

After which I have only to subscribe myself an unworthy Member, and an humble Servant and Admirer of that Illustrious Company.

Dublin,
March 10th. 8 $\frac{1}{2}$.

William Molyneux.

*The Sentiments of the Reverend and Learned
Dr. John Wallis, R. S. Soc. upon the afore-
said Appearance, communicated in a Letter
to the Publisher.*

AS to the last Inquiry (concerning which, you say, the Royal Society would be glad to know my Opinion;) about the apparent Magnitude of the Sun near the *Horizon*, greater than when considerably high:

The Inquiry is ancient: And I remember, I discoursed it near forty Years ago with Mr. *Foster*, then Professor of Astronomy in *Gresham College*: Who did then assure me (from his own Observation, I suppose; for I have never examined it myself,) that the apparent Magnitude taken by Instrument (however the Fancy may apprehend it) is not greater at the *Horizon*, than when higher. And Mr. *Caswell* (when your Letter was communicated to our Company here) affirmed the same.

And (though I have not myself made the Observation) I do not doubt but the Thing is so. For it is agreed; That Refraction near the *Horizon*, though (as to appearance) it alters the Altitude of the Thing seen; yet it alters not the *Azimuth* at all.

And it must needs be so. For, since this equally respects all Points of the *Horizon*; let the Refraction be
S f what

what it will, the whole *Horizon* can be but a Circle: So that there is no Room for the Breadth of a Thing (as to the Angle at the Eye) to be made greater, whatever its Tallness may, (the Refraction not equally affecting all Parts in the Circles of *Altitude*.) Nor is there any Reason why this should rather thrust the other, than that the other thrust this, out of place.

Whereas, in the *Altitude*, it is otherwise: For while what is near the *Horizon* is enlarged, that which is further off is thereby contracted: Which as to the *Azimuth* or *Horizontal* Position cannot be.

In Spectacles indeed it is otherwise; for they represent the Object every way enlarged; and do thereby hide the adjacent Parts. But in Refraction by Vapours, supposing all parts of the *Horizon* equally affected by them, one part cannot be expanded in breadth (whatever it may be as to the height) without thrusting out another, (for the whole *Horizon* can be but a Circle) and why one part rather than another?

Unless we would say, (as perhaps we may, if there shall appear a Necessity for it) That the Rays of a lucid Body do expand themselves every way to the Prejudice of the parts adjacent, by covering them.

But supposing (which I am apt to believe, till the contrary shall be evinced by Experiment) that the Sun or Moon's apparent Diameter taken by Instrument near the *Horizon*, is the same as taken in a higher Position, (I mean, its *Horizontal* Diameter, or that parallel to the *Horizon*; for the erect Diameter, in a Circle Perpendicular to the *Horizon*, may by the Refraction be varied, and thereby made, not greater, but less than when higher; as hath been noted in the Name of *Sol Ellipticus* at the *Horizon*.) supposing, I say, that the Sun's apparent Diameter *Horizontal*, taken by Instrument, is the same near the *Horizon*, as in a higher Position, I take its imaginary Greatness which is fancied near the *Horizon*, to be only a Deception

tion of the Eye; or rather the Imagination from the Eye.

For sure it is, that the Imagination doth not estimate the Greatness of the Object seen, only by the Angle which it makes at the Eye; but, by this compared with the supposed Distance.

True it is that, *Cæteris paribus*, we judge that to be the greater Object, which makes at the Eye the greater Angle: But not so if apprehended at different Distances.

For if through a Casement (or lesser Aperture) we see a House at 100 Yards distance; this House (though seen under a less Angle) doth not to us seem less than the Casement through which we see it, or this greater than that, because it makes at the Eye the greater Angle:) But the Imagination makes a comparative Estimate from the Angle and Distance jointly considered.

So that, of two things seen under the same or equal Angles, if to one of them there be ought which gives the Apprehension of a greater Distance, that to the Imagination will appear greater.

Now sure it is, that one great Advantage for Estimating of a Thing seen is, from the Variety of intermediate Objects between the Eye and the Thing seen. For then the Imagination must allow room for all these Things.

Hence it is that if we see a thing over two Hills, between which there lies a great Valley unseen, it will appear much nearer than if we see the Valley also: And it will appear as just beyond the first Hill. And if we move forward to the Top of the nearest Hill, (that so the Valley may be seen) it will then appear much further than before it did.

And on this Account it is, that the Sun setting, appears to us as if it were but just beyond the utmost of our visible *Horizon*; because all between that and the Sun is not seen. And, upon the same Account, the Heaven itself seems contiguous to the visible *Horizon*.

Now when the Sun or Moon is near the *Horizon*, there

is a Prospect of Hills, and Vallies, and Plaines, and Woods, and Rivers, and Variety of Fields, and Inclosures, between it and us: Which present to our Imagination a great Distance capable of receiving all these. Or, if it so chance that (in some Position) these Intermediates are not actually seen: Yet having been accustomed to see them, the Memory suggests to us a View as large as is the visible *Horizon*.

But when the Sun or Moon is in a higher Position; we see nothing between us and them (unless perhaps some Clouds) and therefore nothing to present to our Imagination so great a Distance as the other is.

