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Supplementary Materials for

Stereopsis is adaptive for the natural environment

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The PDF file includes:

Fig. S1. Distributions of fixation distances and scene distances for the four tasks.
Fig. S2. Median, SD, skewness, and kurtosis of the distributions of horizontal and vertical disparities for each subject and task.
Fig. S3. Cumulative version error distribution across all subjects and all calibrations.
Table S1. Experimental setups and coordinate system conventions in Cumming (*1*), Durand *et al.* (*2*), Gonzalez *et al.* (*65*), Prince *et al.* (*7, 66*), and Samonds *et al.* (*67*).
Legends for movies S1 and S2

Other Supplementary Material for this manuscript includes the following:
(available at www.advances.sciencemag.org/cgi/content/full/1/4/e1400254/DC1)

Movie S1 (.mp4 format). Video showing the distribution of horizontal disparity as a function of elevation.
Movie S2 (.mp4 format). Video showing the distribution of horizontal disparity as a function of azimuth.
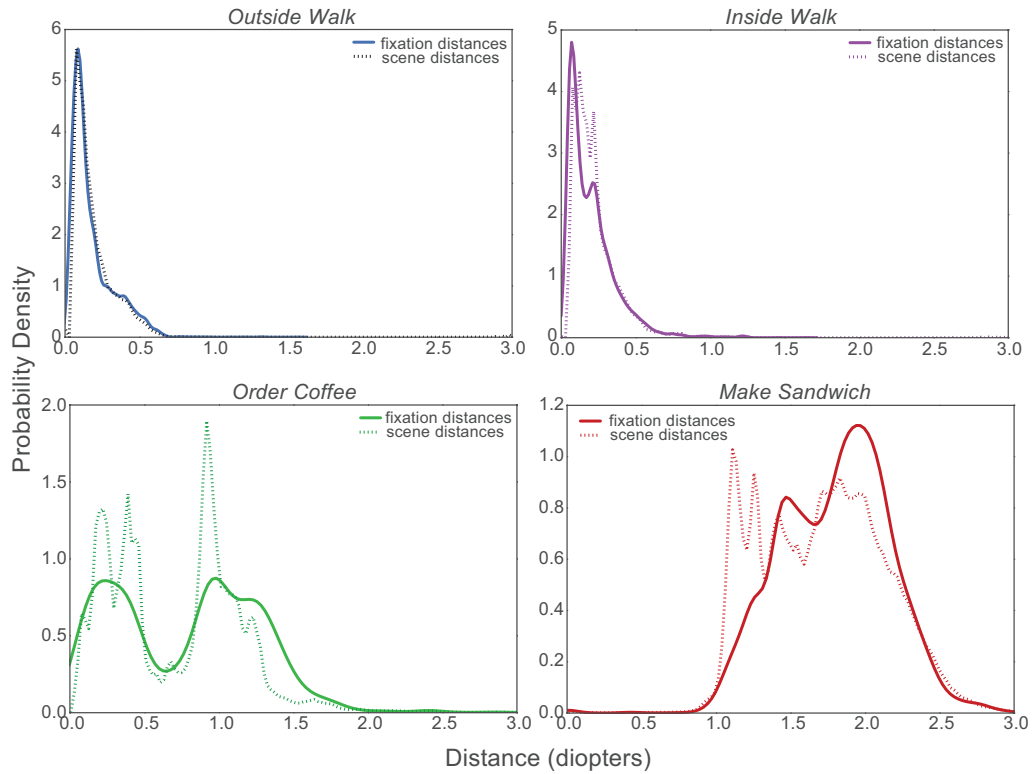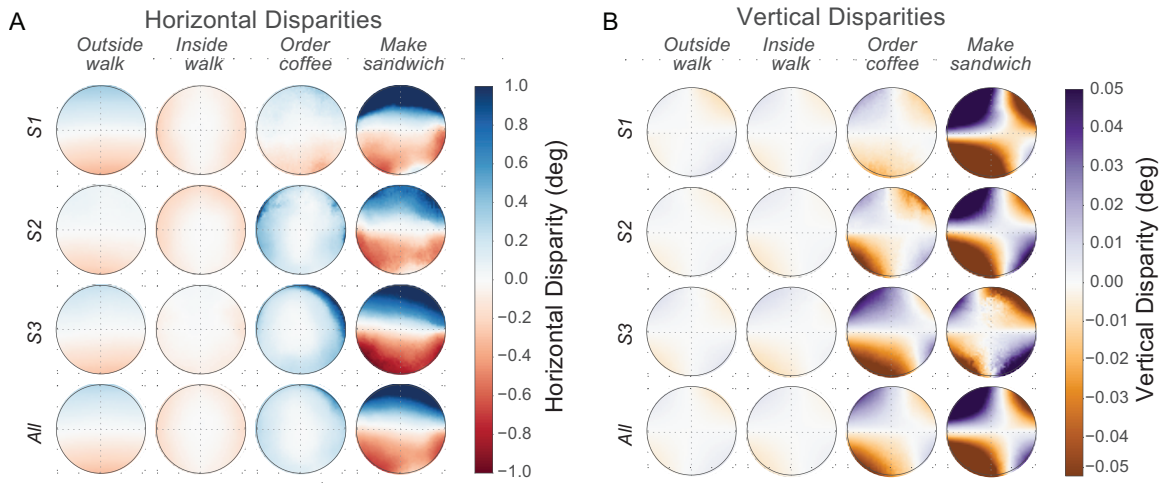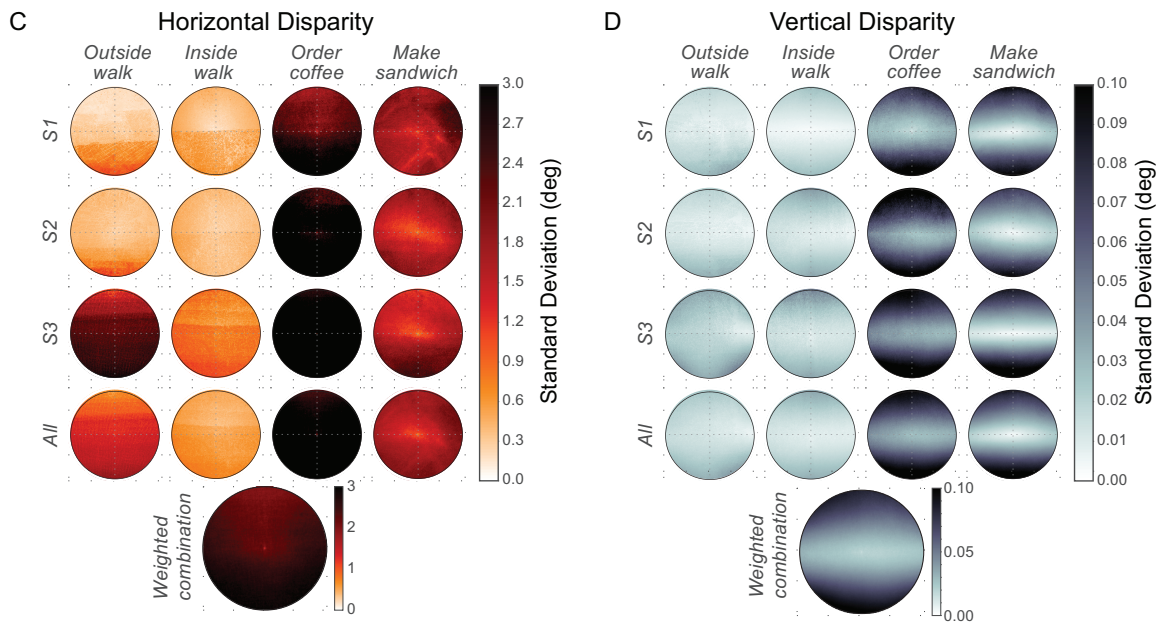
Fig. S1. Distributions of fixation distances and scene distances for the four tasks. Each panel plots the probability of different fixation distances and scene distances as a function of distance in diopters (where diopters are inverse meters). The solid curves represent the distribution of fixation distances averaged across subjects. The dashed curves represent the distribution of distances of visible scene points, whether fixated or not, within 10° of the fovea. All distances are measured from the mid-point on the inter-ocular axis (the cyclopean eye). The median distances for scene and fixation points are: *Outside walk*: fixations 0.125D (800cm); scenes 0.135D (741cm). *Inside walk*: fixations 0.160D (625cm); scenes 0.179D (559cm). *Order coffee*: fixations 0.890D (112cm), scenes 0.731D (137cm). *Make sandwich*: fixations 1.837D (54cm), scenes 1.722D (58cm).

