SHAPESHIFTER – KNOWLEDGE OF THE MOON IN GRAECO-ROMAN EGYPT

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Introduction

Apart from the sun, the moon is the largest and brightest celestial phenomenon as seen from earth. Furthermore, in pre-industrial societies without electric lighting the shifting intensity of nocturnal illumination by the moon played a significantly larger role than today. Hence, it is not astonishing that people used to reflect on the causes and effects of its shift in shape and other associated phenomena. Besides the day-and-night-cycle, the moon's phases are clearly the most evident means of chronological orientation and therefore lunar-based calendrical systems are quite universal.[1]

This paper will present the practical application of the lunar phases to the calendar, the regulation of religious festivals, and the temporal organisation of the priests' services. These indirect pieces of evidence will be further elaborated by Demotic and Greek papyri that contain computations of the moon's movement and phases. Another topic is the role of the moon in astrology, i.e. how visual phenomena (like eclipses), lunar phases or positions of the moon in the zodiac were used to predict the future. Furthermore, I will also show how the moon and the astronomical phenomena related to it were integrated into the religious imagery and symbolism of ancient Egypt. Since the sources derive mainly from the Graeco-Roman period, during which Egypt was characterised by its multicultural society with increasing contacts to the rest of the Mediter-

1 Cf. NILSSON, 1920, pp. 4f., 15f., 147-239.

ranean and Near Eastern world, reflections on possible exchange, transfer or adoption of knowledge are possible.

"Scientific" Knowledge I: Calendars, Accounts, and Astronomers

Initially, knowledge about the moon in ancient Egypt was acquired through careful observance of the heavenly body. That this "finding" of knowledge took place can be deduced from several facts. First of all, the Egyptian month consisting of thirty days, which suggests that lunation was the basis of the division of time: thirty is the average length of the synodic month with about 29.53 days, the time span the moon takes to gain the same visual appearance again. Nevertheless, the solar, so-called Civil Calendar of 365 days dominates over a sometimes-presumed original lunar calendar back as far as the earliest written records. The existence of a lunar calendar is in any case much debated.[2] However, there is no doubt that the moon played an important role in the division of time. For example, days within the lunar cycle are sometimes given in historical inscriptions alongside solar-calendar dates.[3] Thus, even if there is little evidence for the existence of a lunar calendar in parallel to the civil calendar, there is at least evidence that lunar cycles were counted in some form, which indicates that the constant observation of the moon's phases must have been carried out.

Further evidence of lunar observation can be deduced from the fact that several festivals and rituals follow lunar phases,[4] including crucial stages such as new moon, first crescent visibility, and full moon. However, the sixth lunar day, which has no obvious astronomical significance, played an important role

2 Discussed e. g. by LEITZ, 1989, pp. 54-57; LUFT, 1992; DEPUYDT, 1997; LEITZ, 2000, pp. 77f.; NOLAN, 2003; SPALINGER, 2004; BELMONTE, 2009; – On the civil calendar, see most recently GAUTSCHY, 2011; RAMCKE, 2014.

3 Their correlation forms the basis for the absolute chronology of Egyptian history in modern Egyptological research (on these double dates cf. PARKER, 1950, pp. 17-23; LEITZ, 1989, pp. 80-89 [with references]; DEPUYDT, 1997, pp. 177-215; DERSTINE, 2016).

4 A complete list can be found in GRIMM, 1994, pp. 124f., 419-441; BURKARD, 1995, pp. 96-110.

in numerous rituals.[5] All of them were most probably annual "high feasts" rather than monthly events, because specific solar months are given in calendar lists: While a specific period of time in the civil calendar was fixed, the exact date of the beginning of the festival was determined by the lunar phase; this is comparable to the Christian Easter date.[6] The New Moon and Behedet Feast was a particularly famous feast occurring in the month Epiphi (III. *šmw*). It celebrated the arrival of Hathor of Dendera in the temple of Horus of Edfu and their joint journey to the local necropolis.[7] Its duration of fifteen days is evidently oriented towards the lunar cycle, as this represents the time span from new moon to full moon, on which the climax of the festival took place, probably with special processions that reproduce the constellation of sun and moon on that day.[8] However, the term "give appearance to (the god) Min every new moon (*sḫ'j(.t) Mnw n psḏn.tyw nb*)" that is preserved in a festival list in the Temple of Kom Ombo suggests that there were also monthly festivals.[9] Further evidence for this is provided by practices associated with the day of the new moon, on which the moon remained invisible and was therefore thought to be in an endangered state and needed to be secured by rituals against its enemies.[10]

From the time of the Middle Kingdom onward, the lunar calendar also determined and regulated priestly service.[11] The priests were organised in four, later five, so-called *phylai* (sg. *phyle*, literally "tribes", äg. *sꜣ*), each *phyle* being on duty in the temple for one month. Service was to begin on the second lunar day (*ꜣbd*), i.e. the first day the crescent is visible. From the dates given in wheat receipts from the Roman village of Soknopaiou Nesos, the length of the priests' service could be calculated.[12] The services lasted twenty-nine or thirty days, pointing to a connection with the astronomical lunar month and not with average month lengths or months of the solar calendar. By calculating the

5 The most fundamental work is JUNKER, 1910. Further examination of the date can be found in my doctoral thesis on the moon in Graeco-Roman Egypt (ALTMANN-WENDLING, 2018, pp. 833-843).
6 Cf. RICHARDS, 1998, pp. 345-378.
7 See NAGEL, 2014.
8 ALTMANN-WENDLING, 2017, pp. 426-435.
9 GRIMM, 1994, pp. 124f.; BURKARD, 1995, pp. 108f.
10 Concerning the "Book of the New Moon Festival" see most recently VUILLEUMIER, 2016, pp. 176-221; another new-moon ritual that comprises the ritual destruction of the enemies is studied by LEITZ, 2012, pp. 127-129.
11 DEPUYDT, 1997, pp. 147-151; BENNETT, 2008.
12 LIPPERT, 2009.

actual lunar phase that prevailed on the beginning of the service, Sandra L. Lippert has been able to show that these regulations were based on the old Egyptian calendar and did not draw on the Alexandrian calendar that was introduced after the Roman conquest, and which inserts a leap day every fourth year.[13] Furthermore, the comparison between the beginning of each *phyle* and the computed lunar phase revealed that one half gives a date for the re-appearance of the moon that is one or two days too late.[14] Because the beginning of the month is determined by the observation of the old crescent, this means that the priests would have announced the last crescent on a day where there definitively was none.[15] Therefore, according to Lippert, the new crescent was probably not observed, but calculated. Unfortunately, no calculation table is known yet which fits into the observed pattern.[16]

The Egyptian lunar month starts with new moon, i.e. the phase of invisibility.[17] During this time span, the moon stands between the sun and the earth and is therefore not illuminated by sunlight as seen from earth. To determine the exact day when the moon disappeared, the thin crescent had to be closely watched. Prior to the use of computed tables in the Graeco-Roman period, the thin crescent had to be closely watched in order to determine the exact day when the moon disappeared.[18] Because the observation of a celestial body near to the horizon is very difficult due to atmospheric disturbances, one has to factor in a certain amount of inaccuracy,[19] although in general, the observation conditions were probably better than today.[20]

The astronomical observation was carried out by priests, the earliest record dating to the Old Kingdom (the first half of the third millennium BCE) concerning a priest called Tjenti, who bears the title "Overseer of the secret of

13 IBID., pp. 186f.
14 IBID., p. 188.
15 IBID. Conversely, this might indicate that the start of the period of priestly service was determined by observation of the new crescent, not by awaiting the day after new moon. If this was the case, the faint new light could easily have been missed and the *phyle* accordingly started one or even two days delayed.
16 IBID., pp. 193f., see below.
17 The same starting point applies to modern astronomy.
18 See below.
19 WELLS, 2002; DOGGETT/SCHAEFER, 1994; SPALINGER, 2002; BENNETT, 2008, pp. 525-554; GAUTSCHY, 2011, pp. 4f.
20 GAUTSCHY, 2011, p. 14; p. 130; RAMCKE, 2014, p. 323 with notes 30 and 35.

the sky, who sees the secret of the sky (*ḫry-sšꜣ n p.t mꜣꜣ štꜣ n p.t*)".[21] Other possible verbs and designations for stargazing from the Old Kingdom to the Graeco-Roman period are *sbꜣy/wnw.ty*,[22] *wnwn*,[23] and perhaps *wr mꜣ.w*, "Greatest of the Seers", the name of the high priest of Heliopolis, the important religious centre that was known for its solar cult, but where important observations of other celestial phenomena also took place.[24]

