The Path of Science

(a personal viewpoint)

All peoples, cultures, and religions have stories which give meaning to existence, provide a sense of wonder and awe, and in some way explain a relationship to a creative power. The shared language, rituals, and understandings that come from the common story can give a group a sense of belonging and cohesion.

As part of a next step in human evolution - seeing ourselves as one planet and one humanity - I believe we'll also need a common story, one that provides many of the same benefits for humanity as a whole that each peoples' stories have provided for their group. A common story wouldn't deny or diminish the validity of the multitude of existing stories, rather, enhance their essential truth by indicating how each one uniquely contributes to the greater, diverse, all-encompassing story.

I suggest that the story now unfolding in scientific language - of our universe's creation and the evolution that has given rise to our planet and humanity - can potentially provide such a common story, one that is neutral with respect to individual ethnic, religious, and geographical differences. While each group remains served by their distinct laws and practices - common laws, language, and practices of value to the planetary whole can be provided by the path of science.

The following handout is a start to introducing some science language in these gatherings. Here I emphasize the concept of dynamic homeostasis – maintaining balance in an ever changing and challenging world – and present it in the context of understanding some basic science terms via graphs. Much of this is based on a class I did with Rabbi David Wolfe-Bank z"l at the 1991 Kallah, on the Creation Story according to Science and Chassidus.

Probability and Graphs

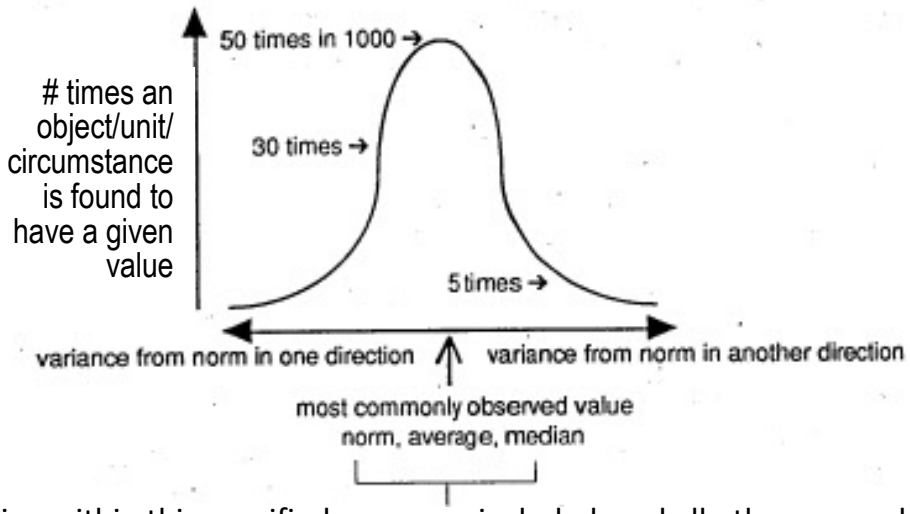
Intrinsic to the scientific outlook is that the nature of reality is amenable to: observation, organizing of observations into patterns, predictions that are testable based on observed patterns, and manipulations based on the reliability of tested predictions. From seeming chaos and randomness, an underlying order emerges, giving rise to laws that have predictive value. This approach to viewing and organizing the world is common to all peoples throughout history.

Underlying the above is the concept of probability. Only a fixed number of events is observed - perhaps small, perhaps large - but never all possible. Patterns arise because some phenomena are more likely to occur, are more probable, than others. Predictability is to to say that something occurs most frequently, or *almost* always. Yet underlying probability is the acknowledgement that laws are not absolute; there is measurable precision but not strict determinism. Even "laws" are based on a limited number of observations. Unusual events, "miracles" are not strictly ruled out – they're just very improbable, under the known set of circumstances.

So enfolded in probability are several concepts that re-occur throughout science and I think are applicable to daily human life, e.g., **tolerance, flexibility, adaptability, indeterminism, resilience** – all related to **dynamic homeostasis**.

Probability, and its associated concepts, are often best expressed by graphs.

A common form of probability distribution is the "bell-shaped curve" (Gaussian distribution)

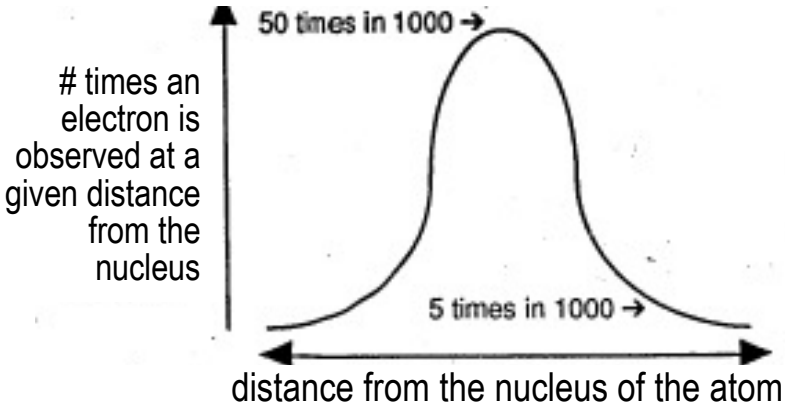


If all "objects" falling within this specified range are included, and all other are excluded, then the large majority of objects/units/circumstances are included – but not all!

