

the Islamic and openly accepted the Christian, at least as he understood it. In *The True Gospel of Jesus Christ asserted* (1732) and *The True Gospel of Jesus Christ Vindicated* (1739) he identified the essence of Christianity with the few simple principles of natural religion as found, for example, in Lord Herbert of Cherbury. He openly compared the propagation of primitive Christianity with the then current spread of Methodism and thereby rejected the claims of supernatural power associated with the early church. He defended his sort of rationalistic Christianity against some of the aspersions of that formidable deist Matthew Tindal. Although Voltaire had some kind words to say about Chubb, it is unlikely that he had read many of Chubb's tracts and certainly did not accept the concept of "Christian deism."

Chubb, like the general run of deists, found reason sufficient to guide humankind to God's favor and the happiness of another world; he was suspicious of mystery and of miracles and critical of some passages in the Scriptures; he regarded revelation not as divine but as the work of honest men who gave a fair and faithful account of matters of fact; he was dubious about a particular providence and, therefore, of prayer; he argued against prophecy and miracle and believed in the dignity of human nature and in free will. Among the multitudinous answers to Chubb from the more orthodox, the foremost came in 1754 from Jonathan Edwards of Massachusetts. *A Careful and Strict Enquiry into The modern prevailing Notions of the Freedom of Will, Which is supposed to be essential To Moral Agency, Vertue and Vice, Reward and Punishment, Praise and Blame*, Edwards's chief claim to philosophical fame, devotes no fewer than nineteen pages to the refutation of Chubb on free will. Chubb, it may reasonably be inferred, was widely read in America.

In fine, though adding little constructive thought to the deistic movement, this humble and least formally educated of the English deists was definitely one of its most valuable and popular spokesmen. In the nonpejorative sense of the term he was a candid freethinker.

See also Deism.

Bibliography

Chubb was prolific in publication, and his ardent deism was expressed in the titles of a few of his chief works: *The Comparative Excellence and Obligation of Moral and Positive Duties* (1730); *A Discourse concerning Reason, With regard to Religion and Divine Revelation* (1731); *The Sufficiency of Reason in Matters of Religion Farther Considered* (1732); *The Equity and Reasonableness of the Divine Conduct, In Pardoning Sinners upon Their Repentance Exemplified* (1737), which was directed against Bishop Butler's famous *Analogy*

of Religion of the previous year; *An Enquiry into the Ground and Foundation of Religion. Wherein Is shewn, that Religion Is founded in Nature* (1740); and *A Discourse on Miracles, Considered as Evidence to Prove the Divine Original of a Revelation* (1741).

Other works by Chubb include *Four Tracts* (1734) and *Some Observations Offered to Publick Consideration... In which the Credit of the History of the Old Testament Is Particularly Considered* (1735). The posthumous *Works of Mr. Thomas Chubb*, 2 vols. (London, 1748) contains the valuable "Author's Farewell to his readers."

See also Sir Leslie Stephen's *History of English Thought in the Eighteenth Century* (London: Smith Elder, 1876; the paperback, 2 vols., New York: Harcourt Brace, 1963, follows the revised edition of 1902) and the general bibliography under the "Deism" entry.

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CHU HSI

See *Zhu Xi*

CHURCH, ALONZO (1903–1995)

Alonzo Church, an American logician and philosopher, was born in Washington, D.C. He received his PhD from Princeton in 1927, having written his dissertation under Oswald Veblen on alternatives to the axiom of choice. He spent a year at Harvard and then a year in Europe, studying first at Göttingen and then at Amsterdam with L.E.J. Brouwer. He returned to Princeton where he was professor of mathematics from 1929 to 1967, after which he moved to UCLA to become professor of mathematics and philosophy. He retired from teaching at UCLA in 1990. Church's most important contributions to logic were his analysis of the concept of effective computability and his proof of the undecidability of first-order logic (Church's theorem).

A function of natural number is effectively computable if there is an algorithm—a surefire method requiring no ingenuity to follow—that will yield the value of the function for any given natural number as input. Church devised a formal system, the lambda calculus (which subsequently became an important tool in computer science), and proposed that a function of natural numbers be taken to be computable if it is *lambda definable*—definable by way of a

formula in the calculus. The analysis has little to recommend it initially, but experience with intuitively computable functions led Church to conjecture that every such function is lambda definable—a conjecture now known as *Church's thesis*. Alan Turing gave a more compelling analysis of computability in terms of abstract computing machines (Turing machines) and it was subsequently shown that lambda definability is equivalent to this notion of *Turing computability*. Various other analyses have been proposed and all have turned out to be equivalent to Church's definition. This is often regarded by logicians as evidence for the correctness of the conjecture. Church's thesis is now almost universally accepted.

Say, for instance, that a property of an expression is (effectively) decidable if there is an algorithm for deciding whether or not any given expression has the property. This notion can be identified with a certain sort of effective computability by supposing that all expressions have been assigned numbers (in some effectively determinate way) and then saying that a property of an expression is *effectively decidable* if there is an algorithm that will yield 0 (*no*) when applied to the number for the expression if the expression does not have the property and will yield 1 (*yes*) if the expression does have the property. If one then identifies the existence of such an algorithm with the lambda definability (or Turing computability) of that function, as Church's (or the Church-Turing) thesis proposes, one has a precise definition of effective decidability. Church's theorem shows that the property of being a valid formula of first-order predicate logic is not decidable in this sense. Thus, unlike the propositional calculus for which truth tables yield an effective procedure for deciding tautologousness, the validity of a first-order formula can not be decided, yea or nay, by any uniform algorithmic procedure.

