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ESSAY REVIEWS

# AVENI HONOURED

*Skywatching in the Ancient World: New Perspectives in Cultural Astronomy. Studies in Honor of Anthony F. Aveni.* Edited by Clive Ruggles and Gary Urton (University Press of Colorado, Boulder, 2007). Pp. xxiv + 392. $65. ISBN 978-0-87081-887-5.

Complete with personalized Foreword, Preface, and an entertaining "Partner's perspective", the front matter of this volume generates a camaraderie appropriate for this festschrift to Anthony Aveni. Beyond that, the volume comprises an introduction proper along with eleven substantive chapters by most of the established names in the field. Six chapters focus on Mesoamerica, two on Andean topics, one on Hawai'i, and the final two consider European related subjects.

Insofar as the volume is intended to reveal "a cohesive whole" meshing with Aveni's field-defining work, as the editors state (p. 4), it clearly delivers — virtually all chapters connect non-trivially to the content of *Skywatchers*, Aveni's landmark publication of 1980. In the title and Introduction, though, the editors suggest a second agenda. Namely, they claim a development of archaeoastronomy, from what they describe as "undisciplined" to what in this volume represents the field's move into "cultural astronomy". If we consider cultural astronomy to be the companion of the move from Processual to Post-processual archaeology — one reflecting a concern with social context, the Linguistic Turn, and the constructivism that modulates the "real" — then the collection of essays here represents a spectrum of work toward its realization. Five chapters successfully realize cultural astronomy methodologies, three are traditionally archaeoastronomical (more at home in the New Archaeology), and three others entered the volume primarily because of the contributors' professional relationships with Aveni.

The two chapters that best reflect a cultural astronomy approach were contributed by the editors themselves. Gary Urton brings a Proskouriakoffian lens to Inka iconography, suggesting that ritual knowledge may find representation in multiple media. He turns to tapestry in search of a non-khipu means for recording calendric information within a mantle containing 1,824 *tukapus* (iconographic constructs). Urton handles the question of intent by looking to the construction of the mantle and finding that it was assembled in a way suggesting that the sizes of the *tukapus* were "manipulated" to "fit the available space" (p. 252) — a complication often faced (and differentially addressed) by scribes of Mayan hieroglyphic text. Urton then argues that the *tukapus* iconographically fit into a near-yearly structure, and that sub-patterns within allow for there to have been as few as "26 distinct place names, even designations, or identities within a five-year calendrical framework" (pp. 261–2). At this time, only the ability to cross-reference individual *tukapus* with those from other tapestries, or the more general cracking of their iconography, will determine whether this is the beginning

of a decipherment, or just a provocative, yet unverifiable hypothesis. Either way, Urton provides a strong claim for considering this patterned mantle within a larger cultural tradition sensitive to the polyvalence of ritual knowledge.

His co-editor Clive Ruggles takes on the architecture of Hawai'i with a judicious consideration of the potential *and limitations* of the available data. He looks broadly at the *heiau* (temples) of Hawai'i within their Polynesian context and then focuses on one locality, Kahinikinui. The key to Ruggles's method is that he first quantitatively categorizes temples by "elevation and distance from shore" (p. 307), allowing him to group them in terms of coastal, N-facing, E-facing, and ENE-facing subgroups. He then finds astronomical *as well as* non-astronomical inspirations for the subgroups considered individually, making subtle use of ethnohistorical records to justify an ENE orientation to the Pleiades.

The third solid contribution to cultural astronomy in this volume is Stephen McCluskey's, which resonates with that of Ruggles in the moderated task it sets up for proper archaeoastronomical methods. McCluskey begins by recognizing the vast number and variety of sources available for work on medieval Europe, yet suggests that archaeoastronomy may still contribute. McCluskey considers the orientations of English churches by means of a "curvigram" method to find a statistically relevant orientation to equinox sunrise of those churches dedicated to All Saints. Without explicit textual support, McCluskey is forced to infer through 'universality' the association between the equinoxes and the celebration of All Saints. Both Ruggles's and McCluskey's statistical moderation of their data allows them to reveal astronomical knowledge as part and parcel of broader cultural agendas.

More within the cultural astronomy fold than not, two chapters in the book complement each other by raising a fundamental, if now largely dismissed, methodological question of calendric continuity across regional communities. In one, John Justeson and David Tavárez shoulder the formidable challenge of recovering the Zapotecan calendar as maintained during the mid-colonial period. The authors look for correlation among a selection of dates given in both Zapotecan and Spanish calendars within booklets recovered by the Inquisition. Of 103 such booklets, Justeson and Tavárez tackle eight in seeking to reconstruct "the colonial Northern Zapotec calendar". Displaying meticulous detective work, they invoke palaeography, historical analogy, dominical calendric practices, and linguistics of three colonial Zapotecan languages, virtually all of which is impressive and convincing. Their overall claim should be taken with caution, however, because of their sample size (of the eight booklets, only three provide the foundation of and an unambiguous corroboration for the reconstructed calendar) and because they do not have full linguistic representation between sample and population.

In their aim, though, Justeson and Tavárez directly engage the following chapter by Edward Calnek. He turns to Postcontact Aztec times to examine three different sources giving two different dates for Hernán Cortés's entry into Tenochtitlan. Because Alfonso Caso assumed universal subscription to a single 260-day count, he handled the conflict by arguing that Sahagun's date was wrong — an error caused by faulty

back calculation — so that no contradiction actually exists. Calnek, however, goes back to Paul Kirchoff's (unpopular) proposal that Sahagun's date was not mistaken; it simply reflected the (dissonant) calendric practices of two cities within the Aztec Empire. Calnek then proposes that the two dates were recorded correctly in their respective traditions, but that the Codex Borbonicus records a 20-day revision by Tenochtitlan relative to that of Tlatelolco. Through provocative re-readings of otherwise well-known records, Calnek's contribution re-vivifies Kirchoff's argument and increases the cloud of ambiguity around Caso's claims.

Of larger import, though, is Calnek's challenge to Caso's presumed uniformity among Mesoamerican daykeeping practices. Here, Calnek's argument is buttressed by a substantial amount of data on calendric *dis*continuity: nine different contemporaneous year names in Central Mexico in Precontact times, with mention of "several dozen more" contributed by Munro Edmonson (pp. 85–86). Such calendric diversity at the heart of the Aztec Alliance challenges assumptions that calendric universality was the norm throughout ancient Mesoamerica. Indeed, it may be that contemporary scholars are held under the hegemony of Classic Mayan historiography, leading to presumptions of calendric universality, which may instead have been maintained idiosyncratically by the Long Count.

A stronger adherence to a cultural astronomy approach, I might add, would not have begun in Justeson's and Tavárez's chapter with the premise of recovering "*the* Northern Zapotec colonial calendar". Rather, it would have begun by asking whether a common calendar existed at all. A focus on the 'cultural' would investigate whether local calendars had been kept, how they might have betrayed alliances or dependencies, or reflected some other social/cultural influence. Such an approach also would bring archaeoastronomy further in line with Post-processual archaeology (and the history of science). On the other hand, to question calendric continuity and uniformity is to assume an extremely unpopular position and to discourage such work as that presented in this volume by Harvey and Victoria Bricker and by Dennis and Barbara Tedlock, which depends explicitly on the GMT correlation and carries continuity along by assumption.

Squarely within traditional archaeoastronomy, the Brickers tackle a computational problem related to the Venus Table of the Dresden Codex. Given the correction mechanisms built into the table, they join several scholars (including John Teeple, Eric Thompson, and Floyd Lounsbury) in attempting to match hypothetical calendric sequences with reconstructions of the synodic location of Venus during Terminal Classic and Postclassic times (*c.* A.D 800–1500). The Brickers utilize computational tools not available to Lounsbury along with a different calendar correlation to look for the best "warning table". There are some questionable linguistic interpretations in the paper (e.g. the "identities" of Venus), but their work for this article does not depend on them significantly. To their intended end, the article succeeds in finding that the oldest variant of the GMT (584,283) does the best job of anticipating Venus first visibilities.

