
SIGMA IRISCOPE

Complete metric reference

All exported measures · algorithms · formulas · versioning

Version 1.0

Ground truth: Sigma Iriscope metric registry (export__metrics.py · export__pairwise_metrics.py)

1041 export keys (875 global + 166 AOI) · 181 pairwise columns · 40+14 groups

Project schema 2.4.0 · writer 2.3.0-v16-analysis-state-provenance

Dr. Mirko Saunders · SIGMA · 2026

Methodological responsibility: interpret with caution, report in full

Iriscope is designed for transparent eye-tracking analysis. Transparency begins with a simple but essential distinction: eye tracking records gaze-related signals. It does not directly record attention, comprehension, cognitive load, interest, decision making, or reading.

It does not even record gaze position as a fact. A gaze sample is itself a model-based estimate — derived from pupil and corneal-reflection geometry and mapped to screen coordinates through a calibration model. Its accuracy depends on that calibration, on the participant, and on the recording conditions. The signal is the starting point of inference, not a measurement that stands outside it.

From there, every further level adds interpretation:

A gaze sample is estimated.
A fixation is detected.
An AOI hit is assigned.
A cognitive process is inferred.

These levels are not interchangeable. Collapsing them is the most common methodological error in eye-tracking analysis. A fixation, in particular, is not a raw measurement. It is an algorithmically detected event derived from a sequence of gaze samples. The same raw data can yield different fixation events depending on the algorithm, its thresholds, the sampling rate, filtering, noise handling, missing-data handling, and overall data quality.

Fixations are useful analytical constructs. They reduce complexity and make gaze behaviour easier to summarise. But they do not provide direct access to what a participant looked at, processed, or understood. They are the result of methodological decisions, and they are valid only as conditional on those decisions.

None of this is an argument against eye tracking. It is an argument for using it at full strength. Used well, eye tracking is one of the few methods that observes behaviour directly and continuously, without depending on what a participant can or chooses to report. It records where gaze went, in what order, and for how long — at a temporal resolution no questionnaire, interview, or retrospective measure can reach. Kept distinct and reported in full, the chain from estimated signal to inferred process becomes a genuine evidentiary trail. Collapsed or left undocumented, the same sensitivity that resolves fine structure will just as faithfully record artefacts. Precision is not a tax on the method. It is what the method is for.

This becomes critical on small spatial units — words, symbols, icons, interface elements, or tightly spaced AOIs — where the choice of detection parameters directly determines the result. The relevant thresholds are not a single dial, and they do not all fail in the same direction. In dispersion-based detection (I-DT), a strict minimum-duration criterion discards short gaze episodes, and stimuli can appear to have been skipped; a loose dispersion radius merges or fragments events depending on layout. In velocity-based detection (I-VT), the velocity threshold governs the boundary between fixation and saccade: a low threshold reclassifies stable samples as saccadic; a high one absorbs genuine saccadic motion into fixations. In both families, an overly permissive setting allows tremor, drift, or oculomotor jitter to be misclassified as additional fixations.

This is why Iriscope reports detection results separately per algorithm (`idt_`, `ivt_`, `ivt_robust_`, and the vendor-style families `tobii_ivt_`, `eyelink_`, `smi_idt_`): the term “fixation” does not mean the same thing across them. A number such as “4 fixations on the target word” means nothing on its own — it is a different finding under a 60 ms duration threshold than under 120 ms, under one velocity threshold than under another, under one AOI definition than under a wider one. A study that reports the metric but not the method has not reported a result.

The standard objection is that full methodological disclosure is tedious. This is exactly the problem Iriscope is built to remove. Every one of these decisions is held with the analysis, not in a researcher’s memory or a side note. The algorithm, its parameters, the active preset, the AOI definitions, the quality and exclusion criteria — all of it travels with the data through the *analysis-state* and *AOI-set* provenance records described in Chapter 2, and can be carried into the report. Reproducibility is therefore not extra work layered on top of the analysis; it is the form the analysis already takes.

AOIs add a further interpretive layer. They do not repair noisy gaze data; they map gaze or fixation events onto theoretically or stimulus-defined regions. If the underlying signal is inaccurate — poor calibration, residual drift, low precision, high data loss — or if AOIs are drawn too narrowly or too broadly, AOI-based metrics become unstable. Accuracy, precision, and data loss are reportable quantities, and they belong in the analysis, not behind it. The purpose of Iriscope is not to hide these decisions behind convenient defaults. It is to make them visible, configurable, documented, and reproducible — and to carry them, in full, from the raw signal to the reported result.

Contents

Practical guide: selecting metrics and reporting them transparently	vi
Step 1: Select metrics deliberately	vi
Scenario A: Classical attention, advertising effects, and visual prioritisation	vi
Scenario B: Reading research, text processing, and ordered gaze paths	vi
Scenario C: Cognitive load and pupillometry	vii
Step 2: Reporting templates for the Methods section	vii
Reporting fixation detection	vii
Reporting AOI definitions and AOI sets	vii
Reporting concrete AOI metrics	viii
Step 3: Report data quality and exclusions	viii
1 Introduction & architecture	1
1.1 Overview of metric groups	1
2 Versioning & reproducibility	4
2.1 Project format and writer provenance	4
2.2 AOI sets: versioned geometry	4
2.3 Analysis states: a hash of the whole decision set	4
2.4 Manual gaze/drift correction: reversible by design	5
2.5 Provenance as export columns	5
2.6 On-demand recomputation (export recompute dialog)	5
2.7 Detection presets & algorithms	5
3 Global metrics	7
3.1 Basis & Dauer	7
3.2 Fixation-based IDT Global Metrics	7
3.3 Fixation-based IVT Global Metrics	8
3.4 Fixation-based IVT-robust Global Metrics	9
3.5 Fixation-based IDT-robust Global Metrics	11
3.6 Fixation-based Tobii-IVT Global Metrics	12
3.7 Fixation-based EyeLink-style Global Metrics	13
3.8 Fixation-based SMI/BeGaze-IDT Global Metrics	14

3.9	Saccade-based IVT Global Metrics	16
3.10	Saccade-based IVT-robust Global Metrics	17
3.11	Saccade-based Tobii-IVT Global Metrics	18
3.12	Saccade-based EyeLink-style Global Metrics	19
3.13	Datenqualität	20
3.14	AOI-Zusammenfassung	21
3.15	Sample-based Transition Structure & Entropy	21
3.16	Fixation-based IDT Transition Structure & Entropy	22
3.17	Fixation-based IDT-robust Transition Structure & Entropy	24
3.18	Fixation-based SMI/BeGaze-IDT Transition Structure & Entropy	25
3.19	Fixation-based IVT Transition Structure & Entropy	26
3.20	Fixation-based IVT-robust Transition Structure & Entropy	28
3.21	Fixation-based Tobii-IVT Transition Structure & Entropy	29
3.22	Fixation-based EyeLink-style Transition Structure & Entropy	31
3.23	Relation to ScanMatch, MultiMatch, and Iriscope AOI-sequence metrics	33
3.24	Scanpath & Levenshtein (within)	34
3.25	Scanpath Strings – IDT	35
3.26	Scanpath Strings – IDT robust	36
3.27	Scanpath Strings – IVT	37
3.28	Scanpath Strings – IVT robust	37
3.29	Scanpath Strings – Tobii IVT	38
3.30	Scanpath Strings – EyeLink-style	39
3.31	Scanpath Strings – SMI/BeGaze IDT	39
3.32	Between-Subject (BS_*)	40
3.33	ScanMatch / MultiMatch (Between-Subject)	41
3.34	Recurrence / RQA	42
3.35	Pupillometrie 0–2000 ms	43
3.36	Pupillometrie 2000–4000 ms	44
3.37	Pupillometrie gesamt	45
3.38	Spatial / räumliche Verteilung	46
3.39	Analyseparameter & Reproduzierbarkeit	47
3.40	Analysezustand / AOI-Set-Provenienz	48
3.41	Manuelle Gaze-/Driftkorrektur	49
4	AOI-level metrics	51
4.1	Sample-based Hits/Visits/Dwell	51

4.2	Sample-based Timing/Order	51
4.3	Sample-based Raw Timestamps	52
4.4	Fixation-based IDT AOI Metrics	52
4.5	Fixation-based IDT-robust AOI Metrics	52
4.6	Fixation-based SMI/BeGaze-IDT AOI Metrics	53
4.7	Fixation-based IVT AOI Metrics	54
4.8	Fixation-based IVT-robust AOI Metrics	55
4.9	Fixation-based Tobii-IVT AOI Metrics	55
4.10	Fixation-based EyeLink-style AOI Metrics	56
4.11	Fixation-based Combined AOI Metrics	57
4.12	Transitions	57
4.13	Flächenkorrigierte Metriken	58
4.14	Pupille/Blinks	58
5	Export formats & pairwise columns	60
5.1	Pairwise columns (181)	60
6	Method texts (citable)	61
6.1	Fixation detection	61
6.2	Detection presets & algorithm comparison	61
6.3	Fixation dispersion & spatial stability	61
6.4	Levenshtein sequence similarity (within-subject)	61
6.5	Recurrence Quantification Analysis (RQA)	62
6.6	MultiMatch similarity	62
6.7	ScanMatch-style similarity	62
6.8	Pupillometry	62
6.9	Area-corrected attention density	62
6.10	Cross-recurrence (CRQA) & lag profile	63
6.11	Reproducibility & provenance	63
7	References	64

Practical guide: selecting metrics and reporting them transparently

This reference contains many metrics because Iriscope supports different research questions, detection algorithms, and export formats. This does not mean that every available metric group should be enabled in every study. A good export starts from a research question, not from the maximum number of columns. The following examples are therefore not fixed rules, but practical starting points for common analysis scenarios.

General principle. Enable only the metrics that match the hypothesis, study design, and planned analysis. Always include analysis parameters, AOI-set provenance, and data-quality metrics so that fixation detection, AOI assignment, and exclusion decisions remain reportable.

Step 1: Select metrics deliberately

Scenario A: Classical attention, advertising effects, and visual prioritisation

Typical question: *Which stimulus regions were viewed, how early, and for how long?* A compact export is often sufficient for this type of question. The following groups are usually useful:

- **Basic and duration metrics**, so that the temporal basis of each trial is transparent.
- **One clearly selected fixation family**, for example `ivt_robust_` for robust I-VT-based analyses, or a vendor-style preset such as `tobii_ivt_` when the analysis is deliberately aligned with a manufacturer-oriented definition.
- **AOI metrics**, especially sample-based and fixation-based measures such as dwell time, hit count, time to first fixation, and fixation count.
- **Area-normalised AOI metrics**, when AOIs differ in size and attention density should be compared more fairly.
- **Analysis parameters, AOI-set provenance, and data quality**, so that the export remains reproducible and methodologically reportable.

Scenario B: Reading research, text processing, and ordered gaze paths

Typical question: *How does gaze move through words, lines, or text regions?* In addition to the metrics from Scenario A, the following are often relevant:

- **Word and line AOIs**, for example generated by PeriTag OCR and manually verified.
- **Scanpath and Levenshtein metrics**, to describe gaze paths, regressions, sequence similarity, and recurring within-subject patterns.

- **Saccade-based and spatial metrics**, when regressions, jump distances, changes in gaze direction, or spatial scan ranges are part of the research question.
- **Data quality and drift/correction status**, because small spatial units are particularly sensitive to calibration error, residual drift, and AOI boundaries that are too narrow.

Scenario C: Cognitive load and pupillometry

Typical question: *Does pupil size change within a defined time window or under higher task demands?* In addition to a compact AOI or global export, the following are useful:

- **Pupillometric windows**, for example a full window and predefined time segments such as 0–2000 ms and 2000–4000 ms, if they match the design.
- **Baseline and change metrics**, when relative pupil changes are to be interpreted.
- **Blink, pupil-loss, and trackloss metrics**, because pupillometry is especially sensitive to blinks, missing samples, and interpolated segments.
- **Analysis parameters and exclusion criteria**, so that time windows, data cleaning, and quality filters remain transparent.

Step 2: Reporting templates for the Methods section

The following text blocks are APA-oriented reporting templates. They should be adapted to the specific study design, and placeholders in square brackets should be replaced by the actual values exported by Iriscope.

Reporting fixation detection

Fixations were identified using the Velocity-Threshold Identification (I-VT) algorithm in its robust variant (Salvucci & Goldberg, 2000). A fixation was defined as a time interval in which point-to-point gaze velocity remained below *[threshold]* *[unit]* and the minimum duration was *[minimum duration in ms]*. Detection used *[smoothing window, if applicable]* and *[gap/missing-data rule, if applicable]*. The effective parameters were stored with the analysis state and are documented in the Iriscope export (Saunders, 2026).

Depending on the algorithm family, relevant export keys include `ivt_robust_velocity_threshold_calculated`, `ivt_robust_velocity_unit_calculated`, `ivt_robust_min_duration_ms_calculated`, and `ivt_robust_smoothing_window_ms_calculated`. For other detection families, use the corresponding prefixes, for example `idt_`, `idt_robust_`, `ivt_`, `tobii-ivt_`, `eyelink_`, or `smi-idt_`.

Reporting AOI definitions and AOI sets

Areas of Interest (AOIs) were defined on the stimulus material in PeriTag *[version]* and then transferred to Iriscope as the versioned AOI set *[AOI-set name or AOI-set ID]*. AOI-based metrics were computed using this active AOI set. The analysis state and AOI-set provenance were stored with the project and documented in the export (Saunders, 2026).

Depending on the export profile, relevant export information includes the AOI-set ID, AOI-set name, active metrics AOI set, analysis state, and analysis-state hash.

Reporting concrete AOI metrics

- **Dwell time.** Example: *The sample-based dwell time in AOI [Name] was [M] ms on average ([SD]). Values were taken from the Iriscope AOI metric `aoi.[Name].dwell_time`.*
- **Fixation count.** Example: *The fixation-based number of fixations in AOI [Name] was [M] on average ([SD]) and was exported from the algorithm-specific Iriscope metric `[algorithm prefix]n_fixations` or the corresponding AOI-level fixation metric.*
- **Area-normalised attention.** Example: *The area-normalised dwell density of AOI [Name] was [X]. Values above 1.0 indicate that the AOI received a disproportionate amount of dwell time relative to its area; values below 1.0 indicate under-proportional dwell time.*
- **Scanpath similarity.** Example: *Gaze-path similarity was described using normalised Levenshtein distance on compact AOI sequences (Levenshtein, 1966). Lower values indicate more similar AOI sequences, whereas higher values indicate more divergent gaze paths.*

Step 3: Report data quality and exclusions

Data quality should not only be checked in the background; it should be reportable in the Methods section. Particularly relevant metrics include `gaze_valid_pct`, `data_loss_pct`, `trackloss_max_gap_ms`, blink metrics, and pupil-loss metrics. Exclusion criteria should, where possible, be defined before analysis.

Data quality was evaluated using the proportion of valid gaze samples (`gaze_valid_pct`), data loss (`data_loss_pct`), and the maximum continuous trackloss gap (`trackloss_max_gap_ms`). Trials or participants were excluded if [*exclusion criterion, e.g., more than 25% data loss or trackloss gaps longer than 2000 ms*] occurred. Quality criteria were informed by methodological recommendations for eye-tracking data quality (Holmqvist et al., 2011) and documented in the analysis state.

Important. If different algorithmic or AOI-set decisions lead to different results, this is not merely a technical inconvenience. It is a methodological finding. Iriscope is designed to make such differences visible, exportable, and reportable.

CHAPTER 1

Introduction & architecture

This document fully describes the metrics that Sigma Iriscope computes and exports. Iriscope exports two classes of regular metrics: *global metrics* apply to the whole trial/stimulus (875 keys across 40 groups), and *AOI metrics* apply to each individual Area of Interest and appear in the export as `aoi.[AOI-name].[metric]` (166 keys across 14 groups). In addition, pairwise long-format exports add 181 dedicated pair-comparison columns (Chapter 5).

Technical architecture — RAM-first. All metrics are computed once on import and held in memory, so every value is available for diagrams and exports without recomputation. Where a metric was not part of the original computation (for example a newly enabled metric group), the on-demand recompute dialog (Section 2.6) can derive it from the stored raw data and refresh the export.

Per-algorithm export. Fixation-, saccade- and transition metrics are exported per algorithm via the prefixes `idt_`, `ivt_`, `ivt_robust_` and — when the corresponding output columns exist in the project metric state — the vendor-style families `idt_robust_`, `tobii_ivt_`, `eyelink_` and `smi_idt_`. Generic keys without an algorithm prefix (e.g. `n_fixations`) are no longer separate export columns; they are resolver aliases mapped to the algorithm-specific keys (priority I-VT robust → I-VT → I-DT).

Three velocity regimes of the I-VT family. Velocity is always formed as a point-to-point forward difference $v_i = \|p_{i+1} - p_i\|/\Delta t$; the variants differ in how the coordinates are pre-processed. *Basic I-VT* operates on the raw coordinates (no smoothing). *I-VT robust* first smooths the positions over a centred time window (20 ms by default) and segments at large timestamp gaps, avoiding artificially long events spanning missing-data phases. *Tobii I-VT* uses the same window-based smoothing in the spirit of Tobii’s noise reduction; the window width is derived adaptively from the sampling rate (20 ms yields ≈ 1 sample at 60 Hz, i.e. essentially no smoothing, and ≈ 6 samples at 300 Hz). The threshold direction is the same in all cases — higher velocity $\Rightarrow$ saccade — and thus opposite to the I-DT dispersion threshold.

A note on interpretation. The interpretation hints and tooltips are heuristics, not deterministic statements. Directional readings (e.g. “high = cognitive load”) hold only under otherwise comparable conditions and must always be checked in the context of the specific stimulus, paradigm and data quality.

1.1 Overview of metric groups

Group (Global)	Keys
Basis & Dauer	11
Fixation-based IDT Global Metrics	26
Fixation-based IVT Global Metrics	26
Fixation-based IVT-robust Global Metrics	26
Fixation-based IDT-robust Global Metrics	26
Fixation-based Tobii-IVT Global Metrics	26

Group (Global)	Keys
Fixation-based EyeLink-style Global Metrics	26
Fixation-based SMI/BeGaze-IDT Global Metrics	26
Saccade-based IVT Global Metrics	23
Saccade-based IVT-robust Global Metrics	23
Saccade-based Tobii-IVT Global Metrics	23
Saccade-based EyeLink-style Global Metrics	23
Datenqualität	27
AOI-Zusammenfassung	20
Sample-based Transition Structure & Entropy	21
Fixation-based IDT Transition Structure & Entropy	26
Fixation-based IDT-robust Transition Structure & Entropy	26
Fixation-based SMI/BeGaze-IDT Transition Structure & Entropy	26
Fixation-based IVT Transition Structure & Entropy	26
Fixation-based IVT-robust Transition Structure & Entropy	26
Fixation-based Tobii-IVT Transition Structure & Entropy	26
Fixation-based EyeLink-style Transition Structure & Entropy	26
Scanpath & Levenshtein (within)	32
Scanpath Strings – IDT	7
Scanpath Strings – IDT robust	7
Scanpath Strings – IVT	7
Scanpath Strings – IVT robust	7
Scanpath Strings – Tobii IVT	7
Scanpath Strings – EyeLink-style	7
Scanpath Strings – SMI/BeGaze IDT	7
Between-Subject (BS_*)	32
ScanMatch / MultiMatch (Between-Subject)	30
Recurrence / RQA	17
Pupillometrie 0–2000 ms	29
Pupillometrie 2000–4000 ms	27
Pupillometrie gesamt	30
Spatial / räumliche Verteilung	18
Analyseparameter & Reproduzierbarkeit	30
Analysezustand / AOI-Set-Provenienz	17
Manuelle Gaze-/Driftkorrektur	29
Global total	875

Group (AOI)	Keys
Sample-based Hits/Visits/Dwell	16
Sample-based Timing/Order	6
Sample-based Raw Timestamps	2
Fixation-based IDT AOI Metrics	14
Fixation-based IDT-robust AOI Metrics	14
Fixation-based SMI/BeGaze-IDT AOI Metrics	14
Fixation-based IVT AOI Metrics	14
Fixation-based IVT-robust AOI Metrics	14

Group (AOI)	Keys
Fixation-based Tobii-IVT AOI Metrics	14
Fixation-based EyeLink-style AOI Metrics	14
Fixation-based Combined AOI Metrics	3
Transitions	4
Flächenkorrigierte Metriken	22
Pupille/Blinks	15
AOI total	166
TOTAL	1041

CHAPTER 2

Versioning & reproducibility

Iriscope treats an analysis not as a single frozen result but as a *reproducible state*. Every metric in this manual is conditional on a set of methodological decisions — which clean/corrected coordinates were used, which AOI geometry was active, which fixation algorithm and preset produced the events, and which metric groups were selected. Version 1.0 records those decisions explicitly and carries them with the project so that any later reader, including the original analyst, can reconstruct exactly how a number was produced.

2.1 Project format and writer provenance

Projects are stored as a self-describing HDF5 container. The container carries a `schema_version` (currently 2.4.0) and a `writer_version` (2.3.0-v16-analysis-state-provenance) at the file root and in the `/project` group. A dedicated `/provenance` group records the software environment (Python, NumPy, pandas, h5py versions, platform) and a processing history with timestamps and actions. A `/snapshot` manifest documents which `ActiveProject` fields were persisted and where each lives in the file, with the policy `load_without_recomputation`: a project reopens in exactly the computed state it was saved in, no recomputation required. Older files are detected by their schema attributes and upgraded transparently on load (legacy projects receive a default AOI set and analysis state).

2.2 AOI sets: versioned geometry

The geometry of all AOIs at a given point is captured as an *AOI set*. Each AOI set has an identifier (`AOI_Set_1`, `AOI_Set_2`, ...), a creation timestamp, a human-readable reason, and a content hash of the AOI geometry (`aoi_geometry_hash`). The hash lets Iriscope recognise when the geometry is unchanged and avoid creating redundant records, and it lets a reader verify that two analyses used the same regions. The raw AOI geometry continues to live in the stimulus data; the AOI-set record *versions* that geometry for reproducible analysis states. The active set is referenced by `active_aoi_set_id` and exported alongside the metrics (Section 2.5).

2.3 Analysis states: a hash of the whole decision set

An *analysis state* is a compact manifest of everything that determines the exported numbers: the active AOI set, the fixation algorithm and preset, the timestamp of the fixation calculation, the active correction layer, the selected metric groups, and the metric-registry state. These fields are serialised and hashed with SHA-256; the resulting `state_hash` gives every distinct combination a stable identity (`state_001_<hash8>`, ...). Identical decisions reuse the same state instead of accumulating duplicates; any change — a new preset, a different AOI set, a correction applied — yields a new state. The active state is referenced by `active_analysis_state_id`. Because the manifest is a hash of the decisions rather than of the data, it answers the practical question directly:

were these two exports produced under the same method?

2.4 Manual gaze/drift correction: reversible by design

Iriscope can apply a manual correction layer to clean gaze data — offset, drift, rotation, scaling, shear, mirroring, axis swap, around a configurable centre. The design guarantee is strict and worth stating plainly: **raw gaze data are immutable and never overwritten**. The first time a correction is applied to a case, the current clean coordinates are copied to an immutable baseline (`gaze_clean_original`); the active clean coordinates (`gaze_clean`) then hold the corrected values. A restore copies the baseline back and recomputes the affected spatial metrics. Every correction is recorded under the `manual_gaze_correction_v1` schema with its full parameter set, scope, and identifier, so the transformation is auditable and fully reversible. Corrections are part of the analysis state, so a corrected analysis is a different, separately identified state from the uncorrected one.

2.5 Provenance as export columns

So that reproducibility survives the move into a statistics package, the active provenance is mirrored into the metric rows and can be exported as ordinary columns. Three optional groups carry this information: *Analysis parameters & reproducibility* (the actually-calculated fixation parameters, suffixed `_calculated`), *Analysis state / AOI-set provenance* (state and set identifiers, hashes, counts, the active algorithm/preset/correction), and *Manual gaze/drift correction* (whether a correction is active, its id, scope, and the full transform parameters). Including these columns means a single exported table carries both the result and the method that produced it.

2.6 On-demand recomputation (export recompute dialog)

The export view lists every metric, including those a given project has not yet computed (for example a metric group enabled after import). Selecting an unavailable metric opens a confirmation dialog: Iriscope offers to recompute the analysis from the stored raw data and refresh the export. Recomputation runs in a background worker with progress reporting and does not block the interface. Crucially, it recomputes only the dependent metrics that follow from the current case status, deletions and selections — within-subject Levenshtein metrics along the active trial order, between-subject measures, and the pairwise scanpath, recurrence and cross-recurrence tables — rather than re-deriving complete trial metrics from scratch. Raw data are untouched; the result is a refreshed, internally consistent export with its analysis state updated accordingly.

2.7 Detection presets & algorithms

Fixation detection in Iriscope is preset-driven. A preset fixes the detection parameters and the working unit (pixels or degrees of visual angle), and feeds the three exported detection families (I-DT, I-VT, I-VT robust). Choosing a preset does *not* introduce new export prefixes; it changes the thresholds that the exported families use. The vendor-style families (`tobii_ivt_`, `eyelink_`, `smi_idt_`, `idt_robust_`) are emitted as additional metric groups when the corresponding output columns exist in the project's metric state, so a project analysed under, say, an EyeLink-style preset also exposes `eyelink_` columns side by side with the core families for direct comparison.

Degree-based presets require screen geometry and viewing distance to convert between pixels and degrees; where this information is missing, Iriscope falls back to the pixel thresholds and records that fallback (`fixation_settings_pixel_fallback_used_calculated`). Built-in presets are locked references; user presets are stored in `~/.iriscope/fixation_presets.json`. The presets below are documented approximations of common vendor/literature defaults, not a claim that a vendor used an identical parser implementation in every software version.

Preset (algorithm)	Unit	Core thresholds	Source / note
Iriscope I-VT robust standard (<code>core</code>)	px	I-VT robust 300 px/s, 80 ms; merge 20 ms; smoothing 20 ms. I-DT 35 px, 80 ms.	Iriscope default working preset.
Tobii Pro I-VT Fixation (<code>tobii_ivt</code>)	deg	30°/s, min. 60 ms, merge 75 ms / 0.5°.	Tobii Pro I-VT whitepaper / Pro Lab.
EyeLink parser standard (<code>eyelink</code>)	deg	30°/s, 8000°/s ² , 0.1° Bewegung/Displacement.	SR Research EyeLink documentation.
SMI BeGaze-style dispersion (<code>smi_idt</code>)	px	Dispersion 50 px, min. 80 ms.	SMI BeGaze manual + cartographic literature.
Literature I-DT standard (<code>core</code>)	deg	1.0° Dispersion, 100 ms.	Salvucci & Goldberg / common IDT guidance.

CHAPTER 3

Global metrics

875 keys across 40 groups. Generic keys without an algorithm prefix are resolver aliases (see Chapter 1).

