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Criteria on the Value of Expert's Opinions for Analyzing Complex Structures in Construction and Real Estate Management

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Abstract

Traditionally an expert is considered somebody who knows more and can appraise something better than anyone else can on the ground of specific knowledge. In this paper, such an assumption is put on solid grounds as to reveal what makes the expert superior to the common observer. Commonly an expert's view on a system is taken to be valid justified by reputation, which is described by the term of experience. Proper experience means to have already investigated a sufficient number of similar systems and therefore to be able to predict values and behavior of system variables within acceptably small margins. This approach refers to the similarity of complex systems, calling for a large number of well-understood systems to form the knowledge base and for an appropriate similarity of the systems to evaluate. Thus, we conclude the resulting accuracy to be naturally poor or the approach mistaken. An expert's expertise can therefore only be judged by the presentation of a comprehensive structure of the given situation leading to a set of evaluations for single branches or, in more sophisticated approaches, a set of possibly nonlinear functions allowing to merge the subsystems into one encompassing system. Then, the singular subsystems may become comparable to known situations and thus are understandable and predictable with sufficient accuracy. This will only help understanding the total system if the concatenation of the subsystems would not introduce additional complexity by taking their interaction into account, i.e. if the subsystems can be considered as superimposable. This will be the case if the interactions are exclusively linear and the proposed structure loop-less. Based on systems theory, this article provides criteria of how the validity of an expert's opinion on a complex system can be strictly evaluated and made use of in further considerations on solid grounds.

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1. Introduction

Since tasks and challenges in particular in Construction and Real Estate Management are becoming more and more complex, means to evaluate and predict a respective situation's or project's future development need to be improved. Furthermore, increasingly high risks require equivalently high accuracy of the predicted results which are particularly difficult to achieve due to the unique character of the considered situation [16, 18, 25, 35, 40, 42]. On this background more and more calls for experts turn up, to offer an expert's opinion on the problem [15, 20, 27, 31] claiming that these have understood such situations and therefore are capable to present valuable and precise advice based on their specific knowledge.

From a statistical point of view, such an approach does not hold. Scientific arguments are not based on opinions but on reasoning. Statistically surveying a large universe transforms the number of irrelevant single opinions into the very relevant parameterization of a situation, i.e. a market of demand or supply, a picture of political or social ambience or an ecologic system [44]. Different from this but based on the same reasoning, technical systems are investigated similarly as a number of irrelevant single issues forming relevant parameters for the complete system [23, 24, 33, 34]. In any case, the precondition is the absolute independency of the single issues as well as the large number of available subjects.

An expert's opinion does not meet even one of the given preconditions. Experts are commonly required if the subject is too complex to evaluate otherwise, in particular neither argumentative methods nor an appropriate universe for a significant survey are available, so only very few expert's opinions are available. A single statement would in terms of statistics lead to a well-defined mean value, with infinite standard deviation $\sim (n-1)^{-1/2}$ while for very few opinions n the add-on to the standard deviation due to the size of the universe according to the Student t-distribution – proportional to $\sim n^{-1/2}$ - will be very large for sufficient accuracy [4, 22]. Furthermore, if more than a single statement is available, the independency of the adepts is to be doubted since their knowledge is likely to be based on the same few situations and they will know each other as well as their backgrounds [1, 28, 29].

Consequently, a statistical approach to the utilization of expert's opinions allows clearly for no substantiation of the given proposition. In the following a more general approach is established to investigate the contribution which can be made by an expert beyond the statistical understanding.

2. The Subject of Interest

First of all the system to be considered needs to be modelled in general, e.g. making use of Systems Theory. Therewith the subject of appraisal is a system of unknown complexity comprising elements and their interactions [13, 36, 41]. Without introducing any restriction, the elements can be considered most simple i.e. containing exactly one variable each. Then all the complexity of the system is located with the interactions, where also nonlinear functions may be given.

2.1. Modelling a System as a Set

Hence the system is defined as a set [2, 38]:

$$S = \left\{ n_i, k_j \,\middle|\, i = 1..N,\ j = 1..K, K \simeq N^{1+\alpha} \right\} \tag{1}$$

Each element n_i contains the single local variable Q_i including the instruction of how to modify it according to the input while each interaction connects exactly one element to another and therewith sends the respective modification value to the requesting element:

$$n_i : \frac{\partial Q_i}{\partial t} = f_i(Q_r) \,\middle|\, r = 1..N \qquad k_j : \left\{ (n_i \to n_r) \,\middle|\, i, r = 1..N \right\} \tag{2}$$

The object of this consideration may be restricted to stationary systems where all variables are at rest. Other systems being far away from equilibrium are more difficult to consider and to predict with some accuracy. In case of