Many distributions contain outliers – values that fall far from the norm. Depending upon what is being described, outliers can be valued as a source of variability and novelty, or can be considered an undesirable source of inaccuracy or deviation. In not including outliers, there can be loss of **adaptability, tolerance, and novelty** – e.g., the ability to maintain **dynamic homeostasis**. But, there can be gain of precision. Circumstances and objectives may determine how outliers are viewed.

<u>Indeterminism</u>: or, basic elements of creation aren't precisely located in time and space

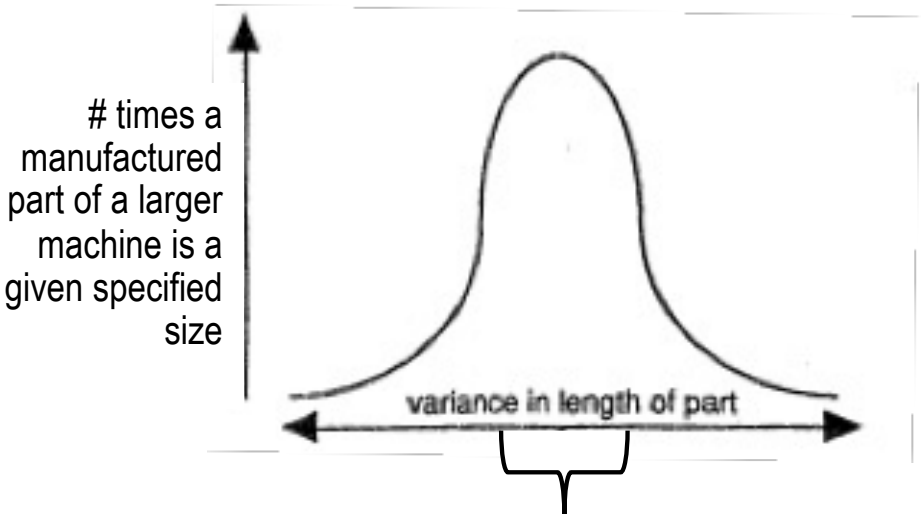
Probability of locating an electron at a specific distance from the nucleus



In the makeup of the atom, the basic building block of matter, the location of the electrons around the nucleus is not fixed - it's indeterminant. Variability is inherent.

<u>Tolerance</u>: or, what's appropriate for me may not be what's most appropriate for you

Given variability, it's the use or purpose for which something is created that's the filter that determines what's most appropriate, how variation is viewed.



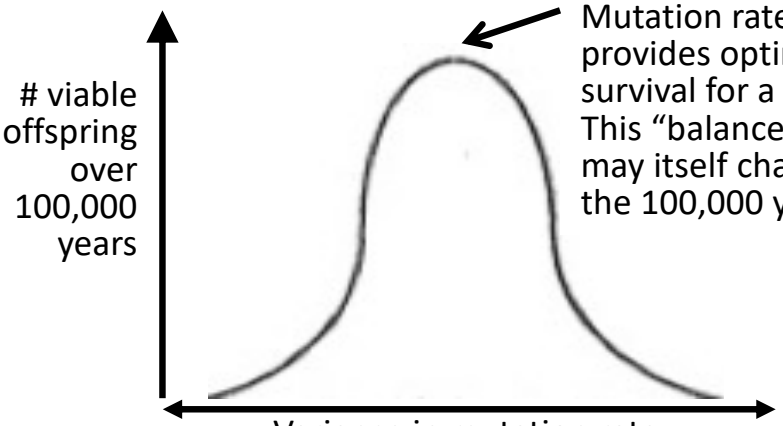
Tolerance limits: for machine X the size of the part may be required to absolutely fall within this range of values for the larger machine to work

Machine Q has greater **Tolerance limits** for the size of this part for its ability to function. Presumably, less effort is needed to manufacture the part. There is greater tolerance for variation/outliers.

<u>Adaptability</u>: a dynamic version of tolerance; tolerance limits may need to be flexible

What works well in some circumstances (time, place, groups) may not work so well in different circumstances. It can be valuable to **stay flexible and resilient** and maintain a range of options, "keep on dancing" to find the best balance point for the current circumstances – **dynamic homeostasis**.

