Nontrivial intermediate syllogisms suggest way to solution of problems of non-monotonic logic

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In earlier publications, we focused on a special group of the validity non-trivial syllogisms related to the property of contrarary in the gradad Peterson square of opposition [1]. Non-trivial logical syllogisms are certain types of logical assertions, where premises containing intermediate quantifiers, e.g. "Most", "Several", "Almost all", etc. pf which we are able to derive a new conclusion. The problem concerning nonmonotonic logic brought us to the idea of also dealing with validity of non-trivial syllogisms, which are related to the property of sub-contrary in graded Peterson's square of opposition [2]. In recent years, there has been a growing acknowledgment that standard logics often overlook a crucial aspect of ordinary common reasoning: its **nonmonotonic** nature. A classic example often cited to illustrate this point is the following: if we are aware that Tweety is a bird, we typically infer, in the absence of *contradictory* evidence, that Tweety can fly. If, however, we later learn that Tweety is a penguin, we will withdraw our prior assumption. Recently, there have been several approaches to formalize this type of non-monotonic reasoning. The inference that birds can fly is handled by having the rule that says that: for any A, "A *can fly*$''$ *is a theorem* if "A *is a bird*$''$ and "A *cannot fly*$''$ *is not a theorem.* As we can observe, this is a certain form of logical inferences and at the same time an invalid form of logical syllogism. Furthermore, this idea leads to properties that are fulfilled in Aristotle's square of opposition. Mainly contradicotry property between the formulas $(\forall x)A(x) \Rightarrow Fly(x)$ and $(\exists x)A(x) \wedge \neg Fly(x)$. The use of intermediate quantifiers, which were formally and semantically processed in other publications (see [3]) to preserve the monotonic behavior of the theory under consideration. A similar approach without the mathematical formulation of intermediate quantifiers was proposed in [4].

References

1. P. Murinová, V. Novák, The theory of intermediate quantifiers in fuzzy natural logic revisited and the model of "many", Fuzzy sets and systems 388 (2020) 56–89.
2. P. Murinová, V. Novák, Analysis of generalized square of opposition with intermediate quantifiers, Fuzzy Sets and Systems 242 (2014) 89–113.
3. V. Novák, On fuzzy type theory, Fuzzy Sets and Systems 149 (2005) 235–273.

4. C. Moore, R., Semantical considerations on nonmonotonic logic, Proceedings of the 18th Intarnational Join Conference on Artificial Intelligence, Germany, August 8-12, 1983 (1983).