The Tedlocks also look to real-time observations for their work on a different

portion of the Dresden Codex. They begin with a very straightforward observation: almanacs 33–51 contain ubiquitous representations of the Moon Goddess, yet scholars have not found a coherent lunar structure to the dates within them. Although the observation is straightforward, resolution is far from it, and the authors should be commended for tackling such a vexing a series of almanacs. On the other hand, although readers will gain a substantial familiarity with the almanac through their work, the results are far from convincing. For one, we must be uncomfortable with their use of three non-sequential almanacs among twelve others to read through a sequence of sidereal elements. Such discomfort might be overlooked if the rest of their methodology were more compelling. Unfortunately, many of their hieroglyphic readings are outdated and their approach to iconography constitutes little more than free association. Perhaps most disturbing, though, is their conclusion: "The most important question to ask when choosing such sources is not whether they come from the same Maya era, place, or language as the text under interpretation, but whether they give evidence of astronomical concepts and practices that contrast with those of the West or run contrary to the commonsense notions of Western readers." While one might read such assertions with some sympathy — Aveni has warned since his early work against looking simply for replicas of European or European-descended astronomy in the work of Western-Hemispheric skywatchers — this and their adherence to it go too far.

Susan Milbrath also takes up a portion of a codex and seeks to recover an historical astronomical motivation behind it. Her chapter would have benefited from a stronger editorial hand, as the introduction is far too long (23 of 43 pages) and mostly covers material already in her 1989 publication. Nonetheless, it does point out the rift between the scholars who see an astronomical reading behind the pages in question and those who dismiss it for more general cosmological perspectives. Firmly in the former camp, Milbrath focuses on page 40 of the Borgia Codex, arguing that the imagery resonates with ethnographic descriptions of an eclipse event. She then turns to Karl Taube's iconographic reading of the Bilimek Vessel for corroboration before examining the body of a crocodile, which is composed of day signs and which frames the page. Counting through these day signs, Milbrath reconstructs an eclipse period of 177 days (actually 146 days extended to 167 using erosion-induced ambiguity, and then the desideratum through blank "spaces" interpreted as holding values of 5 days each). Identifying Venus imagery (via Quetzalcoatl imagery in whole and in part), Milbrath finds an historical date with resonant Venus and eclipse observability. Milbrath herself recognizes her inexpert treatment of iconography; yet the more straightforward question to ask is why the authors of the codex would have forgone a Calendar Round date for so important an event in favour of a possibly suggestive pattern of day signs.

The other three chapters (Tom Zuidema's on partitions of the year at Cuzco; Clemency Coggins's on the connections between the number 20 and Mesoamerican concepts of humanity; and Edwin Krupp's on contemporary wizard iconography) are of interest, but bear little methodological relationship to cultural astronomy. Taken

as a whole, however, *Skywatching in the ancient world* does make good on its first promise to honour Aveni's singular position in the development of archaeoastronomy, speaking to the scope of his influence. In its second aspiration, though, more attention might have been given to Ruggles's suggestion that "… astronomy must form *part* of the method and *part* of the interpretation: the sky must neither be ignored completely nor studied to the exclusion of everything else…" (p. 320) for all the papers to have provided us with "new perspectives in cultural astronomy".

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## ASTRAL PROJECTIONS AND PIES IN THE SKY

*Imagination des Himmels*. Edited by Franziska Brons (*Kunsthistorisches Jahrbuch für Bildkritik*, v/2; Akademie-Verlag, Berlin, 2007). Pp. 108. €29.80. ISBN 978-3-004362-3.

> "The eye comes always ancient to its work, obsessed by its own past and by old and new insinuations of the ear, nose, tongue, fingers, heart, and brain."
>
> Nelson Goodman[1]

*Introduction*

The past fifty years have seen extensive and often heated debate among historians of the sciences over the extents to which personal and social passions and commitments have entered into verbal accounts of the world. However, despite the burgeoning literature on visual representation in the sciences, the treatment of such projections of human interests in the domain of images remains sparse.[2] Why? My suspicion is that conflicting attitudes are at work here. On the one hand there are some who hold images to be incidental to and, at least in principle, dispensable from the real arguments and representations of the sciences. For such historians the structuring of scientific images by personal and social concerns can be at once conceded and dismissed as of marginal import. On the other hand there are many who accept that often in the sciences "a picture is worth a thousand words", but suppose the central and proper role of images to be that of "objective" representation, with their embodiment of personal and social interests again being set aside as marginal. These attitudes are surely misguided. Visual imagery does play a variety of important independent roles in the arguments and representations of the sciences; but, as in the verbal case, expression of personal and social interests and commitments can rarely be tidily separated out from rational argument and objective representation.

The articles in this beautifully produced and well-focused collection consider the various types of projection of human concerns involved in the imaging of the heavens.

Drawing expertly on the history of art and media and paying careful attention to the technicalities of image production, these original pieces bring out the complex and varied ways in which the "objective" representational functions of astronomical images have interacted with their "subjective" embodiments of human ideals and appetencies, hopes and fears.

*Christianizing the Heavens*

Dieter Blume's "Sternbilder und Himmelswesen: Zum Bildgebrauch des Mittelalters" ("Pictures of the stars and the nature of the heavens: On the use of pictures in the Middle Ages") opens dramatically: "Pictures of the stars are projections of humans. It is a matter of projection due to the attempt to create in the inestimable variety the order that we need so as to be able in general to bear the world." Blume here looks at the Christianization of pagan classical images in early medieval computational handbooks and quadrivial texts. Thus we learn how in Gregory of Tours's *De cursu stellarum ratio* the seven sisters of the Pleiades are turned into "harmless grape-angels". (But, I should add, beware: these doctrinally "harmless" angels of Revelation 14 will be far from innocuous when it comes to "trampling out the vintage where the grapes of wrath are stored"!) And we are told how in the miniatures of a showpiece manuscript presented to Charlemagne (the Leiden Aratea) the zodiacal twins assume the form of ideal Christian soldiers. Blume emphasises the way in which geometrical abstraction and narrative vividness are wonderfully linked in these remarkable images, and his general conclusion is that in these tenth-century manuscripts precise portrayal goes hand in hand with the mirroring of human experience.

Simon Schaffer's "Himmlische Mächte" ("Heavenly powers") opens with equal punch: "Which conception a society forms of its ideal state can be read from the way it regards the heavens." After some general remarks on the functions of early-modern celestial maps and globes as symbols of terrestrial and territorial power, he turns to Julius Schiller's *Coelum stellatum christianum* (Augsburg, 1627), a revision of Johann Bayer's *Uranometria* (Augsburg, 1603). Here again, in superb copperplates, we find Christianized heavens, with the Bayer's signs of the zodiac replaced by apostles, his ship of the Argonauts transmuted into Noah's Ark, his Swan metamorphosed into St Helena and the Cross, and so on. Schaffer reads this Christianization as a compensatory response to the political and religious turmoil that culminated in the harsh measures of 1629 against Augsburg's Protestants. The paper concludes with remarks on some later "politicised" images, including the extreme case of Weigel's plan in the 1680s to replace all the ancient constellations with the coats of arms of the ruling houses of Europe.[3]

*Style Wars*

Eileen Reeves's subtle, learned and persuasive "Faking it: Apelles and Protogenes among the astronomers" looks at malicious envy and friendly rivalry in the portrayal

of sunspots as mediated by adoption of the personae of two artists of Antiquity, Apelles and Protogenes. In Book 35 of his *Natural history* Pliny tells of the amicable competition between these two greatest painters of their age, the former famous for his charm and spontaneity and for knowing when to stop, the latter for meticulous accuracy and completeness. Christoph Scheiner took "Apelles hiding behind the painting" ("Apelles latens post tabulam") as his pseudonym in his sunspot letters to Marcus Welser of 1612.[4] Reeves observes how inappropriate this was for one who had invented a pantograph for the exact copying on enlarged or reduced scale of the works of others. She goes on to note how Galileo and his allies denounced Scheiner as "the false Apelles", presenting Galileo as the artist's true heir, appropriately enough given the charm of his lively portrayals of sunspots as malleable and ephemeral phenomena. (It should, however, be noted that Galileo showed distinctly Protogenean tendencies in using Benedetto Castelli's telescopic projection device to obtain exact drawings of the sunspots.[5]) Reeves tells also of another competition with Galileo, friendly this time, engaged in by a pseudonymous Protogenes (perhaps the Venetian nobleman Agostino da Mula), who circulated his rival views on sunspots among Galileo's supporters.