3.1 Basis & Dauer

Export key	Unit	Description & tooltip	Computation / formula	Interpretation
total_gaze_duration	ms	Total gaze duration	$\max(t) - \min(t)$ (finite t)	Reference value for time-based normalisation.
sample_covered_duration	ms	Sample covered duration	$\sum_i \Delta t_i$ (Median-Fallback letztes Δt)	About one sample interval longer than total_gaze_duration.
valid_gaze_sample_duration	ms	Valid gaze sample duration	$\sum_{i \in \text{valid}} \Delta t_i$, $\Delta t_i = t_{i+1} - t_i$	Smaller than total_gaze_duration when data gaps exist.
valid_samples_n	–	Valid samples n	$\#\{i : \text{isfinite}(x_i, y_i, t_i)\}$	High = more reliable metrics.
invalid_samples_n	–	Invalid samples n	$n_{\text{total}} - n_{\text{valid}}$	High $\rightarrow$ calibration problems or poor tracking.
sampling_rate_hz	Hz	Sampling rate hz	$1000 / \text{median}(\text{diff}(t))$	Typical: 60, 120, 300, 600 Hz.
stimulus_onset_time	ms	Stimulus onset time	$\min\{t_i : \text{finite}\}$	Absolute reference point for latency measures.
stimulus_offset_time	ms	Stimulus offset time	$\max\{t_i : \text{finite}\}$	–
stimulus_duration_s	s	Stimulus duration s	$\text{total_gaze_duration} / 1000$	Denominator for rates (fixation rate, saccade rate, etc.).
analysis_window_start_ms	ms	Analysis window start ms	$= \text{stimulus_onset_time}$	–
analysis_window_end_ms	ms	Analysis window end ms	$= \text{stimulus_offset_time}$	–

3.2 Fixation-based IDT Global Metrics

Export key	Unit	Description & tooltip	Computation / formula	Interpretation
idt_n_fixations	–	Number of fixations (I-DT)	$ F $	Robust at low sampling rate.
idt_fixation_rate	1/s	Fixation rate (I-DT)	$ F / \text{stimulus_duration_s}$	Typical: 2–5 fixations/second.
idt_mean_fixation_duration	ms	Mean fixation duration (I-DT)	$\text{mean}\{d_f : f \in F\}$	Typical: 150–400 ms.
idt_median_fixation_duration	ms	Median fixation duration (I-DT)	$\text{median}\{d_f\}$	–
idt_std_fixation_duration	ms	Std fixation duration (I-DT)	$\text{std}\{d_f\}$ (ddof = 0)	–
idt_min_fixation_duration	ms	Min fixation duration (I-DT)	$\min\{d_f\}$	< 80 ms is methodologically questionable.

Export key	Unit	Description & tooltip	Computation / formula	Interpretation
idt_max_fixation_duration	ms	Max fixation duration (I-DT)	$\max\{d_f\}$	> 2000 ms: possible distraction or pause for thought.
idt_first_fixation_duration	ms	First fixation duration (I-DT)	d_{f_1}	Short = fast initial orientation.
idt_last_fixation_duration	ms	Last fixation duration (I-DT)	$d_{f_{ F }}$	–
idt_total_fixation_duration	ms	Total fixation duration (I-DT)	$\sum_{f \in F} d_f$	–
idt_fixation_duration_q1	ms	Fixation duration q1 (I-DT)	$Q_1\{d_f\}$	–
idt_fixation_duration_q3	ms	Fixation duration q3 (I-DT)	$Q_3\{d_f\}$	–
idt_fixation_duration_iqr	ms	Fixation duration iqr (I-DT)	$Q_3 - Q_1$	Less sensitive to outliers than the SD.
idt_first_fixation_latency	ms	First fixation latency (I-DT)	$t_{\text{start}}(f_1) - \text{onset}$	Short = fast initial reaction.
idt_last_fixation_latency	ms	Last fixation latency (I-DT)	$t_{\text{start}}(f_{ F }) - \text{onset}$	–
idt_last_fixation_end_latency	ms	Last fixation end latency (I-DT)	Berechnet auf den IDT-Ereignissen (Verfahren siehe Methodenteil).	–
idt_first_fixation_start_time	ms	First fixation start time (I-DT)	Berechnet auf den IDT-Ereignissen (Verfahren siehe Methodenteil).	–
idt_last_fixation_start_time	ms	Last fixation start time (I-DT)	Berechnet auf den IDT-Ereignissen (Verfahren siehe Methodenteil).	–
idt_last_fixation_end_time	ms	Last fixation end time (I-DT)	Berechnet auf den IDT-Ereignissen (Verfahren siehe Methodenteil).	–
idt_mean_fixation_dispersion	–	Mean fixation dispersion (I-DT)	$\text{mean}_f [(x_f^{\max} - x_f^{\min}) + (y_f^{\max} - y_f^{\min})]$	Large = wide, unsteady fixations. Small = very precise fixations.
idt_median_fixation_dispersion	–	Median fixation dispersion (I-DT)	$\text{median}_f [(x_f^{\max} - x_f^{\min}) + (y_f^{\max} - y_f^{\min})]$	–
idt_max_fixation_dispersion	–	Max fixation dispersion (I-DT)	$\max_f [(x_f^{\max} - x_f^{\min}) + (y_f^{\max} - y_f^{\min})]$	Very high → unstable or disturbed fixation.
idt_fixation_spatial_stability	–	Fixation spatial stability (I-DT)	$1 - \frac{\text{disp}}{\sqrt{w^2 + h^2}}$	Near 1.0 = very stable fixations. Near 0 = very unstable.
idt_mean_inter_fixation_interval	ms	Mean inter fixation interval (I-DT)	$\text{mean}(t_{i+1}^{\text{start}} - t_i^{\text{end}})$	Short = fast, fluent gaze movements.
idt_median_inter_fixation_interval	ms	Median inter fixation interval (I-DT)	$\text{median}(\text{IFI})$	More robust than the mean.
idt_std_inter_fixation_interval	ms	Std inter fixation interval (I-DT)	$\text{std}(\text{IFI})$ (ddof = 0)	Low = even, regular fixation sequence.

3.3 Fixation-based IVT Global Metrics

Export key	Unit	Description & tooltip	Computation / formula	Interpretation
ivt_n_fixations	–	Number of fixations (I-VT)	$ F $	–
ivt_fixation_rate	1/s	Fixation rate (I-VT)	$ F /\text{stimulus_duration_s}$	Typical: 2–5 fixations/second.
ivt_mean_fixation_duration	ms	Mean fixation duration (I-VT)	$\text{mean}\{d_f : f \in F\}$	–
ivt_median_fixation_duration	ms	Median fixation duration (I-VT)	$\text{median}\{d_f\}$	–

Export key	Unit	Description & tooltip	Computation / formula	Interpretation
ivt_std_fixation_duration	ms	Std fixation duration (I-VT)	$\text{std}\{d_f\}$ (ddof = 0)	–
ivt_min_fixation_duration	ms	Min fixation duration (I-VT)	$\min\{d_f\}$	< 80 ms is methodologically questionable.
ivt_max_fixation_duration	ms	Max fixation duration (I-VT)	$\max\{d_f\}$	> 2000 ms: possible distraction or pause for thought.
ivt_first_fixation_duration	ms	First fixation duration (I-VT)	d_{f_1}	Short = fast initial orientation.
ivt_last_fixation_duration	ms	Last fixation duration (I-VT)	$d_{f F }$	–
ivt_total_fixation_duration	ms	Total fixation duration (I-VT)	$\sum_{f \in F} d_f$	–
ivt_fixation_duration_q1	ms	Fixation duration q1 (I-VT)	$Q_1\{d_f\}$	–
ivt_fixation_duration_q3	ms	Fixation duration q3 (I-VT)	$Q_3\{d_f\}$	–
ivt_fixation_duration_iqr	ms	Fixation duration iqr (I-VT)	$Q_3 - Q_1$	Less sensitive to outliers than the SD.
ivt_first_fixation_latency	ms	First fixation latency (I-VT)	$t_{\text{start}}(f_1) - \text{onset}$	Short = fast initial reaction.
ivt_last_fixation_latency	ms	Last fixation latency (I-VT)	$t_{\text{start}}(f_{ F }) - \text{onset}$	–
ivt_last_fixation_end_latency	ms	Last fixation end latency (I-VT)	Berechnet auf den IVT-Ereignissen (Verfahren siehe Methodenteil).	–
ivt_first_fixation_start_time	ms	First fixation start time (I-VT)	Berechnet auf den IVT-Ereignissen (Verfahren siehe Methodenteil).	–
ivt_last_fixation_start_time	ms	Last fixation start time (I-VT)	Berechnet auf den IVT-Ereignissen (Verfahren siehe Methodenteil).	–
ivt_last_fixation_end_time	ms	Last fixation end time (I-VT)	Berechnet auf den IVT-Ereignissen (Verfahren siehe Methodenteil).	–
ivt_mean_fixation_dispersion	–	Mean fixation dispersion (I-VT)	$\text{mean}_f [(x_f^{\max} - x_f^{\min}) + (y_f^{\max} - y_f^{\min})]$	Large = wide, unsteady fixations. Small = very precise fixations.
ivt_median_fixation_dispersion	–	Median fixation dispersion (I-VT)	$\text{median}_f [(x_f^{\max} - x_f^{\min}) + (y_f^{\max} - y_f^{\min})]$	–
ivt_max_fixation_dispersion	–	Max fixation dispersion (I-VT)	$\max_f [(x_f^{\max} - x_f^{\min}) + (y_f^{\max} - y_f^{\min})]$	Very high → unstable or disturbed fixation.
ivt_fixation_spatial_stability	–	Fixation spatial stability (I-VT)	$1 - \frac{\overline{\text{disp}}}{\sqrt{w^2 + h^2}}$	Near 1.0 = very stable fixations. Near 0 = very unstable.
ivt_mean_inter_fixation_interval	ms	Mean inter fixation interval (I-VT)	$\text{mean}(t_{i+1}^{\text{start}} - t_i^{\text{end}})$	Short = fast, fluent gaze movements.
ivt_median_inter_fixation_interval	ms	Median inter fixation interval (I-VT)	$\text{median}(\text{IFI})$	More robust than the mean.
ivt_std_inter_fixation_interval	ms	Std inter fixation interval (I-VT)	$\text{std}(\text{IFI})$ (ddof = 0)	Low = even, regular fixation sequence.

3.4 Fixation-based IVT-robust Global Metrics

Export key	Unit	Description & tooltip	Computation / formula	Interpretation
ivt_robust_n_fixations	–	Number of fixations (I-VT robust)	$ F $	Typically fewer than I-VT, since gaps split segments.
ivt_robust_fixation_rate	1/s	Fixation rate (I-VT robust)	$ F /\text{stimulus_duration_s}$	Typical: 2–5 fixations/second.

Export key	Unit	Description & tooltip	Computation / formula	Interpretation
ivt_robust_mean_fixation_duration	ms	Mean fixation duration (I-VT robust)	$\text{mean}\{d_f : f \in F\}$	More accurate estimate when data gaps exist.
ivt_robust_median_fixation_duration	ms	Median fixation duration (I-VT robust)	$\text{median}\{d_f\}$	–
ivt_robust_std_fixation_duration	ms	Std fixation duration (I-VT robust)	$\text{std}\{d_f\}$ (ddof = 0)	–
ivt_robust_min_fixation_duration	ms	Min fixation duration (I-VT robust)	$\min\{d_f\}$	< 80 ms is methodologically questionable.
ivt_robust_max_fixation_duration	ms	Max fixation duration (I-VT robust)	$\max\{d_f\}$	> 2000 ms: possible distraction or pause for thought.
ivt_robust_first_fixation_duration	ms	First fixation duration (I-VT robust)	d_{f_1}	Short = fast initial orientation.
ivt_robust_last_fixation_duration	ms	Last fixation duration (I-VT robust)	$d_{f_{ F }}$	–
ivt_robust_total_fixation_duration	ms	Total fixation duration (I-VT robust)	$\sum_{f \in F} d_f$	–
ivt_robust_fixation_duration_q1	ms	Fixation duration q1 (I-VT robust)	$Q_1\{d_f\}$	–
ivt_robust_fixation_duration_q3	ms	Fixation duration q3 (I-VT robust)	$Q_3\{d_f\}$	–
ivt_robust_fixation_duration_iqr	ms	Fixation duration iqr (I-VT robust)	$Q_3 - Q_1$	Less sensitive to outliers than the SD.
ivt_robust_first_fixation_latency	ms	First fixation latency (I-VT robust)	$t_{\text{start}}(f_1) - \text{onset}$	Short = fast initial reaction.
ivt_robust_last_fixation_latency	ms	Last fixation latency (I-VT robust)	$t_{\text{start}}(f_{ F }) - \text{onset}$	–
ivt_robust_last_fixation_end_latency	ms	Last fixation end latency (I-VT robust)	Berechnet auf den IVT Robust-Ereignissen (Verfahren siehe Methodenteil).	–
ivt_robust_first_fixation_start_time	ms	First fixation start time (I-VT robust)	Berechnet auf den IVT Robust-Ereignissen (Verfahren siehe Methodenteil).	–
ivt_robust_last_fixation_start_time	ms	Last fixation start time (I-VT robust)	Berechnet auf den IVT Robust-Ereignissen (Verfahren siehe Methodenteil).	–
ivt_robust_last_fixation_end_time	ms	Last fixation end time (I-VT robust)	Berechnet auf den IVT Robust-Ereignissen (Verfahren siehe Methodenteil).	–
ivt_robust_mean_fixation_dispersion	–	Mean fixation dispersion (I-VT robust)	$\text{mean}_f [(x_f^{\max} - x_f^{\min}) + (y_f^{\max} - y_f^{\min})]$	Large = wide, unsteady fixations. Small = very precise fixations.
ivt_robust_median_fixation_dispersion	–	Median fixation dispersion (I-VT robust)	$\text{median}_f [(x_f^{\max} - x_f^{\min}) + (y_f^{\max} - y_f^{\min})]$	–
ivt_robust_max_fixation_dispersion	–	Max fixation dispersion (I-VT robust)	$\max_f [(x_f^{\max} - x_f^{\min}) + (y_f^{\max} - y_f^{\min})]$	Very high → unstable or disturbed fixation.
ivt_robust_fixation_spatial_stability	–	Fixation spatial stability (I-VT robust)	$1 - \frac{\overline{\text{disp}}}{\sqrt{w^2 + h^2}}$	Near 1.0 = very stable fixations. Near 0 = very unstable.
ivt_robust_mean_inter_fixation_interval	ms	Mean inter fixation interval (I-VT robust)	$\text{mean}(t_{i+1}^{\text{start}} - t_i^{\text{end}})$	Short = fast, fluent gaze movements.
ivt_robust_median_inter_fixation_interval	ms	Median inter fixation interval (I-VT robust)	$\text{median}(\text{IFI})$	More robust than the mean.
ivt_robust_std_inter_fixation_interval	ms	Std inter fixation interval (I-VT robust)	$\text{std}(\text{IFI})$ (ddof = 0)	Low = even, regular fixation sequence.

3.5 Fixation-based IDT-robust Global Metrics

This group mirrors its base family key for key; the computation is that of the base family but under the active presets thresholds. It appears in the export only when the corresponding output columns exist in the project metric state.

Export key	Unit	Description & tooltip	Computation / formula	Interpretation
idt_robust_n_fixations	–	Number of fixations (I-DT robust)	$ F $	Robust at low sampling rate.
idt_robust_fixation_rate	–	Fixation rate (I-DT robust)	$ F /\text{stimulus_duration_s}$	Typical: 2–5 fixations/second.
idt_robust_mean_fixation_duration	–	Mean fixation duration (I-DT robust)	$\text{mean}\{d_f : f \in F\}$	Typical: 150–400 ms.
idt_robust_median_fixation_duration	–	Median fixation duration (I-DT robust)	$\text{median}\{d_f\}$	–
idt_robust_std_fixation_duration	–	Std fixation duration (I-DT robust)	$\text{std}\{d_f\}$ (ddof = 0)	–
idt_robust_min_fixation_duration	–	Min fixation duration (I-DT robust)	$\min\{d_f\}$	< 80 ms is methodologically questionable.
idt_robust_max_fixation_duration	–	Max fixation duration (I-DT robust)	$\max\{d_f\}$	> 2000 ms: possible distraction or pause for thought.
idt_robust_first_fixation_duration	–	First fixation duration (I-DT robust)	d_{f_1}	Short = fast initial orientation.
idt_robust_last_fixation_duration	–	Last fixation duration (I-DT robust)	$d_{f_{ F }}$	–
idt_robust_total_fixation_duration	–	Total fixation duration (I-DT robust)	$\sum_{f \in F} d_f$	–
idt_robust_fixation_duration_q1	–	Fixation duration q1 (I-DT robust)	$Q_1\{d_f\}$	–
idt_robust_fixation_duration_q3	–	Fixation duration q3 (I-DT robust)	$Q_3\{d_f\}$	–
idt_robust_fixation_duration_iqr	–	Fixation duration iqr (I-DT robust)	$Q_3 - Q_1$	Less sensitive to outliers than the SD.
idt_robust_first_fixation_latency	–	First fixation latency (I-DT robust)	$t_{\text{start}}(f_1) - \text{onset}$	Short = fast initial reaction.
idt_robust_last_fixation_latency	–	Last fixation latency (I-DT robust)	$t_{\text{start}}(f_{ F }) - \text{onset}$	–
idt_robust_last_fixation_end_latency	–	Last fixation end latency (I-DT robust)	Berechnet auf den IDT-Ereignissen (Verfahren siehe Methodenteil).	–
idt_robust_first_fixation_start_time	–	First fixation start time (I-DT robust)	Berechnet auf den IDT-Ereignissen (Verfahren siehe Methodenteil).	–
idt_robust_last_fixation_start_time	–	Last fixation start time (I-DT robust)	Berechnet auf den IDT-Ereignissen (Verfahren siehe Methodenteil).	–
idt_robust_last_fixation_end_time	–	Last fixation end time (I-DT robust)	Berechnet auf den IDT-Ereignissen (Verfahren siehe Methodenteil).	–
idt_robust_mean_fixation_dispersion	–	Mean fixation dispersion (I-DT robust)	$\text{mean}_f [(x_f^{\max} - x_f^{\min}) + (y_f^{\max} - y_f^{\min})]$	Large = wide, unsteady fixations. Small = very precise fixations.
idt_robust_median_fixation_dispersion	–	Median fixation dispersion (I-DT robust)	$\text{median}_f [(x_f^{\max} - x_f^{\min}) + (y_f^{\max} - y_f^{\min})]$	–
idt_robust_max_fixation_dispersion	–	Max fixation dispersion (I-DT robust)	$\max_f [(x_f^{\max} - x_f^{\min}) + (y_f^{\max} - y_f^{\min})]$	Very high → unstable or disturbed fixation.
idt_robust_fixation_spatial_stability	–	Fixation spatial stability (I-DT robust)	$1 - \frac{\overline{\text{disp}}}{\sqrt{w^2 + h^2}}$	Near 1.0 = very stable fixations. Near 0 = very unstable.
idt_robust_mean_inter_fixation_interval	–	Mean inter fixation interval (I-DT robust)	$\text{mean}(t_{i+1}^{\text{start}} - t_i^{\text{end}})$	Short = fast, fluent gaze movements.

Export key	Unit	Description & tooltip	Computation / formula	Interpretation
idt_robust_median_inter_fixation_interval	–	Median inter fixation interval (I-DT robust)	median(IFI)	More robust than the mean.
idt_robust_std_inter_fixation_interval	–	Std inter fixation interval (I-DT robust)	std(IFI) (ddof = 0)	Low = even, regular fixation sequence.

3.6 Fixation-based Tobii-IVT Global Metrics

This group mirrors its base family key for key; the computation is that of the base family but under the active presets thresholds. It appears in the export only when the corresponding output columns exist in the project metric state.

Export key	Unit	Description & tooltip	Computation / formula	Interpretation
tobii_ivt_n_fixations	–	Number of fixations (Tobii I-VT)	$ F $	Typically fewer than I-VT, since gaps split segments.
tobii_ivt_fixation_rate	–	Fixation rate (Tobii I-VT)	$ F /\text{stimulus_duration_s}$	Typical: 2–5 fixations/second.
tobii_ivt_mean_fixation_duration	–	Mean fixation duration (Tobii I-VT)	$\text{mean}\{d_f : f \in F\}$	More accurate estimate when data gaps exist.
tobii_ivt_median_fixation_duration	–	Median fixation duration (Tobii I-VT)	$\text{median}\{d_f\}$	–
tobii_ivt_std_fixation_duration	–	Std fixation duration (Tobii I-VT)	$\text{std}\{d_f\}$ (ddof = 0)	–
tobii_ivt_min_fixation_duration	–	Min fixation duration (Tobii I-VT)	$\min\{d_f\}$	< 80 ms is methodologically questionable.
tobii_ivt_max_fixation_duration	–	Max fixation duration (Tobii I-VT)	$\max\{d_f\}$	> 2000 ms: possible distraction or pause for thought.
tobii_ivt_first_fixation_duration	–	First fixation duration (Tobii I-VT)	d_{f_1}	Short = fast initial orientation.
tobii_ivt_last_fixation_duration	–	Last fixation duration (Tobii I-VT)	$d_{f_{ F }}$	–
tobii_ivt_total_fixation_duration	–	Total fixation duration (Tobii I-VT)	$\sum_{f \in F} d_f$	–
tobii_ivt_fixation_duration_q1	–	Fixation duration q1 (Tobii I-VT)	$Q_1\{d_f\}$	–
tobii_ivt_fixation_duration_q3	–	Fixation duration q3 (Tobii I-VT)	$Q_3\{d_f\}$	–
tobii_ivt_fixation_duration_iqr	–	Fixation duration iqr (Tobii I-VT)	$Q_3 - Q_1$	Less sensitive to outliers than the SD.
tobii_ivt_first_fixation_latency	–	First fixation latency (Tobii I-VT)	$t_{\text{start}}(f_1) - \text{onset}$	Short = fast initial reaction.
tobii_ivt_last_fixation_latency	–	Last fixation latency (Tobii I-VT)	$t_{\text{start}}(f_{ F }) - \text{onset}$	–
tobii_ivt_last_fixation_end_latency	–	Last fixation end latency (Tobii I-VT)	Berechnet auf den IVT Robust-Ereignissen (Verfahren siehe Methodenteil).	–
tobii_ivt_first_fixation_start_time	–	First fixation start time (Tobii I-VT)	Berechnet auf den IVT Robust-Ereignissen (Verfahren siehe Methodenteil).	–
tobii_ivt_last_fixation_start_time	–	Last fixation start time (Tobii I-VT)	Berechnet auf den IVT Robust-Ereignissen (Verfahren siehe Methodenteil).	–
tobii_ivt_last_fixation_end_time	–	Last fixation end time (Tobii I-VT)	Berechnet auf den IVT Robust-Ereignissen (Verfahren siehe Methodenteil).	–

Export key	Unit	Description & tooltip	Computation / formula	Interpretation
tobii_ivt_mean_fixation_dispersion	–	Mean fixation dispersion (Tobii I-VT)	$\text{mean}_f [(x_f^{\max} - x_f^{\min}) + (y_f^{\max} - y_f^{\min})]$	Large = wide, unsteady fixations. Small = very precise fixations.
tobii_ivt_median_fixation_dispersion	–	Median fixation dispersion (Tobii I-VT)	$\text{median}_f [(x_f^{\max} - x_f^{\min}) + (y_f^{\max} - y_f^{\min})]$	–
tobii_ivt_max_fixation_dispersion	–	Max fixation dispersion (Tobii I-VT)	$\max_f [(x_f^{\max} - x_f^{\min}) + (y_f^{\max} - y_f^{\min})]$	Very high → unstable or disturbed fixation.
tobii_ivt_fixation_spatial_stability	–	Fixation spatial stability (Tobii I-VT)	$1 - \frac{\overline{\text{disp}}}{\sqrt{w^2 + h^2}}$	Near 1.0 = very stable fixations. Near 0 = very unstable.
tobii_ivt_mean_inter_fixation_interval	–	Mean inter fixation interval (Tobii I-VT)	$\text{mean}(t_{i+1}^{\text{start}} - t_i^{\text{end}})$	Short = fast, fluent gaze movements.
tobii_ivt_median_inter_fixation_interval	–	Median inter fixation interval (Tobii I-VT)	$\text{median}(\text{IFI})$	More robust than the mean.
tobii_ivt_std_inter_fixation_interval	–	Std inter fixation interval (Tobii I-VT)	$\text{std}(\text{IFI})$ (ddof = 0)	Low = even, regular fixation sequence.

3.7 Fixation-based EyeLink-style Global Metrics

This group mirrors its base family key for key; the computation is that of the base family but under the active presets thresholds. It appears in the export only when the corresponding output columns exist in the project metric state.

Export key	Unit	Description & tooltip	Computation / formula	Interpretation
eyelink_n_fixations	–	Number of fixations (EyeLink-style)	$ F $	Typically fewer than I-VT, since gaps split segments.
eyelink_fixation_rate	–	Fixation rate (EyeLink-style)	$ F /\text{stimulus_duration_s}$	Typical: 2–5 fixations/second.
eyelink_mean_fixation_duration	–	Mean fixation duration (EyeLink-style)	$\text{mean}\{d_f : f \in F\}$	More accurate estimate when data gaps exist.
eyelink_median_fixation_duration	–	Median fixation duration (EyeLink-style)	$\text{median}\{d_f\}$	–
eyelink_std_fixation_duration	–	Std fixation duration (EyeLink-style)	$\text{std}\{d_f\}$ (ddof = 0)	–
eyelink_min_fixation_duration	–	Min fixation duration (EyeLink-style)	$\min\{d_f\}$	< 80 ms is methodologically questionable.
eyelink_max_fixation_duration	–	Max fixation duration (EyeLink-style)	$\max\{d_f\}$	> 2000 ms: possible distraction or pause for thought.
eyelink_first_fixation_duration	–	First fixation duration (EyeLink-style)	d_{f_1}	Short = fast initial orientation.
eyelink_last_fixation_duration	–	Last fixation duration (EyeLink-style)	$d_{f_{ F }}$	–
eyelink_total_fixation_duration	–	Total fixation duration (EyeLink-style)	$\sum_{f \in F} d_f$	–
eyelink_fixation_duration_q1	–	Fixation duration q1 (EyeLink-style)	$Q_1\{d_f\}$	–
eyelink_fixation_duration_q3	–	Fixation duration q3 (EyeLink-style)	$Q_3\{d_f\}$	–
eyelink_fixation_duration_iqr	–	Fixation duration iqr (EyeLink-style)	$Q_3 - Q_1$	Less sensitive to outliers than the SD.
eyelink_first_fixation_latency	–	First fixation latency (EyeLink-style)	$t_{\text{start}}(f_1) - \text{onset}$	Short = fast initial reaction.
eyelink_last_fixation_latency	–	Last fixation latency (EyeLink-style)	$t_{\text{start}}(f_{ F }) - \text{onset}$	–

Export key	Unit	Description & tooltip	Computation / formula	Interpretation
eyelink_last_fixation_end_latency	–	Last fixation end latency (EyeLink-style)	Berechnet auf den IVT Robust-Ereignissen (Verfahren siehe Methodenteil).	–
eyelink_first_fixation_start_time	–	First fixation start time (EyeLink-style)	Berechnet auf den IVT Robust-Ereignissen (Verfahren siehe Methodenteil).	–
eyelink_last_fixation_start_time	–	Last fixation start time (EyeLink-style)	Berechnet auf den IVT Robust-Ereignissen (Verfahren siehe Methodenteil).	–
eyelink_last_fixation_end_time	–	Last fixation end time (EyeLink-style)	Berechnet auf den IVT Robust-Ereignissen (Verfahren siehe Methodenteil).	–
eyelink_mean_fixation_dispersion	–	Mean fixation dispersion (EyeLink-style)	$\text{mean}_f [(x_f^{\max} - x_f^{\min}) + (y_f^{\max} - y_f^{\min})]$	Large = wide, unsteady fixations. Small = very precise fixations.
eyelink_median_fixation_dispersion	–	Median fixation dispersion (EyeLink-style)	$\text{median}_f [(x_f^{\max} - x_f^{\min}) + (y_f^{\max} - y_f^{\min})]$	–
eyelink_max_fixation_dispersion	–	Max fixation dispersion (EyeLink-style)	$\text{max}_f [(x_f^{\max} - x_f^{\min}) + (y_f^{\max} - y_f^{\min})]$	Very high → unstable or disturbed fixation.
eyelink_fixation_spatial_stability	–	Fixation spatial stability (EyeLink-style)	$1 - \frac{\overline{\text{disp}}}{\sqrt{w^2 + h^2}}$	Near 1.0 = very stable fixations. Near 0 = very unstable.
eyelink_mean_inter_fixation_interval	–	Mean inter fixation interval (EyeLink-style)	$\text{mean}(t_{i+1}^{\text{start}} - t_i^{\text{end}})$	Short = fast, fluent gaze movements.
eyelink_median_inter_fixation_interval	–	Median inter fixation interval (EyeLink-style)	$\text{median}(\text{IFI})$	More robust than the mean.
eyelink_std_inter_fixation_interval	–	Std inter fixation interval (EyeLink-style)	$\text{std}(\text{IFI})$ (ddof = 0)	Low = even, regular fixation sequence.

