Cosmic Cycles, Cosmology, and Cosmography

In the view of classical Hinduism, this world is the domain of time, and time is viewed as a cyclical process. Society and the entire created universe are subject to a recurring sequence of creation and destruction that is endless. The picture painted by the → Purāṇas, Dharmaśāstras (→ Dharmasūtras and Dharmaśāstras), and astronomical treatises known as Siddhāntas (→ astrology and astronomy) is of an ongoing cyclical process that includes different kinds of cosmic cycles. This is not to say that these texts reflect a lack of sense of history, as has often been argued. Nor does it imply that Indian perceptions of history are strictly cyclical, as opposed to the presumed linear – more properly, rectilinear – understanding of history in religious traditions like Judaism, Christianity, and Islam. In fact, although there is a marked difference of emphasis in these traditions vis-à-vis Indian ones, the distinction between cyclical and linear time is not absolute. Judaism, Christianity, and Islam follow cyclical ritual cycles, and Christianity includes the notion of a returning savior. Hindu cosmic cycles are so vast that, in practice, an event such as the great battle described in the → Mahābhārata fulfills a similar role to that of a unique event in a tradition whose history is patterned according to linear time (González-Reimann, 1988, 19; Thapar, 2007, 32–32). The Purāṇas give great importance to genealogy and the lineages of historical kings, in what can also be viewed as an expression of linear time (for detailed discussions see Thapar, 1997; 2007; Malinar, 2007a; 2007b). Nevertheless, such instances of linear time play themselves out against the backdrop of the large recurring cosmic cycles that, in the developed puranic and shastric system, provide the ontological and mythico-historical background for traditional Hinduism.

There are three main cycles in this complex system: the kalpas (also known as days of → Brahmā), the manvantaras, and the yugas, each with its own defining characteristics, and each responding to a certain need within the religious, cultural, and social circumstances of the time when they first appeared in Sanskrit literature. These cosmic cycles involve enormous time periods with durations that dwarf modern estimates of the age of the universe. In the 18th century, some European intellectuals were so impressed by the antiquity that Hinduism claimed for its texts and traditions on the basis of such durations that prominent figures such as Voltaire sought proof in these claims that Indian traditions were older than biblical ones. The enormity of Indian time cycles was also alluded to by Carl Sagan (the well-known 20th-century astronomer and popularizer of modern astronomy and cosmology) when he was explaining modern scientific views of the origin of the universe. If cosmic time in traditional Hinduism is cyclical, then space is circular, because the world is often arranged in a series of concentric circles defining different continents. Alongside this horizontal geographical arrangement, there is also a vertical one, intimately related to levels of existence.

Time

Antecedents: The Vedic Period
(c. 1200–500 BCE)

Time Cycles
In the Rgveda (c. 1200 BCE; → Vedas), there is no developed system of large cycles of time. The word yuga, which would later designate specific periods of prosperity and decay for human society, is sometimes employed by the poets to refer to a human generation or to an unspecified time period. We occasionally hear of an earlier yuga (RV. 10.72.2) or of future yugas, (RV. 10.10.10). In 1.158.6, the sage (→ rṣi) Dirghatamas is said to have grown old or died in his tenth yuga, with a yuga probably representing five or ten years. Subsequent Vedic literature mentions a five-year yuga, a cycle that was not defined astronomically until the Jyotirvedāṇga of Lagadha (c. 400 BCE), where it is used to reconcile solar and lunar cycles by positing that five years consist of 1830 days as well as of 62 synodic months. Although not very precise, this equation was used for calendrical purposes (for details see Pingre, 1973, 6–8).
The closest that Vedic literature comes to the conception of long time periods is a passing reference in the Atharvaveda (8.2.21) to periods of 100 and 10,000 years, as well as of two, three, or four undefined yugas, and the mention in the Taittiriyabrāhmaṇa (13.12.9.5, 16, 19; → Vedas and Brāhmaṇa) of two Vedic soma rituals (→ yajña) performed in the distant past by “the creators of everything” (viśvasṛṣja). These rituals are said to have lasted 1,000 and 100,000 years, the former being divided into four periods of 250 years each.

Just as there is no evidence in the Rgveda of a well-defined system of large time cycles, creation is not viewed by the poets as a recurring process. The text presents several versions of creation, but Rgvedic poets were apparently not concerned with the possibility that the world might someday come to an end. There are no predictions or descriptions of catastrophic events that would herald the destruction of the world. In fact, earth and sky are said to never grow old: they are immortal (ajra; RV. 3.6.4; 6.70.1; 10.31.7), which implies they do not die. And Uṣas, the goddess of dawn, is both unageing and immortal (ajarāmrta; RV. 1.113.13). The gods in general are considered immortal (RV. 4.54.2; 7.17.4; 10.65.15), and this must include sky and earth. Thus, for the Vedic poets, the world was not in danger of being destroyed.

