

# TABLE OF CONTENTS

A POETIC SUMMATION	13
INTRODUCTION	17
EXECUTIVE SUMMARY	21
CHAPTER 1: Preliminaries	29
CHAPTER 2: Framing the Issues	35
CHAPTER 3: Defining Terms	47
CHAPTER 4: The Science of Twilight	63
CHAPTER 5: Exploring the Legal Issues	97
CHAPTER 6: Astronomy and Prayer Time Determination	183
CHAPTER 7: Analysis of Observational Studies	239
CHAPTER 8: Reflections & Recommendations	265
APPENDIX A: What is a Madhab?	305
APPENDIX B: Tracing the Fatwa for the People of Bulghar	313
APPENDIX C: An Example of Early Situational Ethics	331
APPENDIX D: Muslim Engagement with Astronomy	333
APPENDIX E: A Stratification of Observational Quality	341
BIBLIOGRAPHY	345

## INDEX OF TOPICS

CHAPTER 1: Preliminaries	29
1.1 Islam and the natural world	29
1.2 The imperative to follow qualified scholarship	30
1.3 Respecting valid differences of opinion	33
CHAPTER 2: Framing the Issues	35
2.1 Counsel to the Lay Muslim	42
2.2 Counsel to Those Who Determine Prayer Timetables	44
CHAPTER 3: Definitions	47
3.1 Islamic legal definitions	48
3.2 Modern astronomical definitions	50
3.3 The importance of clear definitions	53
3.3.1 Categories of definitions	55
3.4 Disambiguating Islamic and astronomical terms	56
3.5 The categorisation of twilight periods	57
3.6 The relationship between scientific and Islamic definitions of dawn	60
CHAPTER 4: The Science of Twilight	63
4.1 The importance of the science of twilight	63
4.2 The sky at night	65
4.3 A description of twilight	67
4.4 The science of twilight	68
4.4.1 The properties of light	69
4.4.2 Refraction of light	70
4.4.3 Scattering of light	70
4.4.4 Sun-earth position	72
4.4.4.1 A precis of geographical variation	72
4.4.4.2 Solar transit variation across latitudes and seasons	73

## *Introduction*

4.4.5	The effect of latitudinal variation on worship	75
4.4.5.1	Long days, late prayers	75
4.4.5.2	The observation of dawn	76
4.4.5.3	Long twilights	77
4.4.5.4	Persistent twilight	80
4.4.6	Atmospherics	82
4.4.6.1	Atmospheric variation with latitude	84
4.4.7	The Optical system	85
4.4.7.1	The Functioning of the Eye	86
4.4.7.2	Perception and 'Just-Noticeable' Differences	87
4.5	Light pollution and dark adaption	88
4.6	A description of twilight with added science	90
4.7	Chapter 4 Summary	92
CHAPTER 5: Exploring the Legal Issues		97
5.1	The entry of al-subh al-sadiq	98
5.1.1	Scripture relating to al-subh	99
5.1.2	The Hanafi school on al-subh	105
5.1.3	Issues of practicality and geography	110
5.1.4	False dawn	112
5.2	The entry of Isha	115
5.2.1	The Hanafi school on al-shafaq	116
5.2.2	Other schools on al-shafaq	119
5.3	Astronomical timekeeping techniques	121
5.4	The non-entry of Isha	123
5.4.1	The obligation of isha in the absence of its time	124
5.4.1.1	The location of Bulghar	124
5.4.1.2	The position of non-obligation of isha	126
5.4.1.3	The position of continuing obligation	127
5.4.2	Disconnecting prayers from their times	130
5.4.2.1	The Hadith of the Days of Dajjal	132
5.4.2.2	Understandings of the Hadith	134
5.4.3	Classical approaches to taqdir	136
5.4.3.1	The definitions of taqdir	137
5.4.3.2	Taqdir as determination of a time	138
5.4.3.3	Practical application of classical taqdir	141
5.4.4	Combining maghrib and isha	144
5.4.4.1	Classical opinions combination of prayers	145

## SHEDDING LIGHT ON THE DAWN

5.4.4.2	Combining due to non-entry of isha time	147
5.4.4.3	Issues with combination for non-entry	150
5.4.5	The effect of varying positions on the populace	152
5.4.6	Modern approaches to non-entry of isha	154
5.4.6.1	Modern approaches to taqdir	154
5.4.6.2	Applying different methods of taqdir	156
5.4.7	The entry of fajr in persistent twilight	161
5.5	The fiqh of long fasts	162
5.5.1	The artificially shortened fast	163
5.5.2	A critique of the artificially shortened fast	165
5.6	Principles of hardship and facilitation	169
5.6.1	‘Hardship begets facilitation’	171
5.6.2	‘Harm is to be averted’	173
5.7	Chapter 5 Summary	176
<b>CHAPTER 6: Astronomy and Prayer Time Determination</b>		183
6.1	The Quran, prayer times and astronomy	183
6.2	Muslim engagement with astronomy	185
6.3	Astronomers, jurists and the prayer times	187
6.3.1	Folk astronomers	188
6.3.2	Mathematical astronomers	189
6.3.3	A synthesis between the two	190
6.3.4	The relationship between folk and mathematical astronomy	191
6.4	Classical astronomers on twilight	194
6.4.1	What were the classical astronomers measuring?	194
6.4.2	Are classical and modern measurements directly comparable?	196
6.4.3	Issues of variance and juristic clarity	198
6.5	The astronomer-jurists	199
6.5.1	A 19th century summation on juristic astronomy	200
6.6	Modern questions on prayer time determination	203
6.6.1	The western Muslim community	204
6.6.2	Calculation as a basis	206
6.6.3	Calculation based on historical observation	207
6.7	High-latitude observational studies	210
6.7.1	The first attempts at a UK observational calendar	210
6.7.2	The Hizb al-Ulama sightings	212

