THE PROPERTIES OF HUMAN BEING'S DECISION MAKING

- Commemorating the Late Thomas L. Saaty-

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ABSTRACT

In order to honor Thomas Saaty, the developer of Analytic Hierarchy Process (AHP)/ Analytic Network Process (ANP), and focus on the paper he wrote just before he died, this essay mentions the rank order problem due to the addition/deletion of irrelevant alternatives over which there were controversies in the AHP. Saaty ended the controversies with the explanation that both rank preservation and rank reversal are possible depending on the decision making circumstance. In this paper, we will summarize the three properties that fundamentally act on how to prioritize and aggregate the subjective judgments of human beings in ranking alternatives: comparisons, judgmental dependency and rank order. This essay also mentions the rank order in relation to the cases of addition/deletion of irrelevant criteria from previous studies. This essay closes by expressing gratitude to Thomas Saaty for his work.

Keywords: decision making; rank preservation; rank reversal; subjective judgment; comparisons

1. Introduction

This essay is written in honor of the Distinguished Professor Thomas L. Saaty, who created the Analytic Hierarchy Process (AHP)/Analytic Network Process (ANP). The main paper that will be discussed is '*Rank Preservation and Reversal in Decision Making'* (Saaty, 2015). It deals with 'rank order', which has been a major subject of controversy in relation to the AHP. We will also briefly mention his work in which his thoughts and philosophy are considered to have been especially well-organized. Saaty essentially explains human decision making in terms of how to prioritize and aggregate judgements beyond the understanding of the technical methodology. This is recognized as a more philosophical approach to subjective judgment.

2. The rank reversal issue

Rank reversal in AHP dealt with what were perceived to be illegitimate changes in the ranks of the alternatives upon changing the structure of the decision in one of two ways: 1) adding or deleting irrelevant alternatives—copies of an alternative; and 2) adding or deleting an irrelevant criterion under which the priorities of the alternatives would be tied (Saaty et al. 2009). The beginning of such thought was revealed from the controversy of rank reversal caused by irrelevant alternatives in the early 1980's when AHP was popularly known as an innovative methodology of decision making.

Rank reversal by irrelevant alternatives triggered numerous scholars to be interested in the controversy (Saaty et al., 2009). While some critics regarded rank reversal as a shortcoming of AHP, some advocates suggested modified judgement methods of the priorities of alternatives to avoid rank reversal (Yoon & Kinoshita, 2009). Saaty, however, ended the controversy of rank reversal by describing the two decision circumstances as to whether rank reversal is legitimate or not. Saaty posited that, AHP with its pairwise comparisons of the alternatives is concerned with those cases where rank can and should change, and AHP also has a procedure that preserves rank absolutely as needed. The former circumstance requires relative measurement among alternatives, and the latter requires absolute measurement corresponding to the ideal alternative that is obtained from implicit understanding and comparison of many alternatives (Millet & Saaty, 2000).

Using various examples, Saaty also shows whether the attributes of assessment due to the addition or removal of alternatives are intrinsically independent of, or dependent on the given alternatives assessment. There are two lessons from the examples.

> One is that it is we who must decide in a particular decision problem whether, for that problem, rank needs to be preserved or not. It is not automatically written in the abstract structure of the real-life problem itself. The other lesson is that we cannot use one and only one procedure for aggregating preferences in a multiple criteria decision process once and for all. We need one procedure to preserve rank and another to allow rank to change (Saaty, 2015, p. 36).

Therefore, decision-makers experiences and knowledge are important when deciding whether or not rank reversal is legitimate or justifiable.

3. Properties of subjective judgment

Finally, in the paper, we can see Saaty's beliefs about 3 properties of a human being's subjective judgment: comparison, judgmental dependency and rank order (Saaty, 2015).

3.1 Property of comparisons

One of the outstanding contributions of AHP is its pairwise comparisons method to elicit objectively clear priorities from subjectively fuzzy judgments. At this point, it can be found that Saaty believes human being's subjective judgment intrinsically arises from the comparison of one thing to another, sometimes an ideal value. Thus, "the AHP is a decision-making theory based on relative measurement. It derives cardinal scales from paired comparisons" (Saaty 2015, p. 36), and "all methods that do not compare alternatives and the answers they give must and should be suspect" (Saaty 2015, p. 37). There are two ways to compare alternatives, pairwise comparisons among alternatives and comparisons to an ideal alternative. The procedure that preserves rank absolutely as needed is done by comparisons too. For the priorities of criteria, pairwise comparisons have been obviously used.