Creation, however, was an important topic for many poets, and we encounter varying explanations of how the world came into being. We find the description of the god Indra’s heroic slaying of the serpent-demon Vṛtra, who withheld the waters that allowed for life to exist (RV. 1.32), a feat that has been interpreted as an anthropomorphic creation story. There is the important and very influential description of creation that appears in the Puruṣa Sūkta, the Hymn to the Man (RV. 10.90), which portrays the origin of the world as the result of the division or dismemberment of a cosmic man (→ puruṣa) of enormous proportions. Different parts of the physical world, as well as the social structure of four social classes (varṇas; → caste) and the all-important Vedic ritual, are said to have originated from sections of his cosmic body. Creation is also imagined as the work of a cosmic carpenter (RV. 10.81.4), or as the separation of the earth from the sky by gods like Varuṇa (RV. 7.86.1), who then keep these two world halves apart by means of a pole or pillar (skambha, stambha), an image reminiscent of the setting up of a tent. In another version, creation occurs when a cosmic mother spreads her legs in order to give birth to the earth and the directions of space (RV. 10.72.3–4). In a more abstract sense, being, or what is (sat), emerges from a state of nonbeing (asat; RV. 10.72.2–3), although these two states are elsewhere said to come later in the process of creation (RV. 10.129.1).

There is one Rgvedic version of creation that is especially relevant here because of its influence on later puranic cosmology. It is the origin of the world from a hiranyakarība, a golden germ or embryo (RV. 10.121). Equally important is the fact that a frequent feature of Rgvedic cosmogonical descriptions is the presence of water. According to Rgveda 10.129.3, in the beginning everything was water (salīla), while in 10.190 an ocean with waves (samudro arnavah) came into existence at an early stage, and from it emerged the year with its days and nights, thus creating measurable time. The golden germ/embryo itself was on the waters in the beginning (RV. 10.121.7), just as the gods were in the waters (salīla) when they brought the sun (Śūrya) out of the ocean (samudra; RV. 10.72.6–7).

The connection between water and creation continues in the Brāhmaṇa (c. 9th–6th cents. BCE) and Aranyakas (→ Upaniṣads and Aranyakas). The Taittiriyabrāhmaṇa (2.2.9.3) links the ocean, understood as the place of generation, with the placental water of animals, and the notion that water was the original state is frequently reaffirmed (ŚBr. 11.1.6.1; TaiĀ. 1.23.1).

Although Vedic literature shows no awareness of large recurring time cycles, nor does it seem interested in the possibility of world destruction, the three principal astronomical cycles – the day, year, and lunar month – are often portrayed as recurring, circular phenomena, and the periodic disappearance and reemergence of the sun and the moon are frequently depicted as a process of death and rebirth. The year is a wheel (cakra) that revolves endlessly (RV. 1.155.6; 1.164.11, 13), and the moon “becomes new again and again as she is born” (RV. 10.85.19).

These three astronomical cycles share two fundamental characteristics in Vedic tradition that are of great importance for the Vedic ritual. First, they are divided into two halves, one in which light gradually increases, known as the light half, and another in which light decreases, the dark half. In a broader sense, they are an ascending and a descending half. Second, the points at
which one half gives way to the other are transi-
tional periods that carry special ritual signifi-
cance. In the case of the year, the ascending half
begins with the shortest day, at the time of the
winter solstice, and it ends with the longest day, at
the summer solstice. This is the uttarāyana or
udagāyana, the “movement towards the north”
(of the sun at sunrise). The descending half is the
daksināyana or “movement towards the south.”
The moon’s ascending half is called sukla, white,
and it extends from new moon to full moon, after
which the kṛṣṇa, or dark half, begins. In the case
of the day, the division is usually placed at sunrise
and sunset, although it can also be at midnight
and noon (ŚBr. 2.1.3.1–3). The moments of transi-
tion between the two halves of each cycle will
then be the solstices for the year, the new and full
moon for the month, and the two twilights – or
midday and midnight – for the day. These are
critical junctures that require the performance of
prescribed rituals.

The importance of the halves of the year and
their periods of transition is well illustrated in a
ritual described in the Brāhmaṇas, called the
gavamāṇa, which lasts for an entire year.
Throughout the year the priests emulate the sun's
movement by performing the sacrifice in the nor-
mal order during the ascending half, from winter
solstice to summer solstice, and then inverting
the order of the performance for the descending
half. They also pause at the solstices, like the sun
appears to do (KauśBr. 19.1.28–2.22; 25.1.5–6).