3.8 Fixation-based SMI/BeGaze-IDT Global Metrics

This group mirrors the corresponding base family key by key; computation follows the base family, but uses the thresholds of the active preset. It appears in the export only when the corresponding output columns are present in the project metric state.

Export-Key	Unit	Description & tooltip	Computation / formula	Interpretation
smi_idt_n_fixations	–	Number of IDT fixations in the full stimulus/analysis window. [SMI/BeGaze I-DT]	$ F $	Robust at lower sampling rates.
smi_idt_fixation_rate	1/s	IDT fixation rate per second in the full stimulus/analysis window. [SMI/BeGaze I-DT]	$ F /\text{stimulus_duration_s}$	Typical range: 2–5 fixations/second.
smi_idt_mean_fixation_duration	ms	Mean duration of IDT fixations in the full stimulus/analysis window. [SMI/BeGaze I-DT]	$\text{mean}\{d_f : f \in F\}$	Typical range: 150–400 ms.
smi_idt_median_fixation_duration	ms	Median duration of IDT fixations in the full stimulus/analysis window. [SMI/BeGaze I-DT]	$\text{median}\{d_f\}$	Median (robust location estimate) of the underlying quantity; relatively insensitive to outliers.
smi_idt_std_fixation_duration	ms	Standard deviation of IDT fixation durations in the full stimulus/analysis window. [SMI/BeGaze I-DT]	$\text{std}\{d_f\}$ (ddof = 0)	Standard deviation of the underlying quantity; high values indicate heterogeneous or irregular behaviour.

Export-Key	Unit	Description & tooltip	Computation / formula	Interpretation
smi_idt_min_fixation_duration	ms	Shortest IDT fixation duration in the full stimulus/analysis window. [SMI/BeGaze I-DT]	$\min\{d_f\}$	< 80 ms may be methodologically questionable.
smi_idt_max_fixation_duration	ms	Longest IDT fixation duration in the full stimulus/analysis window. [SMI/BeGaze I-DT]	$\max\{d_f\}$	> 2000 ms: possible distraction or deliberation pause.
smi_idt_first_fixation_duration	ms	Duration of the first IDT fixation in the full stimulus/analysis window. [SMI/BeGaze I-DT]	d_{f_1}	Short = rapid initial orienting.
smi_idt_last_fixation_duration	ms	Duration of the last IDT fixation in the full stimulus/analysis window. [SMI/BeGaze I-DT]	$d_{f_{ F }}$	Letzter Wert der Sequenz; charakterisiert den Abschluss der Bearbeitung.
smi_idt_total_fixation_duration	ms	Summe aller IDT-Fixationsdauern im gesamten Stimulus/Analysefenster. [SMI/BeGaze I-DT]	$\sum_{f \in F} d_f$	Summe aller Fixationsdauern; hoch = viel bzw. lange Fixation auf dem Stimulus.
smi_idt_fixation_duration_q1	ms	Erstes Quartil der IDT-Fixationsdauern. [SMI/BeGaze I-DT]	$Q_1\{d_f\}$	Unteres Quartil (25 %) der zugrunde liegenden Verteilung.
smi_idt_fixation_duration_q3	ms	Drittes Quartil der IDT-Fixationsdauern. [SMI/BeGaze I-DT]	$Q_3\{d_f\}$	Oberes Quartil (75 %) der zugrunde liegenden Verteilung.
smi_idt_fixation_duration_iqr	ms	Interquartilsabstand der IDT-Fixationsdauern. [SMI/BeGaze I-DT]	$Q_3 - Q_1$	Weniger empfindlich gegenüber Ausreißern als Std.
smi_idt_first_fixation_latency	ms	Echte IDT-TTFF: Latenz vom Stimulus-/Trialstart bis zum Beginn der ersten IDT-Fixation. [SMI/BeGaze I-DT]	$t_{\text{start}}(f_1) - \text{onset}$	Kurz = schnelle initiale Reaktion.
smi_idt_last_fixation_latency	ms	Latenz vom Stimulus-/Trialstart bis zum Beginn der letzten IDT-Fixation. [SMI/BeGaze I-DT]	$t_{\text{start}}(f_{ F }) - \text{onset}$	Latenz ab Stimulus-Onset; kurz = schnelle Reaktion/Orientierung.
smi_idt_last_fixation_end_latency	ms	Latenz vom Stimulus-/Trialstart bis zum Ende der letzten IDT-Fixation. [SMI/BeGaze I-DT]	Berechnet auf den IDT-Ereignissen (Verfahren siehe Methodenteil).	Latenz vom Stimulus-Onset bis zum Ende; spät = lange/späte Bearbeitung.
smi_idt_first_fixation_start_time	ms	Absoluter Zeitstempel des Beginns der ersten IDT-Fixation. [SMI/BeGaze I-DT]	Berechnet auf den IDT-Ereignissen (Verfahren siehe Methodenteil).	Absoluter Zeitstempel (ms) des Beginns; für zeitliche Verankerung/Provenienz.
smi_idt_last_fixation_start_time	ms	Absoluter Zeitstempel des Beginns der letzten IDT-Fixation. [SMI/BeGaze I-DT]	Berechnet auf den IDT-Ereignissen (Verfahren siehe Methodenteil).	Absoluter Zeitstempel (ms) des Beginns; für zeitliche Verankerung/Provenienz.
smi_idt_last_fixation_end_time	ms	Absoluter Zeitstempel des Endes der letzten IDT-Fixation. [SMI/BeGaze I-DT]	Berechnet auf den IDT-Ereignissen (Verfahren siehe Methodenteil).	Absoluter Zeitstempel (ms) des Endes; für zeitliche Verankerung/Provenienz.
smi_idt_mean_fixation_dispersion	–	Mittlere räumliche Dispersion der IDT-Fixationen. [SMI/BeGaze I-DT]	$\text{mean}_f [(x_f^{\max} - x_f^{\min}) + (y_f^{\max} - y_f^{\min})]$	Groß = weite, unruhige Fixationen. Klein = sehr präzise Fixationen.
smi_idt_median_fixation_dispersion	–	Median der räumlichen Dispersion der IDT-Fixationen. [SMI/BeGaze I-DT]	$\text{median}_f [(x_f^{\max} - x_f^{\min}) + (y_f^{\max} - y_f^{\min})]$	Median (robust location estimate) of the underlying quantity; relatively insensitive to outliers.

Export-Key	Unit	Description & tooltip	Computation / formula	Interpretation
smi_idt_max_fixation_dispersion	–	Maximale räumliche Dispersion einer IDT-Fixation. [SMI/BeGaze I-DT]	$\max_f [(x_f^{\max} - x_f^{\min}) + (y_f^{\max} - y_f^{\min})]$	Sehr hoch → instabile oder gestörte Fixation.
smi_idt_fixation_spatial_stability	–	Globale räumliche Stabilität der IDT-Fixationen; höher bedeutet stabilere Fixationen. [SMI/BeGaze I-DT]	$1 - \frac{\overline{\text{disp}}}{\sqrt{w^2 + h^2}}$	Nahe 1.0 = sehr stabile Fixationen. Nahe 0 = sehr instabil.
smi_idt_mean_inter_fixation_interval	ms	Mittleres Inter-Fixations-Intervall zwischen aufeinanderfolgenden IDT-Fixationen. [SMI/BeGaze I-DT]	$\text{mean}(t_{i+1}^{\text{start}} - t_i^{\text{end}})$	Kurz = schnelle, fließende Blickbewegungen.
smi_idt_median_inter_fixation_interval	ms	Median des Inter-Fixations-Intervalls zwischen aufeinanderfolgenden IDT-Fixationen. [SMI/BeGaze I-DT]	$\text{median}(\text{IFI})$	Robuster als Mittelwert.
smi_idt_std_inter_fixation_interval	ms	Standardabweichung der Inter-Fixations-Intervalle zwischen aufeinanderfolgenden IDT-Fixationen. [SMI/BeGaze I-DT]	$\text{std}(\text{IFI})$ (ddof = 0)	Niedrig = gleichmäßige, regelmäßige Fixationsabfolge.

3.9 Saccade-based IVT Global Metrics

Export key	Unit	Description & tooltip	Computation / formula	Interpretation
ivt_n_saccades	–	Number of saccades (I-VT)	$ S $	–
ivt_saccade_rate	1/s	Saccade rate (I-VT)	$ S /\text{stimulus_duration_s}$	High = active, fast exploration.
ivt_mean_saccade_duration	ms	Mean saccade duration (I-VT)	$\text{mean}\{d_s : s \in S\}$	Typical: 20–200 ms.
ivt_median_saccade_duration	ms	Median saccade duration (I-VT)	$\text{median}\{d_s\}$	–
ivt_std_saccade_duration	ms	Std saccade duration (I-VT)	$\text{std}\{d_s\}$	–
ivt_first_saccade_latency	ms	First saccade latency (I-VT)	$t(s_1) - \text{onset}$	–
ivt_mean_saccade_amplitude	px	Mean saccade amplitude (I-VT)	$\text{mean} \ p_s^{\text{end}} - p_s^{\text{start}}\ _2$	Large = wide-ranging exploration.
ivt_median_saccade_amplitude	px	Median saccade amplitude (I-VT)	$\text{median} \ \Delta p_s\ _2$	–
ivt_std_saccade_amplitude	px	Std saccade amplitude (I-VT)	$\text{std} \ \Delta p_s\ _2$	–
ivt_saccade_amplitude_sum	px	Saccade amplitude sum (I-VT)	$\sum_s \ \Delta p_s\ _2$	–
ivt_mean_saccade_velocity	px/s	Mean saccade velocity (I-VT)	$\text{mean}_s \bar{v}_s$	Main sequence: larger amplitude → higher velocity.
ivt_median_saccade_velocity	px/s	Median saccade velocity (I-VT)	$\text{median}_s \bar{v}_s$	–
ivt_max_saccade_velocity	px/s	Max saccade velocity (I-VT)	$\max_s v_s^{\max}$	Fastest saccade; for quality control.
ivt_min_saccade_velocity	px/s	Min saccade velocity (I-VT)	$\min_s \bar{v}_s$	–

Export key	Unit	Description & tooltip	Computation / formula	Interpretation
ivt_mean_saccade_acceleration	–	Mean saccade acceleration (I-VT)	$\text{mean}_s \bar{a}_s$	High for fast reflexive saccades.
ivt_max_saccade_acceleration	–	Max saccade acceleration (I-VT)	$\max_s a_s^{\max}$	–
ivt_saccade_direction_changes	–	Saccade direction changes (I-VT)	$\#\{ \Delta\varphi \geq 45^\circ \text{ aufeinanderfolgend}\}$	Many changes = exploratory, undirected gaze path.
ivt_mean_saccade_angle	–	Mean saccade angle (I-VT)	$\text{mean} \text{atan2}(\Delta y, \Delta x)$	Indicates the preferred gaze direction.
ivt_median_saccade_angle	–	Median saccade angle (I-VT)	$\text{median} \text{atan2}(\Delta y, \Delta x)$	–
ivt_saccade_angle_dispersion	–	Saccade angle dispersion (I-VT)	$1 - \bar{R} = 1 - \text{mean}(e^{i\theta}) $	–
ivt_mean_saccade_curvature	–	Mean saccade curvature (I-VT)	$\text{mean} (\text{Pfadlänge}/\text{Amplitude})$	> 1.0 = curved saccades (typical under inhibition).
ivt_max_saccade_curvature	–	Max saccade curvature (I-VT)	$\max (\text{Pfadlänge}/\text{Amplitude})$	–
ivt_saccade_efficiency	–	Saccade efficiency (I-VT)	$\text{mean} (\text{Amplitude}/\text{Pfadlänge})$	Low = curved saccades.

3.10 Saccade-based IVT-robust Global Metrics

Export key	Unit	Description & tooltip	Computation / formula	Interpretation
ivt_robust_n_saccades	–	Number of saccades (I-VT robust)	$ S $	–
ivt_robust_saccade_rate	1/s	Saccade rate (I-VT robust)	$ S /\text{stimulus_duration_s}$	High = active, fast exploration.
ivt_robust_mean_saccade_duration	ms	Mean saccade duration (I-VT robust)	$\text{mean}\{d_s : s \in S\}$	–
ivt_robust_median_saccade_duration	ms	Median saccade duration (I-VT robust)	$\text{median}\{d_s\}$	–
ivt_robust_std_saccade_duration	ms	Std saccade duration (I-VT robust)	$\text{std}\{d_s\}$	–
ivt_robust_first_saccade_latency	ms	First saccade latency (I-VT robust)	$t(s_1) - \text{onset}$	–
ivt_robust_mean_saccade_amplitude	px	Mean saccade amplitude (I-VT robust)	$\text{mean} \ p_s^{\text{end}} - p_s^{\text{start}}\ _2$	–
ivt_robust_median_saccade_amplitude	px	Median saccade amplitude (I-VT robust)	$\text{median} \ \Delta p_s\ _2$	–
ivt_robust_std_saccade_amplitude	px	Std saccade amplitude (I-VT robust)	$\text{std} \ \Delta p_s\ _2$	–
ivt_robust_saccade_amplitude_sum	px	Saccade amplitude sum (I-VT robust)	$\sum_s \ \Delta p_s\ _2$	–
ivt_robust_mean_saccade_velocity	px/s	Mean saccade velocity (I-VT robust)	$\text{mean}_s \bar{v}_s$	Main sequence: larger amplitude $\rightarrow$ higher velocity.
ivt_robust_median_saccade_velocity	px/s	Median saccade velocity (I-VT robust)	$\text{median}_s \bar{v}_s$	–
ivt_robust_max_saccade_velocity	px/s	Max saccade velocity (I-VT robust)	$\max_s v_s^{\max}$	Fastest saccade; for quality control.
ivt_robust_min_saccade_velocity	px/s	Min saccade velocity (I-VT robust)	$\min_s \bar{v}_s$	–
ivt_robust_mean_saccade_acceleration	–	Mean saccade acceleration (I-VT robust)	$\text{mean}_s \bar{a}_s$	High for fast reflexive saccades.
ivt_robust_max_saccade_acceleration	–	Max saccade acceleration (I-VT robust)	$\max_s a_s^{\max}$	–
ivt_robust_saccade_direction_changes	–	Saccade direction changes (I-VT robust)	$\#\{ \Delta\varphi \geq 45^\circ \text{ aufeinanderfolgend}\}$	Many changes = exploratory, undirected gaze path.

Export key	Unit	Description & tooltip	Computation / formula	Interpretation
ivt_robust_mean_saccade_angle	–	Mean saccade angle (I-VT robust)	$\text{mean atan2}(\Delta y, \Delta x)$	Indicates the preferred gaze direction.
ivt_robust_median_saccade_angle	–	Median saccade angle (I-VT robust)	$\text{median atan2}(\Delta y, \Delta x)$	–
ivt_robust_saccade_angle_dispersion	–	Saccade angle dispersion (I-VT robust)	$1 - \bar{R} = 1 - \text{mean}(e^{i\theta}) $	–
ivt_robust_mean_saccade_curvature	–	Mean saccade curvature (I-VT robust)	$\text{mean}(\text{Pfadlänge}/\text{Amplitude})$	> 1.0 = curved saccades (typical under inhibition).
ivt_robust_max_saccade_curvature	–	Max saccade curvature (I-VT robust)	$\text{max}(\text{Pfadlänge}/\text{Amplitude})$	–
ivt_robust_saccade_efficiency	–	Saccade efficiency (I-VT robust)	$\text{mean}(\text{Amplitude}/\text{Pfadlänge})$	Low = curved saccades.

3.11 Saccade-based Tobii-IVT Global Metrics

This group mirrors its base family key for key; the computation is that of the base family but under the active presets thresholds. It appears in the export only when the corresponding output columns exist in the project metric state.

Export key	Unit	Description & tooltip	Computation / formula	Interpretation
tobii_ivt_n_saccades	–	Number of saccades (Tobii I-VT)	$ S $	–
tobii_ivt_saccade_rate	–	Saccade rate (Tobii I-VT)	$ S /\text{stimulus_duration_s}$	High = active, fast exploration.
tobii_ivt_mean_saccade_duration	–	Mean saccade duration (Tobii I-VT)	$\text{mean}\{d_s : s \in S\}$	–
tobii_ivt_median_saccade_duration	–	Median saccade duration (Tobii I-VT)	$\text{median}\{d_s\}$	–
tobii_ivt_std_saccade_duration	–	Std saccade duration (Tobii I-VT)	$\text{std}\{d_s\}$	–
tobii_ivt_first_saccade_latency	–	First saccade latency (Tobii I-VT)	$t(s_1) - \text{onset}$	–
tobii_ivt_mean_saccade_amplitude	–	Mean saccade amplitude (Tobii I-VT)	$\text{mean} \ p_s^{\text{end}} - p_s^{\text{start}}\ _2$	–
tobii_ivt_median_saccade_amplitude	–	Median saccade amplitude (Tobii I-VT)	$\text{median} \ \Delta p_s\ _2$	–
tobii_ivt_std_saccade_amplitude	–	Std saccade amplitude (Tobii I-VT)	$\text{std} \ \Delta p_s\ _2$	–
tobii_ivt_saccade_amplitude_sum	–	Saccade amplitude sum (Tobii I-VT)	$\sum_s \ \Delta p_s\ _2$	–
tobii_ivt_mean_saccade_velocity	–	Mean saccade velocity (Tobii I-VT)	$\text{mean}_s \bar{v}_s$	Main sequence: larger amplitude $\rightarrow$ higher velocity.
tobii_ivt_median_saccade_velocity	–	Median saccade velocity (Tobii I-VT)	$\text{median}_s \bar{v}_s$	–
tobii_ivt_max_saccade_velocity	–	Max saccade velocity (Tobii I-VT)	$\text{max}_s v_s^{\text{max}}$	Fastest saccade; for quality control.
tobii_ivt_min_saccade_velocity	–	Min saccade velocity (Tobii I-VT)	$\text{min}_s \bar{v}_s$	–
tobii_ivt_mean_saccade_acceleration	–	Mean saccade acceleration (Tobii I-VT)	$\text{mean}_s \bar{a}_s$	High for fast reflexive saccades.
tobii_ivt_max_saccade_acceleration	–	Max saccade acceleration (Tobii I-VT)	$\text{max}_s a_s^{\text{max}}$	–
tobii_ivt_saccade_direction_changes	–	Saccade direction changes (Tobii I-VT)	$\#\{ \Delta\varphi \geq 45^\circ \text{ aufeinanderfolgend}\}$	Many changes = exploratory, undirected gaze path.
tobii_ivt_mean_saccade_angle	–	Mean saccade angle (Tobii I-VT)	$\text{mean atan2}(\Delta y, \Delta x)$	Indicates the preferred gaze direction.
tobii_ivt_median_saccade_angle	–	Median saccade angle (Tobii I-VT)	$\text{median atan2}(\Delta y, \Delta x)$	–

Export key	Unit	Description & tooltip	Computation / formula	Interpretation
tobii_ivt_saccade_angle_dispersion	–	Saccade angle dispersion (Tobii I-VT)	$1 - \bar{R} = 1 - \text{mean}(e^{i\theta}) $	–
tobii_ivt_mean_saccade_curvature	–	Mean saccade curvature (Tobii I-VT)	mean (Pfadlänge/Amplitude)	> 1.0 = curved saccades (typical under inhibition).
tobii_ivt_max_saccade_curvature	–	Max saccade curvature (Tobii I-VT)	max (Pfadlänge/Amplitude)	–
tobii_ivt_saccade_efficiency	–	Saccade efficiency (Tobii I-VT)	mean (Amplitude/Pfadlänge)	Low = curved saccades.

3.12 Saccade-based EyeLink-style Global Metrics

This group mirrors its base family key for key; the computation is that of the base family but under the active presets thresholds. It appears in the export only when the corresponding output columns exist in the project metric state.

Export key	Unit	Description & tooltip	Computation / formula	Interpretation
eyelink_n_saccades	–	Number of saccades (EyeLink-style)	$ S $	–
eyelink_saccade_rate	–	Saccade rate (EyeLink-style)	$ S /\text{stimulus_duration_s}$	High = active, fast exploration.
eyelink_mean_saccade_duration	–	Mean saccade duration (EyeLink-style)	$\text{mean}\{d_s : s \in S\}$	–
eyelink_median_saccade_duration	–	Median saccade duration (EyeLink-style)	$\text{median}\{d_s\}$	–
eyelink_std_saccade_duration	–	Std saccade duration (EyeLink-style)	$\text{std}\{d_s\}$	–
eyelink_first_saccade_latency	–	First saccade latency (EyeLink-style)	$t(s_1) - \text{onset}$	–
eyelink_mean_saccade_amplitude	–	Mean saccade amplitude (EyeLink-style)	$\text{mean} \ p_s^{\text{end}} - p_s^{\text{start}}\ _2$	–
eyelink_median_saccade_amplitude	–	Median saccade amplitude (EyeLink-style)	$\text{median} \ \Delta p_s\ _2$	–
eyelink_std_saccade_amplitude	–	Std saccade amplitude (EyeLink-style)	$\text{std} \ \Delta p_s\ _2$	–
eyelink_saccade_amplitude_sum	–	Saccade amplitude sum (EyeLink-style)	$\sum_s \ \Delta p_s\ _2$	–
eyelink_mean_saccade_velocity	–	Mean saccade velocity (EyeLink-style)	$\text{mean}_s \bar{v}_s$	Main sequence: larger amplitude → higher velocity.
eyelink_median_saccade_velocity	–	Median saccade velocity (EyeLink-style)	$\text{median}_s \bar{v}_s$	–
eyelink_max_saccade_velocity	–	Max saccade velocity (EyeLink-style)	$\max_s v_s^{\text{max}}$	Fastest saccade; for quality control.
eyelink_min_saccade_velocity	–	Min saccade velocity (EyeLink-style)	$\min_s \bar{v}_s$	–
eyelink_mean_saccade_acceleration	–	Mean saccade acceleration (EyeLink-style)	$\text{mean}_s \bar{a}_s$	High for fast reflexive saccades.
eyelink_max_saccade_acceleration	–	Max saccade acceleration (EyeLink-style)	$\max_s a_s^{\text{max}}$	–
eyelink_saccade_direction_changes	–	Saccade direction changes (EyeLink-style)	$\#\{ \Delta\varphi \geq 45^\circ \text{ aufeinanderfolgend}\}$	Many changes = exploratory, undirected gaze path.
eyelink_mean_saccade_angle	–	Mean saccade angle (EyeLink-style)	$\text{mean} \text{atan2}(\Delta y, \Delta x)$	Indicates the preferred gaze direction.
eyelink_median_saccade_angle	–	Median saccade angle (EyeLink-style)	$\text{median} \text{atan2}(\Delta y, \Delta x)$	–
eyelink_saccade_angle_dispersion	–	Saccade angle dispersion (EyeLink-style)	$1 - \bar{R} = 1 - \text{mean}(e^{i\theta}) $	–
eyelink_mean_saccade_curvature	–	Mean saccade curvature (EyeLink-style)	mean (Pfadlänge/Amplitude)	> 1.0 = curved saccades (typical under inhibition).

Export key	Unit	Description & tooltip	Computation / formula	Interpretation
eyelink_max_saccade_curvature	–	Max saccade curvature (EyeLink-style)	max (Pfadlänge/Amplitude)	–
eyelink_saccade_efficiency	–	Saccade efficiency (EyeLink-style)	mean (Amplitude/Pfadlänge)	Low = curved saccades.

