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# Glossary

**accidental property** A property of a thing,  $x$ , is said to be ‘accidental’ if  $x$  could still be  $x$  and lack that specific property. Properties which are not accidental are said to be ‘essential’. For example, the property of having straight sides is an essential property of a thing’s being a square. But being painted green would be an accidental property of a square.

**algorithm** An algorithm is a step-by-step procedure (recipe) for finding the solution in a finite number of steps to a specified kind of problem. For example, the algorithm for finding whether a natural number (expressed in base ten) is divisible without remainder by three is: “(1) Strike out all occurrences of the digits 0, 3, 6, and 9. (2) Add the remaining digits, if any, together. (3) If the sum is greater than 9, repeat steps (1), (2), and (3). (4) If the result is nil, 3, 6, or 9, then the original number is divisible by 3; if the result is anything else, then the original number is not divisible by 3.”

**a posteriori** By experience

**a priori** A proposition (see “proposition”) is said to be knowable a priori if it can be known *without experience*. Some persons have mistakenly believed that a priori knowledge is knowledge which is possible *prior* to any experience, e.g. would be knowledge attainable by a newborn infant. This is a misconception. When philosophers say that a proposition can be known without experience, they mean that no particular experience of the world, save perhaps learning a language, is necessary to be able to figure out the truth or falsity of the proposition. Various propositions have been offered as examples of this kind of knowledge, e.g. those of mathematics (“Four squared is sixteen”); of logic (“If P and Q are both true, then P is true”); and of (narrow) conceptual analysis (“If A is older than B, then B is younger than A”). Empiricists believe that there are no factual (see “contingent”) propositions which are knowable a priori;

Rationalists, in contrast, believe that there are at least some. (See also the discussion in footnote 8, p. 101.)

**begging the question** A fallacious manner of arguing in which the very thing that one is attempting to establish is assumed as a premise

**belief** Philosophers use the term “belief” broadly. Our use includes religious beliefs, but all other beliefs as well: political beliefs, scientific beliefs, etc. In short, we use this term to encompass anything believed, from beliefs about the origin of the universe to ones as mundane as whether the car needs to be washed.

**Cartesian** Deriving from the philosophy of René Descartes

**class** See “set”.

**coextensive** 1. Two objects,  $O'$  and  $O''$ , are coextensive if they occupy precisely the same region of space.

2. Two events,  $E'$  and  $E''$ , are coextensive if they occupy the same interval of time.

3. Two classes (sets) are said to be coextensive if every member of one is a member of the other and conversely. Thus, for example, the class which is the largest elected legislative assembly on Earth in 1980 is coextensive with the class which consists of the 1980 membership of the United States Senate and the House of Representatives. Note that the class which consists of the United States Senate together with the House of Representatives is, by definition, the United States Congress. But the former class, i.e. the largest elected legislative assembly on Earth, is not – by definition – the Congress; it just happens – as a matter of fact – to comprise the same membership. An alternative way of saying that two classes are coextensive is to say that they are *extensionally equivalent*.

**confirmation** A hypothesis is said to be confirmed if a new prediction derived from that hypothesis is shown to be true. Confirmation is not, however, verification. To verify a hypothesis is to show it to be true. Confirmation is a weaker relation than verification. To confirm a hypothesis is to offer in support evidence which falls short of establishing the truth of that hypothesis. That is, to confirm a hypothesis is to offer evidence which raises the probability of that hypothesis being true, but which does not prove it to be true. For example, someone might try six different chords on a piano and find them all in tune. Such evidence would confirm the hypothesis

that *all* strings on the piano were in tune, but would not verify that hypothesis. It remains possible that some of the untested strings are out of tune.

**contingent** A proposition *P* is said to be contingent if neither it (i.e. *P*) nor its denial (i.e. not-*P*) is self-contradictory. Contingent propositions thus are ones which, from a logical point of view, could be true *and* could be false (e.g. that the Titanic struck an iceberg), i.e. ones which could have *either* truth-value (see p. 28). Whether a proposition is contingent or not has nothing whatever to do with anyone's *knowing* its truth-value; it is wholly a matter of whether or not both it and its denial are free of self-contradiction. Non-contingent propositions are those which are either self-contradictory themselves (e.g. that someone's brother is an only child) or whose denials are self-contradictory (e.g. [the necessary truth] that all squares have four sides). Some philosophers explicate the distinction between contingency and non-contingency by saying that a contingent proposition is one which is true in some possible world(s) and is false in some (other) possible world(s), while a non-contingent proposition either is true in all possible worlds or is false in all possible worlds.