Time as Destroyer

Even if Vedic poets were not preoccupied with
the possible end of the world, they do display a
concern with the end of life. Vedic hymns are
generally inspired and life affirming. However,
they contain the seed of what was to become a
dominant concern at the end of the Vedic period,
namely, the notion that time is an unstoppable
force that eventually leads to death. We witness
an early manifestation of such worries in the
hymns to Usas, dawn (→ Vedic gods). Usas is
praised as the bringer of light and day, the dis-
peller of night’s darkness, and, as such, her arrival
is eagerly awaited. But she is also the bringer of
old age and death, since her daily return makes
us one day older and slowly drives us towards
our end. She causes humans to age (jarayanti; RV.
1.92.10; 1.179.1), and she destroys (praminati)
human generations (RV. 1.124.2). The increasing
importance of time as a powerful force is well
illustrated by the presence of two hymns in the
Atharvaveda (19.53–54), which present time as
the origin of everything. Time, kāla (a word used
only once in the Rgveda), created earth, sky,
the waters, and the Vedas. Time also created Prajāpati – who in the Brāhmaṇas became the
undisputed creator god – thus making time the
creator of the creator. Nothing is higher than
time, and everything exists in it (see also → time
and destiny).

The Brāhmaṇas addressed the concern voiced
earlier in the hymns to dawn by emphasizing the
need to overcome time ritually. The year was
the epitome of time, and its basic cycle. The
Śatapathabrāhmaṇa (10.4.3.1) declares boldly
that the year is death (mrtyu; → death and after-
life), destroying the life span of mortals by means
of its days and nights. Additionally, the year
is equivalent to the god Prajāpati, whose ritual
brick altar, the agnicayana, is constructed with
10,800 bricks, emulating the 10,800
muhārta
s or "minutes" of the year (ŚBr. 10.4.2.1–20; 10.4.3.20).
The ideal year is made up of 360 days, each
containing 30 muhārta, and men can reach
immortality by building this altar to Prajāpati
(10.4.3.10–11). Similarly, the Taittiriyaabrāhmaṇa
(3.11.8.1–6) prescribes the building of a fire altar
called nāciketa that allows the sacrificer to escape
the reach of days and nights.

The rituals described in the Brāhmaṇas serve
to counter the negative impact of time, as the sac-
crifier ritually obtains (āpnoti) the year, which is
to say that he conquers and survives it. But the
year, like the succession of days and nights, is a
solar cycle, so another way of conquering time is
by going beyond the sun. According to the
Taittiriyaabrāhmaṇa (3.11.4), the sacrificer who
conquers the imperishable world beyond the sun
escapes the reach of day and night.

The ideal human life span was 100 years in the
Rgveda (1.89.9; 2.33.2), and this continues in the
Brāhmaṇas. The Satapathabrāhmaṇa states that
100 years is a full life span (āyus), and whoever
lives that long reaches immortality (amṛta;
10.2.6.7–9; 13.2.6.8; 13.4.2.10). Other Brāhmaṇas
(KauśBr. 11.7) contain similar statements, while
the Bhāgavatapurāṇa (3.11.12) will still claim that
100 years is the maximum, or best, length of
human life.

Time’s role as bringer of death and destroyer of
life continues in the Vedic Upaniṣads, where old
age and death are a common concern. In the
Brhadāraṇyakopaniṣad (3.1.3–5), a priest asks the wise Yajñavalkya how the sacrificer can free himself from death, from days and nights, and from the two halves of the moon’s cycle. In one of the late Vedic Upaniṣads, the Maitrāyaniyopaniṣad (6.15), the eternal brahman is said to have two forms, time (kāla) and the timeless (akāla). Its timeless form existed before the sun, prior to the appearance of days and nights, the markers of time.

