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

Dublin, *March* 10*th*. 8½. *William Molyneux.*

The Sentiments of the Reverend and Learned Dr. John Wallis, R. S. Soc. *upon the aforeſaid 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 Al itude 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

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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 inlarged; 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 heighth) 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 grear 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 fanſied 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 fanſied 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 fanſied 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 fanſied 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 fanſied 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* 1*ſt*, was here obſerved about ½ 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 2*d.* 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 Rea-