3.13 Datenqualität

Export key	Unit	Description & tooltip	Computation / formula	Interpretation
data_loss_pct	%	Data loss pct	$\frac{n_{\text{total}} - n_{\text{valid}}}{n_{\text{total}}} \times 100$	> 30%: critical.
gaze_valid_pct	%	Gaze valid pct	$\frac{n_{\text{valid}}}{n_{\text{total}}} \times 100$	> 90%: good. 70–90%: acceptable. < 70%: critical.
blink_count	count	Blink count	$\#\{\text{event} = \text{blink}\}$	Typical: 3–5 blinks/minute.
blink_rate	1/s	Blink rate	blink_count/stimulus_duration_s	–
blink_duration_sum	ms	Blink duration sum	$\sum \text{blink_dur}$	–
mean_blink_duration	ms	Mean blink duration	mean(blink_dur)	Typical: 150–400 ms.
median_blink_duration	ms	Median blink duration	median(blink_duration_ms)	–
pupil_loss_count	count	Pupil loss count	$\#\{\text{event} = \text{pupil_loss}\}$	Many: severe tracking problems.
pupil_loss_duration_sum	ms	Pupil loss duration sum	$\sum \text{pupil_loss_duration_ms}$	–
mean_pupil_loss_duration	ms	Mean pupil loss duration	mean(pupil_loss_duration_ms)	–
median_pupil_loss_duration	ms	Median pupil loss duration	median(pupil_loss_duration_ms)	–
trackloss_max_gap_ms	ms	Trackloss max gap ms	max(gap length)	> 2000 ms: analysis window possibly invalid.
trackloss_mean_gap_ms	ms	Trackloss mean gap ms	mean(gap length)	–
trackloss_median_gap_ms	ms	Trackloss median gap ms	median(Lückenlängen)	–
trackloss_count	–	Trackloss count	Anzahl zusammenhängender Invalid-Segmente	–
mean_pupil	–	Mean pupil	mean(pupil_raw) über finite Samples	Absolute values are device-specific.
median_pupil	–	Median pupil	median(pupil_raw)	More robust against blink artefacts.
std_pupil	–	Std pupil	std(pupil_raw, ddof=0)	–
pupil_min	–	Pupil min	min(pupil_raw)	May reflect blink artefacts.
pupil_max	–	Pupil max	max(pupil_raw)	–
pupil_range	–	Pupil range	pupil_max – pupil_min	Large = strong response during the trial.
pupil_slope_linear	unit/s	Pupil slope linear	OLS-Steigung: pupil ~ timestamp $\times 1000$	Positive = increasing load. Negative = habituation.
pupil_cv	–	Pupil cv	std(pupil_raw) / mean(pupil_raw)	Normalised dispersion measure; comparable across subjects.
pupil_skewness	–	Pupil skewness	$E[(X-\mu)^3] / \sigma^3$	Positive = right-skewed. Negative = left-skewed.
pupil_kurtosis	–	Pupil kurtosis	$E[(X-\mu)^4] / \sigma^4 - 3$	0 = normally distributed. Positive = outliers more frequent.
pupil_missing_pct	%	Pupil missing pct	count(NaN im pupil_raw) / n_total $\times 100$	High = many blinks or tracking problems.
pupil_valid_pct	%	Pupil valid pct	100 – pupil_missing_pct	–

3.14 AOI-Zusammenfassung

Export key	Unit	Description & tooltip	Computation / formula	Interpretation
dwell_time_outside_aoi	ms	Dwell time outside aoi	$\sum \Delta t_i$ für Samples außerhalb aller AOI-Geometrien	High = stimulus regions without an AOI are heavily fixated.
aoi_coverage_order	–	Aoi coverage order	Sortiert nach erstem Hit-Zeitstempel je AOI	Shows the exploration path at AOI level.
aoi_coverage_count	–	Aoi coverage count	count(n_hits > 0) über definierte AOIs	–
unique_aoi_count	–	Unique aoi count	= aoi_coverage_count	–
coverage_ratio_defined_aois	%	Coverage ratio defined aois	aoi_coverage_count / n_aois_defined $\times$ 100	100% = all AOIs visited.
revisit_rate	–	Revisit rate	$\sum n_revisits / stimulus_duration_s$	–
regression_count	–	Regression count	Anzahl fixationsbasierter Rücksprünge	High = elaborate processing or comparison.
regression_rate	–	Regression rate	regression_count / stimulus_duration_s	–
outside_hit_count	–	Outside hit count	count(sample aller AOI-Geometrien)	–
outside_hit_pct	%	Outside hit pct	outside_hit_count / valid_samples_n $\times$ 100	High: the AOI definition does not cover the stimulus sufficiently.
first_aoi_entry_latency	ms	First aoi entry latency	min(ttff über alle definierten AOIs)	–
mean_aoi_dwell_time	ms	Mean aoi dwell time	mean(dwell_time) über AOIs mit dwell_time > 0	–
median_aoi_dwell_time	ms	Median aoi dwell time	median(dwell_time) über AOIs mit dwell_time > 0	–
aoi_dwell_gini	–	Aoi dwell gini	Gini(dwell_times aller AOIs)	Measures the inequality of attention distribution.
aoi_switch_rate	1/s	Aoi switch rate	$\sum transition_in_count / stimulus_duration_s$	High = fast exploratory gaze movements.
aoi_return_rate	1/s	Aoi return rate	$\sum n_revisits / stimulus_duration_s$	–
aoi_entropy	–	Aoi entropy	$H = -\sum p_i \times \log(p_i)$ über definierte AOIs	Low = strong concentration on few AOIs.
aoi_entropy_norm	–	Aoi entropy norm	$H / \log(n_aois)$	For comparisons across stimuli with different numbers of AOIs.
aoi_entropy_with_outside	–	Aoi entropy with outside	H über AOIs + Outside	–
aoi_entropy_with_outside_norm	–	Aoi entropy with outside norm	$H / \log(n_aois + 1)$	–

3.15 Sample-based Transition Structure & Entropy

Export key	Unit	Description & tooltip	Computation / formula	Interpretation
transition_count_total	–	Transition count total	$\sum \sum transition_matrix_dense$	–
transition_rate	1/s	Transition rate	transition_count_total / stimulus_duration_s	–
transition_density	ratio	Transition density	unique_edges / (n_states $\times$ (n_states – 1))	1.0 = all possible transitions observed.
transition_unique_edges	–	Transition unique edges	count(transition_matrix_dense > 0)	–
transition_reciprocity	ratio	Transition reciprocity	$\sum \min(T_{\{ij\}}, T_{\{ji\}}) / \sum T_{\{ij\}}$	High = gaze often goes back and forth.

Export key	Unit	Description & tooltip	Computation / formula	Interpretation
transition_self_loops	–	Transition self loops	$\sum \text{diagonal}(\text{transition_matrix_dense_with_self})$	–
transition_symmetry	ratio	Transition symmetry	Pearson-Korrelation($T_{\{ij\}}$, $T_{\{ji\}}$)	1.0 = perfectly symmetric.
transition_centralization	ratio	Transition centralization	Abweichung der Kantenhäufigkeiten von Gleichverteilung	High = few AOIs dominate the transition pattern.
transition_edge_entropy	–	Transition edge entropy	$H = -\sum p_e \times \log(p_e)$ über alle Kanten	High = evenly distributed transitions.
transition_entropy_incl_outside	bits	Transition entropy incl outside	$H = -\sum \sum p_{\{ij\}} \times \log(p_{\{ij\}})$	High = many different transition patterns.
transition_entropy_norm_incl_outside	ratio	Transition entropy norm incl outside	$H / \log(n_{\text{possible_transitions}})$	–
transition_entropy_excl_outside	bits	Transition entropy excl outside	Wie incl_outside, auf Matrix ohne Outside	–
transition_entropy_norm_excl_outside	ratio	Transition entropy norm excl outside	$H / \log(n_{\text{possible_transitions_no_outside}})$	–
transition_state_entropy_incl_outside	bits	Transition state entropy incl outside	$\text{mean}_i(H_i) = \text{mittlere Entropie pro Zeile der Wahrscheinlichkeitsmatrix}$	High = next step unpredictable.
transition_state_entropy_norm_incl_outside	ratio	Transition state entropy norm incl outside	–	–
transition_state_entropy_excl_outside	bits	Transition state entropy excl outside	$\text{mean}_i(H_i)$ auf Matrix ohne Outside	–
transition_state_entropy_norm_excl_outside	ratio	Transition state entropy norm excl outside	–	–
transition_state_entropy_weighted_incl_outside	bits	Visit-weighted variant of transition_state_entropy_incl_outside: the row-wise entropy is weighted by each AOI's visit frequency (frequently visited AOIs count more) instead of an equal-weight mean. Incl. Outside.	$\sum_i \frac{w_i}{\sum_j w_j} H_i$, $w_i = \text{visit frequency of AOI } i$	High = from the AOIs actually visited often, the next step is hard to predict.
transition_state_entropy_weighted_excl_outside	bits	Like the visit-weighted variant incl. Outside, but only on the defined AOIs without the Outside region.	$\sum_i \frac{w_i}{\sum_j w_j} H_i$ on the matrix without Outside	High = from the frequently visited AOIs, the next step is hard to predict.
transition_entropy_rate_stationary_incl_outside	–	Transition entropy rate stationary incl outside	$H_{\text{rate}} = \sum_i \pi_i \times H(p_{\{i \cdot\}})$	Entropy of the next transition at equilibrium.
transition_entropy_rate_stationary_excl_outside	–	Transition entropy rate stationary excl outside	Wie incl_outside, auf System ohne Outside	–

3.16 Fixation-based IDT Transition Structure & Entropy

Export key	Unit	Description & tooltip	Computation / formula	Interpretation
idt_transition_count_total	–	Transition count total (I-DT)	IDT-Transitionsmatrix: $\sum \sum \text{transition_matrix_dense}$	–
idt_transition_unique_edges	–	Transition unique edges (I-DT)	IDT-Transitionsmatrix: $\text{count}(\text{transition_matrix_dense} > 0)$	–
idt_transition_density	ratio	Transition density (I-DT)	IDT-Transitionsmatrix: $\text{unique_edges} / (n_{\text{states}} \times (n_{\text{states}} - 1))$	1.0 = all possible transitions observed.

Export key	Unit	Description & tooltip	Computation / formula	Interpretation
idt_transition_reciprocity	ratio	Transition reciprocity (I-DT)	IDT-Transitionsmatrix: $\sum \min(T_{\{ij\}}, T_{\{ji\}}) / \sum T_{\{ij\}}$	High = gaze often goes back and forth.
idt_transition_self_loops	–	Transition self loops (I-DT)	IDT-Transitionsmatrix: $\sum \text{diagonal}(\text{transition_matrix_dense_with_self})$	–
idt_transition_symmetry	ratio	Transition symmetry (I-DT)	IDT-Transitionsmatrix: Pearson-Korrelation($T_{\{ij\}}$, $T_{\{ji\}}$)	1.0 = perfectly symmetric.
idt_transition_centralization	ratio	Transition centralization (I-DT)	IDT-Transitionsmatrix: Abweichung der Kantenhäufigkeiten von Gleichverteilung	High = few AOIs dominate the transition pattern.
idt_transition_edge_entropy	bits	Transition edge entropy (I-DT)	IDT-Transitionsmatrix: $H = -\sum p_e \times \log(p_e)$ über alle Kanten	High = evenly distributed transitions.
idt_transition_entropy	bits	Transition entropy (I-DT)	$H = -\sum_{i,j} p_{ij} \log_2 p_{ij}$	High = many patterns. Low = predictable gaze pattern.
idt_transition_entropy_norm	ratio	Transition entropy norm (I-DT)	$H / \log(n_mögliche_übergänge)$	–
idt_transition_entropy_rowwise	bits	Transition entropy rowwise (I-DT)	Berechnet auf den IDT-Ereignissen (Verfahren siehe Methodenteil).	–
idt_transition_entropy_rowwise_norm	ratio	Transition entropy rowwise norm (I-DT)	Berechnet auf den IDT-Ereignissen (Verfahren siehe Methodenteil).	–
idt_transition_entropy_rate_stationary	bits	Transition entropy rate stationary (I-DT)	Berechnet auf den IDT-Ereignissen (Verfahren siehe Methodenteil).	–
idt_transition_count_total_no_outside	–	Transition count total no outside (I-DT)	Berechnet auf den IDT-Ereignissen (Verfahren siehe Methodenteil).	–
idt_transition_unique_edges_no_outside	–	Transition unique edges no outside (I-DT)	Berechnet auf den IDT-Ereignissen (Verfahren siehe Methodenteil).	–
idt_transition_density_no_outside	ratio	Transition density no outside (I-DT)	Berechnet auf den IDT-Ereignissen (Verfahren siehe Methodenteil).	–
idt_transition_reciprocity_no_outside	ratio	Transition reciprocity no outside (I-DT)	Berechnet auf den IDT-Ereignissen (Verfahren siehe Methodenteil).	–
idt_transition_self_loops_no_outside	–	Transition self loops no outside (I-DT)	Berechnet auf den IDT-Ereignissen (Verfahren siehe Methodenteil).	–
idt_transition_symmetry_no_outside	ratio	Transition symmetry no outside (I-DT)	Berechnet auf den IDT-Ereignissen (Verfahren siehe Methodenteil).	–
idt_transition_centralization_no_outside	ratio	Transition centralization no outside (I-DT)	Berechnet auf den IDT-Ereignissen (Verfahren siehe Methodenteil).	–
idt_transition_edge_entropy_no_outside	bits	Transition edge entropy no outside (I-DT)	Berechnet auf den IDT-Ereignissen (Verfahren siehe Methodenteil).	–
idt_transition_entropy_no_outside	bits	Transition entropy no outside (I-DT)	Berechnet auf den IDT-Ereignissen (Verfahren siehe Methodenteil).	–
idt_transition_entropy_norm_no_outside	ratio	Transition entropy norm no outside (I-DT)	Berechnet auf den IDT-Ereignissen (Verfahren siehe Methodenteil).	–
idt_transition_entropy_rowwise_no_outside	bits	Transition entropy rowwise no outside (I-DT)	Berechnet auf den IDT-Ereignissen (Verfahren siehe Methodenteil).	–

Export key	Unit	Description & tooltip	Computation / formula	Interpretation
idt_transition_entropy_rowwise_norm_no_outside	ratio	Transition entropy rowwise norm no outside (I-DT)	Berechnet auf den IDT-Ereignissen (Verfahren siehe Methodenteil).	–
idt_transition_entropy_rate_stationary_no_outside	bits	Transition entropy rate stationary no outside (I-DT)	Berechnet auf den IDT-Ereignissen (Verfahren siehe Methodenteil).	–

3.17 Fixation-based IDT-robust Transition Structure & Entropy

This group mirrors its base family key for key; the computation is that of the base family but under the active presets thresholds. It appears in the export only when the corresponding output columns exist in the project metric state.

Export key	Unit	Description & tooltip	Computation / formula	Interpretation
idt_robust_transition_count_total	–	Transition count total (I-DT robust)	IDT-Transitionsmatrix: $\sum \sum \text{transition_matrix_dense}$	–
idt_robust_transition_unique_edges	–	Transition unique edges (I-DT robust)	IDT-Transitionsmatrix: $\text{count}(\text{transition_matrix_dense} > 0)$	–
idt_robust_transition_density	–	Transition density (I-DT robust)	IDT-Transitionsmatrix: $\text{unique_edges} / (\text{n_states} \times (\text{n_states} - 1))$	1.0 = all possible transitions observed.
idt_robust_transition_reciprocity	–	Transition reciprocity (I-DT robust)	IDT-Transitionsmatrix: $\sum \min(T_{\{ij\}}, T_{\{ji\}}) / \sum T_{\{ij\}}$	High = gaze often goes back and forth.
idt_robust_transition_self_loops	–	Transition self loops (I-DT robust)	IDT-Transitionsmatrix: $\sum \text{diagonal}(\text{transition_matrix_dense_with_self})$	–
idt_robust_transition_symmetry	–	Transition symmetry (I-DT robust)	IDT-Transitionsmatrix: Pearson-Korrelation($T_{\{ij\}}$, $T_{\{ji\}}$)	1.0 = perfectly symmetric.
idt_robust_transition_centralization	–	Transition centralization (I-DT robust)	IDT-Transitionsmatrix: Abweichung der Kantenhäufigkeiten von Gleichverteilung	High = few AOIs dominate the transition pattern.
idt_robust_transition_edge_entropy	–	Transition edge entropy (I-DT robust)	IDT-Transitionsmatrix: $H = -\sum p_{\text{e}} \times \log(p_{\text{e}})$ über alle Kanten	High = evenly distributed transitions.
idt_robust_transition_entropy	–	Transition entropy (I-DT robust)	$H = -\sum_{i,j} p_{ij} \log_2 p_{ij}$	High = many patterns. Low = predictable gaze pattern.
idt_robust_transition_entropy_norm	–	Transition entropy norm (I-DT robust)	$H / \log(\text{n_mögliche_übergänge})$	–
idt_robust_transition_entropy_rowwise	–	Transition entropy rowwise (I-DT robust)	Berechnet auf den IDT-Ereignissen (Verfahren siehe Methodenteil).	–
idt_robust_transition_entropy_rowwise_norm	–	Transition entropy rowwise norm (I-DT robust)	Berechnet auf den IDT-Ereignissen (Verfahren siehe Methodenteil).	–
idt_robust_transition_entropy_rate_stationary	–	Transition entropy rate stationary (I-DT robust)	Berechnet auf den IDT-Ereignissen (Verfahren siehe Methodenteil).	–
idt_robust_transition_count_total_no_outside	–	Transition count total no outside (I-DT robust)	Berechnet auf den IDT-Ereignissen (Verfahren siehe Methodenteil).	–
idt_robust_transition_unique_edges_no_outside	–	Transition unique edges no outside (I-DT robust)	Berechnet auf den IDT-Ereignissen (Verfahren siehe Methodenteil).	–
idt_robust_transition_density_no_outside	–	Transition density no outside (I-DT robust)	Berechnet auf den IDT-Ereignissen (Verfahren siehe Methodenteil).	–

Export key	Unit	Description & tooltip	Computation / formula	Interpretation
idt_robust_transition_reciprocity_no_outside	–	Transition reciprocity no outside (I-DT robust)	Berechnet auf den IDT-Ereignissen (Verfahren siehe Methodenteil).	–
idt_robust_transition_self_loops_no_outside	–	Transition self loops no outside (I-DT robust)	Berechnet auf den IDT-Ereignissen (Verfahren siehe Methodenteil).	–
idt_robust_transition_symmetry_no_outside	–	Transition symmetry no outside (I-DT robust)	Berechnet auf den IDT-Ereignissen (Verfahren siehe Methodenteil).	–
idt_robust_transition_centralization_no_outside	–	Transition centralization no outside (I-DT robust)	Berechnet auf den IDT-Ereignissen (Verfahren siehe Methodenteil).	–
idt_robust_transition_edge_entropy_no_outside	–	Transition edge entropy no outside (I-DT robust)	Berechnet auf den IDT-Ereignissen (Verfahren siehe Methodenteil).	–
idt_robust_transition_entropy_no_outside	–	Transition entropy no outside (I-DT robust)	Berechnet auf den IDT-Ereignissen (Verfahren siehe Methodenteil).	–
idt_robust_transition_entropy_norm_no_outside	–	Transition entropy norm no outside (I-DT robust)	Berechnet auf den IDT-Ereignissen (Verfahren siehe Methodenteil).	–
idt_robust_transition_entropy_rowwise_no_outside	–	Transition entropy rowwise no outside (I-DT robust)	Berechnet auf den IDT-Ereignissen (Verfahren siehe Methodenteil).	–
idt_robust_transition_entropy_rowwise_norm_no_outside	–	Transition entropy rowwise norm no outside (I-DT robust)	Berechnet auf den IDT-Ereignissen (Verfahren siehe Methodenteil).	–
idt_robust_transition_entropy_rate_stationary_no_outside	–	Transition entropy rate stationary no outside (I-DT robust)	Berechnet auf den IDT-Ereignissen (Verfahren siehe Methodenteil).	–

3.18 Fixation-based SMI/BeGaze-IDT Transition Structure & Entropy

This group mirrors its base family key for key; the computation is that of the base family but under the active presets thresholds. It appears in the export only when the corresponding output columns exist in the project metric state.

Export key	Unit	Description & tooltip	Computation / formula	Interpretation
smi_idt_transition_count_total	–	Transition count total (SMI/BeGaze I-DT)	IDT-Transitionsmatrix: $\sum \sum \text{transition_matrix_dense}$	–
smi_idt_transition_unique_edges	–	Transition unique edges (SMI/BeGaze I-DT)	IDT-Transitionsmatrix: $\text{count}(\text{transition_matrix_dense} > 0)$	–
smi_idt_transition_density	–	Transition density (SMI/BeGaze I-DT)	IDT-Transitionsmatrix: $\text{unique_edges} / (\text{n_states} \times (\text{n_states} - 1))$	1.0 = all possible transitions observed.
smi_idt_transition_reciprocity	–	Transition reciprocity (SMI/BeGaze I-DT)	IDT-Transitionsmatrix: $\sum \min(T_{\{ij\}}, T_{\{ji\}}) / \sum T_{\{ij\}}$	High = gaze often goes back and forth.
smi_idt_transition_self_loops	–	Transition self loops (SMI/BeGaze I-DT)	IDT-Transitionsmatrix: $\sum \text{diagonal}(\text{transition_matrix_dense_with_self})$	–
smi_idt_transition_symmetry	–	Transition symmetry (SMI/BeGaze I-DT)	IDT-Transitionsmatrix: $\text{Pearson-Korrelation}(T_{\{ij\}}, T_{\{ji\}})$	1.0 = perfectly symmetric.
smi_idt_transition_centralization	–	Transition centralization (SMI/BeGaze I-DT)	IDT-Transitionsmatrix: Abweichung der Kantenhäufigkeiten von Gleichverteilung	High = few AOIs dominate the transition pattern.

Export key	Unit	Description & tooltip	Computation / formula	Interpretation
smi_idt_transition_edge_entropy	–	Transition edge entropy (SMI/BeGaze I-DT)	IDT-Transitionsmatrix: $H = -\sum p_e \times \log(p_e)$ über alle Kanten	High = evenly distributed transitions.
smi_idt_transition_entropy	–	Transition entropy (SMI/BeGaze I-DT)	$H = -\sum_{i,j} p_{ij} \log_2 p_{ij}$	High = many patterns. Low = predictable gaze pattern.
smi_idt_transition_entropy_norm	–	Transition entropy norm (SMI/BeGaze I-DT)	$H / \log(n_mögliche_übergänge)$	–
smi_idt_transition_entropy_rowwise	–	Transition entropy rowwise (SMI/BeGaze I-DT)	Berechnet auf den IDT-Ereignissen (Verfahren siehe Methodenteil).	–
smi_idt_transition_entropy_rowwise_norm	–	Transition entropy rowwise norm (SMI/BeGaze I-DT)	Berechnet auf den IDT-Ereignissen (Verfahren siehe Methodenteil).	–
smi_idt_transition_entropy_rate_stationary	–	Transition entropy rate stationary (SMI/BeGaze I-DT)	Berechnet auf den IDT-Ereignissen (Verfahren siehe Methodenteil).	–
smi_idt_transition_count_total_no_outside	–	Transition count total no outside (SMI/BeGaze I-DT)	Berechnet auf den IDT-Ereignissen (Verfahren siehe Methodenteil).	–
smi_idt_transition_unique_edges_no_outside	–	Transition unique edges no outside (SMI/BeGaze I-DT)	Berechnet auf den IDT-Ereignissen (Verfahren siehe Methodenteil).	–
smi_idt_transition_density_no_outside	–	Transition density no outside (SMI/BeGaze I-DT)	Berechnet auf den IDT-Ereignissen (Verfahren siehe Methodenteil).	–
smi_idt_transition_reciprocity_no_outside	–	Transition reciprocity no outside (SMI/BeGaze I-DT)	Berechnet auf den IDT-Ereignissen (Verfahren siehe Methodenteil).	–
smi_idt_transition_self_loops_no_outside	–	Transition self loops no outside (SMI/BeGaze I-DT)	Berechnet auf den IDT-Ereignissen (Verfahren siehe Methodenteil).	–
smi_idt_transition_symmetry_no_outside	–	Transition symmetry no outside (SMI/BeGaze I-DT)	Berechnet auf den IDT-Ereignissen (Verfahren siehe Methodenteil).	–
smi_idt_transition_centralization_no_outside	–	Transition centralization no outside (SMI/BeGaze I-DT)	Berechnet auf den IDT-Ereignissen (Verfahren siehe Methodenteil).	–
smi_idt_transition_edge_entropy_no_outside	–	Transition edge entropy no outside (SMI/BeGaze I-DT)	Berechnet auf den IDT-Ereignissen (Verfahren siehe Methodenteil).	–
smi_idt_transition_entropy_no_outside	–	Transition entropy no outside (SMI/BeGaze I-DT)	Berechnet auf den IDT-Ereignissen (Verfahren siehe Methodenteil).	–
smi_idt_transition_entropy_norm_no_outside	–	Transition entropy norm no outside (SMI/BeGaze I-DT)	Berechnet auf den IDT-Ereignissen (Verfahren siehe Methodenteil).	–
smi_idt_transition_entropy_rowwise_no_outside	–	Transition entropy rowwise no outside (SMI/BeGaze I-DT)	Berechnet auf den IDT-Ereignissen (Verfahren siehe Methodenteil).	–
smi_idt_transition_entropy_rowwise_norm_no_outside	–	Transition entropy rowwise norm no outside (SMI/BeGaze I-DT)	Berechnet auf den IDT-Ereignissen (Verfahren siehe Methodenteil).	–
smi_idt_transition_entropy_rate_stationary_no_outside	–	Transition entropy rate stationary no outside (SMI/BeGaze I-DT)	Berechnet auf den IDT-Ereignissen (Verfahren siehe Methodenteil).	–

3.19 Fixation-based IVT Transition Structure & Entropy

Export key	Unit	Description & tooltip	Computation / formula	Interpretation
ivt_transition_count_total	–	Transition count total (I-VT)	IVT-Transitionsmatrix: $\sum \sum \text{transition_matrix_dense}$	–
ivt_transition_unique_edges	–	Transition unique edges (I-VT)	IVT-Transitionsmatrix: $\text{count}(\text{transition_matrix_dense} > 0)$	–
ivt_transition_density	ratio	Transition density (I-VT)	IVT-Transitionsmatrix: $\text{unique_edges} / (\text{n_states} \times (\text{n_states} - 1))$	1.0 = all possible transitions observed.
ivt_transition_reciprocity	ratio	Transition reciprocity (I-VT)	IVT-Transitionsmatrix: $\sum \min(T_{\{ij\}}, T_{\{ji\}}) / \sum T_{\{ij\}}$	High = gaze often goes back and forth.
ivt_transition_self_loops	–	Transition self loops (I-VT)	IVT-Transitionsmatrix: $\sum \text{diagonal}(\text{transition_matrix_dense_with_self})$	–
ivt_transition_symmetry	ratio	Transition symmetry (I-VT)	IVT-Transitionsmatrix: Pearson-Korrelation($T_{\{ij\}}, T_{\{ji\}}$)	1.0 = perfectly symmetric.
ivt_transition_centralization	ratio	Transition centralization (I-VT)	IVT-Transitionsmatrix: Abweichung der Kantenhäufigkeiten von Gleichverteilung	High = few AOIs dominate the transition pattern.
ivt_transition_edge_entropy	bits	Transition edge entropy (I-VT)	IVT-Transitionsmatrix: $H = -\sum p_e \times \log(p_e)$ über alle Kanten	High = evenly distributed transitions.
ivt_transition_entropy	bits	Transition entropy (I-VT)	$H = -\sum_{i,j} p_{ij} \log_2 p_{ij}$	–
ivt_transition_entropy_norm	ratio	Transition entropy norm (I-VT)	$H / \log(\text{n_mögliche_übergänge})$	–
ivt_transition_entropy_rowwise	bits	Transition entropy rowwise (I-VT)	Berechnet auf den IVT-Ereignissen (Verfahren siehe Methodenteil).	–
ivt_transition_entropy_rowwise_norm	ratio	Transition entropy rowwise norm (I-VT)	Berechnet auf den IVT-Ereignissen (Verfahren siehe Methodenteil).	–
ivt_transition_entropy_rate_stationary	bits	Transition entropy rate stationary (I-VT)	Berechnet auf den IVT-Ereignissen (Verfahren siehe Methodenteil).	–
ivt_transition_count_total_no_outside	–	Transition count total no outside (I-VT)	Berechnet auf den IVT-Ereignissen (Verfahren siehe Methodenteil).	–
ivt_transition_unique_edges_no_outside	–	Transition unique edges no outside (I-VT)	Berechnet auf den IVT-Ereignissen (Verfahren siehe Methodenteil).	–
ivt_transition_density_no_outside	ratio	Transition density no outside (I-VT)	Berechnet auf den IVT-Ereignissen (Verfahren siehe Methodenteil).	–
ivt_transition_reciprocity_no_outside	ratio	Transition reciprocity no outside (I-VT)	Berechnet auf den IVT-Ereignissen (Verfahren siehe Methodenteil).	–
ivt_transition_self_loops_no_outside	–	Transition self loops no outside (I-VT)	Berechnet auf den IVT-Ereignissen (Verfahren siehe Methodenteil).	–
ivt_transition_symmetry_no_outside	ratio	Transition symmetry no outside (I-VT)	Berechnet auf den IVT-Ereignissen (Verfahren siehe Methodenteil).	–
ivt_transition_centralization_no_outside	ratio	Transition centralization no outside (I-VT)	Berechnet auf den IVT-Ereignissen (Verfahren siehe Methodenteil).	–
ivt_transition_edge_entropy_no_outside	bits	Transition edge entropy no outside (I-VT)	Berechnet auf den IVT-Ereignissen (Verfahren siehe Methodenteil).	–
ivt_transition_entropy_no_outside	bits	Transition entropy no outside (I-VT)	Berechnet auf den IVT-Ereignissen (Verfahren siehe Methodenteil).	–

