

A Dioptrick Problem, Why four Convex-glasses in a Telescope, shew Objects Erect. by William Molineux of Dublin Esq. R. S. Soc.

IN the *Journal des Scavans* for Munday the 17th. of September 1685. pag. 466. Amst. Edition, we find this passage. *As Perspectives of one Convex-glass make Objects appear Upright, which those of two Convex-glasses invert, and again those of three rectify; so it should seem that those of four ought to invert: And yet Experience shews us that Objects appear upright through these glasses. The Singularity of this Phenomenon obliges all Skil'd in Dioptricks to inquire the reason thereof, but hitherto they have found none. Mr. Regis, who applies himself particularly to this part of Natural Philosophy, believes that he has hit upon the Reason, and makes us hope that he will suddenly Publish it*

Thus far the *Journal*, but it does not tell us whose remark this is, though I am apt to believe 'twas written by Mr. Regis himself, to the Publisher of the *Journal*.

To me this *Phenomenon* appears very easily explicable, from the consideration of placing Glasses in a Tube. Which is thus; after the *Object-glass*, the *Eye-glass* is placed so much distant (towards the Eye) from the *Focus* of the *Object-glass* as is the *Focus* of the *Eye-glass*; then the middle *Eye-glass* is placed so much distant from the *Focus* of the first *Eye-glass*, as is the *Focus* of this middle *Eye-glass*; lastly the nearest *Eye-glass* is placed so much distant from the *Focus* of this middle *Eye-glass*, as is the *Focus* of this nearest *Eye-glass*; and the Eye looking through them all is placed in the *Focus* of this nearest *Eye-glass*.

I say therefore first, that one single Convex-glass, cannot properly be said by it self to shew Objects erect or reverse, but in respect of placing of the Eye that looks through it. For if the Eye that looks through such a single Convex-glass

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be placed nigher thereto, then the Glasses *Focus*, the Objects are erect, if the Eye be placed just in the *Focus*, the Objects are neither erect nor reversed, but all in confusion between both; and if the Eye be placed further from the Glass than the *Focus*, the Objects are reversed. I mean here distant Objects, the Rays flowing from any point whereof may be counted to come parallel towards the *Object-glass*, for such Objects we are to consider when we speak of looking thro' *Telescopes*.

This being laid down, I assert. Secondly, that the *Object-glass* of a Telescope reverses the Object, both to the *Eye-glass* and the Eye, that looks through it: For the *Eye-glass* is placed farther from the *Object-glass* than is the *Focus* of the *Object-glass*. But the *Eye-glass* does nothing towards the Rectification or Reversion; the Eye being placed just in it's *Focus*. Thus we see that the Reversing of Objects in a *Telescope* of two Convex-glasses proceeds wholly from the *Object-glass* and its position, and the *Eye-glass* has nothing to do in the *Affaire*; for were the Eye it self in the place of the *Eye-glass* it would see the Objects inverted thro' the single *Object-glass*.

I come now to consider the second *Eye-glass* placed after the first *Eye-glass*. (the first *Eye-glass* being that next the *Object-glass*) And here it is manifest that placing this as it ought in a *Telescope*, if we place our Eye nearer to this middle *Eye-glass* than it's *Focus*, the Eye sees the Objects inverted and confused: Place the Eye in the *Focus*, it sees the Objects all in confusion, neither erect nor reversed; for here again there is a distinct Representation of the Objects to be received on a piece of Paper, as in the *Focus* of the *Object-glass*; and the Eye being placed at any time at this place (which is usually called the *Distinct-Base*) sees all in confusion. But then let the Eye be placed farther from this middle Glass than its *Focus* (for so is the third or immediate *Eye-glass*, it being alwayes distant from the middle *Eye-glass*, the Aggregate of both their *Foci*) it perceives the Objects erect and confused.

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Laſtly. the third or immediate *Eye-glaſs* does nothing towards the erecting or reverſing the Species, which it receives erect from the middle *Eye-glaſs*; no more than in a Telescope of two Convex-glaſſes, the *Eye-glaſs* does to the Species it receives from the *Object-glaſs*, as we have ſhewn before. The reaſon that this laſt or immediate *Eye-glaſs* has nothing to do in the erecting or reverſing the Species is the ſame, as in a Telescope of two Convex-glaſſes, *viz.* the Eye is placed in its *Focus*, and therefore ſees the Species as 'tis repreſented in the *Diſtinct Baſe*; that is, the Species is inverted in the *Diſtinct Baſe* of the *Object-glaſs*, and therefore a ſingle Convex *Eye-glaſs* brings it to the Eye inverted; but in the *Diſtinct-Baſe* of the middle or ſecond *Eye-glaſs* the Species is erect, and therefore the third or immediate *Eye-glaſs* brings it to the Eye erect.

Wherefore we are to conſider the Telescope conſiſting of an *Object-glaſs* and three *Eye-glaſſes*, as two Telescopes, each conſiſting of two Convex-glaſſes. The firſt conſiſts of the *Object-glaſs* and firſt *Eye-glaſs*, and this inverts the Species; that is, the Species is inverted in the *Diſtinct-Baſe* of the *Object-glaſs*, and ſo brought into the Eye. The ſecond Telescope conſiſts of the two immediate *Eye-glaſſes*, and this erects what the former inverted, that is, the Species in the *Diſtinct-Baſe* of the middle *Eye-glaſs* is erect, and is ſo brought into the Eye by the *Eye-glaſs*; the *Eye-glaſſes* themſelves in neither caſe having any thing to do with the erecting or inverting, but meerly in repreſenting in the ſame poſture the Species immediatly before them.

The *French* Problem therefore ſhould not have broken a Telescope of four Convex-glaſſes into four peices, but into two, and the caſe would have been plain; whereas by breaking it into four *Perspective-Glaſſes*, they attribute that to two of them, which neither of them does, *viz.* inverting and erecting.

Therefore I ſay laſtly, that one Convex-glaſs as poſited in a Telescope inverts; the ſecond (that is the firſt *Eye-glaſs*)

does nothing towards erecting or reverſing, but repreſents the Image as it is in the *Diſtinct-Base* of the *Object-glaſs* before it, that is, inverted. The third Glaſs erects, or rather reſtores what was before inverted. The fourth repreſents the Image as it receives it from the *Diſtinct-Base* of the third, that is, erect. And this I think a ſufficient Solution of this Problem.

An uncommon Inſcription lately found on a very great Baſis of a Pillar, dug up at Rome; with an Interpretation of the ſame by the learned Dr. Voſſius.

THis Inſcription was lent by that excellent Philoſopher and Mathematician Mr. *Adrian Auzout*, who copyed it from the Stone, to Mr. *Juſtel*, who was pleaſed to communicate it to the *Royal Society*, together with the Sentiments of Dr. *Voſſius* therupon, of which the Reader may Judg.

The Inſcription is three fold upon three ſides of the Baſis, and as follows.

P. SVFENATI. P. F. PAL. MYRONI
 EQVITI. ROMANO. DECV
 RIALI. SCRIBARVM. AEDILI
 VM. CVRVLIVM. LVPERCO. LAVRENTI
 LAVINATI. FRETRIACO. NEAPOLI. ANTI
 NOITON. ET. EVNOSTIDON. DE
 CVRIONI. IIII, VIRO. ALBA

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