Radiance in Practice:
A Consultant's Perspective

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Outline

1. **Background – consulting environment**
2. **Other lighting design software**
3. **Moving towards Radiance**
4. **Examples**

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Enermodal Engineering Ltd.

- **Sustainable building design (low energy use, better indoor environments)**

- **Mechanical, electrical, LEED & green consulting**

- **Research oriented (daylighting, energy studies)**

- **Just getting started with Radiance**

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Consulting Engineering

- **Generally paid a flat rate for services**
- **Contracts are often won in a competitive bid**
- **This means the daily work of a consultant is a race against the clock (to be profitable now) while satisfying client objectives (to be profitable in the future)**

Electric Lighting Design

- **Engineers run simulations with commercial lighting simulation packages (i.e. Lithonia Visual, Lumen Designer, AGI32)**
  - **These packages have limitations, but (generally) do what they are designed for well**
- **Emphasis is generally on numbers: i.e. 500 lux, 2% daylight factor**
- **Typically electrical consultants design lighting and only target work-plane illuminance**

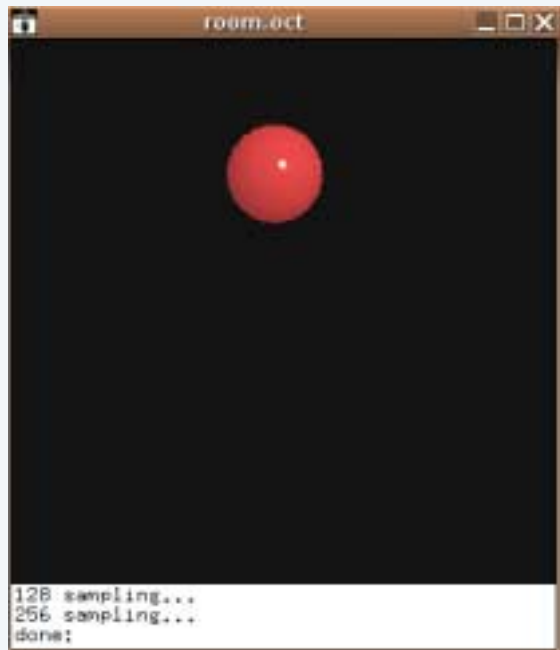# Typical Engineering Software
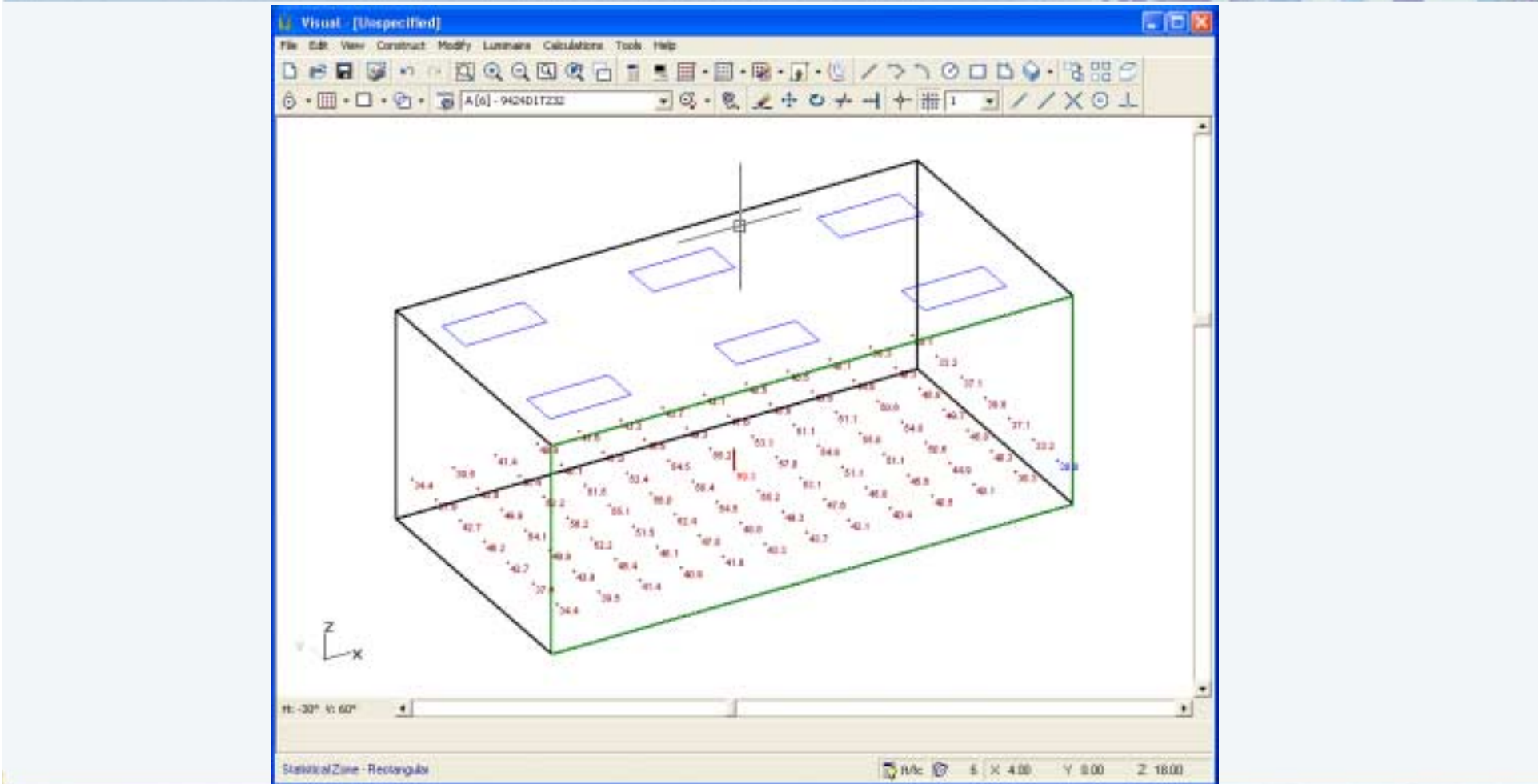
Ultimate Lighting S/W Criteria

