David Levy's Logbooks in Context

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"Truly, the very art [of astronomy] is incomprehensible from the beginning unless through experience" – Mose Sefardi *fl.* 1106-1120 AD (Millás Vallicrosa 1943, 99)[1]

"Recorded observation consists of two distinctive parts: 1st, an exact notice of the thing observed, and all the particulars... and 2dly, a true and faithful record of them..." – Sir John Herschel (1832, 120) [2]

David Levy's generous gift of his digital logbook archive to the RASC, and the world, provides a unique historical resource. In exploring the archive one can obtain insights into an individual's dedication to the night sky, encounter a contemporary example of a long-lived literary form, and have the vicarious experience of observing by the author's side – tasting the quality of the nights, the excitement of discovery, and the enduring bonds of astronomical friendships (if the reader has not done so already, he or she should read Roy Bishop's introduction to David, his logbooks, and his role in contemporary astronomy). Astronomy is a viscerally visual experience in which memory plays a vital role. Records of what has been observed are vital cultural components of what we can remember. Created in the present to store data and experiences, records chronicle the astronomical and human past, and serve to fashion future research agendas through the tally of what was seen, what was not seen, and what might yet be seen.

Astronomers' logbooks are by definition the field notebooks and lab notebooks of those who look at the nocturnal – and diurnal – sky. They have traditionally been the formal material space for astronomical data "hot off the eyepiece," and the surface where the raw stuff of disciplined encounters with astronomical phenomena is set down, the place for the initial expression in endurable, recoverable, and communicable symbols of what was seen, measured, and described, before the processes of reduction, application, or publication. (This does not mean that logbooks are zones devoid of hypotheses and conjectures – far from it). They possess high probative and juridical value in precedence cases, and contain the basic evidence for reconstructing experiments or observational procedures when results are reassessed, irrespective of the brevity of their entries. Besides being physical things, logbooks comprise a literary genre with a history and conventions, and intriguingly and paradoxically are personal documents reflecting the research style of those who created them, however much they may be institutionally mandated, formulated, and owned. The value of primary observational records is arguably greater than that of the apparatus with which they were created. There would be no science of astronomy as we know it without logbooks .

The creation and curation of astronomical records, so quintessentially a part of modernity's scientific enterprise, is a cultural practice of considerable temporal depth. The intention to record data in a retrievable form is seemingly a constant, whether one employs a radio-telescope antenna and a computerized recorder, or the human eye with a sketchpad and pencil. When the young David Levy was keeping his first logbooks and hoping to discover a new comet, his thoughts doubtless turned to the company he wished to join, that of Charles Messier, Jean-Louis Pons, and Leslie Peltier, and to their methods of seeing, thinking, and

inscribing. In the still of the night, under the dome of heaven, it is possible to experience a quiet quickening in the marrow knowing that such archetypal watchers of the sky observed and recorded in a fashion not altogether foreign to the contemporary amateur experience – or so one imagines.

How old is the discipline of astronomical note taking? What is the place of David's logbooks in that tradition?

The search for origins powerfully motivates inquiry, possesses an endless fascination, and perennially disappoints those who crave immutable answers. The late Alexander Marshack argued forcefully that "time-factored, relational" marks on mobilary Upper-Palaeolithic artifacts constitute evidence of the systematic recording of astronomical observations. Central to his discussion were engravings on the abri Blanchard bone, dating to the Auginacian period (*ca*. 32,000 B.P.), and those on several La Placard bone "batons", dating to the Magdalenian III era (*ca*. 13,000 B.P.), which he read as graphical records of lunar phases (Marshack 1972/1991). Archaeoastronomers are willing to grant consideration to the hypothesis and merit to the methodology, although neither are above just criticism (Ruggles 2005, 5-7; Bahn *et al*., 2010; Kelley & Milone 2011, 157-158). The hypothesis remains unproven but not implausible. It offers the possibility of a very long chronology for our habit of astronomical note taking – in fact, an ocean of time in terms of human culture. Even if Marshack's hypothesis receives robust confirmation, it does not necessarily mean that David's – and our – ancestors shared our motivations for recording the night sky (in Babylonian and subsequent eras observation often served astrological purposes, a technical

application few of us would now seriously contemplate). Heaven only knows what a Pleistocene observer would have made of the apparition of a bright naked-eye comet; no glyph or graph has yet been seriously proposed as a Palaeothic record of such an observation.[3] If one should accept the Marshack hypothesis, then at the most basic level three connections can be posited between David's logbooks and stone-age astronomical records; both are products of the hands of hominids of the same genus, both employ symbolic notations, and both must meet contextually set standards of accuracy.