## *Introduction*

6.7.2.1	Critique of Hizb al-Ulama	215
6.7.3	The Preston Observations	218
6.7.4	A light-meter enhanced study	219
6.7.5	The Open-fajr study	220
6.8	Mid-latitude observational studies	222
6.8.1	Structured mid-latitude studies	223
6.8.2	Other mid-latitude studies	226
6.9	Chapter 6 summary	233
CHAPTER 7: Analysis of Observational Studies		239
7.1	Analysis of major UK observational studies	240
7.1.1	Hizb al-Ulama 1988	240
7.1.2	Preston observations 2008	245
7.2	The Subh Project 2012-3	248
7.2.1	Confounders of twilight observation	249
7.2.2	Methodology and limitations	252
7.2.3	A sample dawn-sighting observation record	255
7.2.4	Results and analysis	257
7.2.5	Conclusions	264
CHAPTER 8: Reflections & Recommendations		265
8.1	The observation of dawn and dusk	267
8.1.1	The use of cameras to determine dawn	267
8.2	The legal commencement of fajr and the fast	269
8.2.1	The determination of al-subh al-sadiq	271
8.2.2	The occurrence of al-subh al-sadiq in the UK	273
8.3	The legal entry of isha	274
8.3.1	The determination of ghuyub al-shafaq in the UK	275
8.4	Dealing with isha at high latitudes	277
8.4.1	The obligation of isha in the absence of its time	279
8.4.2	Taqdir of isha in the absence of its time	280
8.4.3	Navigating a very late isha (VLI)	284
8.4.3.1	Dealing with VLI in the presence of an isha time	284
8.4.3.2	Dealing with VLI in the absence of an isha time	286
8.4.3.3	Utilising a legal stratagem to mitigate VLI	287

## SHEDDING LIGHT ON THE DAWN

8.4.3.4	The benefits of utilising the stratagem	289
8.4.3.5	The practical outcome of the stratagem	292
8.4.3.6	The issues with current timetables and VLI	293
8.4.4	Performance of tarawih during VLI	294
8.5	The length of summer fasts and hardship	295
8.5.1	Artificially shortening a long fast because of hardship	295
8.5.2	The commencement of the fast during persistent twilight	296
8.5.3	Navigating the days leading up to persistent twilight	298
8.6	Summary conclusions	299
8.6.1	Principles of time determination	299
8.6.2	The time of dawn	300
8.6.3	Isha and persistent twilight	301
8.6.4	The onset and length of the summer fast	301
8.6.5	Constructing a prayer timetable	302

## LIST OF TABLES

Table 1:	Twilight start, end and duration in Birmingham and Cairo	78
Table 2:	The time taken for the sun to rise from 18-16° below the horizon in Birmingham and Cairo through the year	80
Table 3:	Times of morning and evening twilight in over ten days in mid-summer in London	81
Table 4:	Prayer time calculation according to the nearest city timings	142
Table 5:	Ratios of twilight based on the nearest 'moderate' latitude for solar depressions of 12°, 15° and 18°	157
Table 6:	Isha and Subh times in Aberdeen using moderate latitude taqdir	157

## *Introduction*

Table 7:	Durations of persistent twilight assuming different angular depressions	158
Table 8:	Times of Isha and Fajr with different methods of taqdir – London, 22nd June	159
Table 9:	Times of Isha and Fajr with different methods of taqdir – Aberdeen 22nd June	160
Table 10:	Summary of Modern Observations	230
Table 11:	Hizb al-Ulama Fajr Observations vs Calendar	241
Table 12:	Hizb al-Ulama Isha Observations vs Calendar	242
Table 13:	The Preston Isha Observations in Terms of Angular Depression	246
Table 14:	Times of observations for the Subh Project	257
Table 15:	Angles of observations for the Subh Project	258
Table 16:	The difference in first light in areas of low and high light pollution	262
Table 17:	A Summary of the Subh Project findings	263
Table 18:	The switch between al-abyad and al-ahmar at the changing of the clocks and its effect on isha time in Edinburgh	277
Table 19:	The timings of isha in Taunton in summer at 12° and 15°	285
Table 20:	The timings of isha in Bradford in summer at 12° and 15°	286
Table 21:	The approximate annual times of isha in Bradford using various methods	288
Table 22:	The shifts in isha time in Bradford at the major change points using the hila	290
Table 23:	The latest isha times and duration above 11pm for cities in the UK/Eire	292
Table 24:	A full chronology of the Isha obligation debate	326
Table 25:	Stratified rating of twilight observations	343

## LIST OF DIAGRAMS

Figure 1: Stages in the perception of light	68
Figure 2: The spectrum of light	A
Figure 3: The absence of light scattering without an atmosphere	A
Figure 4: Atmospheric scattering of light	A
Figure 5: Blue skies and red sunsets	A
Figure 6: True night – no scattering of light	A
Figure 7: The scattering of light throughout twilight	A
Figure 8: The earth’s orbit of the sun	A
Figure 9: The sun’s passage through the sky in summer	A
Figure 10: The sun’s passage through the sky in winter	A
Figure 11: The elevation of the sun at noon on the summer solstice seen from different latitudes	A
Figure 12: The sun’s passage through the sky in different seasons in a high latitude country	A
Figure 13: The sun’s transit in high latitude countries in summer	A
Figure 14: The variation of the sun’s passage in mid-latitude countries in summer and winter	A
Figure 15: The sun’s transit during high summer leading to persistent twilight	A
Figure 16: Reduction in solar light intensity by solar depression	79
Figure 17: Classical options in taqdir	144
Figure 18: A breakdown of the early debates around the obligation of isha	318