

Deconstructing building performance: with emphasis on needs, perceived health and productivity

Adrian Leaman

Original version animated in Keynote.

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Healthy Buildings 2015 Europe, Eindhoven, The Netherlands
Monday May 18, 2015

“If you are playing a miser always emphasise their generosity”

Actors' saying

Heuristics

Any approach to problem solving ...

not guaranteed to be optimal or perfect ...

but sufficient for the immediate purposes.

Can be rules of thumb,

professional judgements, educated guesses,

common sense,

models, and more...

Overview

In straightforward terms ...

what are the most important things ...

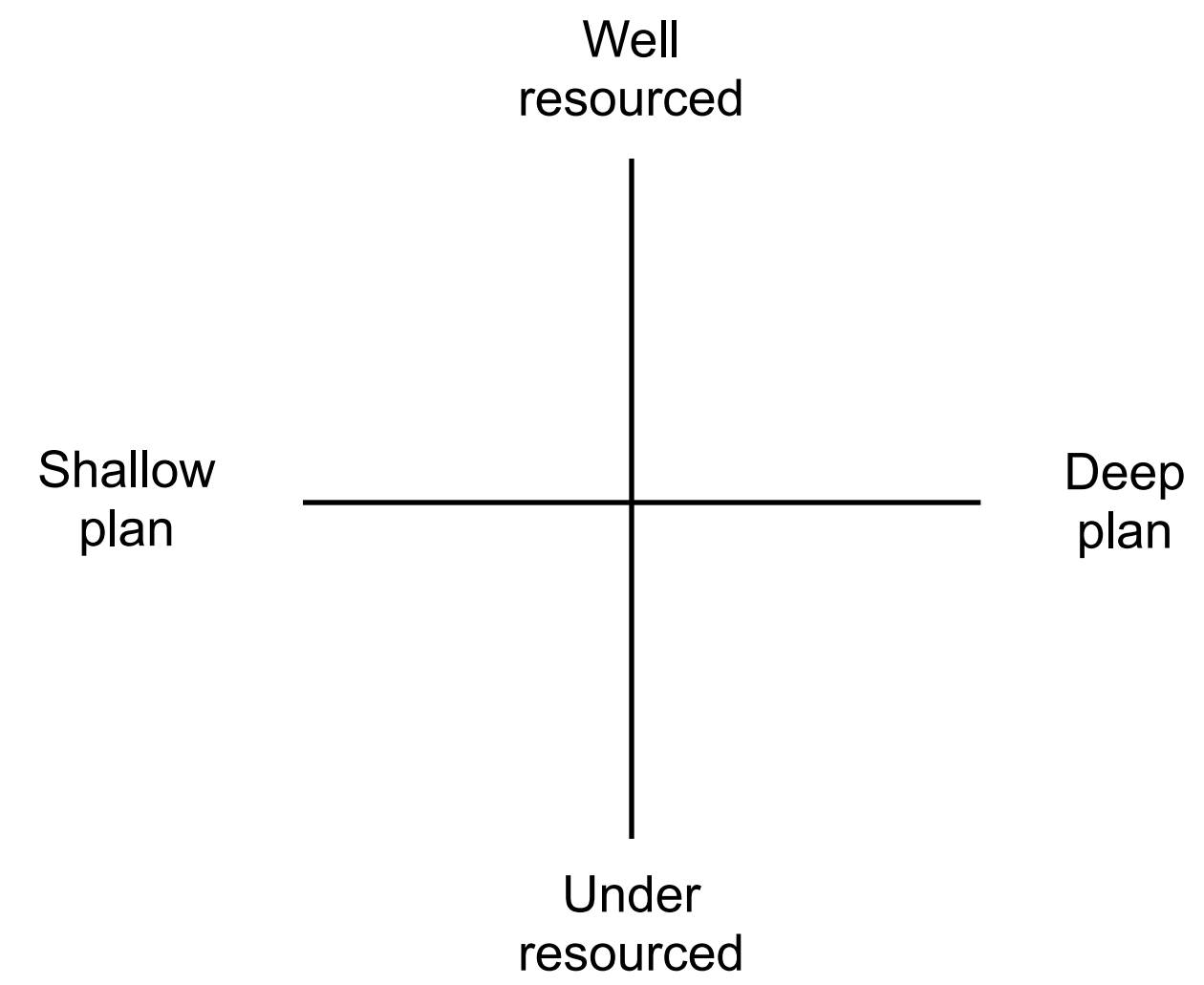
that need concern designers, managers and building users ...

to help improve how well buildings work?

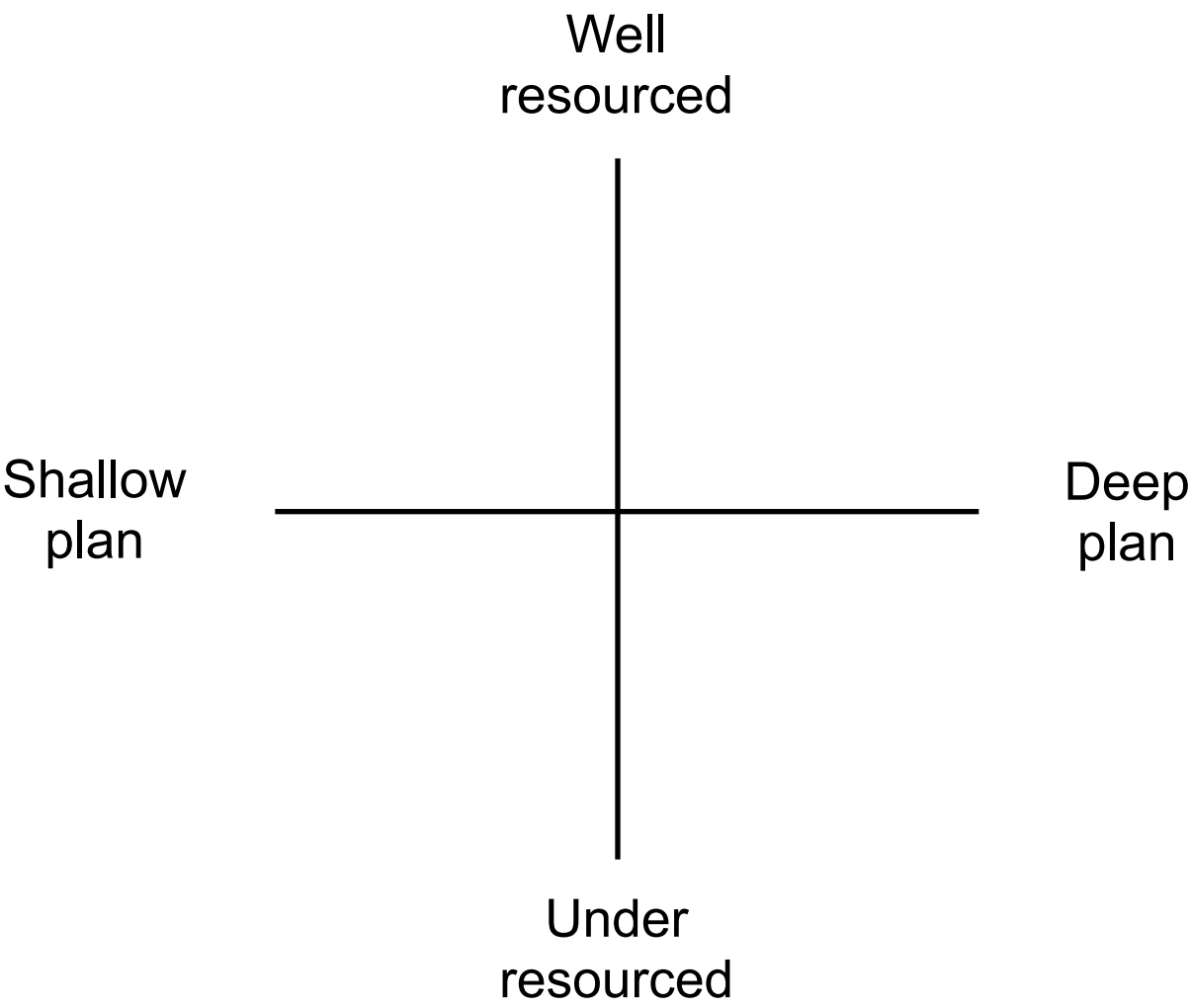
An heuristic diagram may help ...

so let's build one.

Context



Context

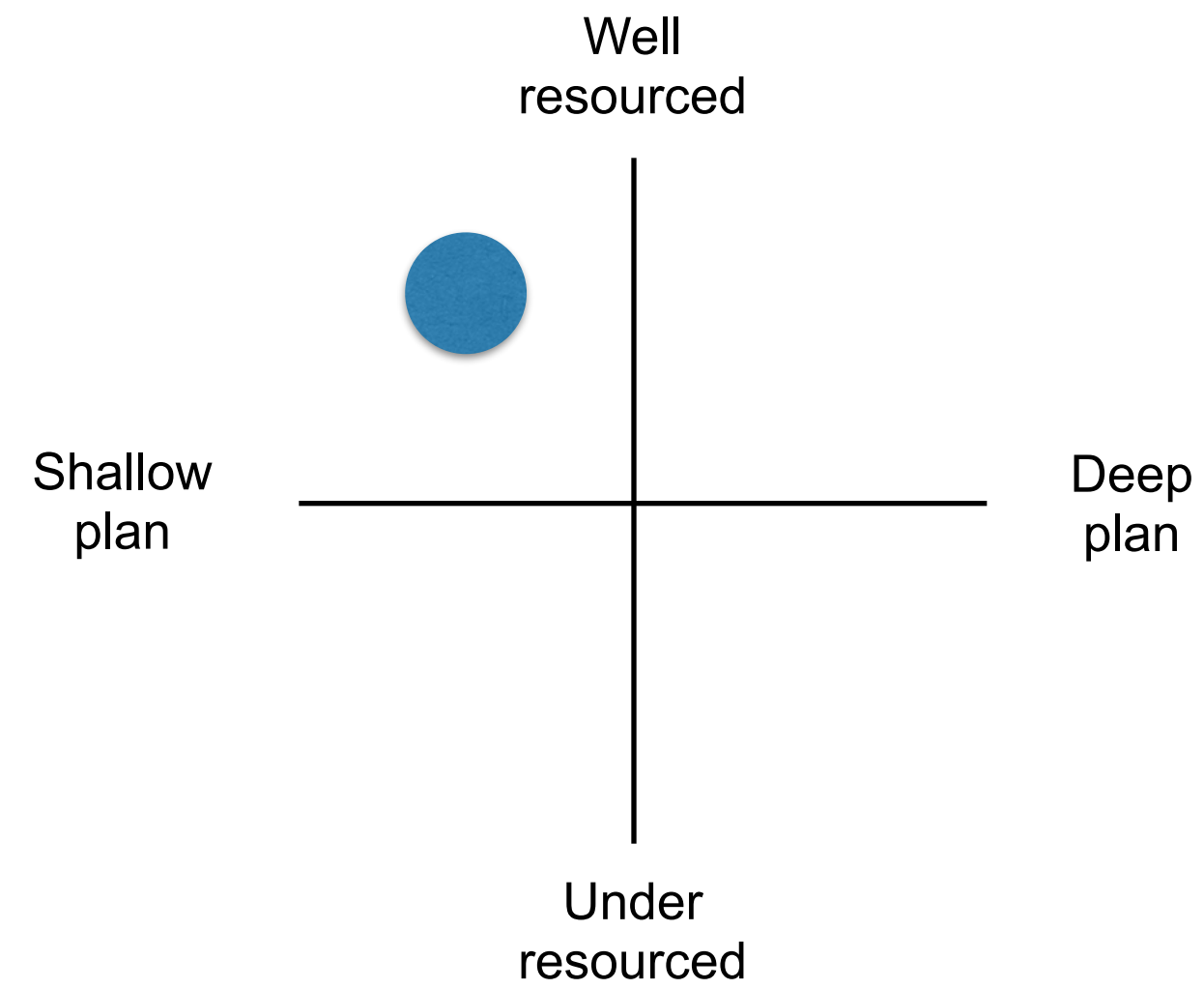


<http://markbrinkley.blogspot.co.uk/2007/06/yvette-cooper-at-offsite-2007.html>



Berriedale, Near Wick, Caithness

Context



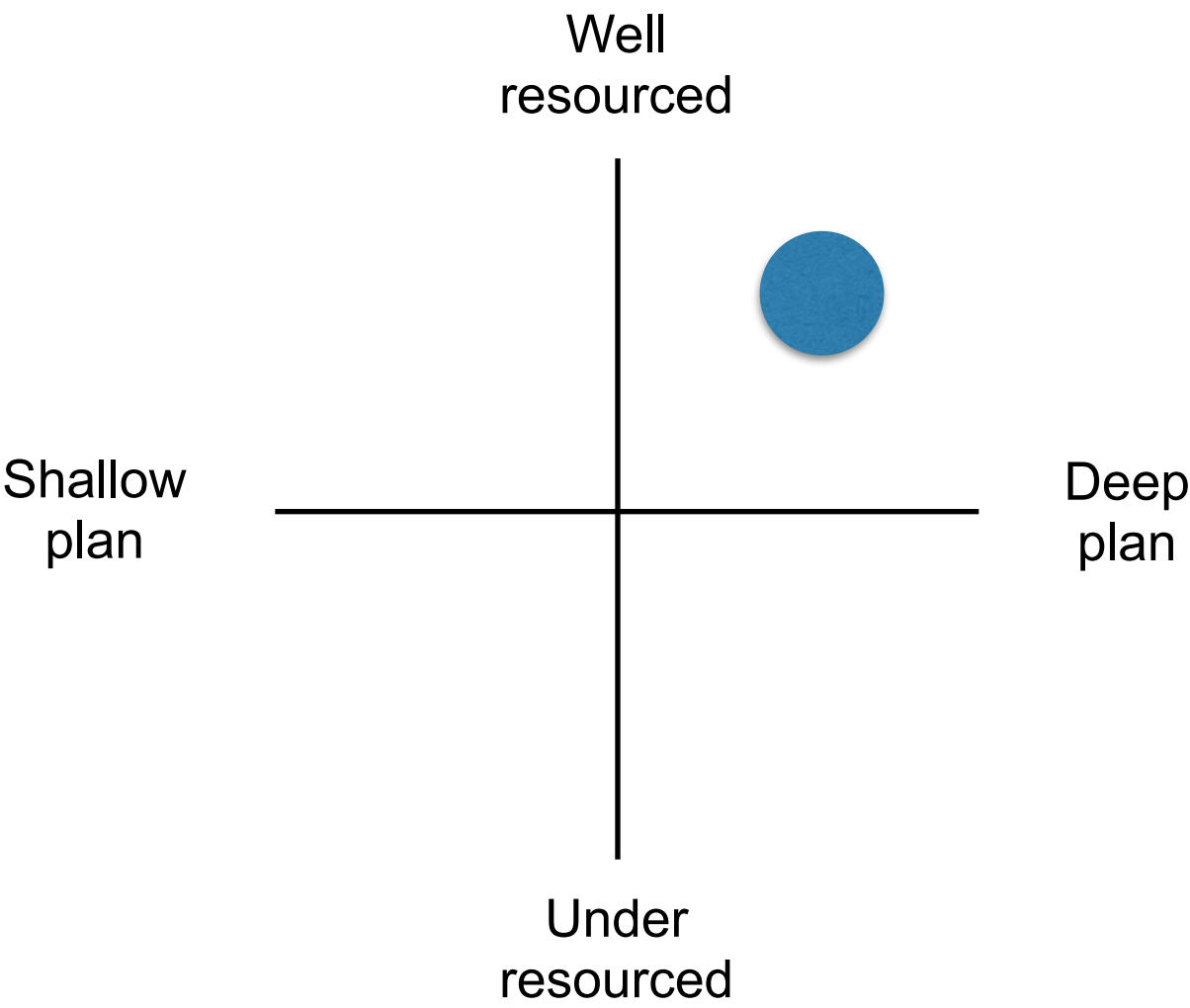
Elizabeth Fry building has the last laugh

The story of the Elizabeth Fry building (AJ 23.4.98) contains a number of ironies. My favourite is that it didn't even make the shortlist of the Green Building of the Year Award in 1996.

DR ROBERT LOWE

Leeds Metropolitan University

Context





The Woodland Trust
interior staircase



TREES OF KNOWLEDGE

Experience gained from the post-occupancy evaluation of the National Trust's Heelis building have been fed into the design of The Woodland Trust's headquarters. The project team compares the in-use performance of both

and discovered the importance of maintaining the 'golden thread' – starting with inception and briefing, then managing expectations throughout the procurement process, building on initial aftercare, post-occupancy evaluation, and closing the feedback loop.

Gathering data
At that time, Max Fordham and Feilden Clegg Bradley Studios were working together on Heelis, the National Trust's 7,605m² (gross) head office in Swindon. The project followed a strong sustainability agenda, though this was somewhat softened by the requirements of the developer, which procured the building after the scheme design had been agreed with the client.

As part of the reality checking advocated by soft landings, a matrix was developed by Feilden Clegg Bradley Studios and Max Fordham, to allow design ambitions for

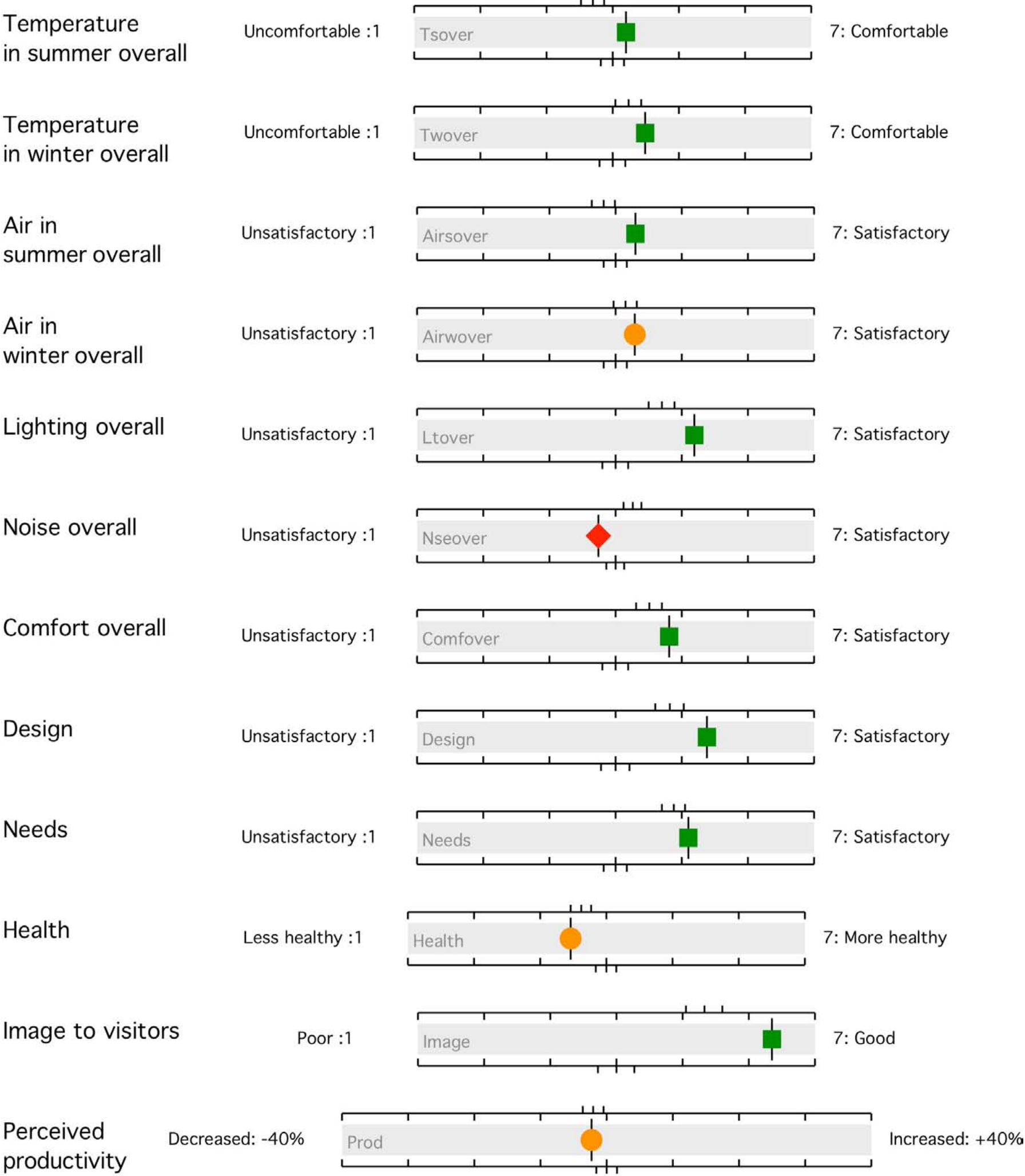
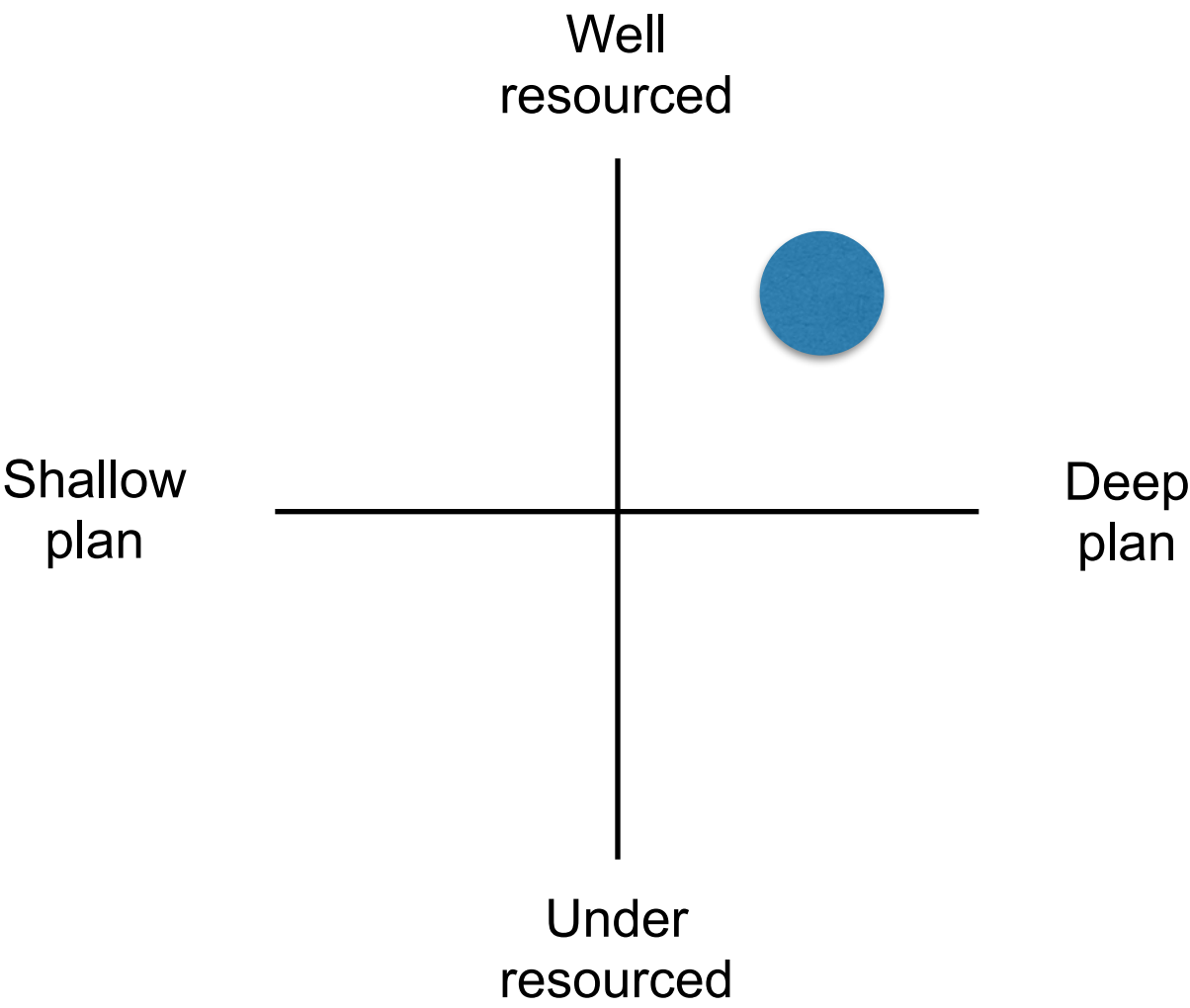
To maintain the 'golden thread'
from design intent to reality when creating the 2,727m² head office for The Woodland Trust, Max Fordham – and architect Feilden Clegg Bradley Studios – used post-occupancy findings from the Heelis building, in Swindon. The outcomes have now been studied, thanks to funding from Innovate UK – formerly the Technology Strategy Board – and its Building Performance Evaluation programme.