However, the most important and best-known sacerdotal title associated with astronomical observation is *wnw.ty* (from the Middle Kingdom on) resp. *jmy-wnw.t* (since the Ramesside period), literally "the one who belongs to/who is in the hour" and therefore called in Egyptology "hourly priest".[25] This designation shows that their task was principally strongly connected with the measuring of time. The exclaiming of the current time by these priests is mentioned in several temple texts.[26] But besides this function, an inscription on the statue of the priest Harkhebis from the Ptolemaic period recounts detailed knowledge of astronomical processes, such as the rising, setting, and culmination of the celestial bodies, the heliacal rising of the star Sirius which marked the beginning of the year, the course of the sun through the year, and the division of the hours during day- and night-time; furthermore, the conjunctions and probably the phases are also mentioned.[27] Another text on a similar statue of the same period names also the praising of the moon (*dwꜣ Jwn-ḥ′*) as the epithet of an *jmy-wnw.t* priest.[28] Demotic inscriptions from Philae and Dakke

21 On the history of Egyptian astronomers, cf. FISSOLO, 2001; LULL, 2004; WINKLER, 2016, pp. 269-274. The title *wrš* "Watchman", known from as early as the Old Kingdom, has been suspected of having been a denomination of stargazer, too, since his place of work was located on high buildings, a reasonable spot for observing the sky. However, a lookout tower would be equally adequate for an actual guard, which seems more plausible for some of the textual appearances of this title (FISSOLO, 2001, p. 16).

22 ČERNÝ, 1963; LULL, 2004, pp. 67f. (with fig. 2). Another possible reading is *wnw.ty* (DAOUD, 1993, p. 263).

23 Wb I, 318, 12; VON LIEVEN, 2000, p. 42, note c.

24 MOURSI, 1972, pp. 147-154. On this location as an important reference point for the known dates of new moon and the heliacal rising of Sirius, cf. LEITZ, 1989, pp. 30f., 51 with note 13, 79, 89-92; GAUTSCHY, 2011, pp. 18, 120, 131.

25 SAUNERON, 1959; DERCHAIN-URTEL, 1989, pp. 178f.; JONES, 1994, pp. 42f.; DIELEMAN, 2003, pp. 278f.

26 Cf. BIRK, 2014, pp. 81-84; SAUNERON, 1959, pp. 36-39.

27 Cf. the extensive commentary by DERCHAIN, 1989, and, more recently, DIELEMAN, 2003, pp. 280f., 285f.; WINKLER, 2016, pp. 272f.

28 BIRK, 2014, pp. 80-84.

that originate from one family of priests mention the title "Prophet of Sothis" (= Sirius), "general" of the moon, priest of the five living stars (= planets), who knows the time of the eclipses of sun and moon (*ḥm-nṯr n Spd.t jmy-rꜣ*[29] *mš' n j'ḥ w'b n pꜣ sbꜣ 5 'nḫ.w nty rḫ pꜣ wš n jr 'b n r' j'ḥ*)."[30] Here, the interpretation of solar and lunar eclipses as portents appears.[31] Further proofs for astronomical knowledge derive from papyrus lists containing information regarding different kinds of priestly knowledge that name the designations of the lunar days and additionally portray the lunar phases in pictorial form, albeit in a much schematised manner.[32]

The attributes of those priests that figure in reliefs and on statues include their measuring devices: a "visor staff", made of a palm leaf, and a shadow clock.[33] With those instruments, the priest had the means to measure time by day and by night. They are also mentioned in the *Stromateis* of Clement of Alexandria (second century CE), who describes the appearance and knowledge of the astronomers in a passage discussing the different types of Egyptian philosophy:

> And after the singer advances the hour-watcher (*hôroskópos*)[34] with a horologe (*horologion*) in his hand, and a palm (*phoinix*), the symbols of astrology. He must have the astrological books of Hermes, which are four in number, always on his lips. Of these, one is about the order of the fixed stars that are visible, <the second about the position (*táxis*) of the sun, the moon, and about the five planets>,[35] another about the conjunctions (*sýnodoi*) and luminous appearances (*phôtismoí*) of the sun and moon; and the rest respecting their risings (*anatolaí*).[36]

29 New reading after QUACK, forthcoming, (chapter 1.2.3.17 Ägyptische astrologische Texte). This could, according to Quack, be the head of a cultic community.
30 GRIFFITH, 1935-1937, pp. 26-31.
31 See below.
32 OSING/ROSATI, 1998, pp. 22-24, Tav. 1; GRIFFITH/PETRIE, 1889, p. 23, plate IX; LEITZ, 2014a, p. 447, plate 91.
33 See the overview by BIRK, 2014; LULL, 2004, pp. 76f.
34 Cf. HEILEN, 2016, p. 534.
35 This part is mentioned later regarding the *Hierogrammateus*, but is allocated to the astronomer in most editions in order to reach the mentioned number of four books (cf. WINKLER, 2016, pp. 271f.).
36 *Clem. Al. Strom.* VI.4, 35, 4, cf. JONES, 1994, pp. 42f.; translation and commentary: DIELEMAN, 2003, p. 278; BIRK, 2014, p. 82; WINKLER, 2016, pp. 271f.

The passage seems to imply that the sharp contrast between scientific astronomy and astrology, the latter considered today predominantly as esoteric superstition, was not existent in antiquity.[37] Archaeological finds of the measuring devices of the astronomer assign them to hourly priests (*jmy-wnw.t*).[38] Again, the inscriptions on those objects provide information about the knowledge of the astronomer, including insight into the course of sun and moon. One of them says: "I know (*rḫ*) the course (*nmt.t*) of the two discs [= sun and moon] and each star at its place (*dmj*)." Other inscriptions about the duties of the hourly priests refer to the announcement of festivals and the temporal organisation of food offerings.[39] Thus, the exact division of time by means of sun, moon and stars mainly served a ritual purpose rather than organising the daily life of every Egyptian.[40] It becomes clear that the observation of the moon constitutes an important part in the duties of the hourly priest and it is therefore not astonishing that this continuous activity over hundreds of years led to detailed knowledge of the movements and phenomena of the earth satellite.

"Scientific" Knowledge II: Calculations, Conjunctions, and Astrology

Several texts from Egypt survive that we, from our present-day perspective, would describe as "astronomical texts".[41] These include tables with dates for the new moons covering cycles of twenty-five years, the period of time that elapses before the pattern of lunar phases is repeated. The reason for this is that

37 Nevertheless, sceptical voices about divination from stars were raised in antiquity, too. One example can be found in Cicero's *De diviniatione*: while he portrays his brother Quintus in the first book as being in favour of divination, Cicero himself speaks in the second book clearly against it (I am grateful to Dominik Berrens for pointing this out to me).

38 BORCHARDT, 1899; BIRK, 2014, p. 82.

39 Cf. note 14.

40 SAUNERON, 1959, p. 36, note 3 compares this to medieval monasteries in which the division of time was mainly related to prayer, with the bells marking prayer times also possibly useful to the laity. In an as yet unpublished manuscript, the sage Imhotep tells the king about the sun, moon, the planets and Sirius in connection with the correct times of festivals (QUACK, 2014, pp. 54f.).

41 JONES, 1994; JONES, 1997; QUACK, 2016, esp. p. 235. – On Egyptian astronomical texts and the problems with interpreting them see recently SYMONS, 2016; HOFFMANN, 2016; on the specifics of Greek astronomical texts JONES, 2016.

exactly 309 synodic months fit into that period.[42] A similar system was utilised in both Babylon and the Hellenistic World, which consisted of a nineteen-year-cycle containing 235 lunar months, referred to by the Greeks from the fifth century BCE onward as the Metonic cycle.[43] Unlike earlier in Mesopotamia, where the beginnings of the months were determined by the observation of the first crescent, the months' lengths were calculated in advance for the Metonic cycle, because the number of days for one cycle is fixed at 6940. The twenty-five-year cycle mentioned in Ptolemy's *Almagest* must in contrast be based on Egyptian models, since only the Egyptian civil year with 365 days fits into this scheme.[44] This can be taken as an indication for a transfer of knowledge between Egypt and Greece, and furthermore, in which direction it took place.