It appears that the civilizations of the Tigris and Euphrates have bequeathed us the oldest unequivocally identifiable observational records surviving in what may be their original state.[4] It is a region which would not have been unknown to David's ancestors. The prime surviving records of observations, the Babylonian Astronomical Diaries, are in the Akkadian language in cuneiform script, on clay tablets, and the earliest surviving example dates from 652 BC (*Astronomical Diaries*; Hunger & Pingree, 1999, 139-158). A concern with contextual accuracy and the recoverability of astronomical data is evident in these most adamantine of records, aspects which we like to think characterize our logbooks as well, although paradoxically the medium of clay tablets can offer on the one hand superior longevity to paper, and yet on the other a potentially greater frangibility (David's logbooks don't shatter when dropped). The medium of the Astronomical diaries raises an interesting recurrent question which can and should be asked of any class of observational document; are these the fundamental first-generation material record of the data they transmit? Are the surviving artifacts the actual physical logs created on the nights of observation, or are they second or third generation copies? Clay tablet technology could have been used under the

night sky, but would it always have been convenient to do so? Were less permanent, easily correctible media employed instead, such as wax tablets? This is a question to which we shall return. When looking through David's logs, what evidence can you find that they are in fact first-generation observational records? What of your own logs?

There may very well have been serious stargazing with some sort of "logbook" practice in pre-Ptolemaic Egypt, as in the pre-Hellenistic Greek sphere, but if so, neither culture has bequeathed much artifactual evidence in the form of first-generation observational records (Evans 1998, 21-22; North 2008, 31, 95, 98).[5] Secondary evidence for the existence (or earnest institution) of first-generation data records picks-up with figures such as Hipparchus (*fl.* 150-125 BC) and Claudius Ptolemy (*ca.* 100-170 AD), the two greatest figures of Hellenistic astronomy. Both made use of the Babylonian corpus of observations, and made their own as well (Pedersen & Jones 2010, 408-421). There are, alas, no logbook survivals from this impressive epoch for mathematical astronomy. In their ultimate physical form observational data may have been distinguished by entry in reed pen and ink on papyrus rolls, a type of book quite different from the codex form of David's logbooks (roll=sheets attached end-to-end to form one continuous writing surface, requiring unrolling and rolling to access; codex=sheets folded down the middle and nested one within the other, usually sewn together through the folds, and given protective covers). The actual books in which Hipparchus or Ptolemy would have entered their observations would probably have been wax tablets – square or rectangular panels of ivory, bone, or wood with hollowed-out planed surfaces covered with a mixture of wax and hardening agents, and written on with styli of metal (silver, copper-alloy, or iron), bone, or ivory. [6] Very cursive, informal scripts were

frequently employed, and some abbreviations used – not unlike David's observational entries in some respects (abbreviations: LOG 01, verso of front cover; LOG 02-02). Wax tablets were often found in codex form, and thus would approximate the physical appearance of David's logbooks.

The Hellenistic astronomical texts, with their observational data both contemporary and retrospective, survive thanks to the efforts of medieval scribes active in the Byzantine, Islamic, and western-Christian cultural spheres. Contrary to misconceptions still popularly held by many astronomers both amateur and professional, there was much scientific enterprise in the period from the "fall" of Rome to the time of Copernicus – it is the "Dark Ages" themselves which are a myth. This period saw considerable and variegated astronomical activity, as McCluskey (1998), North (2008), and Park (2011) among others have so ably established. One can encounter the words "*experimentum*" and "*observatio*" frequently enough in the sources, although their complex lexical meanings may at times possess a different colour from strictly modern usage. Astronomical observation and the recording of observations are certainly to be found, particularly from the late eleventh century forward, with figures such as Prior Walcher of Malvern (*fl*. 1091-1135), William of St. Cloud (*fl*. 1285-1312), and Jean de Murs (*ca*. 1290-*post* 1357; Park 2011, 24-33). The tradition continues through Geoffrey Chaucer (*ca*. 1340-1400), Georg Peurbach (1423-1461), Regiomontanus (1436-1476), and Bernhard Walther (1430-1504), which brings us into the midst of the early-modern period (North 1988; Park 2011, 32-37). A concern with improving the precision of observation can be discerned in the activity of some of these figures, and most were at pains to improve the fit between theory and observation. The modern harvesting

of observational data by amateurs for professional use serves similar ends (*e.g.*, AAVSO), and some of David's mentors such as Leslie Peltier played notable parts in that activity, as has David (see Roy Bishop's comments on David's collaboration with Gene and Carolyn Shoemaker). David continues his advocacy of this important amateur activity to this day.