*Data, Raw and Cooked*

The three remaining articles deal specifically with the needs for skill and the opportunities for imagination opened up or eliminated by new techniques and media of visual representation. Alex Soojung-Kim Pang's "The industrialization of vision in Victorian astronomy" looks in detail at techniques of production of astronomical images from the 1840s to around 1900, that is, the period of introduction and consolidation of photography. Though some in the period imagined, with Agnes M. Clerke, that with photography "stars should henceforth register themselves", in fact, as Pang shows, rather than eliminating the need for artisanal expertise and judgement the transition from drawing and lithographic or steel-plate engraving to photography and photogravure created a need for new skills:

> [T]he reality of photomechanical reproduction was more complicated than the ideal: artisanal skill and judgment were still required to give plates just the right appearance of non-intervention. The difficulty of astronomical subjects guaranteed that they would have to be treated with special care and attention. Halftones of nebula photographs could only be made using dense screens, special papers and inks.... Photogravure was a very delicate process that also required skilled hands and experienced eyes.

Thomas Fechner-Smarsly's "'Die Welt für sich und die Welt für uns': August Strindbergs Celestografien" ("'The world for itself and the world for us': August Strindberg's celestographies") offers reflections on the extraordinary images Strindberg obtained by exposing photographic plates directly to the night sky (images that I find unsettlingly reminiscent of the grimmer passages in his violent seascapes and

cloudscapes). Strindberg declared of these images that they gave the "motion of the world and the actual appearance of the vault of heaven independently of our misleading eyes". He was in deadly earnest about the scientific value of his celestographies, comparing them with X-rays and trying, without success, to attract the attention of the Société Astronomique de France. Fechner-Smarsly relates Strindberg's remarkable faith in his celestographies to other instances of his belief in natural analogies and correspondences — walnut/brain, sunflower/sun, heavens/chaotic entropic images got by pressing the eyeball hard with the eye closed. Thus it is that he could recognise the celestographies as at once merely chemical "disturbances" and representations of the heavens as they really are, undistorted by eyes and other lenses. At the end of the article Fechner-Smarsly notes how Strindberg's celestographies anticipate surrealist techniques of so-called "automatic drawing". But it is worth remarking that, for all their proto-surreal oddity, they belong to a tradition going back at least to the 1780s with Chladni's famous plates (in which sand patterns reveal nodes of vibration obtained by running a bow along the edge of the plate). Throughout the nineteenth century there was widespread fascination with such self-recording devices through which nature could, so to speak, address us in her own language.[6]

It would be wrong to suppose that imaginative projection was involved only in the earlier phases of photography. Indeed, with the development first of airbrushing and powered erasure, then of computer-generated photomosaics, and now of digital image processing, the opportunities for manipulation and enhancement of images have expanded beyond measure. Charlotte Bigg's "In weiter Ferne so nah [this being the title of a 1993 Wim Wenders film]: Bilder des Titans" ("Faraway. So close! Pictures of Titan") tells how the "raw" images of the surface of Titan, a moon of Saturn, transmitted from the Huygens probe in January 2005 were judged to be disappointing: "indistinct pictures of orange rocks". They were, however, released, probably inadvertently, to the public, some of whom processed them with image-enhancing software to such good effect that the European Space Agency considered putting them on the payroll! The ESA went on to generate its own refinements and enhancements as well as "artist's impressions" of the landing of Huygens, impressions showing a striking similarity to images in science fiction paperbacks of the 1960s. In conclusion, Bigg turns to more strictly scientific matters, indicating how the ESA's analyses of the images familiarized them by drawing analogies between the hypothetical physical processes shaping Titan and those that once shaped the Earth.

*Conclusions*

What general lessons are to be learned from this splendidly original collection of articles?

Objectivity is a profoundly problematic category that has been variously conceived and variously realized in representations.[7] Rarely is it the special prerogative of raw observations and first impressions. Thus in the verbal case considerable artifice may be required to produce the requisite objective "plain prose".[8] Equally, as abundantly

shown in these articles (see, for example, the telling passage from Pang cited above), the production of convincingly objective images is a skilled affair. In fact, the division of the functions of images into objective representation and imaginative projection is problematic even in instances where such a split is *prima facie* plausible. Consider, for example, the manuscript illuminations described by Blume, which so beautifully combine geometrical precision in their location of stars with imaginative and uplifting stories told through the figures of the constellations. Can the latter be dismissed as unscientific, as merely rhetorical? Not so. For, as Blume shows, some of the manuscripts are for the teaching of astronomy, with the constellation figures serving as didactic and mnemonic aids, functions that can be regarded as unscientific only if one is prepared to exclude from science the whole business of retention and transmission of knowledge. And even in such 'iffy' cases as the enhancements of the "disappointing" images of Titan described by Bigg, caution is in order. For, as Bigg indicates, some at least of these enhancements and artistic embellishments exploited genuine analogies with more familiar scenarios, and hence could be justified as reasonable speculations.[9]

A second and related question has to do with the frequent theory-ladenness of astronomical images. Take, for instance, the published depictions of sunspots by Galileo and Scheiner, as presented by Reeves.[10] Scheiner's small copperplates in his pseudonymous *Tres epistolae de maculis solaribus* of 1612 show them as persistent "compact, solid, bulging lumps",[11] a portrayal that manifestly embodies his initial view of them as satellites analogous to those of Jupiter rather than as features of the Sun's surface. Very different are the costly large copperplates in Galileo's *Istoria e dimostrazioni intorno alle macchie solari e loro accidenti* of 1613, which reveal the sunspots' "different densities and blackness, the changes in shape, and the mingling and separation".[12] Galileo was at pains not to commit himself to any explicit positive theory about the nature of sunspots; but he was dead set against Scheiner's satellite theory, and he compared their variable density and opacity to that of terrestrial clouds.[13] His fluid images beautifully convey this analogy. In cases where the type of observation is altogether new it is hard to avoid theory-loading of tendentious question-begging kinds; for by virtue of the novelty there is a lack of precedents and standards with which to check accuracy and guide interpretation. The problem is especially acute when image-processing techniques of the types mentioned by Bigg are employed. For many of the procedures used to filter out noise, combine images, improve object definition, etc., depend upon assumptions about the expected kinds and dispositions of objects, their modes of illumination, their textures, etc. Now there is a vast philosophical literature on the theory-loading of factual verbal descriptions in the sciences; indeed, it has become a standard textbook topic.[14] But there is little comparable in the case of theory-loading of imagery, surprisingly so given the extensive roles of theory-laden images in astronomy and many other sciences.[15] As matters stand, it is far from clear in what terms such theory-loading is to be described and analysed. There is, indeed, much in the representational functions of images that can be governed by well-defined "visual languages" — of perspective,

of projection, of shading to convey depth and shape. Conversely, there are plenty of cases in which textual representation functions through "ecphrasis", the verbal conjuring up of an image. But there is little consensus on how far the analogies between verbal and visual representation hold good.[16] In my view, exploration of the types of theory-loading peculiar to visual representations is a major outstanding task for historians and philosophers of science.