And therefore, though both be seen under the same Angle, they do not appear (to the Imagination) of the same bigness, because not both fancied at the same Distances: But that near the *Horizon* is judged bigger (because supposed farther off) than the same when at a greater *Altitude*.

'Tis true, that as to small and middling Distances (beside this Estimate from Intermediates) the Eye hath a means within itself to make some Estimate of the Distance. As, when we already know the bigness of a Thing seen, to which we have been accustomed; as a Man, a Tree, a House, or the like: If such Thing appear to us under a small Angle, and indistinct, and faintly coloured; the Imagination doth allow such Distance, as to make such a Thing so to appear. And, if this, thro' a Prospective Glass, be represented to us under a bigger Angle, and more distinct: It is accordingly apprehended as so much nearer.

But the Case is otherwise, when we do not, by the known bigness, judge the Distance; but, by the supposed Distance, judge of the bigness; as in the Case before us.

And accordingly, different Persons, according to different fancied Distances, judge very differently. As, if two Stars be shewed to ignorant Persons, and you ask how far they

they seem to be asunder: One perhaps will say, a Foot; another, a Yard, or more: And one shall say, The Sun appears to him as big as a Bushel; another, as big as a *Holland* Cheese: Each estimating according to the fancied Distance.

Again; in our two Eyes (when the Object is seen by both) there is yet another means of estimating how far off it is. (And it is this by which we judge of Distances.) Namely, there are, from the same Object, two different visual Cones, terminated at the two Eyes: Whose two Axes contain, at the Object, different Angles, according to different Distances: An acuter Angle at a great Distance, and more obtuse when nearer.

Now, that such Object may be seen by both Eyes, clearly; it is requisite that the Eyes be put into such a Position, as that the Sight of each Eye receive the respective Axe at right Angles. Which requires a different Position of the two Eyes, according to the different Distance of the Object.

As will manifestly appear; if we look, with Attention, on a Finger (or other small Object) at two or three Inches distance from the Eye; and then upon another like Object at three or four Yards beyond it: (and this alternately several Times.) For 'twill be manifest, that while we look intently on the one, we do not see the other (or but confusedly) though both be just before us. And, as we change our View, from the one to the other, we manifestly feel a Motion of the Eyes (by their Muscles) from one Posture to another.

And according to the different Posture in the Eyes, requisite to a clear Vision by both, we estimate the Distance of the Object from us.

And hence it is, that they who have lost the Sight of one Eye, are at a great Disadvantage, as to estimating Distances, from what they could do while they had the Use of both.

But

But now when the Distance grows so great, as that the Position of these visual Axes become Parallel, or so near to Parallel, as not to be distinguishable from it: This Advantage is lost, and we can thenceforth only conclude, that it is far off; but not how far.

Hence it is, that our View can make no Distinction of the Moon's Distance, from that of the other Planets, or even of the fixed Stars: But they seem to us as equally remote from us; though we otherwise know their Distances from us to be vastly different. Because the Parallax, (as I may so call it) from the different Position of the two Eyes, is quite lost, and undiscernable, in Distances much less than the least of these.

And so, of the fixed Stars amongst themselves: Which, though they seem equally remote from us; many (for ought we know) be at Distances vastly different. Nor can we tell, which of them is nearest: (unless perhaps we may reasonably guess, those to be nearest, which seem biggest.) Because, here not only the Parallax from the Distance of the two Eyes; and that from the Earth's Semidiameter; but even that from the Semidiameter of the Earth's great Orb, is quite lost; and none remaining, whereby to estimate their Distance from us.

But (to return to our Case in Hand;) though as to small Distances, we may make some Estimate from the known *Magnitude* of the Object: And, as to middling Distances, from the Parallax (as I may call it) arising from the Interval of the two Eyes: Yet even this latter will hardly reach beyond, if so far as the visible *Horizon*: And all beyond it, is lost.

So that, there being nothing left to assist the Fancy in estimating so great a Distance, but only the intermediate Objects: Where these Intermediates appear to the Eye, (as, when the Sun or Moon are near the *Horizon*) the Distance is fancied greater, than where they appear not, (as when farther from it:) And consequently (though both

both under the same or equal Angles) that near the *Horizon* is fancied the greater. And this I judge to be the true Reason of that Appearance.

You will excuse (I hope) what Excursion I have made; because though some of them might have been spared, as to the present Case; yet they are not impertinent to the Business of Vision; and the Estimate to be thence made, of *Magnitudes* and *Distances*, by the Imagination.

The Sun's Eclipse *May 1st*, was here observed about $\frac{1}{2}$ a Digit; between one and two a Clock after Noon.

Account of a BOOK.

A Continuation of the New Digester of Bones: Its Improvements and new Uses it hath been apply'd to, both at Sea and Land.

Together with some Improvements and new Uses of the Air-Pump, tryed both in England and Italy. By D. Papin, M. D. Fellow of the Royal Society.

THIS Treatise is divided into three Sections; the first contains the Improvements made by the Author on the Digester; with the new Uses it hath been apply'd to. First is given the Description of that which he had made for His Majesty King *Charles the 2d.* of blessed Memory; and he doth not think (considering the Alterations whereby this exceeds the first Invention) that any thing better can be made for such things, as must be stew'd in their own Juices: But for other things that must be boil'd with Water, as Pulse, Gellies, &c. He gives the Description of another Engine, which he finds to be, for seven

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