Species viability and dynamic homeostasis



As the *mutation rate decreases*, there are fewer ongoing errors (most deleterious) so fewer ongoing defects. However, some errors are beneficial and some provide variability. If the environment changes, the species may not have the adaptability to successfully cope with the change, and could become extinct.

As the *mutation rate increases*, more an more errors (most deleterious) accumulate. The species viability may be reduced and it could become extinct.

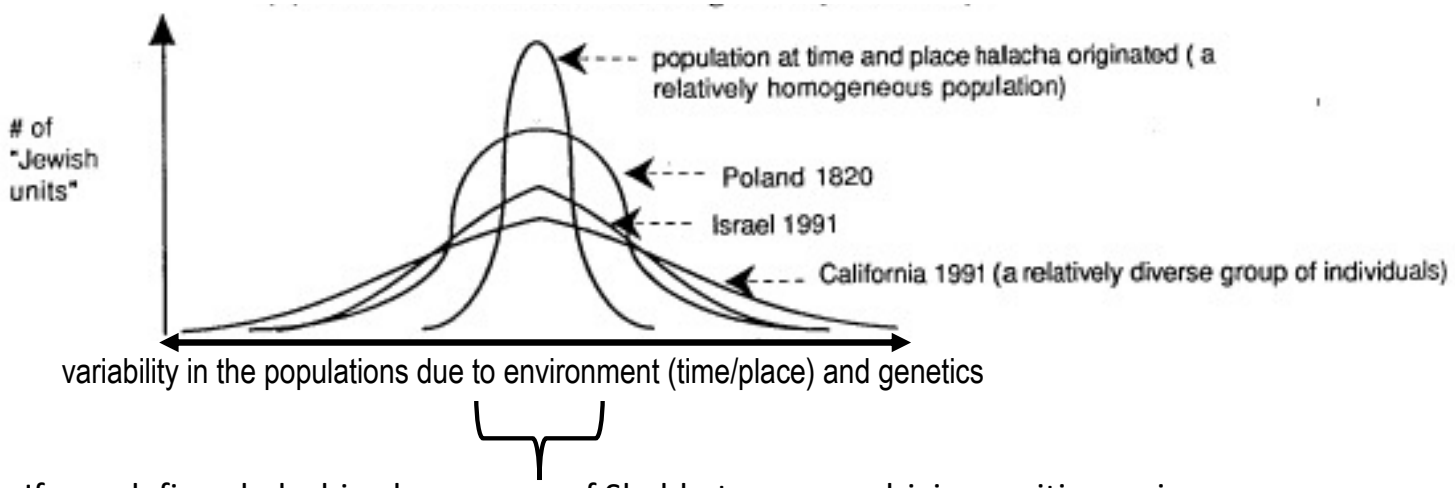
Questions to consider regarding environment, culture, innovation, and dynamic homeostasis

How might the rate and extent of environmental change over time influence a "group's" stability? Innovativeness? Creativity? (e.g., the human species)

How can awareness of dynamic homeostasis' usefulness expand human consciousness to accelerate our evolution as a species and attaining Ruach Shalom?

What about applying graphs/probability to express some less conventional or people-oriented concepts or opinions ……. Here are two examples from me – that everyone might not agree with.

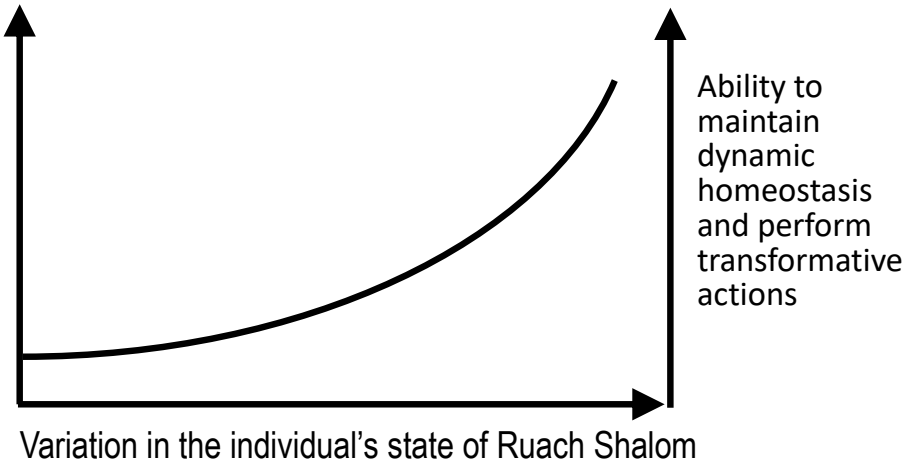
Halacha and tolerance/flexibility/dynamic homeostasis



