



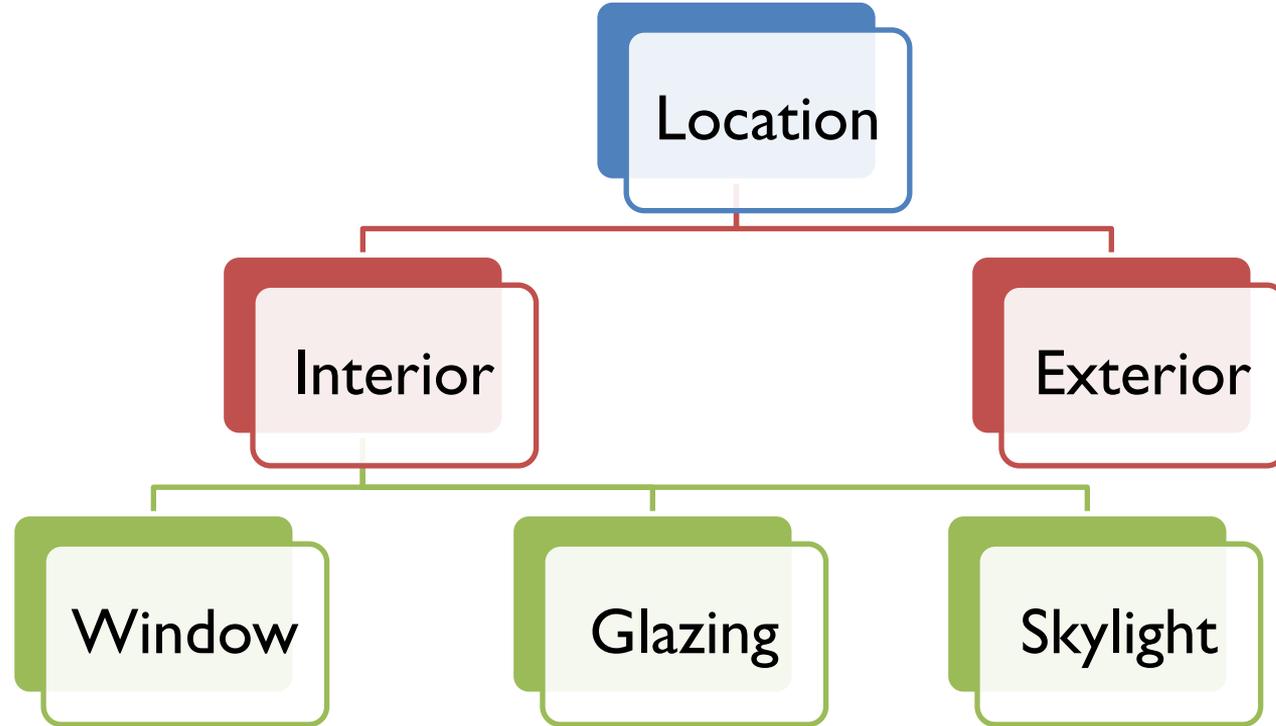
Quantifying View: A Way Forward To Statistically Analyzing The Effect Of View On Human Performance

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View (noun) :The things that can be seen from a particular place.



Why is it important?

- Worker stress reduction and satisfaction (Cuttle, 1983; Shin 2007)
- Improvement in performance (Kaplan 2001; Shin 2007)
- Influence recovery in institutionalized patients (Ulrich 1984)
- Reduction in mental fatigue (Velarde et al. 2007)
- General sense of well being (Finnegan and Solomon, 1981)



Limitations of Past Research

- View has never been ‘quantified’
- Many factors have not been taken into account
- Have been limited to only external factors (natural or man-made)



Project

- EPA funded project (No. R835633): “Evidence-Based Interactions between Indoor Environmental Factors and Their Effects on K-12 Student Achievement”.
- Lighting, acoustic and air quality.
- Lighting factors: Spatial Daylight Autonomy (sDA), Annual Sunlight Exposure (ASE) and View



Variables Involved

Geometric Impact

- Position of subject
- Direction facing

External Factors

- Weather
- Scenery (Built/Natural)

Proposed Methods

Configuration Factor (CF)
Method

Direction of Sight (DoS)
Method



CF Method

- Configuration factors (CF) are used in E calculations to account for the geometric impact a surface has at a particular point or area.
- The CF can be found out at any point on a plane either parallel or perpendicular to the surface.

