

Introduction:

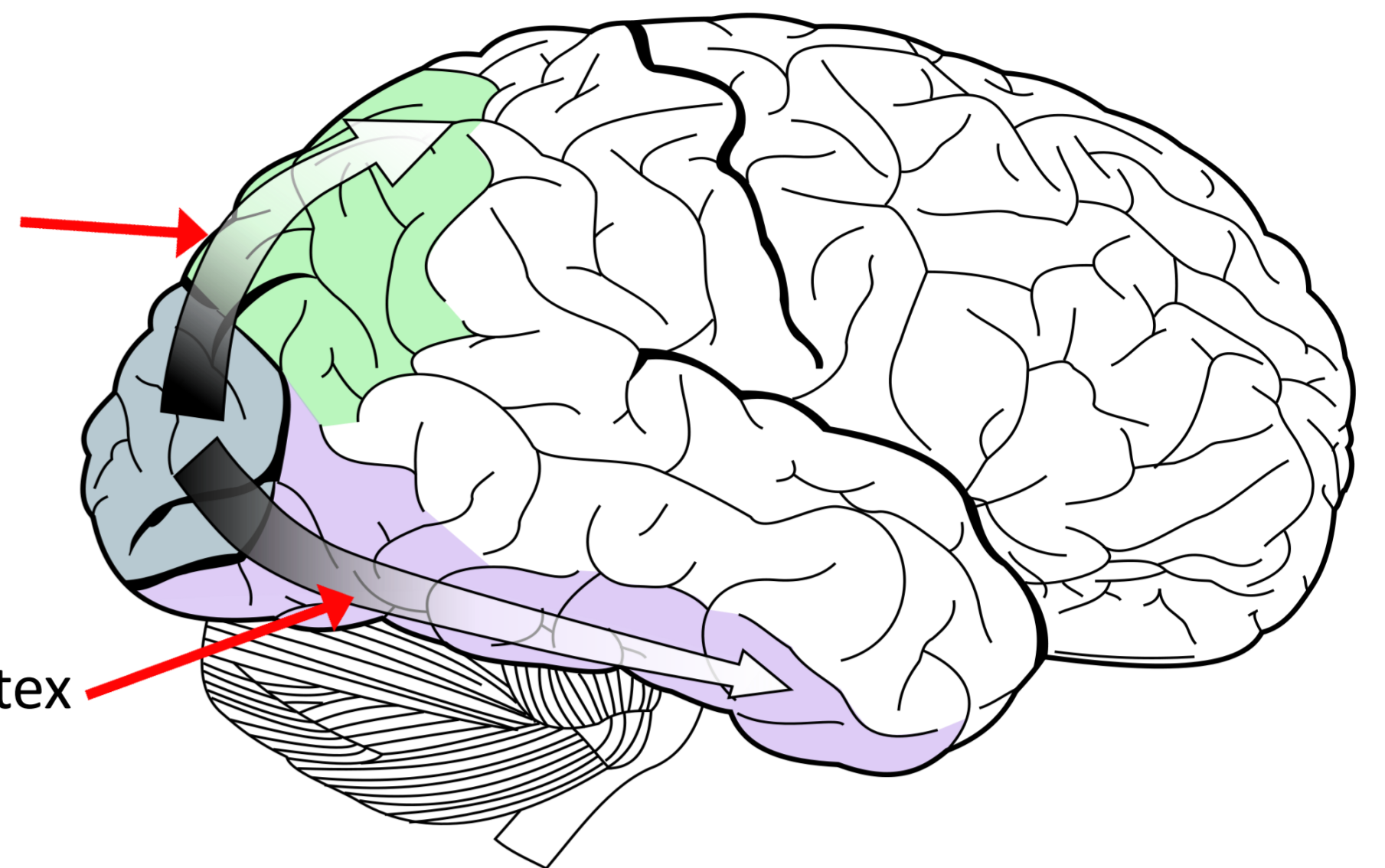
- Previously, dorsal and ventral streams have been evaluated separately with respect to their implied functions¹.
- Here, we designed an experiment where one can:
 1. concurrently test and compare how different/similar their performance will be when tested on an (almost) identical dimension.
 2. parse out the influences of local and global constraints on motion and form integration using the equivalent noise approach.

