

PREPD - Systematic Mapping Review

Identification

- **Theme/ Draft Title:** *Forest Bathing VR for Burnout*
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- **Proponent:** Paula Escudeiro
- **Mentor:** Paula Escudeiro

Step 1 – Protocol + RQs

Research questions

RQ1: What types of nature-based VR are used to reduce stress in adults?

RQ2: Which measures are used (e.g., STAI/PSS, HRV, EDA), and what results do the studies report?

RQ3: Do systems use biofeedback, and is biofeedback more effective than VR without biofeedback or than 2D/audio conditions?

PICOCS

P – Population (who): Adults (≥ 18 years) with day-to-day stress (non-clinical, includes burnout risk).

I – Intervention (what): Nature/forest-bathing VR with or without biofeedback.

C – Comparison: VR without biofeedback; other active comparators when present (e.g., 2D, audio, eyes-closed).

O – Outcomes: Stress/anxiety reduction and physiological improvement (e.g., \uparrow HRV, \downarrow EDA), plus good usability/safety, measured with instruments such as STAI, PSS, HRV, EDA (extras: SUS, SSQ, IPQ).

C – Context (where): Laboratory or office-like contexts, short sessions.

S – Study design: Empirical studies (pre-post, between-groups, crossover, etc.).

Inclusion / Exclusion criteria

Include (I)

I1: Nature-related VR/XR studies.

I2: Adults (≥ 18 years).

I3: At least one stress-related measure (STAI, PSS, HRV, or EDA).

I4: Published 2014–2025, peer-reviewed, English or Portuguese.

Exclude (E)

E1: No stress-related measures.

E2: Children or specific clinical populations/procedures.

E3: Non-empirical works (reviews, editorials, theses).

E4: VR not related to nature (kept only when methodologically relevant, but outside nature-VR synthesis).

Step 2 - Search strategy

Databases

ACM Digital Library

PubMed

Filters

Years: 2014–2025

Type: Journal / Proceedings

Language: English (Portuguese if available)

Keywords (concept clusters)

Virtual reality, VR, XR

Forest bathing, nature, biophilic, greenery, natural environment

Stress, anxiety, burnout, relaxation

Biofeedback, HRV, heart rate variability, EDA, electrodermal, galvanic skin

(for sound-only work) soundscape, binaural, nature sounds, forest sounds

Strings for Advanced Search in ACM

S1 - ("virtual reality" OR VR OR XR) AND ("forest bathing" OR nature OR biophilic OR greenery OR "natural environment") AND (stress OR anxiety OR burnout OR relaxation)

S2 - (VR OR "virtual environment" OR XR) AND (biofeedback OR HRV OR "heart rate variability" OR EDA OR electrodermal OR "galvanic skin") AND (stress OR anxiety OR relaxation)

S3 - ("soundscape" OR "binaural" OR "nature sound*" OR "forest sound*" OR "natural soundscape") AND (stress OR anxiety OR relaxation) AND (experiment OR "user study" OR trial)

Strings for advanced search in PubMed

S1 - (("virtual reality"[Mesh] OR "virtual reality"[tiab] OR VR[tiab] OR "virtual environment*"[tiab] OR XR[tiab]) AND ("forest*"[tiab] OR nature[tiab] OR biophilic[tiab] OR greenery[tiab] OR "natural environment*"[tiab] OR "Forests"[Mesh]) AND ("Stress, Psychological"[Mesh] OR "Anxiety"[Mesh] OR "Burnout, Psychological"[Mesh] OR stress[tiab] OR anxiety[tiab] OR burnout[tiab] OR relaxation[tiab]))

S2 - ("virtual reality"[tiab] OR VR[tiab] OR "virtual environment"[tiab] OR XR[tiab]) AND (biofeedback[tiab] OR "heart rate variab*"[tiab] OR HRV[tiab] OR EDA[tiab] OR electrodermal[tiab] OR "galvanic skin"[tiab]) AND (stress[tiab] OR anxiety[tiab] OR relaxation[tiab]))