Export key	Unit	Description & tooltip	Computation / formula	Interpretation
ivt_transition_entropy_norm_no_outside	ratio	Transition entropy norm no outside (I-VT)	Berechnet auf den IVT-Ereignissen (Verfahren siehe Methodenteil).	–
ivt_transition_entropy_rowwise_no_outside	bits	Transition entropy rowwise no outside (I-VT)	Berechnet auf den IVT-Ereignissen (Verfahren siehe Methodenteil).	–
ivt_transition_entropy_rowwise_norm_no_outside	ratio	Transition entropy rowwise norm no outside (I-VT)	Berechnet auf den IVT-Ereignissen (Verfahren siehe Methodenteil).	–
ivt_transition_entropy_rate_stationary_no_outside	bits	Transition entropy rate stationary no outside (I-VT)	Berechnet auf den IVT-Ereignissen (Verfahren siehe Methodenteil).	–

3.20 Fixation-based IVT-robust Transition Structure & Entropy

Export key	Unit	Description & tooltip	Computation / formula	Interpretation
ivt_robust_transition_count_total	–	Transition count total (I-VT robust)	IVT Robust-Transitionsmatrix: $\sum \sum \text{transition_matrix_dense}$	–
ivt_robust_transition_unique_edges	–	Transition unique edges (I-VT robust)	IVT Robust-Transitionsmatrix: $\text{count}(\text{transition_matrix_dense} > 0)$	–
ivt_robust_transition_density	ratio	Transition density (I-VT robust)	IVT Robust-Transitionsmatrix: $\text{unique_edges} / (\text{n_states} \times (\text{n_states} - 1))$	1.0 = all possible transitions observed.
ivt_robust_transition_reciprocity	ratio	Transition reciprocity (I-VT robust)	IVT Robust-Transitionsmatrix: $\sum \min(T_{\{ij\}}, T_{\{ji\}}) / \sum T_{\{ij\}}$	High = gaze often goes back and forth.
ivt_robust_transition_self_loops	–	Transition self loops (I-VT robust)	IVT Robust-Transitionsmatrix: $\sum \text{diagonal}(\text{transition_matrix_dense_with_self})$	–
ivt_robust_transition_symmetry	ratio	Transition symmetry (I-VT robust)	IVT Robust-Transitionsmatrix: Pearson-Korrelation($T_{\{ij\}}, T_{\{ji\}}$)	1.0 = perfectly symmetric.
ivt_robust_transition_centralization	ratio	Transition centralization (I-VT robust)	IVT Robust-Transitionsmatrix: Abweichung der Kantenhäufigkeiten von Gleichverteilung	High = few AOIs dominate the transition pattern.
ivt_robust_transition_edge_entropy	bits	Transition edge entropy (I-VT robust)	IVT Robust-Transitionsmatrix: $H = -\sum p_e \times \log(p_e)$ über alle Kanten	High = evenly distributed transitions.
ivt_robust_transition_entropy	bits	Transition entropy (I-VT robust)	$H = -\sum_{i,j} p_{ij} \log_2 p_{ij}$	Preferred variant.
ivt_robust_transition_entropy_norm	ratio	Transition entropy norm (I-VT robust)	$H / \log(\text{n_mögliche_übergänge})$	0 = predictable, 1 = maximally unpredictable.
ivt_robust_transition_entropy_rowwise	bits	Transition entropy rowwise (I-VT robust)	Berechnet auf den IVT Robust-Ereignissen (Verfahren siehe Methodenteil).	–
ivt_robust_transition_entropy_rowwise_norm	ratio	Transition entropy rowwise norm (I-VT robust)	Berechnet auf den IVT Robust-Ereignissen (Verfahren siehe Methodenteil).	–

Export key	Unit	Description & tooltip	Computation / formula	Interpretation
ivt_robust_transition_entropy_rate_stationary	bits	Transition entropy rate stationary (I-VT robust)	Berechnet auf den IVT Robust-Ereignissen (Verfahren siehe Methodenteil).	–
ivt_robust_transition_count_total_no_outside	–	Transition count total no outside (I-VT robust)	Berechnet auf den IVT Robust-Ereignissen (Verfahren siehe Methodenteil).	–
ivt_robust_transition_unique_edges_no_outside	–	Transition unique edges no outside (I-VT robust)	Berechnet auf den IVT Robust-Ereignissen (Verfahren siehe Methodenteil).	–
ivt_robust_transition_density_no_outside	ratio	Transition density no outside (I-VT robust)	Berechnet auf den IVT Robust-Ereignissen (Verfahren siehe Methodenteil).	–
ivt_robust_transition_reciprocity_no_outside	ratio	Transition reciprocity no outside (I-VT robust)	Berechnet auf den IVT Robust-Ereignissen (Verfahren siehe Methodenteil).	–
ivt_robust_transition_self_loops_no_outside	–	Transition self loops no outside (I-VT robust)	Berechnet auf den IVT Robust-Ereignissen (Verfahren siehe Methodenteil).	–
ivt_robust_transition_symmetry_no_outside	ratio	Transition symmetry no outside (I-VT robust)	Berechnet auf den IVT Robust-Ereignissen (Verfahren siehe Methodenteil).	–
ivt_robust_transition_centralization_no_outside	ratio	Transition centralization no outside (I-VT robust)	Berechnet auf den IVT Robust-Ereignissen (Verfahren siehe Methodenteil).	–
ivt_robust_transition_edge_entropy_no_outside	bits	Transition edge entropy no outside (I-VT robust)	Berechnet auf den IVT Robust-Ereignissen (Verfahren siehe Methodenteil).	–
ivt_robust_transition_entropy_no_outside	bits	Transition entropy no outside (I-VT robust)	Berechnet auf den IVT Robust-Ereignissen (Verfahren siehe Methodenteil).	–
ivt_robust_transition_entropy_norm_no_outside	ratio	Transition entropy norm no outside (I-VT robust)	Berechnet auf den IVT Robust-Ereignissen (Verfahren siehe Methodenteil).	–
ivt_robust_transition_entropy_rowwise_no_outside	bits	Transition entropy rowwise no outside (I-VT robust)	Berechnet auf den IVT Robust-Ereignissen (Verfahren siehe Methodenteil).	–
ivt_robust_transition_entropy_rowwise_norm_no_outside	ratio	Transition entropy rowwise norm no outside (I-VT robust)	Berechnet auf den IVT Robust-Ereignissen (Verfahren siehe Methodenteil).	–
ivt_robust_transition_entropy_rate_stationary_no_outside	bits	Transition entropy rate stationary no outside (I-VT robust)	Berechnet auf den IVT Robust-Ereignissen (Verfahren siehe Methodenteil).	–

3.21 Fixation-based Tobii-IVT Transition Structure & Entropy

This group mirrors its base family key for key; the computation is that of the base family but under the active presets thresholds. It appears in the export only when the corresponding output columns exist in the project metric state.

Export key	Unit	Description & tooltip	Computation / formula	Interpretation
tobii_ivt_transition_count_total	–	Transition count total (Tobii I-VT)	IVT Robust-Transitionsmatrix: $\sum \sum \text{transition_matrix_dense}$	–
tobii_ivt_transition_unique_edges	–	Transition unique edges (Tobii I-VT)	IVT Robust-Transitionsmatrix: $\text{count}(\text{transition_matrix_dense} > 0)$	–
tobii_ivt_transition_density	–	Transition density (Tobii I-VT)	IVT Robust-Transitionsmatrix: $\text{unique_edges} / (\text{n_states} \times (\text{n_states} - 1))$	1.0 = all possible transitions observed.
tobii_ivt_transition_reciprocity	–	Transition reciprocity (Tobii I-VT)	IVT Robust-Transitionsmatrix: $\sum \min(T_{\{ij\}}, T_{\{ji\}}) / \sum T_{\{ij\}}$	High = gaze often goes back and forth.
tobii_ivt_transition_self_loops	–	Transition self loops (Tobii I-VT)	IVT Robust-Transitionsmatrix: $\sum \text{diagonal}(\text{transition_matrix_dense_with_self})$	–
tobii_ivt_transition_symmetry	–	Transition symmetry (Tobii I-VT)	IVT Robust-Transitionsmatrix: Pearson-Korrelation($T_{\{ij\}}$, $T_{\{ji\}}$)	1.0 = perfectly symmetric.
tobii_ivt_transition_centralization	–	Transition centralization (Tobii I-VT)	IVT Robust-Transitionsmatrix: Abweichung der Kantenhäufigkeiten von Gleichverteilung	High = few AOIs dominate the transition pattern.
tobii_ivt_transition_edge_entropy	–	Transition edge entropy (Tobii I-VT)	IVT Robust-Transitionsmatrix: $H = -\sum p_{e} \times \log(p_{e})$ über alle Kanten	High = evenly distributed transitions.
tobii_ivt_transition_entropy	–	Transition entropy (Tobii I-VT)	$H = -\sum_{i,j} p_{ij} \log_2 p_{ij}$	Preferred variant.
tobii_ivt_transition_entropy_norm	–	Transition entropy norm (Tobii I-VT)	$H / \log(\text{n_mögliche_übergänge})$	0 = predictable, 1 = maximally unpredictable.
tobii_ivt_transition_entropy_rowwise	–	Transition entropy rowwise (Tobii I-VT)	Berechnet auf den IVT Robust-Ereignissen (Verfahren siehe Methodenteil).	–
tobii_ivt_transition_entropy_rowwise_norm	–	Transition entropy rowwise norm (Tobii I-VT)	Berechnet auf den IVT Robust-Ereignissen (Verfahren siehe Methodenteil).	–
tobii_ivt_transition_entropy_rate_stationary	–	Transition entropy rate stationary (Tobii I-VT)	Berechnet auf den IVT Robust-Ereignissen (Verfahren siehe Methodenteil).	–
tobii_ivt_transition_count_total_no_outside	–	Transition count total no outside (Tobii I-VT)	Berechnet auf den IVT Robust-Ereignissen (Verfahren siehe Methodenteil).	–
tobii_ivt_transition_unique_edges_no_outside	–	Transition unique edges no outside (Tobii I-VT)	Berechnet auf den IVT Robust-Ereignissen (Verfahren siehe Methodenteil).	–
tobii_ivt_transition_density_no_outside	–	Transition density no outside (Tobii I-VT)	Berechnet auf den IVT Robust-Ereignissen (Verfahren siehe Methodenteil).	–
tobii_ivt_transition_reciprocity_no_outside	–	Transition reciprocity no outside (Tobii I-VT)	Berechnet auf den IVT Robust-Ereignissen (Verfahren siehe Methodenteil).	–

Export key	Unit	Description & tooltip	Computation / formula	Interpretation
tobii_ivt_transition_self_loops_no_outside	–	Transition self loops no outside (Tobii I-VT)	Berechnet auf den IVT Robust-Ereignissen (Verfahren siehe Methodenteil).	–
tobii_ivt_transition_symmetry_no_outside	–	Transition symmetry no outside (Tobii I-VT)	Berechnet auf den IVT Robust-Ereignissen (Verfahren siehe Methodenteil).	–
tobii_ivt_transition_centralization_no_outside	–	Transition centralization no outside (Tobii I-VT)	Berechnet auf den IVT Robust-Ereignissen (Verfahren siehe Methodenteil).	–
tobii_ivt_transition_edge_entropy_no_outside	–	Transition edge entropy no outside (Tobii I-VT)	Berechnet auf den IVT Robust-Ereignissen (Verfahren siehe Methodenteil).	–
tobii_ivt_transition_entropy_no_outside	–	Transition entropy no outside (Tobii I-VT)	Berechnet auf den IVT Robust-Ereignissen (Verfahren siehe Methodenteil).	–
tobii_ivt_transition_entropy_norm_no_outside	–	Transition entropy norm no outside (Tobii I-VT)	Berechnet auf den IVT Robust-Ereignissen (Verfahren siehe Methodenteil).	–
tobii_ivt_transition_entropy_rowwise_no_outside	–	Transition entropy rowwise no outside (Tobii I-VT)	Berechnet auf den IVT Robust-Ereignissen (Verfahren siehe Methodenteil).	–
tobii_ivt_transition_entropy_rowwise_norm_no_outside	–	Transition entropy rowwise norm no outside (Tobii I-VT)	Berechnet auf den IVT Robust-Ereignissen (Verfahren siehe Methodenteil).	–
tobii_ivt_transition_entropy_rate_stationary_no_outside	–	Transition entropy rate stationary no outside (Tobii I-VT)	Berechnet auf den IVT Robust-Ereignissen (Verfahren siehe Methodenteil).	–

3.22 Fixation-based EyeLink-style Transition Structure & Entropy

This group mirrors its base family key for key; the computation is that of the base family but under the active presets thresholds. It appears in the export only when the corresponding output columns exist in the project metric state.

Export key	Unit	Description & tooltip	Computation / formula	Interpretation
eyelink_transition_count_total	–	Transition count total (EyeLink-style)	IVT Robust-Transitionsmatrix: $\sum \sum \text{transition_matrix_dense}$	–
eyelink_transition_unique_edges	–	Transition unique edges (EyeLink-style)	IVT Robust-Transitionsmatrix: $\text{count}(\text{transition_matrix_dense} > 0)$	–
eyelink_transition_density	–	Transition density (EyeLink-style)	IVT Robust-Transitionsmatrix: $\text{unique_edges} / (\text{n_states} \times (\text{n_states} - 1))$	1.0 = all possible transitions observed.
eyelink_transition_reciprocity	–	Transition reciprocity (EyeLink-style)	IVT Robust-Transitionsmatrix: $\sum \min(T_{\{ij\}}, T_{\{ji\}}) / \sum T_{\{ij\}}$	High = gaze often goes back and forth.

Export key	Unit	Description & tooltip	Computation / formula	Interpretation
eyelink_transition_self_loops	–	Transition self loops (EyeLink-style)	IVT Robust-Transitionsmatrix: $\sum \text{diagonal}(\text{transition_matrix_dense_with_self})$	–
eyelink_transition_symmetry	–	Transition symmetry (EyeLink-style)	IVT Robust-Transitionsmatrix: Pearson-Korrelation($T_{\{ij\}}$, $T_{\{ji\}}$)	1.0 = perfectly symmetric.
eyelink_transition_centralization	–	Transition centralization (EyeLink-style)	IVT Robust-Transitionsmatrix: Abweichung der Kantenhäufigkeiten von Gleichverteilung	High = few AOIs dominate the transition pattern.
eyelink_transition_edge_entropy	–	Transition edge entropy (EyeLink-style)	IVT Robust-Transitionsmatrix: $H = -\sum p_{e} \times \log(p_{e})$ über alle Kanten	High = evenly distributed transitions.
eyelink_transition_entropy	–	Transition entropy (EyeLink-style)	$H = -\sum_{i,j} p_{ij} \log_2 p_{ij}$	Preferred variant.
eyelink_transition_entropy_norm	–	Transition entropy norm (EyeLink-style)	$H / \log(n_{\text{mögliche_übergänge}})$	0 = predictable, 1 = maximally unpredictable.
eyelink_transition_entropy_rowwise	–	Transition entropy rowwise (EyeLink-style)	Berechnet auf den IVT Robust-Ereignissen (Verfahren siehe Methodenteil).	–
eyelink_transition_entropy_rowwise_norm	–	Transition entropy rowwise norm (EyeLink-style)	Berechnet auf den IVT Robust-Ereignissen (Verfahren siehe Methodenteil).	–
eyelink_transition_entropy_rate_stationary	–	Transition entropy rate stationary (EyeLink-style)	Berechnet auf den IVT Robust-Ereignissen (Verfahren siehe Methodenteil).	–
eyelink_transition_count_total_no_outside	–	Transition count total no outside (EyeLink-style)	Berechnet auf den IVT Robust-Ereignissen (Verfahren siehe Methodenteil).	–
eyelink_transition_unique_edges_no_outside	–	Transition unique edges no outside (EyeLink-style)	Berechnet auf den IVT Robust-Ereignissen (Verfahren siehe Methodenteil).	–
eyelink_transition_density_no_outside	–	Transition density no outside (EyeLink-style)	Berechnet auf den IVT Robust-Ereignissen (Verfahren siehe Methodenteil).	–
eyelink_transition_reciprocity_no_outside	–	Transition reciprocity no outside (EyeLink-style)	Berechnet auf den IVT Robust-Ereignissen (Verfahren siehe Methodenteil).	–
eyelink_transition_self_loops_no_outside	–	Transition self loops no outside (EyeLink-style)	Berechnet auf den IVT Robust-Ereignissen (Verfahren siehe Methodenteil).	–
eyelink_transition_symmetry_no_outside	–	Transition symmetry no outside (EyeLink-style)	Berechnet auf den IVT Robust-Ereignissen (Verfahren siehe Methodenteil).	–
eyelink_transition_centralization_no_outside	–	Transition centralization no outside (EyeLink-style)	Berechnet auf den IVT Robust-Ereignissen (Verfahren siehe Methodenteil).	–
eyelink_transition_edge_entropy_no_outside	–	Transition edge entropy no outside (EyeLink-style)	Berechnet auf den IVT Robust-Ereignissen (Verfahren siehe Methodenteil).	–

Export key	Unit	Description & tooltip	Computation / formula	Interpretation
eyelink_transition_entropy_no_outside	–	Transition entropy no outside (EyeLink-style)	Berechnet auf den IVT Robust-Ereignissen (Verfahren siehe Methodenteil).	–
eyelink_transition_entropy_norm_no_outside	–	Transition entropy norm no outside (EyeLink-style)	Berechnet auf den IVT Robust-Ereignissen (Verfahren siehe Methodenteil).	–
eyelink_transition_entropy_rowwise_no_outside	–	Transition entropy rowwise no outside (EyeLink-style)	Berechnet auf den IVT Robust-Ereignissen (Verfahren siehe Methodenteil).	–
eyelink_transition_entropy_rowwise_norm_no_outside	–	Transition entropy rowwise norm no outside (EyeLink-style)	Berechnet auf den IVT Robust-Ereignissen (Verfahren siehe Methodenteil).	–
eyelink_transition_entropy_rate_stationary_no_outside	–	Transition entropy rate stationary no outside (EyeLink-style)	Berechnet auf den IVT Robust-Ereignissen (Verfahren siehe Methodenteil).	–

3.23 Relation to ScanMatch, MultiMatch, and Iriscope AOI-sequence metrics

Iriscope reports related scanpath-similarity measures, but not literal ScanMatch or MultiMatch scores. This distinction is methodologically important. Iriscope metrics should be reported as AOI-based sequence and similarity measures, not as direct implementations of the original procedures.

ScanMatch and MultiMatch are established and valuable approaches for describing and comparing scanpaths. However, they do not answer exactly the same question as the AOI-centred sequence measures in Iriscope. ScanMatch-style methods treat scanpaths as sequences and compare them through alignment or edit-distance logic. To do so, the continuous stimulus space first has to be discretised, for example by a grid, by AOIs, or by other spatial categories. In addition, the analyst has to define how similar or dissimilar two states are. These decisions are legitimate and often useful, but they are not neutral: grid size, AOI definition, time window, substitution logic, and normalisation all help determine what later counts as similar.

MultiMatch-style methods follow a different idea. They compare scanpaths multidimensionally, typically along spatial-geometric and temporal properties such as shape or vector structure, direction, length, position, and duration. This approach is particularly useful when the geometric structure of scanpaths is itself the object of interest. At the same time, it also depends on methodological decisions: Which fixations form the basis? How are vectors constructed from fixations? Are scanpaths simplified or normalised? How are different scanpath lengths handled? Which dimension is considered most relevant? Again, the method is powerful, but it is not assumption-free.

Iriscope therefore deliberately adopts a complementary, AOI-based focus. Many applied studies do not primarily ask whether two scanpaths have the same geometric form in pixel space. More often, the relevant question is whether participants visited the same theoretically defined regions in a similar order. Examples include source figures and response options in mental-rotation tasks, words and lines in reading studies, product image, price and call-to-action elements in advertising or usability research, or safety-relevant elements in complex scenes.

The reduction from spatial trajectory to AOI sequence is therefore not merely a loss of information. It is a theoretical decision about which information is relevant for the research question. Iriscope

makes this decision explicit: gaze samples or fixations are assigned to a versioned AOI set, raw, compact, or time-binned AOI sequences are derived from them, and these sequences are compared with interpretable distance or similarity measures. The advantage is their direct connection to the research logic: a similarity value does not describe the entire gaze geometry in the abstract, but the similarity of viewed AOI sequences under a documented AOI set and a documented fixation or sample basis.

This leads to a clear reporting rule: when Iriscope exports metrics with the prefixes `scanmatch` or `multimatch`, these should be reported as *ScanMatch-style* or *MultiMatch-style* measures. They are conceptually related to the original procedures, but in Iriscope they are tied to AOI-sequence logic, the active algorithmic family, the active AOI set, and export provenance. For research questions that require a full geometric scanpath-shape analysis, classical ScanMatch, MultiMatch, or other specialised procedures remain appropriate reference methods. For AOI-centred research questions, Iriscope provides a directly interpretable and reproducibly documented alternative.

3.24 Scanpath & Levenshtein (within)

Export key	Unit	Description & tooltip	Computation / formula	Interpretation
<code>scanpath_string</code>	–	Scanpath string	Jedes Sample → AOI-Buchstabe konkateniert	Very long; prefer the more compact variants.
<code>scanpath_string_compact_aoi_only</code>	–	Scanpath string compact aoi only	Run-Length-Encoding; Outside ignoriert	Basis for most Levenshtein analyses.
<code>scanpath_string_compact_with_outside</code>	–	Scanpath string compact with outside	Wie <code>aoi_only</code> , Outside explizit kodiert	When gaze outside the AOIs is substantively relevant.
<code>scanpath_length</code>	px	Scanpath length	$\sum p_{i+1} - p_i $ über alle finiten Gaze-Samples	Long = wide-ranging exploration.
<code>scanpath_compact_length</code>	–	Scanpath compact length	<code>len(scanpath_string_compact_aoi_only)</code>	Number of saccades between different AOIs.
<code>scanpath_aoi_changes</code>	–	Scanpath aoi changes	Anzahl Übergänge zwischen verschiedenen AOIs	–
<code>scanpath_unique_aois</code>	–	Scanpath unique aois	<code>len(set(scanpath_string_compact_aoi_only))</code>	High = broad exploration.
<code>scanpath_return_count</code>	–	Scanpath return count	Anzahl revisitierter AOIs im kompakten Scanpath	High = elaborate processing.
<code>scanpath_compression_ratio</code>	ratio	Scanpath compression ratio	<code>len(compact_aoi_only) / len(raw)</code>	Near 0: long fixations. Near 1: constant switching.
<code>scanpath_redundancy</code>	–	Scanpath redundancy	<code>1 - compression_ratio</code>	–
<code>scanpath_efficiency</code>	ratio	Scanpath efficiency	Euklidische Distanz(Start→Ende) / <code>scanpath_length</code>	1.0 = straight path.
<code>scanpath_linearity</code>	ratio	Scanpath linearity	Ähnlichkeit zu idealem linearem Pfad	High = ordered sequential exploration.
<code>scanpath_complexity</code>	score	Scanpath complexity	Kombinationsmaß aus Entropie und Variabilität	High = hard-to-predict gaze patterns.
<code>scanpath_prev_string</code>	–	Scanpath prev string	<code>scanpath_string_compact_aoi_only</code> des n-1 Trials	Basis for within-subject Levenshtein.
<code>scanpath_prev_string_compact_aoi_only</code>	–	Scanpath prev string compact aoi only	<code>= scanpath_prev_string</code>	–
<code>scanpath_prev_string_compact_with_outside</code>	–	Scanpath prev string compact with outside	<code>scanpath_string_compact_with_outside</code> des n-1 Trials	–
<code>levenshtein_prev_raw</code>	–	Levenshtein prev raw	<code>EditDistanz(scanpath_string, scanpath_prev_string)</code>	High = very different gaze behaviour across items.
<code>levenshtein_prev_raw_norm</code>	ratio	Levenshtein prev raw norm	<code>dist / max(len(a), len(b))</code>	0 = identical; 1 = maximally different.

Export key	Unit	Description & tooltip	Computation / formula	Interpretation
levenshtein_prev_compact_aoi_only	–	Levenshtein prev compact aoi only	EditDistanz(compact_aoi_only, prev_compact_aoi_only)	Focus on AOI order.
levenshtein_prev_compact_aoi_only_norm	ratio	Levenshtein prev compact aoi only norm	$\text{dist} / \max(\text{len}(a), \text{len}(b))$	–
levenshtein_prev_compact_with_outside	–	Levenshtein prev compact with outside	EditDistanz(compact_with_outside, prev_compact_with_outside)	–
levenshtein_prev_compact_with_outside_norm	ratio	Levenshtein prev compact with outside norm	–	–
levenshtein_prev_item	–	Levenshtein prev item	prev_stim_name (Resolver-Fallback)	Documents which item was compared.
scanpath_string_time_binned_aoi_only	–	Scanpath string time binned aoi only	Jeder 100-ms-Bin → dominante AOI; Outside ignoriert	Basis for ScanMatch-style analyses.
scanpath_string_time_binned_with_outside	–	Scanpath string time binned with outside	Wie aoi_only; Outside explizit kodiert	–
scanpath_prev_string_time_binned_aoi_only	–	Scanpath prev string time binned aoi only	100-ms-Bin-String des n-1 Trials	–
scanpath_prev_string_time_binned_with_outside	–	Scanpath prev string time binned with outside	–	–
scanpath_time_bin_size_ms	ms	Scanpath time bin size ms	Konstante: 100.0 ms	Document for reproducibility.
levenshtein_prev_time_binned_aoi_only	–	Levenshtein prev time binned aoi only	EditDistanz(time_binned_aoi_only, prev_time_binned_aoi_only)	Absolute distance; prefer the normalised variant.
levenshtein_prev_time_binned_aoi_only_norm	ratio	Levenshtein prev time binned aoi only norm	$\text{dist} / \max(\text{len}(a), \text{len}(b))$	0 = identical; 1 = maximally different.
levenshtein_prev_time_binned_with_outside	–	Levenshtein prev time binned with outside	EditDistanz(time_binned_with_outside, prev_with_outside)	–
levenshtein_prev_time_binned_with_outside_norm	ratio	Levenshtein prev time binned with outside norm	–	–

3.25 Scanpath Strings – IDT

Scanpath strings encode the viewing sequence as an AOI-symbol sequence. One AOI symbol is appended per fixation; compacted (run-length-compressed) variants with and without “Outside“ as well as derived indices (length, unique AOIs, return count) are then generated. These strings are the basis for Levenshtein-based and related ScanMatch-/MultiMatch-style analyses. The algorithmic source (I-DT, I-VT, ...) is indicated by the respective prefix.

