



# Impractical Precision of Calendars



Follow-up motivated by one of the questions raised by "The Heavens and Timekeeping, Symbolism and Expediency", Exton 2011

I argued that the needs of society fulfilled by timekeeping in general (although I looked at calendars) have to do with an astronomical symbolism which presupposes a perceived link to astronomical phenomena.

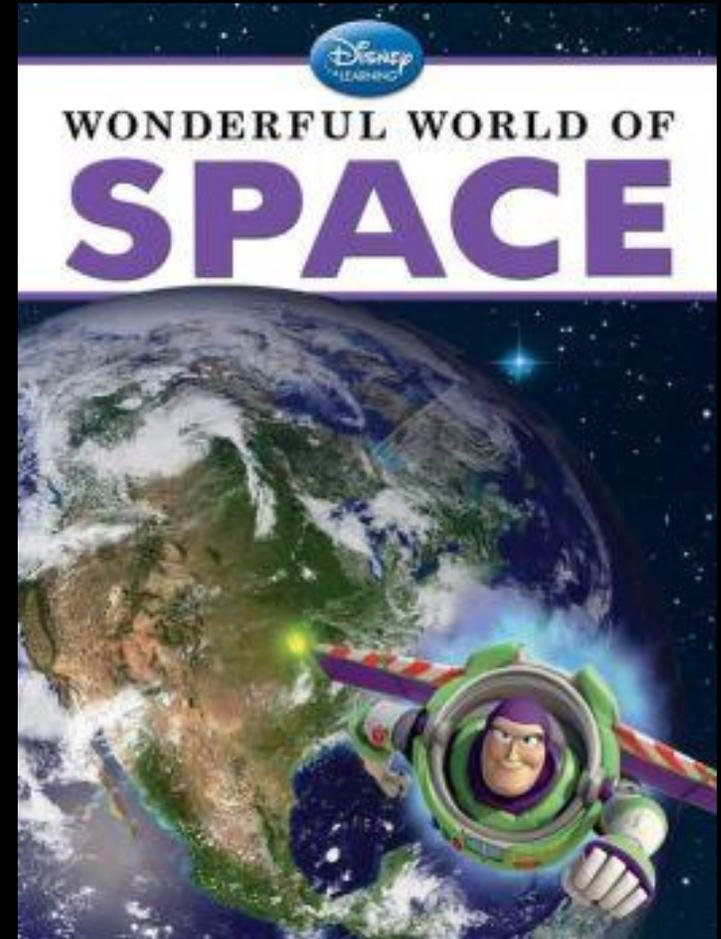
This is in line with the findings of Seago, Seidelmann, Allen: "In no country is legal time known to disregard Earth rotation."



# The Myth



"The earliest astronomers were actually farmers and shepherds. They studied the sky to predict the changing of the seasons. Ancient Egyptians could tell by the movement of the stars when the Nile River would flood each year. They were able to figure out the right time to harvest their crops before the floods began."  
Thea Feldman, *The Wonderful World of Space*. Disney Books, 2012





# The Nile



Otto Neugebauer (1938, 1942), intrigued by the astronomical non-conformity of the best-known Egyptian calendar ( $12 \times 30 + 5$ ), claims that a "schematic calendar" was adopted for record-keeping.

There is ample textual evidence that Egyptians recorded the true motion of the moon meticulously, indeed they did use a lunar calendar alongside the calendar " $12 \times 3 + 5$ ".

The flooding of the Nile fluctuates with a sigma of about a week, and the mean date shifts (long term trends). This was known already around 1904 (publication of Sir William Wilcocks', *The Nile*).

The " $12 \times 30 + 5$ " calendar was of little use in farming.

Paul Gabor, Thu 30 May 2013



# Historiography of Science



"from anachronic internalism to diachronic externalism"

<b>method</b>	<b>philosophy</b>
<1940s: anachronic, i.e., today's knowledge is correct, where did it come from?	<1970s: internalism, i.e., "Science is the absolute organ of culture, and history of science is the history of humanity."
diachronic = contextual, i.e., what was science like in the past	externalism, i.e., science is just another artifact/institution



# What matters?



default	"modern"
what is <i>significant</i> , i.e., having a symbolic value signifies a link to the timeless models of gods and heroes	what is <i>pragmatic, practical,</i> <i>beneficial, profitable</i>
such significance is generally attributed to vital needs	symbols, rituals, etc. are dispensable

We tend to think of the former as "mere luxury":  
these were the only things that truly mattered.  
That is why we have trouble understanding the motivations of  
the builders of Stonehenge, the Easter Island *moai*, the  
pyramids, etc.



# Calendar Accuracy



long-term mean conformity with astronomical cycles

calendar	solar	lunar
Julian (325)	$2E-5 = 1.8 \text{ s/d}$	$2E-7 = 17 \text{ ms/d}$
Hebrew (358)	$1E-5 = 1 \text{ s/d}$	$2E-7 = 17 \text{ ms/d}$
Gregorian (1582)	$8E-7 = 73 \text{ ms/d}$	$2E-7 = 17 \text{ ms/d}$



# Agrarian Accuracy



farmers determine the opportune timing by monitoring weather and the development of the crops

planning on a farm is from one season to the next:

(1) there is no need for accurate timekeeping on the level of centuries, (2) the moon (and menses) provides the most convenient day-counting aid

planning in an agrarian society beyond the immediate needs of farming concerns annual festivals celebrating the solar (tropical) cycle, as well as the more ancient festivals celebrating the lunar (synodic) cycle

The first "calendars" were lunar (cf. Artemis/Diana, links hunting, moon, virginity: the lunar cycle is constant)

Paul Gabor, Thu 30 May 2013



# Calendar Accuracy



Accuracy of calendars exceeds any needs of agricultural societies that we would call "practical".

The drive for astronomical conformity is one of calendric principles irreducible to any "practical" purpose.

Other principles: timelessness (contemporary with foundation myths), continuity, institutional inertia, division of time (ordinary/extraordinary; feasts, fasts)

Calendars result from an interplay of these principles.

"Calendars serve as a link between mankind and the cosmos"  
L. E. Doggett in *Explanatory Supplement to the Astronomical Almanac*



# Conclusion



I agree that practical purposes contributed to the origins and development of timekeeping. However, (1) their creators did not judge their value by what we would view as "practical considerations", but rather (2) their significance was in what they signified: a link between the human world and the timeless world of the gods and heros, ensuring life and prosperity of the society by emulating these models.

Accuracy of calendars itself suggests that agriculture was not the dominant force underlying their development.

"Time is the [cyclically] moving image of eternity."

Plato, *Timaeus*, c. 360 BC