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Supplementary information

A review of indoor environmental quality studies using discrete choice experiments: Valuing comfort

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Table S1. Variables used in review.

Study	Attribute description	Attribute levels	Coding	Interpretation for synthesis
Amaris *et al.*[1]	Adjust smart system	Baseline: no smart system adjustment Adjustment 1: adjust temperature by 1 or 2 °C Adjustment 2: adjust for 2, 4, or 6 hours	Thermal comfort - proxy	Interpreted as occupants' increase in marginal utility from the ability to adjust temperatures of their smart thermostat, with explicit author interpretation towards improving thermal comfort. Value for the longest duration and highest temperature amongst the two countries are taken as a representative value for this review
Appel-Meulenbroek *et al.*[2]	Indoor Air	Baseline: Ventilation indoor-outdoor air Level 1: Ventilation with air treatment Level 2: Ventilation with air treatment & air filtering	Indoor air quality - proxy	Interpreted as building decision makers' increase in marginal utility from improved ventilation systems in offices
	Thermal comfort	Baseline: Radiators + Airco -units (much comfort fluctuation) Level 1: Controlled system with comfort fluctuation Level 2: Balanced system with minor comfort fluctuation + Adjustable per space	Thermal comfort - proxy	Interpreted as building decision makers' increase in marginal utility from improved thermal control systems in offices

	Exposure to light	Baseline: Standard window size + Standard light fittings Level 1: Standard window size with sun blinds + Light fittings with daylight correction Level 2: Large window size with adjustable sun blinds + Adjustable light fittings	Visual comfort - proxy	Interpreted as building decision makers' increase in marginal utility from improved lighting systems in offices
	Noise & Acoustics	Baseline: No acoustic measurements Level 1: Acoustic insulation external sound sources Level 2: Acoustic insulation external & absorption internal sound sources	Acoustic comfort - proxy	Interpreted as building decision makers' increase in marginal utility from improved acoustic systems in offices
Bakaloglou and Belaïd[3]	Thermal comfort after retrofits	Baseline: Same heating temperature in the winter as before Level 1: Higher heating temperature in the winter than before	Thermal comfort - direct	Interpreted as the occupants' increase in marginal utility from an increase in thermal comfort after retrofits
Baker *et al.*[4]	Energy efficiency	Baseline: no upgrades Level 1: Draught sealing Level 2: Thermal block-out blinds or outdoor shadings Level 3: Add or upgrade ceiling insulation	Thermal comfort - proxy	Interpreted as the increase in marginal utility of occupants from an energy efficiency upgrade, which is interpreted by the authors to lead to better thermal comfort

Banfi *et al.*[5]	Window	Level -1: Very old (single glazing, not coated, no rubber seal) Baseline: Medium old (low insulation, not coated, no rubber seal) Level 1: Standard insulation (coated, rubber seal) Level 2: Enhanced insulation (triple glazing, double coated pane, rubber seal)	Thermal comfort - proxy	Coded as thermal comfort due to original authors interpretation. Some cross over effects from insulation in DCE, but larger MWTP from windows
	Ventilation	Baseline: Without air renewal system Level 1: With air renewal system (housing ventilation)	Indoor air quality - proxy	Interpreted as the MWTP of owners and renters to improve ventilation systems
Berto *et al.*[6]	Thermal comfort	Baseline: Underfloor heating with a single thermostat inside the housing Level 1: Underfloor heating with zone control: multiple thermostats inside the housing	Thermal comfort - proxy	Interpreted as the MWTP of homebuyers to purchase a house with underfloor heating as a means to improve thermal comfort
	Visual comfort	Baseline: Manual shutter Level 1: Automatic shutter with integrated sensors	Visual comfort – proxy	Interpreted as the MWTP of homebuyers to purchase a house with automatic blinds as a means to improve visual comfort

	Acoustic comfort	Baseline: Correct design of passive acoustic requirements Level 1: Correct design and on-site verification of passive acoustic requirements	Acoustic comfort – proxy	Interpreted as the MWTP of homebuyers to purchase a house with tested acoustic qualities as a means to improve acoustic comfort
	Indoor air quality	Baseline: Centralized mechanical ventilation Level 1: Decentralized mechanical ventilation with coupled machines	Indoor air quality – proxy	Interpreted as the MWTP of homebuyers to purchase a house with decentralised ventilation systems as a means to improve indoor air quality
Bragolusi[7]	Indoor air quality (AQ)	Baseline: No Level 1: Yes	Indoor air quality – proxy	Interpreted as the occupants' increase in marginal utility from the installation of a mechanical ventilation system that allows for increase in indoor air quality
	Domotic system (DS)	Baseline: No Level 1: Yes	Thermal comfort – proxy	Interpreted as the occupants' increase in marginal utility from the installation of a domotic system that allows for home automation and subsequent increase in thermal comfort
Chau *et al.*[8]	Indoor noise level	Baseline: Unacceptable but without causing major health threats Level 1: Acceptable and without causing major health threats	Acoustic comfort - direct	DCE was designed to directly elicit acceptance for improved acoustic comfort from occupants
	Indoor air quality	Baseline: Unacceptable but without causing major health threats Level 1: Acceptable and without causing major health threats	Indoor air quality - direct	DCE was designed to directly elicit acceptance for improved indoor air quality from occupants