The most famous of the tables is the Demotic papyrus *Carlsberg 9* from the second century CE.[45] Its heading says: "Here is the procedure of enumerating the 25 years of the moon in order to make them known (*dj=j-s pȝ gȝy jp tȝ 25.t rnp.t j'ḥ r dj.t rḫ ['']m*)."[46] The first list on the papyrus equates the beginnings of five of the cycles with the regnal years of the Roman emperors Tiberius to Antoninus (19/20-144/145 CE).[47] After a second list containing a number of zodiacal signs, the papyrus enumerates in a third list the civil day dates for the beginning of the first lunar month in each of the twenty-five years of the cycle. To obtain the dates, the lines of numbers in the papyrus first had to be transformed into reasonable tables, whose arrangement has been discussed by many scholars.[48] The fourth list shows, according to Leo Depuydt, the scheme by which it is possible to complement the dates for the remaining months.[49] For the first year, the beginnings of the lunar months are named for all twelve months, while in the following years only the ones for the season *Akhet* (*ȝḫ.t*). The dates start only with the second lunation, because the first lunation was mentioned already in the third list. Following this pattern, all remaining

42 Strictly speaking, 309 lunar cycles are about one hour shorter than 9123 days (DEPUYDT, 1998, p. 1281).
43 DEPUYDT, 1998, pp. 1283f.; LEHOUX, 2007, pp. 90-93.
44 Cf. also QUACK, 2016, p. 234.
45 NEUGEBAUER/VOLTEN, 1938; NEUGEBAUER/PARKER, 1969, pp. 220-225; DEPUYDT, 1997, pp. 151f., 198-208; DEPUYDT, 1998.
46 NEUGEBAUER/PARKER, 1969, pp. 221 and 223.
47 Concerning the reading of the emperors see DEPUYDT, 1998, p. 1281, note 9; LIPPERT, 2009, pp. 189f. (with table 5).
48 Cf. with the most recent theory and older references DEPUYDT, 1998, pp. 1284-1294.
49 IBID., pp. 1290f.

months can be calculated. Nevertheless, it remains unclear, if a month had twenty-nine or thirty days, and in which order these hollow (twenty-nine) or full (thirty) months were to be arranged.[50]

This, however, is provided by a similar table in the Greek papyrus *Rylands IV 589*, (formerly *Rylands inv. 666*) produced in Egypt in the second century BCE (180 BCE).[51] In its heading, it explains the content explicitly:

> Table of lunar new moons, showing how they are related to the days of the Egyptian twelvemonth. The period of the table is 25 years, 309 months (including intercalary months), 9125 days. It indicates the lunar months and which of them are full, which hollow, which intercalated; the Zodiac sign the sun will be in during each month. When the sun has traversed the 25 years it will return to the same starting point and revolve in the same manner.[52]

It lists not only the dates for the first lunar cycle of each year, but of every new moon. This is in contrast to *pCarlsberg 9*, because the exact length of every lunar month must have been calculated beforehand. *pCarlsberg* starts with a year in which the beginning of the cycle coincides with I. *ȝḫ.t* 1, which seems to be a natural choice, as it is the first day of the civil year. The starting point of *pRylands* on the other hand, I. *ȝḫ.t* 20, has probably been chosen because Ptolemy VI, whose regnal year 1 is mentioned at the beginning of the text, ascended the throne in that year.[53]

Further Egyptian papyri written in Greek containing calculations of the moon's movements and phases are known, mainly from the ancient city of Oxyrhynchus in the Fayum,[54] but also from Tebtunis.[55] One of them is *pLund 35a*, which registers the apogees of the moon, i.e. the days of the least progress in longitude when the moon is at its most distant point from the earth, covering the years 69-109 CE, expressed by the regnal year of the emperor and the Egyptian solar calendar date.[56] It gives the moon's position in the zodiacal signs and its degree inside the sign. In total, a period of 3031 days is covered, which equals 110 anomalistic months, i.e. the time the moon takes between

50 Cf. IBID., pp. 1292f.; LIPPERT, 2009, pp. 192f.
51 TURNER/NEUGEBAUER, 1949, pp. 80-96; DEPUYDT, 1998, pp. 1294f.
52 English translation: TURNER/NEUGEBAUER, 1949, p. 94.
53 DEPUYDT, 1998, p. 1295.
54 Cf. JONES, 1999; see also the list in JONES, 1997, p. 30.
55 JONES/PERALE 2012.
56 IBID., p. 2.

two apogees or perigees (when it is at its nearest point to the earth). Another example is *pRylands 27* (250 CE), which mentions the movements of the moon, not only with respect to the longitude (east-western movement) but also the latitude (height), given in "steps" (*bathmoí*) of 15° each.[57] Papyrus *PSI 1493* is a table of the moon's progress on consecutive days, the preserved part of which covers day 80 to 135.[58] Again, the longitude is given in degrees and minutes. The positions in all the papyri named were calculated by using a predictive scheme that Alexander Jones called the "Standard Lunar Scheme".[59] It allowed for the determination of the conjunction (new moon) with a level of accuracy of less than two hours. According to this scheme, the moon's daily progress varies between about 11.7° and 14.7°, with constant increments of a little over 0.2° per day.[60] This is evidence for existence of an elaborate theory of lunar and solar movement, although it is unclear whether the calculation was carried out geometrically as in the *Almagest* of Ptolemy or arithmetical as the Babylonians did.[61]

Furthermore, papyri with calculations of the moon's movements and phases exist, albeit seldomly, in the native Egyptian language of that time, Demotic. They were mainly discovered in Roman Tebtunis in the Fayum, where papyri are generally well preserved.[62] As many of them have just recently come to light during excavations or are still in the process of being published, our understanding of astronomical knowledge in ancient Egypt might still expand.[63] Ostracon *Berlin P. 30539* contains dates with an interval of around thirty days, which already makes it likely that the moon was the astronomical body observed.[64] A conversion revealed that it represents a list of new moons in 184/185 CE. Papyrus *Carlsberg 638* gives the position of the moon between August and September 13 CE, and would, if complete, probably have covered each day of the year 13/14 CE.[65] That the given dates refer to the earthly satellite could already be concluded from the fact that the movement of up to 15° per day

57 IBID., pp. 2f., 31-34 (translation).
58 IBID., p. 3 with references.
59 IBID., pp. 4-31.
60 HOFFMANN/JONES, 2009, p. 18.
61 HOFFMANN, 2010, p. 235.
62 RYHOLT, 2005, pp. 152f.; QUACK, 2016, p. 235 with note 30.
63 HOFFMANN, 2010, p. 236 mentions two unpublished papyri with lunar dates: pOxford 24/50 from Tebtunis and pStrasbourg 19 vso. from Soknopaiou Nesos.
64 HOFFMANN, 2010, pp. 233-236.
65 HOFFMANN/JONES 2009, pp. 10-20. Hoffmann speculates that it might be a teaching text (IBID., p. 16).

corresponds only with the moon's orbit around the earth. The text lists the day, the sign of the zodiac in which the moon is seen, and the degrees inside the constellation.[66] *pCarlsberg 638* represents the earliest proof of the "Standard Lunar Scheme" that was in use until the fourth century CE.[67]

A papyrus from Roman Soknopaiou Nesos (*pVienna D 4876*) contains the days and hours of full moons, as could be deduced from the temporal distance between the dates.[68] Since lunar eclipses only appear at full moon, this table might have been used for the observation of such events. That calculations were definitely also used for eclipses of the moon, in addition to tracking its movements and marking the beginning of the month, is demonstrated by a papyrus from Abusir el-Melek (*pBerlin P. 13146+47*), which lists explicitly the days of lunar eclipses.[69] It gives two dates for each year where an eclipse could be observed, twenty instances in total. Furthermore, the text states the zodiac sign in which the moon would be seen. The interval of five or six months between the dates is in accordance with the astronomical facts, because a lunar eclipse can only occur when the moon crosses the so-called lunar node, which happens twice a year. The pattern of the eclipses and the position in the signs of the zodiac indicate a date between 84-73 BCE, and the application of the Egyptian civil calendar. With this date, it is the oldest proof for the use of the zodiac in Egypt.

This leads to another field of lunar observation in ancient Egypt: Astrology. In antiquity, it was virtually the same as astronomy and mostly not regarded as less valid.[70] Thus, a definite allocation of most texts to one field of knowledge or the other is impossible.[71] Although the *loci* ("houses") seem to stem from Egypt,[72] horoscopes and depictions of zodiacs, whose provenance is clearly of

66 The text finds a close parallel in the Greek Papyrus *Oxyrhynchos 4174* rto. (JONES, 1999, p. 169).

67 Cf. JONES, 1997, pp. 29f.

68 NEUGEBAUER/PARKER, 1969, pp. 243-250.

69 NEUGEBAUER et al., 1981.

70 Cf. above, note 37; VON LIEVEN, 1999, pp. 99f.

71 HEILEN, 2016, p. 507 argues that a distinction between "astrological" and "astronomical" texts is still possible: As a criterion for astrological texts he states that they deal "with changes that these astral motions allegedly bring about on earth", while astronomical texts deal "with mathematical theories and models of the motions of the heavenly bodies".

