Supplemental materials for "Truth at the Eyepiece—exploring disjunctions between past and present astronomical imagery"

From the year one of telescopic astronomy (*ca*. 1609-), the integrity of observations relied on their believability (as Galileo discovered). A good observer was someone whose observations were reliable sources of data. If you weren't personally acquainted with the observer, the believability became an act of faith in the observer's moral reliability. This attitude still underlies the art of observation in the service of science. In such a system the integrity of the observer guarantees the reliability of the records of observations, be they in numbers, text, or images (astrosketches, *and* astrophotos).

Anyone who has looked at a range of graphic records of observations extending beyond the present will encounter some which look familiar (*i.e.*, they conform to modern canons for accurate renditions of astronomical phenomena), others which look partly off (*i.e.*, they only conform partially to those conventions), and yet others which seem bizarre, and impossible (*i.e.*, they diverge completely from our conventions). Yet all of the images claim to be accurate representations of what was seen through the eyepiece. If that is so, how can the images exhibit such differences, to the degree that we can hardly accept some as witnesses of "truth at the eyepiece"? What is going on here?

Both to introduce the issues, and complement the cases dealt with in the webinar, this supplement offers contrasting images of Jupiter from the "golden age of visual observation", the 2nd half of the 19th to the 1st half of the 20th century. The first set of images presents a highly influential depiction from the very beginning of the period which was considered a standard of its day, and several printed copies of various quality. The second set is images which appeared in "popular" astronomy atlases in the mid point of the period. The third set of images comprises observational drawings published in the professional/serious amateur literature of the 1870s. Also reproduced below is a quote from one of the observers whose work is represented among the latter.

Questions which can be explored through these images and their contrasts are:

- What changes have occurred since 1850 in representing Jupiter?
- Has the development towards current conventions and standards for representing Jupiter been steady and consistent, or irregular and inconsistent?
- How do we know that a "prescient" image is in fact a "precursor" to how we depict Jupiter (*i.e.*, what strikes us as modern and accurate may not have been perceived that way by contemporaries)? The perceived modernity of one representation from the 1870s compared to another may even be due to happenstance.
- How can we best account for the discrepancies we discern between "accurate" representations from various epochs? How ought we to read, and use such images?

Keep in mind that seeking an explanation in changes in instrumentation cannot usefully be invoked unless you have actual experience of using both modern, and antique instruments, and observational techniques (enough 19th-century telescopes survive to confirm that the best were easily diffraction-limited, and generally optically very good).

All of the observers whose work is represented here were considered experienced observers, but clearly they had individual artistic styles and abilities. It is also worth considering what could happen to a first-generation observational image as it was reproduced (see below). And the various audiences to whom the images were directed.

In the first set of images, from our standpoint is the drawing by Warren De la Rue (1. a) worthy of its great reputation as an accurate drawing? That aside, it is notable that its reproduction in the work by the science journalist Guillemin (1. b) is much finer and more faithful than the reproduction in the work by the professional astronomer, Dunkin of the ROG (1. c).

In the second set taken from popular astronomical atlases, it is striking that the series of Jupiter drawings in Weiß' (2. a) and Ball's (2. b) books both appeared in 1892. Ball's are clearly more acceptable now as representing "truth at the eyepiece" than are Weiß's. And it is almost shocking that the images of Jupiter in Naccari's atlas of 12 years later (2. c), and Heath's of three decades later (2. d), are even further from what we'd expect of accurate Jovian depictions. Progress here doesn't appear to be linear. (And a fine example of a bad thing is ready at hand in comparing the quality and style of a drawing Naccari attributes to Gledhill, with a similar image from one of Gledhill's own papers [3, first row], illustrating that a lot can go wrong in successive reproductions of images—a problem which has been noted in illustrations as far back as Galileo's century).

