



## A War of Times in the *Mahabharata*?

Artur KARP

### Abstract

Scientific articles often start with the phrase: “The purpose of this article is to examine facts related to...” The content of *this* paper does not stem from an attempt to render afresh freely available, irrefutable data. Its purpose is to present a new interpretation of specific motifs present in the Indian epic tradition – based mainly on data obtained from reconstructions or *facts in potentia*. The following paragraphs delineate the unfolding of work undertaken long ago, started but not yet finished.

The conclusions presented in this paper are in their nature preliminary. They form hypothetical assumptions and, as such, should be treated as *research postulates*.

**KEYWORDS:** *Mahabharata, Pandavas, Kauravas, numbers, divisibility, calendars, lunar-solar cycles*

**ARTUR KARP** MA indologist; retired Senior Lecturer at South Asian Studies Department, University of Warsaw. In University of Warsaw (1969–2007) he gave classes in Sanskrit and Pali, and lectures on ancient cultures of India, history of Buddhism. 1973–77 lecturer in Polish at Modern European Languages Department, University of Delhi. Author of cross-sectional entries on Indian mythologies and religions for *Religia. Encyklopedia PWN* (vol. 1–10, Warszawa 2001–2003). Till 2018 he taught courses on Indian caste system and untouchability at Historical Anthropology Department, University of Warsaw. At Collegium Civitas he delivered the following lectures: “Indian Civilization” and “Buddhism in the World of Power and Politics.” Translator of Buddhist texts from the Pali language.

 <https://orcid.org/0000-0003-3051-892X>

**E-MAIL:** [karp@uw.edu.pl](mailto:karp@uw.edu.pl)

“I [...] have allowed imagination to roam beyond the bounds of cautious scholarship and so must accept alone the responsibility for having erred.”

Ernest G. McClain, *The Myth of Invariance. The Origin of the Gods, Mathematics, and Music from the Rg Veda to Plato* (1984, XIII).

“In any field, find the strangest thing and then explore it.”

John Archibald Wheeler [quoted in James Gleick, *Genius: the Life and Science of Richard Feynman* (1993, 93)].

“...; me I collect trivial questions. Why this, why that?”

Philip Kerr, *A man without breath* (2013, 36).

## Introduction

The *Mahabharata* armies – 1530900 and 2405700 warriors – are presented as divisible into a sequence of numerically consecutively descending, identical units. Their numbers, however, also possess another sort of divisibility – linking them to the Sun’s and Moon’s periods. Was its presence there introduced deliberately or purely accidental? Of substantial interest is also the defense of the *eleven to seven ratio*, unprecedented in the textual tradition known to me. Those are the questions that form the basis of the research project I undertook. It resulted in an attempt to assign the defense of dramatically differing time concepts – traditional and modernized – to both the alliances.

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Time and space are essential categories of culture. Together, they create the basic system of coordinates within which forms of consciousness related to mythological and religious thinking arise, function, and develop – as represented in art, literature, and science – and as used in trade. The specific approach to both these categories in traditional Indian culture is one of its significant features. It stands out from the early tribal cultures preceding it and the neighboring cultures of the Old World.



Vedic texts created at the beginning of the Iron Age (11<sup>th</sup>–7<sup>th</sup> B.C.) testify to a direct connection between early Indian speculations about the world and solemn sacrificial ceremonies – shaped within the sphere of emerging royal power and serving to legitimise it. The implementation of these, often time-consuming ritual undertakings, required careful preparation. The skills ensuring the unchanging correctness and fully controlled repetition of liturgical procedures have become the carefully guarded property of priestly families, passed on only through initiation. The knowledge relating to uttering of the sacrificial word, measuring the sacrificial space, and determining the time appropriate for the sacrifice was based on the belief in the deep, structural identity of the spheres of the world of humans, the middle world, and the world of gods (Skt. *triloka*). Recognition of the network of equivalences connecting these spheres, it was believed, gave the sacrificial act the power to induce desired events in the future. Works of many scholars, but especially of Oldenberg (1919) and Gonda (1984), have provided evidence that the search for equivalences (Skt. *bandhu*) and parallelisms led to the analysis of qualitative and quantitative features of objects and speculation about their relationship with names as early as in the archaic phase of the development of Indian thought.