- **Minimise time while maximising accuracy**
- **Pictures are great – as long as they mean something**
- **Quick to get numerical results**
- **Easy to model common spaces**
- **Integrated daylighting and electric lighting**

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Enter the Radiance

- **Useful for demonstrating finer points of lighting/daylighting design**

- **Models have been verified by people with letters after their names**

- **Modeling of most construction materials**

- **Daylighting and electric lighting together**

- **Open architecture - easy to develop programs to extend what's already there**

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First Impressions

- **… but then asked to do a comparison of several daylighting measures**
- **It took way longer than expected**
- **Why struggle?**
  - **Commercial s/w frustrating**
  - **I saw future possibilities**

My Radiance Use

- **Still a Radiance Novice™**
- **What do I use Radiance for?**
  - **Some lighting simulations**
  - **Daylighting simulations/evaluations**
- **Have been using Radiance via Cygwin**
  - **Trying out running Linux through VMWare**
- **Have written custom Python scripts**
  - **Analysis, generation**

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Lessons Learned

- **Success with Radiance in consultancy hinges on workflow**

- **Model -> Check -> Analyse -> Repeat**

- **The lack of a unified view (i.e. a GUI) poses a problem to some**

  - **In addition to pictures, consultants need numbers**

  - **However, a bad GUI is worse than the command line**

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Modeling

- `!genbox` **combined with** `xform`
  - **Covers just about everything**
- **Use** `rshow` **(hint: shift-R) and** `rvu`

