evening of the 1st inst. I observed a similar rainbow. I saw it first at 7h. 25m. p.m., the registered time of sunset here for that day. It lasted for nearly fifteen minutes. The western horizon was cloudy, and the sunset a fine one. The bow was exceedingly brilliant, and as far as I could judge, a perfect semicircle, the ends of the arc being about 4° above the horizon. There was a secondary bow equally perfect, and of remarkable brightness; the brilliant glow below the primary, and the marked dulness between it and the secondary, added to the beauty of the sight. After reading Mr. Hill's letter, I published my observations in a letter to the *Argus*, that others might confirm or correct them. I have received six replies, all in accord with my observations. One of my correspondents informed me that he had, some years ago, seen a lunar rainbow formed just before the moon had risen. H. M. ANDREW.

The University, Melbourne, January 26.

The Nest of the Flamingo.

IN an interesting article by Mr. Bowdler Sharpe, entitled "Ornithology at South Kensington," published in the December number of the *English Illustrated Magazine*, there is a description and figure of the flamingo's nest, and an opinion is expressed that the previously-held ideas about the nest being tall, and the female sitting upon it in a straddling manner, might now be considered as exploded.

I have seen numbers of these tall nests in the shallow pans of water—or "vleys," as they are locally called—in Bushmanland, Cape Colony, particularly at Klaver Vley. These quaint nests were built in the water where it was a few inches deep, and at a considerable distance from the shore. They were conical in form, about 18 inches high, and 6 inches in diameter at the top, with a shallow basin-like cavity for the eggs; built, so far as I can recollect, of slimy mud. To perform the office of incubation, the bird must have straddled over the nest. The species no doubt differs from the one described in the article. There should be no difficulty in securing specimens of these nests. Possibly the object aimed at in building the nests in the water is to secure them against some enemy, and the height of the nest, besides conveniencing the long-legged owner, provides for the rising of the water-level. E. J. DUNN.

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Dynamical Units and Nomenclature.

IN his review of Prof. MacGregor's "Kinematics and Dynamics," on page 361, Prof. Greenhill tilts a lance against those whom he terms mathematical precisionists. I do not know this book, and I hold no brief in its defence; but as I owe to these precisionists whatever clear ideas I have on mechanics, I feel bound to enter into the lists on their behalf, little as they need my aid.

Both the precisionists and practical men start with the same two dynamical quantities, which they respectively call *mass* and *force*, *weight* and *force*; of these they select arbitrary units, and respectively name them *pound* and *pound-weight*, *weight-of-a-pound* and *force-of-a-pound* (or *pound-weight* and *pound-force*).

To the single word *pound* the practical man does not, so far as I know, attach any single definite idea, and he cannot, therefore, use this word singly without introducing possible confusion; for it characterizes matter and force equally, and yet *is* neither. On this view Prof. Greenhill's own expression "the attraction of the earth on a pound," should for accuracy and consistency be "the attraction of the earth on the weight of a pound (*or* on a pound-weight)."

To the precisionist a pound *is* a certain mass, just as a foot *is* a certain length, so that the practical man's "weight of a pound" is simply the "pound" of the precisionist, who would no more dream of 'distinguishing' it as "the mass of a pound" than of distinguishing a foot as "the length of a foot."

The attraction of the earth on a certain amount of matter is called "the force of 10 pounds" by practical men, and "the weight of 10 pounds" by precisionists: these are purely *definitions*, so that the phrases are absolutely equivalent. If, then, in the specification of a force produced otherwise than by the attraction of the earth a precisionist is required to speak of it as "a force equal to the weight of 10 pounds," the practical man must follow suit with "a force equal to the force of 10 pounds." These expressions stand, or rather fall, together, and the consistent precisionist would specify the force as "10 pounds-weight" merely.

If, however, a *body*, such as a brickbat or the iron block supplied with a balance and called a "pound weight," is to be introduced into the specification, a precisionist would very properly say "a force equal to the weight of 10 brickbats or of 10 pound-weights"; and the *complete* idea hereby conveyed cannot be expressed by the practical man otherwise than by "the attraction of the earth on 10 brickbats or on 10 pound-weights."

In no way, then, is "a force equal to the weight of a mass of 10 pound-weights," the precisionist equivalent of the practical "force of 10 pounds," nor is it even consonant with precisionist nomenclature.

Since, therefore, the precisionist uses *mass*, *force*, *pound*, *pound-weight*, as the exact equivalents of the practical man's *weight*, *force*, *weight-of-a-pound*, *force-of-a-pound*, the advantage does not seem to lie on the side of the latter, more especially when he is untrue to himself in loosely using the word "weight" as often in the sense of "force" as according to his definition.

But so far both practical men and precisionists labour under the immense disadvantage of dealing with a variable force-unit which can be made precise only by a specification of place; and it is greatly to the credit of the latter that they have introduced a simple invariable force-unit by which all forces, whether due to gravitation or other physical action, may be expressed absolutely in a form which allows of direct comparison between them. With this unit *ma* is the correct measure of a force, and when Prof. Greenhill speaks of "the mathematician straining after the equation $F = ma$, when using the gravitation unit of force," I utterly fail to understand what is meant, considering that this expression of a force necessarily implies an *absolute* force-unit; and I further feel strongly tempted to deny that either for this unintelligible operation or for any other the precisionist ever uses g pounds as a mass-unit, though, if he ever does use a variable mass-unit in measuring the invariable mass of a body, he is surely countenanced by the practical man who does not hesitate to use a variable force-unit in measuring the invariable force exerted by a given spring compressed to a given extent. I might further add that the precisionist *never* measures the weight of a body in "pounds," even if he denotes it by w, and that, if he does sometimes denote this variable force by the same number irrespective of place, it is only when using the practical man's variable force unit.

With regard to confusion arising from the use of the equation $w = mg$ any more than from the use of the equation $w = m$, this would be to me inconceivable, did I not notice that Prof. Greenhill uses the phrase "if the equation $w = mg$ is supposed to be used with absolute units." Does there indeed exist a single man who thinks that this equation can be used with other than absolute units? If such there be, to him certainly will confusion be not only possible, but probable too, and deservedly so; but to others there can surely be no more confusion in expressing a (precisionist) weight as m or mg indifferently than in expressing an angle as θ or $180\,\theta/\pi$, it being of course premised that the proper unit—(*precisionist*) *pound weight* or *poundal*, *radian* or *degree*—is named.

Further, how it can be a solecism to measure pressure in poundals per square foot any more than in pounds-weight per square inch—which latter is the precisionist equivalent of what an engineer would loosely and most inaccurately call "pounds"—I am at a loss to understand, since pressure is the measure of the distribution of force over area, and a poundal is as much a force as "the force of a pound," and very much more definite. And how the expression of the (precisionist) weight of a body in poundals rather than in pounds-weight is a solecism also demands explanation.

Lastly, I must seriously protest against the suggestion that a precisionist should ever ask for, or want to buy, "half a poundal of tea": what he wants is the tea itself, the substance of it and not the earth's action upon it, and very rightly and properly he asks for "half a pound," which the consistent practical man would have to term "the weight of half a pound."

In the above I am not concerned to defend the practice of those mathematicians who select fantastic units of mass or force as a foundation for some puzzling questions of no utility whatever: I have merely attempted to define the position of the physicist or precisionist, and to rebut *seriatim* the charges brought against him in Prof. Greenhill's criticism.

February 27. ROBERT E. BAYNES.