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Reason in this sense includes intuition in so far as that function yields ideas and concepts. It is to be distinguished, however, from intuition regarded as a mere subjective sense. The great distinction in theology, however, is that which exists between reason and a faith resting on some objective or external authority. It is generally conceded that what is intrinsically irrational cannot be a legitimate object of faith.

Literature: see RATIONALISM, REVELATION, and SUPERNATURALISM. (A.T.O.)

Reason (sufficient): see SUFFICIENT REASON, and REASON (in logic).

Reasonable (1) and (2) **Unreasonable**: Ger. *vernünftig, unvernünftig*; Fr. *raisonnable, déraisonnable*; Ital. *ragionevole, irragionevole*. (1) Having, and (2) not having, what is considered adequate ground or justification. See REASON (in logic), and cf. RATIONAL.

The terms—notably unreasonable—are especially (though not exclusively) applied to actions or active decisions, attitudes, &c., having reference to the element of conation which enters into these. We say a conclusion or inference is illegitimate, wrong, or false, but the act based upon this conclusion we call 'unreasonable.' Moreover, there is a slight reproach attaching to a course that is unreasonable which does not attach to what is merely mistaken or ill-judged—a further indication that an element of conation is involved. (J.M.B.)

Reasoned Realism: see REALISM (2).

Reasoning: Ger. *Schliessen* (inference), *Denken* (thought); Fr. *raisonnement*; Ital. *ragionamento*. Thinking in logical form, correct or incorrect.

'Direct' reasoning or inference is the case in which the proof proceeds directly to the conclusion; an 'indirect' conclusion follows from the proof of something else (see PROOF). 'Deceptive reasoning' is reasoning which involves a logical fallacy. (J.M.B.)

Reasoning is a process in which the reasoner is conscious that a judgment, the conclusion, is determined by other judgment or judgments, the premises, according to a general habit of thought, which he may not be able precisely to formulate, but which he approves as conducive to true knowledge. By true knowledge he means, though he is not usually able to analyse his meaning, the ultimate knowledge in which he hopes that belief may ultimately rest, undisturbed by doubt, in regard to the particular subject to which his conclusion relates. Without this logical ap-

proval, the process, although it may be closely analogous to reasoning in other respects; lacks the essence of reasoning. Every reasoner, therefore, since he approves certain habits, and consequently methods, of reasoning, accepts a logical doctrine, called his *logica utens*. Reasoning does not begin until a judgment has been formed; for the antecedent cognitive operations are not subject to logical approval or disapproval, being subconscious, or not sufficiently near the surface of consciousness, and therefore uncontrollable. Reasoning, therefore, begins with premises which are adopted as representing percepts, or generalizations of such percepts. All the reasoner's conclusions ought to refer solely to the percepts, or rather to propositions expressing facts of perception. But this is not to say that the general conceptions to which he attains have no value in themselves.

Reasoning is of three elementary kinds; but mixed reasonings are more common. These three kinds are *induction*, *deduction*, and *presumption* (for which the present writer proposes the name *abduction*).

Induction takes place when the reasoner, already holds a theory more or less problematically (ranging from a pure interrogative apprehension to a strong leaning mixed with ever so little doubt); and having reflected that if that theory be true, then under certain conditions certain phenomena ought to appear (the stranger and less antecedently credible the better), proceeds to *experiment*, that is, to realize those conditions and watch for the predicted phenomena. Upon their appearance he accepts the theory with a modality which recognizes it provisionally as approximately true. The logical warrant for this is that this method persistently applied to the problem must in the long run produce a convergence (though irregular) to the truth; for the truth of a theory consists very largely in this, that every perceptual deduction from it is verified. It is of the essence of induction that the consequence of the theory should be drawn first in regard to the unknown, or virtually unknown, result of experiment; and that this should virtually be only ascertained afterward. For if we look over the phenomena to find agreements with the theory, it is a mere question of ingenuity and industry how many we shall find. Induction (at least, in its typical form) contributes nothing to our knowledge except to tell us approximately how often, in the course of such experience as our experiments go towards constituting, a

given sort of event occurs. It thus simply evaluates an objective probability. Its validity does not depend upon the uniformity of nature, or anything of that kind. The uniformity of nature may tend to give the probability evaluated an extremely great or small value; but even if nature were not uniform, induction would be sure to find it out, *so long as inductive reasoning could be performed at all*. Of course a certain degree of special uniformity is requisite for that.

