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Bidimensional regression beyond goodness-of-fit: measuring geometric distortions in uban mental maps produced by blind people, wheelchair users and people without disabilities

One line of research within disability studies in geography explicitly focuses on the spatial knowledge and competence of people with disabilities, largely on the assumption that a more thorough understanding of the spatial abilities of people with disabilities will contribute, for instance, to creating more effective navigation and orientation devices or to building urban environments more suited to their needs (universal design). Mental maps are one way of studying people's spatial knowledge of a given environment. One method for analyzing mental maps is bidimensional regression, which was originally introduced in the geography literature as a technique to compute the closest fit between two sets of two-dimensional data.

It combines principles of regression analysis (i.e., least-squares methodology) with two-dimensional coordinate transformation models. To date, four models have been mentioned in the literature, three linear and one non-linear in their parameters, with inferential statements proposed for the linear models. When dealing with bidimensional regression models, it is possible to distinguish between the algebraic parameters (i.e., the coefficients found using the least-squares methodology) and the geometric parameters, since for a given model the same algebraic parameters that best fit the data can be expressed as a combination of several different values of geometric transformations carried out in different order. However, this fact has been mostly neglected in the literature on bidimensional regression and, to the author's knowledge, it has not been applied to any data. The author argues that a better understanding of these geometric considerations may help substantiate findings on transformation heuristics already put forward in the cognitive mapping literature. This contribution therefore focuses on the geometric aspects of bidimensional regression by seeking to identify possible differences between blind people, wheelchair users, and people without disabilities in terms of geometric transformation heuristics in relation to the three linear bidimensional regression models.