72 VON LIEVEN, 1999, pp. 101f.; GREENBAUM/ROSS, 2010, pp. 167f.; WINKLER, 2016, p. 247. See IBID., pp. 247-260 on an astrological manuscript (pCarlsberg 81 and related manuscripts) that contains horoscopes that refer to the positions of planets,

Babylonian origin, were only known in Egypt since the Ptolemaic and (mostly) Roman period, because in Mesopotamia the zodiac was not formalised before the second half of the first millennium BCE.[73] However, zodiacs soon started to gain a widespread acceptance.[74] This becomes visible from zodiacs that were frequently depicted in the lids of Roman coffins. Apart from the zodiac schemes, sun and moon are often included in those representations, which is comparable with zodiacs being depicted together with the solar and lunar cycle on temple ceilings.[75] Here as well, an intermixture of new knowledge and old tradition becomes visible.[76] Recent finds of Demotic papyri from the ancient cities Oxyrhynchos, Narmouthis (Medinet Madi), and Tebtunis shed light on Egyptian astrology, too.[77] Horoscopes in the Demotic language are mostly written on Ostraca, while those in Greek are written on papyrus.[78] Parts of astrological manuals or theoretical treatises have survived, though many are as yet unpublished.[79] For example, *pBerlin P. 23547* from year 33 of Augustus (2/3 CE) contains a planet board, with the date (month and day) for the entry of each planet into a zodiac sign.[80] *pWien D 6005* from the Roman period contains the birth dates of several persons, even with the hour in which they

sun and moon in the different *loci* at the time of birth (cf. pp. 251f., 258f. on the moon).

73 E.g. BRACK-BERNSEN/HUNGER, 1999.

74 On the development of the horoscope and the contribution of Egypt's indigene astral lore to it, cf. GREENBAUM/ROSS, 2010; on the earliest sources of astrology in the Hellenistic world, cf. CAMPION, 2000, pp. 539f.; on the acceptance and incorporation of this foreign knowledge, cf. DIELEMAN, 2003, p. 282.

75 On the astronomical ceilings as representation of encyclopaedic knowledge, see LEITZ, 2014b, pp. 1024-1026.

76 Cf. LEITZ, 2006.

77 Cf. for the Tebtunis astrological manuscripts RYHOLT, 2005, pp. 152f.; WINKLER, 2009.

78 QUACK, 2016, pp. 235f. He assumes that the reason is a difference in wealth, not a deviating ethnicity, since the Egyptian elite was mostly bilingual (WINKLER, 2016, p. 246).

79 Cf. WINKLER, 2009, p. 364-366; QUACK, 2016, pp. 236f. with a division in: 1., judicial texts, i.e. they concern king and country; they are mostly based on the heliacal rising of Sirius, but a differing example, which is based on the moon's appearance, is *pVienna D 6286* (see below); 2., decanologies, i.e. they determine the destiny of a child regarding its birth under one of the 36 decans; according to Quack they show a tendency to insist to traditions; 3., Demotic treatises about the planets in the zodiacal signs (*Dodecatropos*, i.e. the twelve "places").

80 HOFFMANN, 1999.

were born.[81] They seem to be notes of an astrologer, who would generate a horoscope for those people. Astrological manuals that include the positions of the moon are the hitherto unpublished *pCarlsberg 66*, *pCarlsberg 81* and *pCarlsberg 89*.[82]

The interpretation of celestial phenomena for the prediction of the future was one of the main interests for Mesopotamian stargazers.[83] Although most Egyptian divination texts date to the Graeco-Roman period, there is evidence for the interpretation of natural phenomena, astral included, since the Ramesside period.[84] As astral signs usually the star Sirius[85] and the decans[86] are used, but there is one text from the ninth century BCE that indicates that the moon was seen already as a portent: In the so-called *Chronicle of King Osorkon* (twentysecond Dynasty), rebellion is mentioned in connection with a lunar eclipse; the utilised term is (*'m p.t j'ḥ*) "the sky swallows the moon".[87] This term is also present in two other sources: in a literary and in a religious text.[88] However, a technical term for "eclipse" is only documented in Demotic: *jrj ȝbȝ* (lit. "to perform an eclipse") or *ȝbȝ j'ḥ* ("eclipse of the moon").[89] In the Roman period, the moon was definitely used as an omen. For example, the Book of the Temple (a normative text about the ideal temple) mentions the "omens of (lunar) eclipses (*sḫn.w jby*)" in the context of priestly knowledge.[90]

81 HOFFMANN, 1995.
82 WINKLER, 2009, pp. 366-368.
83 An overview is given by CAMPION, 2000; cf. also the contribution of Tim Brandes in this volume.
84 JAMBON, 2013, pp. 158-161; VON LIEVEN, 1999, p. 104; QUACK, 2017, pp. 189f.
85 HUGHES, 1951; see also QUACK, 2017, pp. 191f. with a new translation of the Roman pCairo 31222, with Sirius omens IBID., pp. 200f.
86 IBID., p. 193.
87 The passage is much debated; see most recently and again arguing in favour of a lunar eclipse, more precisely the partial eclipse of February 15, 756 BCE, THIJS, 2010, pp. 180-182. – Other alleged mentions of lunar eclipses, but which more probable describe only the prolonged invisibility at new moon, are cited by DERCHAIN, 1962, pp. 31f. The rare description of eclipses – either lunar or solar – is, especially in religious context, probably based on the reluctance to mention irregular phenomena, which pose a threat for the Egyptian concept of the world order called "Ma'at".
88 Cf. recently RYHOLT, 2011, pp. 68f.; ALTMANN, 2010, pp. 93-97.
89 However, this word might derive from the older Egyptian *bjȝ.yt* "wonder", possibly referring to the rarity of the phenomenon.
90 QUACK, 2002, pp. 168f. RYHOLT, 2005, p. 162 proposes the translation "omina and eclipses" since eclipses are seldomly documented; WINKLER, 2016, p. 270, note 80

Furthermore, the text indicates that the task of interpreting celestial omens was carried out only in an advanced stage of the priests' careers.[91]

The most famous astrological treatise concerned with the moon is *pVienna D 6286+6283+6284+6287*, which dates to the late first century CE.[92] It is obviously influenced by Babylonian omen literature, as indicated by the concordance of Egyptian and Babylonian months at the beginning of the text.[93] By interpolation of these months the origin of the text as such – not the papyrus manuscript – could be dated to the seventh to fifth century BCE.[94] The date is further supported by a new reading of the royal cartouche preserved in the text, which Kim Ryholt identified as the name of King Necho II of the twenty-sixth Dynasty (610-595 CE) and as identical with the legendary Nechepsos.[95] This can be taken as further proof that the possible exchange of knowledge had already taken place before the Greek and Roman dominion that has often been stated as cause for the introduction of astrology in Egypt. The most plausible date of transfer of astrological concepts seems to be the time of the Assyrian and then the Persian dominion over Egypt beginning in the seventh century BCE.[96] This is further supported by records from Nineveh that mention scholars and scribes from Egypt together with Assyrian astrologers.[97] In contrast, the autobiographical inscription of an Egyptian called Udjahorresne describes how he was made chief physician of the Persian King

thinks of an interpretation as a *pars pro toto* for all celestial phenomena that found use in divination.

91 However, the occurrence of astronomers in connection with the low-ranking *pastophoros* seems to contradict this high status (WINKLER, 2016, pp. 273f.). Furthermore, the title *jmy-wnw.t* can appear together with other duties, e.g. those of a scribe (IBID.).

92 PARKER, 1959; cf. on the dating due to palaeographical reasons in the first instead of the second century CE QUACK, 2000, p. 85, note 10; see also QUACK, 2016, pp. 236f.; VON LIEVEN, 1999, pp. 101f.; DIELEMAN, 2003, p. 281; QUACK, 2017, p. 193.

93 PARKER, 1959, pp. 29f.

94 More precisely 625-482 BCE (PARKER, 1959, pp. 29f.). This is further supported by the early Demotic language of Text B (QUACK, 2000, pp. 85f.).

95 RYHOLT, 2011, see below.

96 Quack discusses whether the transfer happened directly from cuneiform tablets or via Aramaic texts (QUACK 2018, p. 95). For example, in the fifth and sixth centuries BCE, a Jewish-Aramaic community lived in the city of Elephantine, which is documented by several sources appearing in papyri, ostraca and other media (cf. recently ROHRMOSER, 2014).

