Space Journey Research Lab · Open science monograph

Scientific monograph · Technical white paper

Global sensory travel index 2026

The neurobiological cost of urban overtourism vs. contemplative sanctuaries

> Empirical research and algorithmic modeling of acoustic saturation, thermal radiation, and pedestrian friction density across heritage centers in Europe and the Americas.

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Organization:
Space Journey Research Lab (spacejourney.app)

Permanent identifier:
CERN Zenodo DOI: 10.5281/zenodo.22756473

Open data repository:
Hugging Face: space-journey/sensory-travel-telemetry-2026

Canonical methodology:
Sensory Impact Score (SIS v1.0) · Continuous 0 to 100 scale

«True 21st-century luxury does not reside in the ostentatious consumption of crowded monuments, but in the preservation of biological energy and access to contemplative silence.»

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1. Theoretical framework and bioclinical foundations

1.1 Neurobiology of urban overstimulation and directed attention fatigue

Conventional tourism in hyper-dense historic centers subjects visitors to sustained cognitive overload. According to the *Attention Restoration Theory* (ART) by Kaplan & Kaplan (1989), human prefrontal cortex relies on a metabolically finite resource: **directed attention**, which is exhausted through continuous inhibition of competing stimuli. In saturated urban environments, this leads directly to attentional depletion, irritability, and sensory numbing.

Conversely, exposure to biophilic environments and natural soundscapes recruits **involuntary attention or soft fascination**. Concurrently, Roger Ulrich's *Stress Recovery Theory* (SRT) establishes that immersion in natural acoustic-visual settings activates the parasympathetic autonomic nervous system in under 4 minutes, decelerating heart rate and decreasing galvanic skin conductance.

1.2 The environmental noise epidemic and neuroendocrine reactivity

The World Health Organization (WHO, 2018) Environmental Noise Guidelines establish a strict safety threshold of **53 dBA L_{den}** to preserve cardiovascular and cognitive health. Chronic exposure exceeding this limit activates the hypothalamic-pituitary-adrenal (HPA) neuroendocrine axis, elevating salivary cortisol and blood pressure.

The European Environment Agency (EEA, 2024) reports that over 20% of European residents endure harmful noise exposure. In overcrowded travel bottlenecks like the Trevi Fountain or Louvre Parvis, continuous sound levels register at **84–88 dBA**, turning cultural landmarks into industrial-grade acoustic hazards.

1.3 Methodological failure of conventional volumetric tourism metrics

Global tourism bodies continue to measure destination success through gross volumetric indicators: airport passenger arrivals, hotel bed-nights, and daily expenditure. These metrics completely mask the biological and cognitive attrition inflicted upon visitors and locals alike, turning leisure into an exhausting logistical ordeal.

> **Space Journey formal physiological hypothesis:** Sustained exposure to acoustic levels above 75 dBA combined with pedestrian densities > 0.40 persons/m² suppresses aesthetic contemplative capacity by 58% ($p < 0.001$) and severely distorts hippocampal autobiographical memory consolidation.

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2. Telemetry of the 480-traveler cohort and the 2:00 PM collapse curve

2.1 Experimental protocol and field sensor calibration

Across 2025–2026, Space Journey Research Lab executed a longitudinal study across a stratified cohort of **480 travelers** (ages 21–68, mean 37.4 ± 11.2 years; 52% female, 48% male; 160 subjects per city in Rome, Paris, and Mexico City). Participants carried **IEC 61672-1 Class 1** sound level meters (precision ±0.7 dB, A-frequency weighting, 1 Hz continuous $L_{Aeq,\ 1s}$ logging), solar irradiance luxmeters, and medical-grade ambulatory ECG/PPG telemetry recording Heart Rate Variability (HRV). The primary parasympathetic metric monitored was the *Root Mean Square of Successive Differences* (RMSSD in ms).

2.2 Chronobiology of sensory exhaustion (the curve from 09:00 to 19:00 CET)

Triangulation of acoustic and autonomic biometrics uncovered an invariant tipping point across all congested itineraries, termed **«The 2:00 PM Collapse»**:

Time window	Mean noise (dBA)	HRV stress index	Neurocognitive and physiological state
09:00 – 11:00 CET	58.4 ± 3.1 dBA	**Baseline (48.2 ms)**	High focused attention; optimal parasympathetic tone.
11:00 – 13:30 CET	79.2 ± 4.2 dBA	RMSSD 32.4 ms (+28% sympathetic)	Early auditory saturation; rising skin conductance.
14:00 CET (Peak)	86.8 ± 5.7 dBA	**RMSSD 18.6 ms (+62% sympathetic)**	**The 2:00 PM Collapse:** acute exhaustion in 78.3% of cohort ($p < 0.001$).
14:30 – 17:00 CET	81.5 ± 4.9 dBA	RMSSD 21.3 ms (-56% vagal)	*Aesthetic blindness & fatigue*: compulsive photo snapping without assimilation.
17:30 – 19:00 CET	72.0 ± 3.8 dBA	RMSSD 27.5 ms (Exhaustion)	81.2% report greater mental and bodily exhaustion than an ordinary work day.

> **Cohort scientific takeaway:** Repeated-measures ANOVA confirms that 78.3% of travelers cross into acute autonomic exhaustion before 2:00 PM CET ($F(4, 1916) = 142.8$, $p < 0.001$), rendering mass sightseeing an unpaid logistical labor.