The fourth chapter of the tenth book of the Vedic “Brahmana of one hundred paths” (Skt. *Śatapatha-brāhmaṇa*, approx. 8<sup>th</sup>–6<sup>th</sup> B.C.), a vast text that serves as a compendium of the Vedic ritual, shows how various phenomena were combined into a whole – translatable into the *experience of time*. The demiurge in this text, “The Lord of Creation” (Skt. *prajāpati*), is also a year (Skt. *samvatsara*). Prajāpati-year is the personification of the mythical time, the time of the primeval formation of the landscape, the elements of nature and people, and – finally – culture.<sup>1</sup>

<sup>1</sup> Indological research has devoted much attention to the problem of time. Kirfel (1940) collected and systematically developed knowledge about great time cycles and their relationship to brahminical and ascetic eschatological and soteriological ideas. Kramrisch (1946) has convincingly documented numerical relationships derived from these cycles – present in the spatial structure of the classical Indian temple. Biardeau (1968–1978) and Pocock (1986) explored the question of the role of the category of time, especially cyclic time, in organising formal and content structures in mythological (*Bhagavata-purana*) and epic (*Mahabharata*) narratives. Gonzalez-Reimann’s (2002, rpt. 2010) study complements previous research on the Mahabharata and the cyclic Hindu World Ages.

The classic works of Kane (1930–1962) and Meyer (1937) clearly illustrated the relationship between the formal sacrificial cycle and the rituals of the life cycle and the vegetation cycle, depending on the rhythms of the Moon and the Sun. The historians of science Thibaut (1899), Sen (1971), and Pingree (1981) confirmed the thesis about the subordination of Indian astro-



By continuing to divide and sacrifice himself in the act of priming – Prajāpati ultimately contained in himself the numbers 1, 360, 10800, and 432000 – derived from the sexagesimal system. He thus encompassed the year (10800 “hours;” 360 days and 30 “hours,” (Skt. *muhūrta*) each day, the sacrificial altar (10800 bricks) and the Vedic word (10800 perfect “lines,” 40 syllables each, 432000 syllables in total) – commanding thus perfect numbers to link time with the creations of culture.<sup>2</sup>

Regardless of whether this was inserted into the text later, it is in the Indian tradition the first sign of attempts to give the experience of time the form of internally *perfectly proportional, perfectly divisible* units.

In its tenth chapter (X. 4.2), *The Brahmana of One Hundred Paths*, presents certain divisions that Prajāpati-year underwent as ineffective (Skt. *na vyāpnot* – “did not achieve”) because they did not lead to the desired number of 360. Such divisions were impossible, as they left remainders (e.g., *na saptadhā vyabhavat* – “did not divide into seven”): the number 360 is not divisible by any of the prime numbers, starting with seven. Consequently, mythical time is divisible “perfectly” by some numbers but indivisible by others.

In this version, the myth about Prajāpati contains the directive to give order to the *whole* world, so far “unnamed,” and awaiting organisation. However, it is also a warning against creating chaos: dividing the “unnamed” by imperfect numbers reveals a partition into the sphere of order and chaos, represented by *remnants*. The culture will have to devote all its energy to their taming – or brutal controlling, if necessary. At any rate, one should not talk so much about taming as about constant exorcism: within the orthodox branch of brahminical thought, remnants arouse fear and repugnance and demand negative marking and sanitising. As already suggested by Douglas

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nomical systems not so much to the directive of objective cognition as to the requirements of ritual timing necessary for the proper cosmisation of man in the moments of his ritual activities. An essential work by Schayer (1938) was devoted to the development of the concept of time in the Indian philosophical tradition. From the perspective of the philosophy and methodology of history, the problem of the time was taken up by Balslev (1983), Thapar (1997), and Perrett (1999). The requirements for the methodological correctness of the interpretation of astronomical data in Indian religious and mythological texts were presented by Plofker (2000).

<sup>2</sup> The numerology game that aims to produce the sacred number 432000 was also preserved in the later Chaldean (Berossos, c. 280 B.C.; the sum of the years of the life of 10 kings before the Deluge) and Scandinavian tradition. According to “Edda the Elder” (9<sup>th</sup>–11<sup>th</sup> C.E.), on the “Wolf’s Day,” i.e., at the end of the world, from 540 Valhalla gates, there will emerge units of 800 warriors each, 432000 warriors in total. According to van der Waerden (1974), the fact that this number is derived from the sexagesimal system ( $432000 = 2 \times 60^3$ ) indicates its Babylonian origin.



(1966, 17–53) and Dumont (1970, 46–55), it may be assumed there is an affinity there with the model of *wholeness* and *remnants* that dominate the Indian theory of hierarchical social relations – in thinking about man, culture, and its values.

The myth about the self-division and self-sacrifice of the Primeval Man-Time is also a story about the beginnings of order and chaos, good and evil, life and death, *pure* and *impure*. The “unnamed” potentially contains the principle of perfect organization. It is *good* itself, only *good*. If chaos emerges from it alongside order, this results from attempts to order the reality – in all its experiential complexity.

