some part of the meaning of a term is determined arbitrarily; either by public opinion for general use, or by the individual reasoner, if he wishes to use the term for some special purpose of his own. For this does not imply that there ever was a formal contract as to the meanings of terms. The fact that terms do not mean the same to people of different nations is enough to show that the determination of the meaning by each nation is, in part at least, essentially arbitrary. It is also, I think, clear that there is a part of the meaning of some terms at least which is not arbitrary, when once the arbitrary part has been settled. There is a slight ambiguity about my use of the word "definition," which, however, when once noted, need cause no confusion, as the context will always show in which sense I am using it. Commonly a "definition" denotes an assertion which determines the arbitrary part of the meaning of a term; but when I speak of "the definition" as opposed to "the import" of a term, I mean not this assertion itself, but that part of the meaning of the term which it determines. This explains how it is that I do not regard "the definition" of a term (as opposed to its import) as a *thing*. Even if it is clearly conceived in the mind it is only an abstract idea; but the point is that it is not necessary that it should be conceived at all. Thus it is not necessary that a definition by connotation should be "of something," if that means that the term should have denotation. Even if the term has any denotation, *i.e.* if the mind grasps it as denoting a thing or idea, this denotation must, in a symbolic argument, be regarded as merely "accidental clothing."

Just as some part of the meaning of a term is arbitrary and some part not, so in any system of logic some part of the system is arbitrary and some part not. Now, either the denotation or the connotation of a term may be laid down arbitrarily, but *the connection between the two is not arbitrary*. One cannot arbitrarily lay it down that "such a thing possesses such attributes." If, therefore, a definition is to be an arbitrary assertion, it must only lay down either the denotation or the connotation of a term, and not parts of each. It would, of course, be logically permissible to use the word "definition" in a different sense, but then definitions would not be arbitrary assertions. This is exactly what is done if the assertion "Two straight lines cannot inclose a space" is called a definition by denotation; and therefore, in my system of logic, I cannot admit it to be a definition. This is one of the arbitrary features of my system. But it is not arbitrary when I say that in such assertions as "Nothing can both be and not be," and "Twice two is four," there is nothing absolute at all. The truth of these assertions is determined entirely by the arbitrary parts of the meanings of their terms. Miss Jones says: "If definitions were purely arbitrary, as Mr. Dixon holds, what would prevent my saying that *Four* ($1+1+1$) means *twice two* ($1+1$) + ($1+1$)?" Precisely; this is exactly the point. *There would be nothing at all to prevent it*. Boole actually did this very thing, as his law of indices in his mathematical analysis of logic. According to his law $a^{1+1+1} = a^{(1+1)+(1+1)}$.

There remain one or two minor points to be answered. As to induction, I think Miss Jones's view is substantially the same as mine. Of course it is possible to set out an inductive generalization in a syllogistic form as Miss Jones does; only the whole of the induction is then contained in the assumption of the major premiss—the syllogism itself is in no sense inductive.

If Miss Jones thinks the truth of the formula $(a+b)^2 = a^2 + 2ab + b^2$ is deduced by generalization from a single concrete instance, how does she explain the fact that sometimes $(a+b)^2 = 0$, as in Grassmann's "Aeuessere Multiplication," and sometimes $(a+b)^2 = a+b$, as in Boole's logic?

I see nothing to differ from in the paragraph about S and P; except perhaps that if I define such a term as "metal" by denotation I do not say "This and all other things like it in certain respects" are metal. That would be mixing up denotation and connotation in one definition. I say only "This, and this, and this, . . . are metal."

The explanation of the point about the mathematical truths is simply that I do not consider the assertion "Two straight lines cannot inclose a space" as a mathematical truth at all, if "straight line" is defined by denotation. I certainly believe it to be true, but its truth is not of the same nature as that of the assertion "Twice two is four," or even "*Cogito, ergo sum*"; it is neither a truism nor a necessary truth, in my senses of those terms, but can only be established by induction.

EDWARD T. DIXON.

Trinity College, Cambridge, February 19.

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The Value of Useless Studies.

It is rather surprising that Prof. Ayrton should indulge in covert sneers at Universities for devoting themselves to useless studies. It certainly ill becomes one whose life is bound up with electrical science, which is of such recent growth that nobody can pretend to forget how it owes its origin to those who studied it while useless. If Universities do not study useless subjects, who will? Once a subject becomes useful, it may very well be left to schools and technical colleges, to patent-mongers, and the trade. Mr. Bury is, on the other hand, mistaken in two respects. That a subject is useless is hardly worth considering as a recommendation for its being made *compulsory* on students. There are too many useless subjects for that. The great objection to compulsory Greek is that it is the principal stumbling-stone in the way of any literature being studied by ordinary University students. The Bible produced very little effect until it was read in translations; and the danger of a pagan revival, if ancient literature were studied without the obstruction of difficult languages, is the best reason for insisting on these languages in a Christian University. The second mistake of Mr. Bury is that it is any part of the business of a University to *teach*. Universities should certainly give facilities for students to *learn*. It is the business of the students to learn. If they are so ill prepared that they have not acquired the art of learning, they should go to a college or school or private teachers, and get taught; for teaching is the business of these institutions and persons. The business of Universities is to advance culture and knowledge, and to afford students an opportunity of learning how to do this. Prof. Ayrton, by omission rather than by commission, seems utterly unable to appreciate the value of literature for its own sake. How can all this fierce toil he extols so justly advance a lot of savages?

GEO. FRAS. FITZGERALD.

Trinity College, Dublin, February 13.

The Nickel Heat Engine.

IN trying Mr. Smith's experiment on the rotation of nickel (NATURE, January 28, p. 294), I find my disk has a more complex action.

It will be remembered that the nickel is mounted on a vertical axis, and has the poles of an electro-magnet put near two points, A and B, 90° apart. Let C be any point in the larger arc, and suppose heat is applied to A.

I find that at first the disk moves in the direction ACB with a hesitating, uneven motion; it revolves several times, and almost develops into a steady rotation, when it beats back, oscillates for a while, and goes off with a brisk even spin in the direction BCA. After about two minutes this fails, and a new start is attempted the opposite way, but there is little more movement, until time has been given for cooling.

It makes no difference at which pole the heat is applied. The disk is 50 mm. diameter, rather less than 1 mm. thick, and is covered with lamp-black.

W. B. CROFT.

Winchester College, February 12.

THE UNIVERSITY OF LONDON.

PROBABLY before this letter is in type the Charter of the Albert, or, as it is now to be called, the Gresham, University, will have been presented to Parliament. What will be its ultimate fate remains to be seen. But I have sat through a long night's debate in the House of Commons to see a Government turned out in the small hours of the morning on a University question. I do not suppose that the proposed Charter will raise an issue of that importance. But I think that the Government may not be unmindful of past history, and, in what is probably the last session of a moribund Parliament, may not be willing to push very vigorously what is perhaps the crudest scheme of University organization which has ever been proposed in this country.

Before Parliament takes so serious a step as founding a new educational institution, the question may fairly be asked, On what ground is it necessary? Everyone knows that we have a University in London which is a State institution; and one may not unreasonably inquire,