

Window Size Effects on the Atmosphere of Daylit Spaces at High Latitudes

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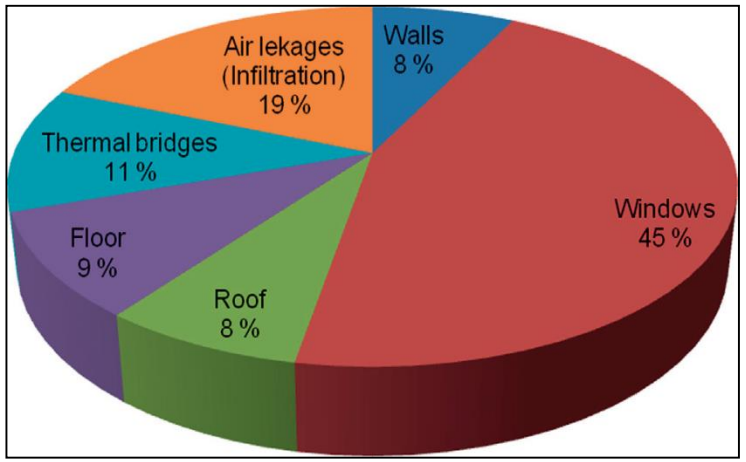
LIGHT &
COLOUR
CENTRE

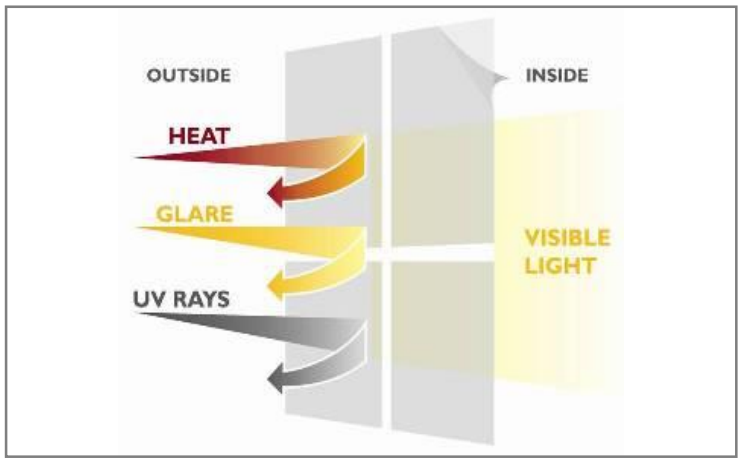
1 | MOTIVATION

Source of heat loss



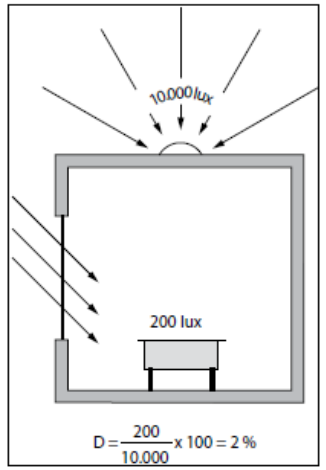
Grynning et al, 2011

Energy efficiency measure



http://www.the-window-treatment-expert.com/images/window-film.jpg

Regulations



Lyskultur, 2014

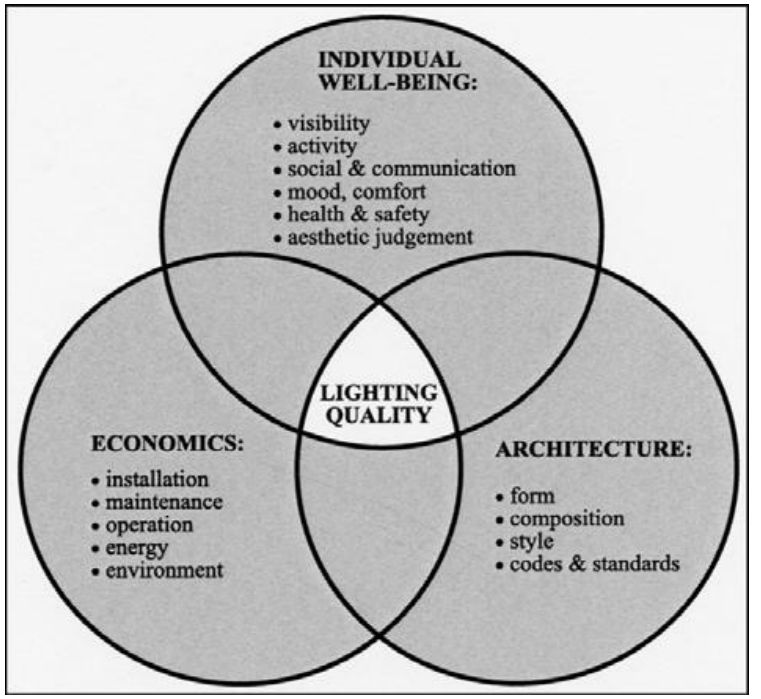
- Luminous conditions allow collection of information of environment, preference selection and effects on mood, human's health and well-being (Boyce et al., 2006).

