

Original letter from Isaac Newton to Richard Bentley, dated 17 January 1692/3

Author: Isaac Newton

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Sir

I agree with you that if matter evenly diffused through a finite space not spherical, should fall into a solid mass, this mass would affect the figure of the whole space, provided it were not soft like the old Chaos, but so hard & solid from the beginning, that the weight of its protuberant parts could not make it yeild to their pressure. Yet by earthquakes loosing the parts of this solid, the protuberances might sometimes sink alittle by their Weight, & thereby the mass might by degrees approach a spherical figure.

The reason why matter evenly scattered through a finite space would convene in the midst you conceive the same with me: but that there should be a Central particle so accurately placed in the middle as to be always equally attracted on all sides & thereby continue without motion, seems to me a supposition fully as hard as to make the sharpest needle stand upright on its point upon a lookingglass. {ffor} if the very mathematical center of the central particle be not accurately in the very mathematical center of the attractive power of the whole mass, the particle will not be attracted equally on all sides{.}

And much harder it is to suppose that all the particles in an infinite space should be so accurately poised one among another as to stand still in a perfect equilibrium. ffor I reckon this as hard as to make not one needle only but an infinite number of them (so many as there are particles in an infinite space) stand accurately poised upon their points. Yet I grant it possible, at least by a divine power; & if they were once so placed I agree with you that they would continue in that posture without motion for ever, unless put into new motion by the same power. When therefore I said that matter evenly spread through all spaces would convene by its gravity into one or more great masses, I understand it of matter not resting in an accurate poise.

But you argue in the next paragraph of your letter that every particle of matter in an infinite space has an infinite quantity of matter on all sides & by consequence an infinite attraction every way & therefore must rest in equilibrio because all infinities are equal. Yet you suspect a parallogism in this argument, & I conceive the parallogism lies in the position that all infinities are Equal. The generality of mankind consider infinities no other ways then definitely, & in this sense they say all infinities are equal, though they {would} speak more truly if they should say they are neither equal nor unequal nor have any certain difference or proportion one to another. In this sense therefore no conclusions can be drawn from them about the equality, proportions or differences of things, & they that attempt to do it, usually fall into parallogism. So when men argue against the infinite divisibility of magnitude by saying that if an inch may be divided into an infinite number of parts, the sum of those parts will be an inch, & if a foot may be divided into an infinite number of parts the sum of those parts must be a foot, & therefore since all infinities are equal those summs must be equal, that is an inch equal to a foot. The falsness of the conclusion shews an error in the premisses, & the error lies in the position that all infinities are equal. There is therefore another way of considering infinities used by Mathematicians, &

that is under certain definite restrictions & limitations whereby infinites are determined to have certain differences or proportions to one another. Thus D^r Wallis considers them in his Arithmetica Infinitorum, where by the various proportions of infinite summs he gathers the <5v> various proportions of infinite magnitudes: which way of arguing is generally allowed by Mathematicians & yet would not be good were all infinites equall. According to the same way of Considering infinites, a Mathematician would tell you that though there be an infinite number of infinitely little parts in an inch yet there is twelve times that number of such parts in a foot; that is, the infinite number of those parts in a foot is not equall to, but twelve times bigger then the infinite number of them in an inch. And so a Mathematician will tell you that if a body stood in equilibrio between any two equal and contrary attracting infinite forces, & if to either of those forces you add any new finite attracting force: that new force how little so ever will destr{oy} the equilibrium & put the body into the same motion into which it would pu{t} it were those two contrary equal forces but finite or even none at all: so tha{t} in this case two equal infinites by the addition of a finite to either of them become unequal in our ways of reconning. And after these ways we must recon, if from the consideration of infinites we would always draw true conclusions.

To the last part of your letter I answer first that if the earth (without the moon) were placed any where with its center in the Orbis magnus & stood sti{ll} there without any gravitation or projection & then at once were infused into it both a gravitating energy towards the sun & a transverse impulse of a just quantity moving it directly in a tangent to the Orbis magnus: the compound of this attraction & projection would according to my notion cause a circular revolution of the earth about the Sun. But the transverse impulse must be of a just quantity, for if it be too big or too little it will cause the earth to move in some other line.

Secondly I do not know any power in nature which could cause this transverse motion without the divine arm. Blondel tells us some where in his book of Bombs that Plato affirms that the motion of the planets is such as if they had all of them been created by God in some region very remote from our Systeme & let fall from thence towards the Sun, & so soon as they arrived at their several orbs their motion of falling turned aside into a transverse one; & this is true supposing the gravitating power of the Sun was doubled at that moment of time in which they all arrive at their several orbs: but then the divine {po}wer is here required in a double respect; namely to turn the descending mo{tion} of the falling planets into a side motion, & at the same time to double the attractive power of the Sun. So then gravity may put the planets into motion but without the divine power it could never put them into such a Circulating motion as they have about the Sun, & therefore for this as well as other reasons I am compelled to ascribe the frame of this Systeme to an intelligent agent.

You sometimes speak of gravity as essential & inherent to matter: pray do not ascribe that notion to me, for the cause of gravity is what I do not pretend to know, & therefore would take more time to consider of it I fear what I have said of infinites will seem obscure to you: but it is enough if you understand that infinites when considered absolutely without any restriction or limitation, are neither equal nor unequal nor have any certain proportion to one another, & therefore the principle that all infinites are equal is a precarious one. Sir I am

Your most humble Servant

Is. Newton

Trin. Coll. Ian. 17.

1692/3

<envelope>

For M^r Bently at the
Palace in

Worcester

A 2^d Letter from M^r Newton in answer to some further Queries
