Symposium on Lighting and Human Performance
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The Future of Lighting Design

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Introduction

• RIBA Plan of Work*

A  Inception  G  Bills of Quantities
B  Feasibility  H  Tender Action
C  Outline Proposals  J  Project Planning
D  Scheme Design  K  Operations on Site
E  Detail Design  L  Completion
F  Production Information  M  Feedback

*www.a4a.sk/RIBA-outline.htm
Introduction

• The Future of Lighting Design: Enabling Performance

  – how do lighting practitioners practice currently?
  – which technological developments will fuel changes in practice?
  – how will lighting practitioners practice in the future?
  – what guidance and tools will they need?
Study Approach

• how do lighting practitioners practice currently?
  – Renzo Piano
  – Speirs and Major Associates
  – James Carpenter

• which technological developments will fuel changes in practice?
  – new sources
  – sustainable design

• how will lighting practitioners practice in the future?
  – Renzo Piano
  – Speirs and Major Associates
  – James Carpenter
Findings

• #1 Renzo Piano
  
  – determine the needs of the client
  – conceptualise the roof shape using hand-drawn sketches
  – computer simulation
  – full-scale mock-ups often on site
Findings

• #2 Speirs and Major Associates

  – Inception and Feasibility: consider the project possibilities and budget
  – Concept Design: generation of lighting design and communication to the client
  – Scheme Design: lighting equipment schedule and calculations
  – Detailed Design and Production: final lighting layouts and equipment specification drawn by hand or in CAD
  – Construction, Focussing and Programming: review and commissioning of the lighting installation
Findings

• #3 James Carpenter
  - collaborative projects with client, architect, designers and artists over long periods (~ 4 years)
  - use of full-scale mock-ups to test structural integrity of systems and lighting effects
Findings

• new light sources

  – light emitting diodes (LEDs)
    • current efficacy 25 - 30 lmW^{-1}; in 10 years white LEDs will possibly yield 100 lmW^{-1}
  – organic light emitting diodes (OLEDs)
    • large area, thin polymer multilayer electroluminescent film (≈ 100 - 500 nm thick) ‘tuned’ to any colour
  – possibilities: lighting is no longer a lamp and luminaire combination - walls and ceilings can be sources of light; the potential to create visual boundaries without actual structure
Findings

• sustainable design

  – at the macro scale - plans by the Japanese for the development of future cities - “hyper-cities” - to harness sustainable technology centrally controlled
Findings

• sustainable design
  
  – at the scale of the individual building - ‘hybrid’ lighting combining four technologies
  
  • collection of natural light (solar collector)
  • generation of artificial light
  • transportation and distribution of light where needed (optical fibres)
  • continuous control of natural and artificial lighting during use

  (Digital Addressable Lighting Interface (DALI) for control of lighting components)
Findings

• sustainable design

  - at the **micro** scale - possible energy savings (improved insulation or rejection of unwanted heat gain) by dynamic control over the spectral characteristics of glazing
    • electrochromics
    • reflective hydrides
    • liquid crystals
    • suspended particle displays
    • photochromics
    • thermotropics
Findings

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Analysis

- RIBA Plan of Work - stages susceptible to change?

A  Inception          G  Bills of Quantities
B  Feasibility        H  Tender Action
C  Outline Proposals  J  Project Planning
D  Scheme Design      K  Operations on Site
E  Detail Design      L  Completion
F  Production Information  M  Feedback
## Conclusions and Design Impacts

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G = guidance  
T = toolkit
Conclusions and Design Impacts

C OUTLINE PROPOSALS

- **Guidance** on the human subjective response to complex luminance patterns produced by the extensive use of OLED room surfaces
- **Guidance** on the appropriateness of ‘hybrid’ lighting systems for different world climatic regions
- **Toolkit** to enable the prediction of the photometric performance of LED arrays
- **Toolkit** to enable the prediction of the dynamic performance of glazing systems with variable spectral characteristics
Conclusions and Design Impacts

- **D SCHEME DESIGN**
  - **Guidance** on the planning approval issues with the extensive use of OLED surfaces (internally and externally)
  - **Guidance** on the planning approval issues for development that is required to harness centrally controlled sustainable technology at the scale of the hyper-city
  - **Toolkit** to enable complex building system modelling for ‘hybrid’ lighting systems which use multiple technologies
  - **Toolkit** to demonstrate that glazing systems with variable spectral characteristics are able to meet appropriate sustainability criteria
Conclusions and Design Impacts

• **E DETAIL DESIGN**
  
  – *Guidance* in the form of a ‘pattern’ book which allows the designer to combine OLED surfaces with conventional architectural elements to promote stimulating, comfortable environments
  
  – *Toolkit* to enable the detail design of LED arrays to produce luminaires of known characteristics
  
  – *Toolkit* to enable the testing and validation of the dynamic performance of glazing systems with variable spectral characteristics
Conclusions and Design Impacts

• F PRODUCTION INFORMATION
  – There is no F PRODUCTION INFORMATION!
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