In 2002-04, the environmental engineer and architect formed part of a research team investigating the potential for soft landings¹,

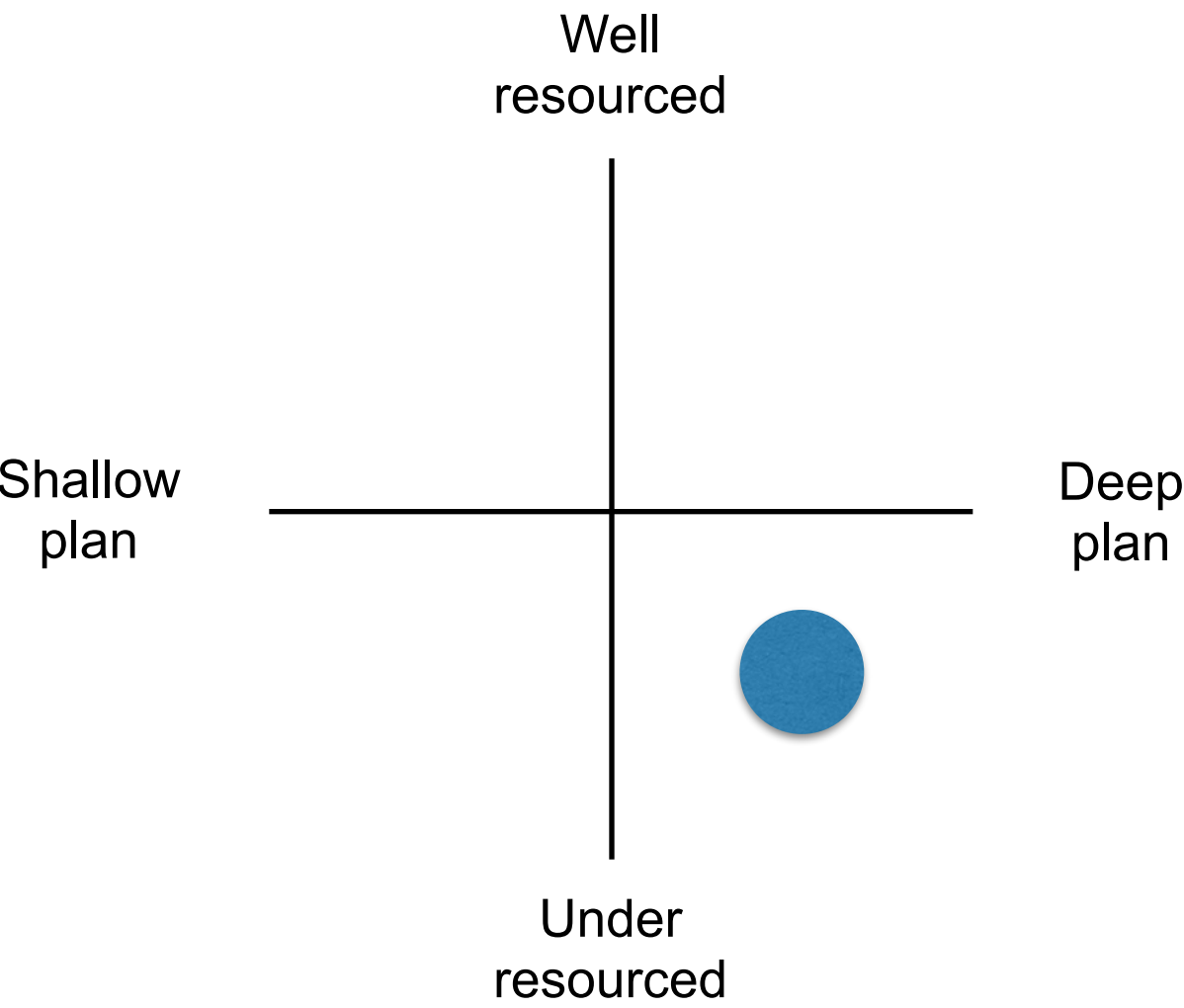
By Bill Bordass, Pete Burgon, Hester Brough, and Matt Vaudin

20 CBSE Journal October 2014 www.cbsejournal.com

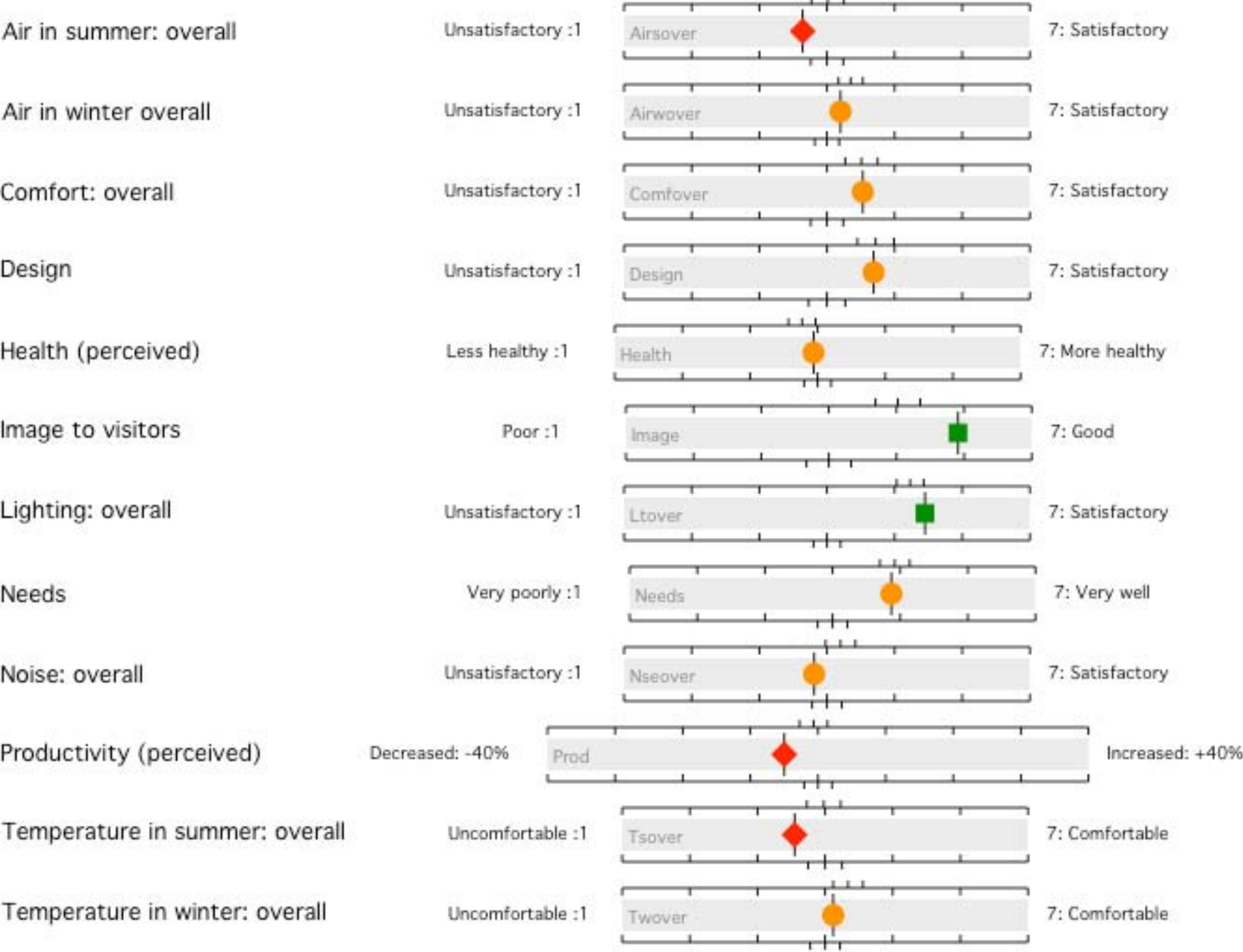
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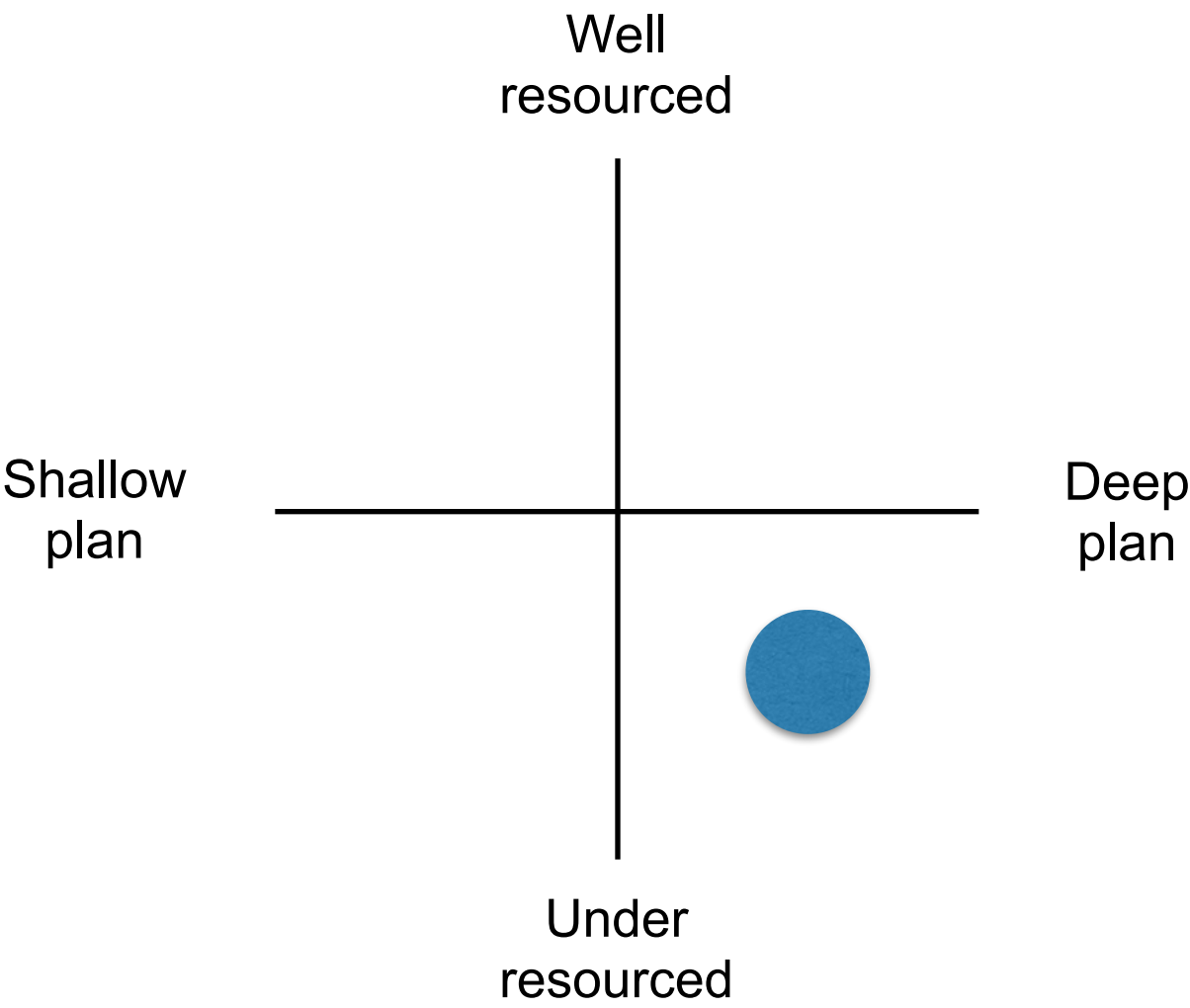
Context



Summary (Overall variables)



Context



After a £38m investment in open-plan learning was completed in 2010, another £4m is now being invested to revert the classrooms back

It was, parents, pupils and the watching world were told, incredibly exciting stuff. Bexhill High School in Sussex was moving onwards and upwards, into newly built premises aimed at “transforming the learning agenda”.

No more would the pupils be stuck in fuddy-duddy “classrooms”. They would enjoy the splendour of “education pods” containing 90 students and a team of teachers.

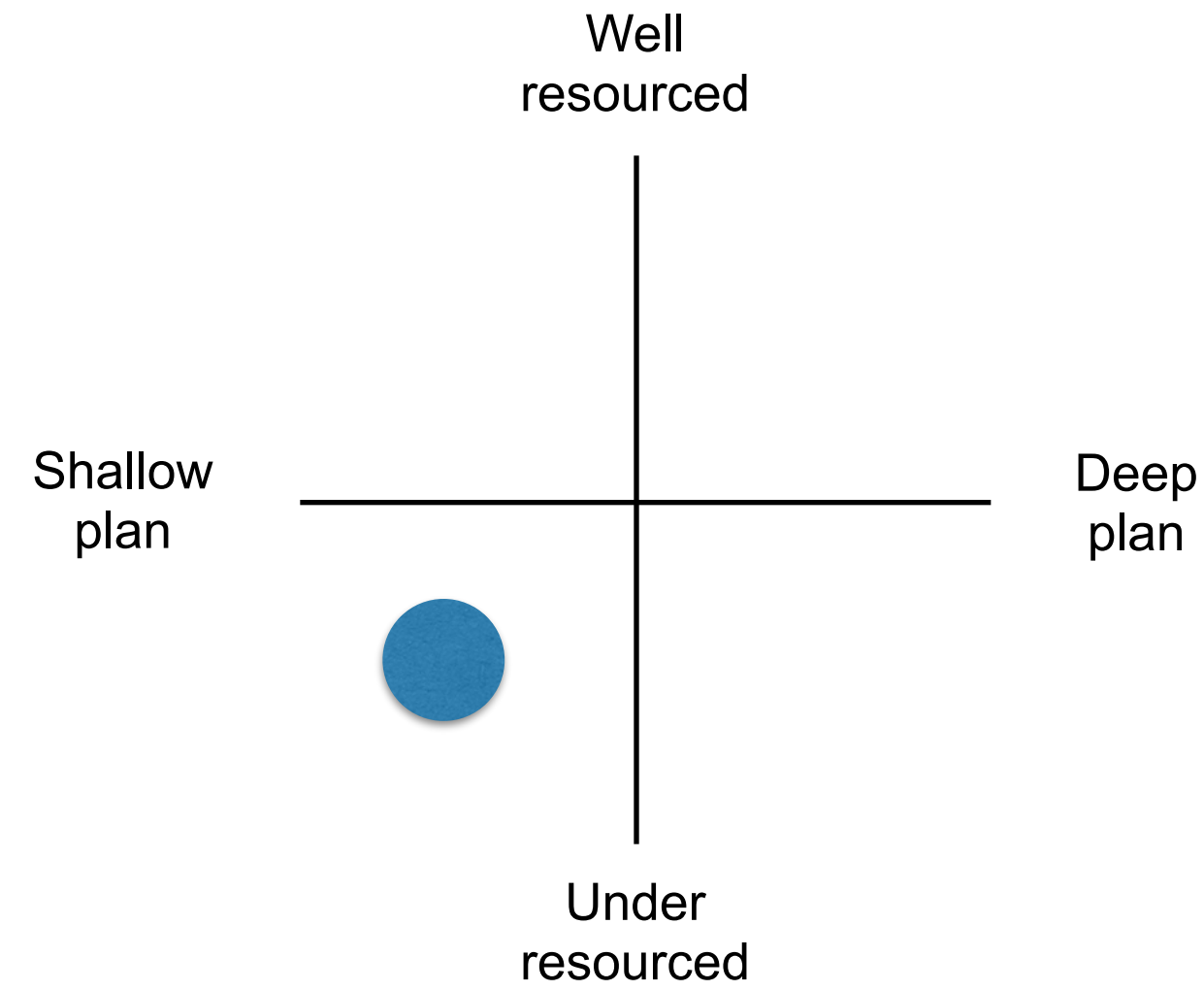
Based on the Scandinavian models of studying, this was open-plan learning. This was the future, and all for just £38m – most of it from central government via the Building Schools for the Future (BSF) investment programme and a further £4m from East Sussex County Council.



The newly built premises were intended to bring an end to pupils stuck in fuddy-duddy “classrooms” (Getty)



Context



Example topic: How appropriate are 'green' technologies such as Mechanical Ventilation and Heat and Recovery (MVHR) for domestic use?

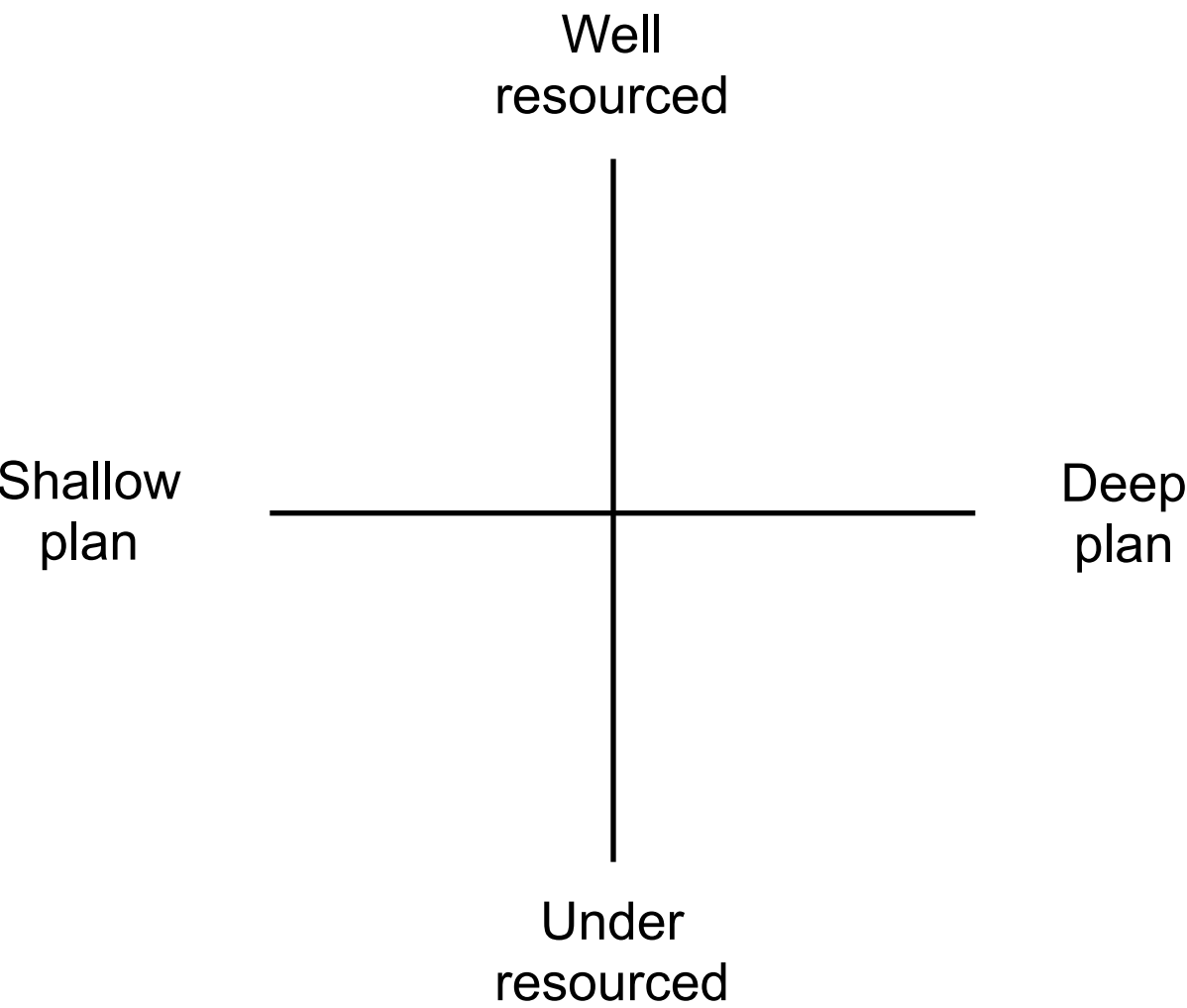


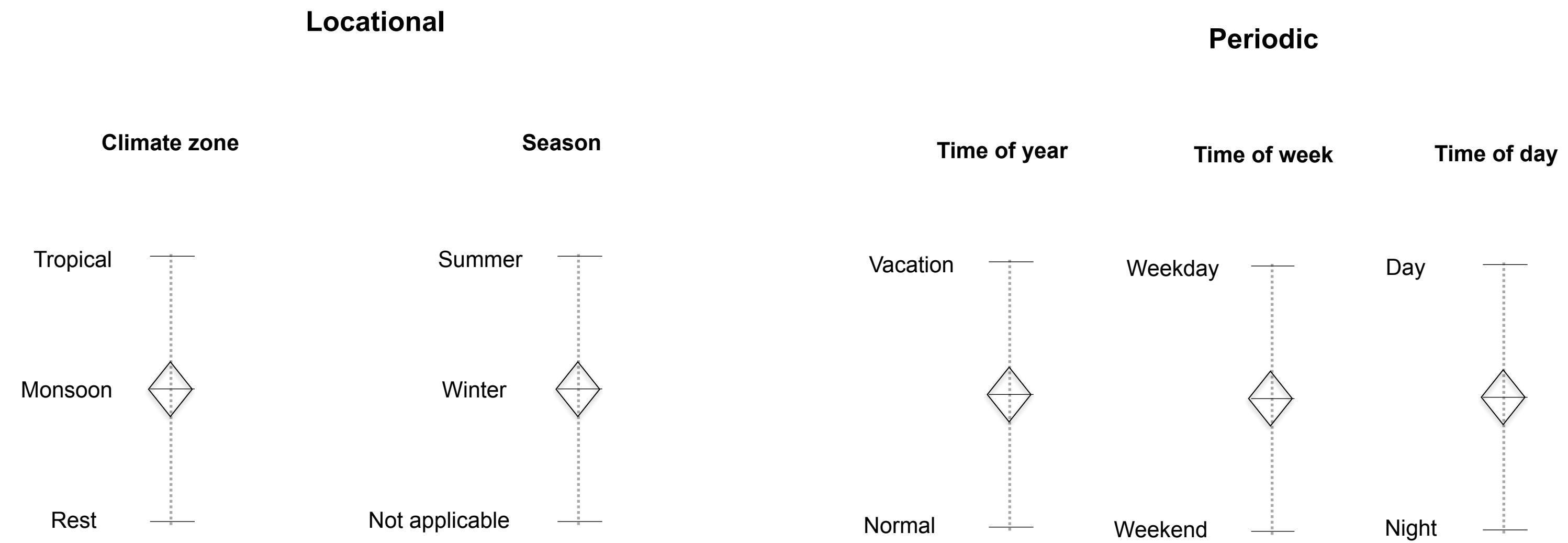
[Association of Environment\(ally\) Conscious Building forum](#)

Green Building Forum

[Green Building Magazine forum](#)

