

Finding Stable Individuals for Reliability Theory: Extending 1908 Spearman-Yule Theory

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Abstract: Measure individuals twice on two occasions with the same or similar tests. The corresponding correlation coefficient r is called a reliability coefficient. Latent variables random effects models form the interpretative framework which holds that a low r indicates test deficiencies. Real differences among individuals are rarely considered as a source of difficulty.

A critical model assumption is that for all individuals, each individual's expected scores on the two occasions match. For many populations such as young children who are easily distracted, may cry, give up, or be influenced in a myriad of ways, such an assumption is patently unrealistic.

In the model proposed, each individual has their own bivariate normal distribution. If the individual's expected values (model means) match the individual is said to be stable and unstable otherwise. The problem is to identify stable individuals from the mixed population of stable and unstable individuals. Classical theory assumes all individuals are stable. The bivariate problem is transformed into a univariate difference score problem resulting in a three component univariate mixture with one stable and two unstable components. The posterior probability of an individual being stable is used in a weighted r to report a more plausible reliability. An example from infant research motivates the model.