A third question made salient by these articles is that of historical change in the imaging of the heavens. Schaffer mentions *en passant*, in connection with Holbein's *Ambassadors*, Bruno Latour's "Opening one eye while closing the other...: A note on some religious paintings".[17] There Latour postulates a major Western transformation from evocation of *heaven* to depiction of *sky*, from religious "re-presentations" of divine presence in the heaven to accurate and replicable scientific representations ("immutable mobiles", in his jargon) of distant places in the sky. Holbein's masterpiece he reads as an icon of this transformation, its anamorphically distorted portions embodying the waning religious regime of representation of heaven, with the direct images of terrestrial and celestial globes introducing the new scientific regime of sky. Taken together these articles militate against any such simplistic Big Picture of the displacement of religion by science in the domain of images of the heavens. As we may gather from Blume's piece, far back into the medieval period Latour's religious "regime of representation" happily coexisted and combined with his "scientific" regime; and, as may be inferred from the articles of Schaffer and Bigg, the abatement of religious imagery by no means bespoke a transition to a regime of purely scientific and objective representation — for other types of projection of human hopes and fears, interests and commitments took over. But though grand narratives like Latour's are seriously undermined, if not refuted, the question arises: Is there a place for middle-sized pictures of historical change in the representation of the heavens? On this score the contributions of Pang and Bigg, with their careful accounts of the technicalities of image production, are particularly suggestive. For they are indicative of ways in which the types of "objective" representation and "subjective" projection, and their interactions, have changed with the opening up of new opportunities for representation and projection by new visual media. If historically genuine "regimes of representation" of the heavens are to be found, this, I suggest, is the place to look.

Above all this fine volume points to the importance of the visual in the history of astronomy. At every level, from critical editing through to analysis of major disciplinary transformations, historians of the sciences should take images much more seriously.

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7. For a seminal account of contrasting "visual technologies" for objective depiction, see S. Alpers, *The art of describing* (London, 1983); for a fascinating application of Alpers's approach to astronomical imagery, J. Vertesi, "Picturing the Moon: Hevelius's and Riccioli's visual debate", *Studies in history and philosophy of science*, xxxviii (2007), 401–21; for explorations of the variety of ways in which images have aspired to "truth to nature", L. Daston and P. Galison, *Objectivity* (New York, 2007), and articles by them there cited.
8. On the rhetorical nature of the early Royal Society's "plain prose", see B. Vickers, "The Royal Society and English prose style", in B. Vickers and N. S. Struever, *Rhetoric and the pursuit of truth: Language change in the seventeenth and eighteenth centuries* (Los Angeles, 1985), 1–76. *Cf*., in a very different vein, Roland Barthes's analysis of the factual "scientific code" of the medical case history used by Poe in "The facts in the case of M. Valdemar": Barthes, "Textual analysis of Poe's 'Valdemar'" [1973], transl. by R. Young, in R. Young (ed.), *Untying the text* (London, 1981), 133–61.
9. On the difficulties of discerning legitimate from 'dodgy' image enhancement, see Lynch and Edgerton, *op. cit*. (ref. 2).
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11. As aptly described by Bredekamp, *op. cit.* (ref. 5), 220–1.
12. Galileo, *Opere*, ed. by A. Favaro (Florence, 1890–1909), v, 117, as cited by Biagioli, *op. cit*. (ref. 5), 73.
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15. For valuable reflections on the roles of hypotheses in perception and visual representation, see E. H. Gombrich's classic *Art and illusion: A study of the psychology of pictorial representation* (London, 1960); on the roles of collective "thought styles" in directing perception and picturing

in the sciences, L. Fleck, "To look, to see, to know" [1947], in R. S. Cohen and T. Schnelle (eds), *Cognition and fact: Materials on Ludwik Fleck* (Dordrecht, 1986), 129–51; on theory-loading of geological imagery, M. J. S. Rudwick, *The great Devonian controversy* (Chicago, 1985), chap. 3.

16. The classic philosophical work on visual languages is Nelson Goodman's *Languages of art: An approach to a theory of symbols* (London, 1969), Goodman's approach being convincingly developed by John V. Kulvicki, *On images: Their structure and content* (Oxford, 2006). For important observations on this issue, see M. J. S. Rudwick, "The emergence of a visual language for geological science 1760–1840", *History of science*, xiv (1976), 149–95, and Alpers, *op. cit.* (ref. 7).
17. In Fyfe and Law, *op. cit.* (ref. 2), 15–38.

*JHA*, xl (2009)

## BOOK REVIEWS

### SUMERO-AKKADIAN STAR NAMES

*Zvezdnoe nebo drevnei Mesopotamii: Shumero-akkadskie nazvaniia sozvezdii i drugikh svetil [The Star Heaven of Ancient Mesopotamia: Sumero-Akkadian Names of Constellations and Other Heavenly Bodies]*. G. E. Kurtik (Aletheia, St. Petersburg, 2007). Pp. 744. 1800 R. ISBN 978-5-903354-36-8.

Scholarly priests of ancient Mesopotamia were devoted observers of the sky and generated numerous documents mentioning celestial bodies, their movements and attributes. The large book by Gennady Kurtik is an extended lexicon of the names of stars, constellations, and planets appearing in Mesopotamian cuneiform texts between the third and first millennium B.C. The idea of such a compilation is not new, of course, and the author himself underlines that his work is a continuation of Felix Gössmann's *Planetarium babylonicum* (Rome, 1950), published as fascicle IV.2 of the first Sumerian dictionnary issued by Anton Deimel. However, after the publication of this forerunner to *Zvezdnoe nebo*..., new texts were discovered, some readings of cuneiform signs changed, previous interpretations frequently were abandoned, and thus Gössmann's book is largely outdated.

The lexicon updated and expanded by Kurtik contains 440 entries in alphabetical order. Some of them are limited to two or three verses, but there are also such important star names as Bull of Heaven or Scorpion, which need dozens of pages for their description. For names that appeared more frequently in original Mesopotamian texts, the article may be divided into several parts. First, there is information about possible name variants and reference to original texts mentioning the celestial body, chiefly lexical series, lists of astral omina (as *Enuma Anu Enlil*), purely astronomical

documents (e.g. *MUL.APIN*), or sometimes magical and ritual tablets. This part includes short quotations of original texts in transliteration and translation. After this lexical definition, several paragraphs discuss the deities associated with a given constellation, star or planet, its symbolism, iconography or — in case of some constellations — names of their parts. If possible, the modern identification is presented, sometimes with a short review of different opinions. The final but usually longest part of an article is devoted to astrology, or rather astromancy (although the author never used the term астромантия). This concluding passage lists omina mentioning the celestial body and its associations with other such bodies.

This catalogue fills more than 600 pages of the book; another 70 contain indices, concordances with Gössmann's entries, Sumerian and Akkadian terms in transliteration, geographical names, names of celestial bodies in cuneifoirm script, and concordances with modern constellations, stars and planets. Unfortunately, all these indices lack references to the page numbers where these terms appear. The author also did not include indices of deities and the cuneiform sources. For such lexica, the more indexing the better, a rule obviously not adopted here. If, for example, you seek an association between a given deity and celestial bodies, you must page through the entire book, which may be irritating.

*Zvezdnoe nebo*... is a lexicon, so Kurtik compiles opinions of various authors and only occasionally presents his own view, usually very cautiously. Speculative interpretations occasionally appear in passages devoted to the religious symbolism of heavenly bodies, e.g. in the definition of $^{mul.d}$MUŠ where we find a suggestion — borrowed from B. Landsberger — that frequent representations of the great serpent on Babylonian boundary stones may be associated with Nirah, a secondary deity from Der, a town located outside Mesopotamia. It is now well known that the identification of astral characters in the *kudurrus* should be treated with great caution (*cf*. the paper by S. Iwaniszewski in *JHA*, xxxiv (2003), 79–93) and such an important figure as the great serpent hardly can be associated with an obscure deity like Nirah, whose name appears only twice in all *kudurrus*.

In general, Kurtik's book is very Mesopotamian in character and to some extent resembles the scholarly compilations produced by ancient scribes. However, such a static lexical scheme with entries and explanatory texts is anachronistic in today's world of hypertext databases. If someone is familiar with Mesopotamian astronomical lore, *Zvezdnoe nebo*... may be a useful research tool, but for sure it is not a book for beginners or non-experts trying to ask any non-standard query. It would have been more convenient if Kurtik had published his compilation as an indexed Internet database with a search engine, as has Etana (www.etana.org) or ETCSL (www-etcsl.orient.ox.ac.uk).

