

Indoor Environmental Quality in Home Offices

A Proof-of-Concept Study on Pleasure and Discomfort

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AIVC Workshop "Indoor Environmental Quality in Sustainable Buildings"
1-2 April 2025 | Stuttgart, Germany

Institut für Arbeits-, Sozial-
und Umweltmedizin

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Healthy
Living Spaces
Institute for Occupational, Social
and Environmental Medicine

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IHTA Institut für
Wärmetechnik
und Akustik

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e3D Lehrstuhl für Energie-
effizientes
Bauen

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EBC | Institute for Energy Efficient
Buildings and Indoor Climate

E.ON Energy Research Center

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Background

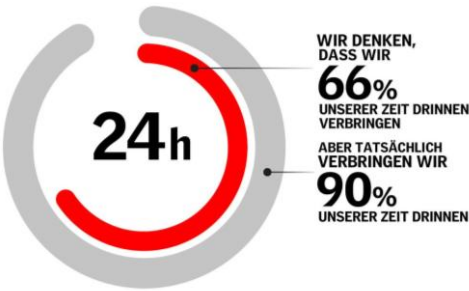


Abbildung: yougove-Studie

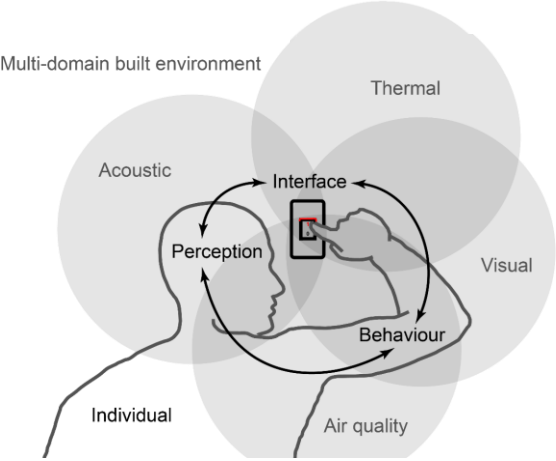
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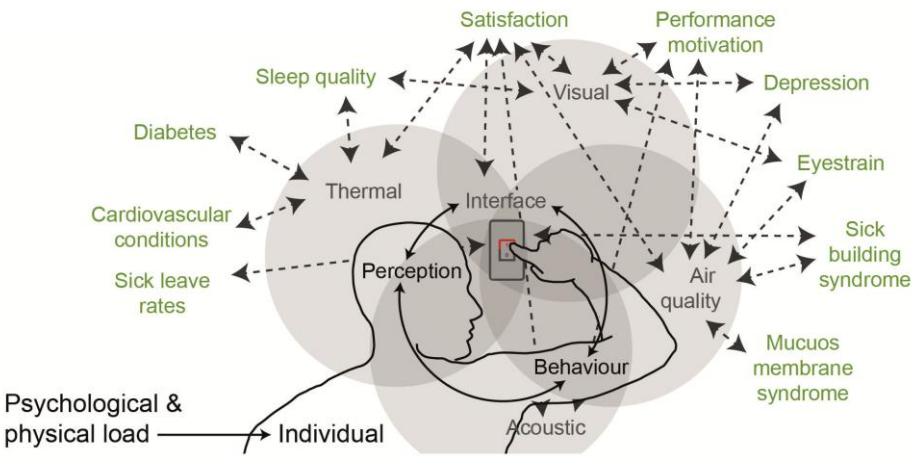
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Background
IEQ



3

Background
Multi-domain approach



4

Background

Health-promoting Built Environment

Background

The notion of pleasure

Monotonous conditions
(thermal/visual) boredom



Dynamic conditions
(Thermal/Visual) delight



Background
WfH environment



<https://elplanetaurbano.com/2022/03/home-office-cuales-son-las-ventajas-y-desventajas-del-teletrabajo/>

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Research gap

- The multi-domain approach in IEQ assessments
- Perceptions in diverse WfH environment and uncontrolled labs
- The link between IEQ factors and stress

