

# Some notes on non-reciprocal matrices in the multiplicative pairwise comparisons framework

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## Abstract-

In most pairwise comparisons methods such as the Analytic Hierarchy Process (AHP) it is assumed that pairwise comparisons are reciprocal, since this is a necessary condition for consistent judgments. However, several empirical studies have shown that the condition of reciprocity is not satisfied when dealing with real human preferences, which might be significantly non-reciprocal due to inherent cognitive biases. This empirical evidence indicates that the study of non-reciprocal pairwise comparisons matrices should not be neglected when dealing with real decision-making processes. However, the literature on this topic is scarce and fragmented. The aim of our study is to fill this gap by discussing advantages and disadvantages of using non-reciprocal judgements multiplicative pairwise comparisons (MPCs), reviewing existing literature and introducing a new measure of non-reciprocity with some natural and desirable properties. In addition, we perform Monte Carlo simulations on randomly generated non-reciprocal MPC matrices and provide percentile tables allowing decision makers to decide whether a level of non-reciprocity of a given MPC matrix is acceptable or not.

**Index Terms-** Pairwise comparisons; multiple-criteria decision making; reciprocity; consistency

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