AN ESSAY ON HOW JUDGMENT AND MEASUREMENT ARE DIFFERENT IN SCIENCE AND IN DECISION MAKING

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ABSTRACT

In decision making the priority scales are derived objectively after subjective judgments are made, and they reflect the importance of the influences we considered. The process is the opposite of what is done in the physical sciences where the subjectivity of interpreting the final number comes at the end.

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ESSAY

In science, measurements of factors with different ratio scales are combined by means of formulas. The formulas apply within structures and involve variables and their relations. Each scale has a zero as an origin and an arbitrary unit applied uniformly in all measurements on that scale but the meaning of the unit remains elusive and only becomes well understood through much practice and use. The meaning and use of the outcome of any measurement on a ratio scale must in the end be interpreted according to the judgment of an expert as to how well it meets our expectations and our experience with it for the situation in which it is being applied or how well it satisfies laws of nature that are always there. The composite numbers derived from formulas that combine the different scales must similarly be understood through experience. Science derives results using numbers objectively; that is, everyone gets the same numbers. But their significance is interpreted subjectively; that is, how well the number serves individual or group goals and understanding.

In decision making, however, because of the diversity of influences with which it is concerned, and the many decisions that may arise, there are no set laws that characterize commonly encountered structures in such fine detail like there are in science. Understanding and familiarity with a situation is needed to structure a problem and the judgment of a human being is always needed to capture importance, preference or likelihood. With the Analytic Hierarchy Process (AHP) these judgments are expressed quantitatively on a common absolute scale that denotes dominance of one element over another so that a best outcome can be derived by combining and trading off different factors or attributes. In the end after applying the AHP rules of composition a multidimensional scaling problem is reduced to a one-dimensional scale of priorities that are relative sets of numbers which belong to an absolute scale. So in the AHP significance is interpreted subjectively at the beginning of the process through judgments, then priority numbers are

objectively derived from them; that is, everyone would get the same results if they started with the same judgments.

Priorities are similar to probabilities. The ratios of AHP priorities are meaningful: for example, a priority of .50 is twice a priority of .25. A priority scale is not the same as the ratio scales used in science. Ratio scales are like yardsticks in that they have a starting point or a zero and a unit. Priority scales do not have a zero nor do they have a fixed and invariable unit. A priority scale is relative in that it is specially derived for a given situation with given factors and alternatives and it is applicable only to that situation. It is not good for all situations and all time like a yardstick is. When the situation changes the priorities may change.

In decision making the priority scales are derived objectively after subjective judgments are made, and they reflect the importance of the influences that we take into consideration. The process is the opposite of what is done in the physical sciences when the subjectivity of interpreting what the final number means comes at the end. Of course there has to be validation of our decision process through many examples to show it works, gives good answers and corresponds to reality somehow. As in other softer sciences it takes time to validate and establish a reliable methodology.

Finally, in science measurement is applied uniformly using the same arbitrary unit from the very small to the very large. This cannot be done using judgment in decision making. Judgment can only be applied meaningfully to homogeneous groups of elements, otherwise they must be put into different clusters with a common pivot element from one cluster to the next to make it possible to compare the elements in each cluster and then combine measurements across clusters. In the physical sciences there is no way to compare the significance of very small numbers with very large numbers in a systematic and meaningful way except by speaking of orders of magnitude. The meaning of the unit does not change from one order of magnitude to another, thus in the physical sciences the interpretation is left subjective and loose.

We look forward to exploring in another article how to bring together science and mathematics based on Cartesian axes and decision making with its relative priorities.

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