Title: Database of movement behavior and EEG in virtual audiovisual everyday-life environments for hearing aid research.

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This database contains movement behavior (head, eye, torso) and EEG signals of 21 young normal-hearing (11 male, 11 female, mean age 25 +/- 3.6 years) and 19 elderly normal-hearing subjects (9 male, 12 female, mean age 69 +/- 5.4 years) measured in virtual audiovisual listening environments in the laboratory. The virtual audiovisual environments that were used are: a living room, a lecture hall, a cafeteria, a street and a train station. The video and audio material for the environments is also available (see Related identifiers). The methods and an analysis of the movement behavior are described in Hendrikse et al. (2019). The supplementary materials to this paper that are published here include plots of the gaze trajectories of the subjects in all environments, plotted separately for the young and elderly subjects so that they can be compared, and histograms of the head-, eye- and torso-rotation for the environments that were not included in the paper.

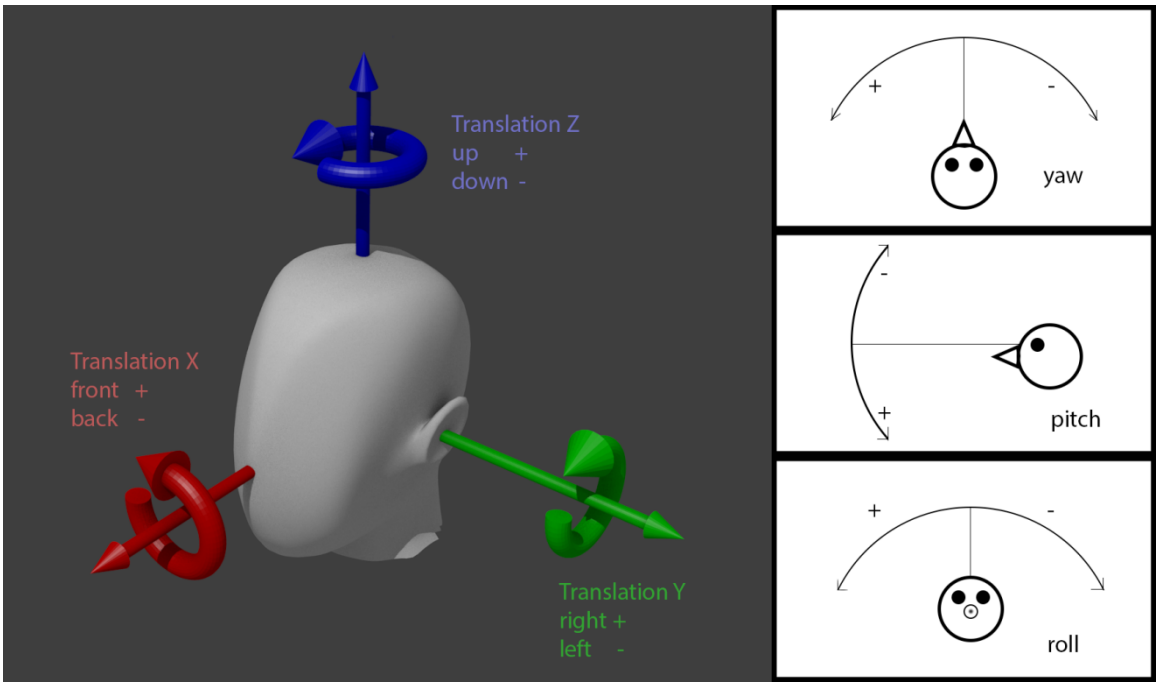

Figure 1: Coordinate system used for the measurements, positive directions and rotations relative to the head of the subject are indicated.