- Lighting quality in a built environment:

  Hopkinson, 1966: *i.* Provide sufficient illumination for task performance and *ii.* Provide pleasant visual environment.

  Veitch & Newsham, 1998: *i.* Appropriate viewing conditions for visual and task performance and *ii.* Contribute to the aesthetic perception of a space.

- Humans spend 80 to 90% of the time indoors – Goal: Satisfactory interaction with the built environment.



Veitch, 1998

2 | EXPERIMENTAL DESIGN

Windows design, more than just the dimensions…
Window size, shape, window-to-wall ratio, etc.

- Geographical location – Sky type
- Space size
- Spatial context

Experimental factors	
Factors	Levels
Window size*	3 (small, medium, large)
Space type*	2 (small, large)
Spatial context	2 (socializing, working)
Sky type	3 (overcast sky, clear sky with high sun angle, clear sky with low sun angle)
***Within-subject factor.**	


https://www.beehivestateexteriors.com/wp-content/uploads/2017/04/iStock-Casement-Window-Pane-300x201.jpg

[a]

[b]

[c]

[d]

[e]

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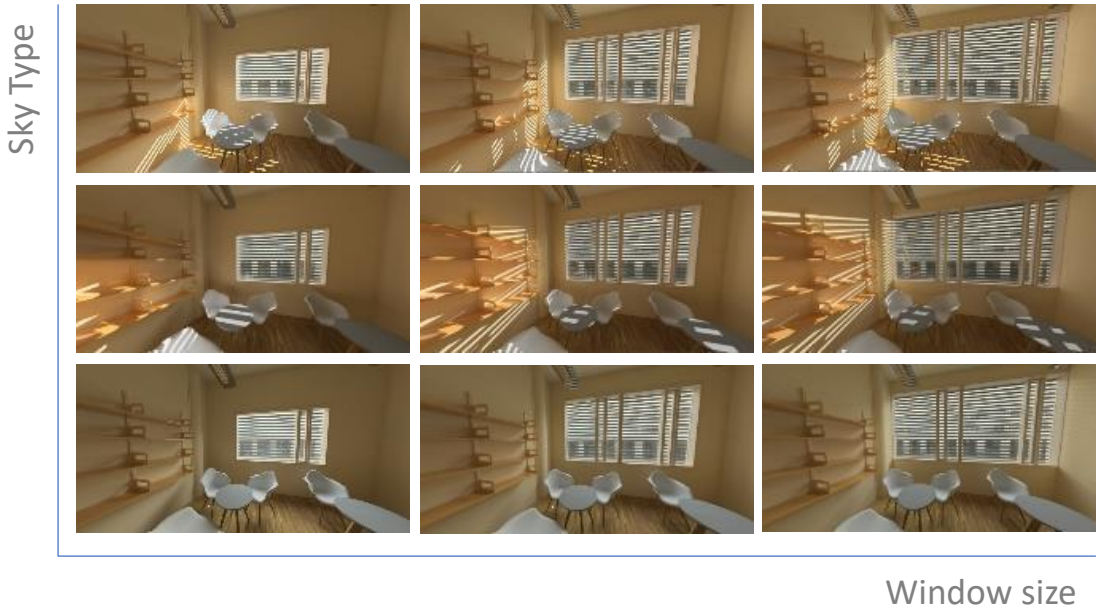
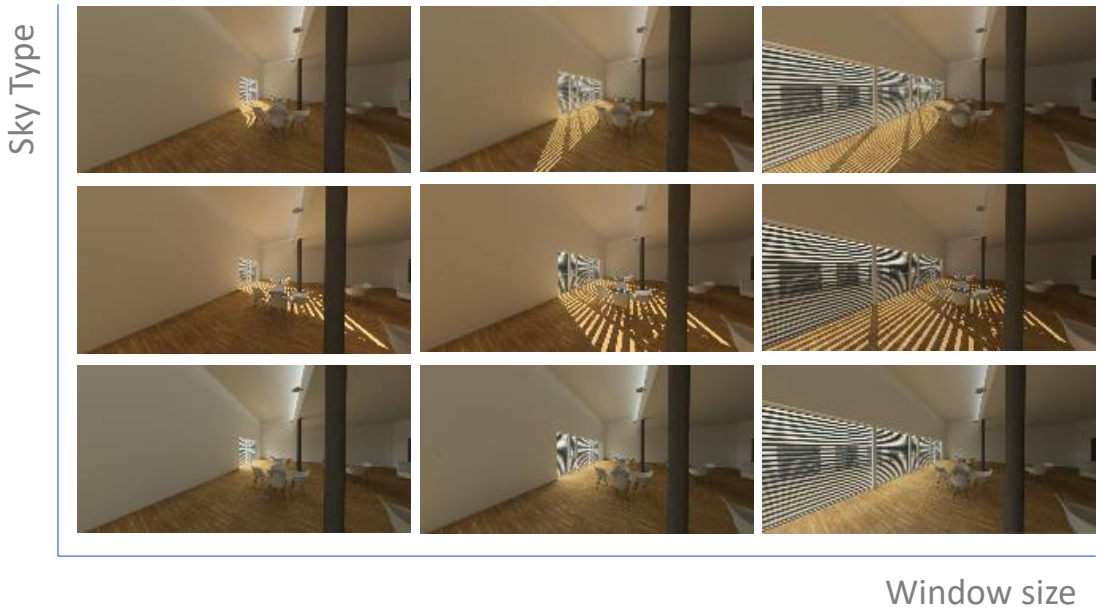