Context





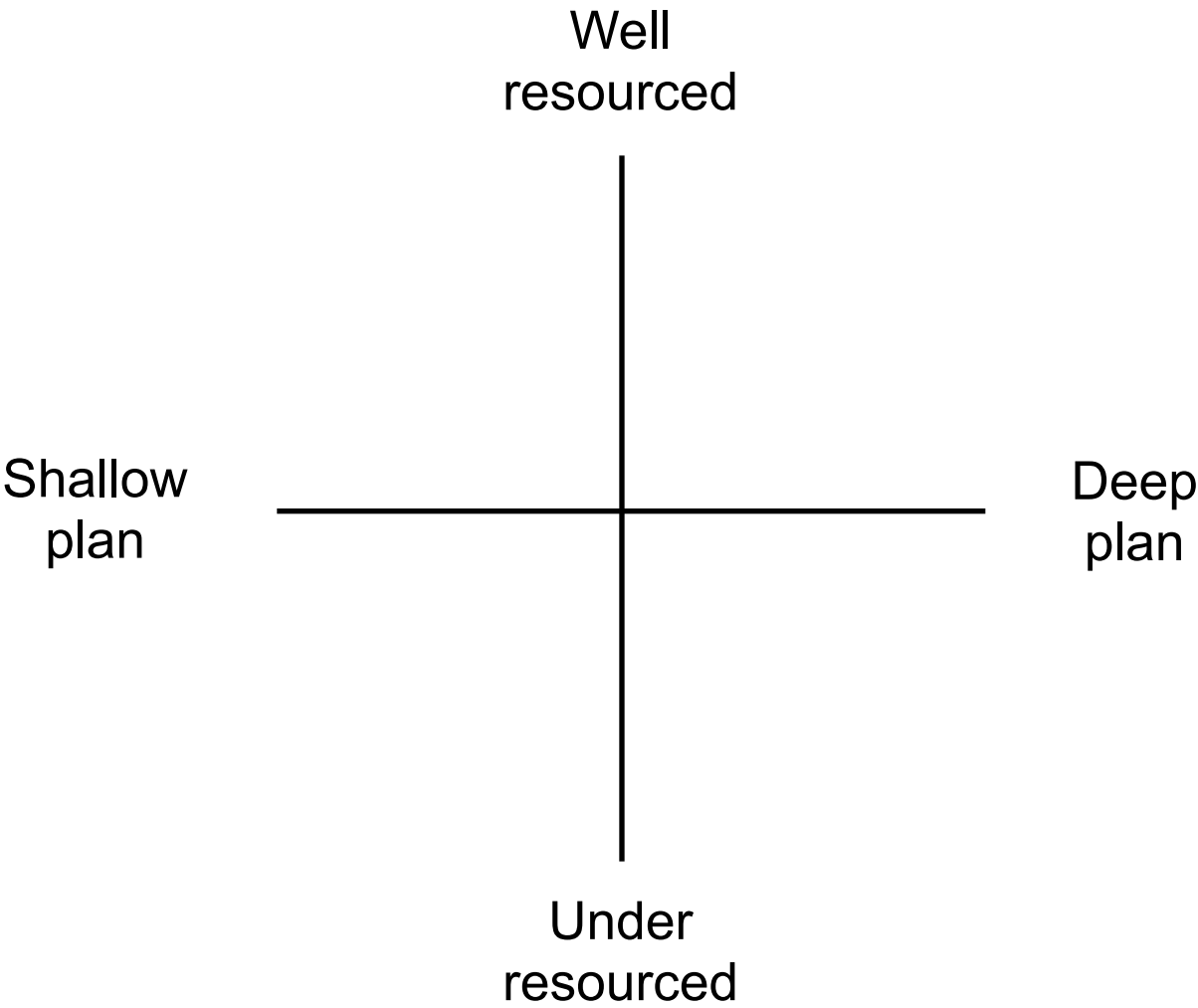
Locational

Climate zone	Season
Tropical	Summer
Monsoon	Winter
Rest	Not applicable

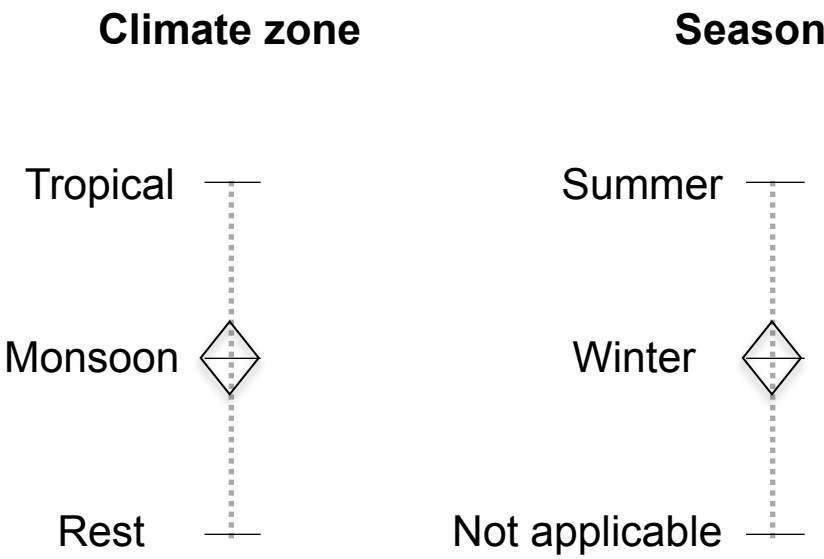
Periodic

Time of year	Time of week	Time of day
Vacation	Weekday	Day
Normal	Weekend	Night

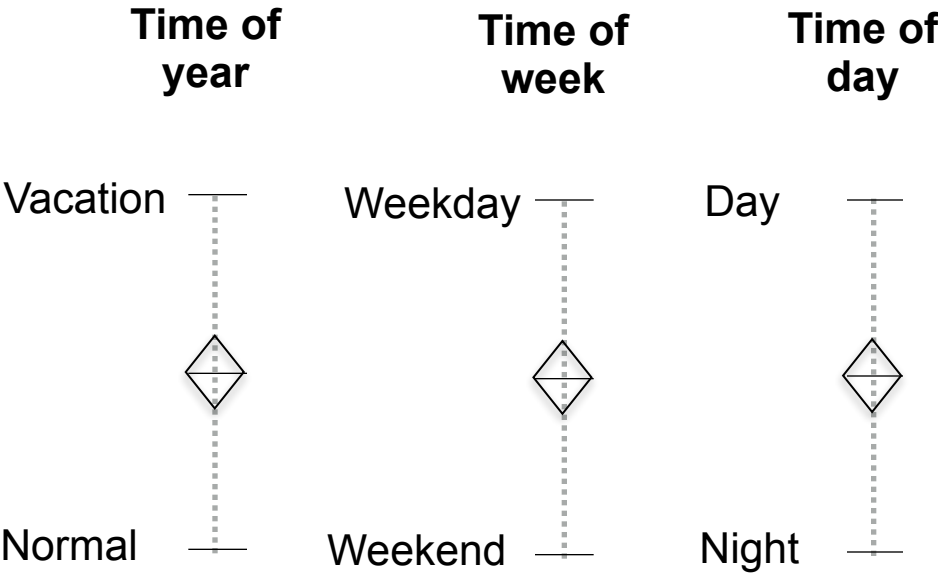
Context

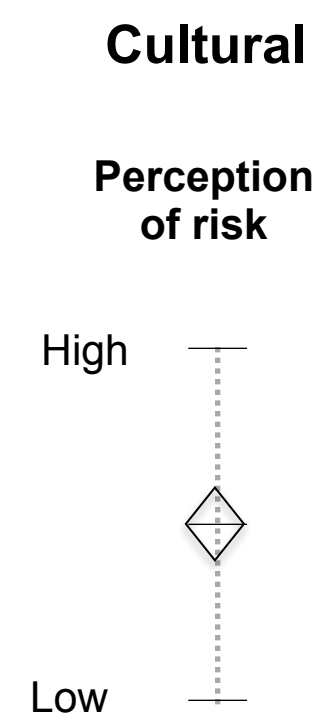


Locational



Periodic

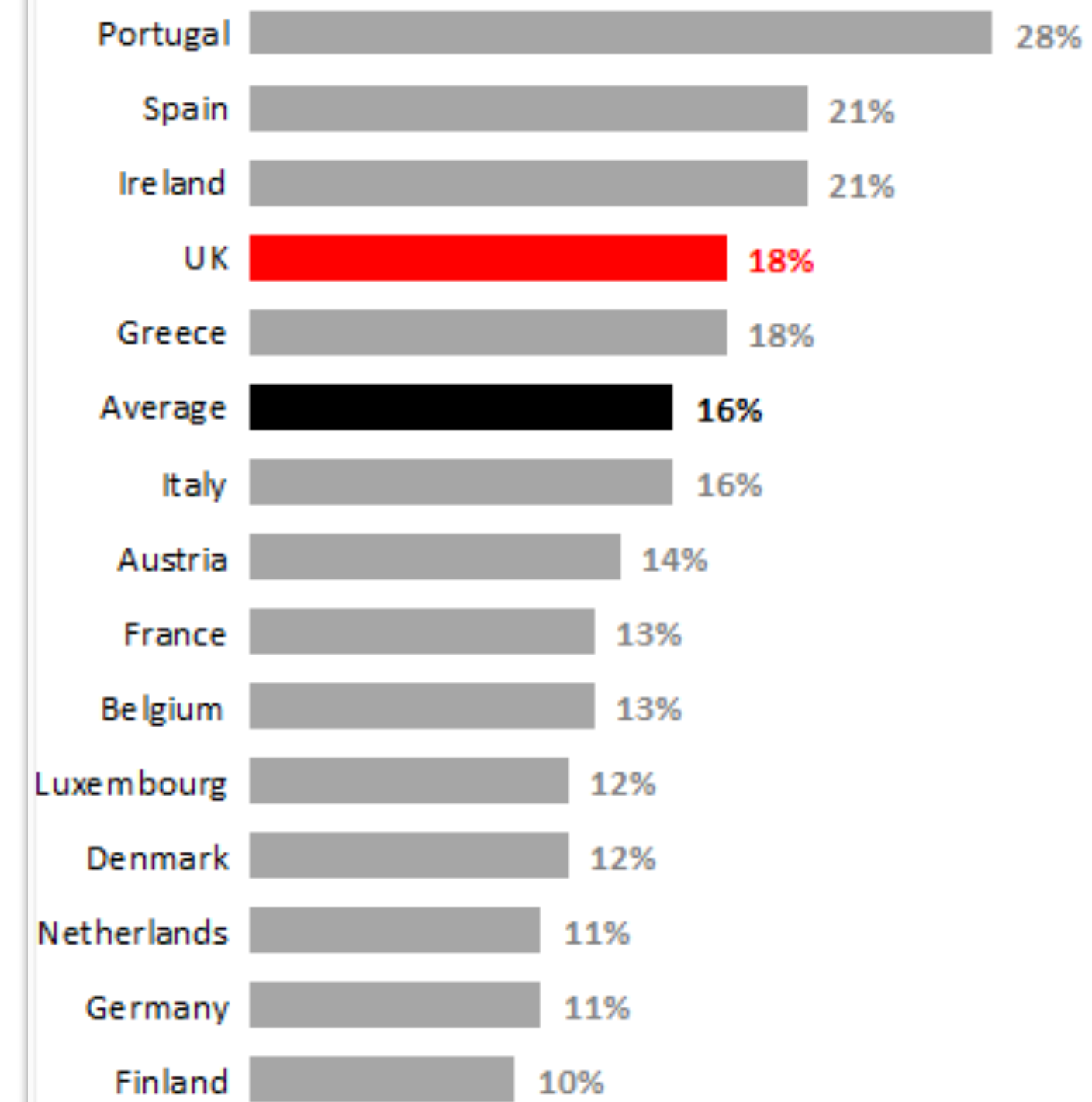




Flood Risk Perception

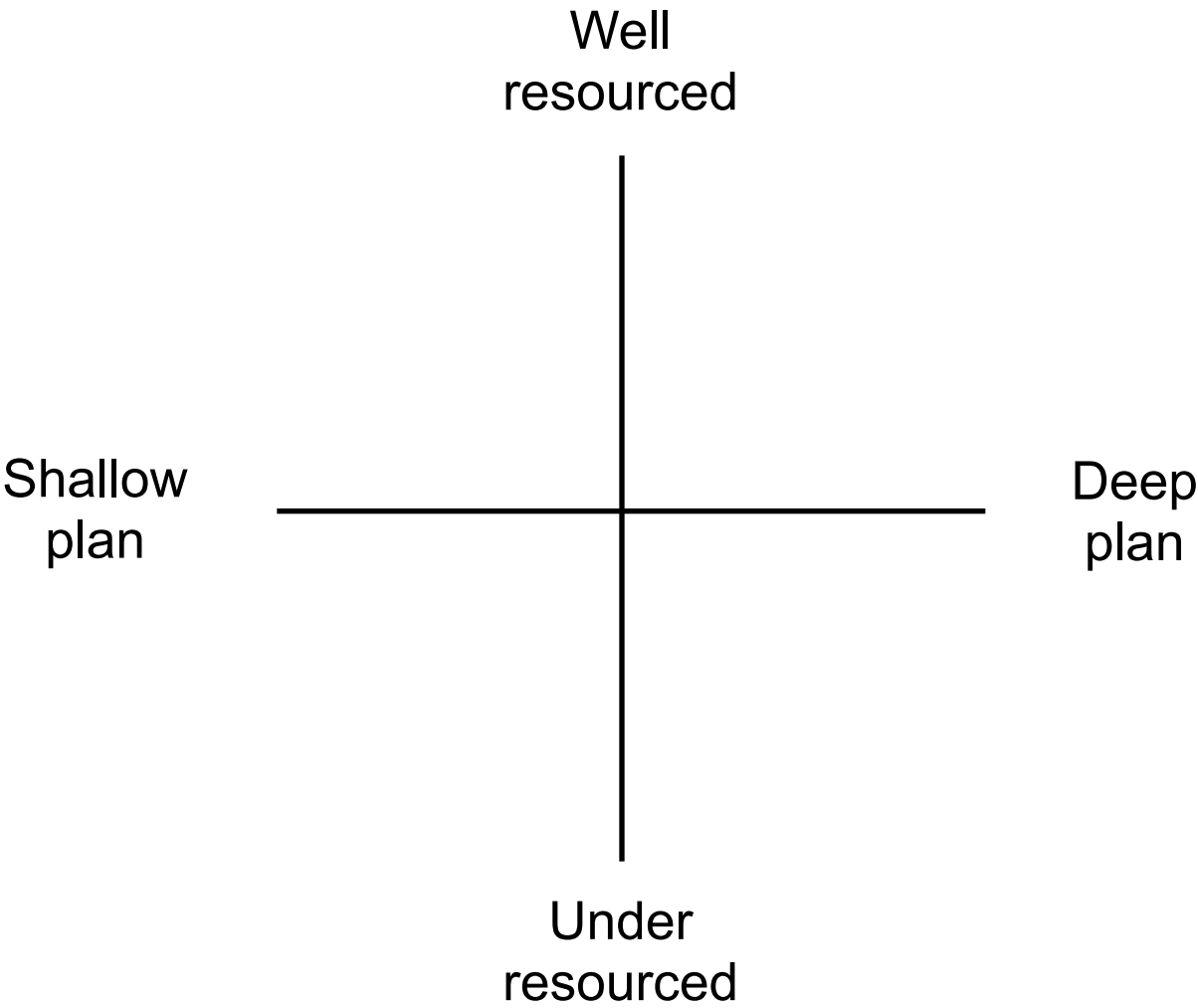
Excess winter deaths

% increase in mortality rate during winter compared to rest of year's average, between 1988 and 1997

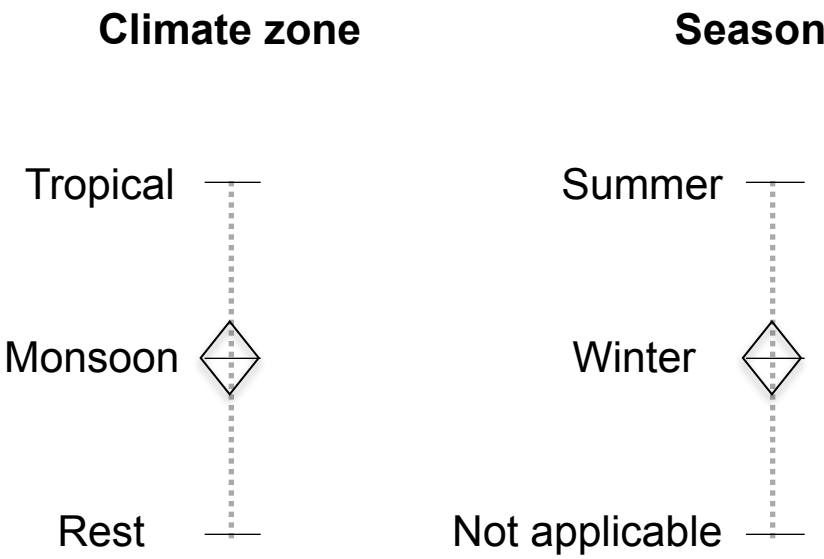


Source: J D Healy: Excess winter mortality in Europe: a cross country analysis identifying key risk factors (2003)

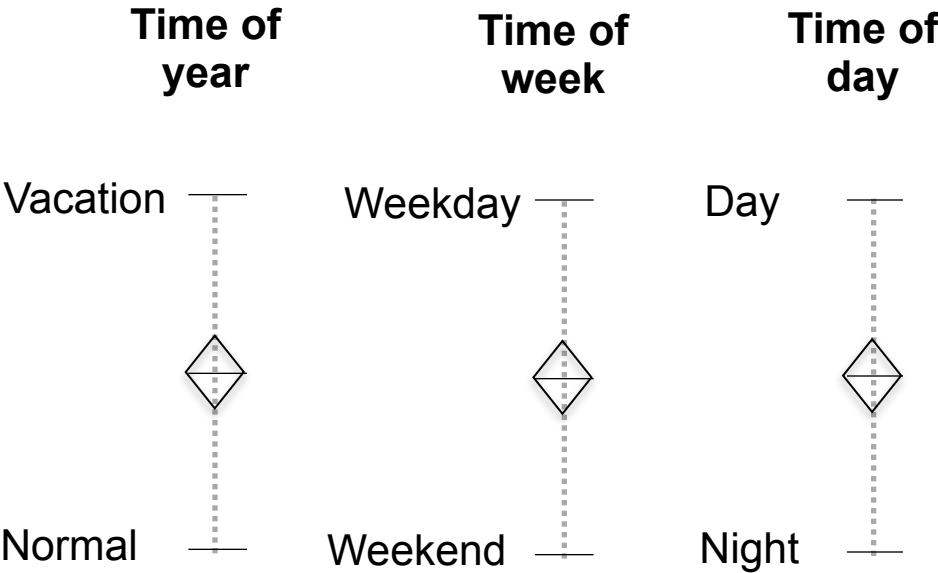
Context



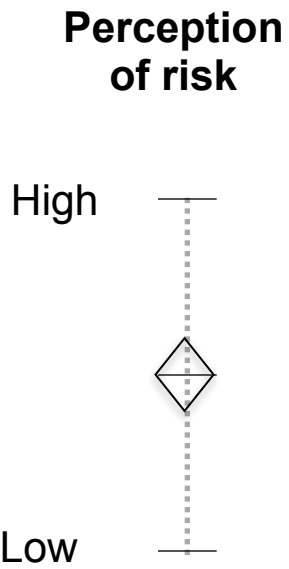
Locational



Periodic

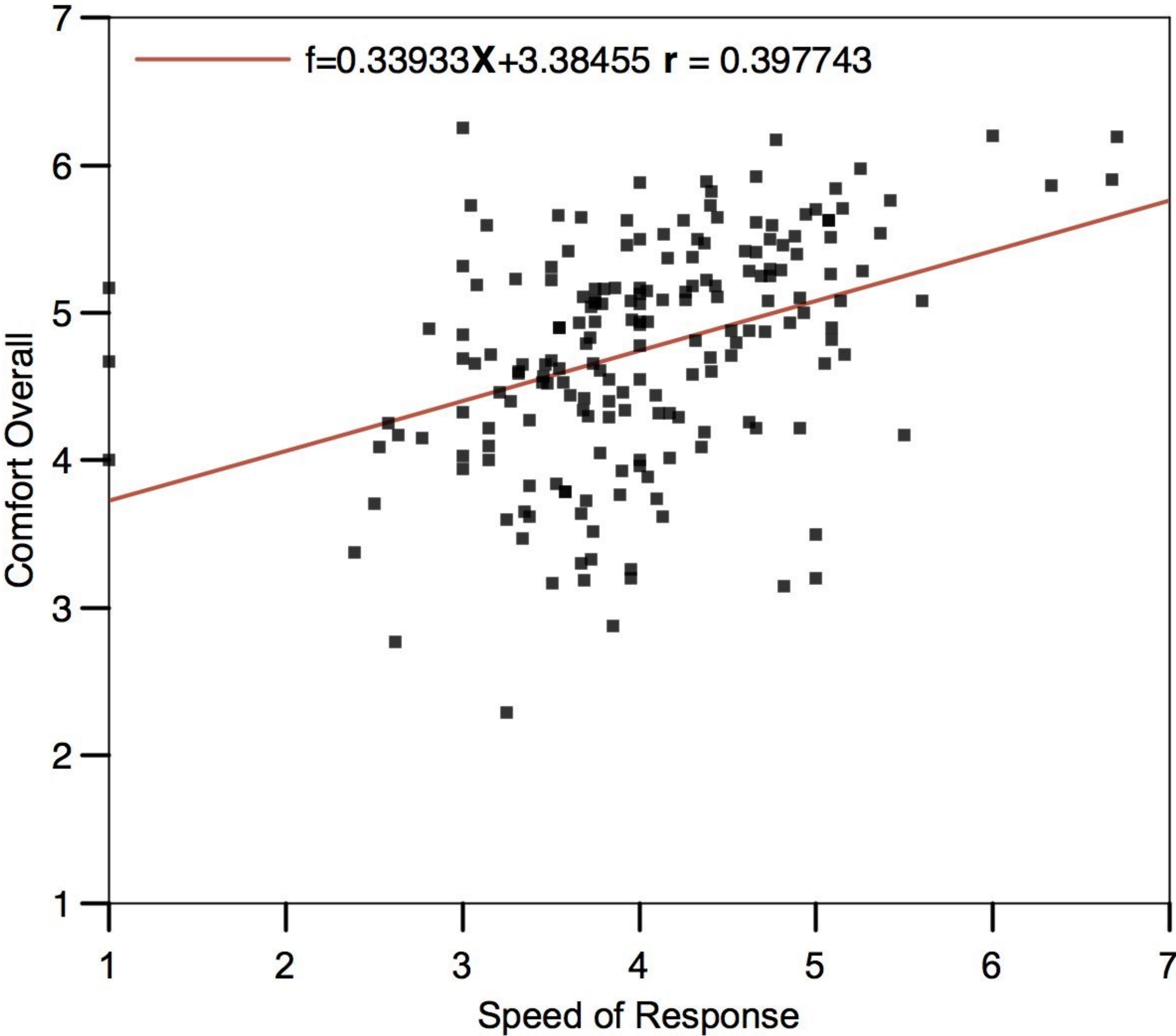
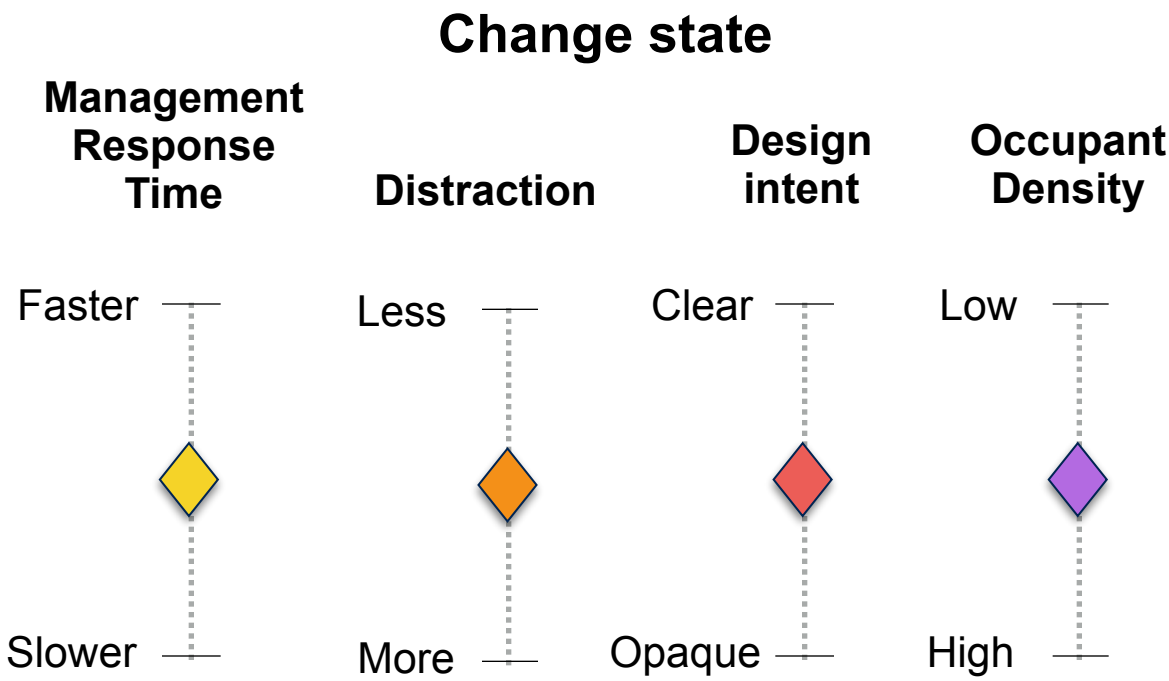


Cultural

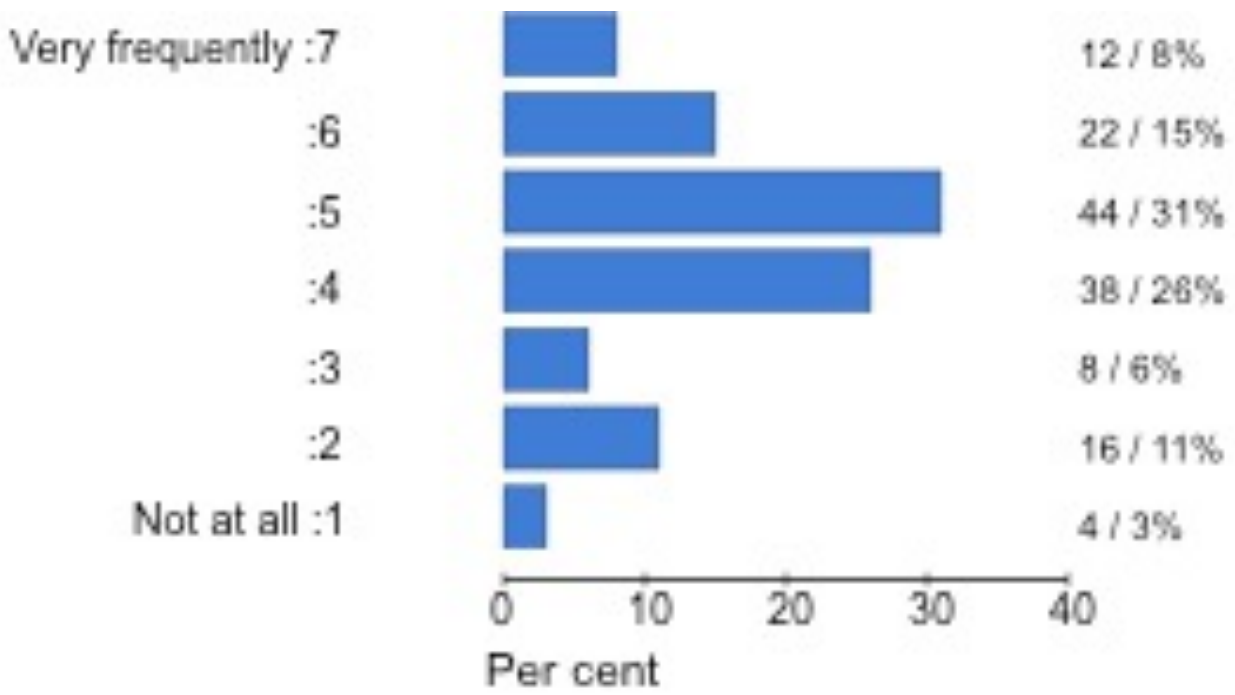
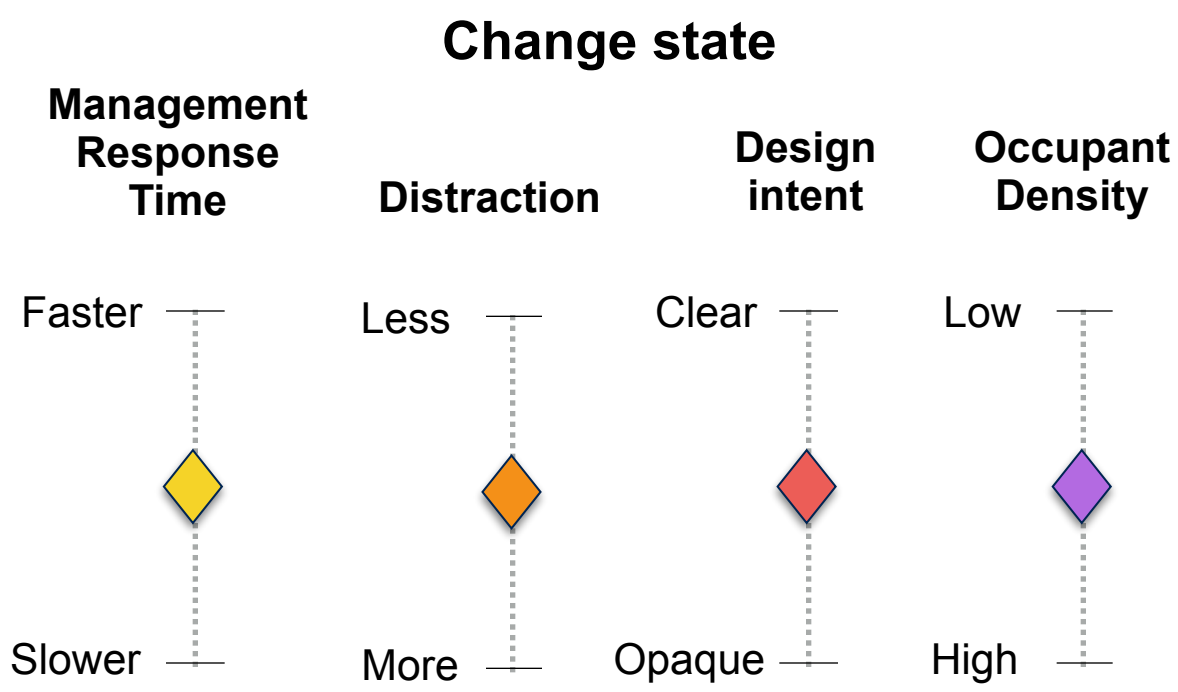


Response time

Source: Building Use Studies 2015. For presentation only. Do not quote in this form.