S3 - ("Sound"[Mesh] OR "Acoustic Stimulation"[Mesh] OR soundscape*[tiab] OR binaural[tiab] OR "nature sound*"[tiab] OR "forest sound*"[tiab] OR "natural soundscape*"[tiab]) AND ("Stress, Psychological"[Mesh] OR "Anxiety"[Mesh] OR stress[tiab] OR anxiety[tiab] OR relaxation[tiab]) AND (experiment*[tiab] OR "user stud*"[tiab] OR trial[tiab] OR randomized[tiab] OR crossover[tiab] OR pre-post[tiab] OR "pre post"[tiab]))

Applying Filters in ACM and PubMed

The screenshot shows the ACM search interface. On the left, there is a sidebar titled "Applied Filters" with two items: "Proceedings" and "2014 - 2025". Below these are "Clear All" and a minus sign. In the center, the search results summary is displayed: "37 Results for: [[Abstract: "virtual reality"] OR [Abstract: vr] OR [Abstract: xr] AND [[Abstract: "forest bathing"] OR [Abstract: nature] OR [Abstract: biophilic] OR [Abstract: greenery] OR [Abstract: "natural environment"] AND [[Abstract: stress] OR [Abstract: anxiety] OR [Abstract: burnout] OR [Abstract: relaxation]] AND [E-Publication Date: (01/01/2014 TO 12/31/2025)]]".

Searched The ACM Full-Text Collection (807,356 records) | [Expand your search to The ACM Guide to Computing Literature](#) (3,908,247 records)



Filters applied: Clinical Trial, Controlled Clinical Trial, Evaluation Study, Observational Study, Randomized Controlled Trial, Validation Study, English, French, Portuguese, Spanish, Humans, Adult: 19+ years, from 2014/1/1 - 2025/10/31. [Clear all](#)

Step 3 - Screening (ACM + PubMed)

	Contagem
Identificados via S1	37+36
Identificados via S2	27+28
Identificados via S3	2+87

Total identificados	217
Duplicados removidos	14
Registros após remoção de duplicados	203
Excluídos por <i>Abstract</i> (E1–E4)	179
Estudos incluídos na extração	24

Titles of the studies included:

Eisen, Aaron M.; Bratman, Gregory N.; Olvera-Alvarez, Hector A.	Susceptibility to stress and nature exposure: Unveiling differential susceptibility to physical environments; a randomized controlled trial.
Yin, Jie; Arfaei, Nastaran; MacNaughton, Piers; Catalano, Paul J.; Allen, Joseph G.; Spengler, John D.	Effects of biophilic interventions in office on stress reaction and cognitive function: A randomized crossover study in virtual reality.
Sadowski, Isabel; Meilleur-Bédard, Marianne; Khoury, Bassam	A Novel Virtual Reality-Based Nature Meditation Program for Older Adults' Mental Health: Results from a Pilot Randomized Controlled Trial.
Tanja-Dijkstra, Karin; Pahl, Sabine; White, Mathew P.; Andrade, Jackie; Qian, Cheng; Bruce, Malcolm; May, Jon; Moles, David R.	Improving dental experiences by using virtual reality distraction: a simulation study.
Xiaoxue, Su; Huang, Xuan	Promoting stress and anxiety recovery in older adults: assessing the therapeutic influence of biophilic green walls and outdoor view.
Tao, Meng; Huang, Haiquan; Gao, Jingchuan; Cao, Yuanyuan; Zhuang, Jie	The effects of combining visual-auditory stimuli with exercise on short-term affect improvement: a randomized controlled trial.
Hackman, Daniel A.; Robert, Stephanie A.; Grübel, Jascha; Weibel, Raphael P.; Anagnostou, Eirini; Hölscher, Christoph; Schinazi, Victor R.	Neighborhood environments influence emotion and physiological reactivity.
Kelton, Katherine; Weaver, Terri L.; Willoughby, Lisa; Kaufman, David; Santowski, Anna	The Efficacy of Binaural Beats as a Stress-buffering Technique.
Masters, Rachel; Interrante, Victoria; Watts, Madeline; Ortega, Francisco	Virtual Nature: Investigating The Effect of Biomass on Immersive Virtual Reality Forest Bathing Applications For Stress Reduction
Li, Jingyi; Ma, Yong; Li, Puzhen; Butz, Andreas	A Journey Through Nature: Exploring Virtual Restorative Environments as a Means to Relax in Confined Spaces
Nicoly, Jalynn Blu; Masters, Rachel; Gaddy, Vidya; Interrante, Victoria; Ortega, Francisco	The Restorative Influence of Virtual Reality Environment Design