Another crucial problem derives from the closed form of a printed book. Over the past twenty years we observe an acceleration of research on the history of Mesopotamian astronomy; every year new important research papers and textual editions are published. It is impossible to update a printed lexicon on a regular basis, so again an Internet database would be better alternative. Even in the moment of its publication,

Kurtik's bibliography is incomplete, lacking many studies and editions issued in recent years. It is possible to understand that introductory, general or explanatory books or papers were neglected (as *The heavenly writing* by Francesca Rochberg, Cambridge University Press, 2004) or essays in the Pingree Festschrift (*Studies in the history of the exact sciences in honour of David Pingree*, Brill, 2004), but nothing excuses omission of such important source text editions as BPO 4 (E. Reiner and D. Pingree, *Babylonian planetary omens: Part four*, Brill/Styx, 2005) or SAA 18 (F. Reynolds and S. Parpola, *The Babylonian correspondence of Esarhaddon and letters to Assurbanipal and Sin-sharru-ishkun from Northern and Central Babylonia*, University of Helsinki Press, 2003). Taking into account the Jupiter omina collected in BPO 4, Kurtik's definition of $^{mul.d}$SAG.ME.GAR was outdated already in the very moment of publication of the lexicon.

University of Warsaw ARKADIUSZ SOLTYSIAK

## ASTRONOMY IN THE WESTERN ISLAMIC WORLD

*Astronomy and Astrology in al-Andalus and the Maghrib*. Julio Samsó (Ashgate Variorum, Aldershot, 2007). Pp. xiv + 366. $125. ISBN 978-0-7546-5934-1.

Thanks to Variorum, the work of historians such as Julio Samsó, who study mainly, but not exclusively, the history of Islamic exact sciences in the western part of the Islamic world and who usually publish in diversified journals and collected works scattered all over the world, can now be made more accessible between the covers of one book. This book in particular is an added blessing, for it not only brings together some of the more specialized articles of Professor Samsó but also includes an updated bibliography in the form of additions and corrections, a detailed general index, and most importantly an index of sexagesimal parameters.

The major section of the text is divided into three parts. Section I includes general articles dealing with works either by Andalusian astronomers or other astronomers such as Biruni and Ibn al-Haytham who were known in al-Andalus or whose works influenced or paralleled the works of Andalusian astronomers. Articles of Section II deal with a wider circle of astronomers and astrologers from the western part of the Islamic world usually called the Maghrib. Both of those sections are signalled in the title and thus need no further comments on their contents. Section III, which is not emphasized enough in the title, is perhaps the most interesting of the three for it considers a rarely stressed phenomenon, namely the influence of major Andalusian astronomical works on the eastern part of the Islamic world. Composed of three major articles, this section deals with the influence of Alfonsine astronomy on the Arab world well beyond the classical period, that is after the standard period of Islamic Andalus that ended with the fall of Granada in 1492. The less known, but important information these articles provide has to do with the traffic of astronomical ideas from

west to east, a very unusual direction throughout Islamic history. With Samsó's work we can now see that results that were established in the Alfonsine environment, and particularly works of Jewish astronomers like Abraham Zacut, seem to have migrated to the eastern part of the Islamic world, as far east as Istanbul, Cairo and Yemen, and kept being quoted or copied all the way until the nineteenth century.

My favourite piece in this fine collection — and every reviewer must have one in a book of this type — is Article XII, devoted to the astronomical observations made in the Maghrib during the fourteenth and fifteenth centuries. This article examines the theoretical issue of how astronomers working in the Islamic world dealt with observations in general and in particular with their own observational results when they seemed to disagree with the inherited Greek tradition. A case in point is the inclination of the ecliptic, reportedly determined by Ptolemy to have been 23;51,20 degrees. In Islamic times and soon after the first translation of the *Almagest* into Arabic in the first half of the ninth century, fresh observations were conducted, most likely either in Baghdad or in Samarra or in both, to determine this specific parameter among others like precession, solar eccentricity, solar apogee, etc. These observations yielded the result that the inclination of the ecliptic did not exceed 23;33 degrees, a value clearly at variance with Ptolemy's. So what did those astronomers do? The easiest solution would have been to dismiss Ptolemy as wrong and to proceed to the next problem. But that was not the route they followed as they seem to have had immense respect for Ptolemy's theoretical and observational acumen and thus were not easily persuaded that he could be simply dismissed. Instead they created an apologetic solution for him, concocting a mechanism which they referred to as trepidation and which stipulated that the inclination of the ecliptic was in fact variable and not fixed. According to this theory, the ecliptic inclination oscillates between two limits, the Ptolemaic value that they inherited and the fresh one they had just determined.

Trepidation theory migrated westwards and took root in al-Andalus. In particular it was accepted by Ibn al-Zarqālluh (d.1100) who set its variation limits to the values of 23:53 and 23:33 degrees. Samsó demonstrates that in the Maghrib there were people who in later centuries continued to test these values. They found results that pushed the lower limit of the inclination even lower, some (such as Ibn al-Tarjumān) finding it to go as low as 23;26 degrees. This meant that either the trepidation theory itself could not account for this phenomenon or that the limits were not appropriately set in the first place. It was then that astronomers of the western part of the Islamic world began to use values from eastern zijes, such as those of Ibn Abī al-Shukr al-Maghribī (d. 1283), who worked in Damascus and Maragha (despite his nisba Maghribī), and Ibn al-Shāṭir of Damascus (d. 1375).

By tracing such borrowings of parameters from one astronomical text to another and from one Islamic region to another, Samsó was able to determine with much certainty the scope of cultural traditions, and in this instance determine that cultural borders between Eastern and Western parts of the Islamic world were not impervious after all. His findings also demonstrated that trepidation theory was beginning to weaken (despite its longevity well into the Renaissance time), and that astronomers

were willing to abandon theories such as trepidation in favour of the stubborn observational results they themselves were finding or those that their eastern friends were finding.

Columbia University GEORGE SALIBA

## NORTH AMERICAN CONSTELLATION MYTHS

*Reachable Stars: Patterns in the Ethnoastronomy of Eastern North America.* George E. Lankford (University of Alabama Press, Tuscaloosa, 2007). Pp. xiv + 303. $35 (paperback). ISBN 978-0-8173-5428-2.

Historians of astronomy generally steer clear of ethnoastronomy, the study of astronomical knowledge in living cultures other than our own. After all, acquiring precise data via oral transmission is far more difficult than employing the written record; and besides, such studies would appear to offer little of interest to those concerned with ancient pre-science (as the author of *Reachable stars* readily admits, p. 1).

Employing a sceptical form of the comparative method (identifying similar sets and subsets of mythic elements across culture groups minus the impossible task of seeking their exact date and place of origin), the folklorist-anthropologist George Lankford demonstrates what can be learned from oral constellation myths transcribed into written texts collected since the seventeenth century among the native tribes of eastern North America. Like ceramic designs, myths exhibit historical aspects that can be discerned, as they change through time to suit the needs of the societies through which they have been transmitted.

An introductory chapter on details of method is followed by two chapters that give readers some examples of what sort of material constitutes myth-texts and the constellations to which they refer. Creation via emergence out of the earth, followed by migration and entry and exit to the upper worlds via portals, suggest a layered universe as a common construct. The remainder of the text is comprised of chapters devoted to The Morning Stars, The Circumpolar Stars of the Northern Sky, The Pleaides, and other asterisms. Wonderfully imaginative stories about the Milky Way ("The Path of Lost Souls") are shared across Native America: thus, "The Great Serpent in the Sky" (Scorpio) sits at the gateway to their destined afterworld, and "The Hand" (the lower portion of Orion) grabs them (at the proper season) and takes them there. In contrast, that other prominent band of stars that circles the sky, the zodiac, is never mentioned, an argument against Mesoamerican influence. Lankford theorizes that such exclusion might be the result of satisfaction with simple solar calendrics derived from the relative position of the Pleiades, as well as the absence of a system of writing with which to record data on planetary positions.