"Contingent" used in its technical sense, as it is in this book, does not mean, as it often does in ordinary English, "conditional upon", as when, for example, one might say, "Their attending the picnic will be contingent upon the weather." This latter, ordinary, use of "contingent" is simply not used at all in this book.

**counterfactual** "Counterfactual" means "contrary-to-(actual)-fact". One of the most common devices philosophers use to try to discover persons' dispositions to use a certain term, *x*, is to ask questions of the sort, "What would you say if such-and-such were (counterfactually) to be so-and-so? Would you describe it as being *x*?" For many philosophical purposes, "counterfactually" and "in another (i.e. non-actual) possible world" may be used interchangeably. (See section 6.4, pp. 108ff.)

**descriptive definition** A descriptive definition is one which reports the standard usage of a term. It may be contrasted with normative and with stipulative definitions. A normative definition is one which attempts to refine a usage, as we see, for example, in some dictionaries warning readers not to use "infer" and "imply" interchangeably. See also "stipulative definition".

**empirical** 1. “Empirical” is most often used as a modifier of “knowledge”. When so used it describes the *mode* by which that knowledge is obtainable. Some authors use the term “empirical” as equivalent to “a posteriori”, i.e. as equivalent to “by experience”. In this book, however, I adopt the stricter (narrower) meaning prescribed by Immanuel Kant in which “empirical” means not “by experience” but “*only* by experience” (see [34], 149-56). When I write that something, *P*, is knowable empirically, I mean that *P* cannot be known (by human beings) in any way other than by experience. Whatever is humanly knowable, but in a way other than by experience, is knowable a priori. (See definitions of “a priori” and “a posteriori”.)

2. Occasionally “empirical” is also used as a modifier of “concept”. An empirical concept is one whose referent is observable or detectable through experience. *Weight* is thus an empirical concept; *soul* and *substance* are often regarded as nonempirical concepts.

**epistemology** One of the principal branches of philosophy, epistemology is the theory of knowledge. Its subject matter includes the role of sense perception in the acquisition of knowledge, the possibility of attaining objective knowledge, the psychological aspects of knowledge, and – on some accounts – the sociological aspects of knowledge. (The adjectival forms are “epistemic” and “epistemological”.)

**eschatological** Pertaining to the end of the world, life after death, etc.

**exobiology** The term “exobiology” was coined (c. 1960) ([21], 355) by the geneticist, Joshua Lederberg ([69]). It refers to the study of (or, for the present time at least, the search for) life beyond the Earth’s atmosphere, in effect on other planets. Whereas the program SETI is the search for *intelligent* extraterrestrial life, the scope of exobiology is wider: it is the search for alien life itself, intelligent or not.

**formal** “Formal” pertains to structure; its contrast is content. For example, the two sentences “Sally sees Richard” and “New York is larger than Boston”, while having different content, share some of the same structure, i.e. are formally alike to a degree, in that both consist of a relational term flanked fore and aft by proper names. In section 8.8, I write about certain formal properties shared by spatial and temporal relations. For example, the spatial relation of *being north of* is, to a certain degree, formally equivalent to the temporal

relation of *being earlier than*. Both are so-called ‘ordering relations’: locations in space (along a line of longitude) may be arranged in order according to the relation *is north of*; similarly, events (subject to certain constraints within special relativity theory) may be ordered according to the relation *is earlier than*. (In logical terms, both these relations bear the formal, or structural, properties of *transitivity*, *asymmetry*, and *irreflexivity*. See, e.g., [34], 339-42.)

**half-truth** There are only two truth-values (see p. 28): true and false. There is nothing ‘intermediate’ between truth and falsity. That is, there is no ‘third’, or ‘middle’ truth-value. (This latter claim has since ancient times been known as the law of the excluded middle.) Thus no single proposition can be either half-true or half-false. However, a *set* of two or more propositions may contain some members which are true and others which are false. Although any set of propositions which contains even a single false proposition is, taken as a whole, false, it is sometimes convenient to designate sets which contain some false propositions and some true propositions as being a ‘half-truth’. A half-truth is thus a ‘mixed’ set of propositions: some of its members are true, but only some; the others are false.

