**Transparent Motion is Always More Likely for Plaids Moving along Oblique Directions than for Plaids Moving along Cardinal Directions.**

J.M. Hupé, N. Rubin. Center For Neural Science, New-York University, NY.

**Background**: Plaids are bi-stable stimuli that can be perceived either as a coherent pattern moving rigidly or as two gratings sliding over each other (Wallach '35, '96). Many studies examined the tendency to perceive one or the other percept by manipulating a variety of parameters. However, most studies used plaids moving only along cardinal directions. To our surprise, informal observations showed that moving the pattern along oblique directions could have a marked effect on the relative strength of coherency versus transparency (tilt your head!). The **purpose** of this study was to quantify this effect. **Methods:** Observers pressed a mouse button as soon as they started to perceive motion transparency, providing the reaction time to see sliding, denoted $RT_{transp}$. Plaid parameters (direction of motion, angle between gratings, speed, duty cycle) were varied. We tested eight directions of pattern motion (step = 45 deg). **Results:** Plaid direction had a very strong effect on $RT_{transp}$, e.g., stronger than a threefold change in stimulus speed, for all 9 subjects. Oblique directions produce shorter $RT_{transp}$ than cardinal directions. Plaids moving in the horizontal directions take the longest to slide. Plaids moving in vertical directions produce intermediate $RT_{transp}$: the values were closer to vertical $RT_{transp}$ were closer to oblique values for some subjects, and to horizontal $RT_{transp}$ for others (for one subject, vertical plaids were slightly longer to slide than horizontal ones). There is strikingly little interaction between the pattern direction of motion and the other parameters: whatever the choice of angle, speed and duty cycle, $RT_{transp}$ is always longer when the pattern moves in cardinal directions. Preliminary results from a control experiment found little if any effect of cardinality of grating (component) direction. **Conclusions**: The existence of a cardinal direction bias imposes an important constraint on models of motion transparency: no model that relies solely on *relative* differences in directions and/or orientations in the stimulus can predict our results. In particular, the cardinality effect may be used to test proposed correspondence between model units and specific neuronal populations.

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