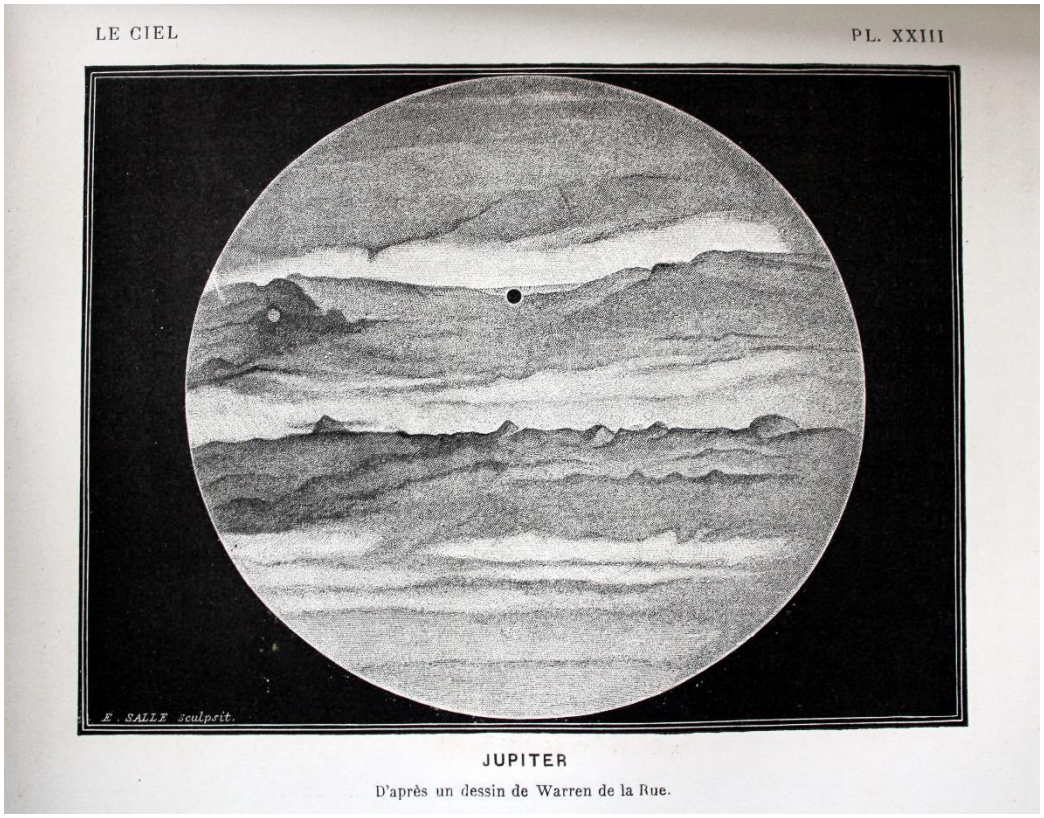
In the third set of images, George Denton Hirst, the amateur astronomer and wine merchant, was the best astronomical artist of the lot (3, second row), clearly the equal and better of George Gwilliam, the professional scientific illustrator (3, second row). Note, both were also microscopists. And their mastery of their materials was superior to that of the professional astronomer, Joseph Gledhill (3, first row).

Finally, the passage from Hirst on some of the issues involved is equally instructive, and ruefully amusing.