dorsal stream

- V1→MT→parietal cortex
- motion processing

ventral stream

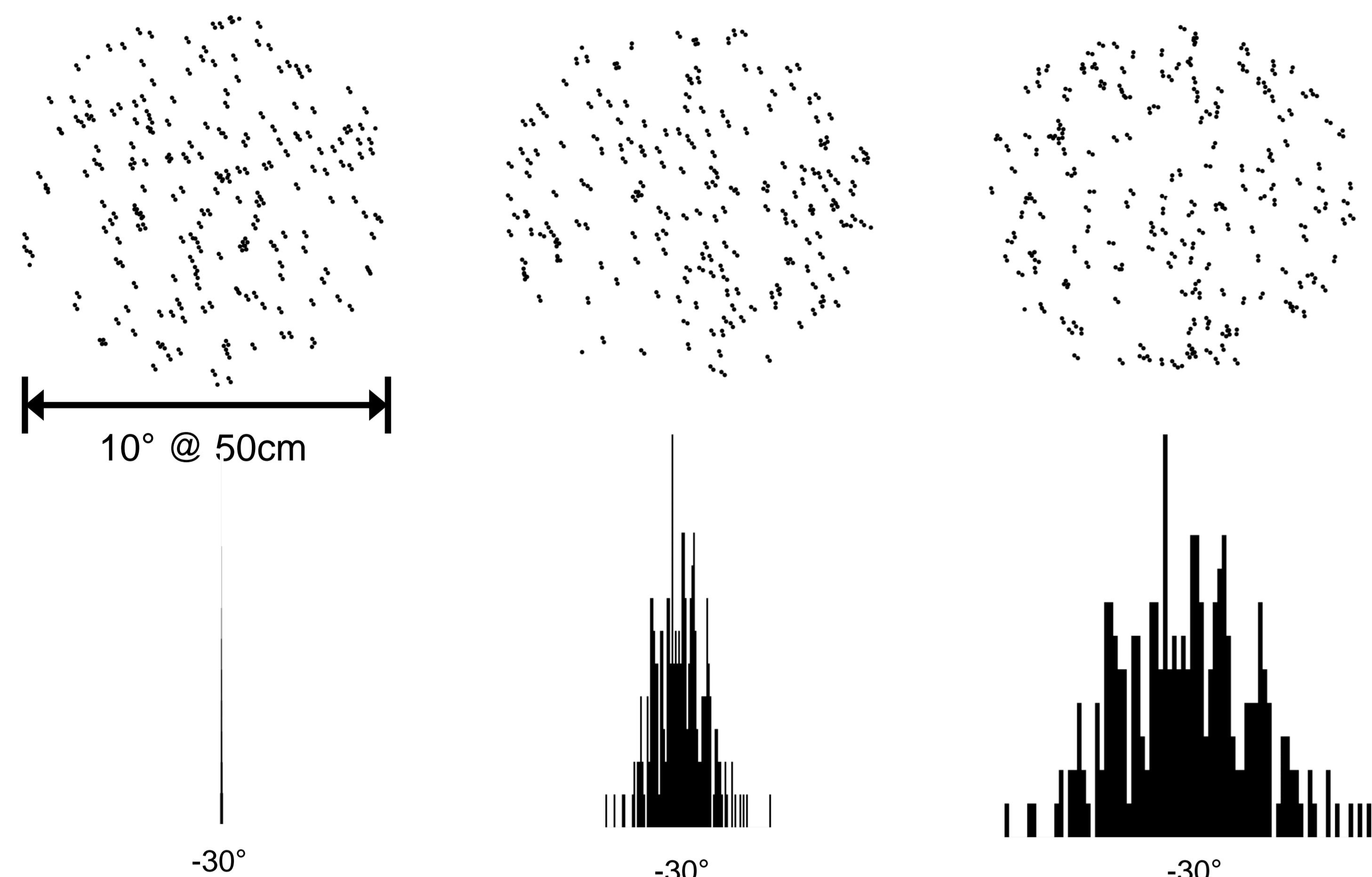
- V1→V2→V4 → temporal cortex
- form perception



$$\mu = -30^\circ, \sigma = 0^\circ$$

$$\mu = -30^\circ, \sigma = 45^\circ$$

$$\mu = -30^\circ, \sigma = 120^\circ$$



Method:

- Observers: 3 males, 1 female (normal, corrected normal acuity)
- Stimuli:

	RDK	Glass
dot size	0.083°	
number of dots	500	500 (250 dipoles)
dot to dot distance	N/A	0.133°
speed of dots	10°/sec	N/A
duration	500msec	
task	direction discrimination	orientation discrimination
variances (deg)	1, 5, 15, 30, 45, 60, 90, 120	

