

## Abstract for the EMPG 1999 Meeting in Mannheim

### **The Nonparametric Procedure for Comparison of Psychometric Functions**

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Application of the Method of Constant Stimuli (MCS) in psychophysical investigations implies subjects' responses to be statistically independent and stable. Actually a subject's decision making strategy changes during the course of experiment, and his/her responses may depend statistically on each other. Then the statistical estimates calculated as the average of measured values would be not correct. Nevertheless, special statistical procedures intended for testing MCS data reliability are usually not employed, and measurement errors are most often ignored. A nonparametric procedure is suggested to test whether results obtained in different experimental sessions (or under varied conditions) are statistically the same. The null hypothesis is that the probabilities of a subject's 'Yes' responses are equal in all experiments for given stimulus magnitude, for which data may be presented as a contingency table. The decision is based on the value of chi-square statistic for a set of these tables. The additivity property of the chi-square distribution is used to compare data of MCS experiments as a whole. Thus, the overall measure of discrepancy for all tables simultaneously is the sum of the respective measures of each table. However this test cannot be applied to experimental data immediately: chi-square statistic is suitable only on specified conditions. So in some cases results of measurements for adjacent stimuli should be combined, pooling the data to form a single table for a set of stimuli close in magnitude. Unfortunately there is no general solution with regard to what grouping rule is optimum, but the pooling categories may significantly affect the inference and its interpretation. So, an algorithm was designed to assess influence of grouping on the estimate. We illustrate this approach by analyzing results of a large set of MCS experiments on discrimination of the lines lengths. The technique was used to test two hypotheses: Test 1: Whether results of a set of experiments, conducted independently of each other may be considered as statistically equivalent. Test 2: Whether the subject's response depends statistically on his preceding decisions. To do this all set of experimental data should be split into two subsets depending of the subject's preceding response. Then these subsets can be compared as different 'experiments'. In general, the method of splitting a data set could be employed to verify a variety of hypothesis about subject's strategies. Exploratory analysis of primary data using a developed algorithm has revealed some peculiarities that are usually not detected by an ordinary statistical data processing, but may have effect on final results. As it would be expected, at least one of assumptions mentioned above is not supported for considerable part of untrained subjects. They often use a strategy of orientation to preceding response, but a few of them apply this strategy regularly.