Ding, Xiaoyan; Chen, Yiwen	The Stress Recovery Effect of Virtual Reality Natural Scene with Different Immersion on Knowledge Talents
Eftekhari Far, Siavash; Thaler, Anne; Troje, Nikolaus F.	Restorative Effects of Visual and Pictorial Spaces After Stress Induction in Virtual Reality
Miller, Noah; Stepanova, Ekaterina R.; Desnoyers-Stewart, John; Adhikari, Ashu; Kitson, Alexandra; Pennefather, Patrick; Quesnel, Denise; Brauns, Katharina; Friedl-Werner, Anika; Stahn, Alexander; Riecke, Bernhard E.	Awedyssey: Design Tensions in Eliciting Self-transcendent Emotions in Virtual Reality to Support Mental Well-being and Connection
Waycott, Jenny; Wadley, Greg; Baker, Steven; Ferdous, Hasan Shahid; Hoang, Thuong; Gerling, Kathrin; Headleand, Christopher James; Simeone, Adalberto L.	Manipulating Reality? Designing and Deploying Virtual Reality in Sensitive Settings
Shimomura, Yuki; Ban, Yuki; Warisawa, Shin'ichi	Presenting a Pseudo-loud Vocal Agency on VR for Stress Reduction
wuyun, bagen; cui, yiguo; jiao, rui; wei, zhuorao; chen, yi; lu, li	Study on the Effect of Virtual Landscape on Stress Relief of College Students
Graf, Linda; Emmerich, Katharina; Liszio, Stefan; Masuch, Maic	The Impact of Emotional Virtual Characters on Emotional State and Player Experience in VR Horror Games
Nasri, Mahsa	Towards Intelligent VR Training: A Physiological Adaptation Framework for Cognitive Load and Stress Detection
Samonte, Mary Jane C.; De Asis, Karlo Miguel R.; Guillem, Ethan Jeriko P.; Reyes, Francesca Angela M.	Relieving Stress Through Psychotherapy Using Internet-of-Things and Virtual Reality Game
Sehrt, Jessica; Yilmaz, Ugur; Kosch, Thomas; Schwind, Valentin	Closing the Loop: The Effects of Biofeedback Awareness on Physiological Stress Response Using Electrodermal Activity in Virtual Reality
Zhang, Jingyu; Jiang, Ke; Wang, Suhan; Ming, Shijie; Wang, Huidi	Forestlight: A Virtual Reality Respiratory Biofeedback System Using Interactive Lighting for Pressure Relief
Newbold, Joseph W.; Luton, Jacob; Cox, Anna L.; Gould, Sandy J. J.	Using Nature-based Soundscapes to Support Task Performance and Mood

Step 4 - Classification system (taxonomy/categories)

4.1 Scope and unit of analysis

Unit of analysis: Individual empirical study (paper) after screening by title/abstract and, when necessary, full text.

Framework: PICOCS (Population, Intervention, Comparator, Outcomes, Context, Study design).

Traceability: For each study, a short supporting quote from the abstract is stored in the extraction sheet for Intervention, Outcomes, and Study design.

Missing data rule: If an abstract does not report a needed field, record “not reported in the abstract”.

4.2 Population (P)

Categories

- General adults: ≥ 18 years, non-clinical.
- University students.
- Knowledge workers: office/technology/service professionals with high cognitive load.
- Older adults without explicit diagnosis.

Required fields: N, age (mean or range), sex (%), inclusion/exclusion criteria if given.

4.3 Intervention (I)

4.3.1 Source of nature

- Real 360°: 360-degree video or spherical capture of real environments.
- CGI: Computer-generated natural environments.