**idealism** Idealism is the theory that the only things that exist are minds and their contents, e.g. pains, beliefs, desires, sensations of sounds, afterimages. Although “idealistic” is often used in ordinary speech to describe persons who have ‘ideals’, i.e. ambitions to better themselves or the world at large, this is not the sense of “idealism” being used in this book. Here, “idealism” is the name of a metaphysical thesis which contrasts, in the first instance, with materialism. (See also “materialism”.)

**individual** (*noun*) In ordinary speech, “individual” usually means a person. But in philosophical terminology, “individual” is given a wider meaning. As often used by philosophers, “individual” means not just persons, but any particular thing whatever: individual noises, cars, violins, pains, memories, molecules, stars, etc. An individual is, then, anything which is located in space and time. Another term which is used virtually interchangeably with “individual” is “particular”. (Note: some philosophers will use “individual” in an even broader sense. They use “individual” to refer to anything whatsoever which may be talked about as the subject of discourse.

Thus they will include the number two, the number three, etc. in the class of individuals even though they may be disinclined to believe that such ‘entities’ are located in space and time. The mere fact that one can attribute properties to numbers, e.g. “The number two is even”, suffices – on this latter account – to win for numbers the status of being individuals.)

**materialism** Materialism is the theory that the only things that exist are material (physical) things: subatomic particles through to human bodies and their brains, and on through to stars, galaxies, and galactic clusters. But beyond these things and their distinctive properties, there are no other sorts of things, e.g. minds or supernatural beings, in the world. This technical sense must be distinguished from the more familiar, ordinary sense in which “materialism” is used to describe the greed of persons who are overly acquisitive of material possessions. (See also “idealism”.)

**methodology** The body of techniques, rules, and procedures adopted for the pursuit of some discipline, e.g. science. Methodological assumptions are sometimes adopted, not so much because they are themselves believed to be *true*, but because their adoption is believed to offer a profitable manner of pursuing truth. For example, some psychologists will adopt behaviorism as a methodological principle, not so much because they believe that all mental acts can in some sense be ‘reduced to’ overt behavior, but because they believe that studying behavior provides the best – and in some instances, the only – access scientists have to the mental states of other persons.

**modality** 1. In philosophy, “modality” refers to that family of properties which includes possibility, impossibility, contingency, and necessity. To specify, then, the *modal status* of a proposition is to say something about its possibility, impossibility, contingency, or necessity. One particularly fashionable way to explicate modal concepts in contemporary philosophy is through the idiom of possible worlds. A proposition is said to be (logically) possible, for example, if it is true in at least one possible world; a proposition is said to be (logically) impossible if it is true in no possible worlds; etc. *Modal status* is often contrasted with *epistemic status*, the latter having to do with whether a proposition is knowable or unknowable, known or unknown. (Modal and epistemic status can link in sixteen different combinations. See [34], esp. 156-75.)

2. In psychology, “modality” refers to any of several different kinds of sensory abilities (or senses), e.g. seeing, hearing, smelling. Sight comprises one sensory modality (or mode); hearing, another; smelling, still another; etc.

**necessary condition** “*x* is a *necessary condition* for *y*” means “if *x* did not exist (/did not occur /was false), then *y* would not exist (/would not occur /would be false)”. For example, *being more than twelve years old* is a necessary condition for *being twenty years old*, inasmuch as a thing/person which was *not* more than twelve years old would *not* be twenty years old. Pulling a face card from a deck of cards is a necessary condition for pulling a Queen, but it is not a sufficient condition: the face card pulled may be a Jack. (See also “sufficient condition”.) If *x* is a necessary condition for *y*, then *y* – in turn – is a sufficient condition for *x*.

**necessary truth** A proposition (see below) is a necessary truth if its denial is self-contradictory. Synonyms for “necessary truth” include “logical truth” and “non-contingent truth”. Using the possible-worlds idiom, a necessary truth may be explicated as a proposition which is true in all logically possible worlds, i.e. true under any logically possible circumstances. Necessary truths include such propositions as “ $2 + 2 = 4$ ” and “All red things are colored.”