If one defines halachic observance of Shabbat as never driving, writing, using electronics, and kosher as separation of milk and meat and list of accepted foods, then only individuals falling within these limits may find that performance of these mitzvot has the potential to elevate personal consciousness and a sanctification of the world

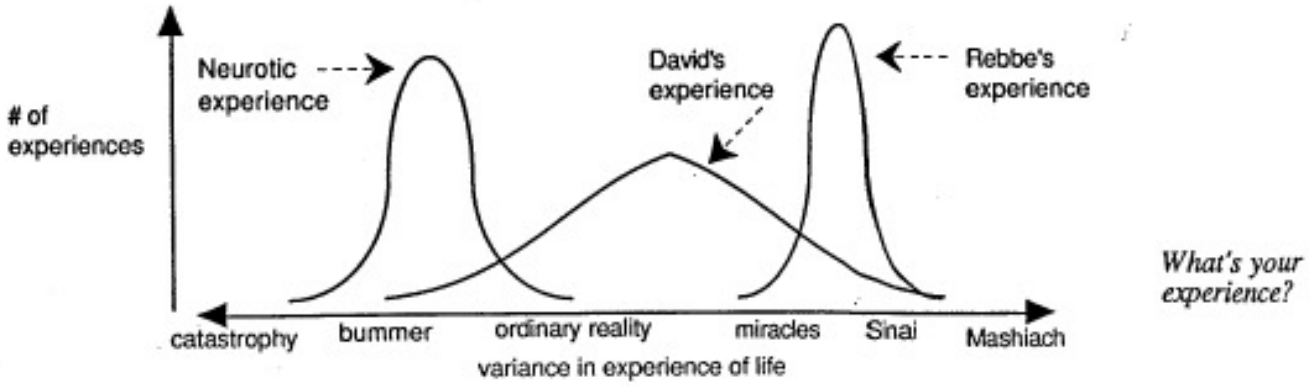
If one e.g., defines Shabbat observance as meaning rest, study, experience of the sacred and kosher as meaning ecokosher, then individuals falling within these limits may find that performance of these mitzvot has the potential to elevate personal consciousness and a sanctification of the world

Ruach Shalom and dynamic homeostasis



Is there some concept, experience, opinion, observation that you might be able to communicate with better ease, clarity, precision, or humor by expressing as a graph?

Below is an example done by R David in 1991 as we worked together preparing our Kallah class – he was my first "pupil" for this.



Consider making a graph to share at next week's gathering

Personal practice opportunity questions:

How well do you maintain balance in ever changing environments (internally and externally) – what is your "dance" to enable living in the "sweet spot"?

Do you see yourself as flexible, resilient? How can these qualities be enhanced?

What does dynamic homeostasis mean for your life?

How can maintaining dynamic homeostasis enhance your practices of tfila, tshuvah, tzedukkah?

From some recent articles where I noted the concept of dynamic homeostasis was applicable

An article in Science about smaller-brained animals going extinct after the dinosaurs died:
Species with bigger brains would theoretically be more flexible in their behavior and more competent to cope with the rapidly changing conditions – and armed early humans – in the Late Quaternary. In other words, the conditions selected for the smartest of the pack …
This theory is supported by evidence that among birds and mammals today, relatively large brains have been found to improve survivability in novel conditions and when the animal is threatened, thanks to behavioral flexibility.

NYTimes version:
After the cataclysmic asteroid strike 66 million years ago that doomed the dinosaurs, our ancestors appear to have prioritized brawn over brains… it might have been the smart evolutionary strategy of the time, giving animals the strength to survive and thrive in a difficult environment ... a large brain was not worth the cost.. ecosystems became crowded with large mammals. Resources were no longer readily available, meaning creatures now had to be clever in order to eat or avoid being eaten and smarter mammals could outcompete their smaller-brained brethren.

From an article about the constitution and Supreme Court:

Bork and Thomas, like Scalia, espoused originalism, a reactionary trend in American jurisprudence whose followers try to recover either the original intent of the framers of the late 18th-century constitution or the meaning the document would have had for the generation that ratified it. This leaves no scope for the notion of a 'living constitution' which evolves in response to the changing practices and beliefs of American society. An adherent of the living constitution might conclude, for example, that the 'cruel and unusual punishment' prohibited by the Eighth Amendment wasn't a historically fixed standard but depended on shifting notions of morality and common decency. Originalists don't see things this way; and the emergence of this paleoconservative fad in the 1980s generated huge anxiety that its proponents wanted to replace late 20th-century freedoms with 18th-century restrictions.