4.3.2 Type of nature

- Forest
- Generic nature (e.g., beach, lake, meadow)
- Canyon / low biomass
- Other (urban park, zen garden, mixed environments)

4.3.3 Modality

- Visual only (no sound described)
- Audio only (nature soundscape without VR)
- Audio-visual (VR with sound)
- Multisensory (e.g., haptics, scent, wind, light)

4.3.4 Biofeedback

- None: exposure only
- Breathing: pacing, entrainment, or visualized breath
- HR or HRV: heart rate or heart rate variability as input

- EDA: electrodermal activity as input
- Multimodal: ≥ 2 signals

Rule: Label as biofeedback only when the physiological signal alters the scene or feedback; if the signal is only recorded as an outcome, code it under Outcomes.

4.3.5 Dose

Record number of sessions per participant, minutes per session, and any breaks.

4.3.6 Rule of thumb

Example: “CG animated forest”, Source: CGI; Type: Forest; Modality: Audio-visual.

4.4 Comparator (C)

- 2D / pictorial: images or video outside the HMD
- Nature audio: soundscape without VR
- Eyes-closed rest
- VR without biofeedback: same scene, no physiological loop
- Non-VR control: e.g., regular waiting room, office task
- None: pre–post without parallel condition

Rule: If multiple comparators exist, record the main one most relevant to stress/anxiety.

4.5 Outcomes (O)

4.5.1 Subjective (psychometrics)

- Stress/anxiety/mood/restorativeness: PSS, STAI (state/trait), ZIPERS, PRS, mood scales.
- Presence: IPQ, PQ, SUS (Slater-Usoh-Steed; not to be confused with System Usability Scale).

4.5.2 Physiological

- HR, HRV (RMSSD, SDNN, LF/HF)
- EDA (tonic/phasic; peaks per minute)
- Blood pressure (SBP/DBP)
- EEG, when reported

4.5.3 Measurement windows

- Pre–post
- During the session
- Follow-up (when applicable)

Rule: Always register both instrument and time window (e.g., “PSS pre–post; HR and EDA during exposure”).

4.6 Context (Ctx)

- Environment: Laboratory; Vehicle/Office; University/Public event; Remote.
- Sequence: After stress induction vs no induction vs other relevant conditions.
- Equipment: HMD or display (model when given).
- Location: Country/city/institution when stated.

Rules

- Self-driving car simulator or office task → Vehicle/Office.
- Museum, campus, exhibitions → University/Public event.
- Controlled room → Laboratory; home/unsupervised → Remote.
- If the abstract omits equipment or location, record “HMD not reported” and omit location.

4.7 Study design (S)

- Pre–post (within-subjects)
- Between-groups
- Crossover
- Quasi-experimental
- Pilot

Example: “N = 21, VR compared to eyes-closed rest” → between-groups or within-subjects depending on design; note explicitly in extraction.

4.8 Intervention families used in mapping

- Nature-VR without biofeedback.
- Nature-VR with biofeedback (breathing or EDA altering the scene).
- Soundscape without VR.
- Other VR relevant to stress, emotion, or methods (kept for context, not part of main nature-VR synthesis).

Step 5 - Coding

5.1 Extraction procedure

Primary source: title and abstract; full text used when needed to fill missing fields.

Required: all PICOCS elements plus a short abstract quote supporting Intervention, Outcomes, and Study design.

Consistency with screening rules:

- E1: no stress measures
- E2: clinical population or patient procedures
- E3: non-empirical
- E4: non-nature VR (kept only if methodologically relevant)

5.2 Effect labels (vote-counting)

- Beneficial: statistically significant improvement or clear claim of benefit.
- Null: no effect or non-significant difference.
- Mixed: divergent patterns between subjective and physiological measures, or effects restricted to a subset of outcomes/conditions.
- Inconclusive: cannot infer direction from the abstract.

