New methods for the validation of scoring results in the classification procedure of equine conformation

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New methods from the field of image analysis have been used for the description of shape variation within a herd of Lipizzan horses from the state stud farm of Piber. This variation can be expressed in a set of so called "shape variables. Based on 246 two-dimensional anatomical and somatometric landmarks, digitized from standardized photographs we applied generalized orthogonal least-squares Procrustes (GPA) procedures and the resulting shape variables have been regressed to the results from linear type trait classifications. The relation of the classification results and the biological shape variation of the horses also can be expressed grafically and be tested for significance for a correct ranking. The rating scores of eight conformation classifiers were tested for agreement yielding an inter-rater correlation ranging from 0.30 to 0.69, respectively a Kappa coefficient ranging from 0.08 to 0.53. From the twelve linear type traits assessed on a valuating scale, only the type related traits (type, breed type and harmony) revealed significant results in a regression analysis of the biological shape variables of horses and their linear type traits. The other functional traits were characterized by a lower agreement between classifiers and didn't result in a significant shape regression.

In this research project we examine which strategies and procedures of image processing techniques in horses may lead to a successful interpretation of the traits (Druml et al., 2015). Moreover, we test the applicability and the possibilities of image analysis for the purpose of animal breeding where the body shape – also called *conformation* – is a central part of breeding and selection concepts. Based on two-dimensional anatomical and somatometric landmarks digitized from standardized images, variation of shape within a population of Lipizzan horses was analyzed using generalized orthogonal least-squares Procrustes (GPA) procedures and correlated to the results from linear type trait classifications. The combination of "objective" measures from the horse shapes and the evaluations from the classifiers could be a tool for standardizing and fine calibrating selection procedures and breeding objectives (see Figure 1). The objective of the "new phenotyping" is to increase the accuracy, objectivity and throughput of phenotypic estimation and it can be a tool for the definition of a breeding objective as well a discrimination tool for the selection of appropriate animals from different genetic background or genealogical origin. It also can be used for calibration of judges' classifications and as a training and evaluation tool for harmonizing the judges' classifications.

Fig.1. Graphical summary of a novel method of phenotyping which is used for analysing breeding objectives and subjective ratings of classifiers.

1) Mean shapes and shape distribution in Lipizzan mares (left) and stallions (right)

2) Averaged shape of the "mean" Lipizzan stallion in the stud farm of Piber

atypical ← → *typical*

3) Ratings of classifiers (trait type) regressed on the shape variables of Lipizzan stallions and recalculated for the trait type = 5, mean of type = 7.8, type = 10. Shape changes according to the judges ratings also were used for the recalculation of averaged images (left type score of 5, right type score of 10) – the negative and positive "ideals" of the breeding objective within one trait.