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This book analyzes design in the way an engineer might analyze a new piece of machinery. An engineer might ask, among other questions, about the machine's purpose: is it for measuring time, wind speed, or income tax? This is a worthwhile question for the engineer because machines are built with a purpose in mind, and any description of a machine should refer to its purpose. Asking what the machine is for helps the engineer understand how it works. To give a trivial example, we would find it easier to work out how a slide rule operates if we knew it was meant for doing calculations and not for digging holes.

Biologists also ask questions about purpose, about what things are for. For example, Lewontin (1984) says: "It is no accident that fish have fins, aquatic mammals have altered their appendages to form finlike flippers, . . . and even seasnakes, lacking fins, are flattened in cross-section. It is obvious that these traits are adaptations for aquatic locomotion" (emphasis ours). In contrast to the engineer, the biologist thinks of design or purpose as the product of natural selection, rather than as the product of a conscious creator. Natural selection chooses traits that are useful in the struggle for survival and reproduction. A lion seems well designed for killing gazelles because traits that make lions good gazelle-killers were useful to the lion's ancestors: they allowed the lion's ancestors to produce more offspring than were produced by lions with other traits.

Design or adaptation is related to fitness (survival and reproductive success) but analyzing design is not the same as measuring fitness. If one attempted to study adaptation simply by measuring survival and reproductive success, one would reach the vacuous conclusion that those that survive and reproduce are those that survive and reproduce (Scriven 1959, Beatty 1980). Even showing that fitness varies between individuals with different traits is not enough to infer adaptation; one must know how the traits influence fitness. In other words, the central question in the study of adaptation is not just whether individuals survive, but how design is related to expected survival and reproduction (Mills and Beatty 1979).