5.3 Aggregated results (mapped set, 23–24 studies)

5.3.1 Overall distribution

- Beneficial: 11
- Mixed: 4
- Null or negative: 3
- Inconclusive: 5

5.3.2 By intervention family

- Nature-VR (11 studies): 8 beneficial; 1 mixed; 0 null; 2 inconclusive.
- Nature-VR + biofeedback (2 studies): 2 beneficial; 0 mixed; 0 null; 0 inconclusive.
- Soundscape without VR (2 studies): 0 beneficial; 1 mixed; 1 null; 0 inconclusive.
- Other VR (8 studies): 1 beneficial; 2 mixed; 2 null; 3 inconclusive.

5.3.3 Comparators and designs

- Frequent active comparators: pictorial/art, eyes-closed rest, less immersive variants, or non-VR controls.
- Several pre–post designs with no parallel control.
- Some studies use explicit stress induction; others use spontaneous/ambient exposure without induction.

5.3.4 Most common outcomes

- Psychometrics: ZIPERS, PRS, STAI, PSS, mood/restorativeness.

- Physiology: HR, HRV, EDA, blood pressure; often measured during exposure plus pre–post.

Step 6 - Analysis and Reporting

6.1 Objective and RQs

Objective: Map and synthesize evidence on nature-VR and related interventions for immediate/short-term stress/anxiety reduction in non-clinical adults (including burnout risk).

RQs

- Does nature-VR reduce stress/anxiety in adults?
- Does biofeedback (breathing / scene-coupled EDA) enhance the effect?
- Which psychometric and physiological measures are more responsive and practical?

6.2 Analyzed set and synthesis

- Included studies: 23 (after applying E1–E4; one additional study kept mainly for methodological context).
- Synthesis: vote-counting by direction of effect (Beneficial, Mixed, Null/Negative, Inconclusive).
- Unit of analysis: study (paper); coding based primarily on abstracts plus extraction notes.

6.3 Descriptive summary

Intervention types

- Nature-VR (no biofeedback): 11
- Nature-VR + biofeedback: 2
- Soundscape only: 2
- Other VR (non-nature; stress/emotion/methods): 8

Comparators

- Active: pictorial/art, eyes-closed, less immersive VR, non-VR controls
- Pre–post only: no parallel comparator in some studies

Outcomes

- Psychometrics: ZIPERS, PRS, STAI, PSS, mood/restorativeness
- Physiology: HR, HRV (RMSSD, SDNN, LF/HF), EDA, BP
- Windows: during exposure plus immediate pre/post

6.4 Vote-counting results

6.4.1 Overall (23 studies)

- Beneficial: 11
- Mixed: 4
- Null/Negative: 3
- Inconclusive: 5

6.4.2 By intervention family

- Nature-VR (11): 8 beneficial; 1 mixed; 0 null; 2 inconclusive.
- Nature-VR + biofeedback (2): 2 beneficial; 0 mixed; 0 null; 0 inconclusive.
- Soundscape (2): 0 beneficial; 1 mixed; 1 null; 0 inconclusive.
- Other VR (8): 1 beneficial; 2 mixed; 2 null; 3 inconclusive.

Main reading

- Nature-VR shows a consistent trend of immediate benefits, especially on subjective measures (mood/restorativeness; ZIPERS/PRS) and, in several studies, on physiological markers (HR/EDA).
- Biofeedback (breathing/EDA coupled to the scene) appears to reinforce short-term benefits, but evidence is still preliminary.

6.5 Sub-analyses

6.5.1 Key illustrative studies

Eisen et al. (2024) randomizaram 64 homens universitários saudáveis para 10 minutos de VR natureza versus VR escritório após um stressor agudo, avaliando recuperação autonómica via HRV. Os resultados, em nível de tendência, sugeriram melhor recuperação da HRV na condição de natureza entre participantes com perfil pró-inflamatório, enquanto estatuto socioeconómico e stresse precoce não moderaram os efeitos, o que limita as conclusões a recuperação fisiológica de curto prazo num subgrupo específico.

Li et al. (2021) desenvolveram um Virtual Restorative Environment (VRE) para espaços confinados e conduziram um estudo intra-sujeitos ($N = 21$) comparando uma sessão curta de VRE com descanso de olhos fechados. O VRE produziu melhorias mais fortes de humor e pequenos benefícios em atenção e memória de trabalho em comparação com o descanso, sustentando o uso de sessões breves de VR natureza calma em adultos não clínicos, embora com amostra reduzida e sem medidas fisiológicas.