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Objectives and approach

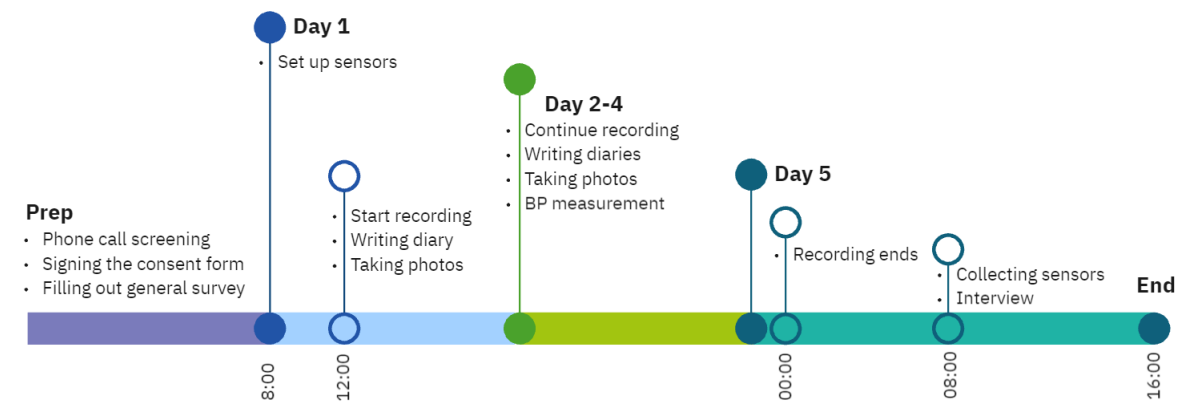
- 1. Identify, discuss and redefine IEQ research objectives in close dialogue with participants
 - 2. Assess IEQ situation in Home-Office work settings and identify improvement potential
 - 3. Investigate the scalability of our living lab approach
- Living Lab / „Reallabor“ characteristics
 - ≡ contextualisation of measurements and embeddedness
 - ≡ inter- and transdisciplinarity
 - A proof-of-concept study
 - Mixed-Methods approach: objective and subjective data collection

Methods
Study design

- Adaptive approach
 - ≡ Allows for modifications
 - ≡ 3 stages (each 5 participants)
 - ≡ Nov, Feb & Apr



Methods
Study design-procedure



11

Methods
Subjective data

Mi.

Stunde des Tages

	0-15	16-30	31-45	46-59
0				
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				
21				
22				
23				

Protokoll

0-1516-3031-4546-59

Bitte vergessen Sie nicht, Fotos mit Ihrem Handy zu machen, die Ihnen helfen, sich an das Wohlbefinden / Unbehagen zu erinnern

Nr.	Wann? Tag (z.B. Montag) Zeit: MM: SS	Bitte kreuzen Sie an: Wohlbefinden ☺	Unbehagen ☹	Beschreiben Sie, was Sie gerade dazu gebracht hat, Freude oder Unbehagen zu empfinden.	Wie hat sich das auf Ihr Tun oder Ihr Verhalten ausgewirkt? Und wie sind Sie mit der Situation umgegangen?
1					
2					
3					
4					

Diary Log

+ General survey

+ Interview

Self-report activity diaries
Bouchard's Physical
Activity Record (BAR)

12

Methods
IEQ sensor system development



13

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Methods
Physiological data collection



Polar H10



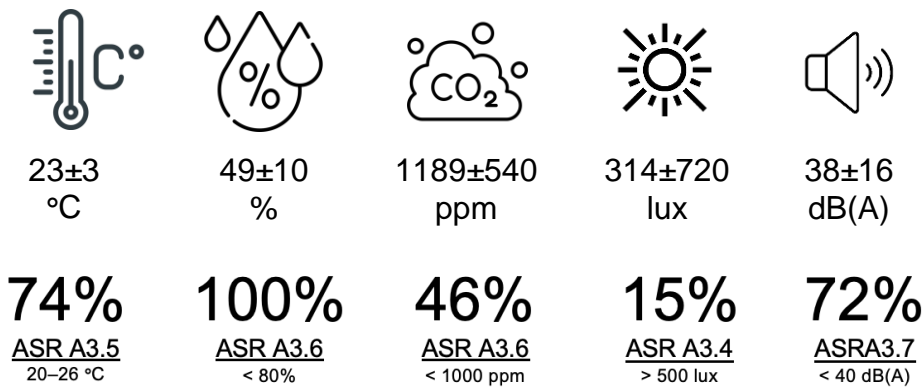
ECGpro Holter-RR

14

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Results
Objective data (IEQ sensors)

■ Comparison of the sensor data to the Technischen Regeln für Arbeitsstätten (ASR)

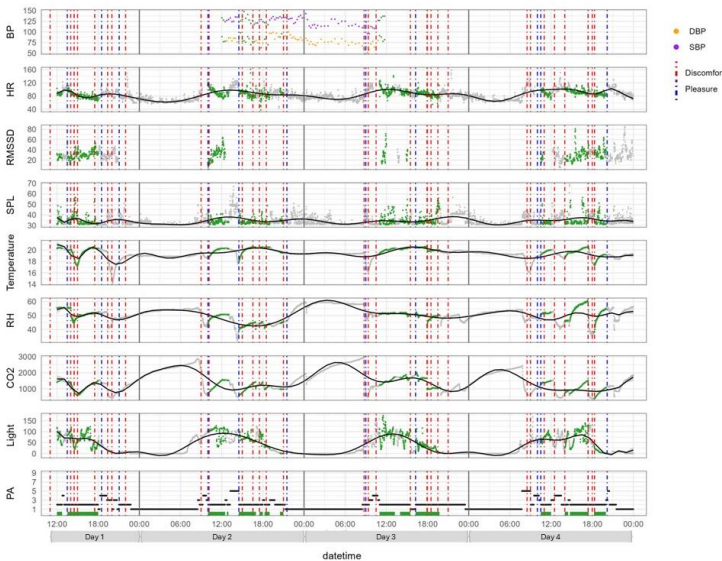


15

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Results
Comprehensive approach