Fig: Example of Glass pattern stimuli to show how they were sampled from the Gaussian distributions with prescribed means & s.d.s

Results:

- Discrimination threshold for both stimuli were constant at lower variance before increasing proportionately with increased variance level.
- Threshold for Glass pattern was consistently higher than that for RDK at different orientation/direction variance evaluated. [mean (n=4) log threshold ratio (Glass/RDK) = 1.503±0.24]
- Thresholds between Glass and RDK seemed to run parallel across external noise, suggesting the difference in efficiency between the streams.³

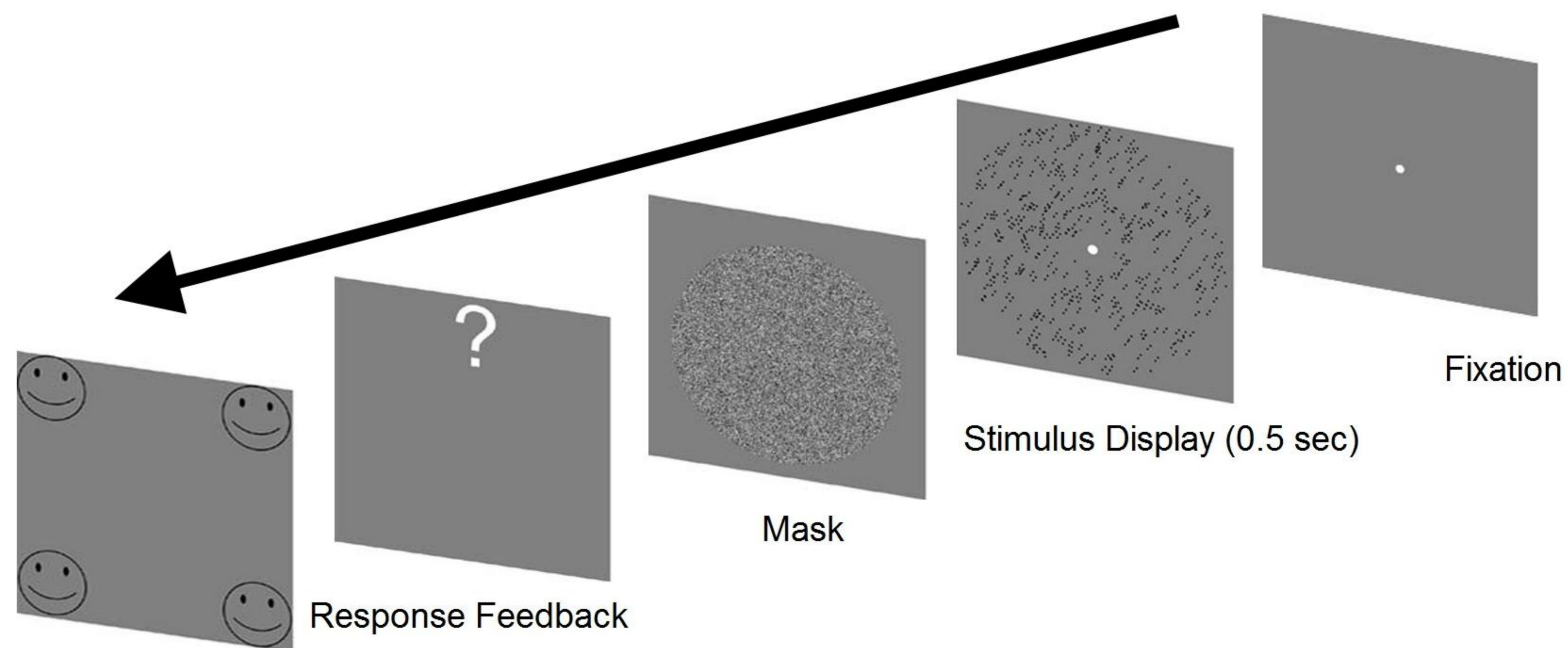
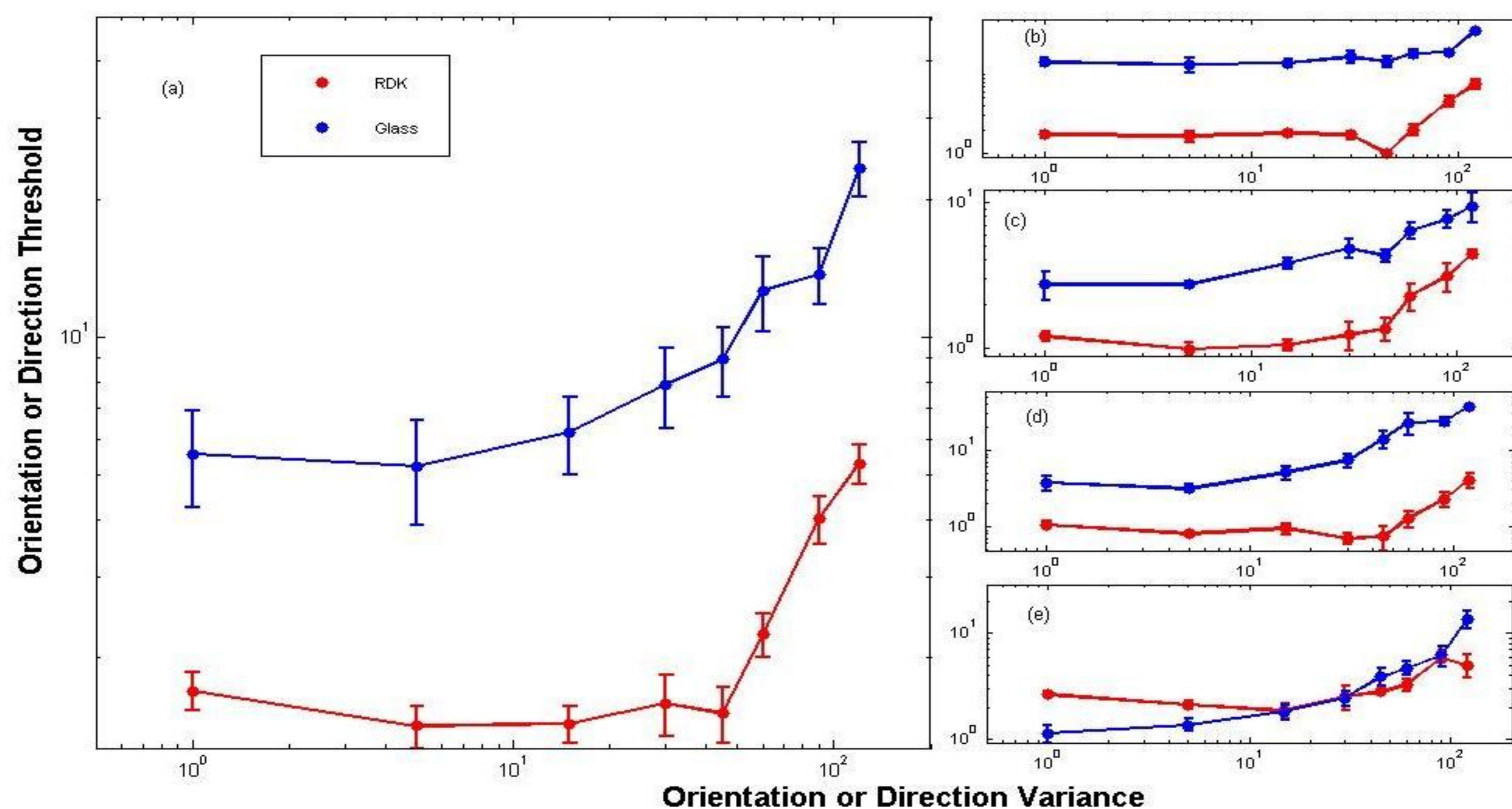


Fig: Schematic representation of a single trial of experiment. Stimulus display shows rightward oriented Glass pattern.



Discussion:

- Observers were more efficient at global motion processing in comparison to global form processing at all levels of external noise.
- Both processing stream is limited by similar internal noise.
- In the future, functional mechanisms of both pathways will be quantitatively modelled with consideration of noise.

References:

1. McIntosh, R. D. and T. Schenk (2009). "Two visual streams for perception and action: current trends." *Neuropsychologia* 47(6): 1391-1396.
2. Glass, L. (1969). "Moire effect from random dots." *Nature* 223(5206): 578-580.
3. Pelli, D. G. (1990) The quantum efficiency of vision. In: C. Blakemore (Ed.) *Vision: Coding and Efficiency* (pp. 3-24). Cambridge: Cambridge University Press.

Fig: Thresholds for direction (RDK) and orientation (Glass) discrimination at different variance levels. Each data point represents the mean value of four observers (a) and individual observers (b,c,d,e). Error bars represent ±1 standard error of mean.