

now. Zadkiel, in his almanac for 1895, says, "Astrology claims the distinction of being the oldest of all sciences; it was kith and kin with all the science and skill of the brightest ages of the world, from the building of the Tower of Babel to the laying of the foundation-stone\* of the Royal Observatory, Greenwich." He does not state its position after this. However, by his modesty in not claiming the period before the Flood, we are enabled to fasten the advertisement of patent medicines on the right offenders. The Antediluvians are clearly responsible. It works out in this way:— They invented the Zodiac, and no doubt Noah transmitted it to the Postdiluvians. Now the Chaldeans were great in astrology, so were the Egyptians, and between them they peopled the sky with heroes and others, naturally paying particular attention to the Zodiac. In the course of time each constellation was credited with peculiar powers, and finally the "Anatomy" was developed. Now it is easily conceivable that believers in astrology, more particularly in the "Anatomy," should repair to the fountain-head to have their troubles set right. Indeed we know our own early astrologers either were or called themselves doctors. What more natural than to point out certain remedies (sold only by themselves) for the various complaints. Finally, the general advertising of patent medicines—the biscuits, baking-powders, cocoa, &c. being after-growths.

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*On the Apparent Increase in Size of the Solar and Lunar Discs when near the Horizon †.*

SINCE early times many theories have been put forward to account for the apparent increase in size of the discs of the Sun and Moon when seen near the horizon. We have collected here the principal of these hypotheses for comparison with a series of observations that we have made on this subject.

According to Descartes an error of judgment is responsible for this appearance. The stars seem to be farther away from us when they are near the horizon than when they are in the zenith, owing to the interposition of terrestrial objects. Another explanation of this kind is that one compares the size of the celestial object with that of objects on the Earth. These hypotheses are overthrown by the following observations:—

1. When the Sun or the Moon is observed as it rises above the sea-horizon it appears to us to be twice as large as it seems to be when on the meridian. But this exaggerated size does not continue to exist for long. Very shortly after rising the apparent size of the disc rapidly diminishes; at a small altitude

\* Flamsteed did cast the horoscope of the Observatory.

† Translation of a note by M. D. Éginitis in 'Comptes Rendus de l'Académie des Sciences' for 1898, May 9.

the apparent size of the disc is sensibly greater than at the zenith, but it differs much from that at the moment of rising. But the influence of the interposition of terrestrial objects has not sensibly changed, whilst the apparent size of the object diminishes constantly and rapidly. Similar reasons show that comparison with terrestrial objects cannot be the cause.

2. When these bodies rise behind a mountain not far away, and consequently at some altitude, the apparent enlargement is the same as when they are at the same altitude, but with an open horizon such as that of the sea. The size that these objects then seem to have is much less than when at zenith-distance  $90^\circ$ , although terrestrial objects interpose and exert the same influence, if any, upon the apparent distance. So that, in spite of the interposition of terrestrial objects, the apparent diameter does not differ from that which the object has when at the same altitude with an open horizon.

3. The augmentation of the discs keeps on diminishing gradually. If, then, the interposition of terrestrial objects was the cause of the phenomenon in question, this gradual decrease up to the zenith would not happen, for after a certain altitude the interposition of terrestrial objects does not exist.

4. The discs of the bodies at the horizon appear greater as the altitude of the station from which one observes is greater. This is another reason to show that the phenomenon is not caused by the interposition of terrestrial objects, because this does not vary with the position of the observer, and does not exist at all with a sea-horizon.

5. If the discs be observed near a horizon from behind an obstacle which masks the intermediate objects, they appear as large as if the terrestrial objects were not masked.

6. In observing the Sun near the horizon at different altitudes, with the naked eye and then through coloured glasses, no sensible difference was noticed in the size, although some of the glasses were thick enough not to allow either the horizon or the surrounding objects to be seen.

7. In observing the Sun setting from different places, from which the distance of the horizon for several local reasons appeared to us to vary considerably, no sensible differences in the size of this object was remarked.

Alhazen attributed the augmentation of objects near the horizon to the elliptic form of the celestial vault. The first of the observations above opposes this explanation: the distance of the celestial vault, on which the body appears projected, up to a certain altitude appears sensibly the same whatever may be the ellipticity: nevertheless the size diminishes very rapidly as the altitude of the object increases; it becomes only about one-half at an altitude of some degrees, although the radius of the celestial vault has not changed sensibly. The second observation also is not in accord with the hypothesis. In effect, when the Sun sets behind a neighbouring mountain, and consequently at a considerable altitude, the sky is there scarcely elliptical at all; but, nevertheless, the disc of the object appears as great as when one observes it at the same height from a position with an open horizon, where the sky does appear elliptical.

8. In observing the Sun setting, first with a sky very elliptical, and then with a sky nearly spherical, one does not notice any sensible difference in the size of his disc. The fourth observation also does not support this explanation, for the ellipticity of the sky does not change considerably with the altitude: it is true that the higher one goes on a mountain the greater is the distance of the horizon to which one refers the augmented discs; but this increase would not at all account for the augmentation of apparent size that one notices as the zenith-distance increases. On the other hand, if the change of size depended on the

increase of the distance with which one compares the objects, when a body is observed just before setting behind a mountain very far away it ought to appear much greater than when rising at the sea-horizon. But this does not happen—the size of the disc is the same.

9. In observing the Moon when in her first quarter during the night near the horizon, at a time when distant objects are invisible and the celestial vault does not appear elliptical, she generally appears much larger than when in the zenith.

Alhazen also suggests another explanation, according to which the apparent increase of these objects near the horizon happens because they appear less bright than when in the zenith; in consequence of this feebleness of light one thinks them *farther away* when on the horizon than when in the zenith, and consequently *larger*. The following observations contradict this theory:—

10. Having observed the Sun through coloured glasses of different thicknesses and with the naked eye, and consequently with very different brightnesses, we have not found any sensible difference of size at similar altitudes.

11. When the objects are partially masked by clouds near the zenith, and appear even less luminous than at the horizon, their size is not affected.

12. With the same atmospheric conditions one sometimes sees from day to day, and even from moment to moment, the Sun having an apparently different size.

All these last observations are equally opposed to the theory of Gassendi, who attributed the phenomenon to a cause arising from dilatation of the pupil, when the light of the celestial object is enfeebled near the horizon. But besides the Sun and Moon, the constellations also, as is well known, appear larger on the horizon than in the zenith; the phenomenon appears at first sight to be due, at least in a great part, to the ellipticity of the sky. But we have noticed several times that even when the sky appears spherical the constellations seem much larger on the horizon than in the zenith: another phenomenon of the same nature, which may possibly arise from a similar cause, is described by saying that when one sees a man standing upright on the top of a small hill a mile or so away, his figure, projected on an open horizon behind, appears colossal; but when one looks more attentively the magnification disappears, and he is seen quite small.

What is, then, the cause of these phenomena? Notwithstanding the observations that I have made I am unable to adduce any satisfactory theory: the only certain result that I am able to arrive at is that the phenomenon does not arise from any of the causes included in the theories quoted above. It is true that the influence of these theories may exist, and they do not appear unreasonable: one may consider that they contribute, with more or less effect, to the production of the phenomena; but, according to our observations, the chief cause still remains unknown.

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