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The *Mahabharata* (*Mbh.*) contains descriptions of many phenomena taking place in the heavenly firmament. These have been earnestly and enthusiastically used to definitively establish the “true and precise” date of the Pandavas and Kauravas’ legendary battle. This particular issue has long bothered those Indian researchers who, motivated by politics and nationalism, would like to assign the epic a date even thirty centuries earlier than the one agreed upon by the Indological community.<sup>3</sup>

As they are not so much the product of actual astronomical observations as the attempts to label certain nodal moments appearing in the text with additional signatures readable to all familiar with the basics of astrology, the value of such data is hard to determine. The most dramatic of these phenomena is the ominous appearance of Saturn (Skt. *śanaiscara*) on the eve of the battle (*Mbh.* V, 141.7), intensified the next day as Arjuna faces the Saturnian form. When Arjuna asked him who he was, Vishnu-Krishna answers: “I am the Ancient Time, the Destroyer of Worlds” (*Mbh.* VI, 33.32).<sup>4</sup>

Two great numbers appearing indirectly in the *Mahabharata* (in books I and V/VI) designate the unequal forces brought to the battlefield by both

<sup>3</sup> An extreme example of such tendencies is to be found in Jha and Rajaram’s (2000) anti-Eurocentric book – where the Vedas are dated to seven thousand years B.C. Contrary to those attempts, the *Mahabharata* is cautiously dated to the period between the 4<sup>th</sup> century B.C. and 4<sup>th</sup> century C.E. The text transmits a mythologised picture of the events – beginning with the formation of early state organisms in the western parts of the Ganges Plain. The final stages of its composition took place during the period of intense contacts of Indian thought and life practice with the civilisational achievements of the Mediterranean. On the history of the authorship and date of the epic, concisely: van Buitenen 1973, xxiii–xxv.

<sup>4</sup> Skt. *kālo’ smi lokakṣayakṛtpravṛddho*.



sides of the epic conflict. More than thirty years ago, while referring to Time as the dominant of the epic, I provisionally assumed they could illustrate units used to calculate time.

After determining their size, I divided the first of them, the greater one (2405700), by the number of days in a year, the primary solar cycle. The surprisingly significant result encouraged me to continue the experiment. As it turned out, that very value is also divisible by the number of days in the draconic<sup>5</sup> and lunar year.<sup>6</sup> The results are *almost* identical with the numbers of days in three short, non-Indian, “foreign” time units: the Saros period,<sup>7</sup> the Moon’s nodes,<sup>8</sup> and the Meton cycle.<sup>9</sup> The second, the smaller number (1530900), becomes expedient only when analysed against the traditional brahminical time-accounting model based on the lunar cycle – the numerical values obtained therein are *precise*.

Although they are only mentioned indirectly, attempts to introduce obviously foreign, “new-fangled” concepts of time seem to touch upon deep axiological concerns. Are these concerns being expressed in the *War of Times*, imposed on the struggle of Good and Evil, as epitomised by the mythical antagonists – the Pandavas and Kauravas?

I referred to my original research in a 2005 article published in Polish: “W poszukiwaniu doskonałości: czas i kalendarz w tradycji indyjskiej” [“In search of perfection: Time and calendar in Indian tradition”] (Karp 2005) I devoted particular attention to the fact that the epic places the final battle in the *eighteen* days immediately preceding the planets’ great conjunction with the Moon and the Sun. Those days marked the great divide separating the last two mythical eras (Skt. *yuga*) – the period of the final closing of all calendar cycles necessary if the counting of the time were to be restarted.

The epic’s text magnifies the atmosphere of an apocalyptic crisis, using the metaphor of battle as an all-encompassing bloody sacrificial rite. The au-

<sup>5</sup> The draconic, or nodical, month of 27.212220<sup>d</sup>, i.e., 27 days 5 hours 5 minutes 35.8 seconds, is the time between the Moon’s passages through the same node, or intersection of its orbit with the ecliptic, the apparent pathway of the Sun, see: Britannica 2011.

<sup>6</sup> Twelve synodic months (29.53125<sup>d</sup> each), i.e., 354.375<sup>d</sup> days.

<sup>7</sup> The periodicity and recurrence of eclipses is governed by the Saros cycle, a period of approximately 6585.3<sup>d</sup> (18 years 11 days 8 hours). It is equal to 223 synodic and 242 draconic months, see: Espenak, n.d.

<sup>8</sup> Twelve draconic months, i.e. 241.999...<sup>d</sup>, rounded to 242 days. Lunar nodes period: 6787.6539<sup>d</sup>.

<sup>9</sup> The Metonic cycle or *enneadecaeteris* is a period of approximately 19 years after which the phases of the moon recur at the same time of the year. The recurrence is not perfect, and by precise observation the Metonic cycle defined as 235 synodic lunar months, 6939.8437<sup>d</sup>, see: Wikipedia 2021.



dience witnesses the death of warriors and – simultaneously – the dying of Time. Another issue raised in this article concerns the relationship between two civilisational directives. The first is to divide the stream of time into *precisely defined periods*. The second – to identify, separate, and negatively label those segments of time which, after adapting the lunar to solar cycles, should be treated as excess, as impure *remnants*.