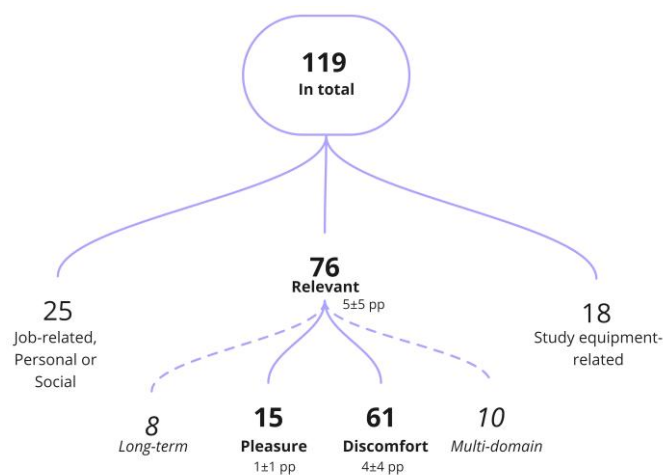
■ **Pleasure/discomfort**
time reported in the
diary is plotted against
objective data to
investigate possible
causes.



16

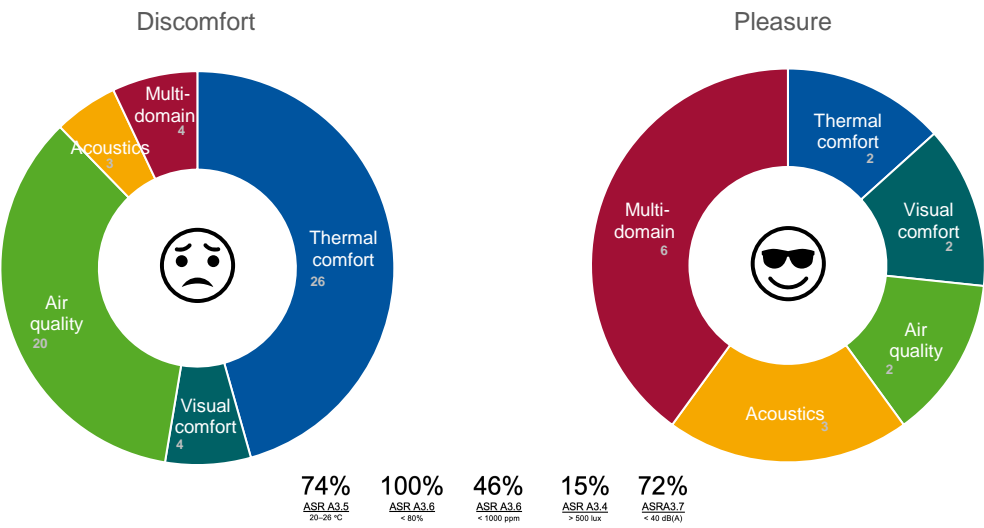
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Results
Diary entries



17

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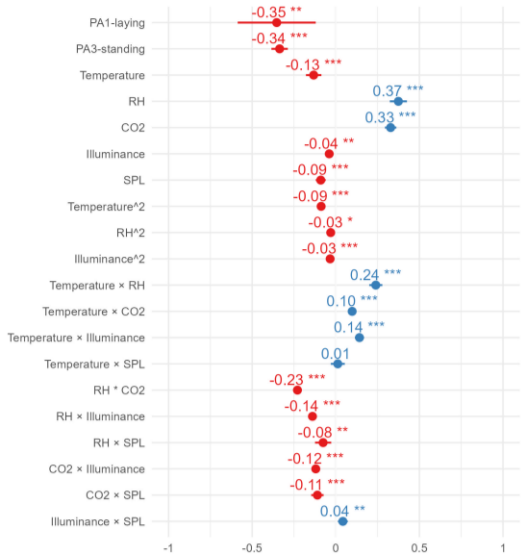
18

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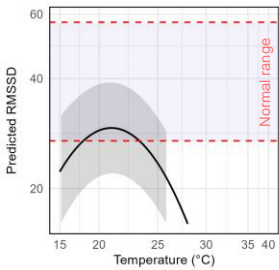
Link between IEQ and HRV (RMSSD)

Linear mixed-effects modeling














- Fixed effects
 - Physical activity
 - IEQ factors
 - IEQ two-way interactions
 - Quadratic terms of
 - Temperature
 - Relative humidity
 - Illuminance
- Random effects
 - participants



Results
Link between Temperature and HRV (RMSSD)



Many thanks to the project team

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Any Questions

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