Analysis

- **Need grid of illuminances**

- **Hacked together a script:**

```
                           ~/rad_sims/st_pats_2/all_glass                    □ ×
mshewfelt@mshewfelt-wxp ~/rad_sims/st_pats_2/all_glass
$

mshewfelt@mshewfelt-wxp ~/rad_sims/st_pats_2/all_glass
$ ../gengrid.py -o render.oct --ab 1 --lx 0.1 --ly 4 --rx 10 --ry 4 --ht 0.85
echo '0.1 4.0 0.85  0 0 1' | rtrace.exe -I -ab 1 -dj 0.7 -ds 0.15 -dt 0.05 -dc 0.5 -dr 3 -sj 0.7 -aa 0.15 -ar 128
r 8 -h -w render.oct
( 0.1, 4.0, 0.85 ): 940.9347294 lux
echo '0.6 4.0 0.85  0 0 1' | rtrace.exe -I -ab 1 -dj 0.7 -ds 0.15 -dt 0.05 -dc 0.5 -dr 3 -sj 0.7 -aa 0.15 -ar 128
r 8 -h -w render.oct
( 0.6, 4.0, 0.85 ): 18223.1065455 lux
echo '1.1 4.0 0.85  0 0 1' | rtrace.exe -I -ab 1 -dj 0.7 -ds 0.15 -dt 0.05 -dc 0.5 -dr 3 -sj 0.7 -aa 0.15 -ar 128
r 8 -h -w render.oct
( 1.1, 4.0, 0.85 ): 20927.5337735 lux
echo '1.6 4.0 0.85  0 0 1' | rtrace.exe -I -ab 1 -dj 0.7 -ds 0.15 -dt 0.05 -dc 0.5 -dr 3 -sj 0.7 -aa 0.15 -ar 128
r 8 -h -w render.oct
( 1.6, 4.0, 0.85 ): 581.721181 lux
echo '2.1 4.0 0.85  0 0 1' | rtrace.exe -I -ab 1 -dj 0.7 -ds 0.15 -dt 0.05 -dc 0.5 -dr 3 -sj 0.7 -aa 0.15 -ar 128
```

- **Future: graphical grid display**

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Challenges for Consultants

- **Modeling can be tricky**
- **Virtual light sources are hard to understand**
- **Few graphical tools for analysis**
- **UNIX-based environments and software are unfamiliar to some**
- **Not enough specific tutorials (I'll try)**
- **Need a powerful computer (2+ procs)**

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Examples

- **Presentations on green design for RAIC**
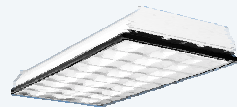- **New construction in Toronto**
- **Daylighting system study**

RAIC Presentations

- **Wanted to show "footcandles don't tell the whole story"**

- **National Research Council – people like bright vertical spaces**
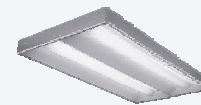
- **Radiance output = immediate response**