Yin et al. (2019) usaram um desenho cruzado randomizado em escritórios simulados em VR para comparar variantes com e sem elementos biofílicos em termos de

indicadores de stresse e desempenho cognitivo (amostra \approx 30 adultos). As configurações biofísicas tenderam a reduzir marcadores fisiológicos de stresse e a melhorar medidas de criatividade, enquanto alguns tempos de reação em tarefas de atenção abrandaram, indicando um trade-off entre ambiente mais restaurativo e atenção mais rápida, com generalização limitada a escritórios reais devido a exposições de laboratório curtas.

6.5.2 Subjective vs physiological

- Recurrent “mixed” pattern: clear subjective improvements (ZIPERS/PRS/mood) with physiological changes that are smaller or not always statistically significant (HR/EDA/HRV).
- Immersion effects: immersive VR nature often outperforms pictorial conditions on subjective outcomes and, in some cases, also reduces EDA.

6.5.3 Strength of comparators

Eyes-closed and pictorial/art conditions are demanding comparators; nature-VR frequently outperforms them, suggesting effects beyond non-specific relaxation.

6.5.4 Context

- Laboratory studies predominate; some work in vehicle/office and public-exhibition contexts.
- Extrapolation to real occupational settings is plausible but under-tested; field trials are still scarce.

6.6 Threats to validity

- Small samples and short follow-up windows in many studies.
- Heterogeneity of content, comparators, and protocols limits meta-analysis.
- Partial reliance on abstracts for coding (risk of missing details).
- Possible publication bias toward positive findings.
- Variation in physiological protocols (e.g., short HRV windows) may reduce sensitivity.

6.7 Conclusions by RQ

RQ1 – Nature-VR: Evidence tends to favor immediate benefits on stress/anxiety, with consistent subjective gains and compatible physiological signs in several studies; advantages over pictorial/eyes-closed support a specific contribution of natural content plus immersion.

RQ2 – Biofeedback: Studies with scene-coupled breathing/EDA suggest additional short-term benefit, but the base is small; more standardized RCTs are needed.

RQ3 – Measures: For short-term effects, ZIPERS and PRS combined with HR and EDA during and after exposure offer a sensitive and feasible panel; HRV (RMSSD/SDNN, \geq 2–5 min windows) is useful when autonomic self-regulation is a goal.

6.8 Practical recommendations (non-clinical adults, stress/burnout risk)

- Short (10–15 min) immersive nature-VR sessions (forest/biophilic, audio-visual).
- Simple breathing biofeedback (e.g., visual pacing, scene interaction) when possible.

Measurement:

- Subjective: ZIPERS (affect/activation) and PRS (restorativeness) post-session.
- Physiological: HR and EDA during and immediately after; HRV (RMSSD/SDNN) when feasible.
- Internal comparator: pictorial/eyes-closed conditions (e.g., alternate days) if evaluating effectiveness in a specific context.

Dose suggestion: start with 3–5 sessions/week; monitor response and adjust.

6.9 Gaps and research agenda

- Larger RCTs with standardized active comparators.
- Consistent HRV protocols (windows, metrics, reporting).
- Dose-response and maintenance (follow-up \geq 1–4 weeks).
- Field studies in real work environments, with occupational outcomes (fatigue, performance, burnout markers).
- Multimodal biofeedback (breathing + EDA/HRV) with scene adaptation and incremental-gain testing.

6.10 Final message

Nature-VR is promising for immediate stress reduction in non-clinical adults, with robust subjective evidence and partial physiological support.

Scene-coupled biofeedback shows additional potential benefit but is still understudied.

For practical use and internal evaluation, short immersive sessions, combined subjective + physiological measurement, and, when possible, simple breath-based biofeedback are recommended.

Glossary

MVP (Minimum Viable Product)

Minimum functional version of a prototype that already allows you to test hypotheses with users and measure results with the least possible effort. It serves to validate before investing in advanced features.