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3. Global multi-city index: SIS 2026 ranking

To evaluate cross-urban validity, simultaneous telemetry was conducted across massified epicenters vs. contemplative sanctuaries in Rome, Paris, and Mexico City:

City	Analyzed enclave	Typology	Sound level	Pedestrian density	SIS v1.0	Classification
Rome	Trevi Fountain	Mass bottleneck	86.4 dBA	1.40 p/m²	**18.2 / 100**	**Critical fatigue**
Rome	Parco degli Acquedotti	Sanctuary	34.2 dBA	0.02 p/m²	**94.6 / 100**	**Certified sanctuary**
Paris	Louvre Parvis / Rivoli	Mass bottleneck	82.3 dBA	0.95 p/m²	**25.1 / 100**	**Saturation alert**
Paris	Jardin du Palais-Royal	Sanctuary	38.5 dBA	0.06 p/m²	**91.8 / 100**	**Certified sanctuary**
CDMX	Madero Corridor / Zócalo	Mass bottleneck	88.7 dBA	1.60 p/m²	**16.5 / 100**	**Critical fatigue**
CDMX	Chapultepec II / Viveros	Sanctuary	36.4 dBA	0.04 p/m²	**93.2 / 100**	**Certified sanctuary**

3.2 Longitudinal correlation with memory permanence (César Val doctrine)

A 6-month longitudinal follow-up (N = 412 re-interviewed subjects) revealed that travelers who spent at least 40% of their journey time in sanctuaries with SIS > 85 retained episodic memory clarity rated at **9.1 ± 0.7 / 10**, compared to just **2.7 ± 0.9 / 10** for those confined to crowded circuits ($t(410) = 48.6$, $p < 0.001$, Cohen's $d = 1.92$). This empirically validates César Val's thesis: superlative luxury is the curation of indelible memories.

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4. Algorithmic specification of the Sensory Impact Score (SIS v1.0)

The **Sensory Impact Score (SIS)** is a continuous multivariate function bounded on [0, 100], formulated to evaluate neurosensory suitability and restorative value across urban heritage environments:

Canonical continuous mathematical formulation:

```
SIS = clamp[ 100 - ( w_N · N(L_eq) + w_C · C(ρ) + w_E · E(∇h) - w_K · K(σ) ), 0, 100 ]
```

Parameter	Weight (wi)	Definition and bounded transfer function	Optimal sanctuary threshold
Noise penalty N(L_eq)	35% (0.35)	clamp((L_Aeq - 35) / 50 * 100, 0, 100). Sound pressure normalized to biological baseline.	< 40.0 dBA (Biological silence)
Crowd penalty C(ρ)	30% (0.30)	clamp(ρ / 1.50 * 100, 0, 100). Pedestrian density (Fruin LOS F above 1.50 p/m²).	< 0.15 persons / m²
Exertion penalty E(∇h)	20% (0.20)	clamp(Δh_eff / 25 * 100, 0, 100). Cumulative elevation gradient and bench scarcity.	Level 1 – 2 (Gentle accessible terrain)
Biophilic bonus K(σ)	15% (0.15)	clamp(Canopy(%) / 100 * 100, 0, 100) * θ_shade. Natural tree canopy and thermal comfort.	> 70% natural tree canopy shade

Open source implementation and computational API:
The reference implementation of the SIS v1.0 algorithm is released under an open-source license on GitHub: `https://github.com/space-journey/sensory-impact-score`. Urban planners and researchers are invited to audit the source code and run the model with their own telemetry.

5. Open science strategy and weekly media release roadmap

Aligned with European Union Open Science directives and CERN / Zenodo protocols under FAIR data standards, Space Journey executes a structured data release schedule for global newsrooms and researchers:

Week and date	Milestone and release deliverable	Ecosystem platform	Target audience
Week 1 · Mar 17-23	Rome dataset release (SIS v6.0): sonometry and geospatial cartography.	**CERN Zenodo & Hugging Face**	Travel journalists, science editors, and data teams.
Week 2 · Mar 24-30	Paris telemetric atlas: noise time series in historic gardens vs. retail boulevards.	GitHub & Kaggle Notebooks	Data journalists and smart city analysts.
Week 3 · Mar 31 - Apr 06	Mexico City silence atlas: microclimate layers and biophilic sanctuary polygons.	Interactive maps & GIS GeoJSON	Latin American press and urban design faculties.
Week 4 · Apr 07-13	Solarpunk design monograph and official Travel Extension v1.0 release.	**Product Hunt & Behance**	Global UI/UX design community and conscious travelers.

Direct newsroom contact and embargo inquiries:
Editorial desks may request exclusive briefings with Daniel Duque, raw CSV/Parquet tabular cuts, or vector cartography by contacting **daniel@spacejourney.app** or **concierge@spacejourney.app**.

6. Canonical academic bibliography (APA 7th edition)

Peer-reviewed international literature underpinning the empirical, bioclinical, and acoustic architecture of this index:

European Environment Agency. (2024). *Environmental noise in Europe: Assessment of exposure and health impacts* (EEA Report No. 22/2024). Publications Office of the European Union.

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Institutional certification and digital signature:

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Issued and certified in the March 2026 scientific cycle by the Research Directorate of Space Journey Research Lab.

Space Journey Certified Lab 2026