected Value.

Q.E.D.

Shabbat Shalom.