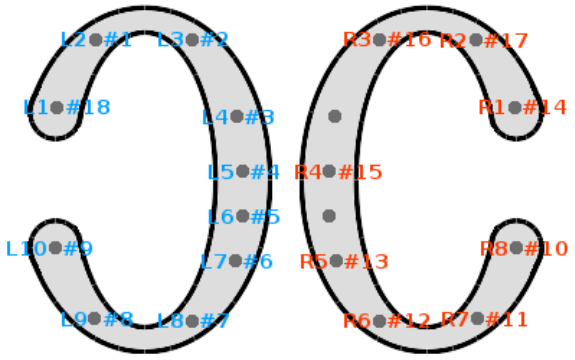

Figure 2: Schematic overview of cEEGrid electrode configuration for 18 channels with electrode labels and corresponding channel numbers

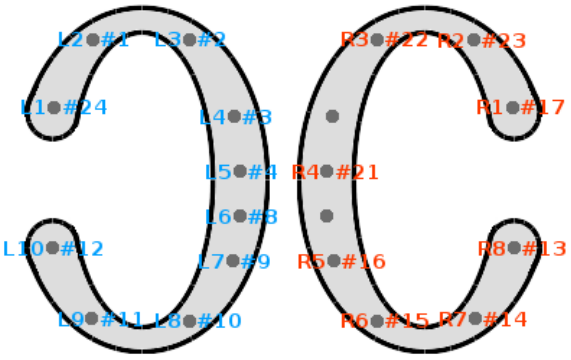

Figure 3: Schematic overview of cEEGrid electrode configuration for 24 channels with electrode labels and corresponding channel numbers

File structure:

-+ Movement behavior.zip	// Zip containing the movement behavior data and calculated measures
|-+ movement_traces.mat	// MAT-file containing the movement behavior variables. All recorded data is resampled to the same time line, with a sample rate of 120 Hz. In the following descriptions, "N" stands for the number of samples, which depends on the duration of the environment. Positive directions of translations and rotations are indicated in Figure 1.
|-eyeangles	// 7x1 cell with 1 cell for each environment (order in "scenes"), containing an Nx41 matrix with the time in the first column and the eye angle relative to the head in degrees for all subjects in the other columns (subject order in "subID").
|-gazedirs	// 7x1 cell with 1 cell for each environment (order in "scenes"), containing an Nx41 matrix with the time in the first column and the gaze direction in degrees for all subjects in the other columns (subject order in "subID").
|-gazedirs_smoothed	// 7x1 cell with 1 cell for each environment (order in "scenes"), containing an Nx41 matrix with the time in the first column and the gaze direction smoothed with a span of 20 samples in degrees for all subjects in the other columns (subject order in "subID").
|-headdirs	// 7x3 cell with 1 cell for each environment (order in "scenes"). The columns contain the data for the different head rotation axes: the first column contain the yaw, the second the pitch and the third the roll. Each cell contains an Nx41 matrix with the time in the first column and the head angle in degrees for all subjects in the other columns (subject order in "subID").
|-headtranss	// 7x3 cell with 1 cell for each environment (order in "scenes"). The columns contain the data for the different head translation axes (order: xyz, front-back, left-right, top-bottom). Each cell contains an Nx41 matrix with the time in the first column and the head translation in metres for all subjects in the other columns (subject order in "subID").
|-scenes	// 1x7 cell containing the names of the environments in the same order as in the data cells (i.e. cell 1x1 corresponds to cafeteria_dualtask, cell 2x1 to cafeteria_listeningonly)
|-subID	// 1x40 cell containing the anonymous ID strings of the subjects, which are ordered in the same way as the variables gazedir etc.
|-subID_old	// 1x19 cell containing the anonymous ID strings of the elderly subjects (last 19 of subID)
|-subID_young	// 1x21 cell containing the anonymous ID strings of the young subjects (first 21 of subID)
|-torsoangles	// 7x1 cell with 1 cell for each environment (order in "scenes"), containing an Nx41 matrix with the time in the first column and the torso rotation around the z axis in degrees for all subjects in the other columns (subject order in "subID").
|+- distractor_positions.mat	// MAT-file containing the distractor positions for each environment. Positive directions are indicated in the figure "headorientation.png".
|-dispos_lecturehall	// struct with distractors in the lecturehall, each field (field name is distractor object) containing an Nx2 matrix with the timestamps ONLY when a distractor is active/visible (first column) and the azimuth angle in degrees
|-dispos_livingroom	// struct with distractors in the livingroom, each field (field name is distractor object) containing an Nx2 matrix with the timestamps ONLY