It is from the later Middle Ages that what appear to be first-generation observational records begin to survive in modest number, perhaps for the first time since the creation of the Babylonian diaries. While there are similarities with David's logbooks, there is one physical from of medieval observational record which seems utterly alien to current practice. It is the entry of observational data in the free spaces around a pre-existing physical text, literally writing in a published book! It is as if David were to take Fred Whipple's dirty-snowball paper from the *Astrophysical Journal* (1950) and write his comet and other observations in the margins, or better yet, try to do the same on the sheets of Antonín Becvár's (1969) comet-hunting atlas, or on the pages in volumes of Gary Kronk's *Cometography* (1999-)! Past human uses of seemingly familiar technologies can strike us as both familiar and foreign at the same time. (Doubtless the reverse is also true – our astronomical ancestors would see aspects of our art of observation as both customary, and alien).

The rate of survival of what may be actual physical logs created on the nights of observation, or at least second-generation records, increases notably as the "renaissance" spawns the "scientific revolution" contributing in time to the Enlightenment (all fraught words – only the last was coined in its day!). With greater temporal proximity comes greater familiarity. Even a cursory comparison of David's logbooks with Galileo's, Christian Huygens', or William

and Caroline Herschel's notebooks, reveals much more in common than not. Not only are the physical aspects of the books functionally indistinguishable, but the information fields are frequently comparable, and the types of page layout (*mise-en-page*) are at times closely analogous. Christian Huygens' logbook entry for 1682 September 5/6 specifies the date, time, and place of observation, the instrument used, object observed and its position, and includes a description and drawing, and on 1990 August 8 David provided the same type of information for the same type of celestial object in his logbook (Huygens 1925, 131; LOG 16-084), only the media and language differ (Latin text in pen and ink on non-acidic hand-made paper in one case, and English text in biro on mass-produced acidic paper in the other). Even before a close reading of their respective contents, it is the immediate visual impression of consonance between the pages of David Levy's and Christian Huygens' respective logbooks which instantaneously makes the case for obvious cultural affiliation.[7]

One very attractive feature of David's logbooks is that they serve as a record of astronomical friendship down the years. It is not just that David entered the names of those with whom he observed on specific nights, but that he frequently had them add their own signed entries. This recalls another type of book familiar to astronomers as members of the republic of letters, from Shakespeare's day, past Halley's, to the evening of Herschel's life; the *Liber amicorum*, or the *Album amicorum*, that is, the "Friendship Book" (Ortelius 1969; Stammbücher 1989; Mauelshagen 2003). The friends of the owner of a *Liber amicorum* would indicate their friendship, esteem and respect for the owner by making the owner the gift of a poetic epigram, or an ode or encomium, a pictorial emblem, a drawing, or a print or woodcut, and their signature, all of which would be entered in the book. (Wealthy friends

could hire professional poets and artists to design and execute their entries for them!). This delightful feature of David's observational records produced some memorable entries. It also points to another feature of astronomical records of which we are not always conscious; logbooks are static representations of dynamic interactions. There is an oral element to observing with other people, and logbook entries can in reality be the product of mixed modes of communication, orality and writing, an aspect which can be difficult to capture from the surviving static texts. (It is possible in some periods that observations were not given written form immediately, but were transmitted orally, and retained in multiple living memories for extended periods, something which is quite different from our modes of data preservation).

The "modern" logbook tradition established in the 17th-18th centuries, which had formed out of earlier traditions of observational record, continued into the Victorian, Edwardian and subsequent eras with various experiments, refinements, and adaptations to new technologies of communication and data entry and storage, but with no breaks.[8] David received that tradition in the second half of the 20th century from his mentors, such as Isobel Williamson, Roy Bishop, and others in the RASC, and elsewhere, who still cultivated an art of observational record which, in its essentials, was little different from that of observers before the invention of achromatic OTAs, and large Herschelian reflectors. Contextually, this is the place occupied by David's logbooks in the tradition of astronomical record making. It is a tradition which is ongoing, and a disciplined practice which serves amateurs well – David and all of us (Markov 2011). In some respects the logbook tradition has an intriguingly – and

perhaps disconcertingly – long pedigree. Perhaps this is another wonder to add to those experienced under a clear night sky.