3.2 Property of judgmental dependency

Comparisons among alternatives implies, how good an alternative is depends on what it is compared with. So, implicitly, comparison with respect to an ideal implies dependence on other alternatives. Therefore, the priorities of an alternative depend on a given set of alternatives. If the set is changed by adding or deleting alternatives, the result of priorities can change with the changed ideal. Hence, alternatives cannot be evaluated independently one at a time. Additionally, "rank may also be allowed to reverse when the weights of the criteria depend on the alternatives so that a criterion becomes more or less important depending on what alternatives there are" (Saaty 2015, p. 37). We know that such dependence of criteria on alternatives can be analytically synthesized by the ANP.

3.3 Property of rank order

In addition to examples of rank order circumstances, Saaty (2015 p. 37) adds that "rank needs to be preserved in established systematic operations and allowed to change (rank reverse) in exploratory and tentative kinds of decisions." In reality, keeping rank order is concerned with whether the established order is to be maintained or allowed to change with a change of circumstances. We add here a more specific description about irrelevant criteria. One of the criticisms of AHP was rank reversal by adding or deleting irrelevant criteria under which the alternatives are equal. The former were called "indifferent criteria" and the latter "wash criteria." The correct approach to deal with wash and indifferent criteria is as follows; do not delete them or add them but simply, in the former case, assign zero priorities to the alternatives and keep that criterion, and in the latter case not to add them or if added to consider this a new decision respecting the influence of added criteria on the final outcome which could lead to different priorities and ranks (Saaty et. al. 2009).

4. Additional remarks on rank reversal

The hierarchic structure of criteria can show how to adjust the current priorities of criteria when irrelevant criteria are added or deleted. Logically, the priority of a criterion is

distributed hierarchically downward to criteria belonging to the same criterion in the upper level. Therefore, addition or deletion of a criterion in a level requires upward changes to the priority of the directly related upper criterion, which can prevent rank reversal. However, it is common that adding or deleting criteria makes it a different decision-making problem.

5. Acknowledgment: honoring Thomas L. Saaty

The AHP was first introduced to Korea in the early 1980s, but it was not until around 1990 that it became widely known in the field of decision making. I received a Master's degree using the AHP in those days, thereby starting a relationship with the process which continued when I earned a doctoral degree with a more systematic approach to the AHP. At the same time, I studied the ANP by myself, and began research activities to solve problems by utilizing the AHP/ANP. I did not even think that the AHP/ANP would be my life partner until then.

I had the unforgettable opportunity of meeting Thomas Saaty for the first time on the day just before the International Symposium on the AHP (ISAHP) in 2003 in Indonesia. Since then, I have attended every ISAHP meeting since 2005 in Hawaii to the 2016 meeting in London, while taking time to become friendly with so many international scholars and researchers.

During my sabbatical leave as a visiting scholar hosted by Saaty at the University of Pittsburgh in 2012, I had a deeper exchange with him and recognized, even at the age of 86, his enthusiastic research and humanity. Recalling this time with him reminds me of his passionate life and my utmost respect for him. Although there are many things that I still vividly remember, some of them that stick out are as follows. First of all, there were always numerous scholars and researchers from other countries studying and doing research with him. Second, it was also very impressive that many researchers from abroad visited the university even for a while to look in on his classes at the Katz Graduate School of Business and hold discussions. Third, his graduate classes had many students who came from other countries and enthusiastically participated to learn the AHP/ANP. Fourth, he provided groups from overseas with short-term courses during summer vacation outside regular classes. Fifth, his occasional tele-seminars with foreign researchers over the internet were also surprising. There is so much more to say.

Even during the few times I visited his home, I was impressed by his humane features thinking about his wife, Rozann. In fact, one thing I should point out is her devoted assistance. As a lifelong partner of Saaty, she not only helped her husband's academic activities, but also demonstrated her ability as a researcher.

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