**ontology** 1. The fundamental categories of what *sorts* or *kinds* of things there are in the universe. At one level of analysis, tables and chairs might be considered to be distinct kinds of things; but for the purposes of ontology, tables and chairs are (usually regarded as being) the same sort of ‘thing’, namely physical (or spatiotemporal) entities. Other ‘fundamental’ sorts of things which have been proposed by various philosophers at one time or another have been: sets (or classes), propositions, facts, states of affairs, universals, numbers, causal connections, forces, substances, souls, minds, spiritual beings, ethical values, purposes, etc.

2. The branch of metaphysics concerned with the fundamental categories of things

**particular** (*noun*) See “individual”.

**particular** (*adj.*) When used as an adjective, “particular” typically modifies “proposition” or “statement”. A particular proposition is one of the form “Some *S* is *P*” or “There are *S*s (which are *P*s).” Another name for “particular proposition” is “existential proposi-

tion". Particular propositions should not be confused with *singular* propositions. Particular propositions are *general* propositions: they refer, not to specific individuals, but to classes of individuals. However, singular propositions, e.g. "Brian Mulroney is prime minister", do refer to specific individuals. Just to make life complicated: singular propositions refer to specific particulars; particular propositions do not.

**phenomenology** A description of the formal structure of the objects of awareness, i.e. a description of the appearance of things, disregarding any account of their origin, explanation, causes, etc. (There is, in addition, a philosophical school called 'Phenomenology', founded by Brentano and extended by Husserl. This latter – different – sense of "phenomenology" is not invoked in this book.)

**physical impossibility** A situation is physically impossible if its description is inconsistent with physical laws (i.e. with the laws of Nature). For example, it is thought that it is a physical law (law of Nature) that no material object can be accelerated past the speed of light (300,000 km/sec). If so, then it is physically impossible for there to be some material object which is accelerated to, let us say, 375,000 km/sec. But note that although this latter situation is said to be *physically* impossible, its description is not logically self-inconsistent, and hence is not *logically* impossible.

**posit** (*noun*) A hypothesis or assumption

**posit** (*verb*) To put forward a posit, i.e. to assume a hypothesis

**predicate** (*verb*) To attribute a quality or relation to

**proposition** Some philosophers use the term "statement" as a synonym for "proposition". Propositions are the sorts of things which are true or false; they are the sorts of things which may be believed, disbelieved, known, doubted, etc. In English, propositions often are expressed by so-called 'that-phrases', e.g. "She knew *that the train would be late*" and "He theorized *that the solution contained copper sulfate*". (For a discussion of several different theories about the metaphysical nature of propositions, see [34], 65-127, esp. 65-86.)

**question-begging** See "begging the question".

**reciprocal** (*math.*) The reciprocal of a number is its multiplicative inverse, i.e. the number which when multiplied by the original num-



ber yields 1 as the product. Thus, the reciprocal of  $3/4$  is  $4/3$ , and of  $-2$  is  $-1/2$ .

**retrodiction** Retrodicting is the analog of forecasting an event, but directed oppositely in time, i.e. to the past rather than the future. Just as one might forecast, from a knowledge of physical laws along with specific data about the current position and speed of a comet, where it will be ten years from now, one might retrodict where it was ten years ago.

**semantics** Semantics is the branch of the theory of signs dealing with *meaning*, e.g. with how descriptive terms (or better, their users) *refer* to items and features in the world.

**set** A set is any class or collection of things. The set (class) may be ‘natural’, e.g. the set of mammals, or it may be completely arbitrary, e.g. the set consisting of Napoleon, the number two, and Vancouver Island. Sets, on most accounts, are regarded as abstract entities and are not to be identified with their members. E.g. the *set* which consists of my daughter’s piano is not itself a piano (nor is it, for that matter, even a physical [material] object). Sets are standardly denoted by braces, e.g. “{Napoleon, 2, Vancouver Island}”.

A set  $A$  is said to be a **subset** of a set  $B$  if every member of  $A$  is also a member of  $B$ . A set  $A$  is said to be a *proper* subset of a set  $B$  if  $A$  is a subset of  $B$ , but not conversely. E.g. the set of women is a proper subset of the set of human beings. Although the terms “subset” and “proper subset” are not, strictly speaking, equivalent, many authors write the former for the latter.

A set  $A$  is said to be a **superset** of a set  $B$  if every member of  $B$  is also a member of  $A$ . A set  $A$  is said to be a *proper* superset of a set  $B$  if  $A$  is a superset of  $B$ , but not conversely. E.g. the set of human beings is a proper superset of the set of women. Again, as with “proper subset”, many authors omit “proper” when writing of proper supersets.