**Death and Rebirth**

There are three crucial developments in the Upaniṣads. First, the belief in reincarnation emerges, and the interval between birth and death is now seen as a brief moment in a long cycle of birth, death, and rebirth. Living beings endlessly rotate (anuparivartante; BĀU. 6.2.16; āvartante; ChāU. 5.3.2; PrU. 1.9) in the wheel of existence (→ sansāra), a term that first appears in the Kathopaniṣad (3.7). Second, the only way to avoid the suffering brought about by repeated birth in this world is to break away from the wheel of time – in whose domain we are bound (baddha) – and to reach the world of the → brahman, beyond time (ChāU. 8.15.1). The Vedic ritual can no longer accomplish this, only knowledge of the brahman. This is → liberation (mokṣa). In the Upaniṣads, reincarnation entails spending time in the moon before returning to earth, while liberation requires going to the sun and beyond (BĀU. 6.2.15–16; ChāU. 5.10.1–6). This is reminiscent of the Vedic idea that the sun moves in the wheel of existence (→ sansāra), a counterpart of something. It is of great relevance in the Upaniṣads, where its ultimate expression can be seen in the identity of the → ātman (the self) with the brahman (the immaterial foundation of the world). The Upaniṣads deal with the birth, death, and rebirth of living beings; but on account of this principle of correspondence or correlation, it seems natural to view the world as going through the same process: it is created, it exists for some time, and it is then destroyed. At the time of destruction, it returns to its source in brahman. Not surprisingly, some upanishadic descriptions of death can be read as allusions to the end of the world, as in Mundakopaniṣad 3.2.6, where the term parāntakāle (at the time of the final end) almost certainly refers to death, but could be read as “at the end of (cosmic) time.” Similarly, kṛṣṇaśayā (the destruction of everything) in the late Maitrāyaniyopaniṣad (4.6; 6.17) probably means death, although it can be construed as referring to world destruction, especially in its second occurrence.

The notion that the world undergoes constant creation and destruction, an idea that becomes prevalent in our next historical phase, is therefore a mirror image, a projection, of the human process of repeated life and death. Likewise, the emerging theory that the world is eventually reabsorbed into its origin is, essentially, a projection of the mystical or yogic process of gradually withdrawing from contact with the external world.
and experiencing a return to the timeless origin (see Biardeau, 1968; 1969). The term pratyāhāra (withdrawal), which is the name of a stage in the classical eightfold yoga of Patanjali (→Patañjala Yoga), is used in the →Mahābhārata (12.209.20; 12.224.74) with both these meanings: the yogin's withdrawal of the senses from objects, and world destruction. Similarly, the compound withdrawal of the senses from objects, and world destruction is also evident in epic passages such as →Mahābhārata 12.271.

**The Formative Period (c. 400 BCE–400 CE)**

The centuries surrounding the beginning of the Common Era were instrumental in the formation of many fundamental puranic beliefs. The many social, political, economic, and religious changes that took place during that long period would inform all later Indian traditions in one way or another. The changes involved a complex combination of internal transformations of the Vedic tradition, foreign influence, and the reaction to, and often assimilation of, local non-Vedic elements.

**World Destruction and Re-creation**

The earliest mentions of cosmic cycles in Sanskrit literature are found in the Yugapurāṇa section of the Gārgiyajyotis (c. 1st cent. BCE), the Mahābhārata (c. 3rd cent. BCE–4th cent. CE), and the Manusmṛti (c. 2nd–3rd cents. CE). In the Mahābhārata, the name applied to the cycle of creation and destruction is not consistent, indicating that these ideas were still being formulated. The cycle is either called a yuga (MBh. 1.1.28; 12.327.89; 13.135.11), a kalpa, meaning a formation or a creation (MBh. 6.31.7 [= BhG. 9.7]; 12.326.70; 12.327.23), or a day of the brahman, or of Brahmā, the creator god (MBh. 12.224.28–31).

Sometimes, it is simply referred to as the process of creation and destruction (samhāravikṣepa; MBh. 12.271.30, 40, 43, 47–49). The ambiguity of the designation of the cycle continued in classical Tamil literature, where the word ālī can designate either a kalpa or a yuga. The first term employed in Sanskrit was probably yuga. In the Mahābhārata, the expression “the end of the yuga” (yugānta) is routinely used by the epic poets to allude to a mythological “end of the world” characterized by natural disasters. This world destruction is usually presided over by the god Śiva, and it involves earthquakes, scorching heat, devastating rains, and strong winds (González-Reimann, 2002, 64–73). We have epigraphical evidence for this use of the term in the Junagarh Rock Inscription of Rudradāman I, from 150 CE (Sircar, 1965, 176–177). These natural disasters are integral to the natural environment of South Asia. The intense heat and torrential rains are part of the yearly monsoon cycle, while earthquakes are also common in the subcontinent. In Sanskrit, the names kalpa and Day of Brahmā eventually became definitely associated with the cycle of creation and destruction. The cycle is compared to the rising and setting of the sun in the Mahābhārata (12.326.71). When the world is created and while it lasts, it is the cosmic day, while the period between its destruction and a new creation is the night. During the day, Brahmā is awake, and during the night, he sleeps (MBh. 6.30.17 [= BhG. 8.17]; 12.224.29–30; see also MaSm. 1.73).