Export-Key	Unit	Description & tooltip	Computation / formula	Interpretation
scanpath_idt_string	–	Source-specific scanpath string or derived sequence index. The source is encoded in the column name.	AOI-symbol sequence: one symbol per fixation, in temporal order.	Raw sequence; basis for sequence and Levenshtein analyses.
scanpath_idt_compact_aoi_only	–	Source-specific scanpath string or derived sequence index. The source is encoded in the column name.	Run-length-compressed AOI sequence; “Outside“ removed and repeated states collapsed.	Focus on pure AOI order without dwell-time weighting; ignores “Outside“.
scanpath_idt_compact_with_outside	–	Source-specific scanpath string or derived sequence index. The source is encoded in the column name.	Run-length-compressed AOI sequence including “Outside“ as its own state.	Like the compact sequence, but with “Outside“ retained as its own state when looks outside AOIs are theoretically relevant.

Export-Key	Unit	Description & tooltip	Computation / formula	Interpretation
scanpath_idt_length	–	Source-specific scanpath string or derived sequence index. The source is encoded in the column name.	$ S = \# \text{fixations in the sequence}$	Long = many fixations or broad exploration.
scanpath_idt_compact_length	–	Source-specific scanpath string or derived sequence index. The source is encoded in the column name.	$ S_c = \# \text{dwell runs after compaction}$	Number of AOI runs (approximately AOI switches + 1); high values indicate frequent switching between AOIs.
scanpath_idt_unique_aois	–	Source-specific scanpath string or derived sequence index. The source is encoded in the column name.	$ \{\text{distinct AOIs in } S_c\} $	Number of different AOIs visited; high values indicate broad exploration.
scanpath_idt_return_count	–	Source-specific scanpath string or derived sequence index. The source is encoded in the column name.	$\#\{i : a_i \in \{a_1, \dots, a_{i-1}\}\}$	Frequent returns to previously visited AOIs indicate comparison or rereading behaviour.

3.26 Scanpath Strings – IDT robust

Scanpath strings encode the viewing sequence as an AOI-symbol sequence. One AOI symbol is appended per fixation; compacted (run-length-compressed) variants with and without “Outside” as well as derived indices (length, unique AOIs, return count) are then generated. These strings are the basis for Levenshtein-based and related ScanMatch-/MultiMatch-style analyses. The algorithmic source (I-DT, I-VT, ...) is indicated by the respective prefix.

Export-Key	Unit	Description & tooltip	Computation / formula	Interpretation
scanpath_idt_robust_string	–	Source-specific scanpath string or derived sequence index. The source is encoded in the column name.	AOI-symbol sequence: one symbol per fixation, in temporal order.	Raw sequence; basis for sequence and Levenshtein analyses.
scanpath_idt_robust_compact_aoi_only	–	Source-specific scanpath string or derived sequence index. The source is encoded in the column name.	Run-length-compressed AOI sequence; “Outside” removed and repeated states collapsed.	Focus on pure AOI order without dwell-time weighting; ignores “Outside”.
scanpath_idt_robust_compact_with_outside	–	Source-specific scanpath string or derived sequence index. The source is encoded in the column name.	Run-length-compressed AOI sequence including “Outside” as its own state.	Like the compact sequence, but with “Outside” retained as its own state when looks outside AOIs are theoretically relevant.
scanpath_idt_robust_length	–	Source-specific scanpath string or derived sequence index. The source is encoded in the column name.	$ S = \# \text{fixations in the sequence}$	Long = many fixations or broad exploration.
scanpath_idt_robust_compact_length	–	Source-specific scanpath string or derived sequence index. The source is encoded in the column name.	$ S_c = \# \text{dwell runs after compaction}$	Number of AOI runs (approximately AOI switches + 1); high values indicate frequent switching between AOIs.
scanpath_idt_robust_unique_aois	–	Source-specific scanpath string or derived sequence index. The source is encoded in the column name.	$ \{\text{distinct AOIs in } S_c\} $	Number of different AOIs visited; high values indicate broad exploration.
scanpath_idt_robust_return_count	–	Source-specific scanpath string or derived sequence index. The source is encoded in the column name.	$\#\{i : a_i \in \{a_1, \dots, a_{i-1}\}\}$	Frequent returns to previously visited AOIs indicate comparison or rereading behaviour.

3.27 Scanpath Strings – IVT

Scanpath strings encode the viewing sequence as an AOI-symbol sequence. One AOI symbol is appended per fixation; compacted (run-length-compressed) variants with and without “Outside“ as well as derived indices (length, unique AOIs, return count) are then generated. These strings are the basis for Levenshtein-based and related ScanMatch-/MultiMatch-style analyses. The algorithmic source (I-DT, I-VT, ...) is indicated by the respective prefix.

Export-Key	Unit	Description & tooltip	Computation / formula	Interpretation
scanpath_ivt_string	–	Source-specific scanpath string or derived sequence index. The source is encoded in the column name.	AOI-symbol sequence: one symbol per fixation, in temporal order.	Raw sequence; basis for sequence and Levenshtein analyses.
scanpath_ivt_compact_aoi_only	–	Source-specific scanpath string or derived sequence index. The source is encoded in the column name.	Run-length-compressed AOI sequence; “Outside“ removed and repeated states collapsed.	Focus on pure AOI order without dwell-time weighting; ignores “Outside“.
scanpath_ivt_compact_with_outside	–	Source-specific scanpath string or derived sequence index. The source is encoded in the column name.	Run-length-compressed AOI sequence including “Outside“ as its own state.	Like the compact sequence, but with “Outside“ retained as its own state when looks outside AOIs are theoretically relevant.
scanpath_ivt_length	–	Source-specific scanpath string or derived sequence index. The source is encoded in the column name.	$ S = \# \text{fixations in the sequence}$	Long = many fixations or broad exploration.
scanpath_ivt_compact_length	–	Source-specific scanpath string or derived sequence index. The source is encoded in the column name.	$ S_c = \# \text{dwell runs after compaction}$	Number of AOI runs (approximately AOI switches + 1); high values indicate frequent switching between AOIs.
scanpath_ivt_unique_aois	–	Source-specific scanpath string or derived sequence index. The source is encoded in the column name.	$ \{\text{distinct AOIs in } S_c\} $	Number of different AOIs visited; high values indicate broad exploration.
scanpath_ivt_return_count	–	Source-specific scanpath string or derived sequence index. The source is encoded in the column name.	$\#\{i : a_i \in \{a_1, \dots, a_{i-1}\}\}$	Frequent returns to previously visited AOIs indicate comparison or rereading behaviour.

3.28 Scanpath Strings – IVT robust

Scanpath strings encode the viewing sequence as an AOI-symbol sequence. One AOI symbol is appended per fixation; compacted (run-length-compressed) variants with and without “Outside“ as well as derived indices (length, unique AOIs, return count) are then generated. These strings are the basis for Levenshtein-based and related ScanMatch-/MultiMatch-style analyses. The algorithmic source (I-DT, I-VT, ...) is indicated by the respective prefix.

Export-Key	Unit	Description & tooltip	Computation / formula	Interpretation
scanpath_ivt_robust_string	–	Source-specific scanpath string or derived sequence index. The source is encoded in the column name.	AOI-symbol sequence: one symbol per fixation, in temporal order.	Raw sequence; basis for sequence and Levenshtein analyses.
scanpath_ivt_robust_compact_aoi_only	–	Source-specific scanpath string or derived sequence index. The source is encoded in the column name.	Run-length-compressed AOI sequence; “Outside“ removed and repeated states collapsed.	Focus on pure AOI order without dwell-time weighting; ignores “Outside“.
scanpath_ivt_robust_compact_with_outside	–	Source-specific scanpath string or derived sequence index. The source is encoded in the column name.	Run-length-compressed AOI sequence including “Outside“ as its own state.	Like the compact sequence, but with “Outside“ retained as its own state when looks outside AOIs are theoretically relevant.

Export-Key	Unit	Description & tooltip	Computation / formula	Interpretation
scanpath_ivt_robust_length	–	Source-specific scanpath string or derived sequence index. The source is encoded in the column name.	$ S = \# \text{fixations in the sequence}$	Long = many fixations or broad exploration.
scanpath_ivt_robust_compact_length	–	Source-specific scanpath string or derived sequence index. The source is encoded in the column name.	$ S_c = \# \text{dwell runs after compaction}$	Number of AOI runs (approximately AOI switches + 1); high values indicate frequent switching between AOIs.
scanpath_ivt_robust_unique_aois	–	Source-specific scanpath string or derived sequence index. The source is encoded in the column name.	$ \{\text{distinct AOIs in } S_c\} $	Number of different AOIs visited; high values indicate broad exploration.
scanpath_ivt_robust_return_count	–	Source-specific scanpath string or derived sequence index. The source is encoded in the column name.	$\#\{i : a_i \in \{a_1, \dots, a_{i-1}\}\}$	Frequent returns to previously visited AOIs indicate comparison or rereading behaviour.

3.29 Scanpath Strings – Tobii IVT

Scanpath strings encode the viewing sequence as an AOI-symbol sequence. One AOI symbol is appended per fixation; compacted (run-length-compressed) variants with and without “Outside” as well as derived indices (length, unique AOIs, return count) are then generated. These strings are the basis for Levenshtein-based and related ScanMatch-/MultiMatch-style analyses. The algorithmic source (I-DT, I-VT, ...) is indicated by the respective prefix.

Export-Key	Unit	Description & tooltip	Computation / formula	Interpretation
scanpath_tobii_ivt_string	–	Source-specific scanpath string or derived sequence index. The source is encoded in the column name.	AOI-symbol sequence: one symbol per fixation, in temporal order.	Raw sequence; basis for sequence and Levenshtein analyses.
scanpath_tobii_ivt_compact_aoi_only	–	Source-specific scanpath string or derived sequence index. The source is encoded in the column name.	Run-length-compressed AOI sequence; “Outside” removed and repeated states collapsed.	Focus on pure AOI order without dwell-time weighting; ignores “Outside”.
scanpath_tobii_ivt_compact_with_outside	–	Source-specific scanpath string or derived sequence index. The source is encoded in the column name.	Run-length-compressed AOI sequence including “Outside” as its own state.	Like the compact sequence, but with “Outside” retained as its own state when looks outside AOIs are theoretically relevant.
scanpath_tobii_ivt_length	–	Source-specific scanpath string or derived sequence index. The source is encoded in the column name.	$ S = \# \text{fixations in the sequence}$	Long = many fixations or broad exploration.
scanpath_tobii_ivt_compact_length	–	Source-specific scanpath string or derived sequence index. The source is encoded in the column name.	$ S_c = \# \text{dwell runs after compaction}$	Number of AOI runs (approximately AOI switches + 1); high values indicate frequent switching between AOIs.
scanpath_tobii_ivt_unique_aois	–	Source-specific scanpath string or derived sequence index. The source is encoded in the column name.	$ \{\text{distinct AOIs in } S_c\} $	Number of different AOIs visited; high values indicate broad exploration.
scanpath_tobii_ivt_return_count	–	Source-specific scanpath string or derived sequence index. The source is encoded in the column name.	$\#\{i : a_i \in \{a_1, \dots, a_{i-1}\}\}$	Frequent returns to previously visited AOIs indicate comparison or rereading behaviour.

3.30 Scanpath Strings – EyeLink-style

Scanpath strings encode the viewing sequence as an AOI-symbol sequence. One AOI symbol is appended per fixation; compacted (run-length-compressed) variants with and without “Outside“ as well as derived indices (length, unique AOIs, return count) are then generated. These strings are the basis for Levenshtein-based and related ScanMatch-/MultiMatch-style analyses. The algorithmic source (I-DT, I-VT, ...) is indicated by the respective prefix.

Export-Key	Unit	Description & tooltip	Computation / formula	Interpretation
scanpath_eyelink_string	–	Source-specific scanpath string or derived sequence index. The source is encoded in the column name.	AOI-symbol sequence: one symbol per fixation, in temporal order.	Raw sequence; basis for sequence and Levenshtein analyses.
scanpath_eyelink_compact_aoi_only	–	Source-specific scanpath string or derived sequence index. The source is encoded in the column name.	Run-length-compressed AOI sequence; “Outside“ removed and repeated states collapsed.	Focus on pure AOI order without dwell-time weighting; ignores “Outside“.
scanpath_eyelink_compact_with_outside	–	Source-specific scanpath string or derived sequence index. The source is encoded in the column name.	Run-length-compressed AOI sequence including “Outside“ as its own state.	Like the compact sequence, but with “Outside“ retained as its own state when looks outside AOIs are theoretically relevant.
scanpath_eyelink_length	–	Source-specific scanpath string or derived sequence index. The source is encoded in the column name.	$ S = \text{\#fixations in the sequence}$	Long = many fixations or broad exploration.
scanpath_eyelink_compact_length	–	Source-specific scanpath string or derived sequence index. The source is encoded in the column name.	$ S_c = \text{\#dwell runs after compaction}$	Number of AOI runs (approximately AOI switches + 1); high values indicate frequent switching between AOIs.
scanpath_eyelink_unique_aois	–	Source-specific scanpath string or derived sequence index. The source is encoded in the column name.	$ \{\text{distinct AOIs in } S_c\} $	Number of different AOIs visited; high values indicate broad exploration.
scanpath_eyelink_return_count	–	Source-specific scanpath string or derived sequence index. The source is encoded in the column name.	$\#\{i : a_i \in \{a_1, \dots, a_{i-1}\}\}$	Frequent returns to previously visited AOIs indicate comparison or rereading behaviour.

3.31 Scanpath Strings – SMI/BeGaze IDT

Scanpath strings encode the viewing sequence as an AOI-symbol sequence. One AOI symbol is appended per fixation; compacted (run-length-compressed) variants with and without “Outside“ as well as derived indices (length, unique AOIs, return count) are then generated. These strings are the basis for Levenshtein-based and related ScanMatch-/MultiMatch-style analyses. The algorithmic source (I-DT, I-VT, ...) is indicated by the respective prefix.

Export-Key	Unit	Description & tooltip	Computation / formula	Interpretation
scanpath_smi_idt_string	–	Source-specific scanpath string or derived sequence index. The source is encoded in the column name.	AOI-symbol sequence: one symbol per fixation, in temporal order.	Raw sequence; basis for sequence and Levenshtein analyses.
scanpath_smi_idt_compact_aoi_only	–	Source-specific scanpath string or derived sequence index. The source is encoded in the column name.	Run-length-compressed AOI sequence; “Outside“ removed and repeated states collapsed.	Focus on pure AOI order without dwell-time weighting; ignores “Outside“.
scanpath_smi_idt_compact_with_outside	–	Source-specific scanpath string or derived sequence index. The source is encoded in the column name.	Run-length-compressed AOI sequence including “Outside“ as its own state.	Like the compact sequence, but with “Outside“ retained as its own state when looks outside AOIs are theoretically relevant.

Export-Key	Unit	Description & tooltip	Computation / formula	Interpretation
scanpath_smi_idt_length	–	Source-specific scanpath string or derived sequence index. The source is encoded in the column name.	$ S = \# \text{fixations in the sequence}$	Long = many fixations or broad exploration.
scanpath_smi_idt_compact_length	–	Source-specific scanpath string or derived sequence index. The source is encoded in the column name.	$ S_c = \# \text{dwell runs after compaction}$	Number of AOI runs (approximately AOI switches + 1); high values indicate frequent switching between AOIs.
scanpath_smi_idt_unique_aois	–	Source-specific scanpath string or derived sequence index. The source is encoded in the column name.	$ \{\text{distinct AOIs in } S_c\} $	Number of different AOIs visited; high values indicate broad exploration.
scanpath_smi_idt_return_count	–	Source-specific scanpath string or derived sequence index. The source is encoded in the column name.	$\#\{i : a_i \in \{a_1, \dots, a_{i-1}\}\}$	Frequent returns to previously visited AOIs indicate comparison or rereading behaviour.

3.32 Between-Subject (BS_*)

Export key	Unit	Description & tooltip	Computation / formula	Interpretation
bs_raw_mean_dist_to_all	ratio	Bs raw mean dist to all	–	–
bs_raw_median_dist_to_all	ratio	Bs raw median dist to all	–	–
bs_raw_min_dist_to_all	ratio	Bs raw min dist to all	–	–
bs_raw_max_dist_to_all	ratio	Bs raw max dist to all	–	–
bs_raw_std_dist_to_all	ratio	Bs raw std dist to all	–	–
bs_raw_n_compared	–	Bs raw n compared	–	–
bs_raw_similarity_rank	rank	Bs raw similarity rank	–	–
bs_raw_similarity_rank_pct	ratio	Bs raw similarity rank pct	–	–
bs_compact_aoi_only_mean_dist_to_all	ratio	Bs compact aoi only mean dist to all	–	–
bs_compact_aoi_only_median_dist_to_all	ratio	Bs compact aoi only median dist to all	–	–
bs_compact_aoi_only_min_dist_to_all	ratio	Bs compact aoi only min dist to all	–	–
bs_compact_aoi_only_max_dist_to_all	ratio	Bs compact aoi only max dist to all	–	–
bs_compact_aoi_only_std_dist_to_all	ratio	Bs compact aoi only std dist to all	–	–
bs_compact_aoi_only_n_compared	–	Bs compact aoi only n compared	–	–
bs_compact_aoi_only_similarity_rank	rank	Bs compact aoi only similarity rank	–	–
bs_compact_aoi_only_similarity_rank_pct	ratio	Bs compact aoi only similarity rank pct	–	–
bs_compact_with_outside_mean_dist_to_all	ratio	Bs compact with outside mean dist to all	–	–
bs_compact_with_outside_median_dist_to_all	ratio	Bs compact with outside median dist to all	–	–
bs_compact_with_outside_min_dist_to_all	ratio	Bs compact with outside min dist to all	–	–
bs_compact_with_outside_max_dist_to_all	ratio	Bs compact with outside max dist to all	–	–

Export key	Unit	Description & tooltip	Computation / formula	Interpretation
bs_compact_with_outside_std_dist_to_all	ratio	Bs compact with outside std dist to all	–	–
bs_compact_with_outside_n_compared	–	Bs compact with outside n compared	–	–
bs_compact_with_outside_similarity_rank	rank	Bs compact with outside similarity rank	–	–
bs_compact_with_outside_similarity_rank_pct	ratio	Bs compact with outside similarity rank pct	–	–
bs_recurrence_mean_dist_to_all	distance	Bs recurrence mean dist to all	mean(paarweise Recurrence-Distanzen)	High = atypical recurrence pattern.
bs_recurrence_median_dist_to_all	distance	Bs recurrence median dist to all	median(paarweise Distanzen)	–
bs_recurrence_min_dist_to_all	distance	Bs recurrence min dist to all	min(paarweise Distanzen)	–
bs_recurrence_max_dist_to_all	distance	Bs recurrence max dist to all	max(paarweise Distanzen)	–
bs_recurrence_std_dist_to_all	distance	Bs recurrence std dist to all	std(paarweise Distanzen)	–
bs_recurrence_n_compared	–	Bs recurrence n compared	$n_subjects - 1$	–
bs_recurrence_similarity_rank	rank	Bs recurrence similarity rank	$rank(mean_dist_to_all)$	1 = most similar recurrence signature.
bs_recurrence_similarity_rank_pct	ratio	Bs recurrence similarity rank pct	$(rank - 1) / (n - 1)$	–

3.33 ScanMatch / MultiMatch (Between-Subject)

Export key	Unit	Description & tooltip	Computation / formula	Interpretation
bs_scanmatch_similarity_mean	ratio	Bs scanmatch similarity mean	mean(scanmatch_similarity über alle Paare); 1 = sehr ähnlich	–
bs_scanmatch_similarity_median	ratio	Bs scanmatch similarity median	median(scanmatch_similarity)	–
bs_scanmatch_similarity_min	ratio	Bs scanmatch similarity min	min(scanmatch_similarity)	–
bs_scanmatch_similarity_max	ratio	Bs scanmatch similarity max	max(scanmatch_similarity)	–
bs_scanmatch_similarity_std	ratio	Bs scanmatch similarity std	std(scanmatch_similarity)	–
bs_scanmatch_similarity_n_compared	–	Bs scanmatch similarity n compared	$n_subjects - 1$	–
bs_scanmatch_similarity_similarity_rank	rank	Bs scanmatch similarity similarity rank	$rank(mean_similarity)$; 1 = ähnlichste Person	–
bs_scanmatch_similarity_similarity_rank_pct	ratio	Bs scanmatch similarity similarity rank pct	$(rank - 1) / (n - 1)$	–
bs_scanmatch_distance_norm_mean	ratio	Bs scanmatch distance norm mean	mean(scanmatch_distance_norm); 0 = ähnlich, 1 = unähnlich	Complementary to bs_scanmatch_similarity_mean.
bs_scanmatch_distance_norm_median	ratio	Bs scanmatch distance norm median	–	–
bs_scanmatch_distance_norm_min	ratio	Bs scanmatch distance norm min	–	–
bs_scanmatch_distance_norm_max	ratio	Bs scanmatch distance norm max	–	–

Export key	Unit	Description & tooltip	Computation / formula	Interpretation
bs_scanmatch_distance_norm_std	ratio	Bs scanmatch distance norm std	–	–
bs_scanmatch_distance_norm_n_compared	–	Bs scanmatch distance norm n compared	–	–
bs_scanmatch_distance_norm_similarity_rank	rank	Bs scanmatch distance norm similarity rank	1 = ähnlichste Person (kleinste Distanz)	–
bs_scanmatch_distance_norm_similarity_rank_pct	ratio	Bs scanmatch distance norm similarity rank pct	–	–
bs_multimatch_vector_similarity_mean	ratio	Bs multimatch vector similarity mean	–	–
bs_multimatch_direction_similarity_mean	ratio	Bs multimatch direction similarity mean	–	–
bs_multimatch_length_similarity_mean	ratio	Bs multimatch length similarity mean	–	–
bs_multimatch_position_similarity_mean	ratio	Bs multimatch position similarity mean	–	–
bs_multimatch_duration_similarity_mean	ratio	Bs multimatch duration similarity mean	–	–
bs_multimatch_overall_similarity_mean	ratio	Bs multimatch overall similarity mean	–	–
bs_multimatch_vector_similarity_n_compared	–	Bs multimatch vector similarity n compared	–	–
bs_multimatch_direction_similarity_n_compared	–	Bs multimatch direction similarity n compared	–	–
bs_multimatch_length_similarity_n_compared	–	Bs multimatch length similarity n compared	–	–
bs_multimatch_position_similarity_n_compared	–	Bs multimatch position similarity n compared	–	–
bs_multimatch_duration_similarity_n_compared	–	Bs multimatch duration similarity n compared	–	–
bs_multimatch_overall_similarity_n_compared	–	Bs multimatch overall similarity n compared	–	–
bs_multimatch_overall_similarity_similarity_rank	rank	Bs multimatch overall similarity similarity rank	–	–
bs_multimatch_overall_similarity_similarity_rank_pct	ratio	Bs multimatch overall similarity similarity rank pct	–	–

3.34 Recurrence / RQA

Export key	Unit	Description & tooltip	Computation / formula	Interpretation
recurrence_rate	ratio	Recurrence rate	$RR = \frac{ \{(i,j) : R_{ij} = 1\} }{N^2}$	High = many repetitions. Low = exploratory.
recurrence_rate_upper	ratio	Recurrence rate upper	Nur obere Dreiecksmatrix	Prevents double counting.
recurrence_rate_offdiag	ratio	Recurrence rate offdiag	Hauptdiagonale (i=j) ausgeschlossen	Self-recurrence excluded.
recurrence_mean	ratio	Recurrence mean	mean(R)	Alternative global value.
recurrence_mean_upper	ratio	Recurrence mean upper	mean(oberes Dreieck von R)	–
recurrence_mean_offdiag	ratio	Recurrence mean offdiag	mean(R, ohne Diagonale)	–

Export key	Unit	Description & tooltip	Computation / formula	Interpretation
recurrence_max_diag	–	Recurrence max diag	$\max(\text{Diagonallinienlängen} \geq l_{\min})$	Longest deterministic phase.
recurrence_lmax	–	RQA $L_{\max}$: longest diagonal line excluding the line of identity (main diagonal). Unlike <code>recurrence_max_diag</code> , which is computed including the main diagonal and equals the sequence length n , $L_{\max}$ measures the longest genuine recurring subsequence.	$\max(\text{off-diagonal line lengths} \geq l_{\min})$	Longest recurring subsequence; high = strongly deterministic, repeated gaze patterns.
recurrence_diag_entropy	bits	Recurrence diag entropy	$H_L = -\sum_{l \geq l_{\min}} p(l) \log_2 p(l)$	Complexity of the deterministic phases.
recurrence_diag_entropy_norm	ratio	Recurrence diag entropy norm	$H_L / \log(n_{\text{diagonal_lines}})$	–
recurrence_vert_entropy	bits	Recurrence vert entropy	$H_V = -\sum_{v \geq v_{\min}} p(v) \log_2 p(v)$	Complexity of the dwell patterns.
recurrence_vert_entropy_norm	ratio	Recurrence vert entropy norm	$H_V / \log(n_{\text{vertical_lines}})$	–
recurrence_determinism	ratio	Recurrence determinism	$\text{DET} = \sum_{l \geq l_{\min}} l P(l) / \sum R_{ij}$	High = predictable patterns. Low = chaotic.
recurrence_laminarity	ratio	Recurrence laminarity	$\text{LAM} = \sum_{v \geq v_{\min}} v V(v) / \sum R_{ij}$	High = many/long fixations.
recurrence_trapping_time	–	Recurrence trapping time	$\text{TT} = \sum v V(v) / \sum V(v), v \geq v_{\min}$	Mean duration of a stable state.
recurrence_diag_count	–	Recurrence diag count	$\text{count}(\text{Diagonallinien mit } l \geq l_{\min})$	–
recurrence_vert_count	–	Recurrence vert count	$\text{count}(\text{Vertikallinien mit } v \geq v_{\min})$	–

3.35 Pupillometrie 0–2000 ms

Export key	Unit	Description & tooltip	Computation / formula	Interpretation
pupil_baseline_mean	unit	Pupil baseline mean	$\text{mean}(\text{pupil} \mid t \in \text{baseline_window}, \text{Standard: 0-200 ms})$	Reference value for all baseline-corrected metrics. Absolute values are device-specific.
pupil_baseline_sd	unit	Pupil baseline sd	$\text{std}(\text{pupil} \mid t \in \text{baseline_window})$	For z-score normalisation ($\text{zscore} = \text{delta} / \text{baseline_sd}$).
pupil_mean_pc_change_0_2000	%	Pupil mean pc change 0 2000	–	–
pupil_peak_pc_change_0_2000	%	Pupil peak pc change 0 2000	–	–
pupil_peak_latency_ms_0_2000	ms	Pupil peak latency ms 0 2000	–	–
pupil_auc_pc_change_0_2000	auc	Pupil auc pc change 0 2000	–	–
pupil_median_pc_change_0_2000	%	Pupil median pc change 0 2000	–	–
pupil_min_pc_change_0_2000	%	Pupil min pc change 0 2000	–	–
pupil_min_pc_latency_ms_0_2000	ms	Pupil min pc latency ms 0 2000	–	–
pupil_pc_slope_linear_0_2000	%/s	Pupil pc slope linear 0 2000	–	–
pupil_pc_recovery_end_0_2000	%	Pupil pc recovery end 0 2000	–	–

