

Chapter 1

Free Will Systems

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Latest Draft: June 2017

*** WORK IN PROGRESS ***

Consider a system composed of a *finite* number of **objects** "O1..On", such that any object can be in any single one of a *finite* number of **states** "S1..Sn".

Let us now consider what *object* and *state* means.

An *object* is any part of reality (actual or imaginary, concrete or abstract) that is somehow *distinguished* from everything else. Intuitive examples are *physical* macroscopic objects such as a rock, a planet or a galaxy; *metaphysical* objects such as persons or pets; and abstract objects such as numbers, words or drawings.

In physics, for instance, an object is usually referred to as a (physical) "system" and the distinction is drawn when that system is considered to be capable of being isolated from the rest: a rock for example is an object (or a

physical system) for it can be physically separated from the surroundings such that certain properties about it remain the same when placed under many different environment, that is, *when the distinction persist*. A subatomic particle, such as an electron, is also a physical object (or system) for it also can be persistently distinguished from other electrons and the rest of the atom on several different scenarios.

An object is a distinction, but distinctions are usually *drawn* rather than inherent. For example, a rock is really just a continuously mutating collection of molecules which just happen to be of a different type from the type of molecules usually found in the environment right around the rock, such as gas, water or dirt, giving that collection of molecules as a whole a certain set of characteristics from which the distinction can easily be drawn (mostly cohesion to form a solid body and surface texture to look a certain way when light reflects on it). Thus the fine details of the *process* of drawing the distinction--between the rock and the world for instance--dynamically defines the rock itself, process which involves the participation of an *external agent* drawing the distinction (whether is a person looking at it, or a mechanical device separating it from other objects).

Let us then define a **proper object** as any object that inherently distinguishes all by itself without the required participation of any external agent specifically drawing the distinction. The simplest examples of proper objects can be found in the abstract world. For example, a two-dimensional circle of radius 'R' centered on the origin of a certain cartesian coordinate system is a distinct proper object all by itself and there is no need to explicitly *make* a distinction in order for the circle to be itself. So is a number, or a word.

Actual *proper objects* in the real world are much more difficult to correctly identify. All our models of the physical universe, from planets to rivers to atoms to quarks, are based on carefully, but artificially, drawn distinctions based on observations and experiments. However, the concept and hypothetical reality of actual proper objects is central to the problem of free will, so this will be refined and qualified through the rest of this work.

State is the collection of qualities, properties, or attributes of, about, or on an object. Simple examples for *physical* objects are *temperature, acceleration, color, shape, etc...* For *metaphysical* objects are *emotions, knowledge, motivation, etc...* For *abstract* objects are "*a list of numbers that represent something that is encapsulated in the abstraction*", "*the style used on a piece of art*"

Notice that in general, the word "state" is used to refer to all of the properties of an object, everything that is to know, or can be known, about it, and not just a part of it, like "position" or "knowledge of history".

In contemporary physics, the state of an object is--almost consistently but implicitly--an **observable**. That is, information *about* the object that is obtained as the result of making the object interact with another object called a measurement device (or just device for short). Since only *that* information constitutes the (physical) state of the object, an object's state doesn't necessarily express directly any intrinsic attribute or property of, or on, the object, even if it is usually considered to be at least an approximation of that. That is, if I, for example, measure the temperature of water with a thermometer, what I'm really looking at is the height of the mercury line, not anything directly and uniquely referring to a thing of the water alone on itself. Furthermore, since any observable (state) is the result of interaction, the resulting state is necessarily about *both* objects, not just the one being observed or measured. For example, there is something about the water that causes the mercury line to reach a certain height, and it is this something the observable state we are measuring, but there is also something about the mercury (and the line) itself causing the measurement. So the resulting height (the water state) is actually about both the water and the thermometer.

In the simple case of macroscopic objects, the measurement devices are specially designed and built to contribute on their part nothing of significance in the resulting value, which allows the measurement to be regarded as a proper approximation of the state of the measure object *alone*, even if in reality, it is information about both the object and the device coupled in interaction.

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Let us also give this hypothetical object an *essential attribute* of **cognition** by which it becomes self-aware of the its intrinsic state.