Church's most important philosophical contributions involve the realism-nominalism controversy in the philosophy of mathematics and logic and problems and theories about meaning. He was a realist or Platonist about abstract entities and provided powerful arguments against various attempts to explain away such entities.

Rudolf Carnap and others associated with logical positivism displayed a general animosity toward such abstracta as numbers, functions, properties, and propositions. Carnap attempted to analyze sentences ostensibly ascribing belief in a proposition to someone in terms of sentences and a relation of "intensional isomorphism" between sentences. Roughly, the relation holds when the sentences in question are made up of necessarily equivalent parts, arranged in the same order. Church objected

that a sentence ascribing a belief to someone does not mention a sentence of a particular language. He goes on to give a detailed and compelling refutation of Carnap's specific proposal. The method used, what is now called the "translation argument," appears to be of general applicability and makes it seem implausible that any replacement of propositions by more concrete things such as sentences will be successful. Church also raised powerful objections to nominalist maneuvers by A. J. Ayer and Israel Scheffler. Problems about the notion of synonymy were raised by Nelson Goodman and Benson Mates. Church answered these decisively.

Church's work on the logic of sense and denotation, a formal intensional logic incorporating some of Gottlob Frege's ideas about meaning, was one of his most important projects for philosophy, but it remains unfinished. The basic new idea is the "delta-relation"—the relation that holds between the sense of an expression and the denotation of that expression in some possible (N.B.) language. This is taken to be a logical relation and it is said that the sense is a *concept* of the denotation. It is postulated that a concept (the sense of some expression in some possible language) is a concept of at most one thing. And if F is a concept of a function f and X is a concept of an object x , then $F[X]$ is a concept of $f(x)$. Church assumes that one can construe concepts of functions as certain functions on concepts, so that $F[X]$, plausibly taken to be a certain complex entity, is just construed as application of the function F to an argument X .

Various difficulties were encountered in working out this last idea, as well as in developing an axiomatic treatment of a *criterion of identity* for concepts that would render them suitable for the analysis and logic of the propositional attitudes—belief, knowledge, and the like. Modifying Carnap's notion of intensional isomorphism, Church proposed that two sentences (or other complex expressions) express the same proposition (or concept) if they are *synonymously isomorphic*—roughly, that they consist of synonymous expressions arranged in the same order. The development of axioms for the logic of sense and denotation that this idea suggests Church calls "Alternative (0)." Church was unable to complete an adequate formalization of this important conception.

See also Ayer, Alfred Jules; Brouwer, Luitzen Egbertus Jan; Carnap, Rudolf; Computability Theory; First-Order Logic; Frege, Gottlob; Goodman, Nelson; Logic, History of; Mathematics, Foundations of; Meaning; Realism; Turing, Alan M.

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CHURCH FATHERS

See *Patristic Philosophy*

CHURCH’S THESIS

See *Computability Theory*

CHWISTEK, LEON

(1884–1944)

Leon Chwistek, a Polish mathematical logician, philosopher, aesthetician, essayist, and painter, was a lecturer at the University of Kraków and from 1930 a professor of mathematical logic at the University of Lvov.

THEORY OF REALITIES

The central problem of Chwistek’s philosophy was a criticism of the idea of a uniform reality. It had been shown by Bertrand Russell that in logic admission of the totality of all functions of x produces contradictions; Chwistek claimed that in philosophy, likewise, many obscure and misleading thoughts result from the assumption of a single all-inclusive reality.

The results of this criticism led Chwistek to the thesis of a plurality of realities. Out of many possible realities

four are particularly important to philosophy. The first, the reality of natural objects, is assumed by common sense; natural objects are of a given form regardless of our perception. Chwistek’s defense of natural reality and our knowledge of it is reminiscent of the British common-sense philosophy of the nineteenth century. The objects studied in physics are not natural; the telescopic and microscopic worlds, matter, and the particles upon which the forces are supposed to act form a second reality. They are constructions, not something naturally given. The third reality, that of impressions, the elements of sensation, as studied by David Hume or Ernst Mach, forms the world of appearances. The fourth reality is that of images, produced by us and dependent on our will, fantasy, and creative processes.

All four of these realities are necessary to account for our knowledge. In addition, when we reflect that we speak about a reality, we cannot include ourselves or our reflection in this reality. Such a reflection must be a part of a higher reality. Otherwise confusions and contradictions arise. The act of discourse cannot be a part of the universe of discourse.

AESTHETICS

Chwistek applied the doctrine of plurality of realities to investigations in many areas—aesthetics, for example. Natural reality is dealt with by primitive art. In primitive art each object is given one color only, and perspective is not obeyed. The primitivist paints not as he sees but as things are supposed to be by themselves. He uses his vision, but mainly he uses his knowledge about the world. Realism in art depicts the physical reality as it is conceived at a given time. Impressionism is the art of the reality of impressions; it flourished in a society that had developed psychological research and made psychologism its fundamental scientific method. Futurism is the art of free images, of an actively created reality of fantasy and mental constructions.

In each style of art the artist tries to give a perfect form to his creation independent of the kind of reality he is working with. The form is the common feature of all works of art. Thus, Chwistek justified all styles by relating them to different realities, and he advocated formism: evaluation of form, not of reality, is the proper aesthetic evaluation.

MATHEMATICS AND SEMANTICS

Chwistek extended his pluralism to mathematics. There is no one system of mathematics, but there are many mutually exclusive systems. Various geometries coincide only