Generalizing nonstrict and strict preference desirability

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Abstract

Recently, there has been a clearly increased interest in the application of modeling uncertainty using sets of desirable gambles [1–3]. These lines of research start from of the notions of desirability formalized by Walley [6] that generalize coherent lower previsions; the earlier notion of desirability can be associated to nonstrict partial preference between gambles, the later one to strict partial preference. Walley builds on the work of Williams [8]; due to the connection with partial preference, work in that area [see, e.g. 4, 5] is also relevant in this context.

In our current research, we wish to create a framework that is based on an operational notion of acceptability of gambles to an agent—e.g., in an elicitation situation—and that combines as much as possible the advantages of both Walley's formalizations. From our perspective, the main advantage of his nonstrict preference-version of desirability [6, App. F] is that it allows indifference assessments to be specified in a natural manner. The advantages of his strict preference-version [7, cf. the notion of favorability in 5] are its natural applicability to decision problems and the mathematically useful order-theoretic structure it engenders [cf. maximal sets of desirable gambles in 1, 2].

In pursuit of this goal, we introduce smallest rational models and sets of gambles considered irrational. Adding the zero gamble to the latter or not corresponds to considering indifference irrational or not. In the former case, we end up with a strict preference framework with which we can (just mathematically?) associate a unique nonstrict preference relation. In the latter case, we end up with a nonstrict preference framework with which we can (more than just mathematically?) associate a unique strict preference relation. Nevertheless, by allowing the agent to make a second type of statement—e.g., of non-indifference—next to acceptability, it is possible to get a unified framework. The question then becomes if one can attach a meaningful or possibly even operational interpretation to this type of statement.

Keywords. desirability, acceptability, indifference, favorability, preference

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