

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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for a short time at a resting light (method of Brücke, 1851), or that of fixating a point while a light moves through the field of view (method of Purkinje), is employed. (C.L.F.)

Literature: E. BRÜCKE, Pogg. Ann. d. Phys. u. Chemie, lxxxiv. 418; J. PURKINJE, Beobacht. u. Versuche zur Physiol. d. Sinne; HESS, Pflüger's Arch., xlix. 190; BOSSCHA, Arch. f. Ophthal., xl. 1; BIDWELL, Proc. Roy. Soc. Lond., lvi. 132; V. KRIES, Zeitsch. f. Psychol., ix. 81, xii. 181, xix. 175; and v. Graefe's Arch., xlii. (3) 95; HESS, v. Graefe's Arch., xl. (2) 259, xlv. 445; HAMAKER, Zeitsch. f. Psychol., xxi. 1; YOUNG, MUNK, as cited above.

Also see SANFORD, Course in Exper. Psychol., expt. 160; CHARPENTIER, Comptes Rend. (1891), cxiii. 147 (referring to communication to the Soc. de Biol., Mar. 10, 1900, 217, 278); and Arch. de Physiol. (1892), 541, 629; TITCHENER, Exp. Psychol. (1901), expt. 4. (C.L.F.-E.B.T.-J.M.B.)

Redeemer [Lat. *redimere*, to redeem]: Ger. *Erlöser*; Fr. *Rédempteur*; Ital. *Redentore*. The term applied to Jesus Christ as the rescuer and saviour of men from sin and its effects. Applied in a secondary sense to religious prophets in general. (A.T.O.)

Redemption [Lat. *redemptio*, from *redimere*, to redeem]: Ger. *Erlösung*; Fr. *rédemption*; Ital. *redenzione*. In Christian theology, salvation from sin and its effects through the atoning work of Jesus Christ.

Redemption is a name for the scheme of Christian salvation as a whole.

Literature: see ATONEMENT, and CONVERSION. (A.T.O.)

Redintegration [Lat. *re + integratio*, from *integer*, whole]: not in use in Ger. and Fr.; Ital. *reintegrazione*. The reinstatement of a total presentation by a partial constituent of it.

Hamilton first introduced this term. He recognizes two fundamental laws of reproduction. The first is that of 'repetition,' which he states as follows: 'Thoughts coincidental in modification but differing in time tend to suggest each other.' The second is that of redintegration: 'Thoughts once coincidental in time are, however different as mental modes, again suggestive of each other, and that in the mutual order which they originally held.' He adds by way of explanation that unity of time involves a totality of thought, 'and that the partial thoughts included in the totality tend immediately to suggest each other as co-constituents of this former whole, and mediately that whole itself.'

When Hamilton says that the whole is only mediately reproduced because the parts are immediately reproduced, he seems to deprive the term redintegration of all distinctive meaning. It is not clear from this point of view that there is any advantage in substituting it for the more familiar 'association by contiguity.' On the other hand, there is a clear gain if the term be taken to denote the tendency of the part to reproduce the whole *as such*, including not merely the other partial constituents, but also their special mode of combination with itself and with each other.

The term redintegration is used by Shadworth Hodgson for associative reproduction in general. He does not, like Hamilton, recognize a distinct law of repetition.

Literature: HAMILTON, Ed. of Reid, ii. Notes D**, D***; S. HODGSON, Met. of Exper. (Index, sub verbo). (G.F.S.)

Reductio ad absurdum [Lat. trans. of Aristotle's *ἀναγωγή εἰς τὸ ἀδύνατον*]. The disproof of a proposition by showing that among its consequences there is one which is impossible or simply false.

This mode of proof is generally considered to be unsatisfactory, as not showing on what general principle the proposition disproved is false. But it is very easy to convert any such proof into a direct proof. Take, for example, the seventh proposition of the first book of Euclid, that on the same side of the base *AB* two triangles *ABC* and *ABD* cannot exist having *AC = AD* and *BC = BD*. Euclid proves this by showing that if there were two such triangles it would follow that the angles *BDC* and *BCD* were equal and also that they were unequal. But precisely the same steps of reasoning show that if there are two triangles *ABC* and *ABD* on the same side of *AB*, and if *AC = AD*, then *BC* is unequal to *BD*, which shows that there are not two triangles having *AC = AD* and *BC = BD*, since things unequal are not equal. (C.S.P.)

