

On Multidimensional Predicates: Social-Choice Model Versus Additive-Difference Model

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A considerable number of studies have been made on the semantics of unidimensional adjectives and common nouns. On the other hand, as far as we know, only a few attempts, except for van Rooij (2011), Suzuki (2012), Sassoon (2013) and D'Ambrosio and Hedden (2024), have so far been made on the semantics of multidimensional adjectives and common nouns. For example, 'good', 'clever' and 'big' are usually taken to be multidimensional adjectives. It is assumed that each dimension gives rise to a separate ordering and that whether someone is better/cleverer/bigger than someone else depends on an overall ordering aggregated from these separate orderings. We (2012) propose a new version of logic for comparisons of multidimensional predicates (adjectives and common nouns)---Multidimensional-Predicate-Comparison Logic (MCL) the model of which can provide, in terms of measurement theory, conditions under which we can justify using the weighted sum of absolute differences as a method to construct orderings for positive and comparative sentences involving multidimensional predicates. Recently, D'Ambrosio and Hedden (2024) have given an analysis of multidimensional adjectives in terms of social choice theory. Harsanyi (1955)'s Aggregation Theorem is considered to be one of the most promising social-choice-theoretic results that can contribute to furnishing a logic of multidimensional predicates with its model. Harvey (1999, p.66) gives the criticism that Harsanyi's Aggregation Theorem assumes that individuals have identical beliefs and that social beliefs are the same as the common individual beliefs but generally the member of a society have different beliefs. In order to escape this critique, Harvey proposes Harvey's Aggregation Theorem (1999, p.72) that has as primitive quaternary preference relations that are only on the set of outcomes but are not on the set of lotteries in Harsanyi's Aggregation Theorem, and that can be represented by algebraic differences (utility differences) (Krantz et al. (1971)). So at least when situations are not concerned with the probabilities of outcomes, and since in the theories of multidimensional predicates, no probabilities of outcomes are normally taken into consideration, multidimensional predicates should be explained not from Harsanyi's Aggregation Theorem but from Harvey's Aggregation Theorem. Since D'Ambrosio and Hedden do not consider in terms of model theory, in this talk we furnish a social-choice model of

MCL based on Harvey's Aggregation Theorem. Let us see the following example:
(Example 1) (1) Ramen shop a is better than ramen shop b. Suppose that in (1) 'better' has such 3-dimensions as cost performance, price, and taste.

Example 1 reveals that this model faces the following two hard problems:

(Problem 1) If multidimensional ordering relations can be represented by weighted sums at all, each dimensional ordering relation must not depend on the other relations. However, the social-choice model of MCL furnishes no conditions (reasons) for excluding such dependent cases as Example 1 where the cost performance of a ramen shop depends on both the prices and the tastes of its ramens.

(Problem 2) Since the social-choice model of MCL states only the existence of the degree of contribution of the dimensional value to the multidimensional value, no function that evaluates this contribution is given.

The aim of this paper is to demonstrate that our additive-difference model (2012) of MCL based on Suppes et al. (1989) surmounts Problems 1 and 2 in the following way: The ordering relation in Example 1 does not satisfy the condition for dimensional independence furnished by the additive-difference model, which excludes such dependent cases as Example 1 and so surmounts Problem 1. Moreover, the functions in the representation theorem of the additive-difference model evaluate the contribution of the dimensional value to the multidimensional value, which surmounts Problem 2.

(使用言語：日本語)

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