The present paper's first part documents the *numerical comparability* of the main military units in the *Mahabharata* battle – and traditional calendar units. It gives an overview of the armies (Skt. *akṣauhīṇī*) belonging to both sides of the conflict and their particular composition. Particular, since their numerical strength was intentionally set in an *unexpected ratio of eleven to seven*.

The second part contains the results of work on the so-far overlooked motives present in the later sections of the *Mahabharata*. Their reflections in the narratives relating to the eschatological crisis seem to suggest the conviction of the Brahmin editors of the old epic that traditional models of time segmentation, ordering the removal of excess, should be linked with the model of the *whole* and *leftovers*, which is fundamental to the Indian conceptualisations of social relations.

## I

1. When completing the *Mahabharata*'s final redaction, its creators placed the great battle, which is the culmination of the epic, in the 18 days preceding the end of the third mythical aeon – the Dvapara-yuga (Skt. *dvāpara-yuga*). In the battle, the participants formed 18 armies, arranged into two unequal camps – of *eleven* (Kauravas) and *seven* (Pandavas) armies.<sup>10</sup> That is by no means a random proportion: the text brings to the Pandavas' encampment, on the eve of the battle, the king of Vidarbha, Rukmin, who wanted to support their forces with his army. His offer, which – it would have changed the ratio of armies to 11:8 – was rejected, however. The Kauravas also refused to accept Rukmin's army (*Mbh.* V, 155,32-36).<sup>11</sup>

<sup>10</sup> The V book of the poem, "The Book of Efforts" (*Udyogaparva*), announces repeatedly that *eleven* armies fought on the side of the Kauravas, and *seven* on the side of the Pandavas (see, especially, V. 152, 23: *akṣauhīṇyo daśaikā ca saṅkhyatāḥ sapta caiva ha / akṣauhīṇyastu saptaiva pāṇḍavānāmabhūdbalam / akṣauhīṇyo daśaikā ca kauravānāmabhūdbalam*).

<sup>11</sup> In its way, the text strengthens this proportion. When the messengers representing both the parties agree on the term of the beginning of the battle, they determine that it should start seven



2. The term *akṣauhiṇī* was used in post-epic literature (i.e., from around the 4<sup>th</sup> century) relatively often. However, a precise list of army components can be found only in three source texts: in the *Mahabharata*, in one of the late Sanskrit lexicons devoted to politics and military art (*Nītiprakāśikā*, of uncertain date) (1882, 66–71), and in the *History of India (Ta'riḫh al-Hind)* by Al-Biruni, the Khwarezmian astronomer-philosopher who used to live in India in the first half of the 11<sup>th</sup> century. It is noteworthy that Al-Biruni calls the *akṣauhiṇī* a “measure;” he also notes that in some astronomical texts, the term may mean “eleven” (Bīrūnī 1910, 407–408).

The list is presented in the *Mahabharata* only once, in the “Book of the Beginning” (*Ādīparva*) – in “Chapter on the Content of Chapters” (*Parvasaṁgrahaparva*, I, 2–20).<sup>12</sup> Being only a fragment of the frame story “surrounding” the actual frame story, which “surrounds” the main epic narrative, it is, undoubtedly, one of the latest parts of the poem.

3. *Akṣauhiṇī* is a perfect creation. According to the term’s etymological meaning (“power-carrier”), 218700 *akṣauhiṇī* units can be presented as  $10 \times 10 \times 3^7$ .

days before the new moon. It will be a particular new moon. One of the heroes, fully aware of what is happening on the heavenly sphere, says: “The demon *Rahu* (the Moon’s ascending node) is *approaching the Sun*” (V, 141, 10: *rāhurarkamupeṣyati*). Thus, on the seventh day of the battle, it may be assumed that by its end, the Earth, the Moon, and the Sun will be in conjunction, which means that a solar eclipse will occur. As the battle will be fought for eighteen days, this eclipse will create a dramatic interlude by dividing its duration into two episodes: of *seven* and *eleven* days.