Appendix: *Scriptura Davidica Jarnacensis*

David's logbook scripts are amenable to several classificatory treatments. They can be analyzed as one would the scripts current when the Bard of Avon wrote of astronomy – an author in whom David has a more than passing interest (Levy 2011, 27-50, 97-98). To use formal palaeographic nomenclature, David's logbooks are written in a bimodal Italic hand, ranging from a formal (set) Italic to a cursive (rapid) Italic, with few Secretary elements, characterized by letter forms nearly shorn of serifs, inessential descenders, ascenders, and ligatures, and displaying a sparing use of abbreviations. The chief difference between his formal and cursive Italic modes is that the one is more carefully produced, and the latter features letters joined by regular connecting strokes (the practical implications are that cursive hands can be written more rapidly than formal hands – but this is not invariable). Or if one wishes to forego historical resonance and surrender analytical capacity, one can follow modern educational theory and speak of "slanted print scripts" (="formal Italic hands") and "cursive scripts" (="cursive Italic scripts"). David's formal (set) Italic predominates in the earliest logbooks 1962-1965 (LOG 01-02), and thereafter his cursive (rapid) Italic predominates (LOG 03-23), but it is never absolute, and both can be found on some pages (LOG 14-007). Occasionally mechanical writing technologies are employed, such as a date stamp throughout 1967 (LOG 04), and typewriter for much of 1968 (LOG 05-018-026). Different coloured inks are occasionally used, usually one colour per dated entry (it seems to have been a matter of using whatever writing implement was at hand). The letter forms of both *Scripturae Davidicae Jarnacenses* show remarkable stability over the better part of half-a century, as do the modules of the scripts (module=ratio of letter height to width, and the ratio of both to the interlinear space). And when the logbooks function as *libri amicorum*, there are other hands present in the logbooks besides David's. The text support is relatively thin, commercially pre-lined wood-derived paper stock of high acidic content, typical of school notebooks of the second half of the twentieth century. In summary, *Scripturae Davidicae Jarnacenses* are highly utilitarian, making up for what they may lack in formal elegance through the virtues of clarity and readability. David would always be able to

decipher the morning after what he had written the night before with a minimum of effort, and he and we can still do so decades later. The manuscript technology of his logbooks, now digitized, has stood the test of time.

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[1] The quote continues "and, likewise, no one can recognize a master of that art without experience" ("Ars etenim ipsa non nisi per experimentum primum potuit comprehendi et magistrum artis similiter sine experimento nemo potest cognoscere").

[2] Sir John (1822, 130) also remarks: "With respect to the record of our observations, it should be not only circumstantial but *faithful*; by which we mean, that it should contain all we did *observe*, and nothing else." That is, the observer's moral integrity as an observer *must* be manifest in his or her records. The approval of circumstantial detail allows considerable freedom of choice as to style, and content – tastes will vary.

[3] Kronk starts with 674 BC; Kronk 1999, x, 1.
[4] They enjoy temporal precedence over the far-eastern material. I will not refer further to Chinese – or for that matter to Indian or Arabic – material in this discussion, for several reasons. That there were borrowings and adaptations of astronomical data, techniques, and equipment between cultures is undeniable. The world of far-eastern astronomical practice was, however, rather remote from the western cultural traditions to which David is heir (one can make a better case for the influence of the Indian and Arabic worlds). Those who are interested in the far-eastern material can turn to Xu *et al*. 2000, and Pankenier *et al*. 2008. Needless to say, I find the Needhamite case overdrawn.
[5] The pre-Ptolemaic (and some of the Ptolemaic) Egyptian heritage can be sampled through the pages of Clagett 1995.
[6] For further details see Rosenfeld 2002 and Rosenfeld 2003.
[7] David has written evocatively on his encounter with some original logbooks of this period; O'Meara 1998, vii. Nicolas Leste-Lasserre (2002, 2004) has written some important unpublished studies of this material.
[8] For an interesting episode of one formative stage see Nasim 2010. I wish to thank Professor Nasim for generously sharing his study with me.