Everyone loves a good story but rarely do two people tell a tale the same way. They substitute elements more familiar to their own way of life. In each chapter, variants

of mythic plots and subplots are broken down into key elements and tabulated for convenient tribal cross-referencing. To give an idea of the complexity of these stories, consider the "Star Husband" myth. Via detailed references Lankford documents 86 stories in which women fall in love with and marry stars. Dissatisfied, they attempt, in 65 instances, to return to earth by digging a hole in the sky floor. In a majority of cases they succeed. Lankford carefully and cautiously maps out each element with the goal of determining via which linguistic groups various parts of these myths might have passed. Intriguingly, the Ursa Major hunt-chase myth involving the ubiquitous bear, widespread above latitude 44°N (Blackfoot, Assiniboine) where Ursa Major is circumpolar, filters, albeit with changes, all the way down to the low 30°s (Pueblo, Navaho). In some instances the diffusion of constellation myths can be extraordinarily widespread. Witness the story of the celestial hunt which, though replaced by a chase involving siblings in the more Southerly Plains, shares elements with northern Asia. And the representation of the Pleiades as children connects with stories derived from as far away as Amazonia.

Tidy chapter summaries head the concluding chapter that follows the "long and tedious" slog (again the modest author's own words, p. 25) through the documentary material. Although the details might overwhelm the uninitiated reader, their presence is necessary if one is to render these stars truly reachable. To the question, Are there different astronomical traditions as defined via use of constellations?, Lankford responds with a convincing "yes". The tabulation of mythic elements shows a clear division between Eastern Woodland and Plains Indians, though not without specific diffusion trends. In *Reachable stars*, we find an astronomically based study that reflects patterns of cultural diffusion motivated by trade, linguistic variation, and diverse styles of living (e.g. hunter-gatherer *v*. sedentary). Even if historians of astronomy rarely consider these items, they are nonetheless worthy of consideration by those of us who seek to explore all open doorways to past knowledge.

Colgate University ANTHONY F. AVENI

## ASTROLOGY DOWN THE AGES

*A History of Horoscopic Astrology: From the Babylonian Period to the Modern Age.* 2nd edn. James Herschel Holden (American Federation of Astrologers, Inc., Tempe, Arizona, 2006). Pp. xviii + 378. $29.95. ISBN 978-0-86690-463-6.

Students of ancient and medieval astronomy do not need to be reminded of the importance of astrological literature, for it has been an essential witness to astronomical practices, especially in the centuries before Copernicus. James Herschel Holden is an American astrologer of a very scholarly disposition, who is moreover at home in the classical languages.

In spite of 'Babylonian' in the title he has only very little to say about that period,

but then he is very good on the Greek material. From there he continues with some useful sections on Arabic and Latin sources. He is, of course, heavily, indeed almost exclusively, dependent on Pingree's editions and translations, while ignoring the less prominent researches of John North and others. He carries on through early modern Europe to the present century, naming a great many people who will mean nothing to the historian of astronomy. It is a strange experience to read his presentation of the work of the astrologers, which is rather like viewing the history of astronomy through the wrong end of the telescope. Vettius Valens, for example, receives a rather more favourable notice than Ptolemy, whose greatest contribution to astrology, we are told, was his adoption of Hipparchus's tropical zodiac. Indeed Holden is rather too prepared to accept the sort of criticism of Ptolemy that we have heard from R. R. Newton. Vettius Valens, "an entirely different sort of person", receives a fulsome notice, but which includes also some interesting translations of a few passages from his work.

If historians of science sometimes complain of this "wretched subject", Holden is quite prepared to answer back, arguing that astronomers suffer from the disadvantage that their science is of little practical value, being used only to regulate clocks and to fix the orbits of space vehicles, whereas the astrologer can offer personal guidance and counsel: hence the astronomer suffers from an "unconscious feeling of inferiority". The problem, as it seems to me, is that astrologers unfortunately maintain a 'closed' society. For example, Holden mentions a number of articles of his own, including some interesting-looking material on the tropical and sidereal zodiacs, published in the *Journal of research* of the American Federation of Astrologers. One would search in vain, however, for such articles in a university library, for this *Journal* is not available for sale to non-members of the Federation. This illustrates the dark side of astrology, with its culture of initiates, in contrast to astronomical science which is simply open to the public.

In spite of these reservations about the context I can recommend this volume, which is so full of carefully documented material, to historians in search of a fresh 'sideways' look at their subject.

University of Cambridge RAYMOND MERCIER

## A CLASSIC OF MEDIAEVAL ASTROLOGY

*The Book of Astronomy.* Guido Bonatti, translated by Benjamin N. Dykes (Cazimi Press, Golden Valley, MN, 2007). Pp. xciv + 1487 (in two vols). $200. ISBN 978-1-934586-00-6 and 978-1-934586-01-3.

Guido Bonatti (*c*. 1210–*c*. 1296) was perhaps the most celebrated astrologer of his time, a distinction that earned him a place in the eighth circle of Dante's *Inferno*, eternally facing backwards for having claimed to see the future before him. His

encyclopedic *Liber introductorius ad judicia stellarum*, the most extensive astrological text composed in the mediaeval Latin west, survives in numerous manuscripts — including a deluxe version prepared for the English King Henry VII (British Library, MS Arundel 66) — as well as in four fifteenth- and sixteenth-century printed editions, under the name *Liber astronomicus*. In the Renaissance, Bonatti's textbook or portions thereof appeared in Italian, German, and English translations (this latter attributed to William Lilly). Now Benjamin N. Dykes, Ph.D. and A.M.A. (Adeptus Medievalis Astrologiae), has brought forth a new English translation of the complete *Liber astronomicus*, based on the 1550 Basel edition.

Dykes himself is a practising mediaeval astrologer, a student of the omnipresent (on the web at least) Robert Zoller, and his translation is clearly aimed at that audience. He situates his own work, in fact, as part of a third wave of astrological translations (the first two being in Baghdad in the eighth century and in western Europe in the eleventh and twelfth centuries), making "traditional astrological learning" available "for use by contemporary astrologers" (p. xxxi), with the aim of "revolutioniz[ing] our current practice and understanding of astrology" (p. xxxiii). Dykes is, in fact, highly critical of contemporary astrologers who do not avail themselves of mediaeval techniques and calls for more cooperation between "such people in the astrological world and those in the mystical, magical, and philosophical disciplines" (p. xlvi). Dykes is by and large successful in the Herculean task of translating Bonatti's massive Latin treatise (which runs to some 200 folios in the Arundel manuscript) into modern English. I found only the occasional error in tense or infelicity, such as his rendering of *In purgantibus per secessum* as "On giving purgative medicines by defecation", which hardly seems physically possible. Dykes has chosen to render into Arabic those astrological terms that are (sometimes awkwardly) Latinized in Bonatti's and other mediaeval treatises on the stars, which could be a source of confusion for one trying to clarify references in other contemporary literary or astrological works.[1]

For as much as Dykes has his credentials in mediaeval astrological technique, however, there are some holes in his knowledge of the history of astrology in the Middle Ages. In particular, glaringly absent from his bibliography are works by some of the contemporary historians most proficient in mediaeval technical astrology: John D. North, Hilary Carey, Nicholas Weill-Parot, and Jean-Patrice Boudet. And their absence from his reading list leaves some gaps in the apparatus that accompanies the translation. Although Dykes purports to give "citations of all currently identifiable source texts throughout the book" (p. xxxii), some of his identifications are odd or incomplete. For example, Aristotle is identified as "one of the most celebrated of ancient Greek astrologers" (p. lii), while Albert the Great is credited with a treatise on astronomy, without any mention of the fact that most scholars consider the *Speculum astronomiae* to be wrongly attributed to Albertus Magnus. Dykes asserts that "Toz the Greek" is "unknown" (p. lvii), but, if he had spent any time with the *Speculum astronomiae* or any of the scholarship about the work, he would have recognized the name as that of an author of three treatises on astronomical images condemned as "abominable" in the *Speculum*, a name also mentioned in the *Picatrix*, the *Lapidario*

attributed to Alfonso X of Castille, and in Hermann of Carinthia's *De essentiis*.[2]