Export key	Unit	Description & tooltip	Computation / formula	Interpretation
pupil_delta_mean_0_2000	unit	Pupil delta mean 0 2000	—	—
pupil_delta_peak_0_2000	unit	Pupil delta peak 0 2000	—	—
pupil_delta_peak_latency_ms_0_2000	ms	Pupil delta peak latency ms 0 2000	—	—
pupil_auc_delta_0_2000	auc	Pupil auc delta 0 2000	—	—
pupil_delta_median_0_2000	unit	Pupil delta median 0 2000	—	—
pupil_delta_min_0_2000	unit	Pupil delta min 0 2000	—	—
pupil_delta_min_latency_ms_0_2000	ms	Pupil delta min latency ms 0 2000	—	—
pupil_delta_slope_linear_0_2000	unit/s	Pupil delta slope linear 0 2000	—	—
pupil_delta_recovery_end_0_2000	unit	Pupil delta recovery end 0 2000	—	—
pupil_mean_z_0_2000	z	Pupil mean z 0 2000	—	—
pupil_peak_z_0_2000	z	Pupil peak z 0 2000	—	—
pupil_peak_z_latency_ms_0_2000	ms	Pupil peak z latency ms 0 2000	—	—
pupil_auc_z_0_2000	auc	Pupil auc z 0 2000	—	—
pupil_median_z_0_2000	z	Pupil median z 0 2000	—	—
pupil_min_z_0_2000	z	Pupil min z 0 2000	—	—
pupil_min_z_latency_ms_0_2000	ms	Pupil min z latency ms 0 2000	—	—
pupil_z_slope_linear_0_2000	z/s	Pupil z slope linear 0 2000	—	—
pupil_z_recovery_end_0_2000	z	Pupil z recovery end 0 2000	—	—

3.36 Pupillometrie 2000–4000 ms

Export key	Unit	Description & tooltip	Computation / formula	Interpretation
pupil_mean_pc_change_2000_4000	%	Pupil mean pc change 2000 4000	—	—
pupil_peak_pc_change_2000_4000	%	Pupil peak pc change 2000 4000	—	—
pupil_peak_latency_ms_2000_4000	ms	Pupil peak latency ms 2000 4000	—	—
pupil_auc_pc_change_2000_4000	auc	Pupil auc pc change 2000 4000	—	—
pupil_median_pc_change_2000_4000	%	Pupil median pc change 2000 4000	—	—
pupil_min_pc_change_2000_4000	%	Pupil min pc change 2000 4000	—	—
pupil_min_pc_latency_ms_2000_4000	ms	Pupil min pc latency ms 2000 4000	—	—
pupil_pc_slope_linear_2000_4000	%/s	Pupil pc slope linear 2000 4000	—	—
pupil_pc_recovery_end_2000_4000	%	Pupil pc recovery end 2000 4000	—	—
pupil_delta_mean_2000_4000	unit	Pupil delta mean 2000 4000	—	—
pupil_delta_peak_2000_4000	unit	Pupil delta peak 2000 4000	—	—
pupil_delta_peak_latency_ms_2000_4000	ms	Pupil delta peak latency ms 2000 4000	—	—

Export key	Unit	Description & tooltip	Computation / formula	Interpretation
pupil_auc_delta_2000_4000	auc	Pupil auc delta 2000 4000	–	–
pupil_delta_median_2000_4000	unit	Pupil delta median 2000 4000	–	–
pupil_delta_min_2000_4000	unit	Pupil delta min 2000 4000	–	–
pupil_delta_min_latency_ms_2000_4000	ms	Pupil delta min latency ms 2000 4000	–	–
pupil_delta_slope_linear_2000_4000	unit/s	Pupil delta slope linear 2000 4000	–	–
pupil_delta_recovery_end_2000_4000	unit	Pupil delta recovery end 2000 4000	–	–
pupil_mean_z_2000_4000	z	Pupil mean z 2000 4000	–	–
pupil_peak_z_2000_4000	z	Pupil peak z 2000 4000	–	–
pupil_peak_z_latency_ms_2000_4000	ms	Pupil peak z latency ms 2000 4000	–	–
pupil_auc_z_2000_4000	auc	Pupil auc z 2000 4000	–	–
pupil_median_z_2000_4000	z	Pupil median z 2000 4000	–	–
pupil_min_z_2000_4000	z	Pupil min z 2000 4000	–	–
pupil_min_z_latency_ms_2000_4000	ms	Pupil min z latency ms 2000 4000	–	–
pupil_z_slope_linear_2000_4000	z/s	Pupil z slope linear 2000 4000	–	–
pupil_z_recovery_end_2000_4000	z	Pupil z recovery end 2000 4000	–	–

3.37 Pupillometrie gesamt

Export key	Unit	Description & tooltip	Computation / formula	Interpretation
pupil_mean_pc_change_0_4000	%	Pupil mean pc change 0 4000	–	–
pupil_peak_pc_change_0_4000	%	Pupil peak pc change 0 4000	–	–
pupil_peak_latency_ms_0_4000	ms	Pupil peak latency ms 0 4000	–	–
pupil_auc_pc_change_0_4000	auc	Pupil auc pc change 0 4000	–	–
pupil_median_pc_change_0_4000	%	Pupil median pc change 0 4000	–	–
pupil_min_pc_change_0_4000	%	Pupil min pc change 0 4000	–	–
pupil_min_pc_latency_ms_0_4000	ms	Pupil min pc latency ms 0 4000	–	–
pupil_pc_slope_linear_0_4000	%/s	Pupil pc slope linear 0 4000	–	–
pupil_pc_recovery_end_0_4000	%	Pupil pc recovery end 0 4000	–	–
pupil_delta_mean_0_4000	unit	Pupil delta mean 0 4000	–	–
pupil_delta_peak_0_4000	unit	Pupil delta peak 0 4000	–	–
pupil_delta_peak_latency_ms_0_4000	ms	Pupil delta peak latency ms 0 4000	–	–
pupil_auc_delta_0_4000	auc	Pupil auc delta 0 4000	–	–
pupil_delta_median_0_4000	unit	Pupil delta median 0 4000	–	–
pupil_delta_min_0_4000	unit	Pupil delta min 0 4000	–	–

Export key	Unit	Description & tooltip	Computation / formula	Interpretation
pupil_delta_min_latency_ms_0_4000	ms	Pupil delta min latency ms 0 4000	–	–
pupil_delta_slope_linear_0_4000	unit/s	Pupil delta slope linear 0 4000	–	–
pupil_delta_recovery_end_0_4000	unit	Pupil delta recovery end 0 4000	–	–
pupil_mean_z_0_4000	z	Pupil mean z 0 4000	–	–
pupil_peak_z_0_4000	z	Pupil peak z 0 4000	–	–
pupil_peak_z_latency_ms_0_4000	ms	Pupil peak z latency ms 0 4000	–	–
pupil_auc_z_0_4000	auc	Pupil auc z 0 4000	–	–
pupil_median_z_0_4000	z	Pupil median z 0 4000	–	–
pupil_min_z_0_4000	z	Pupil min z 0 4000	–	–
pupil_min_z_latency_ms_0_4000	ms	Pupil min z latency ms 0 4000	–	–
pupil_z_slope_linear_0_4000	z/s	Pupil z slope linear 0 4000	–	–
pupil_z_recovery_end_0_4000	z	Pupil z recovery end 0 4000	–	–
pupil_deconv_energy	auc	Pupil deconv energy	$\sum \text{deconv_signal}^2$	Represents the overall strength of the cognitive response.
pupil_deconv_peak	unit	Pupil deconv peak	$\max(\text{deconv_signal})$	Magnitude of the strongest single response.
pupil_deconv_auc	auc	Pupil deconv auc	deconv_signal dt	Total cognitive load after overlap correction.

3.38 Spatial / räumliche Verteilung

Export key	Unit	Description & tooltip	Computation / formula	Interpretation
spatial_entropy	bits	Spatial entropy	Stimulus in $n \times m$ Bins; $H = -\sum p_{\text{bin}} \times \log(p_{\text{bin}})$	Measures how evenly gaze points are spread over the stimulus space. Low values mean concentration on few regions; high values indicate broad spatial exploration across the whole stimulus.
spatial_entropy_norm	ratio	Spatial entropy norm	$H / \log(n_{\text{bins}})$	Normalised variant of the spatial entropy. Useful for comparisons across stimuli or projects with different grid resolutions.
spatial_entropy_with_outside	bits	Spatial entropy with outside	Wie spatial_entropy, Outside-Bereich als eigene Zellen	–
spatial_entropy_with_outside_norm	ratio	Spatial entropy with outside norm	–	–
convex_hull_area	px ²	Convex hull area	ConvexHull(Fixationspositionen)	Area of the smallest convex hull around all valid gaze/fixation points. Large values indicate wide spatial coverage; small values indicate focused gaze behaviour.
bounding_box_area	px ²	Bounding box area	$(\max_x - \min_x) \times (\max_y - \min_y)$	Area of the smallest axis-aligned rectangle enclosing all gaze points. A simple measure of the horizontal and vertical extent of exploration.

Export key	Unit	Description & tooltip	Computation / formula	Interpretation
center_bias_mean_distance	px	Center bias mean distance	$\text{mean}(\ p_i - \text{center}\)$	Mean distance of gaze points from the stimulus centre. Low = strong centre bias; high = peripheral exploration.
center_bias_median_distance	px	Center bias median distance	$\text{median}(\ p_i - \text{center}\)$	–
mean_gaze_x	px	Mean gaze x	$\text{mean}(x_{\text{clean}})$	–
mean_gaze_y	px	Mean gaze y	$\text{mean}(y_{\text{clean}})$	–
std_gaze_x	px	Std gaze x	$\text{std}(x_{\text{clean}})$	–
std_gaze_y	px	Std gaze y	$\text{std}(y_{\text{clean}})$	–
horizontal_scan_range	px	Horizontal scan range	$\max(x) - \min(x)$	Maximum horizontal extent of gaze behaviour. High values show the stimulus was scanned widely from left to right.
vertical_scan_range	px	Vertical scan range	$\max(y) - \min(y)$	Maximum vertical extent of gaze behaviour. High values show that upper and lower stimulus regions were also covered.
spatial_density_peak	–	Spatial density peak	max(KDE) über Blickpunkte	Maximum local gaze density. High values mean gaze points concentrate strongly in a limited region.
spatial_spread	–	Spatial spread	Kombinationsmaß (implementierungsabhängig)	General dispersion measure of the gaze distribution. High = broad spatial spread; low = focused or localised gaze behaviour.
path_efficiency	–	Path efficiency	Euklidische Distanz(Start→Ende) / scanpath_length	Ratio of the direct start-to-end distance to the actual scanpath length. Values near 1 indicate a direct gaze path; low values indicate detours, regressions or exploratory scanning.
fractal_dimension	–	Fractal dimension	Box-Counting oder Hausdorff-Dimension	Measure of the geometric complexity of the gaze path. Higher values indicate more complex, branched or less linear search patterns.

3.39 Analyseparameter & Reproduzierbarkeit

Export key	Unit	Description & tooltip	Computation / formula	Interpretation
analysis_calculation_current	–	Analysis calculation current	–	–
analysis_calculation_timestamp	–	Analysis calculation timestamp	–	–
fixation_settings_preset_calculated	–	Fixation settings preset calculated	–	–
fixation_settings_preset_name_calculated	–	Fixation settings preset name calculated	–	–
fixation_settings_preset_description_calculated	–	Fixation settings preset description calculated	–	–
fixation_settings_requested_unit_calculated	–	Fixation settings requested unit calculated	–	–

Export key	Unit	Description & tooltip	Computation / formula	Interpretation
fixation_settings_pixel_fallback_used_calculated	–	Fixation settings pixel fallback used calculated	–	–
idt_dispersions_threshold_effective_px_calculated	–	Dispersion threshold effective px calculated (I-DT)	–	–
idt_min_duration_ms_calculated	–	Min duration ms calculated (I-DT)	–	–
idt_max_gap_ms_calculated	–	Max gap ms calculated (I-DT)	–	–
idt_robust_dispersions_threshold_effective_px_calculated	–	Dispersion threshold effective px calculated (I-DT robust)	–	–
idt_robust_min_duration_ms_calculated	–	Min duration ms calculated (I-DT robust)	–	–
idt_robust_max_gap_ms_calculated	–	Max gap ms calculated (I-DT robust)	–	–
ivt_velocity_threshold_calculated	–	Velocity threshold calculated (I-VT)	–	–
ivt_velocity_unit_calculated	–	Velocity unit calculated (I-VT)	–	–
ivt_min_duration_ms_calculated	–	Min duration ms calculated (I-VT)	–	–
ivt_robust_velocity_threshold_calculated	–	Velocity threshold calculated (I-VT robust)	–	–
ivt_robust_velocity_unit_calculated	–	Velocity unit calculated (I-VT robust)	–	–
ivt_robust_min_duration_ms_calculated	–	Min duration ms calculated (I-VT robust)	–	–
ivt_robust_smoothing_window_ms_calculated	–	Smoothing window ms calculated (I-VT robust)	–	–
tobii_ivt_velocity_threshold_calculated	–	Velocity threshold calculated (Tobii I-VT)	–	–
tobii_ivt_velocity_unit_calculated	–	Velocity unit calculated (Tobii I-VT)	–	–
tobii_ivt_min_duration_ms_calculated	–	Min duration ms calculated (Tobii I-VT)	–	–
tobii_ivt_smoothing_window_ms_calculated	–	Smoothing window ms calculated (Tobii I-VT)	–	–
eyelink_velocity_threshold_calculated	–	Velocity threshold calculated (EyeLink-style)	–	–
eyelink_velocity_unit_calculated	–	Velocity unit calculated (EyeLink-style)	–	–
eyelink_acceleration_threshold_calculated	–	Acceleration threshold calculated (EyeLink-style)	–	–
eyelink_displacement_threshold_calculated	–	Displacement threshold calculated (EyeLink-style)	–	–
eyelink_min_duration_ms_calculated	–	Min duration ms calculated (EyeLink-style)	–	–
eyelink_smoothing_window_ms_calculated	–	Smoothing window ms calculated (EyeLink-style)	–	–

3.40 Analysezustand / AOI-Set-Provenienz

Export key	Unit	Description & tooltip	Computation / formula	Interpretation
analysis_state_id	–	Analysis state id	–	–
analysis_state_hash	–	Analysis state hash	–	–
analysis_state_created_at	–	Analysis state created at	–	–

Export key	Unit	Description & tooltip	Computation / formula	Interpretation
analysis_state_reason	–	Analysis state reason	–	–
analysis_state_count_project	–	Analysis state count project	–	–
aoi_set_id	–	Aoi set id	–	–
aoi_set_count_project	–	Aoi set count project	–	–
analysis_state_correction_set_id	–	Analysis state correction set id	–	–
analysis_state_fixation_algorithm	–	Analysis state fixation algorithm	–	–
analysis_state_fixation_preset	–	Analysis state fixation preset	–	–
analysis_state_metric_groups	–	Analysis state metric groups	–	–
analysis_state_scope	–	Analysis state scope	–	–
analysis_state_is_project_level	–	Analysis state is project level	–	–
analysis_state_case_key	–	Analysis state case key	–	–
analysis_state_case_is_affected_by_correction	–	Analysis state case is affected by correction	–	–
analysis_state_case_correction_version	–	Analysis state case correction version	–	–
analysis_state_case_correction_id	–	Analysis state case correction id	–	–

3.41 Manuelle Gaze-/Driftkorrektur

Export key	Unit	Description & tooltip	Computation / formula	Interpretation
gaze_correction_applied	–	Gaze correction applied	–	–
gaze_correction_id	–	Gaze correction id	–	–
gaze_correction_scope	–	Gaze correction scope	–	–
gaze_correction_restored_from_original	–	Gaze correction restored from original	–	–
gaze_correction_has_original_clean	–	Gaze correction has original clean	–	–
gaze_correction_history_count_project	–	Gaze correction history count project	–	–
gaze_correction_created_at	–	Gaze correction created at	–	–
gaze_correction_offset_x	px	Gaze correction offset x	–	–
gaze_correction_offset_y	px	Gaze correction offset y	–	–
gaze_correction_drift_x	px	Gaze correction drift x	–	–
gaze_correction_drift_y	px	Gaze correction drift y	–	–
gaze_correction_rotation_deg	deg	Gaze correction rotation deg	–	–
gaze_correction_scale_x	factor	Gaze correction scale x	–	–
gaze_correction_scale_y	factor	Gaze correction scale y	–	–
gaze_correction_shear_x	factor	Gaze correction shear x	–	–

Export key	Unit	Description & tooltip	Computation / formula	Interpretation
gaze_correction_shear_y	factor	Gaze correction shear y	—	—
gaze_correction_mirror_x	—	Gaze correction mirror x	—	—
gaze_correction_mirror_y	—	Gaze correction mirror y	—	—
gaze_correction_swap_axes	—	Gaze correction swap axes	—	—
gaze_correction_center_mode	—	Gaze correction center mode	—	—
gaze_correction_center_x	px	Gaze correction center x	—	—
gaze_correction_center_y	px	Gaze correction center y	—	—
gaze_correction_case_is_affected	—	Gaze correction case is affected	—	—
gaze_correction_subject_id	—	Gaze correction subject id	—	—
gaze_correction_stimulus_name	—	Gaze correction stimulus name	—	—
gaze_correction_case_key	—	Gaze correction case key	—	—
gaze_correction_case_version	—	Gaze correction case version	—	—
gaze_correction_case_history_count	—	Gaze correction case history count	—	—
gaze_correction_project_corrected_case_count	—	Gaze correction project corrected case count	—	—

CHAPTER 4

AOI-level metrics

166 keys across 14 groups. Exported as `aoi.[AOI-name].[metric]`.

4.1 Sample-based Hits/Visits/Dwell

Export key	Unit	Description & tooltip	Computation / formula	Interpretation
<code>n_hits</code>	–	N hits	<code>count(sample ∈ AOI_ geometry)</code>	Raw measure; depends on sampling rate.
<code>hit_proportion</code>	ratio	Hit proportion	<code>n_hits / valid_samples_n</code>	More sampling-rate-independent than <code>n_hits</code> .
<code>dwell_time</code>	ms	Dwell time	$\sum \Delta t_i$ für alle Samples ∈ AOI	Central attention measure.
<code>gaze_proportion</code>	ratio	Gaze proportion	<code>dwell_time / valid_gaze_sample_duration</code>	Comparable across trials of different duration.
<code>visit_count</code>	–	Visit count	–	–
<code>n_revisits</code>	–	N revisits	<code>n_visits - 1</code>	0 = AOI visited only once.
<code>sample_refixation_count</code>	–	Sample refixation count	–	–
<code>sample_revisit_count</code>	–	Sample revisit count	–	–
<code>aoi_entry_revisit_count</code>	–	Aoi entry revisit count	–	–
<code>total_visit_duration</code>	ms	Total visit duration	$\sum \text{Dauer}(\text{visit}_i)$	Equals <code>dwell_time</code> when there are no blinks within.
<code>mean_visit_duration</code>	ms	Mean visit duration	<code>mean(Besuchsdauern)</code>	Short = scanning; long = intensive processing.
<code>median_visit_duration</code>	ms	Median visit duration	<code>median(Besuchsdauern)</code>	–
<code>std_visit_duration</code>	ms	Std visit duration	<code>std(Besuchsdauern, ddof=0)</code>	–
<code>longest_visit_duration</code>	ms	Longest visit duration	–	–
<code>max_dwell_time</code>	ms	Max dwell time	<code>max(Besuchsdauern)</code>	–
<code>min_dwell_time</code>	ms	Min dwell time	<code>min(Besuchsdauern)</code>	< 80 ms: possible artefacts.

4.2 Sample-based Timing/Order

Export key	Unit	Description & tooltip	Computation / formula	Interpretation
<code>time_to_first_aoi_entry</code>	ms	Time to first aoi entry	–	–
<code>time_to_last_aoi_hit</code>	–	Time to last aoi hit	–	–
<code>entry_order</code>	–	Entry order	Ordinalrang des ersten Besuchs unter allen AOIs	NaN if the AOI is never visited.
<code>first_pass_duration</code>	ms	First pass duration	Dauer des ersten Visits	Short = fast initial orientation.
<code>second_pass_duration</code>	ms	Second pass duration	Dauer des zweiten Visits; NaN wenn < 2 Visits	–
<code>revisit_latency</code>	ms	Revisit latency	<code>timestamp(Beginn Visit 2) - timestamp(Ende Visit 1)</code>	NaN if <code>n_visits ≤ 1</code> .

4.3 Sample-based Raw Timestamps

Export key	Unit	Description & tooltip	Computation / formula	Interpretation
first_aoi_entry_time	ms	First aoi entry time	–	–
last_aoi_hit_time	–	Last aoi hit time	–	–

4.4 Fixation-based IDT AOI Metrics

Export key	Unit	Description & tooltip	Computation / formula	Interpretation
idt_n_fixations	–	Number of fixations (I-DT)	$ F $	Robust at low sampling rate.
idt_total_fixation_duration	ms	Total fixation duration (I-DT)	$\sum_{f \in F} d_f$	–
idt_mean_fixation_duration	ms	Mean fixation duration (I-DT)	$\text{mean}\{d_f : f \in F\}$	Typical: 150–400 ms.
idt_median_fixation_duration	ms	Median fixation duration (I-DT)	$\text{median}\{d_f\}$	–
idt_std_fixation_duration	ms	Std fixation duration (I-DT)	$\text{std}\{d_f\}$ (ddof = 0)	–
idt_time_to_first_fixation	ms	Time to first fixation (I-DT)	Berechnet auf den IDT-Ereignissen (Verfahren siehe Methodenteil).	–
idt_time_to_last_fixation	–	Time to last fixation (I-DT)	Berechnet auf den IDT-Ereignissen (Verfahren siehe Methodenteil).	–
idt_refixation_count	–	Refixation count (I-DT)	IDT-Fixationen: Fixationsbasierte Revisit-Zählung	–
idt_first_fixation_start_time	ms	First fixation start time (I-DT)	Berechnet auf den IDT-Ereignissen (Verfahren siehe Methodenteil).	–
idt_last_fixation_start_time	ms	Last fixation start time (I-DT)	Berechnet auf den IDT-Ereignissen (Verfahren siehe Methodenteil).	–
idt_last_fixation_end_time	ms	Last fixation end time (I-DT)	Berechnet auf den IDT-Ereignissen (Verfahren siehe Methodenteil).	–
idt_time_to_last_fixation_end	–	Time to last fixation end (I-DT)	Berechnet auf den IDT-Ereignissen (Verfahren siehe Methodenteil).	–
idt_fixation_order_first	–	Fixation order first (I-DT)	Berechnet auf den IDT-Ereignissen (Verfahren siehe Methodenteil).	–
idt_fixation_order_last	–	Fixation order last (I-DT)	Berechnet auf den IDT-Ereignissen (Verfahren siehe Methodenteil).	–

4.5 Fixation-based IDT-robust AOI Metrics

This group mirrors its base family key for key; the computation is that of the base family but under the active presets thresholds. It appears in the export only when the corresponding output columns exist in the project metric state.

Export key	Unit	Description & tooltip	Computation / formula	Interpretation
idt_robust_n_fixations	–	Number of fixations (I-DT robust)	$ F $	Robust at low sampling rate.

Export key	Unit	Description & tooltip	Computation / formula	Interpretation
idt_robust_total_fixation_duration	–	Total fixation duration (I-DT robust)	$\sum_{f \in F} d_f$	–
idt_robust_mean_fixation_duration	–	Mean fixation duration (I-DT robust)	$\text{mean}\{d_f : f \in F\}$	Typical: 150–400 ms.
idt_robust_median_fixation_duration	–	Median fixation duration (I-DT robust)	$\text{median}\{d_f\}$	–
idt_robust_std_fixation_duration	–	Std fixation duration (I-DT robust)	$\text{std}\{d_f\}$ (ddof = 0)	–
idt_robust_time_to_first_fixation	–	Time to first fixation (I-DT robust)	Berechnet auf den IDT-Ereignissen (Verfahren siehe Methodenteil).	–
idt_robust_time_to_last_fixation	–	Time to last fixation (I-DT robust)	Berechnet auf den IDT-Ereignissen (Verfahren siehe Methodenteil).	–
idt_robust_refixation_count	–	Refixation count (I-DT robust)	IDT-Fixationen: Fixationsbasierte Revisit-Zählung	–
idt_robust_first_fixation_start_time	–	First fixation start time (I-DT robust)	Berechnet auf den IDT-Ereignissen (Verfahren siehe Methodenteil).	–
idt_robust_last_fixation_start_time	–	Last fixation start time (I-DT robust)	Berechnet auf den IDT-Ereignissen (Verfahren siehe Methodenteil).	–
idt_robust_last_fixation_end_time	–	Last fixation end time (I-DT robust)	Berechnet auf den IDT-Ereignissen (Verfahren siehe Methodenteil).	–
idt_robust_time_to_last_fixation_end	–	Time to last fixation end (I-DT robust)	Berechnet auf den IDT-Ereignissen (Verfahren siehe Methodenteil).	–
idt_robust_fixation_order_first	–	Fixation order first (I-DT robust)	Berechnet auf den IDT-Ereignissen (Verfahren siehe Methodenteil).	–
idt_robust_fixation_order_last	–	Fixation order last (I-DT robust)	Berechnet auf den IDT-Ereignissen (Verfahren siehe Methodenteil).	–

4.6 Fixation-based SMI/BeGaze-IDT AOI Metrics

This group mirrors its base family key for key; the computation is that of the base family but under the active presets thresholds. It appears in the export only when the corresponding output columns exist in the project metric state.