Median

A Horizontal Disparities

Outside walk *Inside walk* *Order coffee* *Make sandwich*

S1

S2

S3

All

Horizontal Disparity (deg)

B Vertical Disparities

Outside walk *Inside walk* *Order coffee* *Make sandwich*

S1

S2

S3

All

Vertical Disparity (deg)

Standard Deviation

C Horizontal Disparity

Outside walk *Inside walk* *Order coffee* *Make sandwich*

S1

S2

S3

All

Weighted combination

Standard Deviation (deg)

D Vertical Disparity

Outside walk *Inside walk* *Order coffee* *Make sandwich*

S1

S2

S3

All

Weighted combination

Standard Deviation (deg)

Skewness

E Horizontal Disparity

F Vertical Disparity

Kurtosis

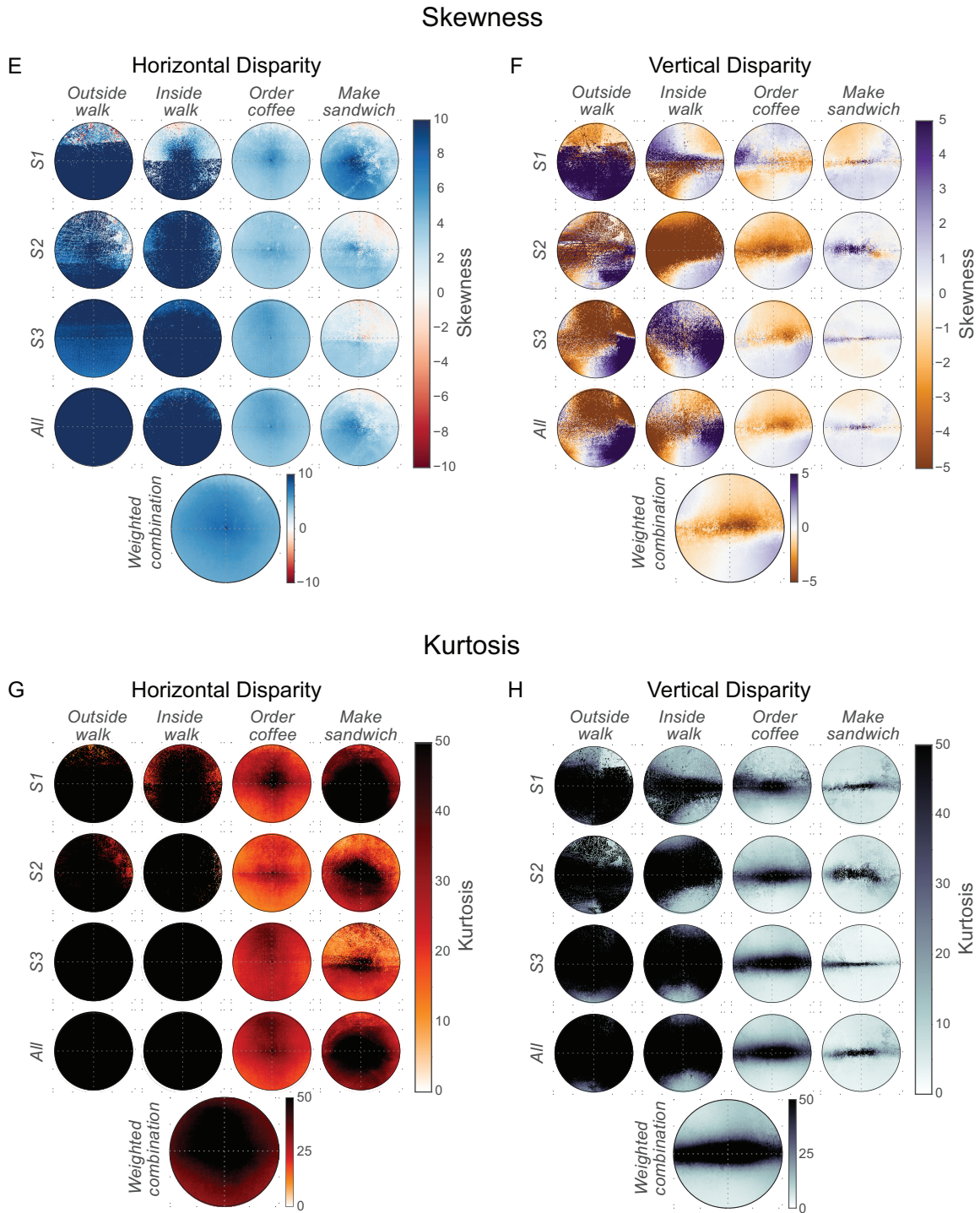**G** Horizontal Disparity

H Vertical Disparity

Fig. S2. Median, standard deviation, skewness, and kurtosis of the distributions of horizontal and vertical disparity for each subject and task. Each panel plots the statistical property as a function of visual-field position with the fovea in the center. **(A)** The medians for the horizontal-disparity distributions. The columns show the values for the four tasks. The rows show the values for the three subjects and the across-subject averages. **(B)** The medians for the vertical-disparity distributions. **(C)** The standard deviations for the horizontal-disparity distributions. **(D)** The standard deviations for the

vertical-disparity distributions. The larger panels at the bottom show the values for the weighted-combination data. Darker colors represent greater standard deviations. The standard deviation is by definition zero at the fovea. It remains low along the horizontal meridian in the vertical-disparity distributions because vertical disparity is zero along that meridian when the eyes are torsionally aligned. The standard deviation of horizontal disparities is task dependent being greatest in the order-coffee task and lowest in the indoor-walk task. **(E & F)** Skewness of the distributions of horizontal and vertical disparity for each subject and task. Skewness is a measure of the asymmetry of a distribution about its mean:

$$S = E\left[(X - \mu)^3\right]\Big/\sigma^3$$

where X is the data, μ the mean, and σ the standard deviation. Darker colors represent more positive skewness. Positive skewness means that the distribution has a longer tail toward positive values: in our case, toward uncrossed disparity. **(G & H)** Kurtosis of the distributions of horizontal and vertical disparity for each subject and task. Kurtosis is a measure of the "peakedness" of the distributions of disparity:

$$K = \left([E(X - \mu)^4]\big/\sigma^4\right) - 3$$

where X is the data, μ the mean of the data, and σ the standard deviation. Darker colors represent greater kurtosis or more peaked distributions. The kurtosis is very high in the horizontal-disparity distributions. For comparison, K is 0 and 3 respectively for Gaussian and Laplacian distributions.
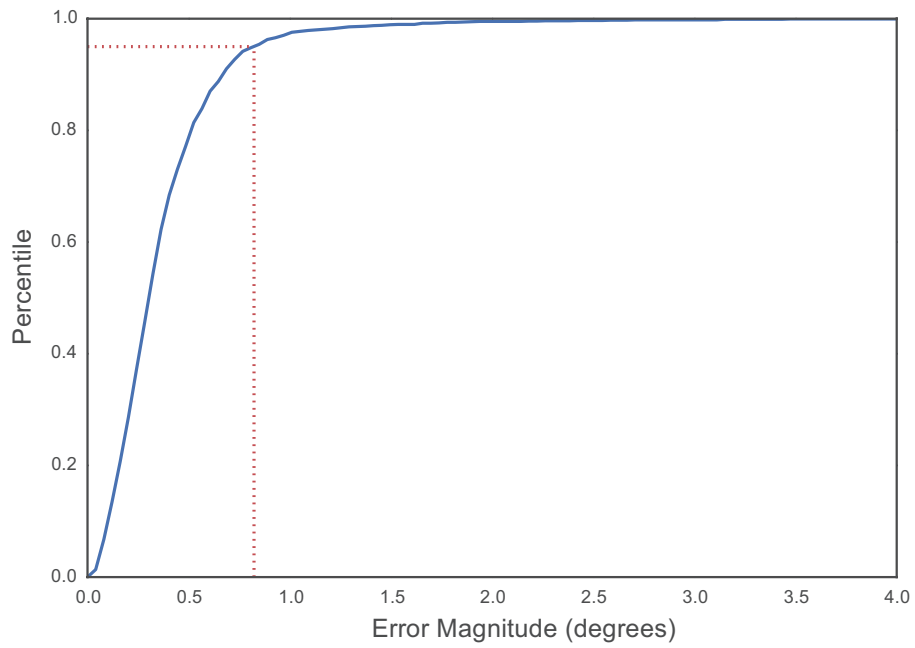
Fig. S3. Cumulative version error distribution across all subjects and all calibrations. The median error magnitude was 0.29º. 95% of the errors were less than 0.82º (red dotted line).

Table S1. Experimental setups and coordinate-system conventions in Cumming (2002), Durand et al., (2007), Gonzalez et al. (2010), Prince et al. (2002), and Samonds et al. (2012). We took the geometry of the setups into account and unified these conventions into one Helmholtz coordinate system (see Materials and Methods).

Author	Screen Distance	Horizontal VF Convention	Vertical VF Convention	HD Convention	VD Convention	Viewing Geometry
Cumming	89cm	Left is positive (deg from centerline)	Up is positive (deg from centerline)	Negative is crossed (L-R)	Positive is left eye higher (L-R)	Haploscope simulating single screen
Durand	50cm	Right is positive (assumes 1cm = 1deg)	Up is positive	Negative is crossed (R-L)	Positive is right eye higher (R-L)	Single screen
Gonzalez	57.7cm	Right is positive (assumes 1cm=1deg)	Up is positive	Negative is crossed (R-L)	NA	Wheatstone haploscope w/ eyes parallel
Prince	89cm	Left is positive (deg from centerline)	Up is positive (deg from centerline)	Negative is crossed (L-R)	NA	Haploscope simulating single screen
Samonds	57cm	Right is positive (assumes 1cm=1deg)	Up is positive	Negative is crossed (R-L)	NA	Single screen
Us	NA	Left is positive (deg latitude)	Up is positive (deg longitude)	Negative is crossed (L-R)	Positive is left eye higher (L-R)	NA

Movie S1. Video showing the distribution of horizontal disparity as a function of elevation. The weighted-combination data were used to generate the distributions. The circle in the upper right represents the central 20° of the visual field. The dot along the vertical meridian indicates the position in the visual field being sampled. In the main panel, horizontal disparity is plotted on the abscissa and probability density on the ordinate. As the video runs, the region of interest moves downward along the vertical meridian, showing how the distribution shifts with visual field location. The vertical dashed line indicates a disparity of 0° and the solid red line indicates the median disparity.

Movie S2. Video showing the distribution of horizontal disparity as a function of azimuth. The weighted-combination data were used to generate the distributions. The circle in the upper right represents the central 20° of the visual field. The dot along the horizontal meridian indicates the position in the visual field being sampled. In the main panel, horizontal disparity is plotted on the abscissa and probability density on the ordinate. As the video runs, the region of interest moves rightward along the horizontal meridian, showing how the distribution changes with visual field location. The vertical dashed line indicates a disparity of 0° and the solid red line indicates the median disparity.