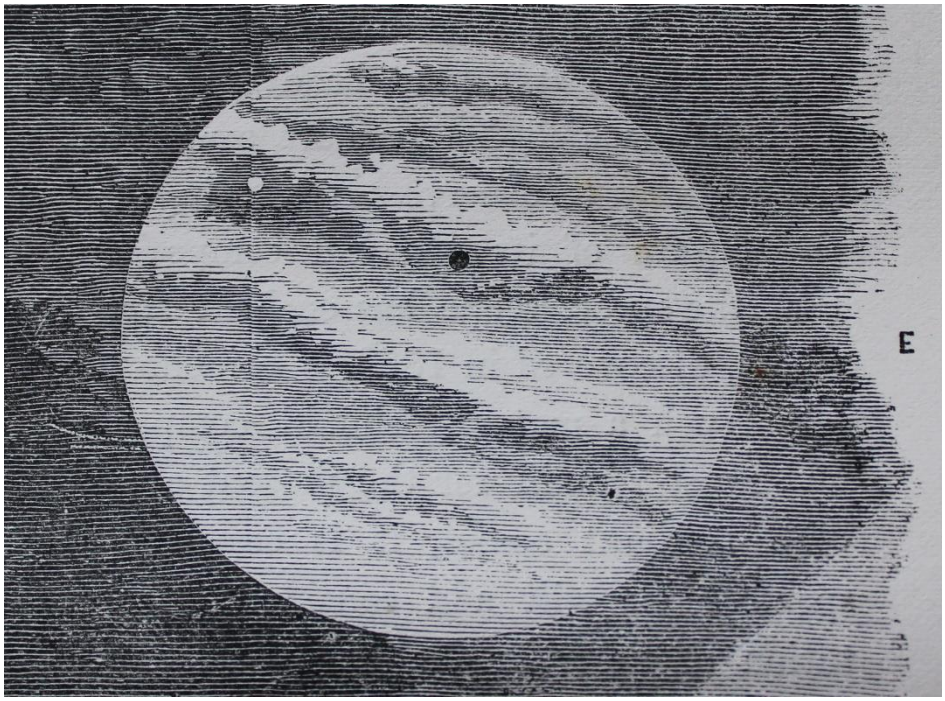
1. 1856 De la Rue "standard image"

1. a) Warren De la Rue, 1856 October 25 drawing of Jupiter, 13-inch reflector; Cambridge, Cambridge University, Institute of Astronomy Library, AMI/79/C. *Note: De la Rue, (1815-1889), FRS, was a wealthy printer, & famous amateur astrophotographer. Thomas William Webb, "The Planet Jupiter",* Nature *3 (1871 March 30), 430-431, referred to this image as "...*the finest drawing hitherto published*...".*

1. b) reproduction of De la Rue 1856 in Amédée Guillemin, *Le ciel*…, 5ième ed. (Paris: Libraire Hachette et cie, 1877), pl. XXIII. *Note: Guillemin (1826-1893) was a journalist specializing in science.*