Export key	Unit	Description & tooltip	Computation / formula	Interpretation
smi_idt_n_fixations	–	Number of fixations (SMI/BeGaze I-DT)	$ F $	Robust at low sampling rate.
smi_idt_total_fixation_duration	–	Total fixation duration (SMI/BeGaze I-DT)	$\sum_{f \in F} d_f$	–
smi_idt_mean_fixation_duration	–	Mean fixation duration (SMI/BeGaze I-DT)	$\text{mean}\{d_f : f \in F\}$	Typical: 150–400 ms.
smi_idt_median_fixation_duration	–	Median fixation duration (SMI/BeGaze I-DT)	$\text{median}\{d_f\}$	–
smi_idt_std_fixation_duration	–	Std fixation duration (SMI/BeGaze I-DT)	$\text{std}\{d_f\}$ (ddof = 0)	–
smi_idt_time_to_first_fixation	–	Time to first fixation (SMI/BeGaze I-DT)	Berechnet auf den IDT-Ereignissen (Verfahren siehe Methodenteil).	–
smi_idt_time_to_last_fixation	–	Time to last fixation (SMI/BeGaze I-DT)	Berechnet auf den IDT-Ereignissen (Verfahren siehe Methodenteil).	–

Export key	Unit	Description & tooltip	Computation / formula	Interpretation
smi_idt_refixation_count	–	Refixation count (SMI/BeGaze I-DT)	IDT-Fixationen: Fixationsbasierte Revisit-Zählung	–
smi_idt_first_fixation_start_time	–	First fixation start time (SMI/BeGaze I-DT)	Berechnet auf den IDT-Ereignissen (Verfahren siehe Methodenteil).	–
smi_idt_last_fixation_start_time	–	Last fixation start time (SMI/BeGaze I-DT)	Berechnet auf den IDT-Ereignissen (Verfahren siehe Methodenteil).	–
smi_idt_last_fixation_end_time	–	Last fixation end time (SMI/BeGaze I-DT)	Berechnet auf den IDT-Ereignissen (Verfahren siehe Methodenteil).	–
smi_idt_time_to_last_fixation_end	–	Time to last fixation end (SMI/BeGaze I-DT)	Berechnet auf den IDT-Ereignissen (Verfahren siehe Methodenteil).	–
smi_idt_fixation_order_first	–	Fixation order first (SMI/BeGaze I-DT)	Berechnet auf den IDT-Ereignissen (Verfahren siehe Methodenteil).	–
smi_idt_fixation_order_last	–	Fixation order last (SMI/BeGaze I-DT)	Berechnet auf den IDT-Ereignissen (Verfahren siehe Methodenteil).	–

4.7 Fixation-based IVT AOI Metrics

Export key	Unit	Description & tooltip	Computation / formula	Interpretation
ivt_n_fixations	–	Number of fixations (I-VT)	$ F $	–
ivt_total_fixation_duration	ms	Total fixation duration (I-VT)	$\sum_{f \in F} d_f$	–
ivt_mean_fixation_duration	ms	Mean fixation duration (I-VT)	$\text{mean}\{d_f : f \in F\}$	–
ivt_median_fixation_duration	ms	Median fixation duration (I-VT)	$\text{median}\{d_f\}$	–
ivt_std_fixation_duration	ms	Std fixation duration (I-VT)	$\text{std}\{d_f\}$ (ddof = 0)	–
ivt_time_to_first_fixation	ms	Time to first fixation (I-VT)	Berechnet auf den IVT-Ereignissen (Verfahren siehe Methodenteil).	–
ivt_time_to_last_fixation	–	Time to last fixation (I-VT)	Berechnet auf den IVT-Ereignissen (Verfahren siehe Methodenteil).	–
ivt_refixation_count	–	Refixation count (I-VT)	IVT-Fixationen: Fixationsbasierte Revisit-Zählung	–
ivt_first_fixation_start_time	ms	First fixation start time (I-VT)	Berechnet auf den IVT-Ereignissen (Verfahren siehe Methodenteil).	–
ivt_last_fixation_start_time	ms	Last fixation start time (I-VT)	Berechnet auf den IVT-Ereignissen (Verfahren siehe Methodenteil).	–
ivt_last_fixation_end_time	ms	Last fixation end time (I-VT)	Berechnet auf den IVT-Ereignissen (Verfahren siehe Methodenteil).	–
ivt_time_to_last_fixation_end	–	Time to last fixation end (I-VT)	Berechnet auf den IVT-Ereignissen (Verfahren siehe Methodenteil).	–
ivt_fixation_order_first	–	Fixation order first (I-VT)	Berechnet auf den IVT-Ereignissen (Verfahren siehe Methodenteil).	–
ivt_fixation_order_last	–	Fixation order last (I-VT)	Berechnet auf den IVT-Ereignissen (Verfahren siehe Methodenteil).	–

4.8 Fixation-based IVT-robust AOI Metrics

Export key	Unit	Description & tooltip	Computation / formula	Interpretation
ivt_robust_n_fixations	–	Number of fixations (I-VT robust)	$ F $	Typically fewer than I-VT, since gaps split segments.
ivt_robust_total_fixation_duration	ms	Total fixation duration (I-VT robust)	$\sum_{f \in F} d_f$	–
ivt_robust_mean_fixation_duration	ms	Mean fixation duration (I-VT robust)	$\text{mean}\{d_f : f \in F\}$	More accurate estimate when data gaps exist.
ivt_robust_median_fixation_duration	ms	Median fixation duration (I-VT robust)	$\text{median}\{d_f\}$	–
ivt_robust_std_fixation_duration	ms	Std fixation duration (I-VT robust)	$\text{std}\{d_f\}$ (ddof = 0)	–
ivt_robust_time_to_first_fixation	ms	Time to first fixation (I-VT robust)	Berechnet auf den IVT Robust-Ereignissen (Verfahren siehe Methodenteil).	–
ivt_robust_time_to_last_fixation	–	Time to last fixation (I-VT robust)	Berechnet auf den IVT Robust-Ereignissen (Verfahren siehe Methodenteil).	–
ivt_robust_refixation_count	–	Refixation count (I-VT robust)	IVT Robust-Fixationen: Fixationsbasierte Revisit-Zählung	–
ivt_robust_first_fixation_start_time	ms	First fixation start time (I-VT robust)	Berechnet auf den IVT Robust-Ereignissen (Verfahren siehe Methodenteil).	–
ivt_robust_last_fixation_start_time	ms	Last fixation start time (I-VT robust)	Berechnet auf den IVT Robust-Ereignissen (Verfahren siehe Methodenteil).	–
ivt_robust_last_fixation_end_time	ms	Last fixation end time (I-VT robust)	Berechnet auf den IVT Robust-Ereignissen (Verfahren siehe Methodenteil).	–
ivt_robust_time_to_last_fixation_end	–	Time to last fixation end (I-VT robust)	Berechnet auf den IVT Robust-Ereignissen (Verfahren siehe Methodenteil).	–
ivt_robust_fixation_order_first	–	Fixation order first (I-VT robust)	Berechnet auf den IVT Robust-Ereignissen (Verfahren siehe Methodenteil).	–
ivt_robust_fixation_order_last	–	Fixation order last (I-VT robust)	Berechnet auf den IVT Robust-Ereignissen (Verfahren siehe Methodenteil).	–

4.9 Fixation-based Tobii-IVT AOI Metrics

This group mirrors its base family key for key; the computation is that of the base family but under the active presets thresholds. It appears in the export only when the corresponding output columns exist in the project metric state.

Export key	Unit	Description & tooltip	Computation / formula	Interpretation
tobii_ivt_n_fixations	–	Number of fixations (Tobii I-VT)	$ F $	Typically fewer than I-VT, since gaps split segments.
tobii_ivt_total_fixation_duration	–	Total fixation duration (Tobii I-VT)	$\sum_{f \in F} d_f$	–

Export key	Unit	Description & tooltip	Computation / formula	Interpretation
tobii_ivt_mean_fixation_duration	–	Mean fixation duration (Tobii I-VT)	$\text{mean}\{d_f : f \in F\}$	More accurate estimate when data gaps exist.
tobii_ivt_median_fixation_duration	–	Median fixation duration (Tobii I-VT)	$\text{median}\{d_f\}$	–
tobii_ivt_std_fixation_duration	–	Std fixation duration (Tobii I-VT)	$\text{std}\{d_f\}$ (ddof = 0)	–
tobii_ivt_time_to_first_fixation	–	Time to first fixation (Tobii I-VT)	Berechnet auf den IVT Robust-Ereignissen (Verfahren siehe Methodenteil).	–
tobii_ivt_time_to_last_fixation	–	Time to last fixation (Tobii I-VT)	Berechnet auf den IVT Robust-Ereignissen (Verfahren siehe Methodenteil).	–
tobii_ivt_refixation_count	–	Refixation count (Tobii I-VT)	IVT Robust-Fixationen: Fixationsbasierte Revisit-Zählung	–
tobii_ivt_first_fixation_start_time	–	First fixation start time (Tobii I-VT)	Berechnet auf den IVT Robust-Ereignissen (Verfahren siehe Methodenteil).	–
tobii_ivt_last_fixation_start_time	–	Last fixation start time (Tobii I-VT)	Berechnet auf den IVT Robust-Ereignissen (Verfahren siehe Methodenteil).	–
tobii_ivt_last_fixation_end_time	–	Last fixation end time (Tobii I-VT)	Berechnet auf den IVT Robust-Ereignissen (Verfahren siehe Methodenteil).	–
tobii_ivt_time_to_last_fixation_end	–	Time to last fixation end (Tobii I-VT)	Berechnet auf den IVT Robust-Ereignissen (Verfahren siehe Methodenteil).	–
tobii_ivt_fixation_order_first	–	Fixation order first (Tobii I-VT)	Berechnet auf den IVT Robust-Ereignissen (Verfahren siehe Methodenteil).	–
tobii_ivt_fixation_order_last	–	Fixation order last (Tobii I-VT)	Berechnet auf den IVT Robust-Ereignissen (Verfahren siehe Methodenteil).	–

4.10 Fixation-based EyeLink-style AOI Metrics

This group mirrors its base family key for key; the computation is that of the base family but under the active presets thresholds. It appears in the export only when the corresponding output columns exist in the project metric state.

Export key	Unit	Description & tooltip	Computation / formula	Interpretation
eyelink_n_fixations	–	Number of fixations (EyeLink-style)	$ F $	Typically fewer than I-VT, since gaps split segments.
eyelink_total_fixation_duration	–	Total fixation duration (EyeLink-style)	$\sum_{f \in F} d_f$	–
eyelink_mean_fixation_duration	–	Mean fixation duration (EyeLink-style)	$\text{mean}\{d_f : f \in F\}$	More accurate estimate when data gaps exist.
eyelink_median_fixation_duration	–	Median fixation duration (EyeLink-style)	$\text{median}\{d_f\}$	–
eyelink_std_fixation_duration	–	Std fixation duration (EyeLink-style)	$\text{std}\{d_f\}$ (ddof = 0)	–

Export key	Unit	Description & tooltip	Computation / formula	Interpretation
eyelink_time_to_first_fixation	–	Time to first fixation (EyeLink-style)	Berechnet auf den IVT Robust-Ereignissen (Verfahren siehe Methodenteil).	–
eyelink_time_to_last_fixation	–	Time to last fixation (EyeLink-style)	Berechnet auf den IVT Robust-Ereignissen (Verfahren siehe Methodenteil).	–
eyelink_refixation_count	–	Refixation count (EyeLink-style)	IVT Robust-Fixationen: Fixationsbasierte Revisit-Zählung	–
eyelink_first_fixation_start_time	–	First fixation start time (EyeLink-style)	Berechnet auf den IVT Robust-Ereignissen (Verfahren siehe Methodenteil).	–
eyelink_last_fixation_start_time	–	Last fixation start time (EyeLink-style)	Berechnet auf den IVT Robust-Ereignissen (Verfahren siehe Methodenteil).	–
eyelink_last_fixation_end_time	–	Last fixation end time (EyeLink-style)	Berechnet auf den IVT Robust-Ereignissen (Verfahren siehe Methodenteil).	–
eyelink_time_to_last_fixation_end	–	Time to last fixation end (EyeLink-style)	Berechnet auf den IVT Robust-Ereignissen (Verfahren siehe Methodenteil).	–
eyelink_fixation_order_first	–	Fixation order first (EyeLink-style)	Berechnet auf den IVT Robust-Ereignissen (Verfahren siehe Methodenteil).	–
eyelink_fixation_order_last	–	Fixation order last (EyeLink-style)	Berechnet auf den IVT Robust-Ereignissen (Verfahren siehe Methodenteil).	–

4.11 Fixation-based Combined AOI Metrics

Export key	Unit	Description & tooltip	Computation / formula	Interpretation
mean_fixation_duration_combined	ms	Mean fixation duration combined	$\text{mean}(\text{IDT} + \text{IVT} + \text{IVT-Robust Fixationsdauern} \in \text{AOI})$	Algorithm-agnostic measure.
median_fixation_duration_combined	ms	Median fixation duration combined	$\text{median}(\text{alle Fix} \in \text{AOI})$	–
std_fixation_duration_combined	ms	Std fixation duration combined	$\text{std}(\text{alle Fix} \in \text{AOI})$	–

4.12 Transitions

Export key	Unit	Description & tooltip	Computation / formula	Interpretation
transition_in_count	–	Transition in count	$\sum T_{\{j \rightarrow i\}}$ über alle $j \neq i$	How often gaze enters this AOI from other AOIs.
transition_out_count	–	Transition out count	$\sum T_{\{i \rightarrow j\}}$ über alle $j \neq i$	–
transition_in_rate	1/s	Transition in rate	$\text{transition_in_count} / \text{dwell_time_s}$	–
transition_out_rate	1/s	Transition out rate	$\text{transition_out_count} / \text{dwell_time_s}$	–

4.13 Flächenkorrigierte Metriken

Export key	Unit	Description & tooltip	Computation / formula	Interpretation
aoi_area_px2	px ²	Aoi area px2	Geometrische Formel je nach AOI-Typ	Basis for all density metrics.
aoi_area_pct	%	Aoi area pct	$\text{aoi_area_px2} / \text{stimulus_area_px2} \times 100$	10.0% = the AOI covers 10% of the stimulus area.
aoi_area_px2_mean	px ²	Aoi area px2 mean	mean(area_px2) über Zeitpunkte	Informative for dynamic AOIs.
aoi_area_pct_mean	%	Aoi area pct mean	mean(area_pct) über Zeitpunkte	–
aoi_area_px2_time_weighted	px ²	Aoi area px2 time weighted	$\sum \text{area_px2_t} \times \Delta t / \sum \Delta t$	Fairest area basis for density metrics with dynamic AOIs.
aoi_area_pct_time_weighted	%	Aoi area pct time weighted	$\sum \text{area_pct_t} \times \Delta t / \sum \Delta t$	–
aoi_area_px2_min	px ²	Aoi area px2 min	min(area_px2) über Zeitpunkte	–
aoi_area_pct_min	%	Aoi area pct min	min(area_pct) über Zeitpunkte	–
aoi_area_px2_max	px ²	Aoi area px2 max	max(area_px2) über Zeitpunkte	–
aoi_area_pct_max	%	Aoi area pct max	max(area_pct) über Zeitpunkte	–
dwelling_density	ratio	Dwell density	$\frac{\text{Dwell-Anteil} [\%]}{\text{Flächenanteil} [\%]}$	> 1: over-attended. < 1: under-attended. Not capped at 1.
dwelling_density_rel	ratio	Dwell density rel	$\text{dwelling_density} / \text{mean}(\text{alle AOI dwelling_density})$	1.0 = average. < 1 = below average.
dwelling_density_rank	rank	Dwell density rank	rank(dwelling_density); 1 = höchste Dichte	NaN if the area is unknown.
hit_density	ratio	Hit density	$(\text{n_hits} / \sum \text{hits}) \times 100 / \text{area_pct}$	–
hit_density_rel	ratio	Hit density rel	$\text{hit_density} / \text{mean}(\text{alle AOI hit_density})$	–
hit_density_rank	rank	Hit density rank	rank(hit_density); 1 = höchste Dichte	–
fixation_density	ratio	Fixation density	$\frac{(\text{Fix-Anteil}) [\%]}{\text{area_pct}}$	–
fixation_density_rel	ratio	Fixation density rel	$\text{fixation_density} / \text{mean}(\text{alle AOI fixation_density})$	–
fixation_density_rank	rank	Fixation density rank	rank(fixation_density); 1 = höchste Dichte	–
visit_density	ratio	Visit density	$\frac{(\text{Visit-Anteil}) [\%]}{\text{area_pct}}$	–
visit_density_rel	ratio	Visit density rel	$\text{visit_density} / \text{mean}(\text{alle AOI visit_density})$	–
visit_density_rank	rank	Visit density rank	rank(visit_density); 1 = höchste Dichte	–

4.14 Pupille/Blinks

Export key	Unit	Description & tooltip	Computation / formula	Interpretation
mean_pupil_size	unit	Mean pupil size	mean(pupil sample ∈ AOI)	Larger = cognitive load/arousal driven by AOI content.
median_pupil_size	unit	Median pupil size	median(pupil sample ∈ AOI)	More robust against blink artefacts.
std_pupil_size	unit	Std pupil size	std(pupil sample ∈ AOI)	–

Export key	Unit	Description & tooltip	Computation / formula	Interpretation
pupil_valid_n	samples	Pupil valid n	$\text{count}(\text{isfinite}(\text{pupil}) \cap \text{AOI})$	–
pupil_missing_n	samples	Pupil missing n	$\text{total AOI-Samples} - \text{pupil_valid_n}$	–
pupil_valid_pct	%	Pupil valid pct	$100 - \text{pupil_missing_pct}$	–
blink_count	count	Blink count	$\#\{\text{event} = \text{blink}\}$	Typical: 3–5 blinks/minute.
blink_duration_sum	ms	Blink duration sum	$\sum \text{blink_dur}$	–
mean_blink_duration	ms	Mean blink duration	$\text{mean}(\text{blink_dur})$	Typical: 150–400 ms.
median_blink_duration	ms	Median blink duration	$\text{median}(\text{blink_duration_ms})$	–
blink_rate	1/s	Blink rate	$\text{blink_count}/\text{stimulus_duration_s}$	–
pupil_loss_count	count	Pupil loss count	$\#\{\text{event} = \text{pupil_loss}\}$	Many: severe tracking problems.
pupil_loss_duration_sum	ms	Pupil loss duration sum	$\sum \text{pupil_loss_duration_ms}$	–
mean_pupil_loss_duration	ms	Mean pupil loss duration	$\text{mean}(\text{pupil_loss_duration_ms})$	–
median_pupil_loss_duration	ms	Median pupil loss duration	$\text{median}(\text{pupil_loss_duration_ms})$	–

CHAPTER 5

Export formats & pairwise columns

Sigma Iriscope exports data in four formats; the choice is made in the export tab's format combo, and the right sidebar adapts automatically.

Wide — one row per subject $\times$ stimulus; each enabled metric is its own column, AOI metrics as `aoi.[name].[metric]`. Suited to SPSS, Excel, R, Python.

Long — the same data in tidy form: one row per subject $\times$ stimulus $\times$ metric, columns `subject_id`, `stimulus`, `metric`, `value`. Preferred for the tidyverse, pandas and mixed models.

Long pairwise — *subjects $\times$ subjects (per stimulus)* — for each stimulus all $n(n-1)/2$ subject pairs are compared (keys `stimulus`, `subj_a`, `subj_b`). Pairs require both subjects to be active in the filter panel.

Long pairwise — *items $\times$ items (per subject)* — for each subject all $m(m-1)/2$ item pairs are compared (keys `proband_id`, `item_a`, `item_b`). The pairwise metric columns are structurally identical across both pairwise formats; only the key columns differ. The 181 pairwise columns are documented in full below.

5.1 Pairwise columns (181)

Group	Columns	Note
Levenshtein-Distanzen	10	5 variants $\times$ (absolute, normalised distance).
Sequenzlängen	10	Lengths of the compared sequences per variant.
ScanMatch	3	similarity, distance_norm, distance.
MultiMatch	10	5 dimensions + overall + helper fields.
Recurrence / RQA	62	6 global distance measures + 14 RQA features $\times$ 4 (<code>_a</code> , <code>_b</code> , <code>_diff</code> , <code>_abs_diff</code>).
Cross-Recurrence / CRQA AOI-only	17	17 CRQA measures (AOI state, Outside excluded).
Cross-Recurrence / CRQA incl. Outside	17	17 CRQA measures (Outside as its own state).
Cross-Recurrence / CRQA Lag-Profil (with Outside)	21	21 lag / leader-follower measures (with Outside).
Cross-Recurrence / CRQA Lag-Profil (AOI-only)	21	21 lag / leader-follower measures (shared AOI fixation only).
Scanpath-Strings	10	optional; <code>scanpath__a/_b</code> per variant.
Pairwise total	181	

CHAPTER 6

Method texts (citable)

The following passages can be inserted directly into the methods section of a paper.

6.1 Fixation detection

Fixations were identified with the velocity-threshold identification (I-VT) algorithm (Salvucci & Goldberg, 2000). A fixation was a period with a point-to-point velocity below the active preset’s threshold and a minimum duration as defined by the preset (Iriscope default: 300 px/s, 80 ms; merge gap 20 ms; pre-smoothing 20 ms for the robust variant). In parallel, fixations were computed with the dispersion-threshold identification (I-DT) algorithm (Salvucci & Goldberg, 2000) and a robust I-VT variant with gap segmentation. The preset used, the effective thresholds and the calculation timestamp are recorded in the project’s analysis state and can be exported via the “Analysis parameters & reproducibility” column group. All analyses were performed with Sigma Iriscope v1.0 (Saunders, 2026).

6.2 Detection presets & algorithm comparison

To make the sensitivity of the results to the detection method testable, fixations were additionally computed under vendor-style presets (Tobii Pro I-VT, EyeLink parser, SMI/BeGaze dispersion) and exported as separate metric families (`tobii_ivt_`, `eyelink_`, `smi_idt_`). Because the direction and meaning of the thresholds differ between dispersion- and velocity-based detection, the families were reported separately rather than collapsed into a single sensitivity measure. All computations were performed with Sigma Iriscope v1.0 (Saunders, 2026).

6.3 Fixation dispersion & spatial stability

The spatial extent of each fixation (dispersion) was computed as the sum of the horizontal and vertical spread $(x_{\max} - x_{\min}) + (y_{\max} - y_{\min})$ of the gaze points within the respective robust I-VT fixation (equivalent to the I-DT dispersion measure; Salvucci & Goldberg, 2000). The `fixation_spatial_stability` is given by $1 - \overline{\text{disp}} / \sqrt{w^2 + h^2}$. All computations were performed with Sigma Iriscope v1.0 (Saunders, 2026).

6.4 Levenshtein sequence similarity (within-subject)

The consistency of gaze sequences was computed using normalised Levenshtein distance (Levenshtein, 1966). Scanpaths were encoded as compact AOI sequences; the normalised distance is $\text{Lev}(a, b) / \max(|a|, |b|)$ ranging from 0 (identical) to 1 (maximally different). For ScanMatch-style analyses, time-binned sequences (100 ms bins) were additionally computed. All analyses were performed with Sigma Iriscope v1.0 (Saunders, 2026).

6.5 Recurrence Quantification Analysis (RQA)

To analyse temporal patterns in gaze behaviour, a recurrence quantification analysis (RQA) was performed (Webber & Zbilut, 1994; Marwan et al., 2007). Recurrence plots were built from spatial gaze coordinates (threshold $\varepsilon = 25$ px; minimum line length $l_{\min} = 2$ time steps). Recurrence rate (RR), determinism (DET), laminarity (LAM), trapping time (TT) and the Shannon entropy of diagonal and vertical lines were evaluated. All computations were performed with Sigma Iriscope v1.0 (Saunders, 2026).

6.6 MultiMatch similarity

The multidimensional similarity of scanpaths was computed with a MultiMatch-style procedure (after Jarodzka et al., 2010). The fixation sequences of both trials were resampled to a common length by linear interpolation (up to 128 points) and compared point-wise. For each of the five dimensions (position, duration, vector, length, direction) the mean deviation was mapped to a similarity between 0 and 1 (1 = identical); the overall value is the mean of the available dimensions. All computations were performed with Sigma Iriscope v1.0 (Saunders, 2026).

6.7 ScanMatch-style similarity

The similarity of gaze sequences was quantified with a ScanMatch-style procedure (after Cristino et al., 2010). Scanpaths were encoded as time-binned AOI sequences (window 100 ms; dominant AOI per window) and compared via the normalised Levenshtein distance; similarity is $1 - \text{normalised distance}$. All computations were performed with Sigma Iriscope v1.0 (Saunders, 2026).

6.8 Pupillometry

Pupillometric analyses were performed on the non-spatially-filtered raw data (Beatty, 1982). The pupil signal was Savitzky–Golay filtered (150 ms) and blink gaps up to 250 ms were interpolated. The baseline was the mean of the first 200 ms after stimulus onset. Mean and maximum pupil dilation and the area under the curve (windows 0–2000 ms, 2000–4000 ms, 0–4000 ms) were evaluated. All computations were performed with Sigma Iriscope v1.0 (Saunders, 2026).

6.9 Area-corrected attention density

To compare attention to AOIs of different size fairly, area-corrected densities were computed. The `dwell_density` is (this AOI's share of dwell time in %) / (the AOI's area share in %). Values > 1.0 indicate over-proportional, values < 1.0 under-proportional attention relative to area. Relative densities and ranks were additionally computed. All computations were performed with Sigma Iriscope v1.0 (Saunders, 2026).

6.10 Cross-recurrence (CRQA) & lag profile

To quantify the temporal agreement of two gaze paths, a cross-recurrence quantification analysis (CRQA) was performed (Marwan & Kurths, 2002; Marwan et al., 2007). For each pair a rectangular cross-recurrence matrix was built (AOI state match; minimum line length 2). To determine the direction of coupling (leader–follower), a diagonal-wise recurrence profile (DRP) was computed from the matrix: both paths were placed on a stimulus-onset-anchored time grid (100 ms bins), and for each lag k the cross-recurrence rate was determined. Lag asymmetry and the RR-weighted lag centroid served as directional measures. CRQA values were treated as interpretable only from ten valid bins per trajectory. All computations were performed with Sigma Iriscope v1.0 (Saunders, 2026).

6.11 Reproducibility & provenance

All methodological decisions — AOI geometry (AOI set), fixation algorithm and preset, manual correction layer and selected metric groups — were recorded in the project as a hashed analysis state and exported together with the metrics. Raw data remained immutable; manual gaze/drift corrections were kept reversible against a stored clean baseline. The reported values are thus tied to a uniquely identified, reproducible analysis state (Sigma Iriscope v1.0; Saunders, 2026).

References

- Beatty, J. (1982). Task-evoked pupillary responses, processing load, and the structure of processing resources. *Psychological Bulletin*, 91(2), 276–292.
- Cristino, F., Mathôt, S., Theeuwes, J., & Gilchrist, I. D. (2010). ScanMatch: A novel method for comparing fixation sequences. *Behavior Research Methods*, 42(3), 692–700.
- Eckmann, J.-P., Kamphorst, S. O., & Ruelle, D. (1987). Recurrence plots of dynamical systems. *Europhysics Letters*, 4(9), 973–977.
- Henderson, J. M. (2003). Human gaze control during real-world scene perception. *Trends in Cognitive Sciences*, 7(11), 498–504.
- Holmqvist, K., Nyström, M., Andersson, R., Dewhurst, R., Jarodzka, H., & van de Weijer, J. (2011). *Eye Tracking: A Comprehensive Guide to Methods and Measures*. Oxford University Press.
- Jarodzka, H., Holmqvist, K., & Nyström, M. (2010). A vector-based, multidimensional scanpath similarity measure. *Proceedings ETRA 2010*, 211–218.
- Levenshtein, V. I. (1966). Binary codes capable of correcting deletions, insertions and reversals. *Soviet Physics Doklady*, 10(8), 707–710.
- Marwan, N., Romano, M. C., Thiel, M., & Kurths, J. (2007). Recurrence plots for the analysis of complex systems. *Physics Reports*, 438(5–6), 237–329.
- Marwan, N., & Kurths, J. (2002). Nonlinear analysis of bivariate data with cross recurrence plots. *Physics Letters A*, 302(5–6), 299–307.
- Salvucci, D. D., & Goldberg, J. H. (2000). Identifying fixations and saccades in eye-tracking protocols. *Proceedings ETRA 2000*, 71–78.
- Saunders, M. (2026). *Sigma Iriscope v1.0* [Software].
- Shannon, C. E. (1948). A mathematical theory of communication. *Bell System Technical Journal*, 27(3), 379–423.
- Webber, C. L., & Zbilut, J. P. (1994). Dynamical assessment of physiological systems and states using recurrence plot strategies. *Journal of Applied Physiology*, 76(2), 965–973.
- Wierda, S. M., van Rijn, H., Taatgen, N. A., & Martens, S. (2012). Pupil dilation deconvolution reveals the dynamics of attention at high temporal resolution. *PNAS*, 109(22), 8456–8460.