<sup>12</sup> *Mbh.* I, 2, 3–10: “The bard [Skt. *sūta*] said: [...] During the time between the Treta- and Dvapara-yuga valiant [Paraśu] Rama repeatedly ravaged the noble lineage of kshatriyas. And having annihilated the entire lineage of kshatriyas [...], he created five lakes of blood in Samantapanchaka [Skt. *samantapañcaka*]... And within those lakes, blood was, not water [...] (and he sacrificed) and sated his ancestors with blood. Appearing before him [...] they stopped him, saying, “Calm down!” And he gave up his toil. And that sanctified place, which was near those blood lakes, was called Samantapanchaka [...] And when the time between the Dvapara- and Kali-yuga came, a battle took place on Samantapanchaka between the Kaurava and Pandava armies. *In this most sacred of places, [...] eighteen armies of akshauhini gathered getting ready for battle* (Skt. *tasminparamadharmiṣṭhe deśe bhūdoṣavarjite / aṣṭādaśasamājagmurakṣauhiṇyo yuyutsayā*).”

*Mbh.* I, 2, 15–24: “The seers [Skt. *ṛṣayah*] said: We would like to hear [...] what you mean by the word akshauhini [...]. Tell us [...] everything you know about the number of chariots and horses, warriors, and elephants (making up) one army.

The bard said: One chariot, one elephant, five foot-soldiers, and three horses, scholars call ‘*patti*.’ Triple *patti* they call ‘*senamukha*’ [Skt. *senāmukha*]. Three *senamukhas* they call ‘*gulma*.’ Three *gulmas* are called ‘*gana*’ [Skt. *gaṇa*], three *ganas* – ‘*vahini*’ [Skt. *vāhini*]. Three *vahinis* are thought to equal [...] ‘*prtana*’ [Skt. *pr̥tana*]. Three *prtanas* are ‘*chamu*’ [Skt. *camū*]; three *chamu* form ‘*anikini*’ [Skt. *anikini*]. Ten-time *anikini* scholars of arithmetic call ‘*akshauhini*.’”



Seven successive powers of 3 appear to suggest a link to the numerology and cosmology of the Pythagoreans.

4. As already mentioned, *eleven* armies took part in the battle on the side of the Kauravas, and *seven* – on the Pandavas side. The ratio of 11:7 has a respectable record within the mathematical tradition – as the equivalent of  $\frac{1}{2}$  of the number  $\pi$ , widespread in ancient times (also in India)<sup>13</sup> and the Middle Ages (Beckmann 1971, 84). A semicircle, based on the diameter measuring seven equal sections, measures eleven such sections (with  $\pi = \frac{22}{7}$ , i.e., 3.14285714...). The semicircle and its underlying diameter, although uneven, correspond to each other, belong together and are, in this sense, equivalent. Similarly, the numerically unequal Kaurava and Pandava troops are equivalent to each other.

5. Indian tradition associates the numbers *eleven* and *seven* with many phenomena, objects, or activities. In the Vedic ritual, *seven* is the number of demiurge – Prajāpati and Agni, the deified sacrificial fire. According to the *Brahmana of One Hundred Paths*, it encompasses phenomena within the fire altar – measured by the seven-fold reach of an adult male’s arms. Seven priests serve the altar. Its seven successive layers are the seven seasons, seven regions, seven worlds of the gods, seven parts of the human body, seven verse measures, and the seven breaths of life.

*Eleven* is, above all, a number in which the power of Indra, the Vedic god of warriors, is expressed. Hymns to Indra were sung using a forty-four syllable verse (four *padas* of eleven syllables each; Skt. *triṣṭubh*). The number *eleven* completes the cosmology of the *seven* layers of the altar with plant and animal forms. On the sacrificial square, eleven sacrificial posts were embedded close to the fire altar; each post with one sacrificial animal – in more developed rituals with eleven animals – tethered to it. Minor sacrifices were made during the principal rite, usually on eleven shells.

6. Duryodhana, the Kauravas’ leader, appeals to the complex semantic universe of sacrifice when he says before the battle: “...we prepared ourselves for the sacrificial rite of war. Let Yudhishtira be our sacrificial animal... Let my chariot be an altar, my sword a sacrificial spoon, my club – a pitcher, from

<sup>13</sup> The value of  $\pi$  expressed by the fraction is mentioned – referring to earlier practices – in late Indian astronomical treatises, which, already, use much better approximations; among them the *Mahāsiddhānta* of Aryabhata II (describing it as a useful approximation). Cf. Bose, Sen, Subbayaarappa 1971, 187; see also: Plofker 2009, 190; Gupta 1988.



which liquid oblations are poured...; let my horses be the four priests, and my glory – melted sacrificial butter” (*Mbh.* V, 57, 10–18).

The battle-sacrifice will take place at the end of time, when all the hallmarks of the previous epochs, of the Krita-, Treta- and Dvapara-yuga are exhausted (V, 140, 6–15). That is a time of dramatic breakthrough,<sup>14</sup> symbolically separating the Bronze Age from the Iron Age (Skt. *kali-yuga*), the closing time for all calendar cycles, necessary if the time count is to be restarted. It is also the period when lunar cycles are transformed into solar ones and excess lunar “leftovers” removed.