	when a distractor is active/visible (first column) and the azimuth angle in degrees
|-dispos_street_active	// struct with distractors in the street_active, each field (field name is distractor object) containing an Nx2 matrix with the timestamps ONLY when a distractor is active/visible (first column) and the azimuth angle in degrees
|-dispos_street_passive	// struct with distractors in the street_passive, each field (field name is distractor object) containing an Nx2 matrix with the timestamps ONLY when a distractor is active/visible (first column) and the azimuth angle in degrees
|-dispos_trainstation	// struct with distractors in the trainstation, each field (field name is distractor object) containing an Nx2 matrix with the timestamps ONLY when a distractor is active/visible (first column) and the azimuth angle in degrees
|+- target_positions.mat	// MAT-file containing the speech target angles of each environment. Positive directions are indicated in the figure "headorientation.png".
|-loclecture	// array with angular position (degrees azimuth) of lecturer when lecturer is talking, NaN otherwise, timestamps of the data are in movement_traces->gazedirs->lecturehall (cell 3)->first column
|-locstory1	// array with active speaker angular position (degrees azimuth) for story 1, timestamps of the data are the same as in movement_traces->(eyeangles/gazedirs/gazedirs_smoothed/headdirs/torsoangles)->cafeteria_listeningonly (cell 2)->first column
|-locstory5	// array with active speaker angular position (degrees azimuth) for story 5, timestamps of the data are the same as in movement_traces->(eyeangles/gazedirs/gazedirs_smoothed/headdirs/torsoangles)->cafeteria_dualtask (cell 1)->first column
|-locstory6	// array with active speaker angular position (degrees azimuth) for story 6, timestamps of the data are the same as in movement_traces->(eyeangles/gazedirs/gazedirs_smoothed/headdirs/torsoangles)->street_active (cell 6)->first column
|-loctv	// array with angular position (degrees azimuth) of TV when news is playing, NaN otherwise, timestamps of the data are the same as in movement_traces->(eyeangles/gazedirs/gazedirs_smoothed/headdirs/torsoangles)->livingroom (cell 4)->first column
|+- movement_and_similarity_measures.mat	// MAT-file containing the computed variables using the calculate_measures.m script on the provided data.
|-DistractorSim	// 7x40 matrix with outcomes for DistractorSim, rows correspond to different environments (order in "scenes"), columns to different subjects (order in "subID")
|-GazeDelay	// 7x40 matrix with outcomes for GazeDelay, rows correspond to different environments (order in "scenes"), columns to different subjects (order in "subID")
|-GazeRangeStd	// 7x40 matrix with outcomes for GazeRangeStd, rows correspond to different environments (order in "scenes"), columns to different subjects (order in "subID")
|-GazeSpeedMean	// 7x40 matrix with outcomes for GazeSpeedMean, rows correspond to