Damigos *et al.*[9]	Annual savings - heating	Continuous variable (baseline: 0)	Thermal comfort - proxy	Taken from the AS-SIEP model, the thermal comfort co-benefits of savings in annual heating was assumed by the original authors to be considered as part of the occupants decision process in the DCE
Faccioli *et al.*[10]	Comfort	Baseline: 2.7 Level 1: 2.9 Level 2: 5.6 Level 3: 7.1	Thermal comfort – direct	The original authors specify that the comfort attribute encompass thermal comfort, acoustic comfort, ventilation, and electromagnetic interference. However, with the focus of the DCE on CO_2 emissions and energy consumption, there is implied focus on thermal comfort vis-à-vis other comfort factors due to the larger energy and CO_2 impact in maintaining thermal comfort
Galassi and Madlener[11]	Room air quality	Level -1: AIRQ_worse Baseline: null Level 1: AIRQ_better	Indoor air quality – direct	Using Model (3) of that had the highest goodness of fit, renters are asked for their preferences of these 3 qualities, amongst other attributes, in order to discover their valuation of indoor comfort
	Room temperature	Baseline: null Level 1: TEMP_warm	Thermal comfort – direct	
	Noise reduction	Baseline: NOISE_none Level 1: NOISE_out Level 2: NOISE_in/out	Acoustic comfort - Proxy	

Galassi and Madlener[12]	Temperature adjustment measure	Baseline: I do not adjust anything Option 1: Heating off Option 2: Window fully open + heating off Option 3: Window tilted Option 4: Window fully open	Thermal comfort - proxy	Unlike many other temperate papers, this one looks at occupants becoming overly warm in the winter and derives their marginal utility from opening windows as an adaptive action, which is explicitly interpreted by the original author to correlate with thermal comfort. The options in the DCE are designed as thermo-adaptive options instead of strict attribute levels, and the 'Window fully open + heating off' option was chosen in this review due to having the highest estimates and being statistically significant.
He *et al.*[13]	Indoor air quality	Baseline: Unacceptable but without causing major health threats Level 1: Acceptable and without causing major health threats Level 2:Comfortable	Indoor air quality – direct	Interpreted as per the original authors' intent
	Thermal comfort	Baseline: Unacceptable but without causing major health threats Level 1: Acceptable and without causing major health threats Level 2:Comfortable	Thermal comfort - direct	Interpreted as per the original authors' intent
Hou and Lan[14]	Lighting intensity	Baseline: dim lighting (0-200 lux) Level 1: Moderate lighting (200-500 lux) Level 2: Bright lighting (500-1000 lux)	Visual comfort - direct	Interpreted as occupants' marginal utility from different lighting levels. Considered direct due to the VR-based methodology

	Intrusive noise	Baseline: Low intrusive noise Level 1: Medium intrusive noise Level 2: Strong intrusive noise	Acoustic comfort - direct	Interpreted as occupants' marginal utility from different noise levels. Considered direct due to the VR-based methodology. Intrusive noise chosen due to literature evidence for higher discomfort from sudden and irregular noise.
Jusoh *et al.*[15]	Natural indoor air ventilation	Baseline: Not good Level 1: Good Level 2: Very good	Indoor air quality - direct	Interpreted as per the original authors' intent
Li *et al.*[16]	Increase in home comfort	Baseline: Low Level 1: Moderate Level 2: High	Thermal comfort - direct	Interpreted as per the original authors' intent
Marmolejo-Duarte and Ampudia-Farias[17]	Active conditioning	Baseline: Heating Level 1: Air conditioning + Heating	Thermal comfort - proxy	Based on the original authors' interpretation of the results, where occupants were attracted to these features to improve their thermal comfort
Marmolejo-Duarte and Bravi[18]	Active conditioning	Baseline: Heating Level 1: Heating + Air conditioning	Thermal comfort - proxy	Based on the original authors' interpretation of the results, where occupants were attracted to these features to improve their thermal comfort
Stolyarova *et al.*[19]	Heating energy source	Baseline: No change Option 1: DEH Option 2: Heat pump Option 3: Wood burning stove Option 4: Electricity Option 5: Renewable energy sources		The original authors conclude that cold-sensitive households are willing to invest more in renewable RSHS systems to improve their thermal comfort and was used in this review to represent thermal comfort
Taranu *et al.*[20]	Improvement in the level of thermal comfort	Baseline: small Level 1: big	Thermal comfort - direct	Interpreted as per the original authors' intent

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