THE OPEN COURT SERIES OF CLASSICS OF SCIENCE AND PHILOSOPHY, NO. 3; THE GEOMETRICAL LECTURES OF ISAAC BARROW, TRANSLATED, WITH NOTES AND PROOFS, AND A DISCUSSION ON THE ADVANCE MADE THEREIN ON THE WORK OF HIS PREDECESSORS IN THE INFINITESIMAL CALCULUS

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ISAAC BARROW & J. M. CHILD

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TRANSLATED, WITH NOTES AND PROOFS, AND A DISCUSSION ON THE ADVANCE MADE THEREIN ON THE WORK OF HIS PREDECESSORS IN THE INFINITESIMAL CALCULUS

BY

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LECTIONES Geometricæ;

In quibus (præsertim)

GENERALIA *Curvarum Linearum* SYMPTOMATA

DECLARANTUR.

Auctore ISAACO BARROW Collegii SS. *Trinitatis* in Acad. *Cantab.* Socio, & *Societatis Regiæ* Sodale.

Οἱ φύσει λογιστικοὶ εἰς πάντα τὰ μαθήματα, ὡς ἔπος εἰπεῖν, ὀξεῖς φαίνονται· οἵ τε βραδεῖς, ἂν ἐν τούτῳ παιδευθῶσι καὶ γυμνάσωνται, κἂν μηδὲν ἄλλο ὠφεληθῶσιν, ὅμως εἴς γε τὸ ὀξύτεροι αὐτοὶ αὑτῶν γίγνεσθαι πάντες ἐπιδιδόασιν. Plato de Repub. VII.

LONDINI,

Typis *Gulielmi Godbid*, & prostant venales apud *Johannem Dunmore*, & *Octavianum Pulleyn* Juniorem.

M. DC. LXX.

Note the absence of the usual words "Habitæ Cantabrigiæ," which on the title-pages of his other works indicate that the latter were delivered as Lucasian Lectures.—J. M. C.

PREFACE

Isaac Barrow was the first inventor of the Infinitesimal Calculus; Newton got the main idea of it from Barrow by personal communication; and Leibniz also was in some measure indebted to Barrow's work, obtaining confirmation of his own original ideas, and suggestions for their further development, from the copy of Barrow's book that he purchased in 1673.

The above is the ultimate conclusion that I have arrived at, as the result of six months' close study of a single book, my first essay in historical research. By the "Infinitesimal Calculus," I intend "a complete set of standard forms for both the differential and integral sections of the subject, together with rules for their combination, such as for a product, a quotient, or a power of a function; and also a recognition and demonstration of the fact that differentiation and integration are inverse operations."

The case of Newton is to my mind clear enough. Barrow was familiar with the paraboliforms, and tangents and areas connected with them, in from 1655 to 1660 at the very latest; hence he could at this time differentiate and integrate *by his own method* any rational positive power of a variable, and thus also a sum of such powers. He further developed it in the years 1662–3–4, and in the latter year probably had it fairly complete. In this year he communicated to Newton the great secret of his geometrical constructions, as far as it is humanly possible to judge from a collection of tiny scraps of circumstantial evidence; and it was probably this that set Newton to work on an attempt to express everything as a sum of powers of the variable. During *the next year* Newton began to "reflect on his method of fluxions," and actually did produce his *Analysis per Æquationes*. This, though composed in 1666, was not published until 1711.

The case of Leibniz wants more argument that I am in a position at present to give, nor is this the place to give it. I hope to be able to submit this in another place at some future time. The striking points to my mind are that Leibniz bought a copy of Barrow's work in 1673, and was able "to communicate a candid account of his calculus to Newton" in 1677. In this connection, in the face of Leibniz' persistent denial that he received any assistance whatever from Barrow's book, we must bear well in mind Leibniz' twofold idea of the "calculus":—

(i) the freeing of the matter from geometry,
(ii) the adoption of a convenient notation.

Hence, be his denial a mere quibble or a candid statement without any thought of the idea of what the "calculus" really is, it is perfectly certain that on these two points at any rate he derived not the slightest assistance from Barrow's work; for the first of them would be dead against Barrow's practice and instinct, and of *the second Barrow had no knowledge whatever*. These points have made the calculus the powerful instrument that it is, and for this the world has to thank Leibniz; but their inception does not mean the invention of the infinitesimal calculus. This, the epitome of the work of his predecessors, and its completion by his own discoveries until it formed a perfected method of dealing with the problems of tangents and areas for *any curve in general*, *i.e.* in modern phraseology, the differentiation and integration of any function whatever (such as were known in Barrow's time), must be ascribed to Barrow.

Lest the matter that follows may be considered rambling, and marred by repetitions and other defects, I give first some account of the circumstances that gave rise to this volume. First of all, I was asked by Mr P. E. B. Jourdain to write a short account of Barrow for the *Monist*; the request being accompanied by a first edition copy of Barrow's *Lectiones Opticae et Geometricae*. At this time, I do not mind confessing, my only knowledge of Barrow's claim to fame was that he had been "Newton's tutor": a notoriety as unenviable as being known as "Mrs So-and-So's husband." For this article I read, as if for a review, the book that had been sent to me. My attention was arrested