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Letter to the Editor

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Dear Editor,

Hereby we reply to a letter from Antonio J. Del Águila-Carrasco and Iván Marín-Franch concerning the recent study by Leube, Kostial, Alex Ochakovski, Ohlendorf, and Wahl (2018).

In Leube et al. (2018) the authors report on experiments, conducted under monochromatic lighting conditions, where the reduction of visual acuity (VA) due to induced spherical defocus was symmetric between negative and positive defocus. In a second experiment, the optical vergence as a possible influencing factor was removed by using simulated defocus and again, the reduction in VA was symmetric between positive and negative induced spherical defocus. In line with previous studies (Fincham, 1951; Kruger, Mathews, Aggarwala, & Sanchez, 1993), the conclusion was drawn that the longitudinal chromatic aberration of the eye provides a directional cue for the visual system to detect the sign of defocus. Based on the missing significant difference between the conditions "vergence + blur" and "blur-only", a second, more speculative conclusion was made that "[…] high spatial frequency channels have no input from light vergence for the detection of the sign of defocus, or in any case, its input does not affect VA."

In comparison to the recent studies from Del Águila-Carrasco et al. (2017) and Marín-Franch et al. (2017), the main difference is the spatial frequency content of the used stimulus. The experiments described by Del Águila-Carrasco and Marín-Franch are based on investigations of the accommodative response using a Maltese cross as a stimuli and monochromatic lighting conditions, either with or without optical vergence. This stimulus contains a variety of spatial frequencies (Okada et al., 2006) and it was previously shown that the accommodative response depend on the spatial frequency distribution of the target (Bour, 1981; Charman & Tucker, 1977). Since the study by Leube et al. (2018) was based on the measurement of the resolution ability of an spatial stimuli (using a Landolt C), the visual system was exhibited to only a single spatial frequency, which was in case of the visual acuity, the smallest just resolvable frequency. This important difference in the visual task and the spatial frequency distribution of the used stimuli was emphasised by Leube et al. (2018), when the authors acknowledged in their discussion that "Further investigations will have to show if the results are valid also for low-frequency channels in the visual system, as it is known that accommodation responds best to light vergence at intermediate spatial frequencies of around 3–5 cycles per degree (Mathews & Kruger, 1994)." Additionally, from studies in polychromatic light it is known that differences between positive and negative induced defocus depend on the spatial frequency as well (Leube, Ohlendorf, & Wahl, 2016; Radhakrishnan, Pardhan, Calver, & O'Leary, 2004). We suggest to design further experiments to investigate the influence of the spatial frequency content on the ability of optical vergence to provide directional cue.

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