with a special one of the individuals i, j, k attached to it in order to show in what order these individuals are to be selected, and how. Σ_i will mean that i is to be a suitably chosen individual, Π_j that j is any individual, no matter what. Thus,

$$\Sigma_i \, \Pi_j \, l_{ji}$$

means that there is an individual i such that every individual j loves i; and

$$\Pi_j \, \Sigma_i \, l_{ji}$$

will mean that taking any individual j, no matter what, there is some individual i, whom j loves. This is the whole of this system, which has considerable power. This use of Σ and Π was probably first introduced by O. C. Mitchell in his epoch-making paper in *Studies in Logic*, by members of the Johns Hopkins University.

In Peirce's algebra of dyadic relatives the signs of aggregation and composition are used; but it is not usual to attach indices. In place of them two relative operations are used. Let l be 'lover of,' s 'servant of.' Then $l\,s$, called the relative product of s by l, denotes 'lover of some servant of'; and $l\dagger s$, called the relative sum of l to s, denotes 'lover of whatever there may be besides servants of.' In MS. the tail of the cross will naturally be curved. The sign $\mathbf{1}$ is used to mean 'numerically identical with,' and T to mean 'other than.' Schröder, who has written an admirable treatise on this system (though his characters are very objectionable, and should not be used), has considerably increased its power by various devices, and especially by writing, for example, Π before an expression containing u to signify that u may be any relative whatever, or Σ to signify that it is a possible relative. In this way he introduces an abstraction or term of second intention. (c.s.p.)

Peano has made considerable use of a system of logical symbolization of his own. Mrs. Ladd-Franklin advocates eight copulasigns to begin with, in order to exhibit the equal claim to consideration of the eight propositional forms. Of these she chooses 'No a is b' and 'Some a is b' ($a \vee b$ and $a \vee b$) as most desirable for the elements of an algorithmic scheme; they are both symmetrical and natural. She thinks that a symbolic logic which takes 'All a is b' (Boole, Schröder) as its basis is cumbrous; for every statement of a theorem, there is a corresponding statement necessary in terms of its contrapositive. This, she says, is the source of the parallel columns of theorems in Schröder's *Logik*; a single set of theorems is all-sufficient if a symmetrical

pair of copulas is chosen. Some logicians (as c.s.p.) think the objections to Mrs. Ladd-Franklin's system outweigh its advantages. Other systems, as that of Wundt, show a complete misunderstanding of the problem. Cf. Syllogism (2).   (c.s.p., c.l.f.)

Symbolic logic finds occasion to single out two terms as of peculiar significance, and to represent them by the special symbols o (zero) and ∞ (infinity); all other terms have both application and signification, but the first of these has no object of consciousness to which it is applicable, and simply signifies the non-existent, while the second has every object of consciousness as its application, and has no signification whatever. These properties are expressed in formal language by saying that

$$a < \infty, \quad o < a$$

are, no matter what a may be, propositions of no content, though always true. But

$$\infty < a, \quad \bar{a} < o$$

state, the first, that everything is a, and the second, that $\bar{a}$ is non-existent. These last two propositions are contrapositives one of the other, and ∞ and o are a pair of contradictory terms (i.e. each is the negative of the other). Much confusion would be saved in discussions in non-symbolic logic by the recognition of these special terms.   (c.l.f.)

Literature: Leibniz, *Philos. Schriften*, t. vii, ed. Gerhardt (Berlin, 1890); *Opuscules et fragments inédits de Leibniz*, ed. Couturat (Paris, 1902); Lambert, *Neues Organon* (Leipzig, 1764); Ploucquet, *Methodus calculandi in logicis* (1763); Gergonne, *Essai de dialectique rationnelle*, Ann. de Math., t. vii; De Morgan, *Formal Logic* (London, 1847); *Syllabus of a Proposed System of Logic* (1860); *On the Syllogism*, in Trans. Camb. Philos. Soc., viii, ix, x (1847-64); George Boole, *The Mathematical Analysis of Logic* (London, 1847); *An Investigation of the Laws of Thought* (Cambridge, 1854); Stanley Jevons, *Pure Logic* (London, 1864); C. S. Peirce, articles in Proc. Amer. Acad. Arts and Sci., vii, x, xiii; *Memoirs of the same*, ix, Amer. J. of Math., iii, iv, vii; Robert Grassmann, *Die Begriffslehre oder Logik* (Stettin, 1872); Delbœuf, *Logique algorithmique* (Liège, Bruxelles, 1877); and in the Rev. Philos., ii, iii; Hugh MacColl, articles on the Calculus of Equivalent Statements, London Math. Soc., ix, x, xi, xvi, xxviii, xxix, xxx; and in Mind, 1880, 1897, and xi, N. S., No. 33; Ernst Schröder, *Der Operationskreis des Logikkalkuls* (1877); *Algebra d. Logik*, i (1890), ii (1) (1891); iii (1), *Algebra u. Logik d. Relative*