97 GREENBAUM/ROSS, 2010, pp. 176f.; ROCHBERG, 1988, p. 34.

Cambyses and was later under Darius I sent back from Persia to Egypt to rebuild the destroyed "Houses of life", the Egyptian centres of knowledge.[98] The exchange of personnel from one country to the other shows a possible way how texts and knowledge could have been transferred.

The divination that is described in the papyrus Vienna is of the judicial or universal type, meaning that it concerns king and country as is common in the Mesopotamian texts.[99] Furthermore, both the Mesopotamian and the Egyptian apodoses, i.e. the outcomes of the predictions, often concern agricultural and military themes (see Table 1).[100] Several times the event of death is predicted at the beginning of the year, a time that was generally regarded as dangerous according to both Mesopotamian and Egyptian belief.[101] All in all a slight tendency to negative prediction prevails.

Topic	Subtopic	Column and line	Evaluation[102]
Agriculture	famine/no harvest	IV, 21; IV, 24; IX, 13; XIV, 10-11	–
	high/abundant inundation	IV, 22; XIII, 3-4; frag. 1a, 3	+
	barley and emmer abundant	VII, 4; VIII, 15; IX, 10-11; XIII, 12; frag. 1a, 4	+
	fish and fowl abundant	VIII, 9-12; frag. 1a, 6-7	+
Military	ruler sends to ruler	IV, 20; VII, 13-14	+/–

98 DIELEMAN, 2003, p. 281; see recently STERNBERG-EL-HOTABI, 2017, pp. 15-19; the respective passage IBID., p. 24. Herodotus (3.129.2) also discusses the Egyptian physicians of King Darius (this reference was provided by Dominik Berrens). On the transfer of medical knowledge in general, see POMMERENING, 2018, on the exchange with Babylonia especially pp. 171-175.

99 This seems to be the original use of celestial omens (QUACK, 2017, p. 191). Also, the judicial omens make use of rare phenomena such as eclipses, whereas predictions for individuals are more concerned with the regular movements of the planets in the zodiacs (IBID.).

100 Cf. the lists in MISIEWICZ, 2016, pp. 376-382; see the edition of the lunar omens in the *Enuma Anu Enlil* (ROCHBERG, 1988).

101 Col. XIV, 3: PARKER, 1959, p. 46; XVI, 2: IBID., 1959, p. 47.

102 My own assessment.

	ruler attacks ruler	IX, 8; XVI, 6	–
	ruler is captured	IV, 27	–
	army is defeated	IV, 26; IV, 27	–
	army revolts	XV, 6-9	–
	foreign countries attacking	VIII, 5-7	–
	great fighting	VIII, 4-5; IX, 9	–
	internal turmoil	IX, 6; XII, 3-4; XII, 11-12; XIV, 7-8	–
	Egypt mourns	XIII, 12-13	–
	Egypt is strong	XIII, 17-18	+
	Egypt slaughters enemies	VII, 6-7; VIII, 8-9; XII, 5-6	+
	peace with enemies	XIII, 15-16	+
others	very happy	IV, 25; IV, 31	+
	good things	IX, 11-12; frag. 1a, 4	+
	King of Egypt lives happily	frag. 1a, 5-6	+
	people of Egypt lives	XVI, 7	+
	death	IV, 28; VII, 5; VIII, 15-16; X, 3; XIII, 6-8; XIV, 3-4; XVI, 2-3; XVII, 3	–
	poverty	VII, 4-5	–
	theft among Egyptians	XII, 12-14; XIV, 8-10	–
	strong wind	XIII, 13-14	–
	death of a star	frag. 1a, 7	–

Table 1: The topics mentioned in the apodoses of the predictions of pVienna.

Two texts are included: The first (A, col. I-V) deals with eclipse omens, and is very close to examples known from Mesopotamia in terms of phraseology and

content.[103] Thus, the predictions refer not only to Egypt, but also to four foreign territories: Crete, Amurru, Assyria and Hebrew(-land).[104] Furthermore, it divides the celestial dome into different areas that are allocated to different countries; the same holds true for the months and the hours of day and night.[105] As is explicitly stated at the beginning of the text, both solar and lunar eclipses (*ȝbȝ pȝ r' j'ḥ*) are treated.[106] The concordance of the months and the divisions of months, sky and hours are repeated a second time before the section about the lunar eclipses. A passage on an unplaced fragment also probably belongs to the lunar passage, as it mentions the day of the full moon and the number of fifteen days, which constitutes the time span of half a month:

[*nȝ s*]*šw rḫ pȝ tš* [...] *pȝ tȝ pȝ Jšwr* [...] *mtw=w jr pȝ hrw nw* [...*pȝ*] *hrw 15 r-ḥr=f* [...]*jr smd.t r-ḥr pȝ* [...].[107]

[... the wr]itings of knowing the pattern […] the land of the Syrian […] and they make the day of seeing […the] 15 days before it […ma]ke the 15th (lunar) day before the […]

Both negative and positive predictions occur.[108] The text says for example:

jn[109]*-nȝ.w j'ḥ jr ȝbȝ IV. pr*[*.t pȝ ȝbd js nȝ Grty ḏd=f r pȝ tȝ*] *rn=f r nfr m-sš*.[110]

103 PARKER, 1959, pp. 28-34. See also the contribution of Tim Brandes in this volume.

104 The lands mentioned are an adaptation to the demands of an Egyptian text and the contemporary political situation, which speaks in favour of an original composition of the text in the seventh and sixth centuries BCE (QUACK, 2017, p. 196).

105 PARKER, 1959, pp. 30-33. Here as well, deviations from the Mesopotamian system are visible. Thus, the sky is partitioned in the Egyptian text into three and not four parts. Furthermore, it divides the months into three groups in the section about the sun, and into four parts in the section about the moon. While the division into four groups is known from the Mesopotamian sources, this dual system is not proven. The first might be derived from the three Egyptian seasons, while the four groups in the lunar section could be influenced by the four parts into which the lunar month can be subdivided (PARKER, 1959, p. 32).

106 Col. I, 24: PARKER, 1959, pp. 8f.

107 Unplaced fragment, a-e: transliteration and translation: PARKER, 1959, pp. 16f.

108 However, Quack's statement that "no normal or even especially positive prognoses for the foreign regions are attested" (QUACK, 2017, p. 195) does not apply on text A from *pVienna*, since both for Crete and for Amurru it is stated that the land in question should be "exceedingly happy (*nfr m-sš*)" (Col. IV, 25 and 31: PARKER, 1959, pp. 24-27).

If the moon eclipses in (the month) IV. *pr.t*, [(since) the month belongs to the Cretans, it means: The land] named shall be exceedingly happy

Quack points out that, because of the relative high frequency of lunar eclipses – compared to solar eclipses – the fear of disastrous conditions must have prevailed, if the omens had been believed to be true.[111] He considers it more plausible that rituals against those negative outcomes were carried out and that the absence of catastrophes would be taken as a sign of their efficacy in appeasing the gods, for example.[112] The knowledge contained in the predictions would rather be used by the rulers in order to make his political decisions.[113]

Another phrase seems to refer to the acquisition of "new" knowledge and is therefore most important in the present paper:

[r]ḫ [n]ꜣ ꜣbꜣ.w j'ḥ[... r] nꜣ sš.[w] mꜣ[y r]ḫ ꜣy nb mtw=f jr n-jm=w ḥn' nꜣ mš'[...]
[r]ḫ nꜣ tš nꜣ ꜣbd.w [rḫ nꜣ] ꜣbd.w mtw j'ḥ ḫnm n-jm=w ḥn' nꜣ h[...][114]

[Kn]owing the eclipses of the moon […according to] the ne[w] writing[s]. [Kn]owing every month which produces them, together with the movements […].
Knowing the patterns of the months [… Knowing the] months in which the moon is friendly, together with the […].

Nothing is said about the knowledge being foreign, but this seems plausible, considering the similarities between Mesopotamian omen literature and text A of the Vienna papyrus.