Reduction [Lat. *re + ducere*, to lead]: Ger. *Zurückführung*; Fr. *réduction*; Ital. *riduzione*. (1) The process of bringing an object from its given form into some standard form or state, for purposes of clearness, certainty, or use.

(2) In logic, the process of bringing a syllogism into the standard form of the first figure.

Thus a syllogism of the second figure, such as

No P is M
No S is P,
No S is M

may be reduced to the first figure by simply converting the first premise.

In dealing with the syllogism (*Anal. Prior.*, Bk. I), Aristotle regards the first figure as the complete or 'perfect' type of syllogism. The two other figures of syllogism recognized by Aristotle require, in order to make perfectly clear their actual force, the addition of immediate inferences from the premises, or other alteration of their structure, whereby they come to be stated in the first figure. These additions Aristotle states at some length. The devices for the reduction of the incomplete syllogisms, or of those of other figures, to the form of the first figure, were later developed in the textbooks of logic into a series of rules, kept in mind through mnemonic devices. Recent psychology has very generally tended to vivify these formal rules for reduction by efforts at new statements of the fundamental nature and of the true form of the syllogism. (J.R.)

Reduction has been recognized as necessary by Aristotle and almost all logicians; and before Kant it was generally recognized as proving that indirect syllogisms involved two or more steps of inference. But Kant from the same premises inferred that reasoning in the first figure is the only reasoning; and this extraordinary conclusion is reached by simply not calling immediate inferences reasoning, because they have not two premises. On that ground, nothing ought to be called reasoning except uniting two propositions into one copulative proposition. Cf. SYLLOGISM.

Reduction is either *ostensive* or *apagogical* (*per impossibile*). Ostensive reduction proceeds directly from the premises of the syllogism to be reduced to its conclusion, by means of conversions and a direct syllogism. Apagogical reduction proceeds indirectly by showing by direct syllogism that from the denial of the conclusion of the syllogism to be reduced and one of the premises the denial of the other premise would follow. Any syllogism of the second figure and any of the third except Darapti and Felapton (which are not valid if the universal be taken in the Philonian sense) can be apagogically reduced.

Ostensive reduction is either short or long. Short reduction involves the conversion of one proposition only; long reduction the conversion of two propositions, and, except in the fourth figure, the transposition of the premises.

In order to ascertain that which reduction is intended to ascertain, the nature of the different moods of syllogism, the first requisite

is to recognize that we do not seek to trace out the process of reasoning; but what we seek to do is to analyse the precise logical conditions which render each mood valid. When this is recognized, it becomes easy to see and to generalize the relations expressed by the premises and note just at what point they cease to be cogent. For this purpose, appeal must be made to the logic of RELATIVES (q. v.). De Morgan has worked out the moods (*Cambr. Philos. Trans.*, x. 350). (C.S.P.)

Reduction-division: Ger. *Reduktions-theilung*; Fr. *division réductionnelle*; Ital. *divisione riduttiva*. The special form of CELL DIVISION (q. v.) which results in the formation of gonads (male or female elements).

As gonads have half the number of chromosomes found in the somatic cells of a given species, whenever gonads arise from cells there must be effected a reduction of the number of chromosomes. This reduction is completed during the final division of the cells, hence the term reduction-division. When the male or female nuclei fuse in the process of fertilization, the chromosomes are again brought up to their usual number. See SEX, CHROMOSOME, and FERTILIZATION.

Literature: HENNEGUY, La Cellule; E. B. WILSON, The Cell in Devel. and Inheritance; HERTWIG, Die Zelle. (C.S.M.)

Reduplication: see Recurrent Resemblance under RESEMBLANCE.

Reduplication (in biology): see SEGMENTATION.

Reflection [Lat. *reflectio*, from *re + flectere*, to bend]: Ger. *Reflexion*; Fr. *réflexion*; Ital. *riflessione*. (1) In popular language, any train of thought following a first impulse to believe or act, and reversing, modifying, or confirming it.

(2) Its technical meaning in psychology may be stated in the words of Locke: 'That notice which the mind takes of its own operations and the manner of them' (*Essay*, i. 78, § 4).

Reflection, in its psychological use, has a narrower application than 'self-consciousness,' and a wider than 'introspection.' All awareness of the self with its states comes under SELF-CONSCIOUSNESS (q. v.). But such awareness is not reflection unless interest and attention is predominantly directed to the self and its state. When I fail to hit a mark with a missile I become aware of myself as disappointed, and to that extent I am self-conscious. But I may not stay to think about my subjective state. On the contrary,