Concerning the above, a question arises: what could have been the purpose of an exceedingly accurate numerical representation of the armies and their components?

Is it merely a case of unaccountably meaningless textual bureaucracy?

## II

A series of hypotheses may be formulated based on the analysis of, particularly, the remarkable divisibility of the numbers equal to *seven-* and *eleven times* the value of the *akṣauhiṇī*.

### 1. The *seven* of the Pandavas

A. Pandava troops numbered seven armies *akṣauhiṇī*, therefore:

$$218700 \times 7 = 1530900 \text{ warriors.}$$

The number possesses particular divisibility – evident if divided according to the numerological requirements of traditional Indian astronomy by 4320 – its sacred number:

$$\frac{1530900}{4320} = 354.375$$

<sup>14</sup> By focusing on the dramatic collapse of the traditional idea of Brahmanhood, *Mahabharata* presents this crisis in a particular way: “*na vratāni cariṣyanti brāhmaṇā vedanindakāḥ / na yakṣyanti na hoṣyanti hetuvādavilobhitāḥ* (*Mbh.* 3.188.29) [“The brahmins shall find fault with the Veda and abandon their vows; / seduced by argumentations, they will offer neither worship nor sacrifices”], see: van Buitenen 1973, 596.



The value obtained from this division is very close to the length of twelve synodic months adopted in Indian astronomy (354.36704). Therefore, it can be assumed that the units of Pandava armies could correspond to the units of empirical time (natural days). In a Greek text from the 1<sup>st</sup> century C.E. (Gemini 1898, VIII, 56), there is a statement about the equality of 63 natural and 64 lunar ( $\frac{1}{30}$  of synodic month) days. From the proportion built basing on this statement,  $\frac{63}{64} = \frac{x}{30}$ , we obtain the value 29.53125 for  $x$  – corresponding to the value of the *synodic month* used in Greece. 12 such months are equal to 354.375 days, that is – precisely – the value obtained by dividing the number of Pandava troops by 4320. The ratio of the parameter used in Indian astronomy and the value “hidden” in the Pandava number answers 1 to 1.0000224. The *seven* of the Pandavas would, therefore, correspond to

$$4320 \times 12 = 51840 \text{ synodic months, counting } 29.53125^d \text{ each,}$$

$$\frac{1530900}{51840} = 29.53125$$

B. The basic units of time that regulate the rhythms of India’s ritual life are derived from lunar time. As already mentioned, the synodic month possesses two “wings” (Skt. *pakṣa*) divided in turn into 15 “lunar days” (called *tithi*):<sup>15</sup> the “light wing” runs from the new Moon to the full Moon, the “dark wing” – from the full Moon to the new Moon. Three hundred sixty *tithis* of the twelve synodic months constitute the annual ritual calendar. On the full Moon, sacrifices are made to gods, on the new Moon, to the spirits of ancestors.

At the end of a given period, the calculation of its duration is performed in solar time. It is done by purging from the period those *tithi* and synodic months that occurred in it as a result of intercalation. In other words – a given period should contain the same number of solar and pure synodic months and the same number of natural days and so-called pure *tithis*. The surplus creates intercalated months, appearing from time to time as the thirteenth and therefore defiling “excessive” months (Skt. *adhikamāsa*). During these months, as also during the intercalated *tithis*, human activity should be limited to the necessary minimum. The “lunar excess” created by the intercalated *tithis*/synodic months is regarded as a sign of *chaos*.

<sup>15</sup> ( $t^t = \frac{1}{30}$  of lunation). In *Yavanajātaka* 79.5 Sphujidhvaja gives the definition of a *tithi* as  $\frac{63}{64}$  of a civil day: *dinaṃ catuṣṣaṣṭilavonaṃ āhus tithiṃ...* On controversies related to the reception of this text, see: Mak 2013.



The difference between the period of 1530900 natural days and the same period expressed in *tithi*,

$$51840 \times 30 = 1555200^{\tau}$$

allows for the precise reproduction of the number of *tithis* rejected in the final settlement of the cycle and referred to as “the days to be killed” (Skt. *kṣayāha*). The number of such *tithis* (intercalated after every 63 “pure” *tithis*) amounted over to:

$$1555200^{\tau} - 1530900^d = 24300$$

C. The number of Pandava troops links lunar time units with the perfect, sacred numbers 360, 4320, and 51840. By using the number 218700 as a kind of module and linking it with the numeral *seven*, which is saturated with symbolic meanings, the epic editors obtained a number that characterises the Pandava army as *pure*, containing no traces of chaos.