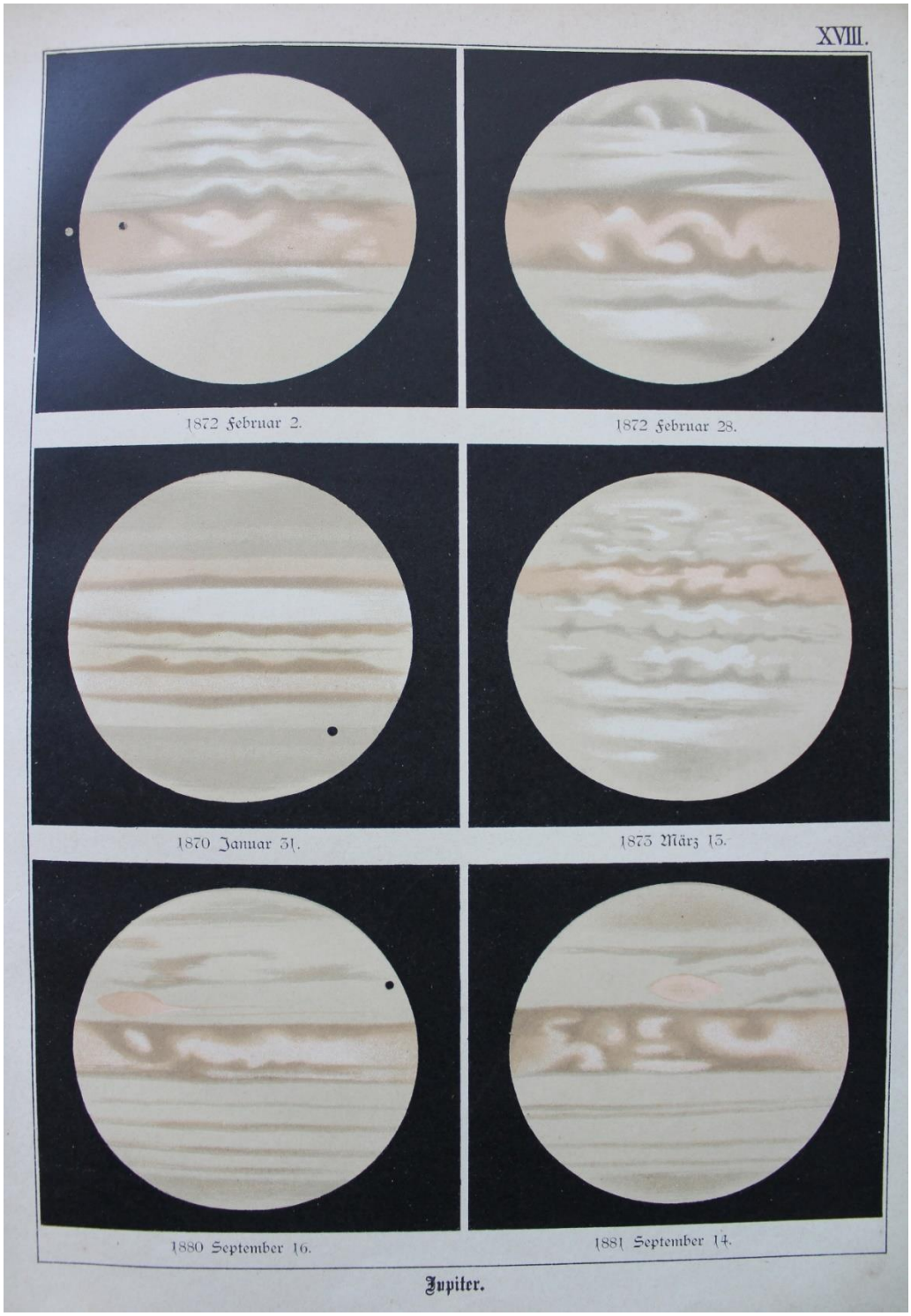


1. c) Edwin Dunkin, *The Midnight Sky…* (London: The Religious Tract Society, 1869), p. 281. *Note: Dunkin (1821-1898), FRS, rose to be First Assistant at Greenwich (1881-1884) under the Astronomer Royal, Christie. Dunkin's* Midnight Sky *emulated Guillemin's superior work (1st ed. 1867), but the debt was unacknowledged*.