	different environments (order in "scenes"), columns to different subjects (order in "subID")
|-HeadGazeRatio	// 7x40 matrix with outcomes for HeadGazeRatio, rows correspond to different environments (order in "scenes"), columns to different subjects (order in "subID")
|-HeadGazeRatio_excl_behavior	// 7x40 matrix with outcomes for HeadGazeRatio_excl_behavior, rows correspond to different environments (order in "scenes"), columns to different subjects (order in "subID")
|-HeadGazeRatio_excl_move	// 7x40 matrix with outcomes for HeadGazeRatio_excl_move, rows correspond to different environments (order in "scenes"), columns to different subjects (order in "subID")
|-HeadGazeRatio_excl_smallangle	// 7x40 matrix with outcomes for HeadGazeRatio_excl_smallangle, rows correspond to different environments (order in "scenes"), columns to different subjects (order in "subID")
|-N_GazeJumps	// 7x40 matrix with outcomes for N_GazeJumps, rows correspond to different environments (order in "scenes"), columns to different subjects (order in "subID")
|-similarity_score	// 7x2 cell containing a 40x40 matrix with the pairwise similarities between subjects in the first cell and a 40x40 matrix with the detected outliers (zero if not an outlier) and their adjusted outlyingness in the second cell
|-TargetSim	// 7x40 matrix with outcomes for TargetSim, rows correspond to different environments (order in "scenes"), columns to different subjects (order in "subID")
|- calculate_measures.m	// MATLAB function file to calculate the movement and similarity measures (as described in Hendrikse et al. (n.d.)) from the provided data
-+ EEG.zip	// Zip containing the EEG data and info
|+- EEG_measurements.mat	// MAT-file containing the following variables:
|-EEG_signals	// 7x40 cell containing the EEG signals measured for each subject (columns, order in "subID") in each environment (rows, order in "scenes"). Each cell contains a 26xN matrix or a 20xN matrix with the time in the first row, the computer time in the second row and the measured electrode channels #1-24 or #1-18 in the other rows. The electrode configurations (which electrode belongs to which channel) can be found in Figure 2 and Figure 3. The measured EEG signals contain a delay of approximately 40ms.
|-scenes	// 1x7 cell containing the names of the environments in the same order as in the data cells (i.e. cell 1x1 corresponds to cafeteria_dualtask, cell 2x1 to cafeteria_listeningonly)
|-subID	// 1x40 cell containing the anonymous ID strings of the subjects, which are ordered in the same way as the variables gazedir etc.
|-subID_old	// 1x19 cell containing the anonymous ID strings of the elderly subjects (last 19 of subID)
|-subID_young	// 1x21 cell containing the anonymous ID strings of the young subjects (first 21 of subID)

-+ Test Retest.zip	// Zip containing the data for the retest (and corresponding data for the test):
|+- test_retest_ movement_traces.mat	// MAT-file containing the movement behavior variables for the test-retest. All recorded data is resampled to the same time line, with a sample rate of 120 Hz. In the following descriptions, "N" stands for the number of samples, which depends on the duration of the environment. Positive directions of translations and rotations are indicated in Figure 1.
|-eyeangles	// 7x1 cell with 1 cell for each environment (order in "scenes"), containing an Nx11x2 matrix with the time in the first column and the eye angle relative to the head in degrees for all test-retest subjects in the other columns (subject order in "subID"). The test data is in layer 1, the retest data in layer 2.
|-gazedirs	// 7x1 cell with 1 cell for each environment (order in "scenes"), containing an Nx11x2 matrix with the time in the first column and the gaze direction in degrees for all test-retest subjects in the other columns (subject order in "subID"). The test data is in layer 1, the retest data in layer 2.
|-gazedirs_smoothed	// 7x1 cell with 1 cell for each environment (order in "scenes"), containing an Nx11x2 matrix with the time in the first column and the gaze direction smoothed with a filter length of 20 samples in degrees for all test-retest subjects in the other columns (subject order in "subID"). The test data is in layer 1, the retest data in layer 2.
|-headdirs	// 7x3 cell with 1 cell for each environment (order in "scenes"). The columns contain the data for the different head rotation axes: the first column contain the yaw, the second the pitch and the third the roll. Each cell contains an Nx11x2 matrix with the time in the first column and the head angle in degrees for all test-retest subjects in the other columns (subject order in "subID"). The test data is in layer 1, the retest data in layer 2.
|-headtranss	// 7x3 cell with 1 cell for each environment (order in "scenes"). The columns contain the data for the different head translation axes (order: xyz, front-back, left-right, top-bottom). Each cell contains an Nx11x2 matrix with the time in the first column and the head translation in metres for all test-retest subjects in the other columns (subject order in "subID"). The test data is in layer 1, the retest data in layer 2.
|-scenes	// 1x7 cell containing the names of the environments in the same order as in the data cells (i.e. cell 1x1 corresponds to cafeteria_dualtask, cell 2x1 to cafeteria_listeningonly)
|-subID	// 1x10 cell containing the anonymous ID strings of the subjects, which are ordered in the same way as the variables gazedir etc.
|-torsoangles	// 7x1 cell with 1 cell for each environment (order in "scenes"), containing an Nx11x2 matrix with the time in the first column and the torso rotation around the z axis in degrees for all test-retest subjects in the other columns (subject order in "subID"). The test data is in layer 1, the retest data in layer 2.
|-scene_times	// Duration of the environments (order as in "scenes").
|+- distractor_positions.mat	// MAT-file containing the distractor positions for each environment. Positive directions are indicated in the figure "headorientation.png".
|-dispos_lecturehall	// struct with distractors in the lecturehall, each field (field name is distractor