But all the above is at variance with the doctrines of almost all logicians; and, in particular, they commonly teach that the inductive conclusion approximates to the truth because of the uniformity of nature. They only contemplate as inductive reasoning cases in which, from finding that certain individuals of a class have certain characters, the reasoner concludes that every single individual of the class has the same character. According to the definition here given, that inference is not inductive, but is a mixture of deduction and presumption. Cf. INDUCTION, and PROBABLE INFERENCE.

On the methods of inductive reasoning see DIFFERENCE (method of), CONCOMITANCE (logical), AGREEMENT (method of), and Elimination under SCIENTIFIC METHOD. For Eliminative Reasoning (Ausschlussverfahren—Eisler) see SYLLOGISM.

Presumption, or, more precisely, *abduction* (which the present writer believes to have been what Aristotle's twenty-fifth chapter of the second *Prior Analytics* imperfectly described under the name of *ἀναγωγή*, until Apellicon substituted a single wrong word and thus disturbed the sense of the whole), furnishes the reasoner with the problematic theory which induction verifies. Upon finding himself confronted with a phenomenon unlike what he would have expected under the circumstances, he looks over its features and notices some remarkable character or relation among them, which he at once recognizes as being characteristic of some conception with which his mind is already stored, so that a theory is suggested which would *explain* (that is, render necessary) that which is surprising in the phenomena.

He therefore accepts that theory so far as to give it a high place in the list of theories of those phenomena which call for further examination. If this is all his conclusion amounts to, it may be asked: What need of reasoning was there? Is he not free to examine what theories he likes? The answer is that it is a question of economy. If he examines all the

foolish theories he might imagine, he never will (short of a miracle) light upon the true one. Indeed, even with the most rational procedure, he never would do so, were there not an affinity between his ideas and nature's ways. However, if there be any attainable truth, as he hopes, it is plain that the only way in which it is to be attained is by trying the hypotheses which seem reasonable and which lead to such consequences as are observed.

Presumption is the only kind of reasoning which supplies new ideas, the only kind which is, in this sense, synthetic. Induction is justified as a method which must in the long run lead up to the truth, and that, by gradual modification of the actual conclusion. There is no such warrant for presumption. The hypothesis which it problematically concludes is frequently utterly wrong itself, and even the method need not ever lead to the truth; for it may be that the features of the phenomena which it aims to explain have no rational explanation at all. Its only justification is that its method is the only way in which there can be any hope of attaining a rational explanation. This doctrine agrees substantially with that of some logicians; but it is radically at variance with a common theory and with a common practice. This prescribes that the reasoner should be guided by balancing probabilities, according to the doctrine of inverse PROBABILITY (q.v.). This depends upon knowing antecedent probabilities. If these antecedent probabilities were solid statistical facts, like those upon which the insurance business rests, the ordinary precepts and 'practice' would be sound. But they are not and cannot, in the nature of things, be statistical facts. What is the antecedent probability that matter should be composed of atoms? Can we take statistics of a multitude of different universes? An objective probability is the ratio of frequency of a specific to a generic event *in the ordinary course of experience*. Of a fact *per se* it is absurd to speak of objective probability. All that is attainable are subjective probabilities, or likelihoods, which express nothing but the conformity of a new suggestion to our prepossessions; and these are the source of most of the errors into which man falls, and of all the worst of them. An instance of what the method of balancing likelihoods leads to is the 'higher criticism' of ancient history, upon which the archaeologist's spade has inflicted so many wounds. Cf. PRESUMPTIVE INFERENCE.