Another related text is the unpublished *pBM* 10651 from the first to second centuries CE.[115] It contains predictions according to eclipses and the appear-

109 Instead of *ky* (Parker's reading) cf. QUACK, 2000, pp. 84f.
110 Col. IV, 24-25: PARKER, 1959, pp. 24f. (translation modified after QUACK, 2000).
111 QUACK, 2017, p. 197. It should be pointed out that, although solar eclipses are theoretically more frequent than lunar ones, they can only be seen on a locally limited strip on earth and only total or very near to total eclipses are recognized with the naked eye. Lunar eclipses, on the other hand, are visible on the complete nightside of the earth where the moon stands over the horizon; furthermore, partial eclipses are clearly visible, too.
112 IBID., pp. 197f.
113 The provenance of most of the manuscripts is not distinctive; they probably derive from a priestly milieu, although their exact usage remains unclear (IBID.).
114 Col. IV, 7-8: transliteration and translation: PARKER, 1959, pp. 20f.
115 QUACK, 2017, p. 193, partly translated on pp. 204f.

ance of the planets. Yet, the manual is structured according to the genuine Egyptian concept of the decanal stars, i.e. on a ten-day basis. The prognoses resemble mostly those in the Mesopotamian texts and *pVienna* regarding the outcomes that deal with peace and war, fertility and death. But additionally, they mention the efficacy of medical remedies. Its hieratic script, combined with Demotic grammar, is unusual for its date and content; this might indicate that the text is based on an older manuscript, possibly from the Saïtic period.[116]

The second text of papyrus Vienna (B, Col. VI-XVII) is even more interesting, as it provides unique information without an exact parallel in Babylonian sources. It describes omens that are based on the colour of the moon and on other phenomena that appear on or besides the moon disc that always seems to represent the full moon or phases near to it.[117] They might be occultations of stars or planets, or even comets.[118] The different colours of the disc are shown in depictions (vignettes).[119] The text is divided into two registers, the upper referring to the disc as *pȝ jtm* "the disc", the lower designating it explicitly *j'ḥ "*moon". This can lead to the presumption that the upper register does in fact show the sun, since it is frequently called "disc", although other celestial bodies, including the moon, can be called "disc", too. It was mostly argued that stars beside the disc would eliminate this possibility.[120] Other researchers have instead suggested sunspots as an explanation.[121] The question cannot be answered definitively, but the mention of the fifteenth lunar day relating to the disc (*jtm*) (col. VIII, 2) might indicate that the moon is the celestial body in question.

An example where the preserved vignette shows a disc with a separate part in the middle runs as follows:

j.jr=k nw j'ḥ [...] *jw=f jwn nb r wn w' jtm m-ḫr-jb=f j.jr=k ḏd ḫr=f r mwt r ḫpr pȝ tȝ ḏr=f r pȝy=f 'nḫ r nfr m-sš jt bd.t*[122]

116 IBID., p. 193.
117 PARKER, 1959, p. 35.
118 On the debate whether comets were known in ancient Egypt, see WINKLER, 2011, p. 158, note 208.
119 They have been added after the basic layout, as can be deduced from the application of paint, and from col. X on they are shifted by one position, because by mistake the vignette of one column was left out (IBID.).
120 PARKER, 1959, p. 35; QUACK, 2017, p. 194.
121 BOHLEKE, 1996, p. 27, note 87.
122 Col. VIII, 13-17: PARKER, 1959, p. 40.

If you see the moon in the first month of inundation,[123] when it is in the colour of gold, while there is a disc inside it, you shall say about it: Death will occur (in) the entire country, (but) its life will be exceedingly good (with) barley and emmer.[124]

Another one, where the vignette has unfortunately been destroyed, says:

j.jr=k nw j'ḥ jw=f sḫty r wn w' sw ḫnw=f j.jr=k ḏd ḥr=f r tḫtḥ r ḫpr Kmy rnp.t 3.t mtw pȝ ḏry ṯzy pȝ jḫy [*pȝ*] *gb r mn-mtw=w pḥṯ=f r nḥm<=f> jw=w skȝ tȝ sḫ.t bn jw=w* (*r*) *gm šm*[125]

If you see the moon being bright, there being one star in it, you shall say about it: Confusion will occur in Egypt for three years, and the strong one will take the possession of [the] weak one while he has no power to save <himself>. They will cultivate the field, but will not find harvest.

Again, bad and good predictions are included, although the ones with an ill outcome predominate. Other than Text A, the prognoses refer exclusively to Egypt, though interaction with foreign countries is mentioned. Along with it goes the fact that the phenomena are described as such and not in combination with a month in which they appear, each month being ascribed to a certain country. This represents another difference from the omen manuals from Mesopotamia. Even though there are Babylonian omen interpretations concerning the outer appearance of the moon, such as the direction of the "horns" of the moon,[126] and the colour (red) or dimness,[127] no description exactly similar to the second part of papyrus Vienna is known.[128] However, some

123 QUACK, 2017, p. 202, note 49 proposes the reading *tpj ȝḫ.t* instead of *ḥty* (PARKER, 1959, p. 40).

124 See on those contradicting statements QUACK, 2017, pp. 196f., which are also known from Greek predictions.

125 Col. XIV, 5-11: PARKER, 1959, p. 46, corrections by QUACK, 2017, p. 204.

126 See the contribution of Tim Brandes in this volume. The "horns" do not necessarily refer to the crescent, but can refer to eclipses (MISIEWICZ, 2016, p. 355, note 20). The omens also describe phenomena that cannot be observed in reality, probably to include all possible scenarios that were imaginable for the Mesopotamians (CAMPION, 2000, pp. 536f.).

127 Both appear as well in the Greek texts about lunar omens of the sixth century CE (MISIEWICZ, 2016, pp. 373-375).

128 ROCHBERG, 1988, p. 34.

similarities exist with passages about solar omens in the *Enuma Anu Enlil*.[129] Nevertheless, at least an independent development of the text is plausible. This is supported by the grammatical form *j.jr=k ḏd* used in the apodoses of the predictions, which comply with the older form *ḏd.ḫr=k* that is typical of Egyptian medical prescriptions, for example.[130] The text therefore seems to be adopted rather than only translated.[131] This also applies to the aforementioned vignettes, which are frequent in Egyptian papyri, mostly in religious contexts, but obviously impossible on cuneiform tablets. Even if the text was based on a Mesopotamian model, it was clearly edited and adapted to Egyptian style, form and traditions.

Religious Knowledge I: Rising and Setting, Waxing and Waning – The Cycle of Lunation

The other type of knowledge about the moon can be found in the religious texts of the Graeco-Roman period, mostly deriving from temple walls.[132] What seems surprising for a modern scientific mind is, however, in accordance with the fact that many of the known astronomical texts in Egypt have a religious background.[133] In the Egyptian language, the moon was denominated by the terms *J'ḥ* or *Jwn-ḥ''*. Depictions either show the actual celestial body as a disc, combined with a subjacent crescent, or as a deity with such a disc above its

129 VAN SOLDT, 1995, pp. 16-50 (Tablet 24 [25] III). This was pointed out by Andreas Winkler in his unpublished PhD thesis on divination and astrology in ancient Egypt (WINKLER, 2011), which thanks to the author I was able to read.

130 WINKLER, 2011, pp. 158f.; QUACK, 2017, p. 194. Quack points out that the announcement of the prediction by the astrologer cannot be found in Mesopotamian divination texts either (IBID., p. 193).

131 See likewise MISIEWICZ, 2016 on a broader sense of adaption of concepts and not a "word-for-word transmission of omen statements" between Mesopotamian and Greek lunar omens (IBID., p. 358). A direct access to cuneiform tables by the Greek is ruled out by Misiewicz due to the large time gap (see below).

132 A full collection and assessment of these texts and an extensive commentary on all concepts related to the moon can be found in my PhD thesis ALTMANN-WENDLING, 2018.

133 QUACK, 2016, pp. 232-234. VON LIEVEN 1999, pp. 188-190 terms this "religious astronomy".

head. The Roman temple of Esna presents the unique depiction of the whole lunar cycle with the gradually waxing and waning disc and a lunar crescent standing upright.[134] This differs from the common iconography of the disc in a lying position, as can be observed in regions near to the equator. It could be interpreted as a very late type of representation adopted from Graeco-Roman culture, if it were not for the relief of the goddess Nut in the Osireion of Sety I in Abydos from the New Kingdom (thirteenth century BCE). Here, the moon is shown as a small crescent near the lap of the goddess.[135] Moreover, the combination of a disc with a crescent on its right side can be found on a funerary papyrus from the twentieth Dynasty; it can probably be interpreted as the waxing crescent.[136] Nevertheless, the depiction of the lunar cycle in Esna with a sequence of twenty-eight separate phases has never been shown this way before. The only other known examples of this series of lunar phases are to be found on two papyri from the same period that contain sacerdotal knowledge.[137]

The common illustration of the lunar cycle, however, comprises scenes with thirty or fifteen gods; in the latter case, they only cover the waxing phase, each of them representing one day. Every god proclaims to enter the moon or to fill it with different parts and thus contributes to the process of the lunation. The texts, however, describe many different and more elaborate concepts of the events and phenomena during the month. Some of them deal with the outer appearance of the moon and frequently mention a "disc" (*jtn*), e.g. "disc of the night (*jtn n grḥ*)". This illustrates that the focus was always put on the most perfect state of the heavenly body, i.e. the full moon. Further specifications include the terms "disc of gold" (*jtn n ktm.t*) or "he who gleams as the Golden one" (*psḏ m nbw*). This might describe either the colour the moon can take during its rising, or it may refer to the well-documented concept that the nocturnal disc was seen as an equivalent to the sun.