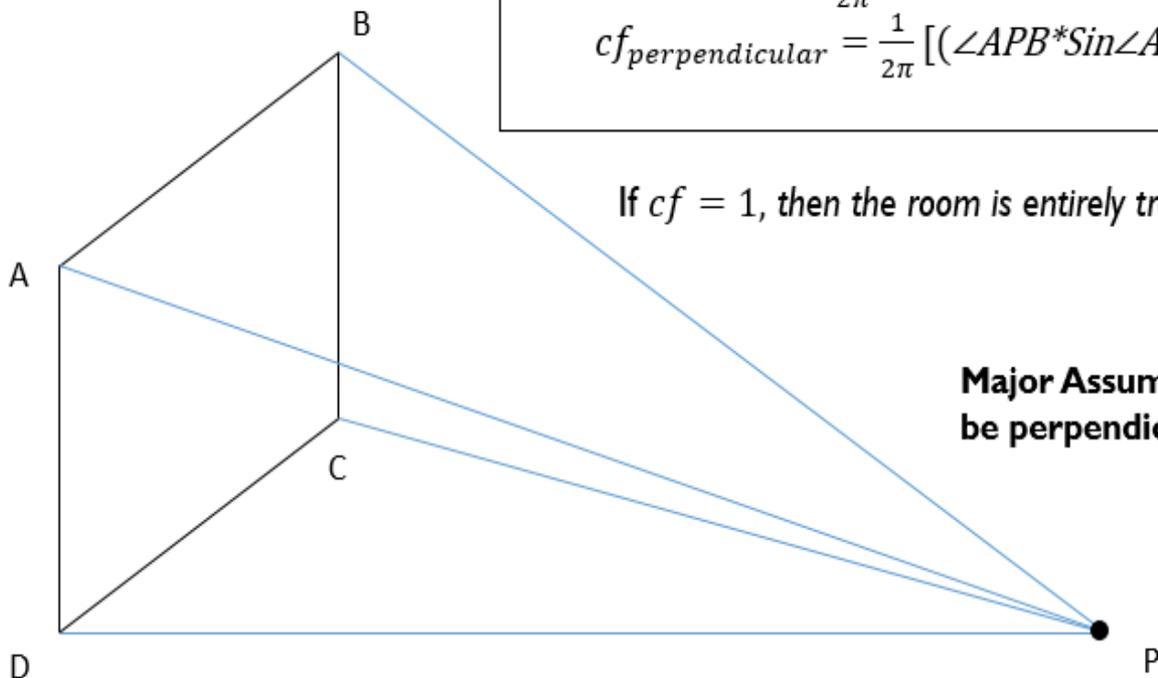


CF Method

$$cf_{parallel} = \frac{1}{2\pi} [(\angle APB * \sin \angle APD) + (\angle BPC * \sin \angle CPD)]$$
$$cf_{perpendicular} = \frac{1}{2\pi} [(\angle APB * \sin \angle APD) + (\angle BPC * \sin \angle CPD)]$$

If $cf = 1$, then the room is entirely transparent.