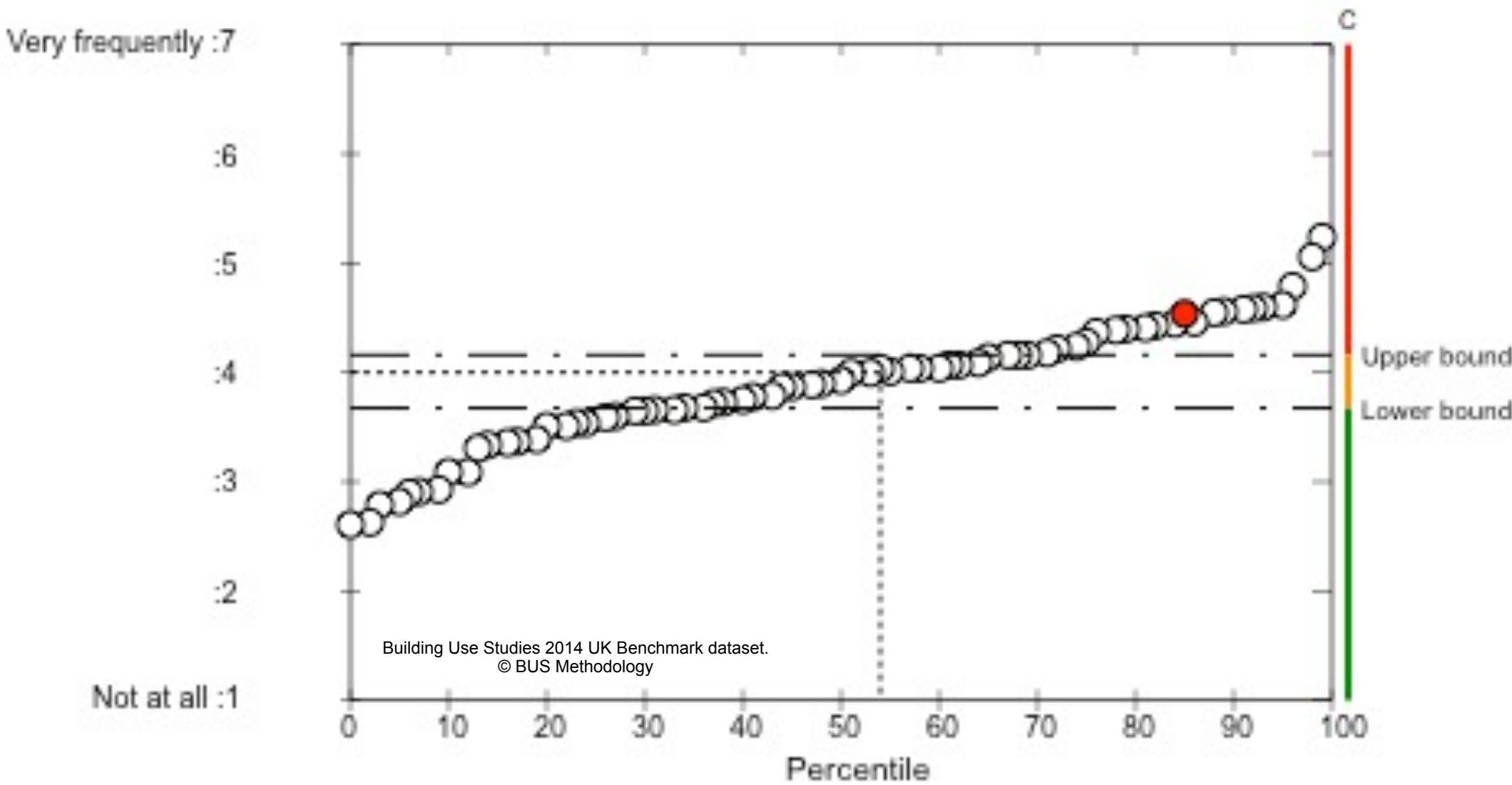


Distraction



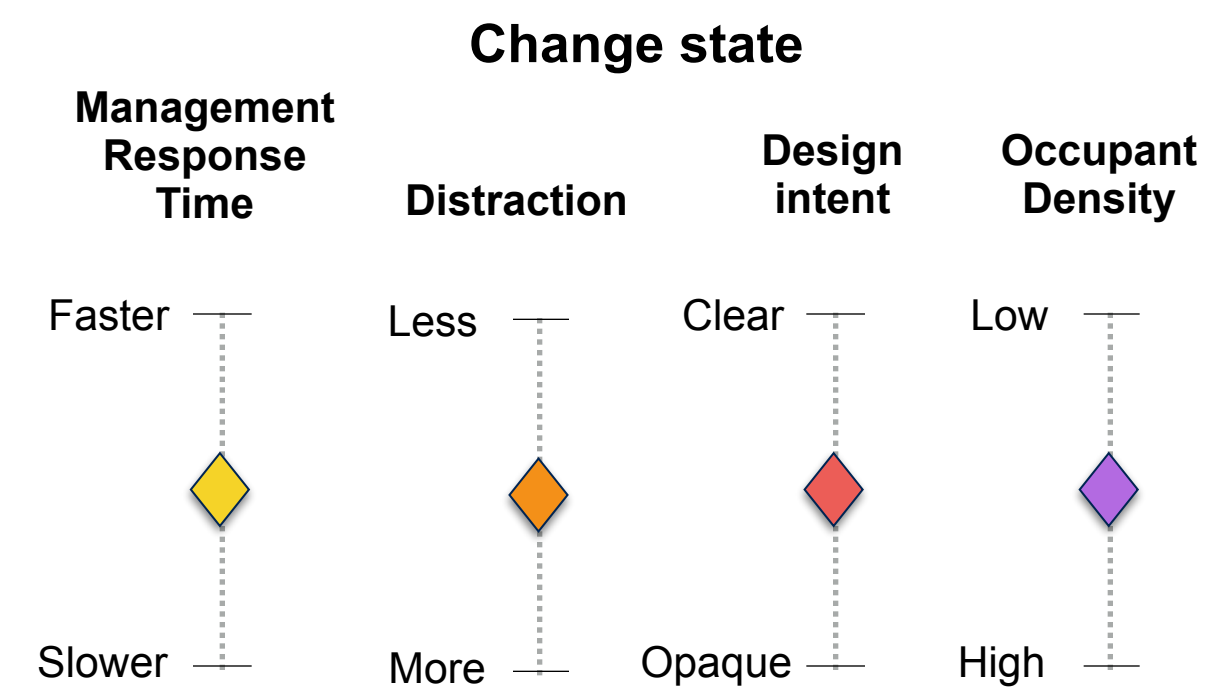
From building shown in slide 8.

Scores for interruptions from noise.



Design intent

If users understand how something is supposed to work, they will be more tolerant if it does not work properly.



This device has no labelling or annotation. It looks like an on/off switch but is a push-button for an unidentified system.

The switch is for stepless operation depending on the length of time the switch is depressed.



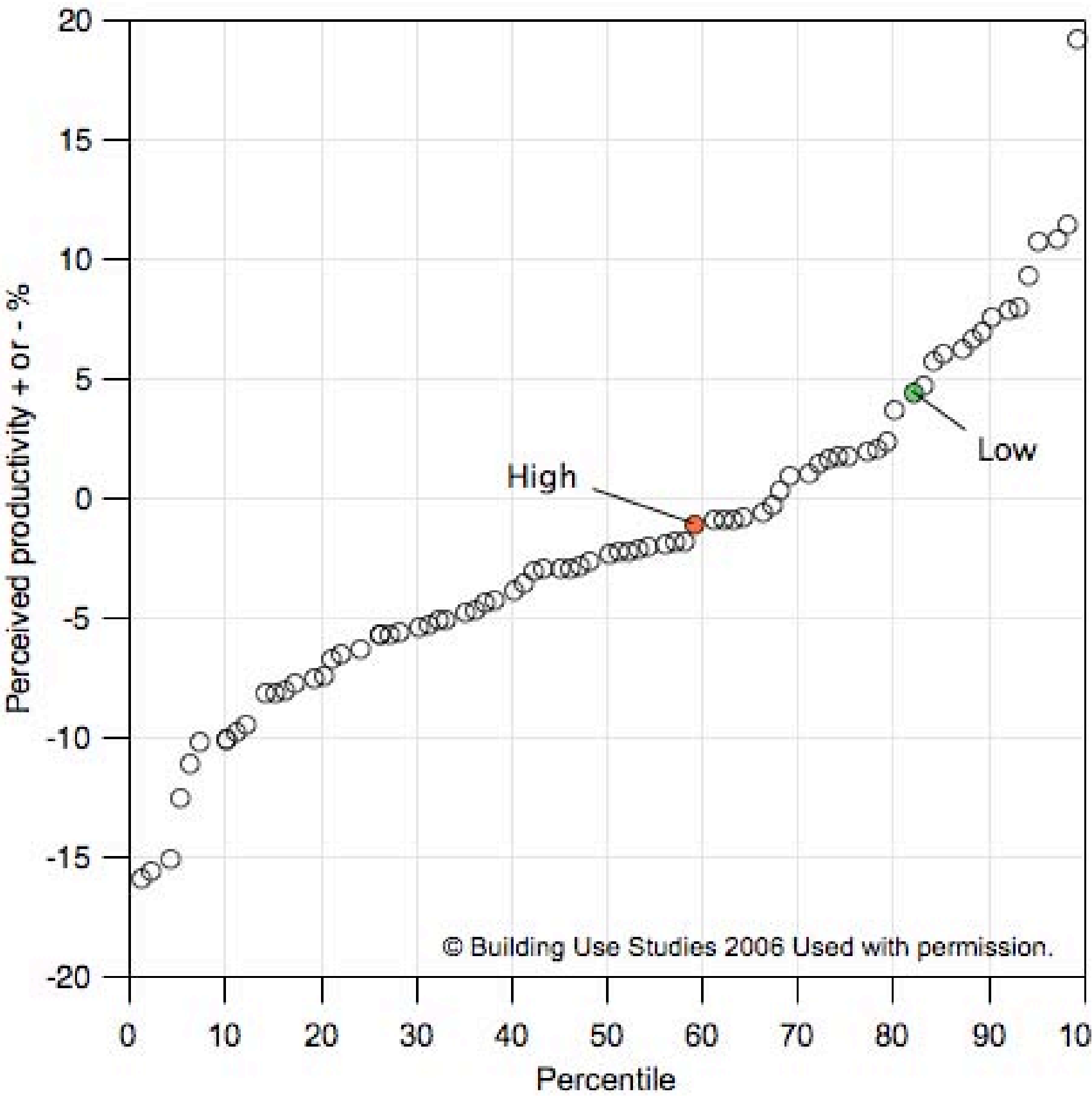
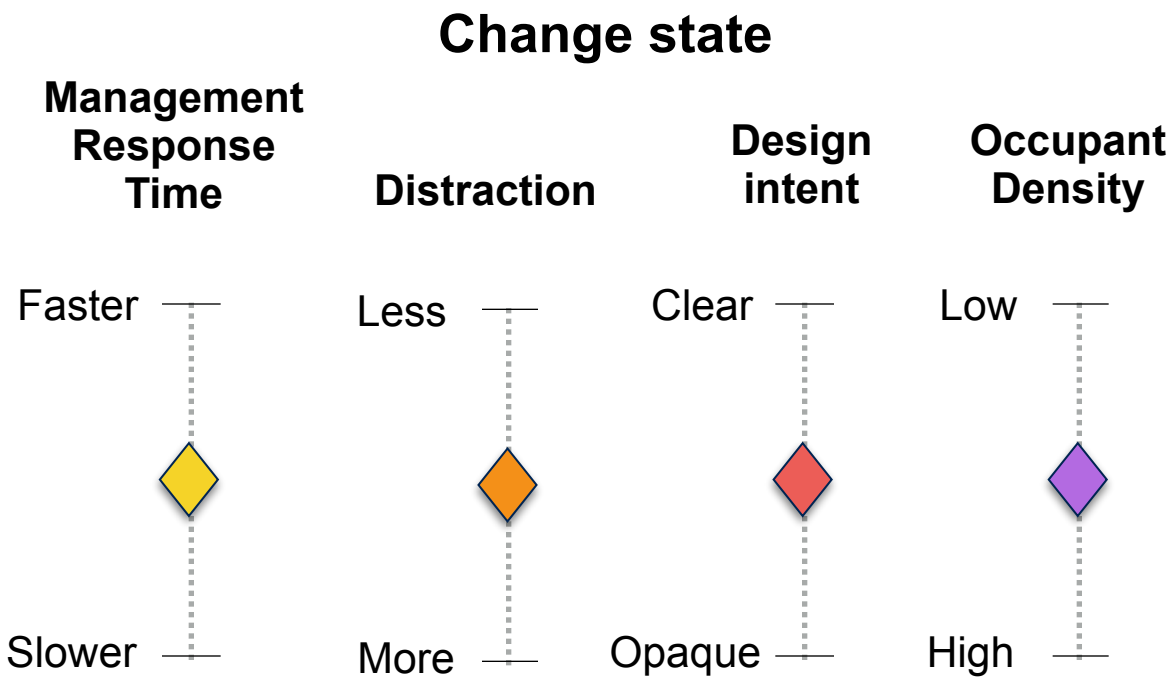
Usability criteria	Ranking (controller as supplied)	
	Poor	Excellent
Clarity of purpose	●	
Intuitive switching	●	
Labelling and annotation	●	
Ease of use	<div></div>	
Indication of system response	●	
Degree of fine control	●	

Occupant density

“Theer’s most fratching weer theer’s least room.”
Yorkshire saying

Fratch = quarrel

Comparisons between low and high density areas for corporate UK office.



Context

Shallow plan

Well resourced

Deep plan

Under resourced

Geographical

Climate zone

Season

Tropical
Monsoon
Rest

Summer
Winter
Not applicable

Periodic

Time of year

Time of week

Time of day

Vacation
Normal

Weekday
Weekend

Day
Night

Cultural

Perception of risk

High
Low

Change state

Management Response Time

Distraction

Design intent

Occupant Density

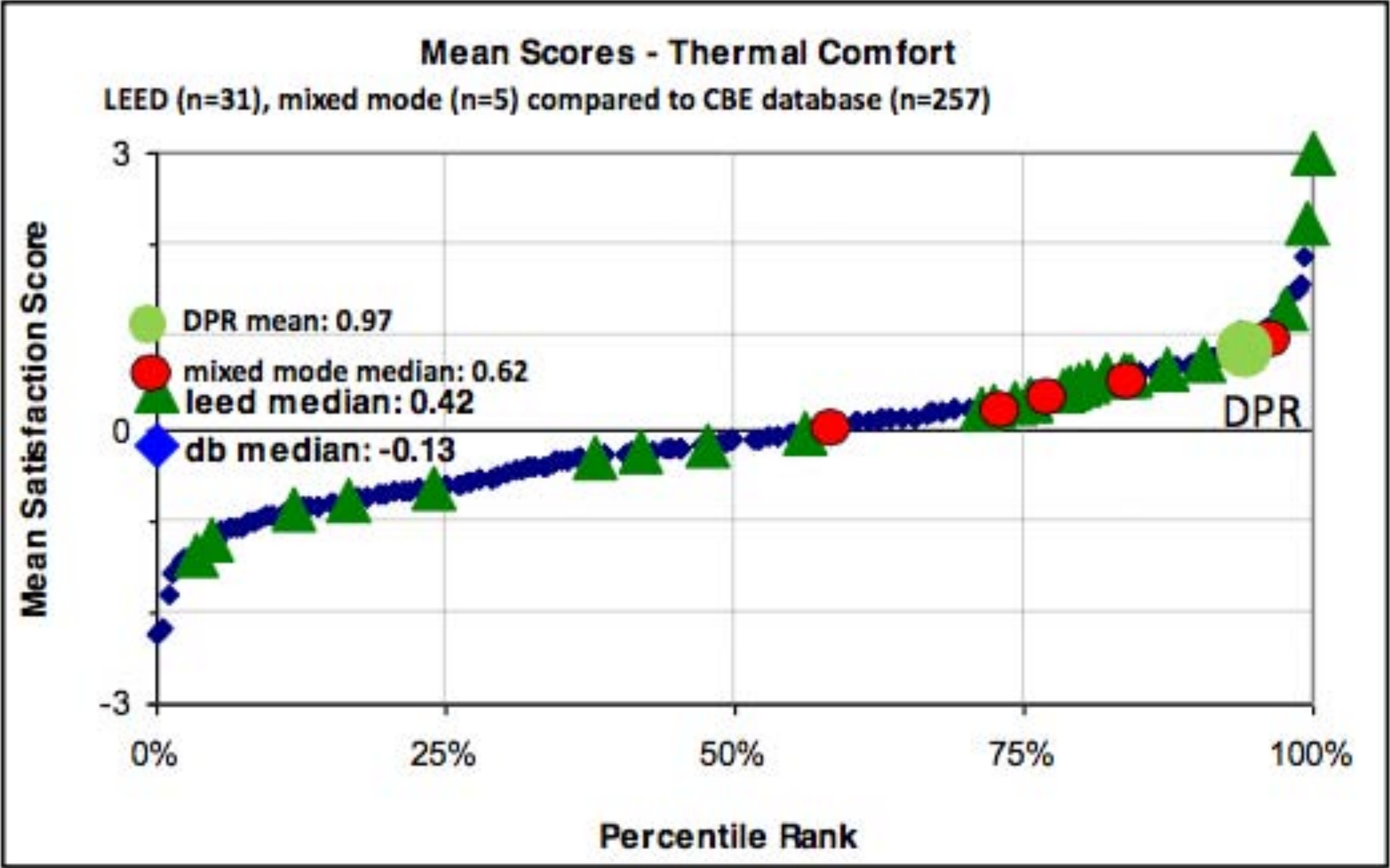
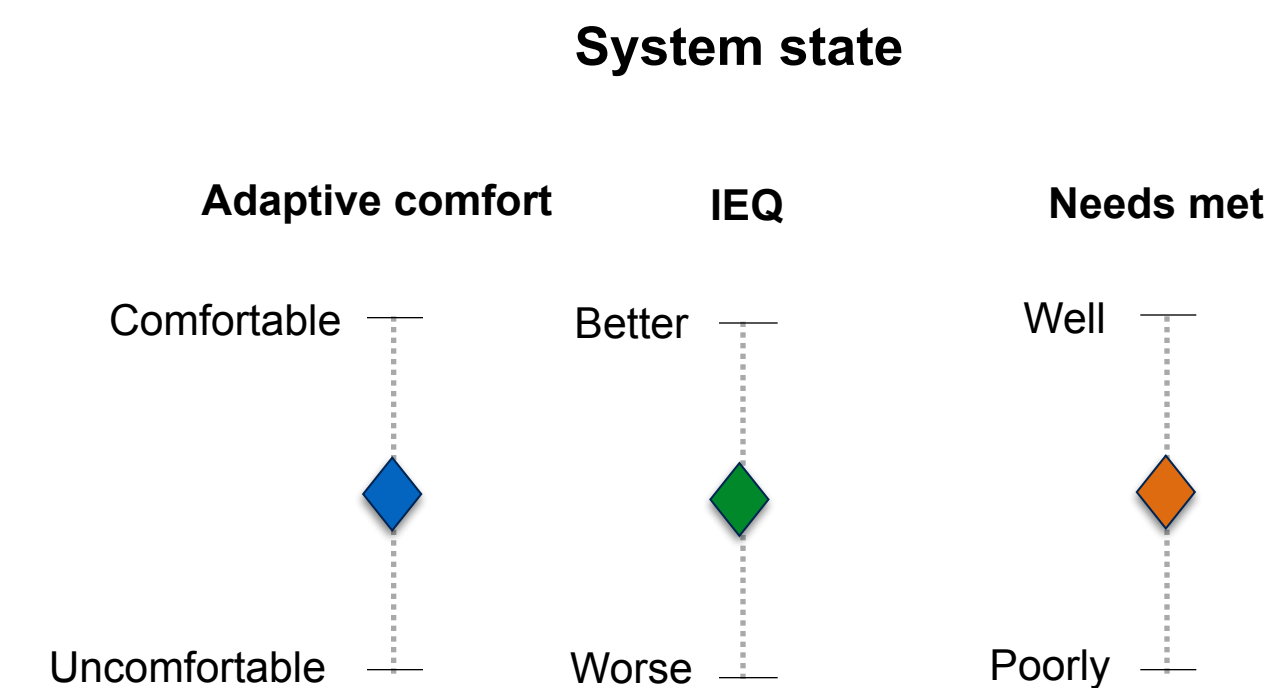
Faster
Slower

Less
More

Clear
Opaque

Low
High

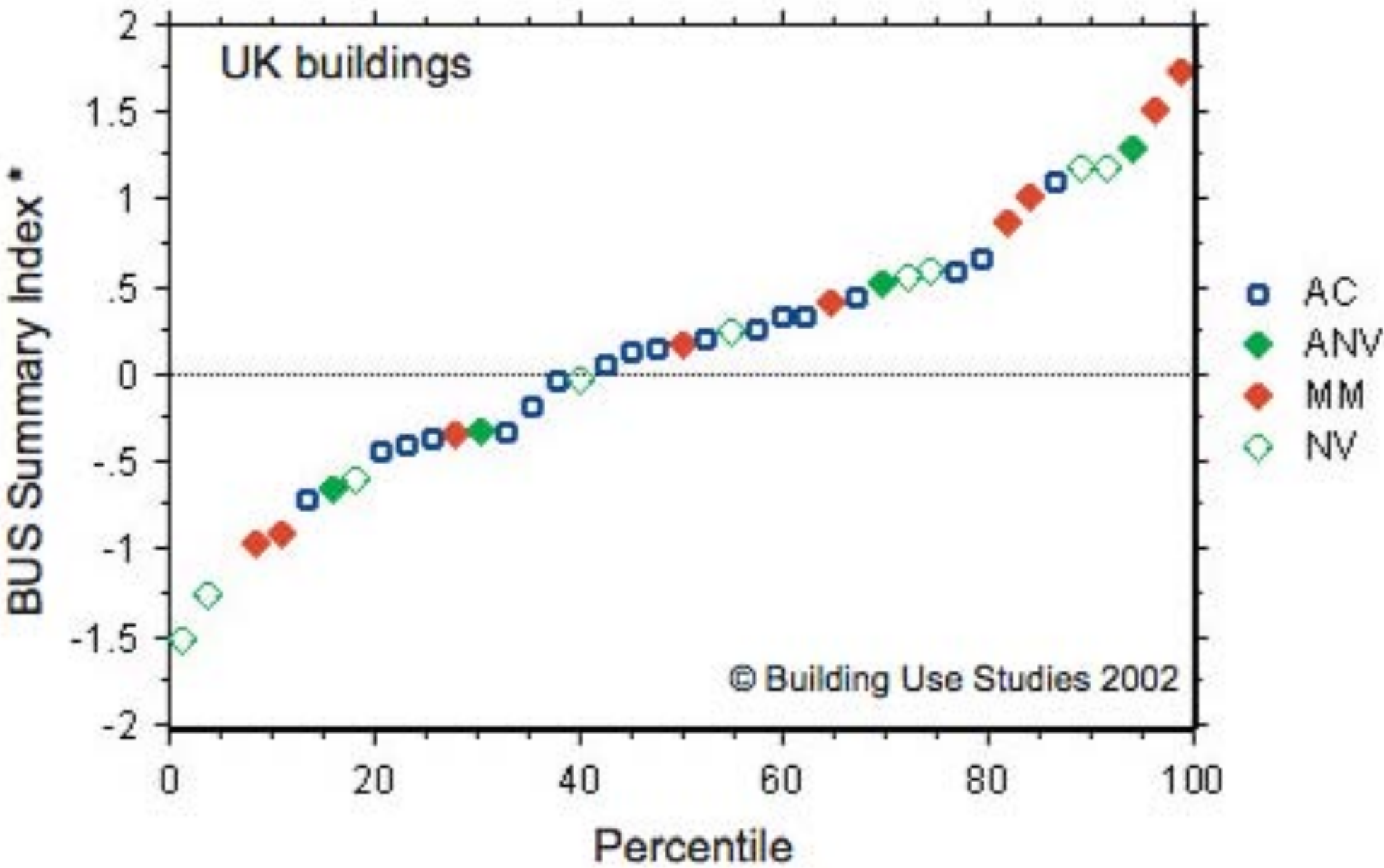
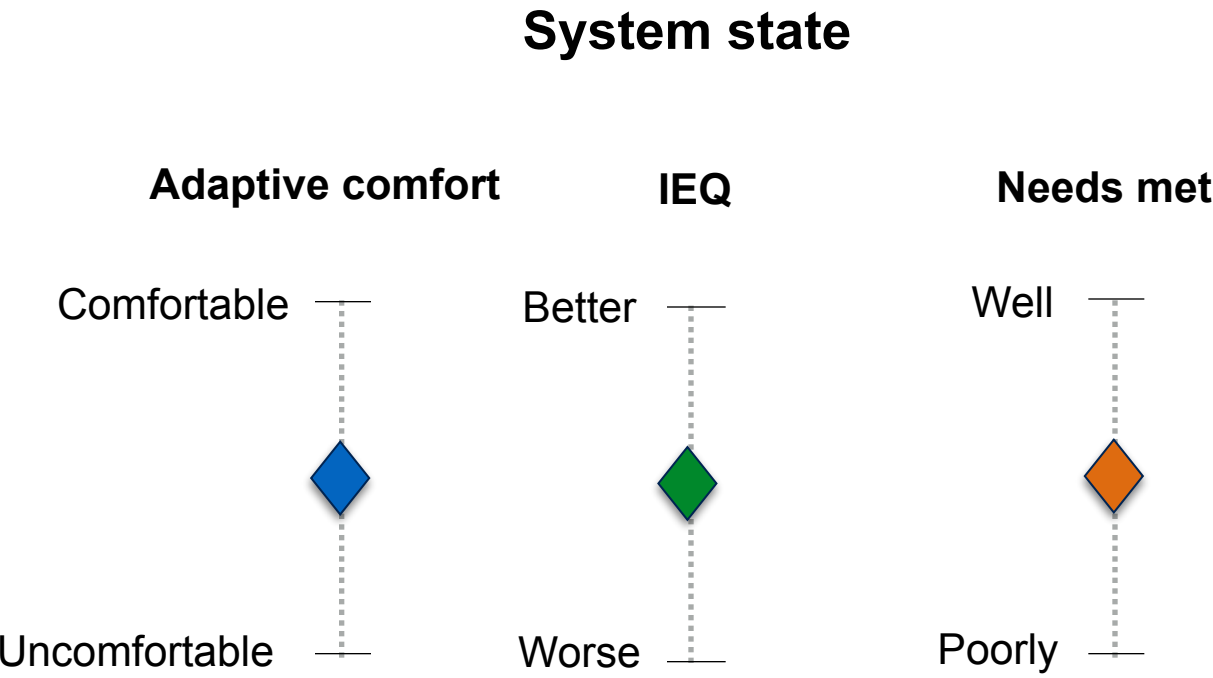
Adaptive comfort



