Hafez looking at the Cup of Jamshid, Bibliothèque nationale de France, Turkish manuscript of 1477, author unknown, from Shîrâz, Iran

JĀM-E JAM, LEGENDARY IN VISUAL OPTICS

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"Jām-e Jam" (Globe or Cup of Jam or Jamshid) is a common word in Persian classical, mythological, mystical and fiction literatures. "Jām-e Jahān- bin" (Globe or Cup for seeing the world), "Jām-e Jahān Nama" (Globe or Cup that shows all the world), "Jām-e Giti nama" (Globe or Cup that shows all the universe) and other similar words may be referred to the "Jām-e Jam" concept.[1] Jamshid is a legendary ancient Persian king who made many great inventions.[2] He invented a cup that was filled by elixir or crystal globe or mirror so that he could see the future and the world.[2]

In classical Iranian mystical poems and literature, the "Jām-e Jam" concept is usually synonymous to "insight", "intelligence" and "vision". For instance, in a famous poem of Hafez, he says: "For years, our heart has been seeking out "Globe of Jam" from us, - Begging from strangers what he was already owned". The ancient concept of "Jām-e Jam" originated in Persia and then entered into Europe. In Europe it is known as Saint Ciarán of Saighir Cup.[3,4] Although there are many symbols for predicting devices in ancient legends, the most common one is a magician globe. The magician globe was a well-known device for everyone who was living in ancient times and it seems to have originated from ancient legends.

Many researchers believe that exaggeration of realities and facts are presented as myth and legends. Therefore, in each legend, some aspects of realities may be found. There are some small spherical crystals that have been found in archeological excavations in different parts of Persia (ancient Iran). These small spherical jewels may be the reality of "Jām-e Jam".

Visual optics may give an answer to the legend:

1. Small spherical transparent natural crystals (gems) may be considered as small thick convex lenses with radii of curvature around a few centimeters.
2. According to the thick lens formula[5] the vertex focal length of the lens (gem) is around a few centimeters too. As a result, these small gems have great dioptric powers.
3. Refractive error is corrected by superimposition of the second focal point of correcting lens on the far point.[5] The far point is located behind the eye in hyperopic eyes and in front of the eye in myopic eyes. The far point is very near to the eye in high refractive errors. Therefore, high power lenses with small focal length are needed for correcting high refractive errors. Changing the lens position also alters its effective correcting power.[5]
4. It seems, in Persia, people held the gems in front of their eyes and saw clear images by changing its distance from their eyes. In a specific position, according to the optical properties of the gem and refractive error of the eye,

that far point of the eye and focal point of the gems are coincident, the clearest image would be seen!

5. As these gems are similar to a high power convex lens, their correcting effect is completely obvious. The objects are seen straight and clear, according to the lens position. Interestingly, it is also possible for myopic eyes to see the far objects clearly by convex lenses! According to the far point principle, if the far point of a myopic eye is located between the eye and a convex lens in a manner that the far point and the second focal point of the lens are coincident, the far objects are focused on the retina. This implies that in this specific circumstance, this high myopic eye can be corrected by convex lens but the visual perception of the image is inverted. To explain such a thought-provoking phenomenon, some knowledge of visual optics and perception are needed. When light from an object comes from infinity toward a convex lens, the image will be a point on the second focal point of the convex lens. After rays from infinity parallel to the axis are refracted by the convex lens at this focal point, the light rays also change their direction as they leave the focal point. This means light rays cross one another at this focal point. Therefore, when the parallel ray comes from the top of the object horizontally to the convex lens parallel to its axis, it refracts through the convex lens and passes through the focal point on the far side of the lens and crosses over. For this reason, in the situation where the far point of a myopic eye and the second focal point of the lens are coincident, the retinal image in this circumstance will be erect and thus the visual perception of such an image will be inverted.
6. High-power convex lenses (gems) may be also considered as a magnifier!

Therefore, gems, which are very beautiful and decorative for rich people, may also work as low vision aids for high myopic or high hyperopic individuals for far and near distances. The spherical crystal may improve vision for some people to see the world. An exaggerated description of these spherical crystals may be the "Jām-e Jam" (Globe of Jam or Jamshid).

The Crystal Ball by John William Waterhouse

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