SMALL SPACE



LARGE SPACE

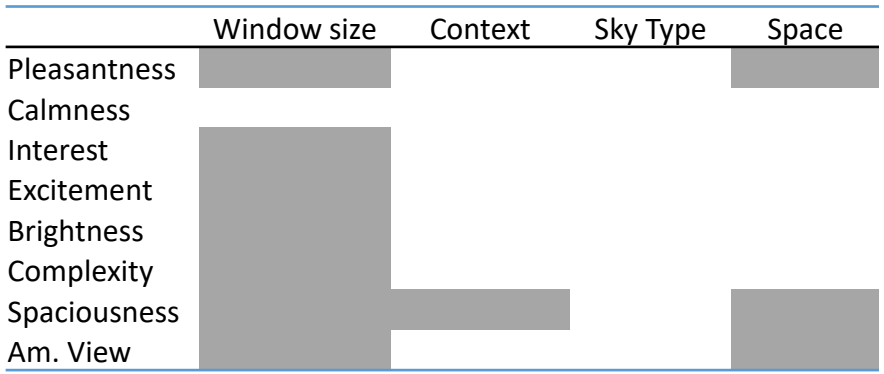
2 | EXPERIMENTAL DESIGN

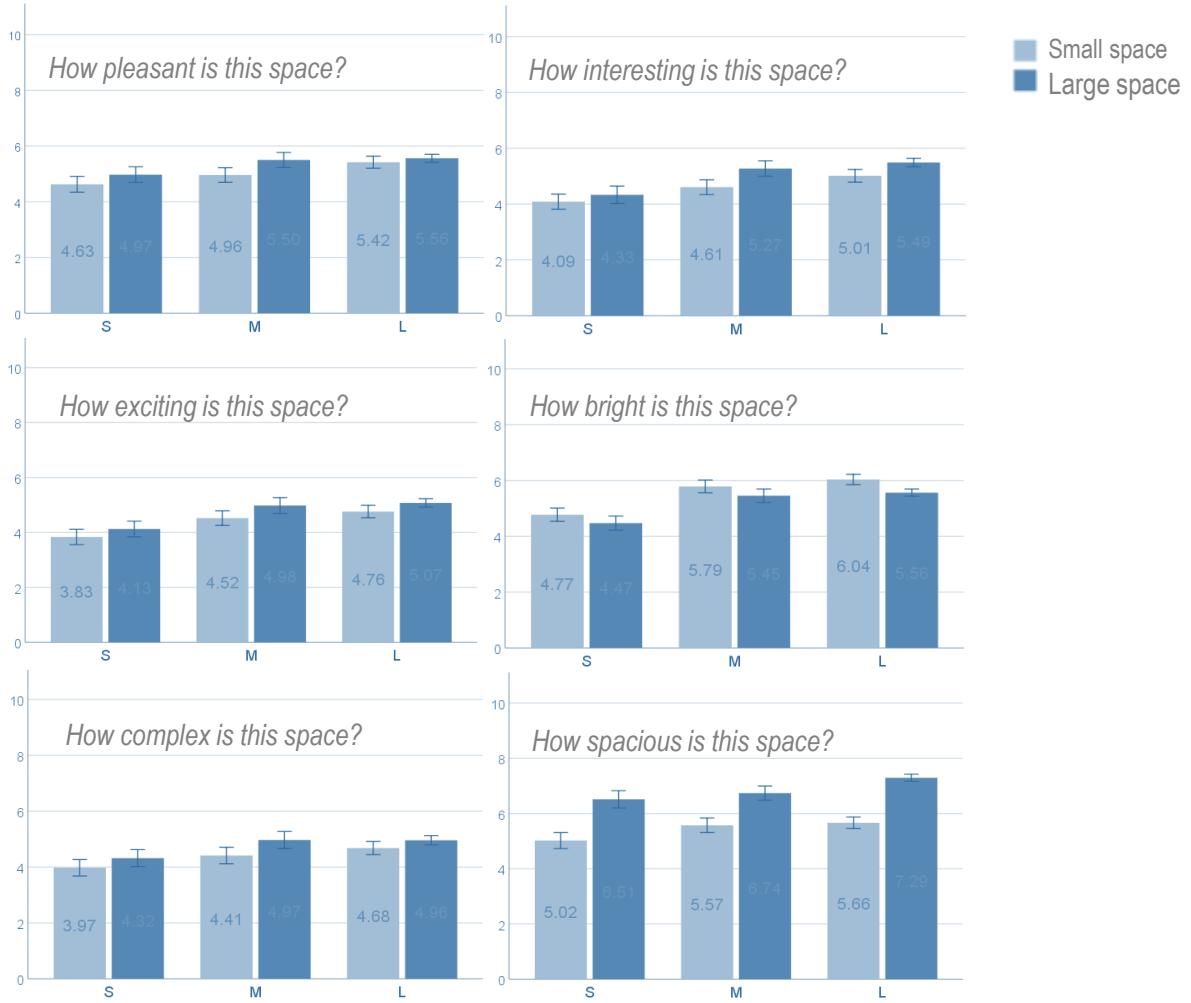
- 150 participants [86 male, 64 female]
- Likert-type scale [11-point scale, from 0 to 10]
- Linear mixed model analysis

Dependent variables and their respective questionnaire items	
Pleasantness	How pleasant is this space?
Calmness	How calming is this space?
Interest	How interesting is this space?