## 2. The *eleven* of the Kauravas

A. Kaurava troops numbered eleven armies *akṣauhiṇī*, therefore:

$$218700 \times 11 = 2405700 \text{ warriors.}$$

The number of units in the Kaurava army is not divisible without a remainder by any of the lunar time parameters extracted from the *seven* of the Pandavas. Instead, it is divisible by 24300 – the number of “impure,” intercalated *tithis* – associated by implication with the Pandavas:

$$\frac{2405700}{24300} = 99$$

From this point of view, the Kaurava forces would consist of nothing but leftovers, elements of the surplus symbolically eliminated from the Pandava forces.<sup>16</sup>

<sup>16</sup> The multiplier of 99 is reminiscent of the instruction preserved in the *Śatapathabrāhmaṇa* as to how from a herd of 1000 cows, one symbolising the god Soma was selected. The remaining 999 cows were treated as impure leftovers, not to be used for ritual purposes, see: *Śatapathabrāhmaṇa* 1885, IV, 5, 8, 1–2.



B. The text itself indicates the orderly and clean (in the cultural sense of these words) character of the Pandava armies. While listing various signs and omens as well as miraculous events accompanying the Pandavas on their march to the battlefield, the authors emphasise all the more their fidelity to the ritual order of things: the troops of the Pandavas, whose friend and spiritual adviser Krishna has images of the three visible phases of the Moon on his chariot, are circled by forest animals from left to right, and the accompanying birds are not predatory.

Tellingly contrasting images are associated with the Kaurava army. Forest animals walk around these troops from right to left; rivers run off their banks and divert their course, water pours out of wells. Flocks of hawks, crows, and vultures, and herds of jackals follow the Kauravas; swarms of flies surround them (*Mbh.* V, 141, 7–26).

C. Could the Kaurava troops' linkage with creatures that feed on waste, unclean and uncountable, be matched by their additional characteristics, made using a numerical code? If introduced, it would point not only to the ethical and ritual attitude of the Kauravas, questionable from the perspective of the creators' of the epic – “they show hatred to the Brahmins, they also hate the teachers” (*Mbh.* V. 141, 24)<sup>17</sup> – but to the dangerous nature of calendar refuse excreted by Time as well.

D. The foregoing considerations have been so far based on the orthodox Brahmin model of time segmentation. It also focused on the Pandavas – giving them the *positive* characteristics of the first members of a series of oppositions operating within Indian culture, such as *whole* – remnant, *order* – chaos, *pure* – impure, *right* – left, and so on.

That perspective can be changed, provided the requirement of the perfect divisibility of the Kauravas' “military numbers” is waived.

The number of the Kaurava troops:

$$218700 \times 11 = 2405700$$

is not divisible without a remainder by 354.375<sup>d</sup> (12 synodic months); the division produces a number that ends with a fraction:

$$\frac{2405700}{354.375} = 6788.5714$$

However, this is not a nonsensical result.

<sup>17</sup> “Brāhmaṇānprathamam dveṣṭi gurūṁśca madhusūdana.”



6788.5714 is a value close to that postulated by numerous Babylonian, Greek, and Indian texts (approx. 6785–6795<sup>d</sup>) for the period of a full rotation of the line joining the nodes of the Moon. This period is one of the basic parameters the knowledge of which is essential for predicting the eclipses of the Moon and the Sun.

D. Equally thought-provoking outcomes result from the division of the number of units in the Kaurava army by the numbers corresponding to the length of the solar and the so-called eclipse year:

$$\frac{2405700}{365.26} = 6586.2673;$$

$$\frac{2405700}{346.62} = 6940.4535.$$

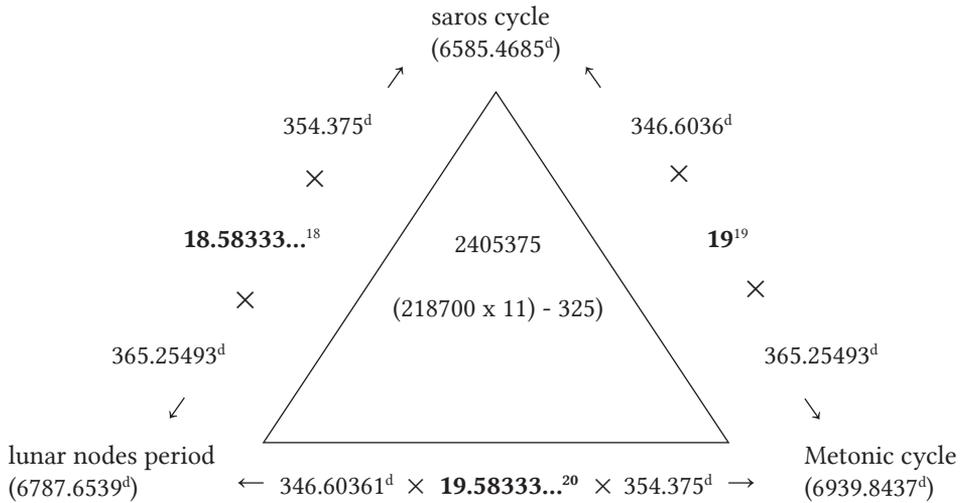
The values obtained from these divisions correspond respectively to periods known since antiquity and used to predict eclipses: the *Saros cycle* (223 synodic months, 19 eclipse years) and the *Metonic cycle* (235 synodic months, 19 solar years). The deviations from classical values are minor, so small that they can be explained as a product of the rounding forced by the use of module 218700. As the length of the *Saros* adopted in classical sources is 6585.333...<sup>d</sup>, it remains to the value “extracted” from the Kauravas’ number in a ratio of 1 to 1.0001419. The *Metonic cycle* (6939.75<sup>d</sup>) remains in an analogous relation to the second of the “extracted” values (1 to 1.0001013).