	object) containing an Nx2 matrix with the timestamps ONLY when a distractor is active/visible (first column) and the azimuth angle in degrees
|-dispos_livingroom	// struct with distractors in the livingroom, each field (field name is distractor object) containing an Nx2 matrix with the timestamps ONLY when a distractor is active/visible (first column) and the azimuth angle in degrees
|-dispos_street_active	// struct with distractors in the street_active, each field (field name is distractor object) containing an Nx2 matrix with the timestamps ONLY when a distractor is active/visible (first column) and the azimuth angle in degrees
|-dispos_street_passive	// struct with distractors in the street_passive, each field (field name is distractor object) containing an Nx2 matrix with the timestamps ONLY when a distractor is active/visible (first column) and the azimuth angle in degrees
|-dispos_trainstation	// struct with distractors in the trainstation, each field (field name is distractor object) containing an Nx2 matrix with the timestamps ONLY when a distractor is active/visible (first column) and the azimuth angle in degrees
|+- target_positions.mat	// MAT-file containing the speech target angles of each environment. Positive directions are indicated in the figure "headorientation.png".
|-loclecture	// array with angular position (degrees azimuth) of lecturer when lecturer is talking, NaN otherwise, timestamps of the data are in movement_traces->gazedirs->lecturehall (cell 3)->first column
|-locstory1	// array with active speaker angular position (degrees azimuth) for story 1, timestamps of the data are the same as in movement_traces->(eyeangles/gazedirs/gazedirs_smoothed/headdirs/torsoangles)->cafeteria_listeningonly (cell 2)->first column
|-locstory5	// array with active speaker angular position (degrees azimuth) for story 5, timestamps of the data are the same as in movement_traces->(eyeangles/gazedirs/gazedirs_smoothed/headdirs/torsoangles)->cafeteria_dualtask (cell 1)->first column
|-locstory6	// array with active speaker angular position (degrees azimuth) for story 6, timestamps of the data are the same as in movement_traces->(eyeangles/gazedirs/gazedirs_smoothed/headdirs/torsoangles)->street_active (cell 6)->first column
|-loctv	// array with angular position (degrees azimuth) of TV when news is playing, NaN otherwise, timestamps of the data are the same as in movement_traces->(eyeangles/gazedirs/gazedirs_smoothed/headdirs/torsoangles)->livingroom (cell 4)->first column
|+- test_retest_EEG.mat	// MAT-file containing the following variables:
|-EEG_signals	// 7x10x2 cell containing the EEG signals measured for each subject (columns, order in "subID") in each environment (rows, order in "scenes") for the test (layer 1) and for the retest (layer 2). Each cell contains a 26xN matrix or a 20xN matrix with the time in the first row, the computer time in the second row and the measured electrode channels #1-24 or #1-18 in the other rows. The electrode configurations (which electrode belongs to which channel) can be found in Figure 2 and Figure 3. The measured EEG signals