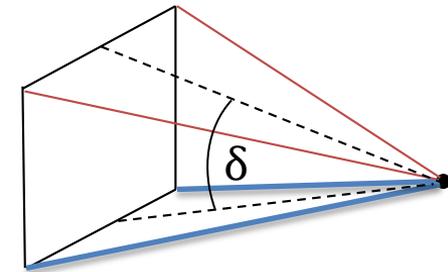
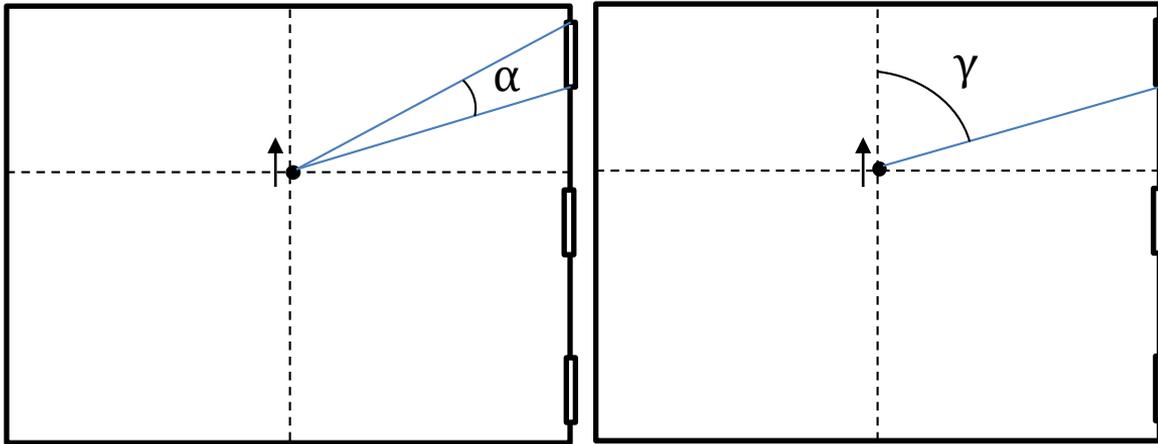
Major Assumption: The point P has to be perpendicular to one of the corners



- For points that do not lie on a line perpendicular to the corner, the method of superposition can be used to determine the configuration factor.

DoS Method

- Takes into consideration position of subject and direction of sight.
- Quadrant-wise measurement.
- Windows outside field of view are not included in calculations.

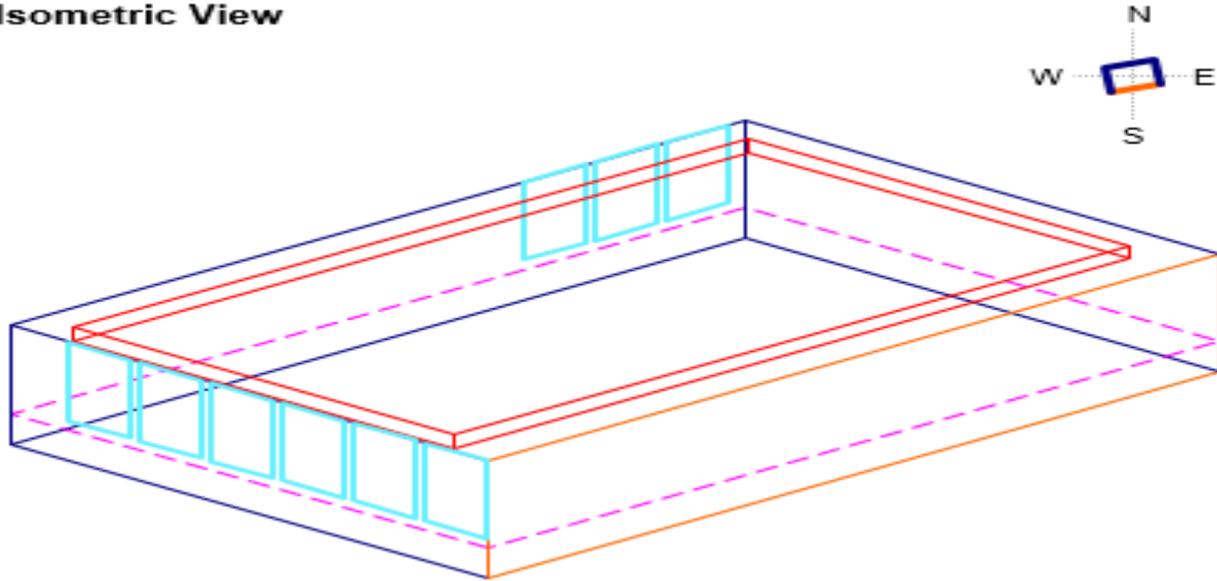


$$VF = \sin\alpha * \cos\gamma * \sin\delta$$

Case Study

- Classroom at Westbrook Elementary School, Omaha.