Source: Cited by E. Ahrens, H Zuang, Air Movement: its role in conditioning building interiors efficiently, Presentation, California Air Resources Bard, March 15, 2015
Original: CBE exact source not known

<http://www.arb.ca.gov/research/seminars/arens/arens.pdf>

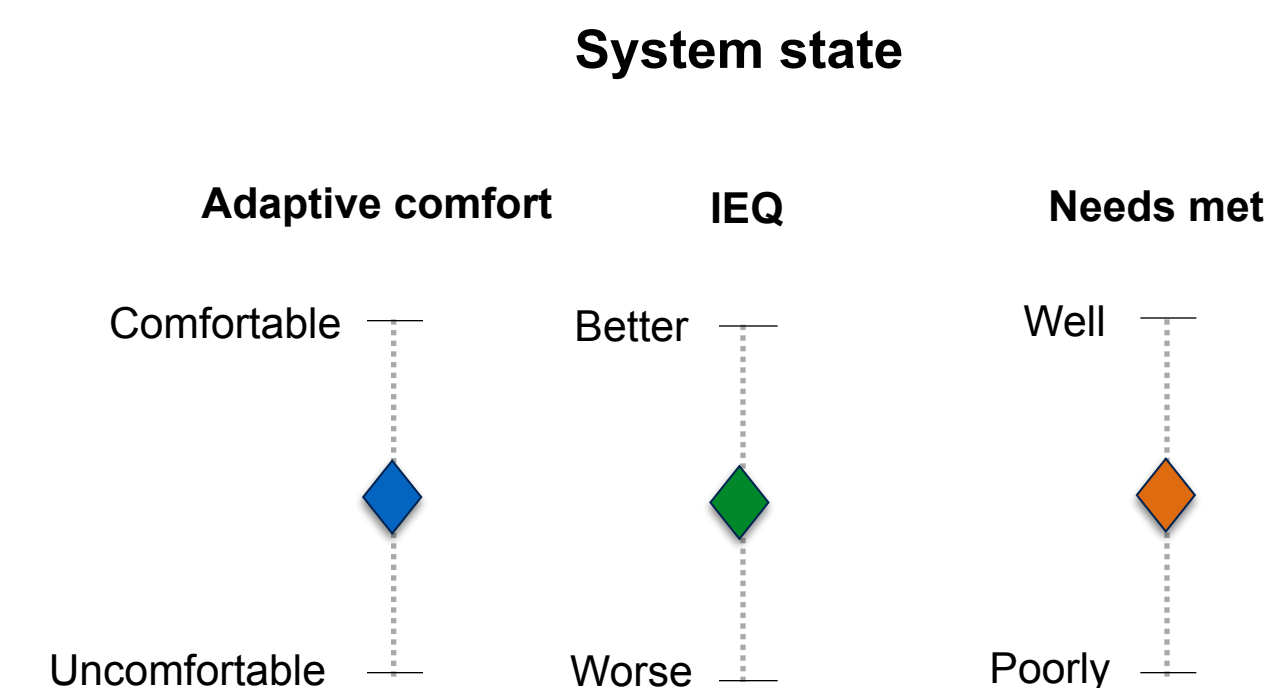
Adaptive comfort



* Combines comfort and satisfaction with equal weightings to both.

Source: Building Use Studies 2002

Indoor environmental quality



Scholar

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Articles

Case law

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[BOOK] Indoor environmental quality

T Godish - 2010 - books.google.com

When we think of indoor pollution, we usually think of conditions originating from faulty ventilation systems, second hand smoke, and other air borne pollutants. Taking an in-depth, hard science look at the problems of indoor environmental pollution, Indoor Environmental ...

Cited by 127 Related articles All 5 versions Cite Save More

Indoor Environmental Quality

TA Taylor - Guide to LEED® 2009 Estimating and Preconstruction ... - Wiley Online Library

In addition to the Materials and Resources category, this section of the LEED rating system heavily involves the contractor. When we discussed the LEED requirements as they may appear in the general conditions section of the specification, we called special attention to ...

Cite Save

Indoor environmental quality

P Harrison - Occupational and environmental medicine, 2002 - ncbi.nlm.nih.gov

Indoor air quality sampling methodologies, 1st edition Indoor environmental quality Systematic occupational health and safety ma synthetic pyrethroids will encourage the emergence of resistant strains of vectors, the control of which is sought, is touched upon. ...

Cited by 1 Related articles All 3 versions Cite Save

Indoor environmental quality.

JE Cone - Western journal of medicine, 1998 - ncbi.nlm.nih.gov

374WIM, D 1 the mean distance from a geographic center of the cases. This method was found to be a sensitive way to identify a subset of workers in a distinct location within a building at increased risk, despite the building having overall a relatively reduced ...

Cited by 4 Related articles All 12 versions Cite Save

[PDF] Occupant satisfaction with indoor environmental quality in green buildings

S Abbaszadeh, L Zagreus, D Lehrer... - Center for the Built ..., 2006 - escholarship.org

Abstract: This paper summarizes the results of a large indoor environmental quality survey in office buildings, comparing green with non-green buildings. On average, occupants in green buildings were more satisfied with thermal comfort and air quality in their workspace. ...

Cited by 141 Related articles All 13 versions Cite Save More

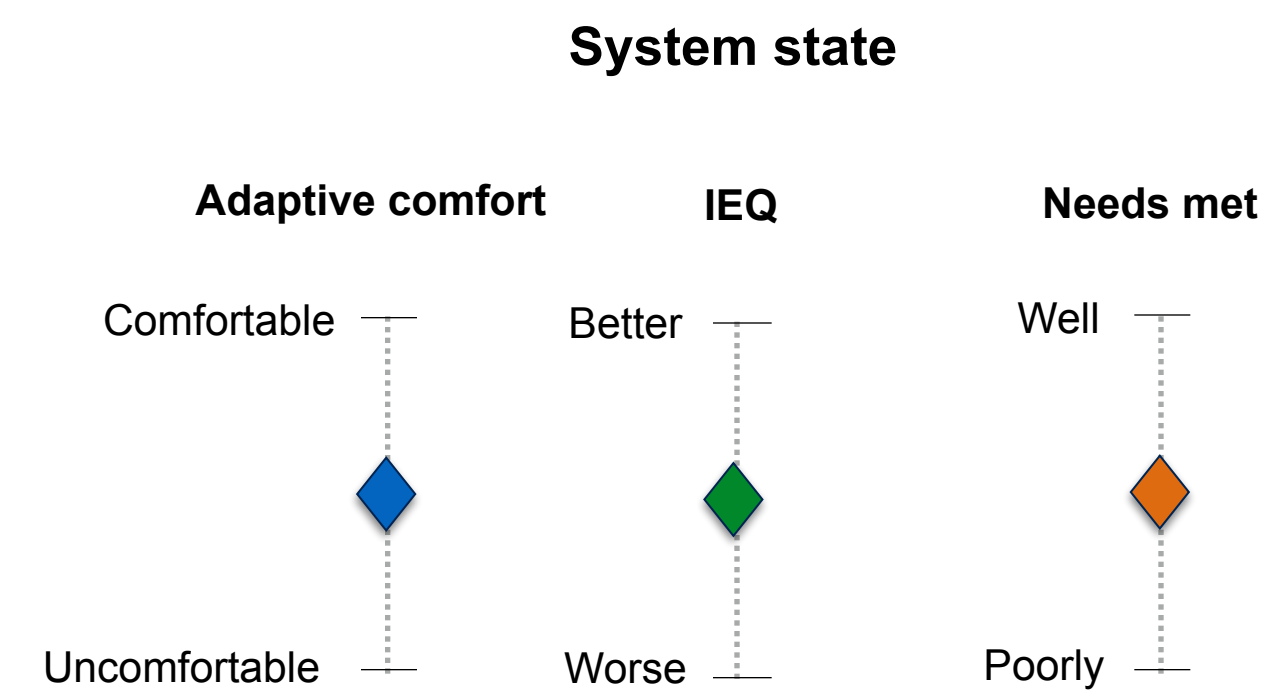
[PDF] Air quality and thermal comfort in office buildings: results of a large indoor environmental quality survey

C Huizenga, S Abbaszadeh, L Zagreus... - Center for the Built ..., 2006 - escholarship.org

Abstract: This paper presents results of over 34,000 survey responses to air quality and thermal comfort questions in 215 buildings in US, Canada, and Finland. Results show that 80% or more of the occupants expressed satisfaction with their thermal comfort in only 11 ...

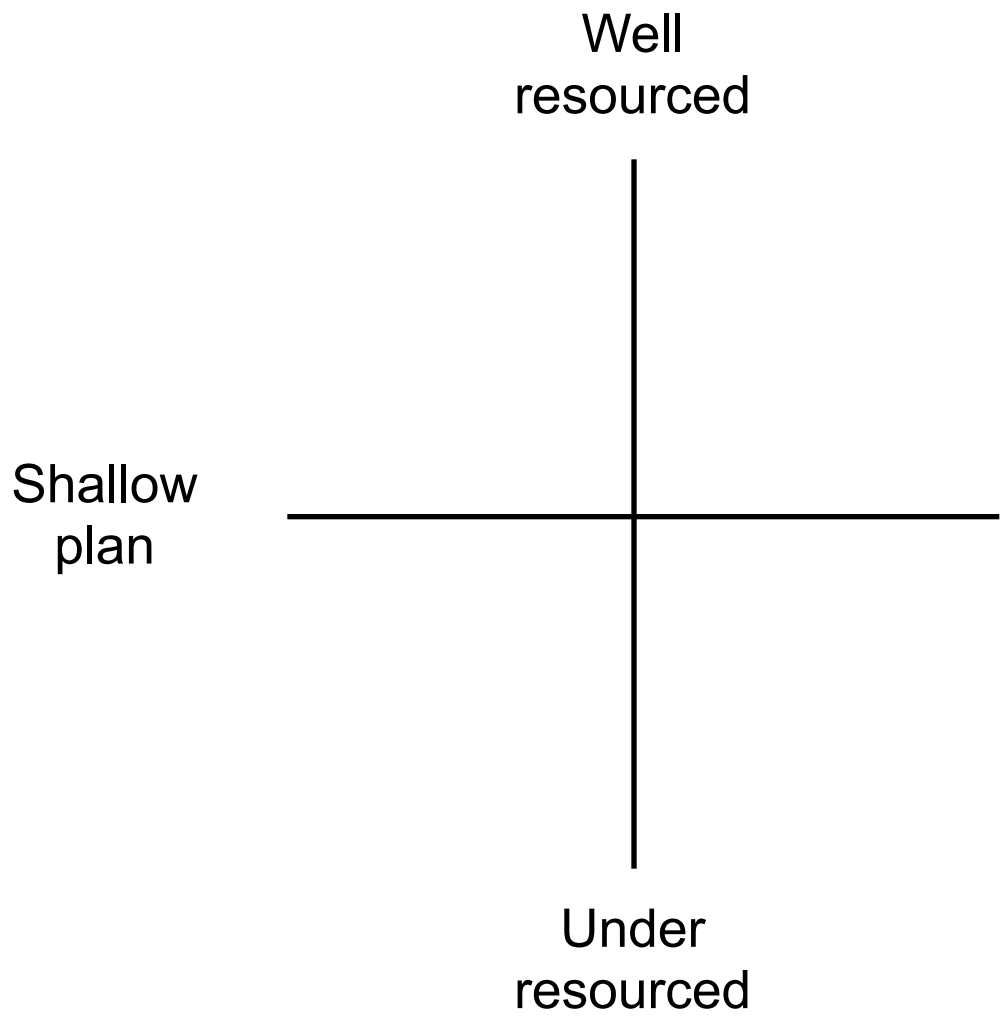
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Needs met (or not?!)

