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See also EQUALITY; INTEREST; PAIN; PLEASURE; PREFERENCES (PREFERENTIALISM); RIGHTS; SINGER, PETER.

ARISTOTLE (384–23 BC): See EPICUREANISM; EUDAIMONIA; HAPPINESS.

ARROW'S THEOREM

Prior to the publication in 1951 of Kenneth Arrow's *Social Choice and Individual Values*, the formal analysis of collective decision-making focused on particular voting procedures. Each of these procedures exhibits its unsatisfactory features. For example, majority rule is subject to Condorcet's Paradox, which is illustrated with the following example. There are three candidates for an election (A, B, and C) and three voters, with voter 1 preferring A to B to C, voter 2 preferring B to C to A, and voter 3 preferring C to A to B. In pair-wise majority contests, A beats B, B beats C, and C beats A. There is a cycle and, hence, no clear-cut winner.

For Arrow, collective decision-making is concerned with preference aggregation: based on the preferences of the relevant individuals, a social ranking of the alternatives is determined. The alternatives could be anything: candidates for an election, allocations of resources, etc. Instead of considering specific aggregation procedures, Arrow proposed a number of properties, the Arrow axioms, that he argued any reasonable preference aggregation procedure

ARROW'S THEOREM

should satisfy. Arrow's Theorem shows that it is impossible to satisfy them all.

A preference is a binary relation on the set of alternatives, interpreted as "weakly preferred to" (i.e. 'strictly preferred or indifferent to'). It is *reflexive* if any alternative is weakly preferred to itself; *complete* if for any two distinct alternatives, at least one of them is weakly preferred to the other and *transitive* if whenever one alternative is weakly preferred to a second and the second is weakly preferred to a third, then the first is weakly preferred to the third. A preference is an *ordering* if it satisfies these three "rationality" properties.

For a society with a fixed number of individuals, a *profile* is a list of individual preferences, one for each individual. An *Arrovian social welfare function* assigns a social preference ordering to each profile in some domain of admissible profiles. This function is determined before the actual individual preferences are known, just as voting rules are adopted before votes are cast. By requiring that social preferences be orderings, cycles are precluded.

There are four Arrow axioms. (1) *Unrestricted Domain*: the domain consists of all possible profiles. (2) *Weak Pareto*: if everybody strictly prefers one alternative to a second, then the first alternative is socially strictly preferred to the second. (3) *Independence of Irrelevant Alternatives*: if two profiles coincide on a pair of alternatives, then the corresponding social preferences also coincide on this pair. (4) *Nondictatorship*: there is no dictator. An individual is a *dictator* if the social preference on any pair of alternatives agrees with this individual's preference whenever it is strict. Arrow's Theorem shows that these axioms are incompatible if there are at least three alternatives and the population is finite. Consequently, any attempt to expand on Arrow's axioms is fruitless. When there are only two alternatives, majority rule satisfies all four axioms. Some of these axioms are now regarded as

being too strong. The literature on Arrovian social choice has considered the implications of relaxing the axioms, resulting in a mix of possibility and impossibility theorems.

Amartya Sen (1970) has raised a more fundamental concern. He has argued that the way Arrow has modelled collective decision-making is inadequate for making any social decision for which individual welfares are relevant. With an Arrovian social welfare function, one cannot use any nonpreference information. In particular, it is not possible to consider social decision rules such as utilitarianism or maximin utility because they make use of interpersonal utility comparisons. In order to take account of such information, Sen proposed using a *social welfare functional*, which assigns a social preference ordering of the alternatives to each admissible profile of individual utility functions. Different assumptions about the measurability and interpersonal comparability of utility can be easily handled using these functionals. This framework has been used to axiomatically characterize a variety of social decision rules, including Classical Utilitarianism.

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See also INTERPERSONAL UTILITY; POPULATION; PREFERENCES (PREFERENTIALISM); RATIONAL CHOICE; WELFARE (WELFARISM).

ASSOCIATIONISM

Associationism is a psychological theory of learning adopted and developed by those who defended utilitarianism in the nineteenth century. The theory has its origins in Aristotle's discussion of memory, but became a comprehensive psychological theory in the eighteenth century in the work of John Gay (1731), David Hume (1739–40), David Hartley (1749), and Joseph Priestley (1775), and found its full articulation in James Mill's *Analysis of the Phenomena of the Human Mind* (1829), later edited with notes by J. S. Mill (1869). The theory also developed into experimental introspective psychology in the nineteenth century in the work of Wilhelm Wundt (1904) and his student Edward Bradford Titchener (1901–5), and was swept up by and into the behaviouristic learning theories of the twentieth century.

According to associationist theory, in consciousness we have sense impressions and ideas where ideas are sensory images derived from those impressions. Suppose that we have a sense impression of sort *A* standing in relation *R* to a sense impression of sort *B*, and suppose that facts of this *ARB* sort repeat themselves several times in our experience. After a number of repetitions, an association between *As* and *Bs* will be established in our mind, where to say that there is an association is to say that when we come

to have another sense impression of sort *A*, then we have an idea of sort *B*, and where we have an idea of sort *A*, then we have an idea of sort *B*. At first, the association is weak: only sometimes is the impression of an *A* followed by an idea (image) of a *B*, but the more occurrences there are of facts *ARB*, the more regularly will an *A* be followed by a *B*: the greater the number of those *ARB* experiences, the stronger the association between *A* and *B*. It should be noted that complex ideas as well as simple impressions may stand in such a relation *R*, with association producing ideas that are still more complex. Many of our complex ideas may, thus, be derived not directly from sense impressions but from ideas acquired earlier.

It is sometimes said that the theory is mechanistic and determinist and, therefore, does not allow for human freedom of choice, thereby excluding the possibility of morality. The theory is indeed determinist, but it also allows for human freedom. Freedom is doing or being able to do what one wants, and nothing in Associationism denies that one can do as one wants. It is in fact a theory that describes human growth and our development into free persons who can choose and, one hopes, choose wisely: it describes how one can educate an infant or indeed oneself to determine one's future free choices.

Three relations *R* are relevant, each giving rise to different associations. First, *R* could be the relation of spatiotemporal succession: *As* are followed by *Bs*. In this case, the association is such that a sense impression of an *A* sort is followed by an idea (image) of a *B* sort or an idea of an *A* sort is followed by an image of the *B* sort. An association of this sort, if strong enough, is a *causal judgment*. Second, the relation *R* could be that of copresence or simultaneity where *As* are jointly present with *Bs*. In this case, the association is that of a *concrete thing* or a *substantial kind* of concrete thing. There are the sense impressions which, when copresent,

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