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See also Empiricism; Humanism; Machine Intelligence; Mathematics, Philosophy of; Oxford Philosophy

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## LOGICAL CONNECTIVES

Logical connectives (otherwise known as 'logical constants' or 'logical particles') have seemed challenging to philosophers of language. In a dazzling little analysis (bk III, chap. VII, entitled 'Of Particles') in *An Essay concerning Human Understanding*, LOCKE presented the essence of connectives:

> To think well, it is not enough that a man has ideas clear and distinct in his thoughts, nor that he observes the agreement or disagreement of some of them; but he must think in train, and observe the dependence of his thoughts and reasonings upon one another. And to express well such methodical and rational thoughts, he must have words [Locke called them 'particles'] to show what connexion, restriction, distinction, opposition, emphasis &c., he gives to each respective part of his discourse.

The trouble is that while the particles are clearly meaningful and hence useful, they appear to be short of deter-

minate sense (no corresponding idea to be found, in Locke's theory of ideas). Thus, hearing the word 'horse' one would picture a horse; hearing the word 'but' the similar thing does not happen (nothing comes to mind).

As Locke noted, logical connectives are used to construct complex expressions from simpler ones. Examples from daily use are 'and', 'or' and 'not'. TRUTH tables describe the semantics of a connective, given the truth-values of its arguments. It is well known that classical LOGIC fails to provide an adequate handling of some non-truth-functional connectives, for example 'because'.

Early great logicians (BOOLE, CARROLL, DE MORGAN, JEVONS, MILL, VENN, et al.) have all thought about and contributed to the lore of logical connectives. So have WHITEHEAD and RUSSELL, and WITTGENSTEIN advanced the state-of-the-art regarding connectives and truth tables. In his renowned paper on VAGUENESS, Russell noted that logical words share the ambiguity of other words. He, however, thought that we are able to imagine precise meanings for words such as 'or' and 'not' because we grasp their symbolic usage. AYER regarded the necessity for logical truths as dependent on the regulations governing the use of logical connectives. Still, it was probably STRAWSON who clarified and standardized matters significantly. Strawson stated that connectives are expressions 'dignified by selection by formal logicians to figure as constants in their representative verbal patterns or formulae'. He was also careful to add that 'there is nothing logically holy about [them]', except that they figure in discussion of a variety of subjects. A common approach to signalling the logical connectives is to identify them with 'syncategorematic' signs which serve to indicate how meaningful terms are combined.

Strawson demonstrated that the chasm between the truth-functional connectives and the notions of ORDINARY LANGUAGE – especially between the material conditional and 'if … then …' – is wider than commonly acknowledged. Thus, formal logic is not adequate for revealing all the structural features of natural language.

Logical connectives can be marked out as 'topic-neutral' (a term proposed by Gilbert RYLE). We have reason to care about the topic-neutral expressions, and to treat them differently from others, because we are interested in logic as a universal guide for reasoning. Thus, a logical truth is a statement whose truth is assured as long as the meanings of the logical constants are fixed. DUMMETT posits that the logical constants of a language are its grammatical particles – the expressions by means of which complex sentences are built up from atomic ones – while non-logical expressions are the simple expressions of which atomic sentences are composed.

H.P. GRICE thought that words such as 'and', 'or' and 'if' mean the same as with the corresponding symbols in logic. He blamed the differences between ordinary language and the logical language to 'implicature', a class of licensed inferences guided by a set of maxims. Take 'if X then Y', uttered by a speaker. According to Grice, this seems to mean that X can be regarded as a reason for believing Y. However, when symbolized using the material conditional, this utterance yields a logical expression, which simply asserts that X is false or Y is true.

Grice used such discrepancies to present his influential pragmatic theory of conversational implicature. Briefly, what people say and what they mean may be poles apart, and these differences are amenable to systematic elucidation. Disjunction, for example, specifies that at least one of the propositions it disjoins must be true. It is apparently analogous to natural language's 'either … or', for example 'Either we go to the movies or we stay at home'. Yet, in use, the latter has a more specific meaning, that is, that only one of the alternatives is taken, not both.

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See also Language, Philosophy of