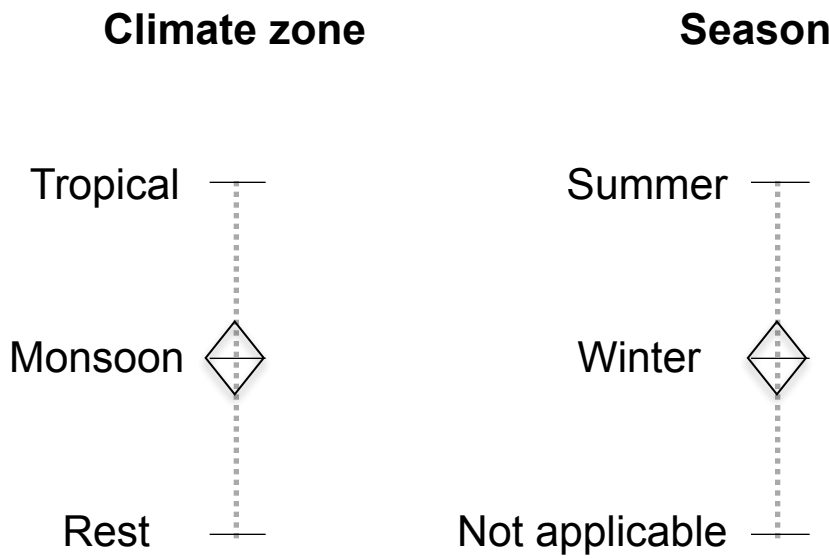


Source: author

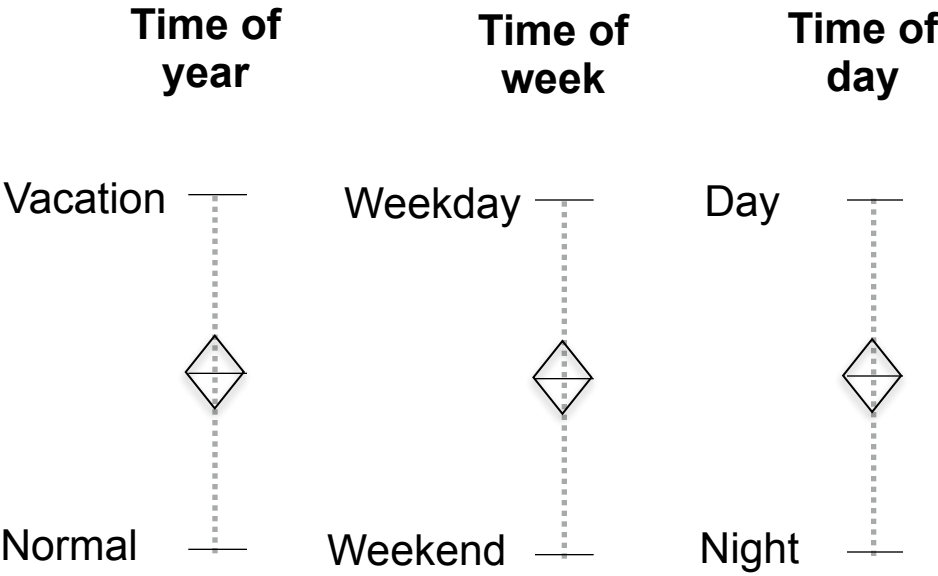
Context



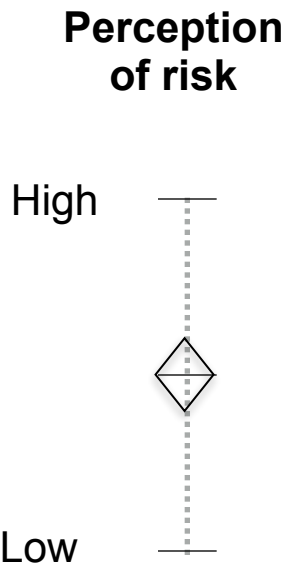
Geographical



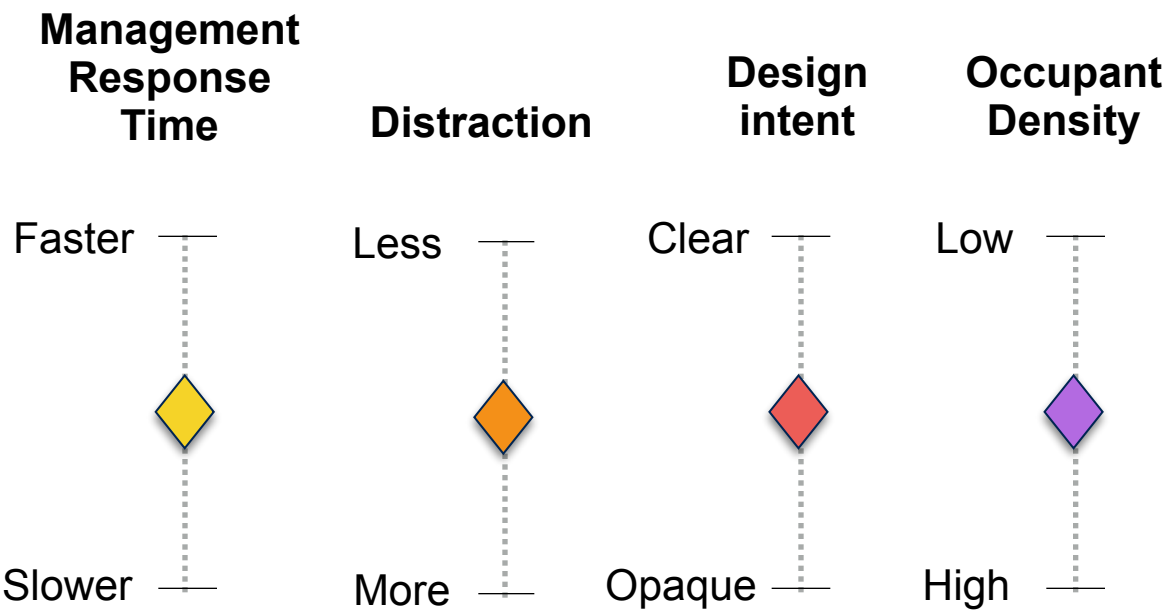
Periodic



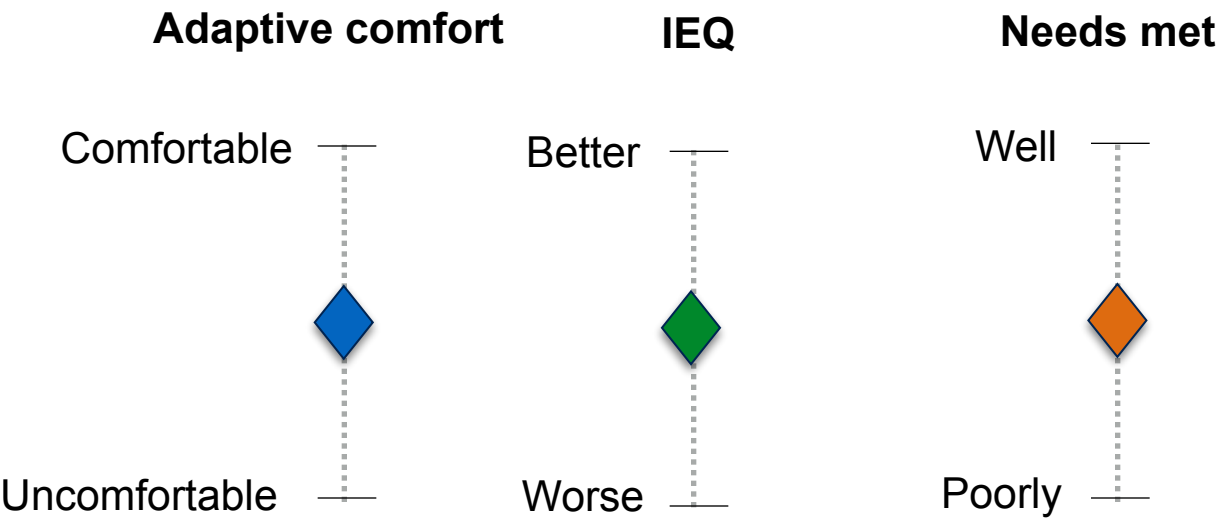
Cultural



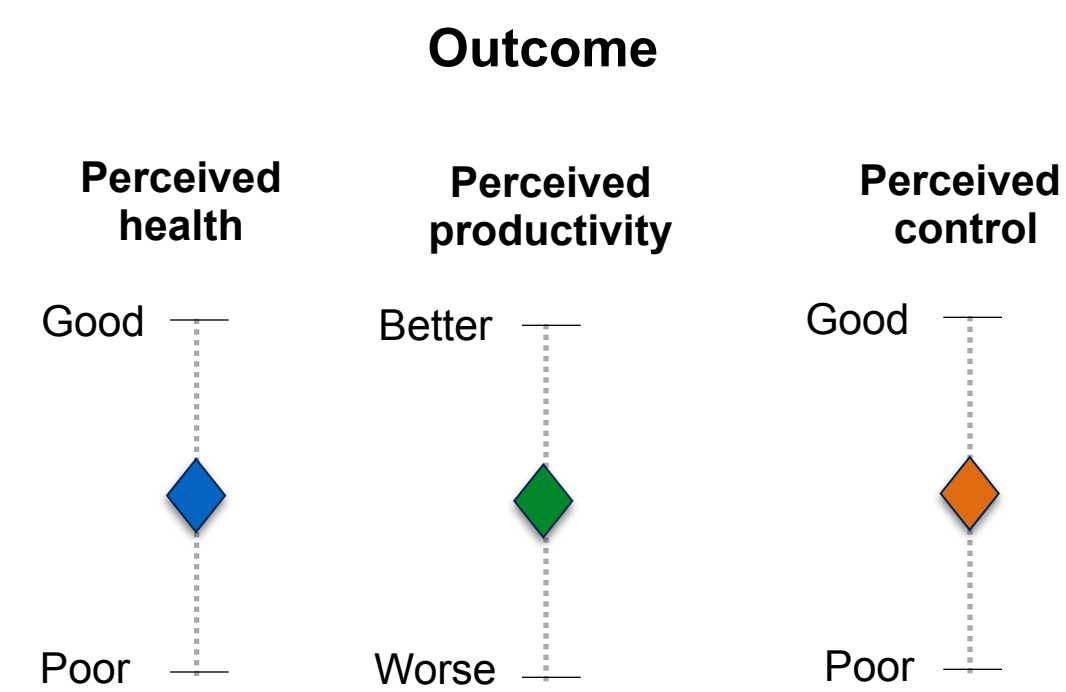
Change state



System state

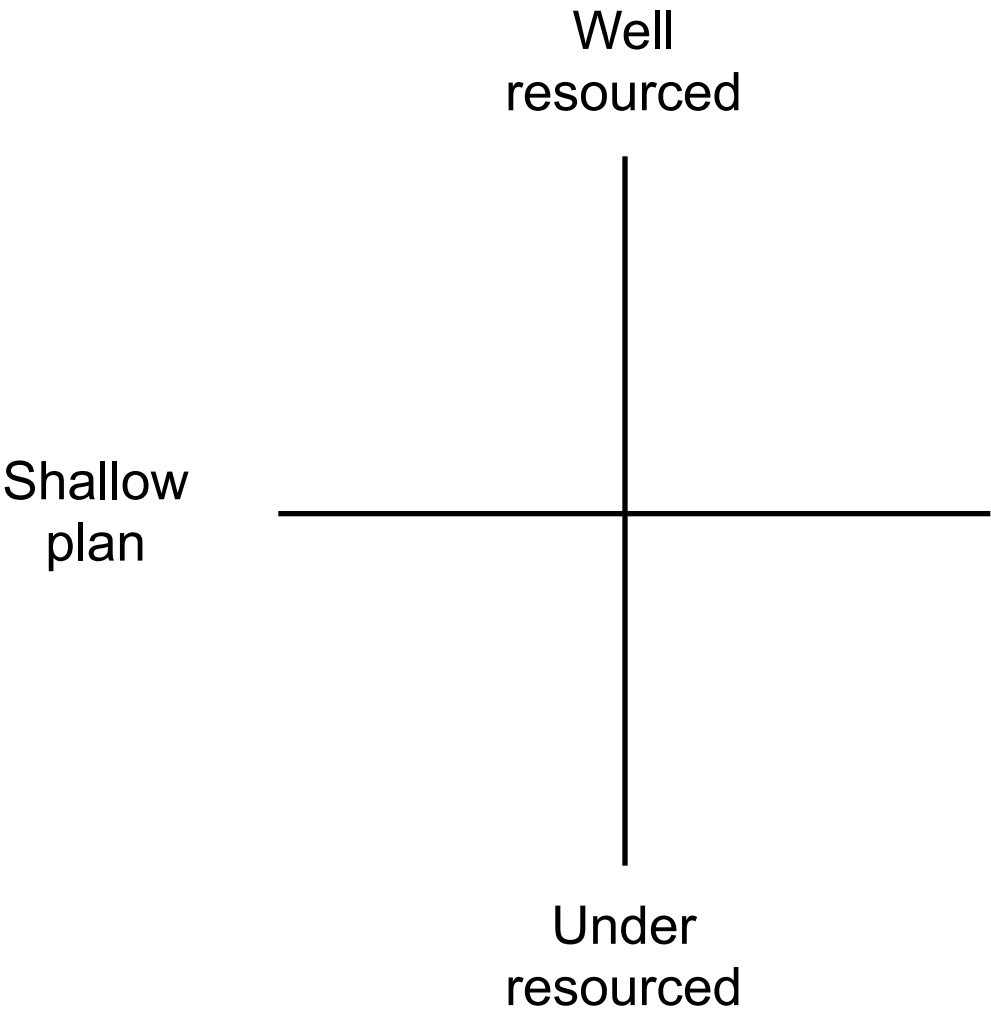


Achievable outcomes

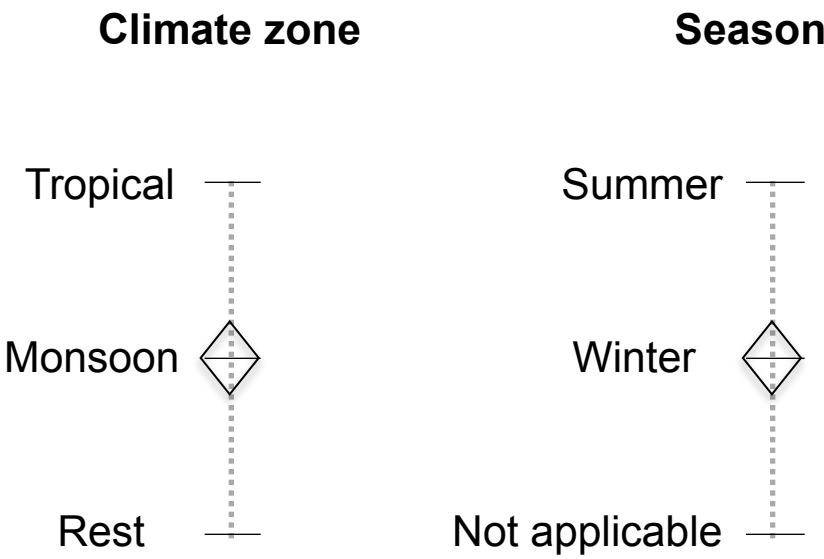


<http://www.building.co.uk/white-design's-kingsmead-primary-school-gets-full-marks-for-effort/3068070.article>

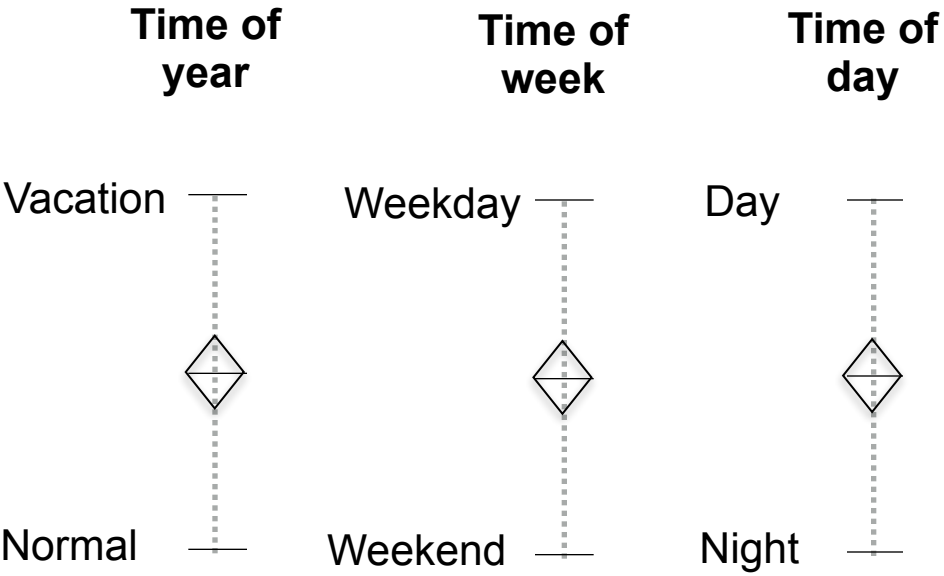
Context



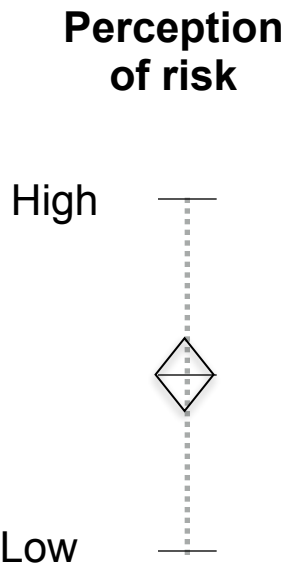
Geographical



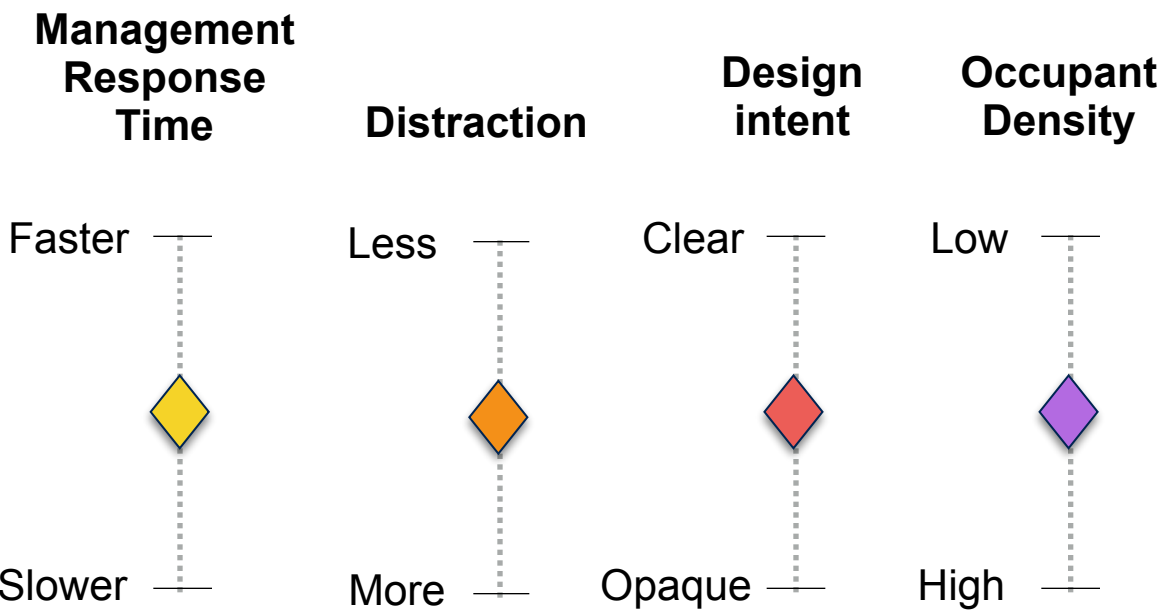
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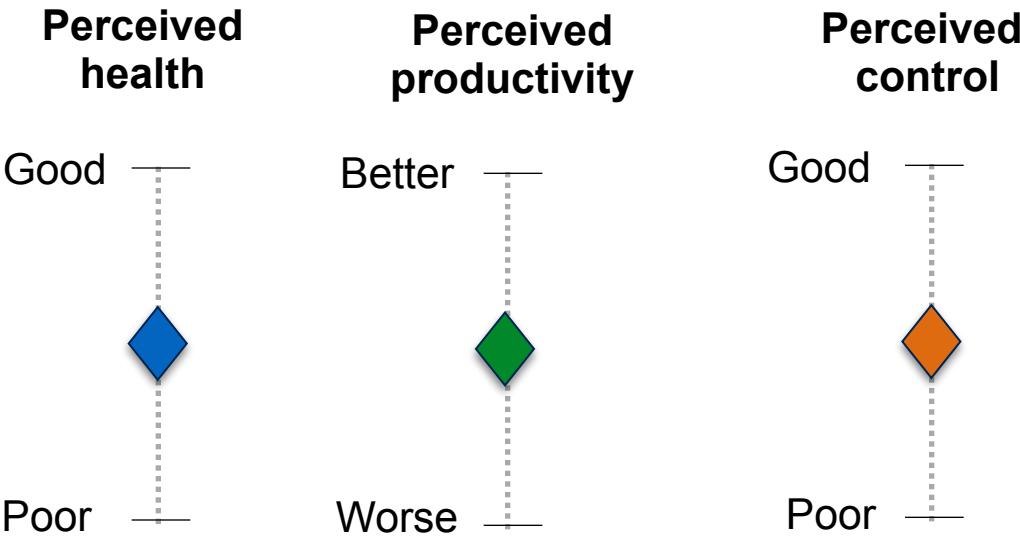
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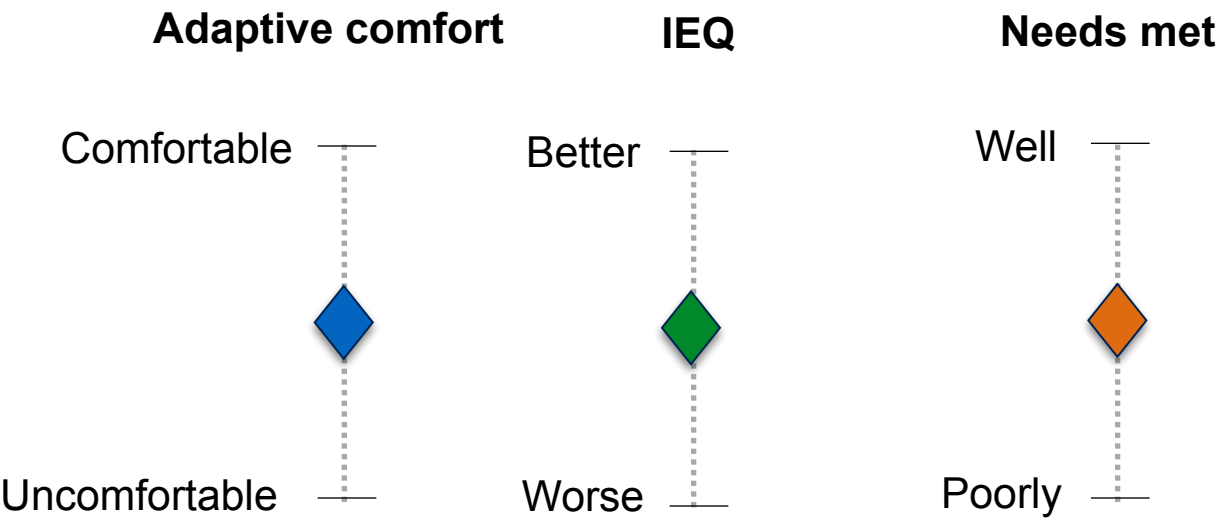
Change state



Outcome

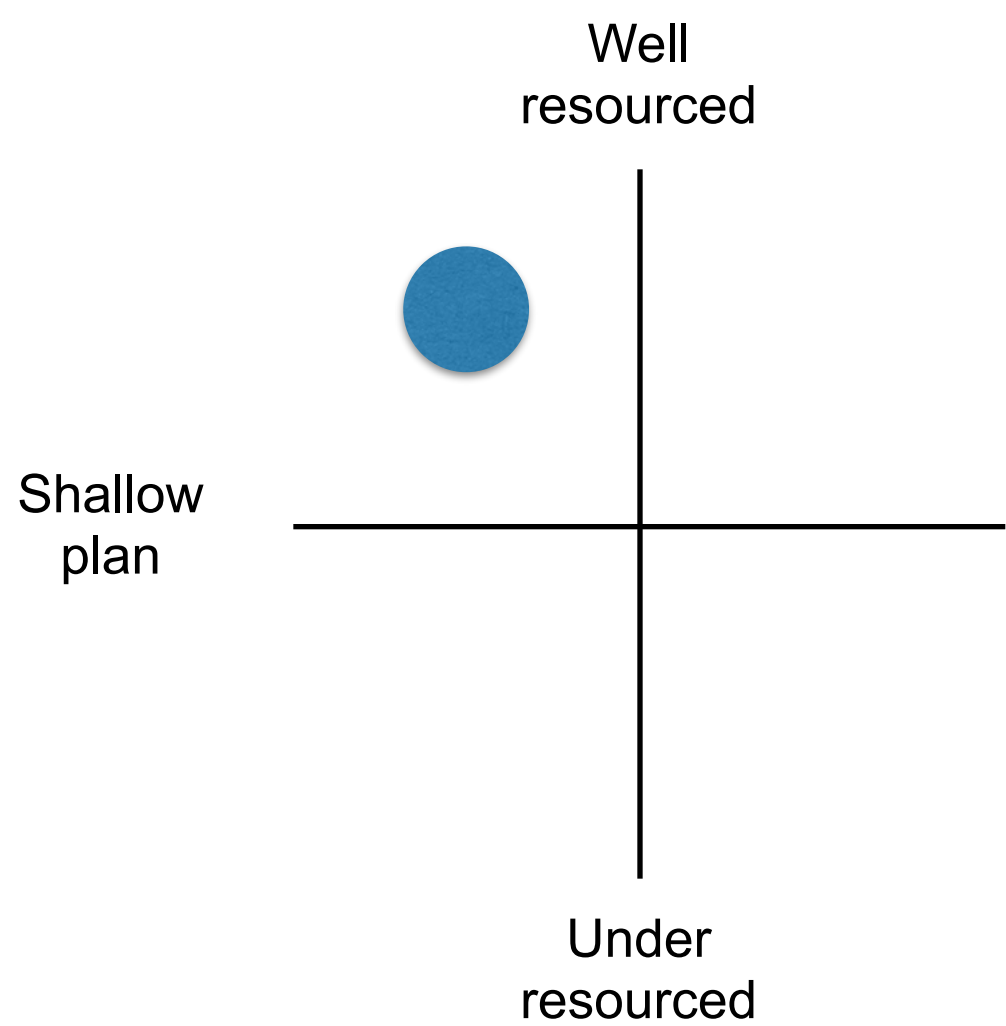


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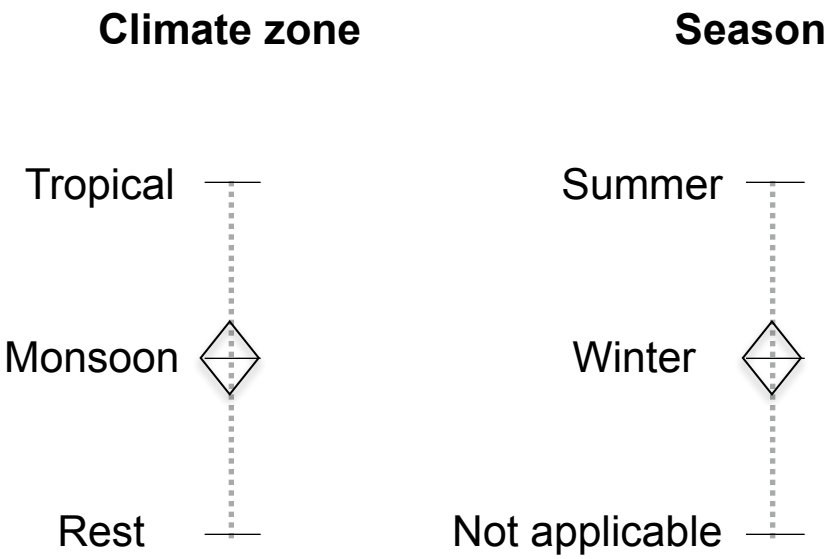


Animation 1

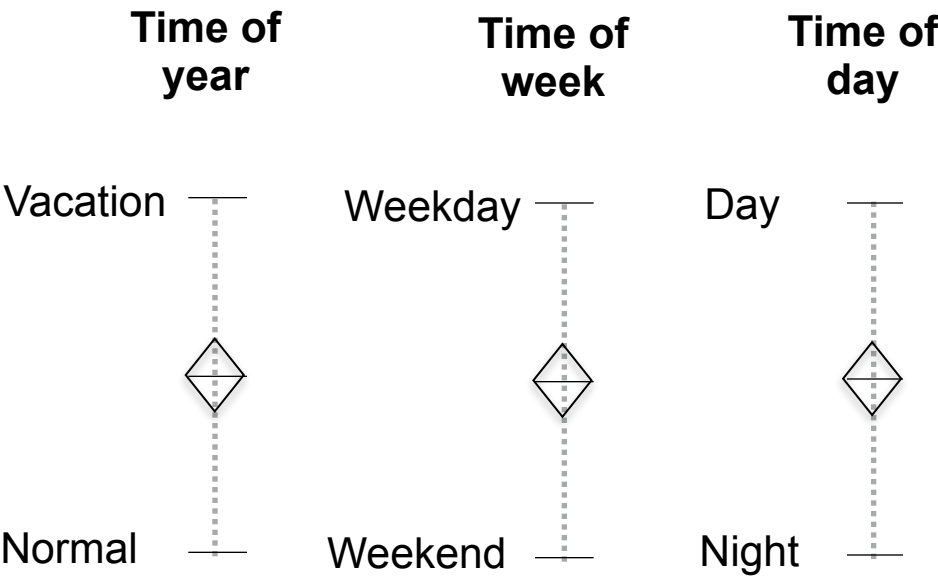
Context



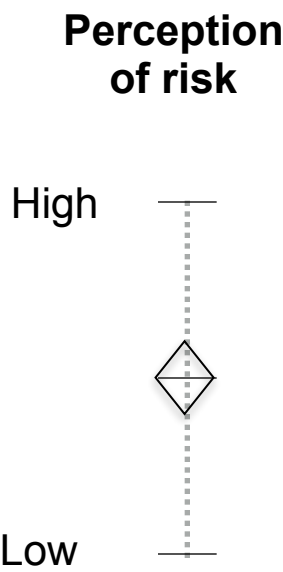
Geographical



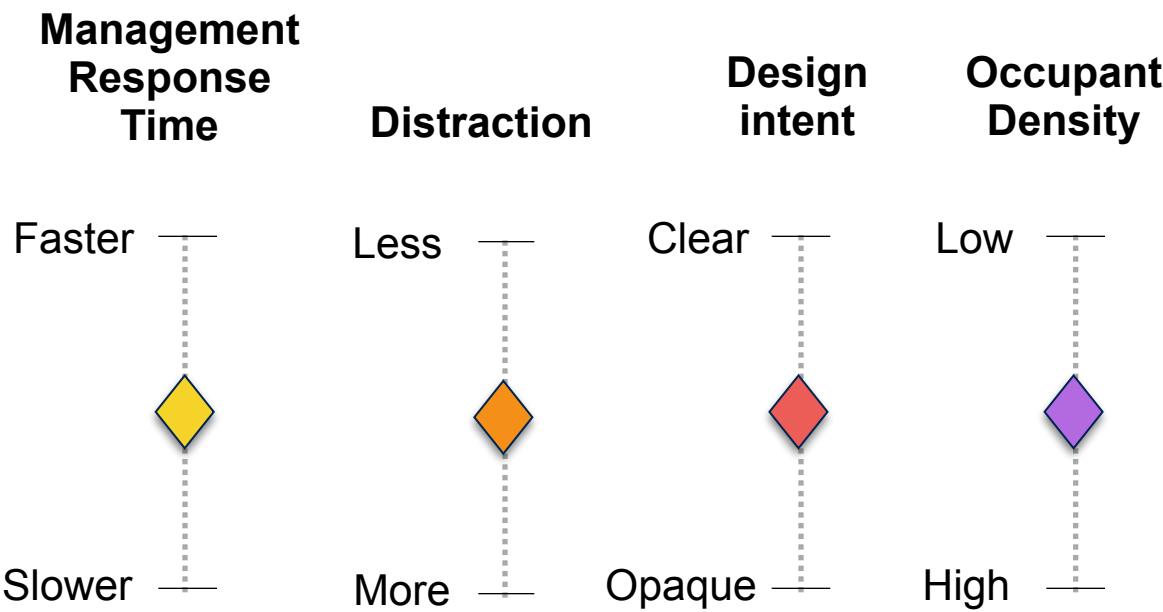
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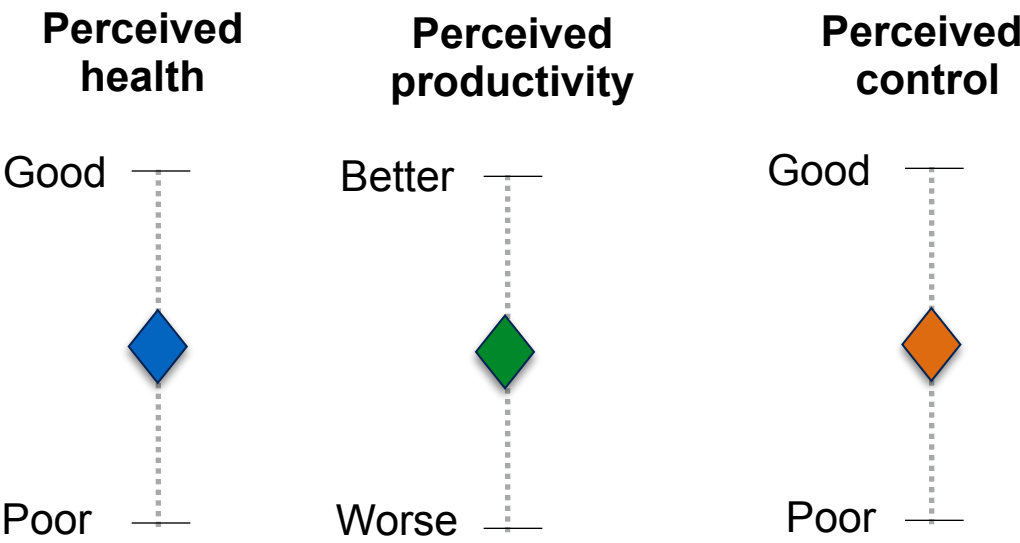
Cultural