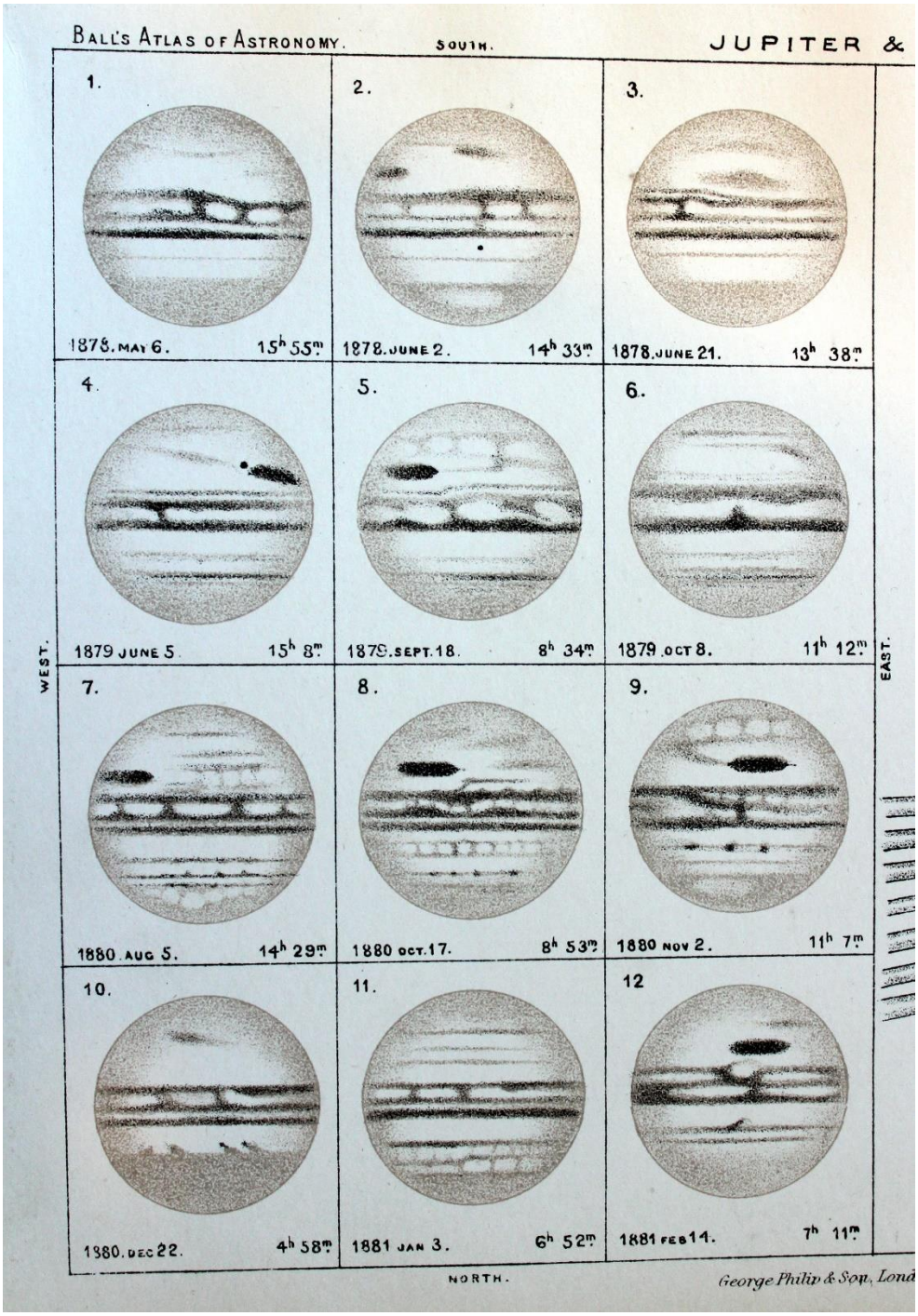


2. scientific Jovian images in "popular" astronomy atlases *ca*. 1890-1900

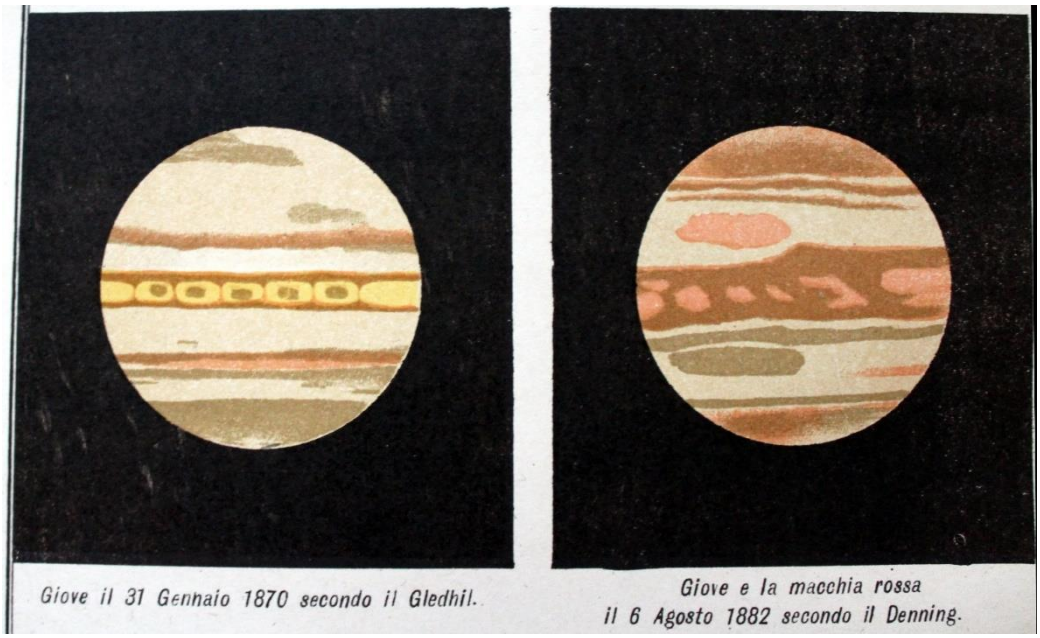
2. a) Edmund Weiß, *Bilder-Atlas der Sternenwelt…*, 2nd ed. (Eßlingen bei Stuttgart: J.F. Schreiber, 1892), pl. XVIII. *Note: Weiß (1837-1917) reproduces images by John Browning (1831-1925), FRAS, the famous instrument maker, and HCO (=Trouvelot).*



