

BROADENING THE SCOPE OF THE ILLUSION OF LINEARITY: A CONCEPTUAL REANALYSIS OF PROBABILISTIC MISCONCEPTIONS

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Linear (proportional) relationships are undoubtedly one of the most common models for representing and solving both pure and applied problems in mathematics. But according to several authors, the attention given to linear models in current elementary and secondary mathematics education creates in students a tendency to use these linear models also in situations wherein they are not applicable, e.g. the belief that if the side of a square is doubled, the area also will be doubled (NCTM, 1989). This phenomenon is referred to as the illusion of linearity.

This short oral communication reports the results of a review of the literature about the illusion of linearity in the domain of probability. This literature survey has shown that there are several probabilistic misconceptions that have a remarkable common feature: the fallacious reasoning can be conceptually linked to and possibly explained by an improper application of proportions or linear functions when approaching probabilistic situations. The obtained inventory of linearity-related misconceptions contains both misconceptions that have already been studied intensively before as well as phenomena of a more anecdotal nature found in the literature.

Within the inventory of linearity-related misconceptions, we identified a special category of very closely related erroneous reasonings, wherein there is an improper assumption of a linear relationship between the determining variables of a binomial chance situation. This framework appeared to be a powerful tool to analyse the possible linear reasoning that might be elicited in binomial chance settings. It offered a new viewpoint for looking at some historical and well-known misconceptions and for seeing conceptual links between these – apparently very different – struggles with the laws of probability.

In a next step in our research, we set up an empirical study aimed at investigating to what extent the overreliance on the linear model is indeed the mechanism underlying students' faulty thinking when they suffer from the probabilistic misconceptions that we described in this short oral. The preliminary results are reported in Van Dooren, De Bock, Depaepe, Janssens, & Verschaffel (2002).

NCTM (1989). *Curriculum and evaluation standards for school mathematics*. Reston, VA: Author.

Van Dooren, W., De Bock, D., Depaepe, F., Janssens, D., & Verschaffel, L. (2002). Secondary school students' illusion of linearity: Expanding the evidence towards probabilistic reasoning. *Research report presented at PME26*. Norwich, UK.