	contain a delay of approximately 40ms.
|-scenes	// 1x7 cell containing the names of the environments in the same order as in the data cells (i.e. cell 1x1 corresponds to cafeteria_dualtask, cell 2x1 to cafeteria_listeningonly)
|-subID	// 1x10 cell containing the anonymous ID strings of the subjects, which are ordered in the same way as the variables gazedir etc.
|+- test_retest_measures_correlations.mat	// MAT-file containing the computed variables using the calculate_measures_testretest.m script on the provided data
|-corr_overall	// struct with the r and p value of the overall correlation for each measure
|-DistractorSim	// 7x10x2 matrix with outcomes for DistractorSim, rows correspond to different environments (order in "scenes"), columns to different subjects (order in "subID"), test data is in layer 1, the retest data in layer 2.
|-GazeDelay	// 7x10x2 matrix with outcomes for GazeDelay, rows correspond to different environments (order in "scenes"), columns to different subjects (order in "subID"), test data is in layer 1, the retest data in layer 2.
|-GazeRangeStd	// 7x10x2 matrix with outcomes for GazeRangeStd, rows correspond to different environments (order in "scenes"), columns to different subjects (order in "subID"), test data is in layer 1, the retest data in layer 2.
|-GazeSpeedMean	// 7x10x2 matrix with outcomes for GazeSpeedMean, rows correspond to different environments (order in "scenes"), columns to different subjects (order in "subID"), test data is in layer 1, the retest data in layer 2.
|-HeadGazeRatio	// 7x10x2 matrix with outcomes for HeadGazeRatio, rows correspond to different environments (order in "scenes"), columns to different subjects (order in "subID"), test data is in layer 1, the retest data in layer 2.
|-HeadGazeRatio_excl_behavior	// 7x10x2 matrix with outcomes for HeadGazeRatio_excl_behavior, rows correspond to different environments (order in "scenes"), columns to different subjects (order in "subID"), test data is in layer 1, the retest data in layer 2.
|-HeadGazeRatio_excl_move	// 7x10x2 matrix with outcomes for HeadGazeRatio_excl_move, rows correspond to different environments (order in "scenes"), columns to different subjects (order in "subID"), test data is in layer 1, the retest data in layer 2.
|-HeadGazeRatio_excl_smallangle	// 7x10x2 matrix with outcomes for HeadGazeRatio_excl_smallangle, rows correspond to different environments (order in "scenes"), columns to different subjects (order in "subID"), test data is in layer 1, the retest data in layer 2.
|-N_GazeJumps	// 7x10x2 matrix with outcomes for N_GazeJumps, rows correspond to different environments (order in "scenes"), columns to different subjects (order in "subID"), test data is in layer 1, the retest data in layer 2.
|-perc_sig_sub	// struct with the percentage of subjects with a significant test-retest correlation for each measure
|-similarity	// 7x1 cell containing a 40x40 matrix with the pairwise similarities between subjects (test data versus retest data)
|-similarity_mean	// 7x10x2 matrix with outcomes for the mean similarity of each subject with the other subjects, rows correspond to different environments (order in "scenes"), columns to different subjects (order in "subID"), test data is in layer 1, the retest data in layer 2.

|-TargetSim	// 7x10x2 matrix with outcomes for TargetSim, rows correspond to different environments (order in "scenes"), columns to different subjects (order in "subID"), test data is in layer 1, the retest data in layer 2.
|- calculate_measures_ testretest.m	// MATLAB function file to calculate the movement and similarity measures and correlations (as described in Hendrikse et al. (n.d.)) for the test-retest data
-Supplementary Materials.pdf	// Supplementary Materials to the paper Hendrikse et al. (2019), including plots of the gaze trajectories of the young and elderly subjects in all environments and histograms of the head-, eye- and torso-rotation for the environments that were not included in the paper.
-README.pdf	// This file

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Reference:

Hendrikse, M. M. E., Llorach, G., Hohmann, V., & Grimm, G. (2019). Movement and gaze behavior in virtual audiovisual everyday-life listening environments. *Trends in Hearing*.