E. If the *eleven* of the Kauravas is to be treated like a number expressed in natural days, no other divisions give meaningful results. However, since the numerical data obtained from the three presented divisions allow control of the relationship between the speeds and cyclical phenomena in the movement of the Sun, the Moon and the Moon’s nodes, it can be concluded that the number of the Kauravas may have served as a kind of mnemotechnic abbreviation, the possession of which allowed for quick retrieval of primary eclipse arithmetic data from memory. Several elementary parameters and a few simple relations were sufficient to activate this abbreviation.

### III

1. All these data fit exactly and “work” in the number 2405375, smaller by 325 units than 2405700. A mnemotechnical system reconstructed in this way may be presented thus:





**Figure 1.** Mnemotechnical system. Designed by Artur Karp.

2. From the perspective of Kaurava time, the number of units in the Pandava troops is meaningless. It is not possible to “extract” from it by divisions either any number of solar years convenient for the construction of short calendar cycles, or any significant number that could be associated with the speed of movement of the Moon’s nodes or with the period of the Sun passing through the nodes (“eclipse years”).

3. Operating with the vast periods ( $4320 \times 12$  “pure” synodic months) characteristic of the Pandava *seven* is, it can be inferred, a reflection of the cultural imperative that requires people and all their activities to be anchored not so much in the temporary arrangement of celestial bodies, as in the time of the mythical beginnings.

It is this anchoring that gives the Pandavas the *negative* qualities of the second elements of another series of oppositions, such as observed – *mythical*, accessible – *inaccessible*, technical – *ritualised*.

4. The Brahmin orthodoxes themselves judged the arithmetical procedures supported by ritualistic activities as pure. Only they could re-create

<sup>18</sup>  $\frac{223 \text{ synodic months}}{12}$

<sup>19</sup>  $\frac{228 \text{ solar months}}{12}$

<sup>20</sup>  $\frac{235 \text{ synodic months}}{12}$



the harmony and beauty of the spheres of the cosmos because they inserted the reality of empirical time into the ideal numerological structure of the sexagesimal system.<sup>21</sup>

Thus, it may be tempting to say that by assigning to the Kauravas their specific number, the editors of the epic characterised them additionally as “people of short time,” those who reject the traditional ideas of harmony and beauty in favour of efficiency and productivity – and, therefore, are capable of any evil.

The great Indian mathematician and astronomer Aryabhata II (5<sup>th</sup> century C.E.) became the target of attacks by defenders of traditional cosmogonic and cosmological ideas who called him a proponent of Evil. Long-lasting disputes over the ideological model of Indian astronomy indicate that the supporters of the new scientific concepts which pervaded India from the Hellenistic world since the beginnings of Common Era might have been seen and treated in a similar way. Although their applications allowed for the development of new, useful technologies, the world of irrational numbers and numerical leftovers expressed by infinite fractions must have aroused fear mixed with revulsion in the defenders of tradition.

## IV

The peculiar divisibility of the numbers appearing in the *Mahabharata* and depicting the strength of the mythical opponents’ armies *is a fact*.

There is *no mention of it* in texts and studies devoted to Indian mathematics and astronomy history.

The question of its authorship and its value, expressed by its particular placement, *demands an answer*.

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<sup>21</sup> Was the symbolic linking of the *eleven* Kaurava armies with incalculability and remnants only meant to evoke a repulsion against the evil embodied in them as the enemies of the Godly? Could it not also refer to the real, non-schematic relations between the seven-unit diameter and the semicircle based on it? Regardless of its externally perfect form, such a semicircle cannot be divided into exactly eleven sections – it must contain a remnant that eludes simple measurements, resulting from the irrationality of the number  $\pi$ . It would contain an infinite shortage, or – excess, if the popular “approximation” formula were used: circumference = diameter  $\times \sqrt{10}$ ;  $\pi = \sqrt{10}$ .



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