here offers a powerful insight into urban solar access. More significantly, it paves the way for the formulation of urban design principles where the morphology and fabric of buildings are fashioned in response to the local solar access to maximize their energy-saving potential; one of the goals of urban sustainability.

Notes

1. Standard overcast sky brightness patterns can be mimicked in artificial skies for physical modelling or reproduced exactly for computer simulation studies.

2. These hourly time series are known variously as Test Reference Year (TRY) or Typical Meteorological Year (TMY) datasets. They are readily available for many locales across the developed world and are ordinarily used for dynamic thermal modelling.

3. As well as specifying the position of the sun, the altitude and azimuth also fix the position of the circumsolar region for non-overcast skies.

4. Pronounced IQ.

5. The images are best appreciated in colour. A set of 'online' colour figures for this Chapter are available from the author.

6. A points-based calculation is one that produces a prediction for one or points in list form. As the list of numbers is not directly associated with the scene geometry, it is impossible to understand the form and variation of solar access in a way that is comparable to the ICUE image-based approach.

7. As is common with 3D models on the web, the San Francisco model was in Virtual Reality Markup Language (VRML) format. The VRML format was designed to be converted to and not from. Thus, there were difficulties in converting it to a form needed for the simulations, and a few polygons were lost in the process (missing roof tops in Figure 19.4). The VRML itself would have been generated from CAD formats such as DXF of 3D Studio. The city model would have imported into the simulation intact had these formats been available.

8. There exists in ICUE a capability to generate time-series irradiation data for selected pixels as well as cumulative totals. The possibility of generating an image representing some summary of the degree of occurrence of transient effects is currently being investigated.

9. The San Francisco Financial District is used once again because it was the most complex city model available to the author at the time.

10. The algorithms that compute the total facade area are not exact and the degree of imprecision will depend on the building form. In particular, facades on re-entrant building surfaces may be partially accounted for. However, these usually make up only a small percentage of the total facade area. This is a minor imprecision in the context of the wealth of previously unobtainable data and insight delivered by the ICUE system.

11. That is, not a physically correct lighting simulation.

12. The 'jaggies' in the contour lines result from sampling the continuous motion of the sun at discrete intervals. Here, the sampling is equivalent to a sun position sampled at intervals of less than 1 hour throughout the year. The 'jaggies' can never be entirely eliminated, but they can be reduced with greater computational effort (i.e. more frequent sampling).

13. There are believed to be instances where a new building with a highly reflective facade causes 'injury' on neighbouring buildings by reflecting solar radiation onto them and increasing their cooling load.

References

Butti, K. and Perlin, J. (1980) *A Golden Thread: 2500 Years of Solar Architecture and Technology*, Van Nostrand Reinhold, New York.

Department of Trade and Industry (DTI) (2000) *Photovoltaics in Buildings: BIPV Projects* ETSU S/P2/00328/REP, London.

International Energy Agency (IEA) (1998) *Photovoltaic Power Systems Programme – Strategy Document 1998–2002*, International Energy Agency, London.

Knowles, R. (1981) *Sun Rhythm Form* Cambridge, MIT Press, Massachusetts and London.

Mardaljevic, J. (1995) Validation of a Lighting Simulation Program under Real Sky Conditions. *Lighting Research and Technology* **27(4)**: 181–188.

Mardaljevic, J. (1997) *Validation of Lighting Simulation Program: A Study Using Measured Sky Brightness Distributions*, Lux Europa 97, Amsterdam, Proc. 555–56.

Mardaljevic, J. (2001) The BRE-IDMP Dataset: A New Benchmark for the Validation of Illuminance Prediction Techniques. *Lighting Research and Technology* **33(2)**:117–136.

Mardaljevic, J. (2002) Quantification of Parallax Errors in Sky Simulator Domes for Clear Sky Conditions. *Lighting Research and Technology* **34(4)**: 313–332.

Mardaljevic, J. (2002) Shadowlands. *The Architects' Journal*, **215 (9 May)**: 44–46.

Mardaljevic, J. and Rylatt, M. (2003) Irradiation Mapping of Complex Urban Environments: An Image-Based Approach. *Energy and Buildings* **35 (2003)**: 27–35.

Rubinstein, F.D., Jennings, J., Avery, D., and Blanc, S. (1999) Preliminary results from an advanced lighting controls testbed. *IESNA 1998 Annual Conference*, San Antonio, TX, 10–12 August 1998, and published in *Journal of the Illuminating Engineering Society*.

Ward Larson, G. and Shakespeare, R. (1998) *Rendering with Radiance: The Art and Science of Lighting Visualization,* Morgan Kaufmann, San Francisco.