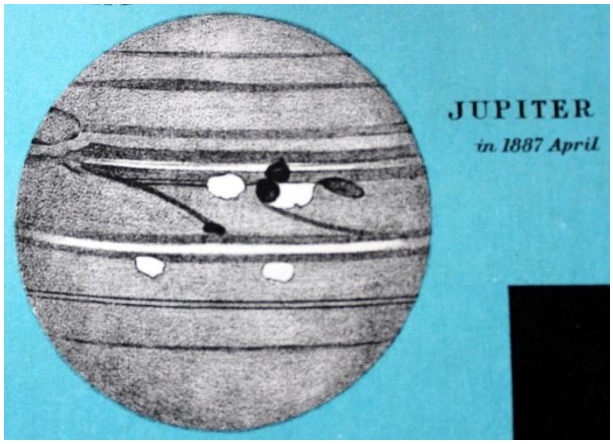
2. b) Robert Stawell Ball, *An Atlas of Astronomy…* (London–Liverpool: George Philip and Son, 1892), pl. 10. *Note: Sir Robert Ball (1840-1913), FRS, Lowndean Professor of Astronomy and Geometry at Cambridge, and Director of the Cambridge University Observatory, claims to reproduce the images of Dr. Oswald Lohse (1845-1915), Chief Observer at the Königliche Astrophysikalische Observatorium at Potsdam, from the* Beobachtungen und Untersuchungen über die physische Beschaffenheit der Planeten Jupiter und Mars, *Publicationen des Astrophysikalischen Observatoriums zu Potsdam, Nr. 9: Dritten Bandes erstes Stück (Potsdam: Wilhelm Engelmann in Leipzig, 1882), pp. 1-76, at 1-16, but the dates, and styles, don't coincide!*



2. c) G. Naccari, *Atlante astronomico…* (Milan: Franceso Vallardi, 1904), pl. XI. *Note: strongly debased versions of drawings by Joseph Gledhill (1837-1906), and W.F. Denning (1848-1931). Giuseppe Naccari was a one-time astronomer at the Osservatorio Astronomici di Padova, and later professor at the Royal Naval Institute in Venice.*

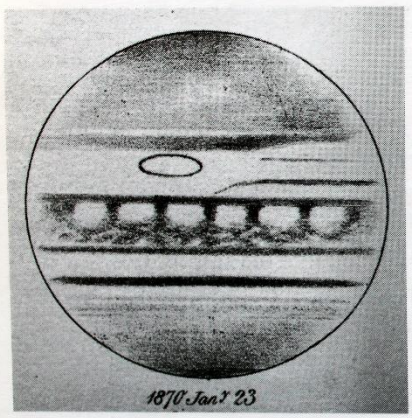


2. d) Thomas Heath, *The Twentieth Century Atlas of Popular Astronomy* (Edinburgh: W. & A.K. Johnston, Limited, 1922), pl. VIII. *Note: Heath (fl. 1880-1905) was Piazzi Smyth's final First Assistant at the Calton Hill Observatory, Edinburgh. The observational artist of this image is not identified.*