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RAIC Presentations

2-T8 Parabolic

2-T5 Lensed

Desk Illuminance: 400 lux
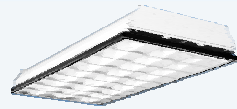
LPD: 8.8 W/m2

Desk Illuminance: 400 lux

LPD: 9.1 W/m2

RAIC Presentations

2-T8 Parabolic

2-T8 Pendant

Desk Illuminance: 400 lux

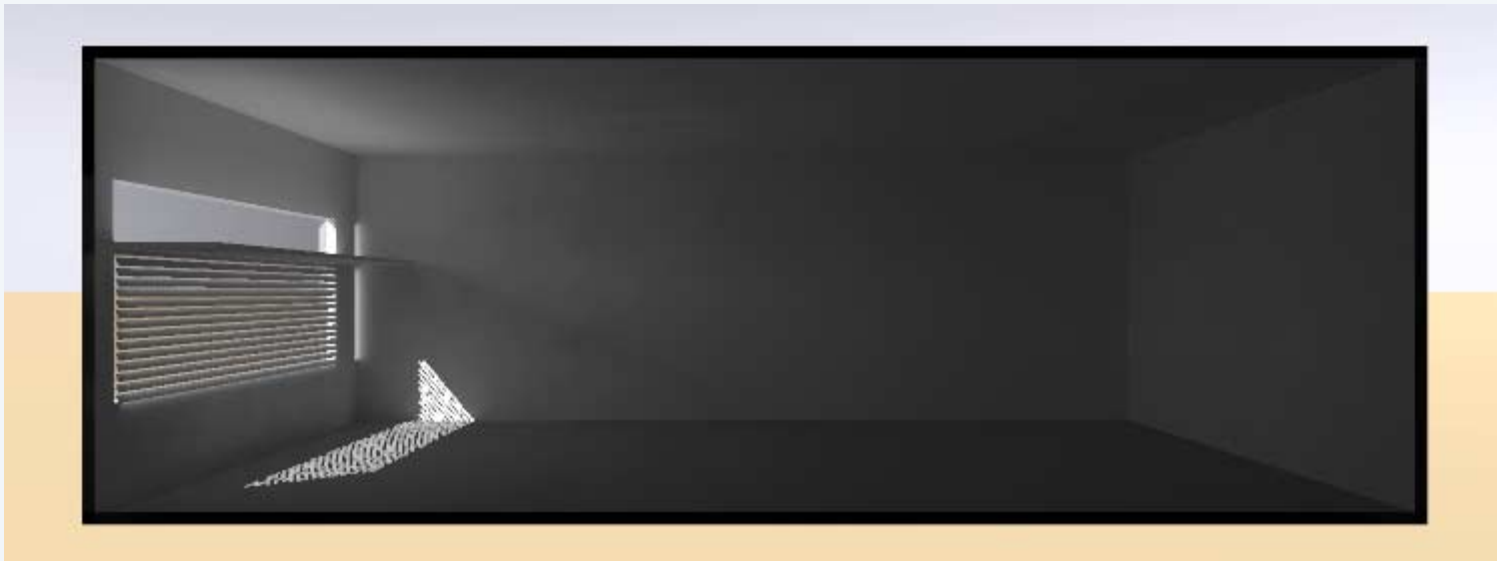Desk Illuminance: 400 lux

LPD: 8.8 W/m2

LPD: 8.5 W/m2

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Daylighting System Study

- **Wanted to compare Solera, Frosted Glass, Light Shelf for daylighting efficiency**
- **Needed to produce a graph of illuminance values vs. distance from window**
- **Hard to model translucent materials in other packages**
- **Client wanted pictures**
- **Demonstrated daylighting systems c/w blinds**
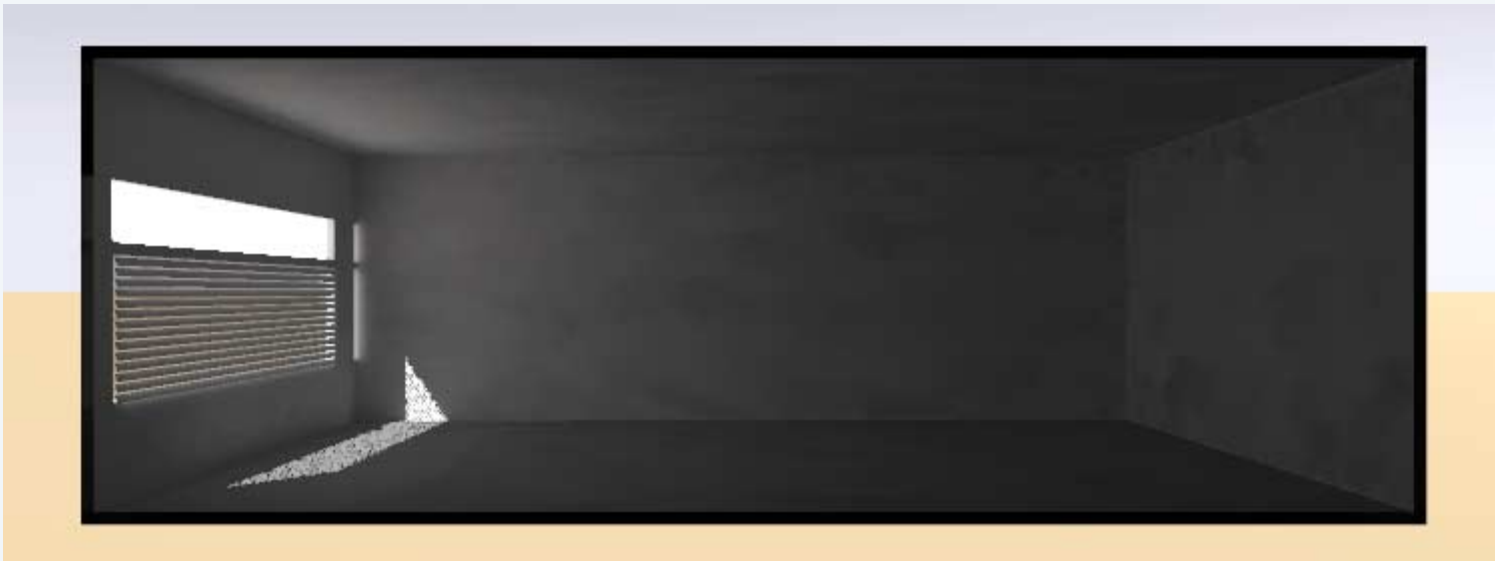
Daylighting System Study