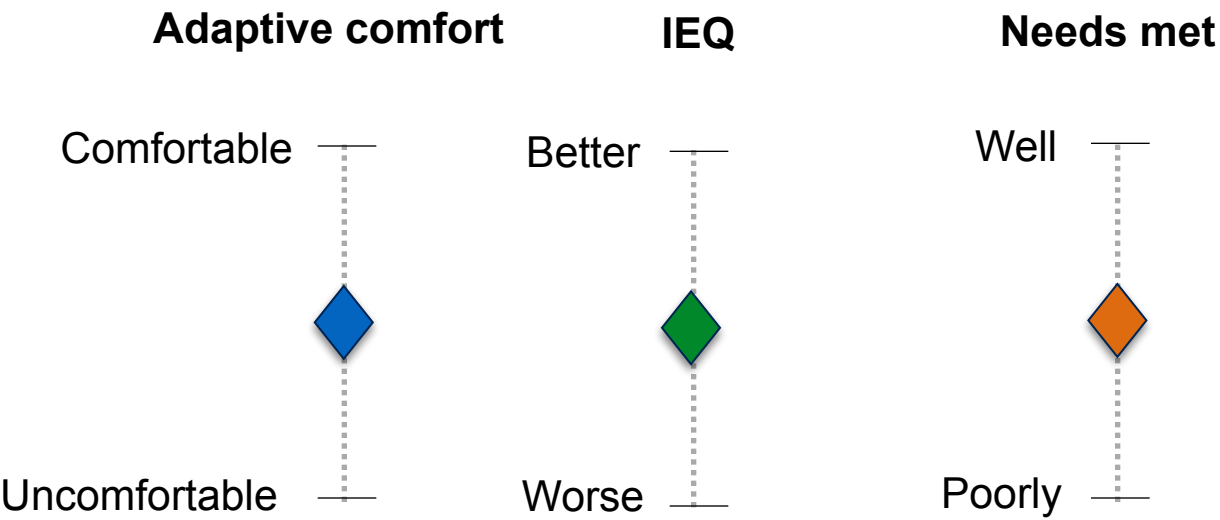
Change state



Outcome

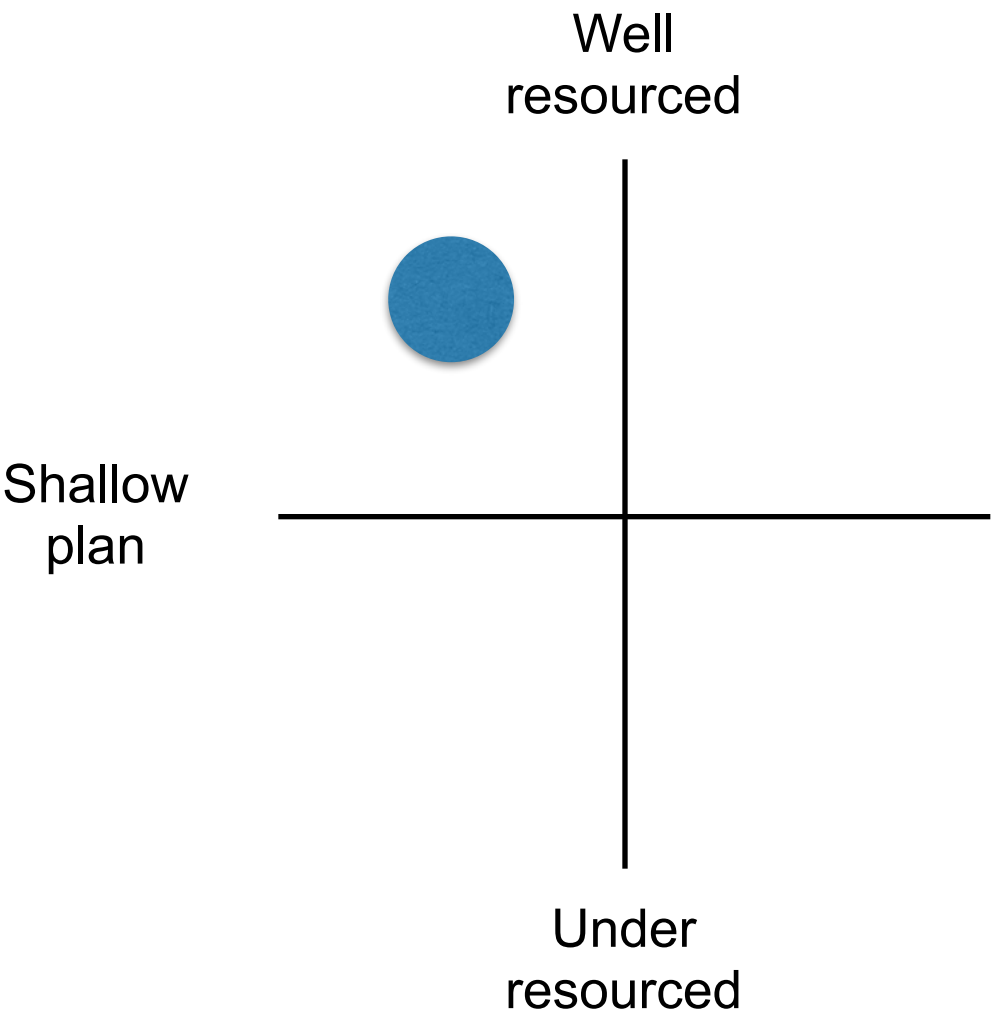


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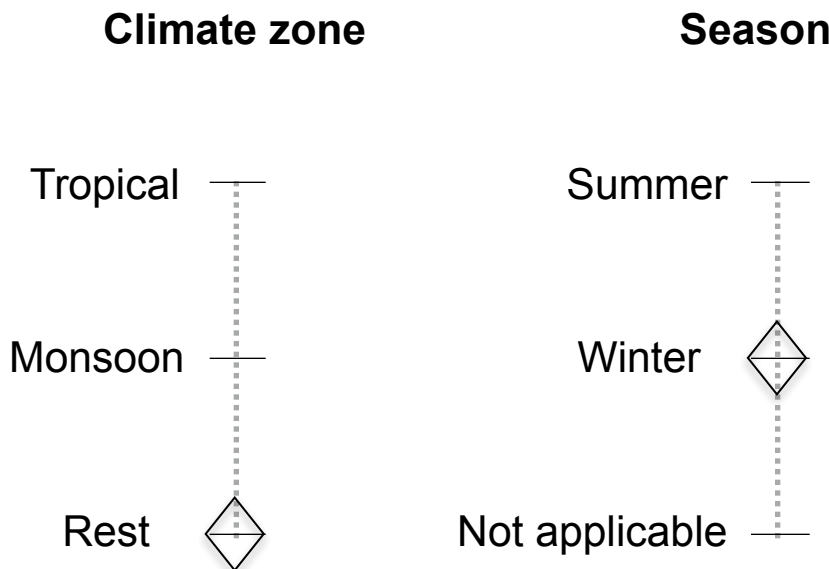


Animation 1

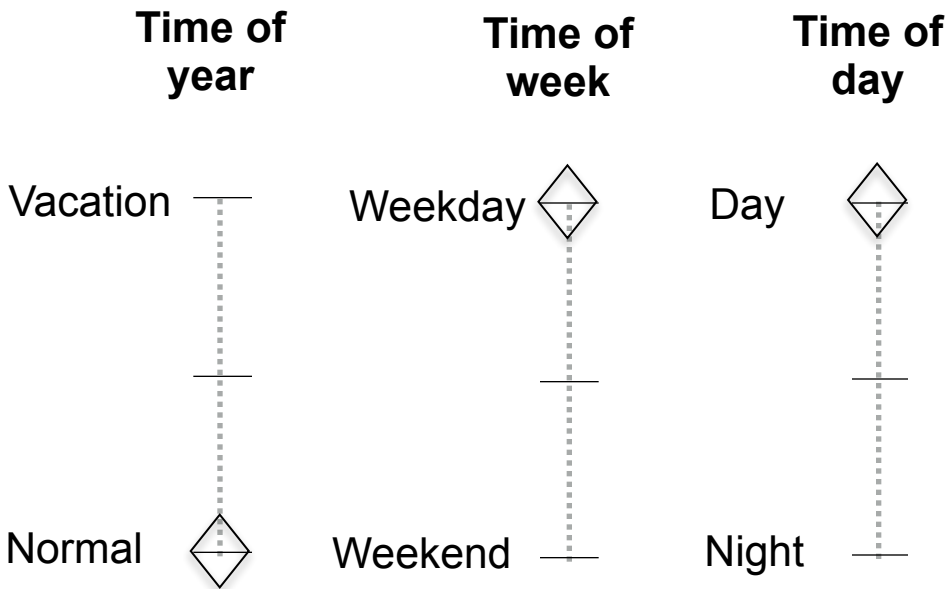
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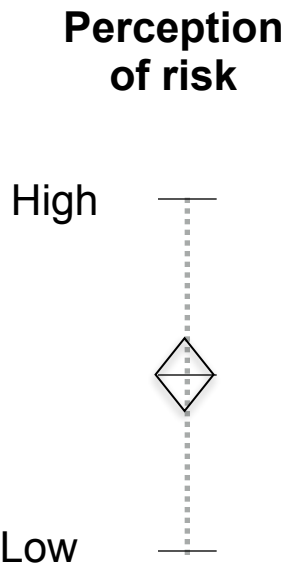
Geographical



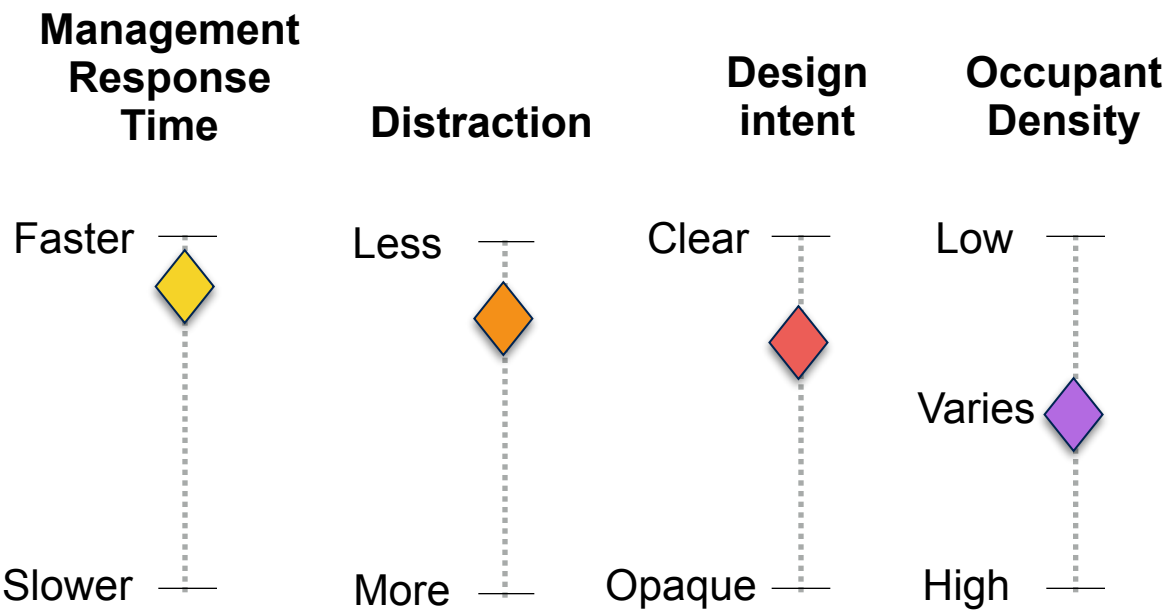
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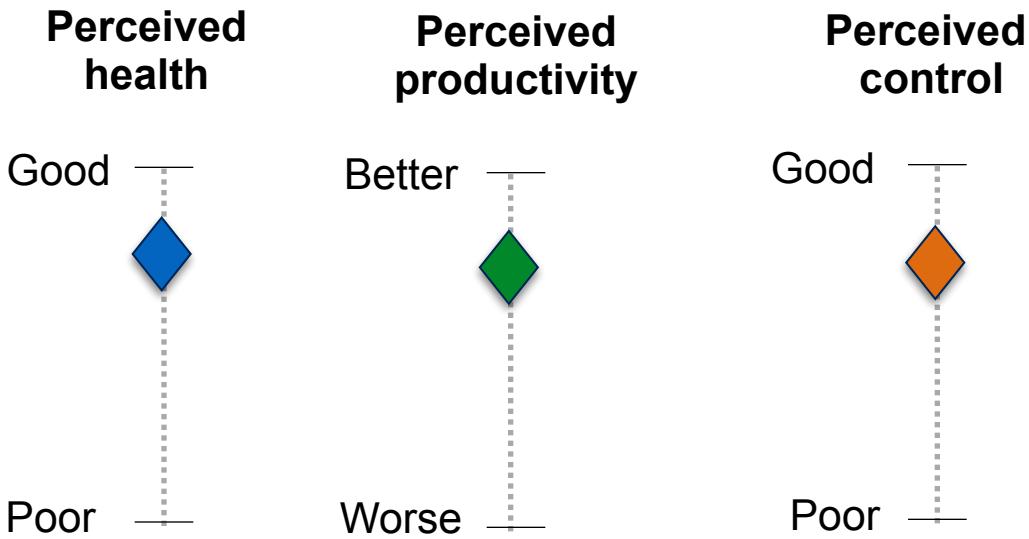
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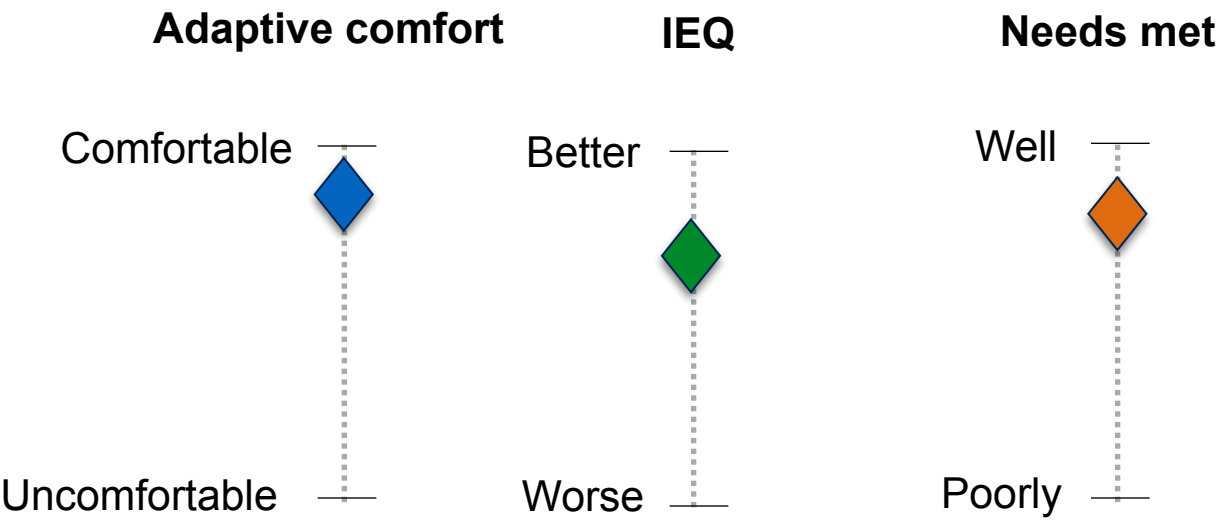
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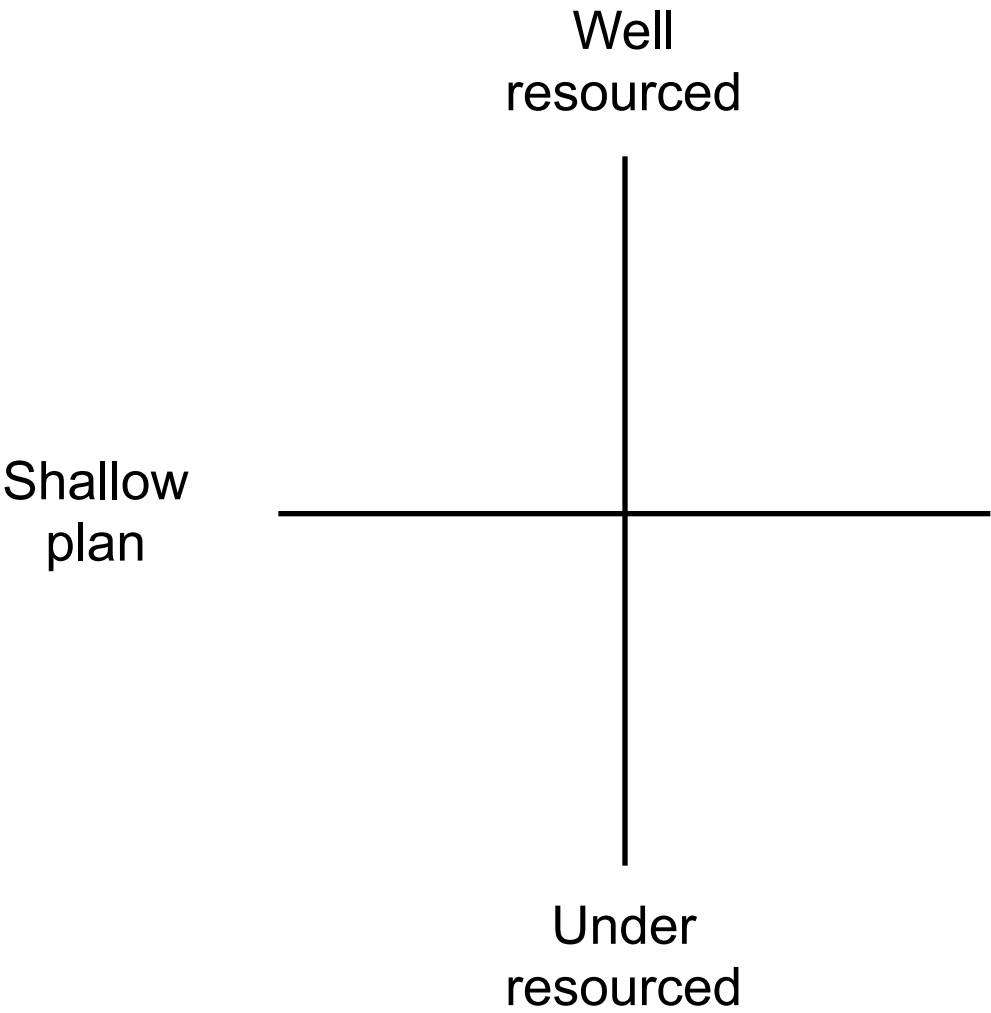
Outcome



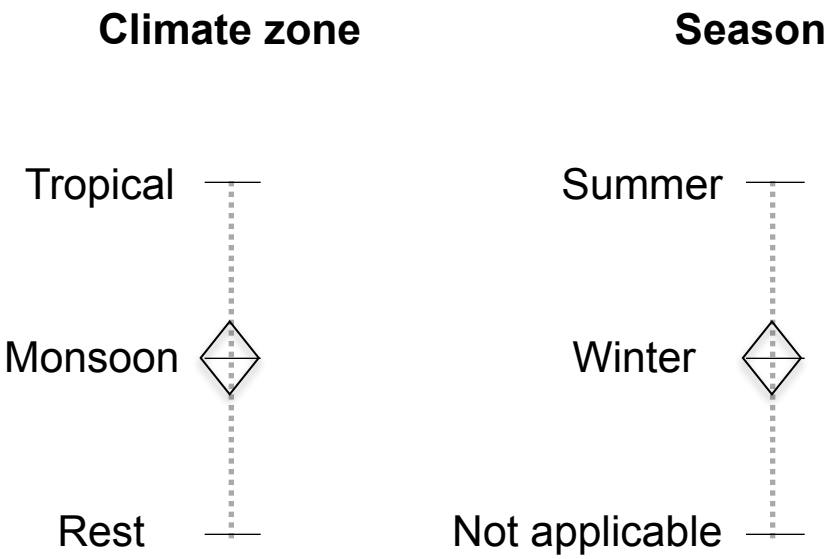
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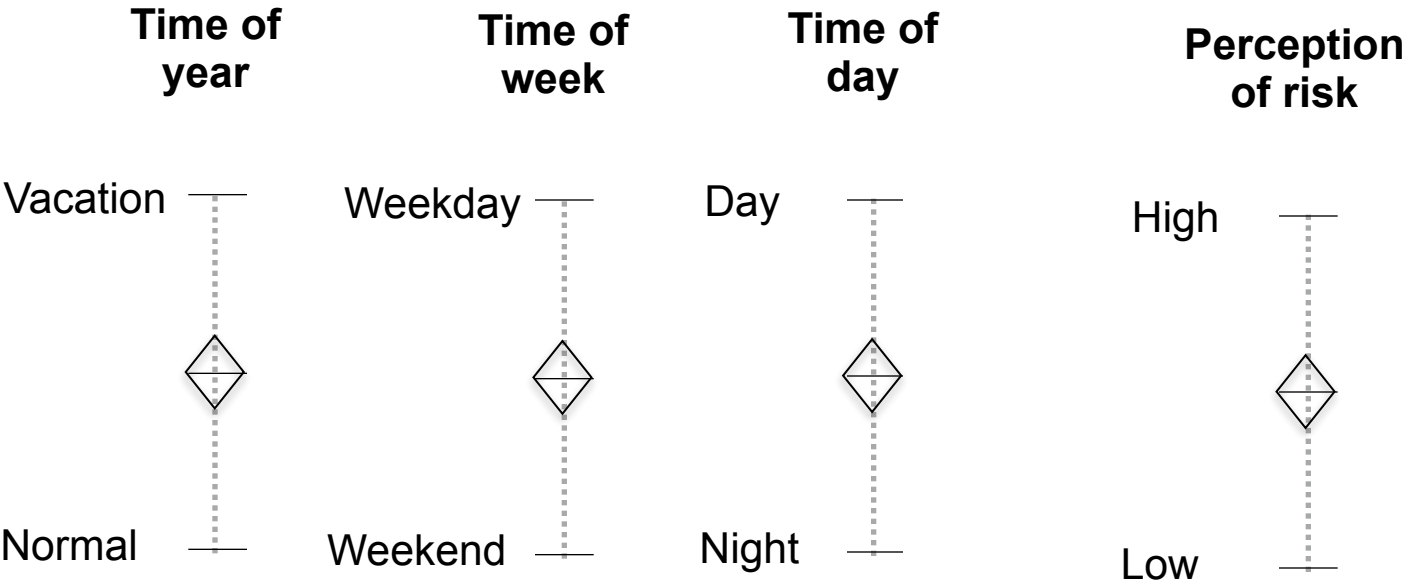
Context



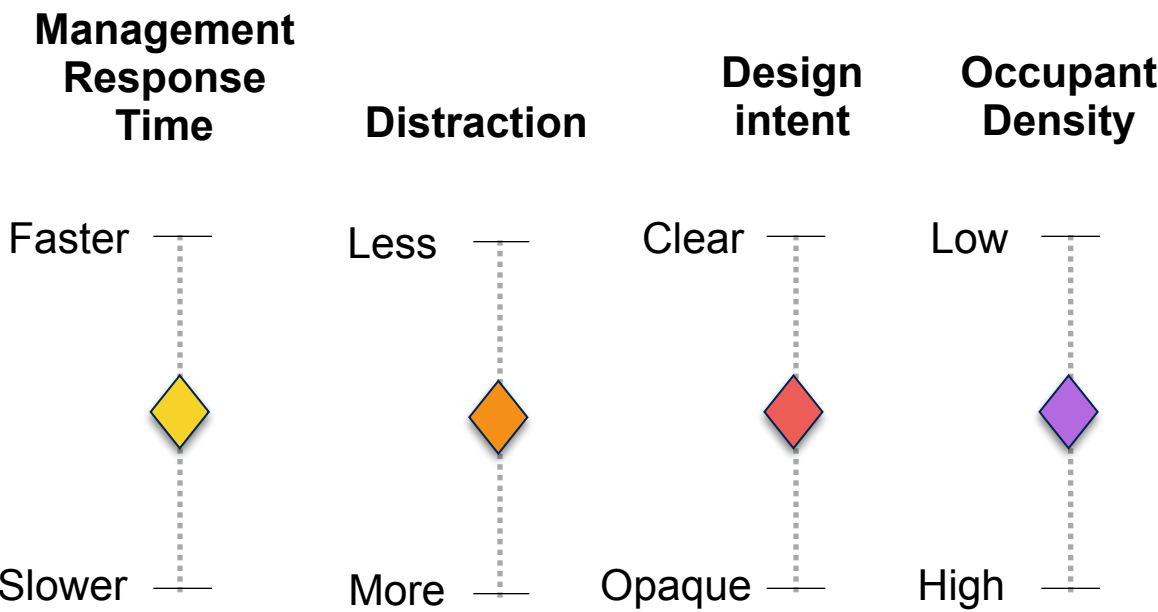
Geographical



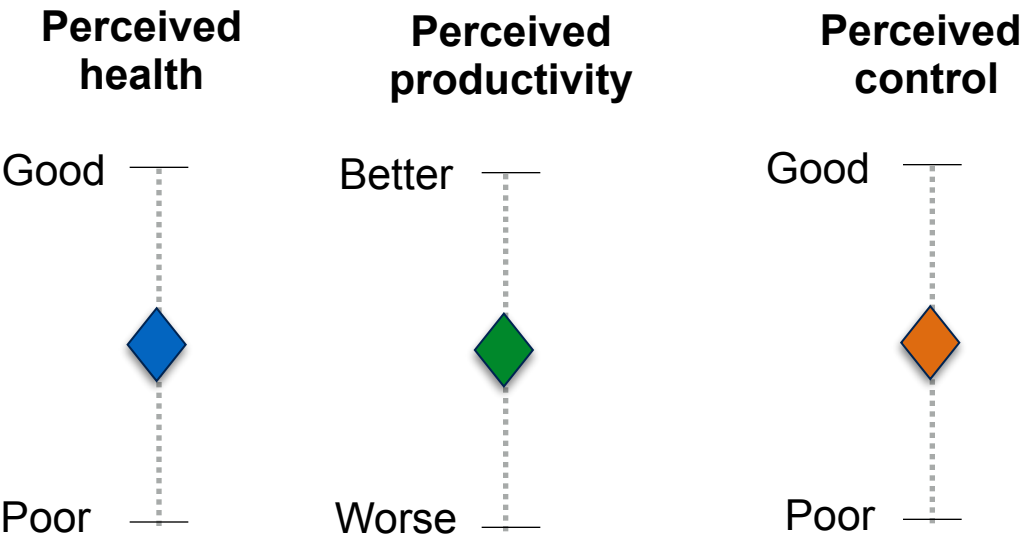
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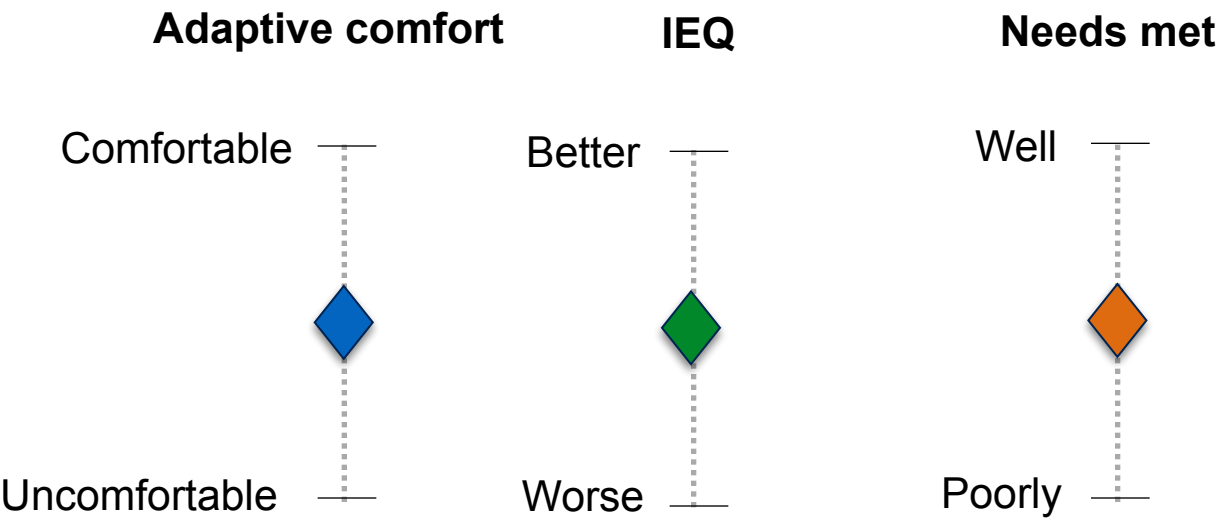
Change state