(1895); *Studies in Logic*, by members of the Johns Hopkins University (Peirce, Mrs. Ladd-Franklin, Mitchell, &c.) (Boston, 1883); G. Peano, *Calcolo geometrico* (Turin, 1888); *Arithmetices Principia, I Principii di Geometria* (ibid., 1889); *Formulaire de Mathématiques, en collaboration* (i, 1895; ii, 1897-9; iii, 1901); and Rev. de Math., i–vii, 1891–1901); W. E. Johnson, The Logical Calculus, Mind, 1892; Keynes, *Studies and Exercises in Formal Logic* (3rd ed., 1894); A. N. Whitehead, *Universal Algebra*, i. Bk. II (Cambridge, 1898); Eugen Müller, *Ueber d. Algebra d. Logik* (Leipzig, 1900, 1901); Platon Poretsky, *Sept lois fondamentales de la théorie des égalités logiques* (Kazan, 1899); Bibliothèque du Congrès int. de Philos., iii, containing the papers of Johnson, MacColl, Poretsky, Schröder, Peano, Burali-Forti, Padoa, and Pieri (Paris, 1901). For the history of Symbolic Logic see Liard, *Les logiciens anglais contemporains* (Paris, 1878); Venn, *Symbolic Logic* (London, 2nd ed., 1894); and Peano's *Formulaire de Mathématiques* (for indications of sources of formulae). (L.C., C.L.F.)

Symbolical: Ger. *symbolisch*; Fr. *symbolique*; Ital. *simbolico*. (1) Relating to symbols in the general sense. See Symbol (1).

(2) Relating to symbols, novel or peculiar. In this sense the treatment of logic by means of peculiar characters or old characters put to peculiar uses is by some writers called Symbolic(al) Logic (q.v.).

(3) Relating to an algebraical method in which operations are denoted by letters and made the subject of operations.   (c.s.p.)

Symbolism: Ger. *Symbolismus*; Fr. *symbolisme*; Ital. *simbolismo*. (1) In aesthetics: (a) symbols considered abstractly; (b) the theory of the nature and use of the Symbol (q. v. 2).

(2) In religion: the use of objects in a symbolic sense; that is, as sensuous emblems of spiritual acts and objects; as, for example, ritual in worship and the sacraments in one aspect of their significance.

Symbolism in this sense has a wide use in religion, the objects of which are unseen and intangible. Hence the need of helping the imagination by means of sensuous objects which may serve as fitting materializations of the spiritual. Symbolism enters into every phase of religion, including the architecture of its churches and temples. The significance of sacred architecture is never wholly that of adaptation to certain functions, but it is determined also to a degree by the spiritual

import of those functions and by the influence of religious ideas.   (A.T.O.)

Literature: see Symbol; also G. Ferrero, *I simboli* (1892); G. Marchesini, *Il simbolismo* (1901).   (E.M.)

Symbols (and **Symbolics**) [Gr. σύμβολον, a sign]: Ger. *Symbole*; Fr. *symboles*; Ital. *simboli*. The authoritative doctrines or creeds of the Christian Church. Symbolics: a department of ecclesiastical history which treats of the origin, history, and contents of the various creeds of Christendom.

The term symbol was first employed in a theological sense by Cyprian in the year 250 A.D., and after the 4th century came into general use. It was first applied to the Apostles' Creed as a military watchword, distinguishing Christians from Pagans. Luther and Melanchthon first applied the name to Protestant confessions. Since Reformation times the use has been general.

Literature: Oehler, *Lehrb. d. Symbolik* (1876); Wundt, *Symbolik d. römisch-katholischen Kirche* (1880); Literature in the Creeds (1878); Schaff, *Creeds of Christendom*.   (A.T.O.)

Symmetry [Gr. σύν, with, + μέτρον, measure]: Ger. *Symmetrie*; Fr. *symétrie*; Ital. *simmetria*. The arrangement in reverse order, on opposite sides of a perpendicular line or plane, of like and equal parts of an object. More loosely, the equable distribution of parts in the formation of a balanced whole.

In the latter sense it is almost synonymous with proportion, consistency, and congruity. In the narrower sense applied most appropriately in architecture and sculpture; more ambiguously in drawing and painting. Applied rarely and somewhat metaphorically to canon and fugue in music, referring to the temporal repetition of musically similar passages, to metrical relations, as in the asclepiadic verse, and to the structure of the drama, as involving 'exposition,' 'conflict,' and 'solution.' For closely connected meanings see Balance, Harmony, and Proportion.

The Greek term was probably first applied to the commensurability of numbers, thence to the parts of a statue, and finally to the relations of form in general. The aesthetic value of the quality has been recognized by practically all aestheticians from the earliest Greek writers down to the present day. The principle, with its connected categories, harmony and proportion, is, however, so fundamental to the Greek conception of beauty, that it plays relatively a mere important