Isometric View

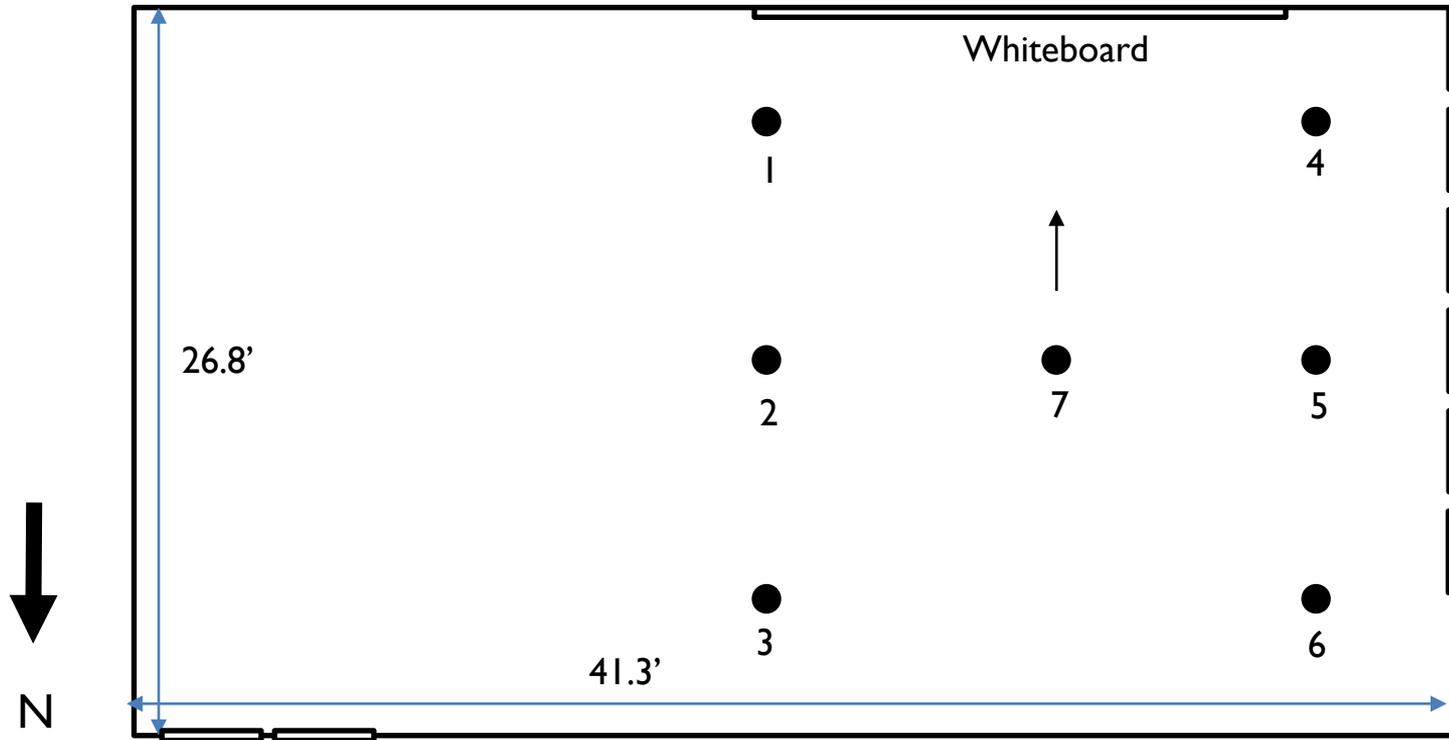


Initial Observations and Assumptions

- Eye level at 40" AFF (46" for Middle Schoolers)
- Whiteboard is on the South wall.
- Window dimensions: 6.6 ft L * 3.3 ft W
- View factor calculated at 7 points over the rectangular seating area.



