7 Summary

Bettina Siemers: Behavioral analytic investigations of color vision in farm animals (african dwarf goat, *Capra hircus,* L.)

1. An existing software was modified and (continued) developed further for presentation of color stimuli on an RGB-monitor, which was a part of the apparatus for color choice experiments with dwarf goats . The program registers each animal that wears a responder, records the choices, and regulates the water reward. (**Kap. 2**).

2. The color stimuli were measured with a simultaneous spectral photometer (Oriel, Darmstadt) at different intensities and graphically shown in dependence on the wavelength (**Anhang A**).

3. There was no preference for or dislike against one of the color stimuli “red“, “green“ or “blue“ in spontaneous unrewarded tests (**Kap. 3.1.1**, **Kap. 3.1.2**).

4. Learning curves were measured for each animal. The curves show differences in learning speed and give the acquisition level, which was > 95 % correct choices for all tested animals (**Kap. 3.2**).

5. It was shown by two different methods that there exists an absolute threshold (Up and Down Method). Each animal shows intensity graphs (random order) that demonstrate the choice frequency in dependence to relative intensities for each color stimulus (**Kap. 3.3, 3.4**). That these intensity graphs are approximate sigmoidales.

6. At an absolute threshold of 90 % correct choices, equally bright color stimuli were read off the intensity graphs and tested against an equally bright achromatic color stimulus. All animals discriminated the color stimuli “red“, “green“ and “blue“ with at least 68 % correct choices from equally bright “gray“ light. The color stimuli “yellow“, “turquoise“ and “violet“ were discriminated with at least 60 % correct choices (**Kap. 3.5**).

7. In order to test the dependency of the results to the equal-brightness-criterion for the color stimuli, the intensity of the alternative color stimuli was varied. The discrimination graphs show distinct minima indicating the minimal color stimulus differences between "gray" light and the alternative color stimuli “red“, “green“ and “blue“, for each animal. These minima were > 68 % for all animals. The minimal color stimulus differences for “turquoise“ were close to the confusion point of 50 %, whilest there was a higher level for “yellow“ and “violet“ light (> 75%) at the minimum (**Kap. 3.6**).

8. Licht mixture experiments with a „gray“ color stimulus and color stimuli of different intensities with a minimal color distance to “gray“ show different graphs with different steepness for the color stimuli “red“, “green“ and “blue“ (**Kap. 7**).

9. The learning-curves (**Anhang D**) of the 9 male dwarf goats show a smaller learning speed, than those of the females (**Anhang C**). The intensity graphs show also differences and brought out other equally bright color stimuli, which were the basis of the light mixture experiments for the male animals (not minimal difference to “gray“). Percentual “red”-“white“ light mixtures reach the confusion point at 70% “white”-light, “green”-“white“-light mixtures at 90% “white”-light for all animals. The graphs of the “blue”-“white“-light mixtures did not show a confusion point at any percentual “white”-light percentage, except for one animal which showed a confusion point at 70% “white”-light (**Kap. 3.7**).

10. Dwarf goats are trichromats and their color stimulus discrimination space is three-dimensional.