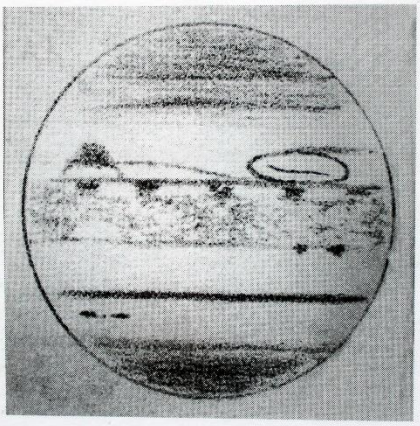


3. observational drawings as found in the professional literature 1870s

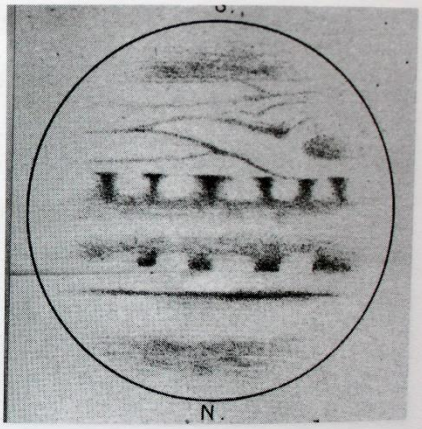
These are reproduced from John H. Rogers, *The Giant Planet Jupiter*, Practical astronomy handbook series (Cambridge–New York: Cambridge University Press, 1995), detail of Pls. 2 & 3. *Note: the observers are Joseph Gledhill (1837-1906), FRAS, the professional observer of Edward Crossley's Bermerside Observatory, Henry Pratt (1838-1891), FRAS, a watchmaker and experienced lunar & planetary observer, George Denton Hirst (1846-1915), FRAS, a wine merchant (Sydney AUS), and an experienced microscopist as well as amateur astronomer (“*As an astronomical draughtsman Mr. Hirst had no equal in Australia*”;* MNRAS *76, 4 [1916 February], 261), and George Thorn Gwilliam (1857-1930), FRAS, a professional scientific illustrator (“*microscopic artist draughtsman*”;* QJRMS *56 237 1930 October, 416).*



(7) 1870 Jan 23.
Gledhill.

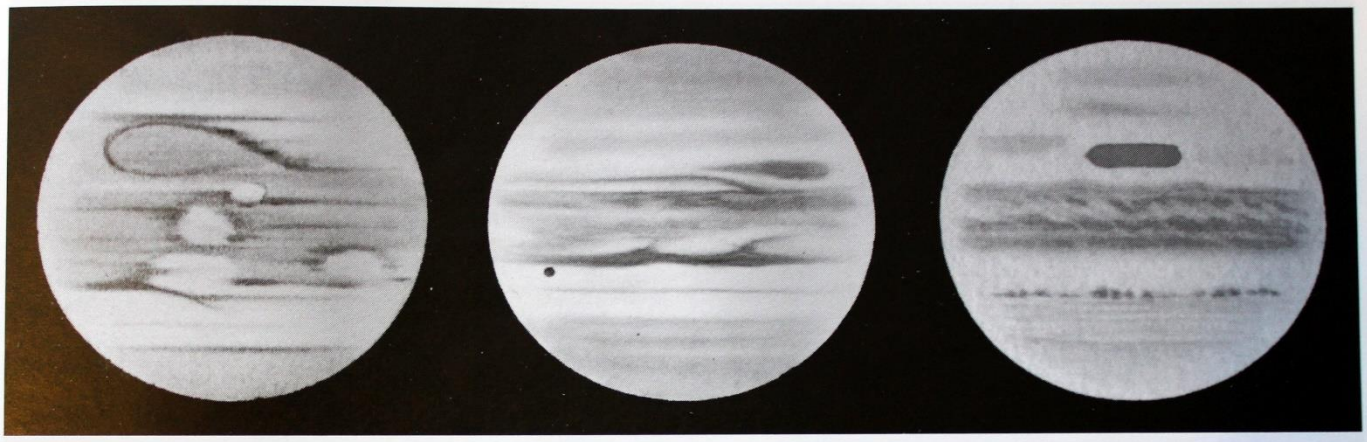


(8) 1871 Dec 1.
Gledhill.