Further special designations for the waxing and waning moon also exist: "He who casts off his form" (*wʒḥ-qj=f*) can be interpreted as the waning phase, whereas "he who repeats his form" (*wḥm-qj=f*) apparently refers to the cyclical

134 A second instance occurs in the temple of Deir el-Haggar in Dakhla Oasis, which also dates back to the Roman period.

135 This means it is in the east and therefore shows the old crescent, because all celestial bodies are swallowed by the goddess when they set (= west), and are born again when they rise (= east).

136 AUFRÈRE, 1995, plates 25f.

137 See note 32.

re-appearance of its phases. The frequent term "secret form" (*sštȝ*) indicates that the lunar cycle seemed a mystery for the Egyptians as well, as it might allude to the disappearance at new moon. In contrast, the joy of seeing the moon, on the part of either men or gods, is also described.

Another important topic is the rising of the moon, often in connection with the corresponding cardinal point. Caused by the rotation of the earth, the eastern horizon is the usual place where every astronomic body appears. Thus, it is surprising that a rising at the western horizon is also mentioned. Its shining could relate to its setting, especially on the morning after full moon, when the moon sets while the sun rises simultaneously. Indeed, this astronomical constellation is described several times. However, the appearance or rising in the west is a different phenomenon, namely the last crescent visibility. On this day, the moon becomes visible about one hour after sunset and then soon sets itself. As has been pointed out already, this moment had to be observed by the priests in order to define the beginning of the month. This explains its crucial importance in the religious texts about the moon.

Connected to the daily rising of the moon is its progress, which is frequently mentioned in the epithets of the moon god. Of course, its path across the celestial dome leads from east to west, as previously explained. But this is only an imaginary course. A unique characteristic of the moon, and certainly of greater significance, is its proper motion, which originates from its orbit around the earth. Each day during its circulation, the moon moves about 13° to the east with respect to the fixed stars. This motion stands in adverse contrast to the starry sky and was certainly recognised by the ancient Egyptians. Therefore, I suggest that the frequent designations of the moon as "he who traverses the sky" (*ḫns nn.t*), or "lord of the path" (*nb mṯn*) might refer to this special movement.

Finally, some expressions should be mentioned that might be explanations for the occurrence of new and full moon. In one instance, the beaming of the sun is held responsible for hiding (*sdg*) the moon. This account is in accordance with the astronomical explanation for the conjunction. On the other hand, in a text about the eve of the full moon, the mixing rays of light of the two luminaries are described. This in turn corresponds with the opposition of sun and moon at that moment. In some examples, the sun obviously appears in the dominant part of the illumination. Of course, this might be based on its theological superiority. But statements concerning the moon catching the light of the sun do in fact point to knowledge about the true constellation of sun and moon. For example, it is stated on the propylon of the Khonsou temple in

Karnak that on full moon "the Left (eye) (= the moon) is equipped with the beams of the Right (eye) (= the sun) (*jʒb.t 'pr m stw.t n wnm.t*)".[138]

Religious Knowledge II: Rejuvenation and Radiance – The Religious Interpretation of the Moon

Apart from its shape, the moon was associated with a number of other items or topics. For example, it was frequently termed *Jwn-ḥ''*, which means "The rejoicing pillar". It was also simply called "pillar of the heavens" which might be the origin of this image. An association with strength and power figures particularly in the designation *kʒ psj* "blazing bull" with reference to the full moon. The similarity of the bent horns and the crescent may have contributed to this concept and can also be found in other cultures. In contrast to this powerful state, the waning moon or new moon, when the earth satellite has lost all its strength, was subsequently called "ox (*s'b*)" and a designation for the full moon was *snsn-kʒ.wy* "the union of the two bulls". This term might derive from the position of sun and moon during the evening of the full moon, when they can be observed standing directly opposite to each other like two bulls in their "sparring matches". Associated with the moon's comparison with a bovine animal is its power to enhance the fertility of bulls and cows, which is frequently mentioned. An association of fecundity and the moon is widely spread due to its waxing during the first half of the month. However, the connection to the inundation mentioned by Plutarch is rather adopted from the moon's identification with the god Osiris. This frequent relationship can be explained by the similarity and parallel accounts of the lunar cycle (with the temporarily disappearance and subsequent gradual waxing) and the myth of Osiris: The god was killed by Seth, his body parts were scattered across the land and eventually put together and revived. Therefore, lunar scenes and allusions to the moon frequently occur in Osirian temples and contexts.

Another characteristic Egyptian lunar metaphor is the identification of the moon as an eye. The same holds true for the sun, as both celestial bodies can be interpreted as right and left eye of the sun god. Myths that involve these heavenly eyes are often intermingled and dependent upon each other. The

138 Clère, 1961, plate 12.

process of filling, healing, providing and counting of the eye is closely associated with this concept.

Another important identification is that of the moon as a child. Here, the process of lunation is equated with the cycle of human life. It is mostly applied on the first crescent after invisibility, because this reappearance is also called the birth of the moon. Its conception is dated on new moon, the first day of the lunar month that lies only one or two days before the new crescent. Apparently, the short time span between conception and birth raised no problem for the use of this symbolic image. However, the moon does not stay in the state of infancy, rather it ages. This is evidenced in the word *jmꜣḫw*, meaning the "provided one", a term used for the desired state after death. The moon gains this stadium on the fifteenth lunar day, i.e. the day on which full moon ideally occurs. Furthermore, both its aging and rejuvenation are described as happening in the right moment or the moment the moon desires. Therefore, death and rebirth were seen as equally important stages during lunation. Similar to the Chinese philosophy of Yin and Yang, one cannot exist without the other.

The moon's fundamental role in chronology becomes evident in expressions like "he who opens the month", "he who appears at the right time" or "he who divides the seasons, the months and the years". Yet, the most important task ascribed to the moon in the texts was illumination at night-time. The desire for driving away the darkness is not only connected with superstitious fears, rather it is also related to more practical concerns. In days with little artificial light the lunar radiance was of great importance; in fact, at full moon the illuminance is 250 times brighter than without. Connected with this is the equation or comparison of moon and sun. The moon acts as the sun's deputy by night, shines and gleams like the star, and is called its companion. This concept especially applies to full moon, when moon and sun appear by coincidence in the same size for an observer on earth. In reality, the sun is 400 times larger than the moon, but its distance to earth is 400 times as far, too.

Even though the moon ranked far below the sun in status in Egyptian theology, its description is not restricted to a few repeatedly used expressions or names. Instead, many different astronomical observations were absorbed into religious imagery and texts, and a broad range of interpretations and equations can be found.

Finding, Inheriting *and* Borrowing – The Ways of Transmission of Lunar Lore

The first kind of knowledge that was presented here, which is displayed in the calendric system, religious festivals and the regulation of the priestly service, can be considered as "found" by the Egyptians themselves. It was acquired by constant observation of the heavenly bodies, one of them being the moon, by a narrow group of people. The main duty of those specialised priests was to announce the time for the punctual execution of rituals and offerings in the temple. In a more or less unbroken tradition over three millennia, the amount and accuracy of this knowledge must have improved on a continual basis. Therefore, one could also speak of an intra-cultural "inheriting" or an Egyptian tradition of stellar lore that was handed down from one generation to the other.

The same holds true for the calculations of lunar months, although they have only so far been proven to have existed since the Graeco-Roman period. Peculiarities in the methods of computation show that the techniques were not directly taken over by other cultures (like the Mesopotamian or the Greek), but were developed in Egypt. Since bilingualism was widely spread in Graeco-Roman Egypt, especially among the highly educated priestly class, the Greek language of some astronomical manuscripts, e.g. *pRylands IV 589*, does not imply that they were written by non-indigenous Egyptians.[139] These Greek texts found in Egypt are therefore no proof for the acquisition of knowledge by Hellenistic culture.

Regarding astrology, the zodiacal system was surely adopted from Mesopotamia, where the system was initially developed. Nevertheless, it was adapted by the Egyptians to their own cultural and religious framework. For instance, the depictions of the zodiac signs comprise a mixture of Mesopotamian motifs (e.g., Capricorn) and Egyptian ones (such as Gemini, which is represented as the Egyptian divine couple Shu and Tefnut).[140] Obviously, an Egyptian equivalent was preferred, whenever possible, but the exact reasons why one phenomenon would be "egyptianised" and others not, must remain in the dark. The same holds true for the only known Egyptian treatise about lunar

139 QUACK, 2016, pp. 236, 238f.; QUACK, 2017, p. 192; VON LIEVEN, 2012, p. 125; JONES, 1994, pp. 46-48. On bilingualism in Egypt, cf. PAPACONSTANTINOU, 2010.