An **ordered** set (denoted by angle brackets) is one in which both its membership and the *order* of the members determine the set. The (non-ordered) set  $A$ ,  $\{2, 5, 8\}$ , is identical to the set  $B$ ,  $\{5, 8, 2\}$ :  $A$  and  $B$  have the same membership. But this set also gives rise to six nonidentical ordered sets:  $\langle 2, 5, 8 \rangle$ ,  $\langle 2, 8, 5 \rangle$ ,  $\langle 5, 2, 8 \rangle$ ,  $\langle 5, 8, 2 \rangle$ ,  $\langle 8, 2, 5 \rangle$ , and  $\langle 8, 5, 2 \rangle$ .

An **ordered pair** is an ordered set having two members.

**stipulative definition** A stipulative definition is one which lays down a specific, usually specialized and technical, usage for a term. Examples may be found in the definition of “contingent” above and “world” below. See also “descriptive definition”.

**sufficient condition** “*x* is a *sufficient condition* for *y*” means “if *x* exists (/occurs /is true), then *y* exists (/occurs /is true)”. For example, *being twenty years old* is a sufficient condition for *being more than twelve years old*, inasmuch as any thing/person which *is* twenty years old is thereby guaranteed to be a thing which *is* more than twelve years old. Pulling a Queen from a deck of playing cards is a sufficient condition for pulling a face card, but it is not a necessary condition: one could pull a face card which was not a Queen, i.e. a King or a Jack. (See also “necessary condition”.) If *x* is a sufficient condition for *y*, then *y* – in turn – is a necessary condition for *x*.

**sui generis** In a class by itself

**topology** Geometry has two branches: metrical geometry and topology. Metrical geometry concerns measurement and size – such matters as, for example, proportionality; relative sizes of angles; lengths of peripheries; angles formed by the intersection of diagonals; projections of three-dimensional objects onto two-dimensional surfaces; and perspective. Topology, in contrast, is concerned with those aspects of geometry which are independent of the sizes of the figures, indeed which would still obtain even if the figure were to be ‘stretched’ or ‘distorted’ (short of ‘tearing’ it) – such matters as, for example, the existence of paths connecting two or more regions; the equivalence of knots; and the number of colors required (in principle) to color any arbitrary map so that no two adjacent regions have the same color. From a metrical point of view, a sphere, an oval, and an ellipse are all different figures; from a topological point of view, they are identical. Similarly, from a topological point of view, these three figures share the same topological dimensions: they are two-dimensional whatever their sizes or however they are stretched.

**underdetermined** A hypothesis or theory is said to be underdetermined by the evidence which supports it if that evidence does not logically guarantee the truth of that hypothesis or theory. If some

evidence underdetermines a hypothesis, then that same evidence also underdetermines (some) competing theories. Thus, for example, using the (necessarily inconclusive) evidence produced by the Warren Commission, many writers have proposed several different theories of John F. Kennedy's assassination: e.g. that Oswald acted alone, that Oswald was not the assassin, that there was a second shooter, that organized crime planned the operation, and that foreign nationals planned the operation.

**universal** (*adj.*) The adjectival form of "universal" means "for all of the universe, i.e. throughout all of space and time." "Universal" is not limited just to the planet Earth. (See "world".) "Universal" does not mean "necessary". Something can be universally true without being necessarily true, e.g. that the speed of light is greater than 290,000 km/sec.

**universal** (*noun*) According to the theory of Realism, the *properties* of particulars (see above) are posited to be (abstract) entities 'subsisting' outside of space and time. Such entities are usually called "universals". In this theory, the class of universals includes greenness, triangularity, solubility, hardness, etc. As well, especially since the early twentieth century, it has become usual for Realism to include among universals the *relations* obtaining between particulars, e.g. *being to the left of* or *being older than*. Needless to say, the ontological status of universals, i.e. the 'nature' of their existence, has been a subject of intense controversy in metaphysics since Plato first introduced the topic. For more on universals, see chapter 9, esp. sect. 9.3.

**world** Throughout this book, when I use the term "world", I mean the entire universe, both what is known of it and what is unknown; I also include all of the world's history, its present, and its future in this all-encompassing term. I never use "world" to mean (just) the planet Earth, or – for that matter – any other planet.

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