Excitement	How exciting is this space?
Brightness	How bright is this space?
Complexity	How complex is this space?
Spaciousness	How spacious is this space?
Amount of view	How satisfied are you with the amount of view?

3 | RESULTS

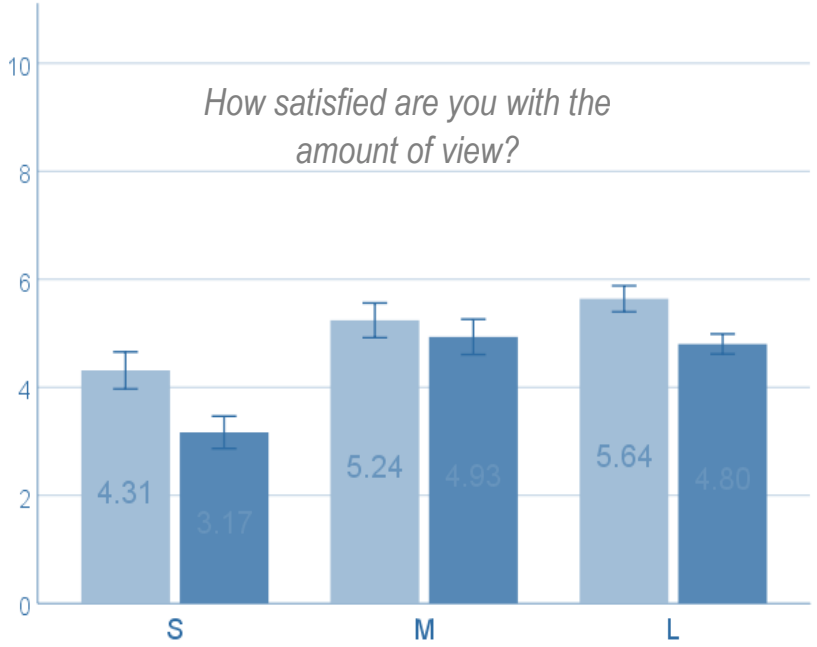
- Main factors: all significant *ps* < 0.0001
- Three studied 2-way interactions:
  - Window size * Context - *ns*
  - Window size * Sky Type - *ns*
  - Window size * Space – *Satisf. Amount of view*

