

Refer to as: Bogerd CP & Brühwiler PA (2009). Thermal perception of ventilation changes in full-face motorcycle helmets. In: 4th European Conference on Protective Clothing (Dezaire J, Den Hartog E & Luiken A, eds.), 10 – 12 June, 2009, Arnhem, the Netherlands, pp 41.

THERMAL PERCEPTION OF VENTILATION CHANGES IN FULL-FACE MOTORCYCLE HELMETS

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Unfavorable temperature perception and thermal discomfort are often given as reasons for not wearing motorcycle helmets. The effects of operating the ventilation systems equipped on such helmets perception are currently unknown. The motivation for the present work is to systematically study effects of these on wearer comfort.

Eight subjects (aged 28.0 ± 5.4 years) underwent two experimental trials in a climate chamber at 23.7 ± 0.4 °C or 27.5 ± 0.3 °C, offered in a balanced order. In each trial, the acclimated subject underwent two examination phases, each lasting approximately 20 min. To investigate the effects of the ventilation system, the vent configuration (all open or all closed) was changed in the scalp section, directly followed by perceptual assessment of i) temperature, ii) airflow, iii) noise, and iv) thermal comfort. Four helmets differing in their heat transfer characteristics were assessed during a given examination phase, taking about 5 min per helmet at a wind speed of 39.2 ± 1.9 km/h or 59.3 ± 1.4 km/h. The subjects experienced both wind speeds at each of the ambient temperatures. After changing the helmet each subject sat still for 3 min, upon which the vent configuration was changed and he was asked to evaluate his perception of possible changes. Similar assessments were made for the face. The four full-face motorcycle helmet models employed in this study presented conditions ranging from high to very low vent-induced heat loss ($\Delta\dot{Q}$).

$\Delta\dot{Q}$ in the scalp ranged from -6.1 W to 6.1 W. $\Delta\dot{Q}$, subject and helmet are identified as the most important predictors of the response behavior. Additional analysis yielded the following observations: i) perception thresholds, suggesting a higher likelihood of the subjects to perceive opening of vents compared to closing; ii) helmet specific sensitivities, possibly caused by different internal airflow patterns; finally, iii) strong similarity in the perception of temperature and airflow for both the scalp and face.

An extensive description of this study is published in: Physiological and cognitive effects of wearing a full-face motorcycle helmet. Ph.D. thesis, ETH Zurich, Switzerland, available at www.nielsbogerd.com.