Other omissions stem from a lack of experience with the basic mediaeval context. For example, commenting on Bonatti's assertion that Abraham the patriarch had taught astronomy to the Egyptians, Dykes nods to "certain Jewish legends", failing to note that mediaeval readers were familiar with this tale through Josephus's *Jewish antiquities* and thence in such other standards as the *Historia scholastica* of Petrus Comestor. When Bonatti, defending the science of the stars, notes that "some tunic-wearing people could rise up (one of which was that fool)" (p. 13) and dispute the notion of planetary influences, Dykes comments, "It is unclear which 'fool' Bonatti means" (p. 13, n. 18). But eleven pages later, Bonatti specifically criticizes "certain silly fools" who attacked astrology, "of which one was that hypocrite John of Vicenza of the Order of Preachers" (p. 24). Dykes helpfully identifies the Order of Preachers as the Dominicans, but fails to connect the Dominican habit with the tunic of the "fool" Bonatti had mentioned previously.

In part through such gaps, Dykes's translation and notes make a good case for precisely the sort of cooperation between practising astrologers and professional academics whose paucity he so laments. Busy astrologers will doubtless find the translation useful and easily navigable. Evidently many already have. Only 191 of Dykes's original print run of 500 are left. But historians of astrology or astronomy interested in Bonatti's work will probably prefer the Latin original, particularly since the 1550 edition from which Dykes worked is available on-line (http://hardenberg.jalb.de/display_dokument.php?elementId=5257). Still, for an undergraduate or curious reader without any Latin, who wants to know what sorts of questions a mediaeval astrologer was expected to answer, Dykes's translation of Bonatti's *Book of astronomy* would be a wonderful source to mine.

University of Arkansas at Little Rock LAURA A. SMOLLER

REFERENCES

1. E.g., *al-mubtazz* for *Almutem*, *hilaj* for *Ylem*, *al-kadukhadah* for *alcocodem*.
2. See, e.g., Nicolas Weill-Parot, *Les "images astrologiques" au Moyen Âge et à la Renaissance: Spéculations intellectuelles et pratiques magiques (XIIe–XVe siècle)* (Paris, 2002), 41–42, 48–49.

## *TERTIUS INTERVENIENS* IN TRANSLATION

*Kepler's Astrology: The Baby, the Bath Water, and the Third Man in the Middle*. Translated by Ken Negus, introduction and editor's notes by Valerie Vaughan (Earth Heart Publications, Amherst, MA, 2008). Pp. 222. $17. Not registered for ISBN.

Shortly after the appearance of the *Astronomia nova* (1609), Kepler became entangled in an astrological dispute. In response to criticism by Helisäus Röslin, Kepler

completed in September 1609 what he conceived as "a better explanation of my own word", removing from astrology nearly everything but the configurations that he identified as geometrical harmonies "between the light rays of two planets here on Earth" (*KGW*, iv, 103, 140). Kepler's response to Röslin preceded the publication of Philipp Feselius's *Gründtlicher Discurs von der Astrologia Judiciaria* (1609), in which Feselius adopted an anti-astrological stance that starkly contrasted with the elaborate prophecies of Röslin. Feselius and Röslin dedicated their works to the same patron, Margrave Georg Friedrich von Baden-Durlach. Concerned that his response to Röslin would be received as an endorsement of Feselius, Kepler quickly composed *Tertius interveniens* (1610), a German text in which he made the case "with simple words" for a middle way between the two extremes (*KGW*, iv, 151).

As the first complete English translation of *Tertius interveniens*, *Kepler's astrology* represents a significant step forward in the historical study of astrology during a period of increasing polarization. By addressing Feselius's criticism, Kepler clarified his own conception of astrology, which he characterized by the interdisciplinary notion of "all professions offering their hands to one another" (*KGW*, iv, 245). Astrology constituted only a part of Kepler's larger cosmological argument, and here the editor of the volume encounters difficulties. Vaughan argues that Negus, an astrologer, is more capable of fully grasping the subject than other scholars. In her polemical introduction, she confuses the course of astrological reform with what she calls the "scientistic agenda" of historians of science (p. 10). Yet if modern scholars mistake Kepler's predictive success as "an accident that requires explaining" (p. 10), this mistake was also made by Kepler's contemporaries. In a letter of March 1608, for example, Johann Georg Brengger objected to "the great number and variety" of influential configurations accepted by Kepler, which could be applied in multiple ways to evaluating "any alteration of the air" (*KGW*, xvi, no. 480, 6–11). Such an objection reflects the empirical nature of Kepler's astrology, according to which he criticized Girolamo Cardano for having put forward predictive principles "on the basis of single examples" (p. 200). Although Kepler accepted in *Tertius interveniens* three additional aspects as influential (beyond the original five adopted by Ptolemy), he awaited further observational evidence, wondering whether they would "be quiet or create a little disturbance" in the coming year (p. 130). Kepler continually referred the aspects to the observations that he collected over the course of his career; yet the geometrical principles linking his astrology to his larger cosmological argument do not corroborate Vaughan's claim that one of the "earliest applications of the 'scientific method'" occurred with Kepler's astrometeorology (p. 10).

Vaughan's introduction is followed by a sampling of passages that, without providing page numbers for the primary sources, illustrates various components of Kepler's astrology. In the next section, Negus translates an excerpt from Kepler's 1597 interpretation of his own birth chart, an autobiographical exercise from which biographers have borrowed heavily. Despite "the rough, note-like quality of the prose" (p. 49), Negus's translation is far too free. At one particularly charitable point, Negus renders Kepler's contempt for "the opinions of ordinary people" contrarily. Negus's

loose translation leads to similar errors in *Tertius interveniens*, whose structure he occasionally alters by splitting sentences into separate paragraphs. Amongst Negus's more notable omissions, he neglects the adjective "small" in Kepler's comparison of "the motion of the small Earth" with that of "the huge heavens" (p. 61); he leaves out "experience" in Kepler's summary of the astrological foundations forsaken by Feselius (p. 77); he fails to qualify the experience on which Kepler bases his predictions according to "the future procession of the heavens" (p. 77); and he wrongly refers to the "Werkstatt" of the Earth, responsible for promoting meteorological processes in response to certain celestial configurations, as an "observatory" (p. 100). In addition, a translation of "Himmel" as "heavens" rather than Negus's "sky" would clarify matters when Kepler articulates the supralunar expanse in which "the Earth's sphere runs around" (p. 190). Perhaps most troubling is the uncertainty surrounding the title, which is variously expressed as "*Third man in the middle*" (p. 1, echoing Sheila Rabin), "*Third party intervening*" (p. 30), and simply "*Tertius interveniens*" (p. 53).

These errors notwithstanding, Negus generally provides a useful translation of a work that, along with Kepler's other German writings, has received far less attention than its Latin counterparts. Negus makes Kepler's middle way clear. As part of a larger causal scheme, astrology constitutes "the action", rather than the passive reception, "of the nature into which the heavens flow" (*KGW*, iv, 220). Through observational evidence, "the kernel of astrology" can be separated from "the chaff" and progressively improved upon in the same way that physicians such as Feselius accumulate practical experience (p. 161). It is to the detriment of natural philosophy that "reason has with full attention attacked astrology", by which "the pepper has become mixed with the mouse droppings" (p. 164). Such poignant phrases are skilfully rendered by Negus, whose oversights are relatively insignificant in comparison with the sense of absence felt for the target of *Tertius interveniens*. Despite Kepler's practice of recalling Feselius's arguments before refuting them, there remains much to learn about his rival.