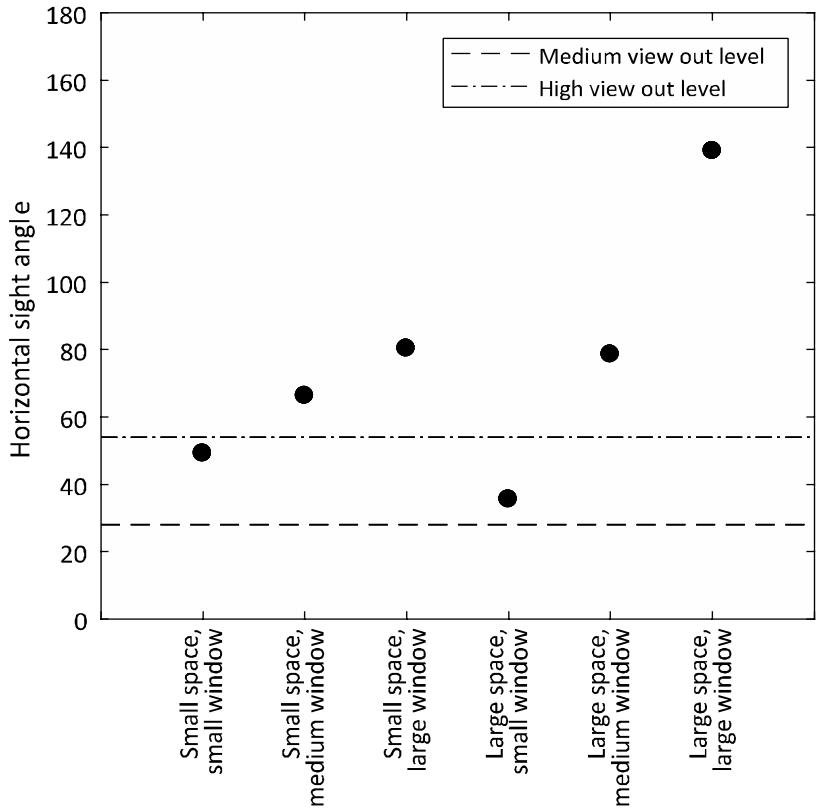




3 | RESULTS

- Distribution of horizontal sight angle from the observer's viewpoint across the studied stimuli, according to the European Standard EN 17037:2018.





3 | RESULTS

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Post-hoc pairwise comparisons of the three window sizes for seven of the studied attributes. Estimates β (comparison: row minus column) and adjusted significance levels are shown for pairs with significant differences.

Pleasantness				**Interest**				**Excitement**			
	S	M	L		S	M	L		S	M	L
S				S				S			
M	0.421**			M	0.726*			M	0.764*		
L	0.672*	0.25****		L	0.961*	ns		L	0.893*	ns	

Brightness				**Complexity**				**Spaciousness**			
	S	M	L		S	M	L		S	M	L
S				S				S			
M	0.997*			M	0.538*			M	0.389**		
L	1.225*	0.228***		L	0.570*	ns		L	0.798*	0.408*	

Satisf. amount of view			
	S	M	L
S			
M	1.343*		
L	1.774*	0.431*	

*Significance levels: *=0.000, **=0.001, ***=0.015, and ****=0.039.*

4 | CONCLUDING REMARKS

- Evaluations of *pleasantness, interest, excitement, brightness, spaciousness* and *satisfaction with the amount of view* increased as the window size increased.

- Satisfaction with the amount of view seems to be dependent on other factors, such as the space in which the window is placed.

- For the perception of *interest*, *excitement* and *complexity*, there seems to be an 'upper threshold' for window preference.

- Obs! Studies made at high latitudes, studies comparing window size preferences on different latitudes are forthcoming…

Thank you for your attention.

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