Improving Design Decision-Making Through A Re-Representation Tool For Visual Comfort Consideration In Dynamic Daylit Spaces

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**Introduction**

**Visual Comfort**

"That state of mind that expresses satisfaction with the visual environment."

Walter Grondzik

Visual comfort is one of the key elements of lighting quality. Discomfort is most often caused by an excessive contrast in perceived brightness.
Visual Adaptation

Visual system limits

Visual adaptation
Aspects of Visual Discomfort

Visual Discomfort Aspects

Glare
- Disability Glare
- Discomfort Glare

Light Quality
- Color
- Contrast

Amount of Light
- Distribution
A study showed that occupants’ salary represent the highest cost among all building energy consumption cost. Over a 30-year life, salaries account for 94% of a building’s total cost (Council, 2003).
Visual Comfort Evaluation

Concept

Architect

Visual Comfort Condition

Redesign

Schematic Design

Visual Comfort Aspects Evaluation

3D-mass & Circulation

Visual Comfort Analysis and Simulation
Tool Development Journey

1. Literature Review
2. Problem Identification
3. Initial Daylighting Survey
4. Initial Prototype (Version1) + Logical Argumentation
5. Members Checking
6. Prototype (Version2)
7. Immersive Case Study - Members Collaboration
8. Delphi
Visual Comfort Evaluation Tool - Framework

Tool Framework Overview

1- Data input
- 3D-Model
- Geographical location
- Sky condition
- Date and time
- Materials properties
- Building orientation
- Surroundings
- Examined space
- Circulation path

2- Analysis and simulations
A-Light distribution Evaluation (Illuminance)
Useful Daylight Illuminance

B- Contrast Evaluation (Luminance)
Luminance contrast ratio

C- Glare Evaluation (Luminance)
Daylight Glare Index and Daylight Glare Probability

3- Final Evaluation
Discomfort occurrence
Final visual discomfort condition

4- Designer decision
Redesign

Results and Conclusions
Visual Comfort Evaluation Tool

1- Introduction
   - Download and Installation Instructions
   - Basic Definitions

2- Simulation Input
   - Geometry
   - Days and times
   - Circulation Passage
   - Geographical location

3- Evaluation Process
   - Evaluation Metrics
   - Visual Comfort Aspects
   - Evaluation Results Representation
   - Visual Comfort Condition

4- Final Visual Comfort Condition
   - Save results
   - Final Designer decision
   - View different aspects effects
Dynamic Visual Comfort
Evaluation Tool

INTRODUCTION

TUTORIALS

PROCEED TO
EVALUATION
Visual Comfort Evaluation Tool
Visual Comfort Evaluation Tool
Dynamic Visual Comfort Evaluation Tool
Dynamic Visual Comfort Evaluation Tool
Dynamic Visual Comfort Evaluation Tool
Dynamic Visual Comfort Evaluation Tool

2. Visual Comfort Evaluation: Glare

a. DGP(avg) condition: 0.20 = Subtle
   - Subtle: perceptible
   - Disturbing: 0.33
   - Intolerable: 0.53

b. DGI(avg) condition: 18.4 = Perceptible
   - Subtle: perceptible
   - Disturbing: 18
   - Intolerable: 31

Play Passage Glare Evaluation
Dynamic Visual Comfort Evaluation Tool

Central zone: adjacent zone: non-adjacent zone = 1:3:10

Light Quality effect: Subtle
Dynamic Visual Comfort Evaluation Tool

Final Evaluation result
Perceptible Glare*

Play walkthrough video
June 21- (9AM)
June 21- (12 Noon)
June 21- (3PM)

Apply Effects
DGP
DGI
Central vision

Save Results  Place Building on Google Earth  Evaluate Another Design

*Perceptible Daylight Glare Index (DGI): there is perceptible glare sensation
THANK YOU!

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