RECALL — RECAPITULATION

The third elementary way of reasoning is *deduction*, of which the warrant is that the facts presented in the premises could not under any imaginable circumstances be true without involving the truth of the conclusion, which is therefore accepted with necessary modality. But though it be necessary in its modality, it does not by any means follow that the conclusion is certainly true. When we are reasoning about purely hypothetical states of things, as in mathematics, and can make it one of our hypotheses that what is true shall depend only on a certain kind of condition—so that, for example, what is true of equations written in black ink would certainly be equally true if they were written in red—we can be certain of our conclusions, *provided no blunders have been committed*. This is 'demonstrative reasoning.' Fallacies in pure mathematics have gone undetected for many centuries. It is to ideal states of things alone—or to real states of things as ideally conceived, always more or less departing from the reality—that deduction applies. The process is as follows, at least in many cases:

We form in the imagination some sort of diagrammatic, that is, iconic, representation of the facts, as skeletonized as possible. The impression of the present writer is that with ordinary persons this is always a visual image, or mixed visual and muscular; but this is an opinion not founded on any systematic examination. If visual, it will either be geometrical, that is, such that familiar spatial relations stand for the relations asserted in the premises, or it will be algebraical, where the relations are expressed by objects which are imagined to be subject to certain rules, whether conventional or experiential. This diagram, which has been constructed to represent intuitively or semi-intuitively the same relations which are abstractly expressed in the premises, is then observed, and a hypothesis suggests itself that there is a certain relation between some of its parts—or perhaps this hypothesis had already been suggested. In order to test this, various experiments are made upon the diagram, which is changed in various ways. This is a proceeding extremely similar to induction, from which, however, it differs widely, in that it does not deal with a course of experience, but with whether or not a certain state of things can be imagined. Now, since it is part of the hypothesis that only a very limited kind of condition can affect the result, the necessary experimentation can be very quickly completed; and it

is seen that the conclusion is compelled to be true by the conditions of the construction of the diagram. This is called 'diagrammatic or schematic reasoning.'

Literature: F. A. LANGE, *Logische Stud.* (1877, unfinished); J. S. MILL, *A System of Logic* (1842); treatises on logic generally; many treatises on psychology, in loc.; BIBLIOG. C, 2, j, k. (C.S.P.)

Recall: see REVIVAL.

Recapitulation (law of) [Lat. *re + caput*, head, through Fr.]: Ger. *Wiederholungsgesetz*; Fr. *loi de recapitulation*; Ital. *legge di ricapitolazione*. The theory according to which the individual in his ontogenic development passes through a series of stages which represent successive forms in the descent of the species (phylum) to which he belongs; the theory that ontogenesis recapitulates phylogenesis. Cope suggested the term 'Bioblastology' for the science of the relation of the two genetic series of forms. Cf. ONTOGENY.

The facts were recognized—so far as the parallelism is concerned—by Agassiz, and formulated, for the development of the embryo, by v. Baer (see v. BAER'S LAW). Haeckel interpreted the principle as a law of evolution. It is now very generally recognized as, in principle, true, although liable to much variation due to other forces and conditions. Modifications of it have been formulated in the 'law of ACCELERATION' (q.v.), and the theory of abbreviation, with that of SHORT CUTS (q.v.). Eimer (*Organic Evolution*, Eng. trans., 30) makes the following general statement regarding abbreviation: 'Every lower stage of the phyletic growth is abbreviated [in ontogeny] for the benefit of the newer [higher].' Variations in the series have been recognized as arising from the necessary accommodation of the organism to changed environment, and the effects of mechanical forces, of unlike and unequal food-supply, &c. (Sedgwick). Moreover, it has been pointed out, by the present writer, that the rigid working of recapitulation must have been subordinated to the requirements of the creature's own survival—variations in recapitulation coming under the action of natural selection. Thus the rise of an infancy period is necessitated by the demands of later life in creatures in which plasticity and intelligence take the place of fixity and instinct. Such creatures are born helpless, and depend upon parental care, thus failing to pass through the stage of rich instinctive endowment which would correspond to that of their ancestors. So

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