- **Light Shelf**

Daylighting System Study
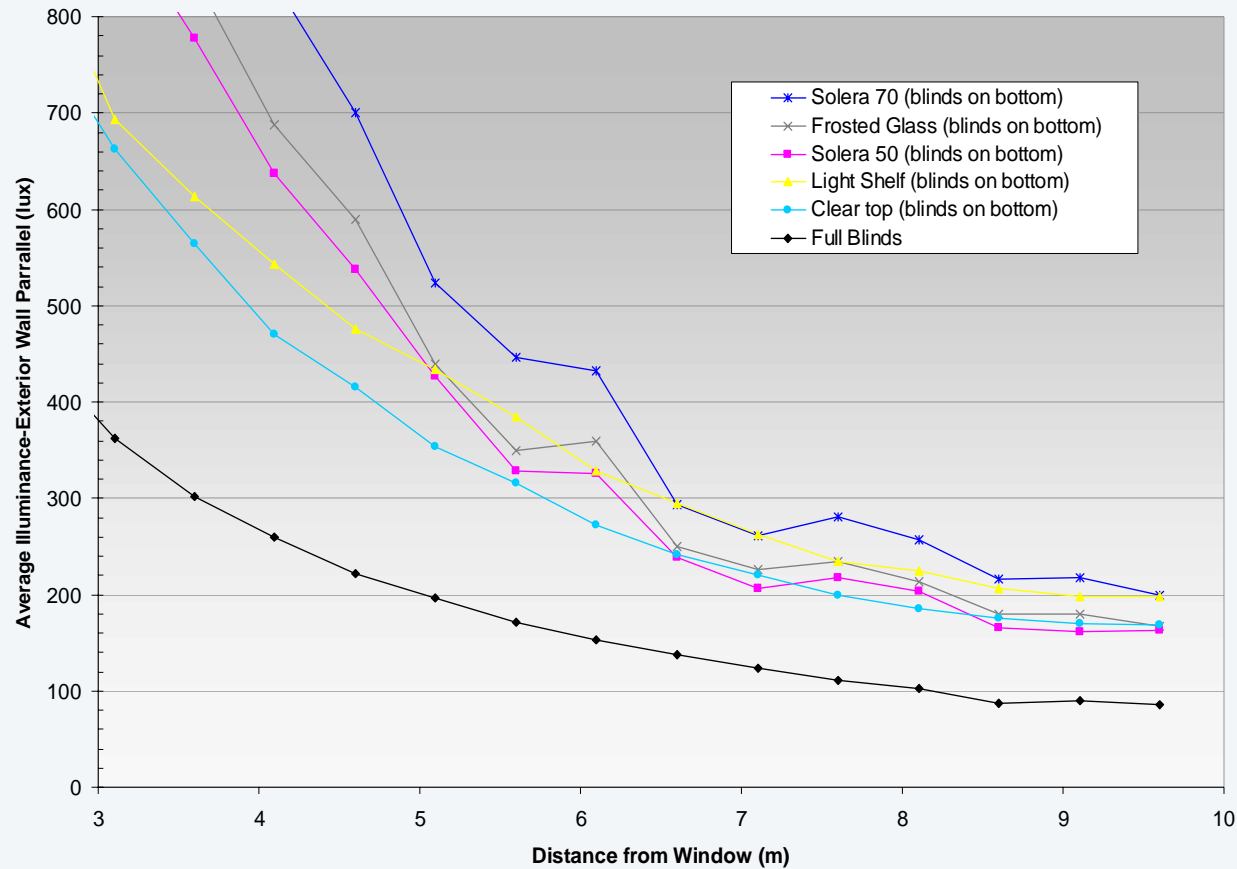
- **Solera Glazing**

Daylighting System Study

Workplane Illuminance at 1 m, March 21 2:00 pm

Conclusion

- **Radiance is a worthwhile tool for consultants to use**
- **It's unconventional, but that's a good thing**
- **My future plans:**
  - **Develop own library of objects/materials/skies**
  - **Pre-setup projects**
  - **Need to abstract all the difficult bits**
  - **Improve analysis tools**