Johns Hopkins University PATRICK J. BONER

## GLOBAL TIME ZONES

*One Time Fits All: The Campaigns for Global Uniformity*. Ian R. Bartky (Stanford University Press, Stanford, 2007). Pp xxvi + 292. $50. ISBN 978-0-8047-5642-6.

Whether or not they are familiar with Ian Bartky's previous book *Telling the true time: Nineteenth century time-keeping in America* (Stanford University Press, 2000), many will welcome this volume's study of the complex and controversial issues of global time-keeping in the modern era. Sadly Bartky is no longer with us to enjoy the positive reception likely to be afforded this rich and well researched volume. It

is, nevertheless, a fitting final opus for a former U.S. government scientist whose dedicated his career to studying the costs and benefits of implementing daylight saving time in North America, the dominant topic of the latter part of this book.

This is a broad study that will interest historians not just of astronomy but also of modern culture, politics, science, technology, and transportation, covering as it does the emergence of datelines, meridians, global time zones, and seasonal clock shifting during the last century and a half. Only a limited section will be of direct interest to historians of astronomy, namely the unification of civil and astronomical time by 1925. However, the author adeptly shows that this dissolution of an awkward chronological dualism was intimately linked to other developments in the organization of international time-keeping after the First World War. That is why the main thrust of the volume is to address the evolution of international time management up to the mid-1920s, with only an epilogue to bring matters up to 2007.

*One time fits all* is not without its infelicities. The tripartite structure of the book is somewhat awkward. The first part, "Creating a dateline", is constituted by one short chapter beginning in 1522, the first time maritime circumnavigators encountered uncertainty of dates, as forecast two centuries earlier by polymath bishop Nicholas Oresme (p. 10), and ending in 1921, with the settling of an international dateline somewhat arbitrarily down the middle of the Pacific Ocean. Similarly the final section on "Employing clock time as a social instrument,1883–1927", focuses on Barky's professional specialism of daylight saving in two chapters of a section that lasts a mere 49 pages.

The middle section, "Campaigning for a uniform time" for the period 1870–1925, comprises eight chapters that bear the main burden of the argument about how different countries chose to interrelate their millennia of highly localized autonomous frameworks for recording time. As Bartky shows, this problem was most pressing for railway managers encountering the high-speed challenge of setting train guards and passengers adjusting to radically discrepant times at each major station stop ... with incidental dangers of missed trains and fatal crashes. We see, however, that it was not just train travellers but also maritime navigators and astronomers who wanted — even needed — a shared framework for adjudicating time.

Bartky compellingly rejects the popular myth that the 1884 International Meridian Conference resolved the question of where to locate the zero meridian (at Greenwich) and how to organize international time (into 24 zones). In fact it took thirty to forty more years for these outcomes to arrive. This was an indirect result of international co-operation after the First World War and, more specifically, of recognizing that one possible contributory factor to the Titanic catastrophe in 1911 was the confusing locations of icebergs specified in terms of both London and Paris meridians. Bartky's ensuing three chapters document how and why navigators finally agreed to shift their day-start from midnight to that of the astronomical day starting at noon so that by 1925 nautical almanacs were produced in all major countries without ambiguity as to whose division of the day was employed. Revealingly, Bartky emphasizes the role of the French in facilitating the new global uniformity, thus

downplaying their oft-stigmatized earlier refusal to abandon the Paris meridian for that of Greenwich.

Given the rich and rewarding content of the book, one might be forgiven for wishing that a more felicitous title had been chosen. After all, as Bartky himself was at pains to emphasize, we do not now have the 24 time zones "for all" that Canadian Sandford Fleming had proposed in 1878 (pp. 50–54). We now have as many as 39 time zones including, for example, Nepal that is $5\frac{3}{4}$ hours in advance of Greenwich mean time. And as our author starkly reminds us, to find the time in some particular country, the surest way is to contact a city hotel (p. 204). *Pace* Bartky, some things really have not changed in the past two centuries.

University of Leeds GRAEME GOODAY

## A PIONEER'S AUTOBIOGRAPHY

*Secrets of the Hoary Deep: A Personal History of Modern Astronomy.* Riccardo Giacconi (The Johns Hopkins University Press, Baltimore, 2008). Pp. xiv + 411. $45. ISBN 978-0-8018-8809-0.

Perhaps more than any other individual, Riccardo Giacconi altered the nature of astronomical thought in the late twentieth century. Before he began work in x-ray astronomy in 1959, the cosmos seemed to be populated by stars and galaxies that produced radiation in the visible and radio spectra. While interesting, these objects appeared somewhat mundane compared to celestial bodies, such as binary systems that exhibited rapid time variations, intense gravitational fields, and explosive high temperatures — all "visible" only in the high-frequency portion of the spectrum. In recognition of the shift in thinking to which he contributed, Giacconi received half of the Nobel Prize in Physics in 2002.

*Secrets of the hoary deep* constitutes Giacconi's scientific autobiography. Fortunately, it goes beyond a description of the author's evolving interests and his 1956 arrival in the United States to pursue cosmic ray physics (though this account is interesting). Rather, the book provides a sense of how the discipline of astronomy changed after 1945. One learns, for example, how experimental physicists who had little formal training in astronomy began migrating into the profession. Unlike traditional astronomers, these physicists had become comfortable working with experimental devices that proved useful for examining high-energy cosmic phenomena. We also see in this story the manner in which government policy played a major role in the advance of astronomy. Starting work at a private American Research & Development firm after the "space race" began in the late 1950s, Giacconi took advantage of governmental largesse to employ suborbital rockets and long-lived satellites to carry equipment into space for detecting x-rays. (X-rays from celestial objects cannot penetrate the Earth's atmosphere; hence, space-borne techniques must be used to observe the radiation.)

But the adoption of these new techniques (and dependence on government support) had its downfalls. As Giacconi observes, government support for all space research dwindled after the manned lunar landing in 1969, delaying (often for decades) the acquisition of data needed for making progress in understanding the cosmos.

Giacconi gained status in the astronomy community largely for his pioneering x-ray astronomy work in the 1960s and 1970s. His research team identified the first nonsolar x-ray object in 1962 using Geiger counters launched on a short-lived rocket; within a decade, his group had mapped the x-ray sky using satellite-borne instruments, leading to discoveries of x-ray binary systems and other energy-intense phenomena in space. This work gave him credentials to pursue other opportunities, such as leading research at the Harvard-Smithsonian Center for Astrophysics, directing the Space Telescope Science Institute, and becoming Director General of the European Southern Observatory and President of the Associated Universities, Inc., the organization that operates the National Radio Astronomy Observatory. Giacconi's book offers first-hand accounts of managing these large institutions while also illustrating the new social structure of astronomy, in which cutting-edge research depends on huge institutions, large research teams, and massive government support for expensive technologies.

As an autobiography, the book naturally offers one-sided opinions of institutions and individuals. Though he praises the National Aeronautics and Space Administration (NASA) officials who provided him early opportunities to perform research, for example, Giacconi remains critical of their actions in the 1970s and later. Among other things, he credits their poor management for the failure to test properly the Hubble Space Telescope, which suffered almost fatal problems after its launch in 1990. He also criticizes the technically unsound and politically motivated choices NASA made while pursuing the space shuttle and space station programs. Giacconi further shows disdain for some peer review committees, which disapproved of his proposal to study quasars with a new wide-field x-ray telescope. And he has harsh words for the National Science Foundation for supporting construction of second-tier observatories for use by large numbers of scientists. He argues that better research would have emerged from development of premier facilities available to fewer, but élite, investigators.

Some readers may have a difficult time ploughing through the book's overly technical descriptions of path-breaking research. Understandably proud of his team's creation of the first optical x-ray telescope in the 1960s, for example, Giacconi describes the innovation with equations and diagrams that seem more appropriate for technical papers than for an autobiography. Despite these sometimes tedious discourses, *Secrets of the hoary deep* still succeeds in providing a sense of how the 'new' astronomy emerged in the last fifty years.

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