

**Trigonometric and Astronomical Tables in Medieval Islam:  
The Hidden Craft of Numerical Computation**

Glen Van Brummelen  
Bennington College  
Paris, March 15, 2004

**Introduction**

**Meeting Astronomical Needs**

- Models of the sun's motion; eclipses
- Determining the positions of the planets
- Ritual needs: the qibla, lunar crescent visibility, prayer times

**Tabular Solutions**

- The zīj and other sources of mathematical/astronomical tables
- Trigonometric tables: improving accuracy
- Solar tables: the mean motions and equations
- Planetary tables: the problem of double arguments
  - Ptolemy
  - Kūshyār ibn Labbān
- Multi-purpose tables of “auxiliary functions”
  - Shams al-Dīn al-Khālīlī

**Mathematical Methods of Table Construction**

- Tables of sines and  $\sin(1^\circ)$ 
  - Ptolemy
  - Al-Kāshī
  - Al-Samaw'al
- Interpolation in theory (quadratic, cubic)
- Interpolation in practice (“distributed” linear interpolation)
- Use of trigonometric identities
- Simplifying the use of the tables: shift and displacement

**Unlocking Tables' Secrets with Statistical Methods**

- Reconstructing numerical parameters (Benno van Dalen)
- Determining interdependence between tables (Glen Van Brummelen)

**Conclusion**