140 NEUGEBAUER/PARKER, 1969, p. 208; cf. LEITZ, 2006.

omens, which is no mere translation, but has been transformed according to culture-specific requirements with respect to layout, language and content.

It has often been stated that Greek astrology was taken over directly from Mesopotamia and only afterwards transmitted to Egypt.[141] However, it can be conjectured that the Greeks might in fact have learnt the new "science" from the Egyptians, as they themselves claimed. Besides the Persian Zoroaster and Babylonian sages – in general called Chaldeans[142] –, the Egyptian king Nechepso (or Nechepsos) together with a priest Petosiris are mentioned in some traditions as the source of Greek astrology.[143] The existence of this king is doubtful und probably to be understood as Necho II, with the epithet "the wise" (*pȝ sšȝ*).[144] The association of this king of the twenty-sixth Dynasty with astrology is possibly based on a lunar eclipse that marked the beginning of his reign.[145] His companion Petosiris is not only known from Greek sources, but is also attested as an Egyptian sage under the name Petesis.[146] He might also be identical with an individual from Egypt that is named in Assyrian temple records from the eighth to seventh century BCE.[147] A Greek lunarium names as its two sources firstly, a text which the *Hierogrammateus* Melampous wrote for the same king Nechepso, and secondly, a hieroglyphic text from the temple of Heliopolis from the reign of Psammetichus.[148] Nevertheless, modern scholars mostly consider the transmission of astrological knowledge from Egypt to Greece only as pseudo-epigraphy that was proclaimed in order to legitimise the new knowledge by ascribing it to the admired antique culture of Egypt, which was known for its profound and at the same time mysterious wisdom; the attribution was therefore rejected as unhistorical.[149] However, besides eurocentric views of the nineteenth and early twentieth century that represent the post-enlightenment belief that all European "wisdom" is based on

141 CAMPION, 2000, pp. 538f.; DIELEMAN, 2003, pp. 284f.
142 Cf. e.g. Cicero, *De divinatione* I.2; Strabo, *Geographica* XVI, I.6.
143 GREENBAUM/ROSS, 2010, pp. 176f.; QUACK, 2018, pp. 110-120 – Diodorus even states that the Egyptians believed that the Chaldeans learned astrology from them (Diodorus I.81.6; cf. also Diodorus I.81.3-5).
144 RYHOLT, 2011.
145 IBID., pp. 68-72.
146 On both names as variants of the same individual, see IBID., pp. 70f.
147 GREENBAUM/ROSS, 2010, p. 176.
148 *Catalogus Codicum Astrologorum Graecorum* (CCAG) VIII/4, 105, 2-5, see QUACK, 2017, p. 199.
149 E.g., DIELEMAN, 2003, p. 279, who calls it a "mistaken attribution" and a "paradox".

ancient Greece, this frequent interpretation was mainly based on a lack of available Egyptian astronomical and astrological texts, a situation only recently rectified.[150] But notably, Greek and Roman astrological texts show no direct parallel with Babylonian astrological treatises, but are instead very close to Egyptian Demotic sources.[151] Also, they do not work with the intercalary month of Mesopotamia. Instead, for example, in the *Geoponica* (1.10),[152] the beginning of the year is connected with the heliacal rising of the star Sirius, which is clearly an Egyptian concept of time division. There are other examples of Greek astrological papyri that definitely must have had Egyptian models. Some of them, e.g. the work of Hephaistion of the fifth century CE who was an Egyptian himself, uses omens based on Egyptian concepts like the rising of Sirius or the Decans.[153] He explicitly names ancient Egypt as a source, especially in his chapter about eclipse omens.[154] Zoë Misiewicz, in a study of the transmission of Mesopotamian lunar omens to the moon book in Lydus' *De ostentis* from the sixth century CE, compares the topics of the apodoses of this source with those from the *Enuma Anu Enlil*.[155] The similarities, although not completely identical, lead her to the assumption that they share the same tradition and that those concepts generally circulated in the ancient world.[156] Since many of the respective topics can also be found in the Egyptian *pVienna* (see table 1), here again Egypt could represent a possible intermediate step in the transmission of astrological knowledge across the Mediterranean. This seems all the more plausible, as Lydus himself names as one of his sources the Egyptians in general, especially the famous Petosiris.[157]

Albeit written mostly in Greek, most of the astrological tables are not necessarily derived from Greek culture. There is evidence for the association

150 Cf. QUACK, 2016, pp. 230f., 235.
151 QUACK, 2016, p. 238. See also VON LIEVEN, 2012, p. 125.
152 The text is an agricultural treatise preserved in a version dating to the tenth century but uses Greek authors from the fourth century CE.
153 QUACK, 2017, pp. 198f. Further natural phenomena named by Hephaistion are thunder, the colours of stars and the position of the moon in different zodiac signs, and comets (cf. VON LIEVEN, 1999, pp. 104f.). Except for comets, all of these phenomena can be found in Egyptian sources as well.
154 *Apotelesmatika*, I, 20. This tradition lived even further on since Hephaistion's work has been included in the Byzantine astrological corpus. Sirius omens still appear in texts from later oriental cultures (IBID.).
155 MISIEWICZ, 2016, pp. 376-382; see also ROCHBERG, 1988, pp. 30, 34.
156 MISIEWICZ, 2016, p. 383.
157 Lydus, *De Ostentis*, 2.

of texts written in Greek and Egyptian on one single papyrus and *vice versa*: For example, a Greek commentary on Aristotle appears together with an Egyptian astrological manual, and a Greek astronomical almanac was combined with an Egyptian religious text.[158] Furthermore, the combination of an astrological text in Demotic on the recto and an astronomical manual in Greek on the verso is known.[159] Thus, even though the astronomical and astrological concepts and components of knowledge are at least partially based on the Mesopotamian culture, Egypt is still a plausible intermediate step in the transmission of this knowledge from Mesopotamia to Greece.[160]

Astronomical knowledge of the celestial body also becomes visible in the religious texts about the moon (god). It relates, in particular, to lunar movement and the phenomena at the most significant phases of the lunation: new and waning crescent, new and full moon. Their incorporation into the theological concepts of the moon shows the strong interest in the earth satellite that can easily be explained by the monthly monitoring of the moon's phases by the priests to keep track with the lunar cycle in order to organise feasts and the priestly service. The awareness of those basic astronomical facts that belong to the field of celestial mechanics could be obtained by visual observation. Therefore, there is no need to ascribe this knowledge to foreign influence. However, some passages give the impression that the illumination of the moon had already been recognised in the astronomically correct way, i.e. that the true source of light is the sun, whose light is only reflected from the moon's surface. This fact was demonstrably known in Greek culture.[161] Some of the required measurements, such as that of the globe's circumference, were even taken in Egypt. Last but not least, the famous Alexandrian Library, the

158 QUACK, 2016, p. 239. One might argue that the papyrus could have been reused, but the content is not typical for reutilisation, which appears mainly with files and accounts (pers. com. Joachim F. Quack). Palaeography affirms a contemporaneous record, too.

159 WINKLER, 2016, p. 245.

160 JONES, 1994, pp. 46-48; GREENBAUM/ROSS, 2010, pp. 175f.; QUACK, 2016, p. 235. Quack even proclaims that "Graeco-Roman Egypt should no longer be seen as a backwater, but as a hotbed of technological transfer" (IBID.). A more lose association can be found in the *Tetrabiblos* of Ptolemy, which contained eclipse omens as well, but used a completely different formula than the Mesopotamian and Egyptian sources (ID., 2017, pp. 199f.).

161 BREIDBACH, 2015.

undisputed centre of knowledge in the ancient world, was based in the land of the Nile. A transfer of this piece of knowledge is thus conceivable.[162]

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162 On the mechanism of cultural transfer e.g. SCHIPPER, 2001; VERHOEVEN, 2005; concerning astronomy and astrology, HOFFMANN, 2000, pp. 103f., 119-125; STEELE, 2016. Some scholars assume that the measurement of the globe's circumference or the insight that earth, moon and sun are of global shape already stem from the Egyptians during the New Kingdom, but this is much debated (cf. *pro*: LEITZ, 1989, pp. 101-104; WESTENDORF, 2002; *contra*: e.g. KRAUSS, 2016).

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