Outcome



System state



Animation 2

Context

Shallow plan

Well resourced

Deep plan

Under resourced



Geographical

Climate zone

Season

Tropical
Monsoon
Rest

Summer
Winter
Not applicable



Periodic

Cultural

Time of year

Time of week

Time of day

Perception of risk

Vacation
Normal

Weekday
Weekend

Day
Night

High
Low



Change state

Management Response Time

Distraction

Design intent

Occupant Density

Faster
Slower

Less
More

Clear
Opaque

Low
High



Outcome

Perceived health

Perceived productivity

Perceived control

Good
Poor

Better
Worse

Good
Poor



System state

Adaptive comfort

IEQ

Needs met

Comfortable
Uncomfortable

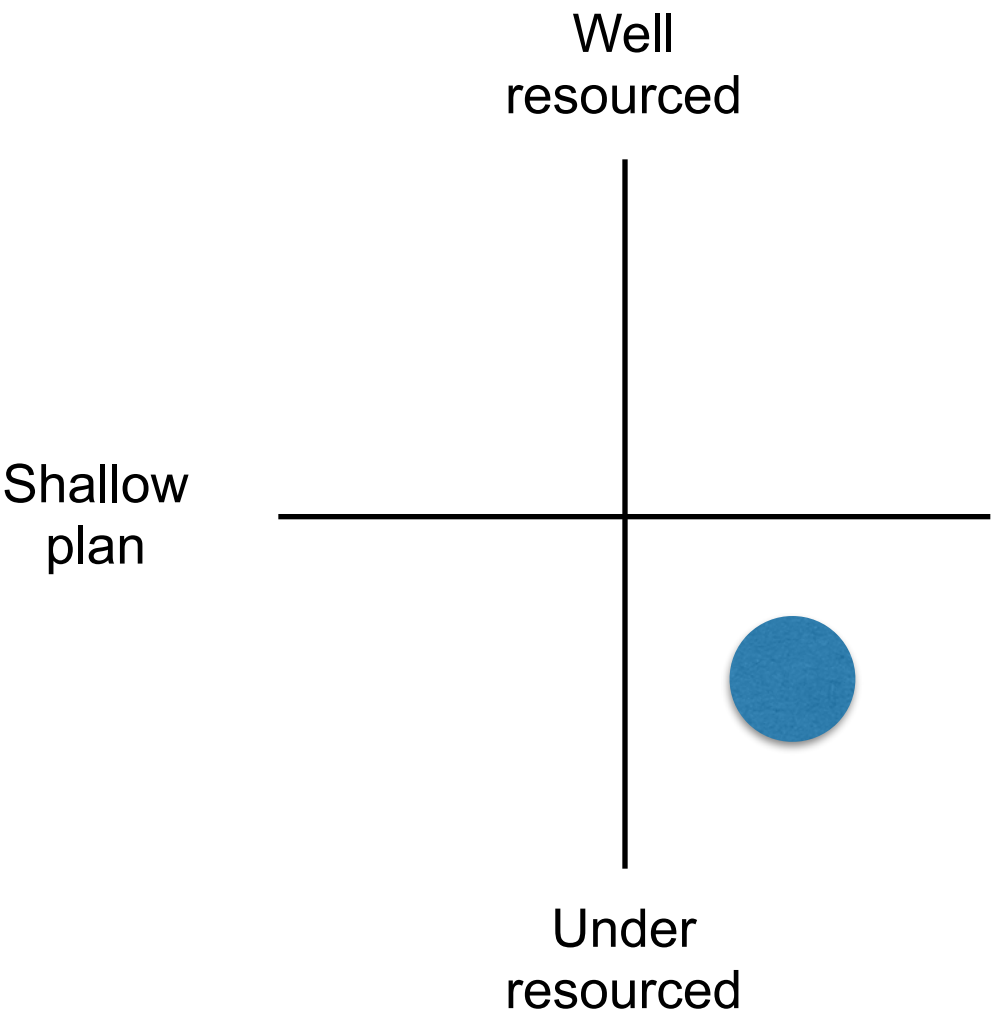
Better
Worse

Well
Poorly

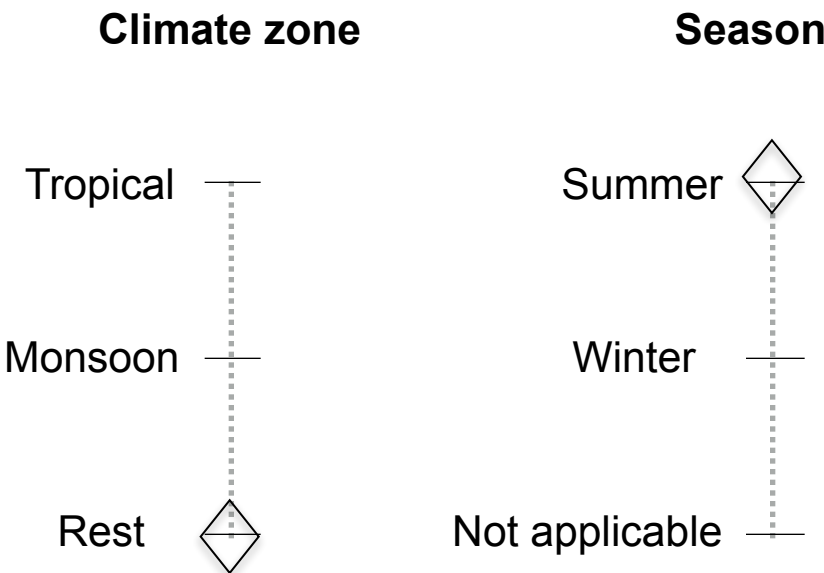


Animation 2

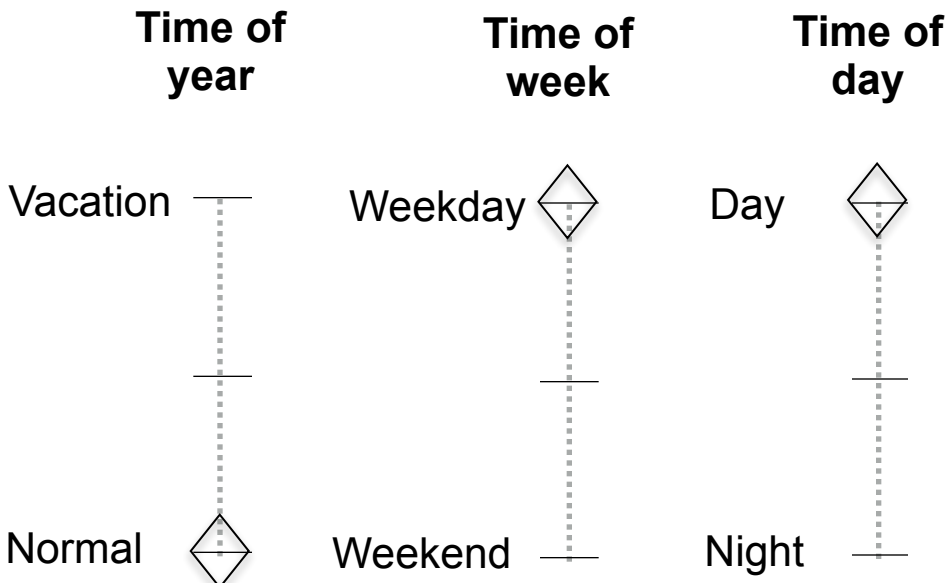
Context



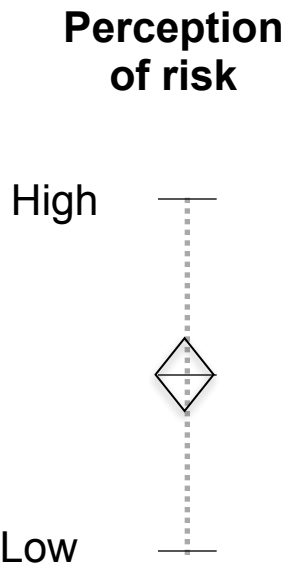
Geographical



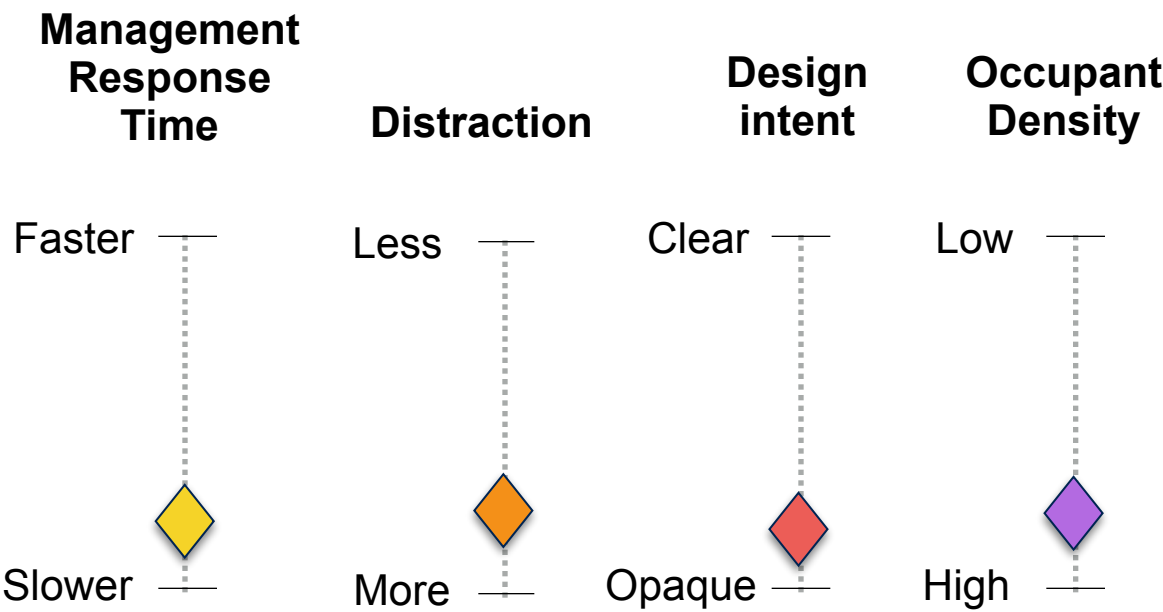
Periodic



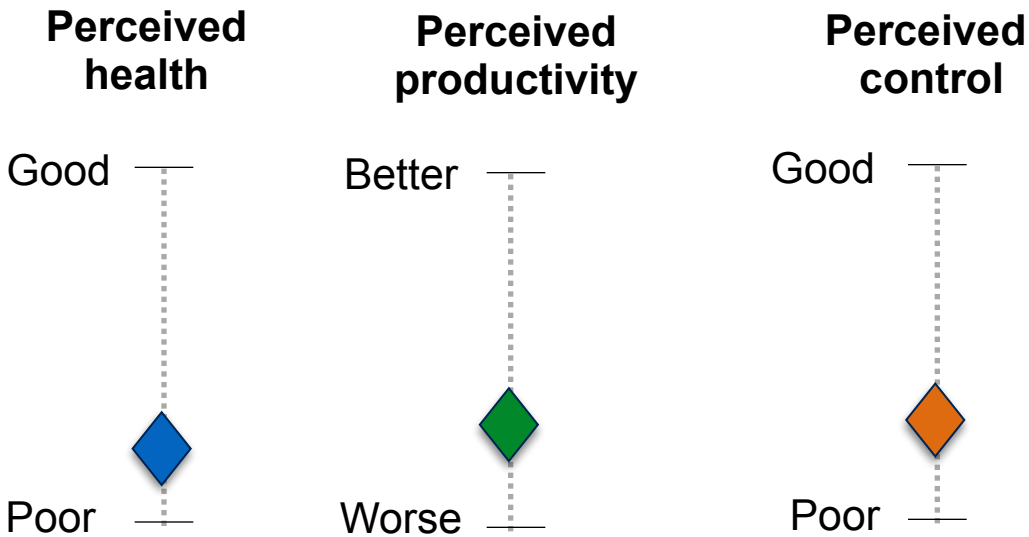
Cultural



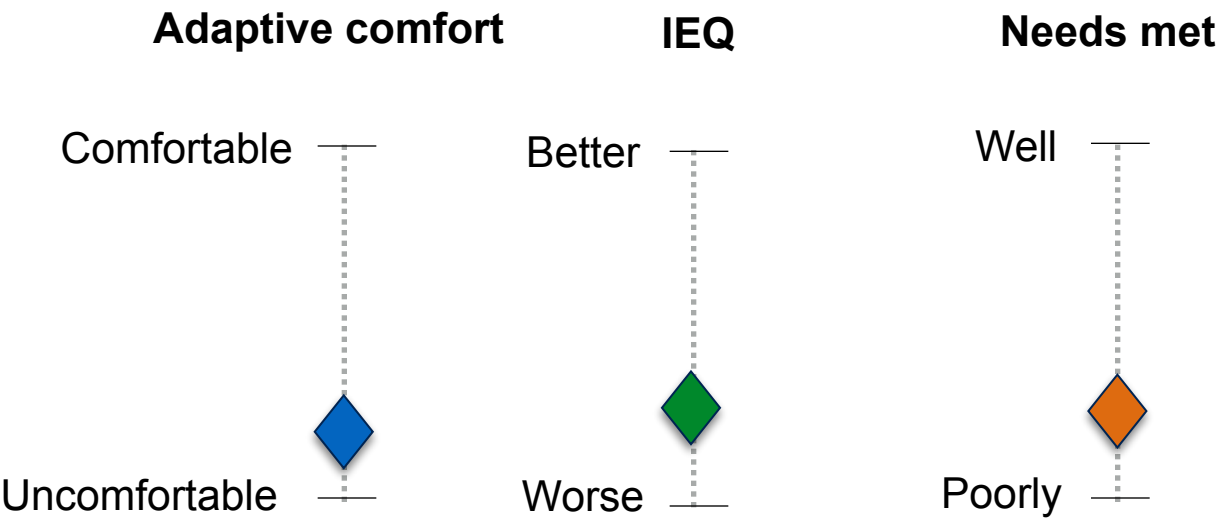
Change state



Outcome



System state



Emphasise ...

Heuristics, with balanced emphasis on context, judgement, and cases, backed by calibrated models and larger sample data only where possible and appropriate.

The public interest, with objective feedback case studies openly available to professionals, clients and the public.

Building evaluation as a knowledge domain in its own right, highlighting buildings as real-world systems with their outcomes, actual and likely.

http://www.chelseagreen.com/bookstore/item/thinking_in_systems:paperback

<http://www.tandfonline.com/toc/rbri20/41/1#>

Afterthoughts

Will different behaviour become habitual?

Visitors to hi-tech £1bn Glasgow hospital keep getting stuck in lifts with no buttons



By **Mary-Ann Russon**

May 10, 2015 17:39 BST



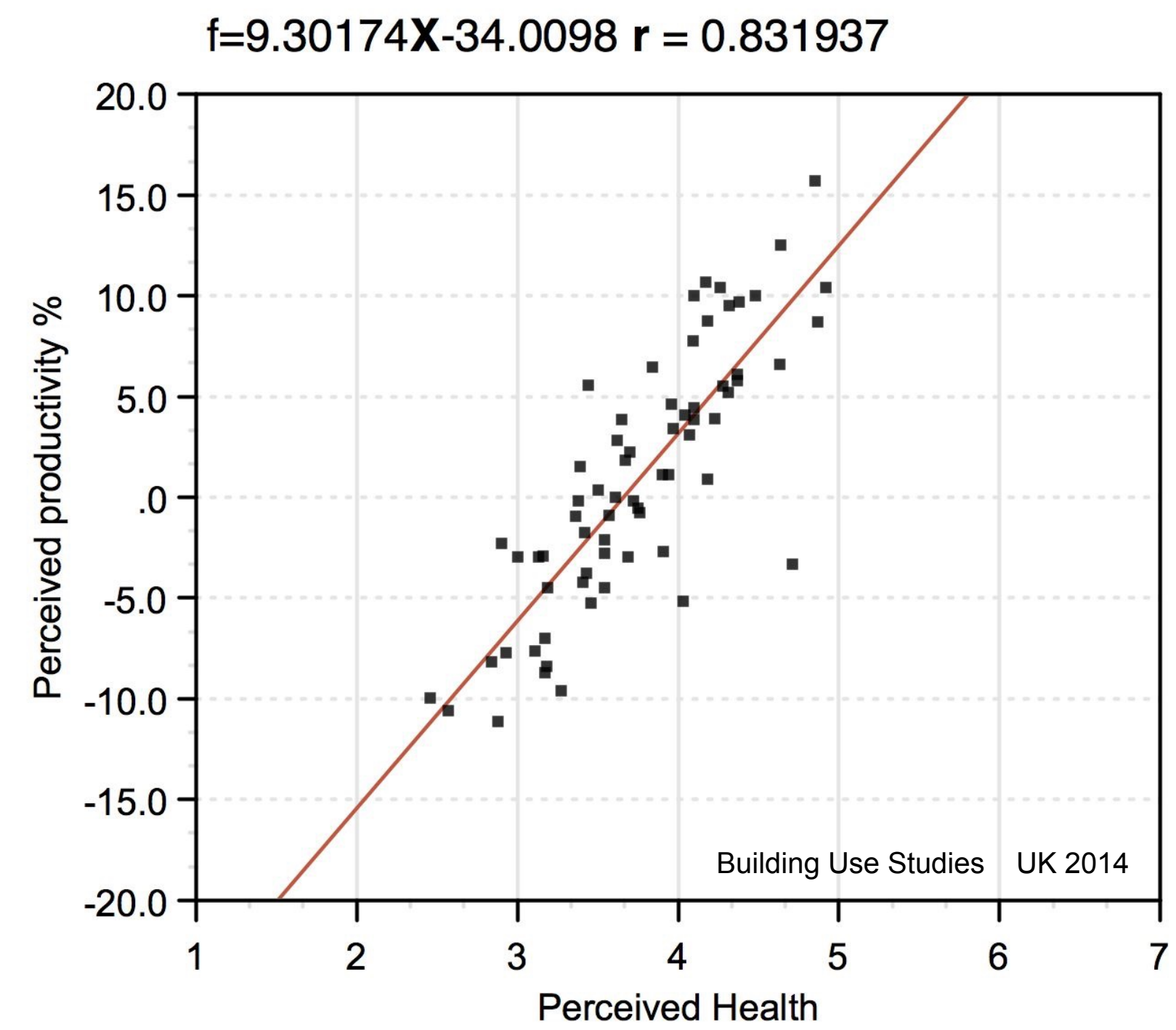
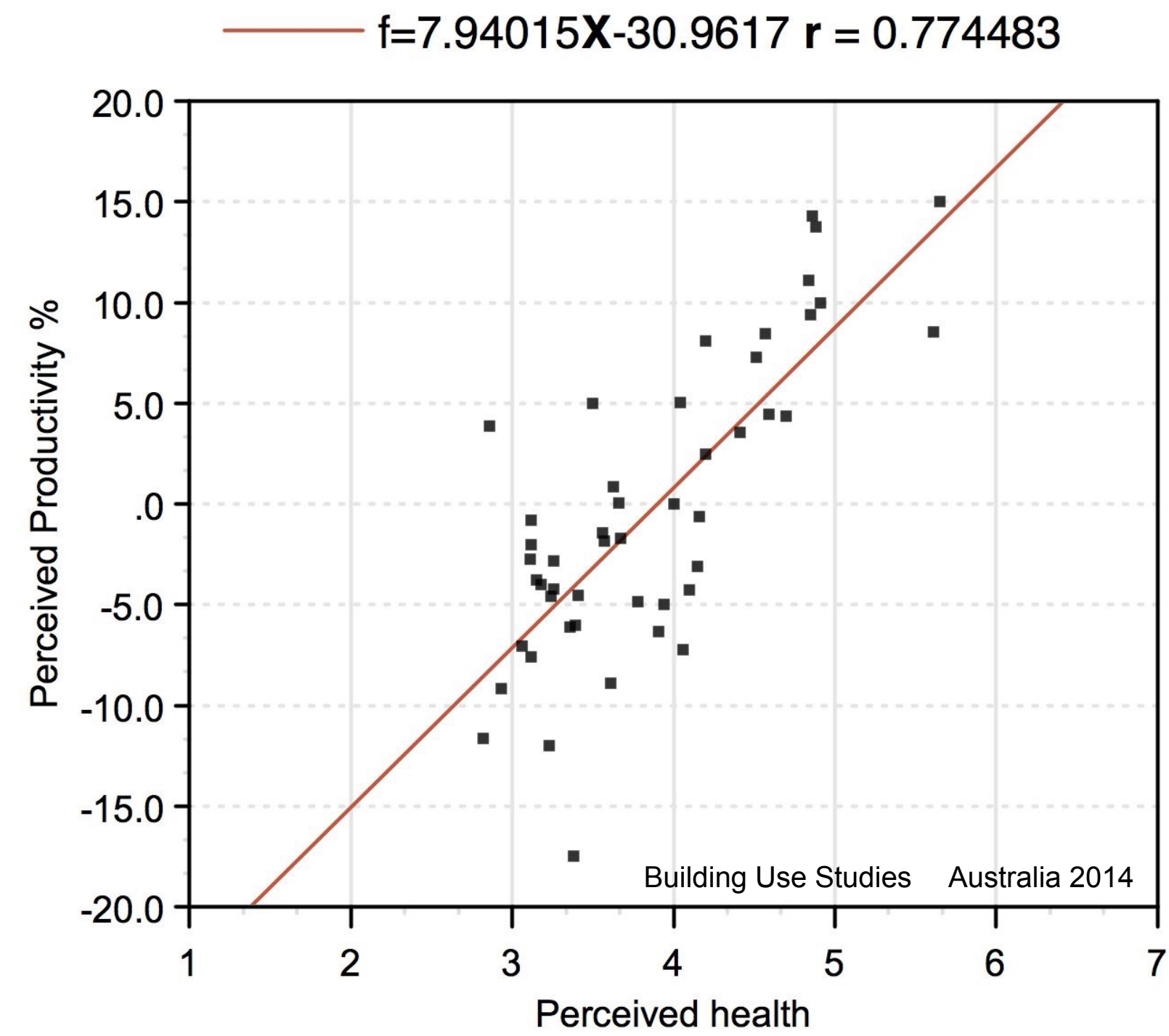
"It's an amazing building but I've spent the majority of my time in the lift so far." ... HOSPITAL WORKER



SOURCE: www.ibtimes.co.uk/visitors-high-tech-1bn-glasgow-hospital-keep-getting-stuck-lifts-no-buttons-1500606



Hoge Veluwe / Kruller Muller



Sources and supplementary material

for

Deconstructing building performance: with emphasis on needs, perceived health and productivity

Adrian Leaman

Original version animated in Keynote.

Healthy Buildings 2015 Europe, Eindhoven, The Netherlands
Monday May 18, 2015

Slide number

Cover		http://www.usablebuildings.co.uk
3	Heuristics definitions	http://www.thefreedictionary.com/heuristics
5	BRE house Cottages, Near Wick, Caithness	http://markbrinkley.blogspot.co.uk/2007/06/yvette-cooper-at-offsite-2007.html http://www.landmarktrust.org.uk/search-and-book/properties/shore-cottages-no-1-12005/
6	Elizabeth Fry Building	http://www.usablebuildings.co.uk/Probe/FRY/FRYAPR98.PDF
7	Woodland Trust	http://www.usablebuildings.co.uk/Pages/Unprotected/CIBSEOct1pp20-26WoodlandTrust.pdf
8	BUS Survey for Woodland Trust	http://www.usablebuildings.co.uk/Pages/Unprotected/CIBSEOct1pp20-26WoodlandTrust.pdf
9	BUS Survey for unnamed deep plan office building. Typical response profile.	
10	Bexhill High School reversion	http://www.independent.co.uk/news/education/schools/bexhill-high-school-multimillion-pound-investment-in-education-pods-ends-in-failure-10208125.html
11	Association of Environmentally Conscious Building forum	http://www.aecb.net/forum/index.php/board,11.0.html?PHPSESSID=v0tor51p56t9mkbkrh7gttm6o7
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16	Excess winter mortality in Europe: a cross country analysis identifying key risk factors J D Healy J Epidemiol Community Health 2003;57:784-789 doi:10.1136/jech.57.10.784	http://jech.bmj.com/content/57/10/784
20	Sash window usability	http://www.idostuff.co.uk/sections/DIY/Sash Windows/Sash History 4.html
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