(9) 1872 Jan 6.
Pratt.

(7–9) The GRS before (1870) and during (1871/72) a SEB Revival. In no.9, the GRS is near the f. limb and its ring shape is disrupted. Throughout, EZ is shaded (coloured) with SEBn disturbed. No.9 also shows a NEB Revival in progress. (All from *Astronomical Register*, vol.8, p.209, and vol.10, pp.1, 42, 69, by courtesy of the RAS Library. Also see colour plate P12.1–2.)



(1) 1876 Jun 3.
G.D. Hirst (Australia).
GRS as ‘the pink fish’. GRS and whole equatorial region are coloured orange-brown.

(2) 1878 Oct 20.
G.D. Hirst (Australia).
GRS as a vivid brick-red streak (on f. half), as SEB(S) fades.

(3) 1880 Nov 29.
G.T. Gwilliam.
GRS brick-red.
NTBs jetstream spots.

(1–3) These drawings are from coloured originals in the RAS archives. In nos.2, 3, and 4, the GRS is brick-red, NEB orange-brown, SEB(N)/EZ(S) either brown or grey, and NTB grey. (Also see colour plate P12.)

4. George Denton Hirst on drawing Jupiter, from G.D. Hirst, "Some Notes on Jupiter During His Opposition of 1876", in *Journal and Proceedings of the Royal Society of New South Wales* 10 (1876), 83-98, at pp. 86-87.

"...one of the first things that attracted my attention, when looking up the observations recorded of Jupiter during the last ten or fifteen years [*i.e.*, back to 1866, or 1861], was the remarkable paucity, I might almost say the entire absence, of any reliable or well-executed drawing of the planet. I must, of course, confine this assertion to any published drawings for there may be, and probably are, many fine delineations in the hands of those who drew them, which will never see the light; but speaking of those pictures which have been given to the scientific world through the medium of the papers of astronomical societies, periodicals, or books, I must confess it a matter of great surprise, that so few and such crude attempts have yet been made to give the general astronomical reading public an idea of the telescopic appearance of this, the most magnificent of our planets; and the reason I am at a loss to see; for...Jupiter is certainly, excepting our Moon, the easiest of all telescopic objects, and after a little practice, any one I am sure, with a decent notion of using his pencil or chalks. may give a far more accurate representation of the planet than he will find in the most elaborate and expensive astronomical work he can lay his hands on. Very few drawings ever represent colours at all; in a very extensively got up work I have in my library the belts are represented as straight lines—as if, to save trouble, they had been drawn with a ruler; in others there is an attempt at a ragged, cloudy appearance, but the artists who represented them evidently drew from what they had heard rather than from what they had seen. Messers De La Rue [*sic*.] and Lassell have both furnished what have been said to be remarkably fine drawings, and probably the originals may be; but if this is the case a lithograph copy of one of them that I have seen must be a most woeful libel. Mr. Browning, of London, has one or two coloured representations of Jupiter; his most recent, I think, is that in the fifth volume of the "Student and Intellectual Observer." The volume is now before you, and I should be glad if any member present would tell me if it represents anything like what he has ever seen of the planet. In making these remarks, be it understood, I am not claiming for my own attempts any superiority; nobody can be more conscious than I am myself of their shortcomings, and much that I have seen has baffled all my endeavours to portray—as for instance, I have again and again, on favourable opportunities, seen a perfectly metallic appearance on some parts of the equatorial zone, which I cannot even describe, much less draw; so what I have said is not so much to depreciate what has already been done, but to express a surprise that more has not been done in this class of astronomical work, by those who have the skill, the time, and the instrumental means".