XR (Extended Reality)

Umbrella that includes VR (Virtual Reality), AR (Augmented Reality) and MR (Mixed Reality).

VR (Virtual Reality)

Fully synthetic environment (CGI or 360° video) seen on an HMD; The real world is hidden.

AR (Augmented Reality)

Overlay of virtual elements on the real world (mobile phone/transparent glasses).

HMD (Head-Mounted Display)

VR/AR helmet/goggles (e.g., Quest, Vive). Relevant because the model and refreshment rate influence comfort and cyber-motion sickness.

CGI

Computer-generated content (3D graphics), in contrast to 360° video captured in the real world.

Biofeedback

Technique that returns to the user physiological signals in real time (breathing, HRV, EDA) to regulate the state (relax, focus).

RSA-BT (Respiratory Sinus Arrhythmia – Breathing Training)

Breathing training to maximize respiration-linked cardiac variability (RSA). Used to reduce anxiety.

HR (Heart Rate)

Heart rate (beats/min).

HRV (Heart Rate Variability)

Beat-by-beat variation. Indicator of autonomic (parasympathetic) balance. — RMSSD: root of the mean square of successive differences; robust short-term HRV metric. — SDNN: standard deviation of the NN ranges (most global).

EDA (Electrodermal Activity)

Skin conductance (sweat); grows with activation/alert. Useful for viewing stress response during exposure.

BP (Blood Pressure)

Blood pressure (SBP/BPD). Some studies measure it as an additional physiological outcome.

PSS (Perceived Stress Scale)

Perceived stress questionnaire (last weeks). It measures general state/trait, not just momentum [Cohen et al.].

STAI (State-Trait Anxiety Inventory)

It measures state anxiety (momentary) and trait (propensity). The STAI-S subscale is the relevant one in the short term [Spielberger].

ZIPERS (Zuckerman Inventory of Personal Reactions)

Affect/activation scale (e.g., positive affect, arousal). Used "post-exposure" to capture mood swings.

PRS (Perceived Restorativeness Scale)

Perception of restorativeness of the environment (being "taken out", fascination, compatibility) [Kaplan].

Attendance / Attendance Questionnaires

Feeling of "being there" in the virtual world. Common instruments: IPQ, PQ (Witmer & Singer), SUS (Slater-Usoh-Steed). Not to be confused with System Usability Scale.

PICOCS

Scheme for formulating the review: Population, Intervention, Comparator, Outcomes, Context, Study design.

RQ (Research Question)

Research question(s) that the review aims to answer.

SLR vs SMS

SLR (Systematic Literature Review) synthesizes evidence of effect (ideally with meta-analysis).

SMS (Systematic Mapping Study) catalogs the terrain (topics, methods, gaps) – what we are doing in PREPD.

PRISMA

Set of items/flow to report systematic reviews/mappings (diagram: identified → screened → included).

Pre-post (within-subjects)

The same participant is measured before/after the intervention (no control group).

Between-subjects

Different participants in different conditions (e.g., VR vs 2D).

Crossover

Each participant experiences all conditions, in counterbalanced order (reduces order bias).

ANOVA

Analysis of variance; compares averages between conditions/times (e.g., 2×2 immersion×stress).

Effect size

Magnitude of the difference (e.g., Cohen's d). Essential for practical interpretation, even when p-value is significant.

Randomization / Counterbalance

Techniques for distributing bias (order, learning) among conditions in an experimental study.

Exposure

Total duration and minutes per session. It matters to compare studies and define the MVP.

cybersickness

Malaise (nausea, dizziness) in VR; monitor with SSQ (Simulator Sickness Questionnaire).

SUS – System Usability Scale

10-item usability questionnaire (0–100). Not to be confused with the SUS of presence.

Ecology / Context

Degree to which the study reflects the actual environment (laboratory, office, vehicle). It influences generalization.

Active comparator

Credible alternative condition (e.g., close eyes, pictorial 2D) instead of "with nothing".

Vote-counting

Simple aggregation by direction of effect (beneficial/mixed/null) when there are no data for meta-analysis.

Power

Probability of detecting a real effect. Studies with small N have little power and more unstable results.