Dimensions and Calculation points



Calculations and Results

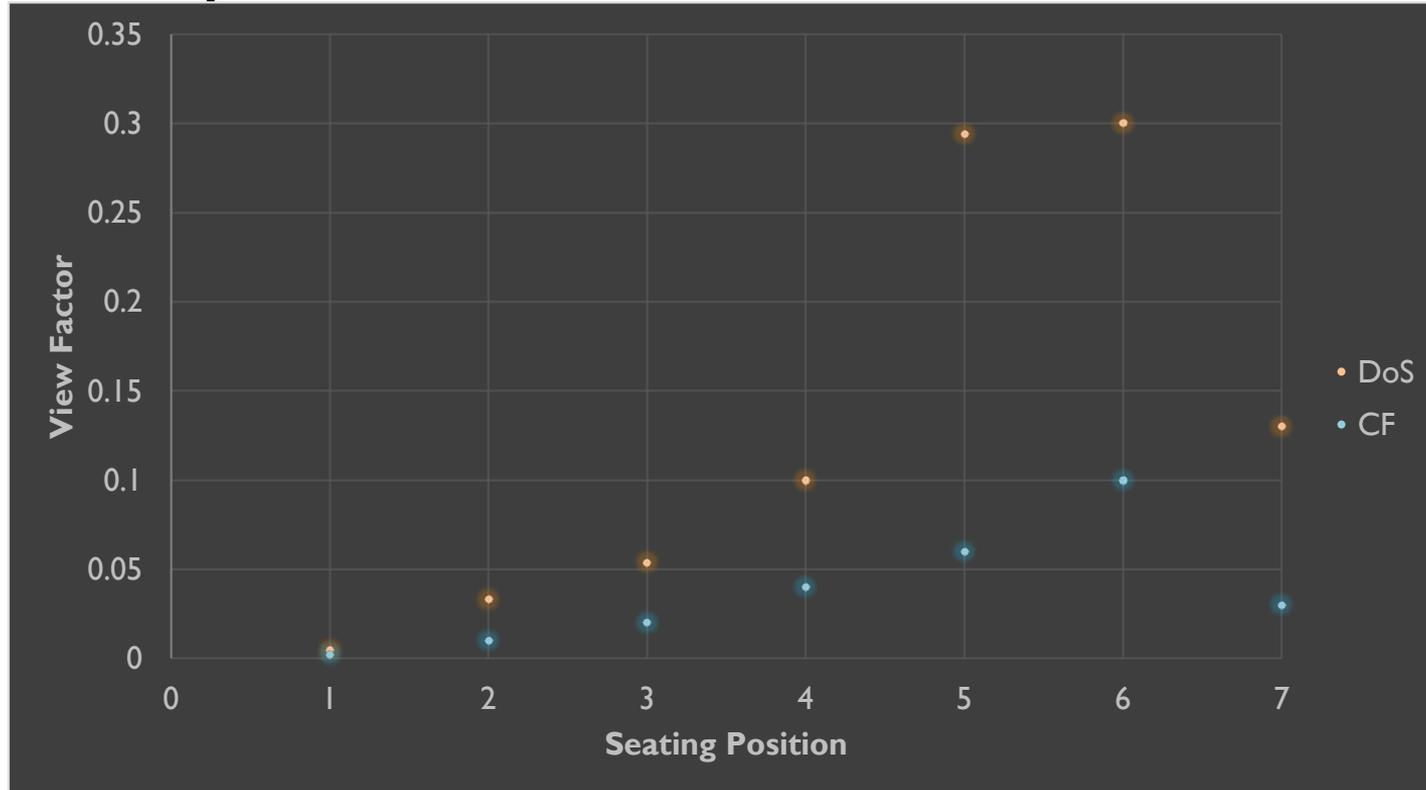
CF



DoS



Comparison



Work in Progress

- Statistical significance of these values.
- More complex calculations involving multiple eye positions.
- Implementing external factors into view calculation.



How NMIs and CORM can help

- Development of a view metric.
- Expert inputs on measurement protocols.
- Funding projects exploring the view metric.



References

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THANK YOU

QUESTIONS AND COMMENTS