Vaiṣṇavism appropriated Brahmā's role as creator by explaining that the god who wakes up and goes to sleep is Nārāyaṇa-Viṣṇu (MBh. 12.327.89). However, Brahmā's participation was still included in the Vaiṣṇava narrative, where Brahmā himself is said to come from →Viṣṇu. Brahmā is born on a lotus that grows out of Viṣṇu's navel when he wakes up at the end of the rainy season (Gangdhar Stone Inscription of Viśvavarman, lines 20–21; Fleet, 1888, 75, 77).

The old association of water with creation is now given new life and is placed within the emerging cyclical cosmogonical worldview. If the
world is created repeatedly, and if water is present at the beginning, then water must set in after the world's destruction and remain there until a new creation arises. The idea of a devastating flood at the time of world destruction now gains prominence. The serpent on which Viṣṇu reclines during the cosmic night floats on the cosmic waters (MBh. 3.194.8–12; 12.328.14–15; 12.335.18–20), which comprise a dreadful “single ocean” (ekārnava). As for the presence of a lotus at the moment of creation, this is an older motif that appears in the Tatītiyabrāhmaṇa (1.1.3.5–7), where Prajāpati, in the form of a boar, sees a lotus leaf on the surface of the cosmic ocean and dives to retrieve some earth from the bottom. He then spreads it on the lotus leaf to create earth. This boar, which in the Rāmāyana (2.102.2–4) is said to be Brahmā, becomes Viṣṇu in the Vaiṣṇava narrative. Water is also the source of creation in the myth of the churning of the ocean, which appears first in the Mahābhārata (1.15–17) and the Rāmāyana (1.44). The gods and the demons (→ asuras), intent on obtaining āmṛta, the drink of immortality, churned the ocean like one would churn milk to obtain butter. In the detailed Mahābhārata version, their churning turned the water into milk and produced, among other things, the sun, moon, goddess Śrī/Laṅkāśī, and god Dhanvantari, who held a jar containing the āmṛta.

Kalpas and Yugas

The earliest known datable mention of the kalpa as a long period appears in the fourth and fifth stone edicts of King Asoka's Prakrit inscriptions (3rd cent. BCE; → historical periods). They state that his descendants will follow the (Buddhist) dharma (teaching) throughout the kalpa, but no duration is given for the kalpa. The kalpas are absent from the Upaniṣads, with the exception of an also undefined passing reference in the late Śvetāsvataropanisad (6.22). The puranic kalpa theory will include three phases: creation, duration, and destruction, associated with the gods Brahmā, Viṣṇu, and Śiva, respectively. Interestingly, the Buddhist version of the kalpas – as expounded in the Abhidharmakosā (3.89–90) of Vasubandhu (c. 5th cent. CE) – adds the time during which the world does not exist as a fourth phase (this would correspond to the night of Brahmā). It describes a mahākalpa (great kalpa) made up of four smaller “innumerable” (asamkhhyeya) kalpas. These four subdivisions of the mahākalpa correspond to the four phases: destruction of the world, duration of destruction, re-creation of the world, and duration of the world. The "innumerable" kalpas, in turn, consist of 20 still smaller, intermediate (antara) kalpas. The Mahābhārata uses the term mahākalpa five times, but it probably has no specific technical meaning (12.323.1; twice in 12.326.104; 13.17.122; 13.110.71). In the first of these instances, it could be synonymous with the mahāyuga, which we will now discuss.

The mahāyuga or caturyuga (fourfold yuga) is a cycle characterized by a gradual decay of → dharma, a term that, for our purposes, can be understood mainly as proper behavior in accordance with one's social class (varṇa; → caste). By contrast to the largely ontological kalpa or Day of Brahmā, the mahāyuga is concerned with society and morality. The cycle, often called simply a yuga, includes four successive minor yugas, in the course of which dharma wanes from a perfect state into one of confusion and disarray. It must be understood that in puranic and shastric discourse, it is the Brahmanical dharma that is at stake. Historically, the centuries immediately preceding and following the beginning of the Common Era presented the Brahmanical tradition with serious challenges. First, there was the rising influence of local traditions – mainly Buddhism and Jainism – which denied the validity of the Vedas and rejected the notion of a creator god (see also → historical periods; → Hinduism and Buddhism; → Hinduism and Jainism). Followers of these traditions were usually called nāstikas, nonbelievers. Second, there was a growing presence of foreign invaders who sometimes embraced Buddhism and did not recognize the Vedic system of four social classes. These threats were viewed as the “end of the world” in some Brahmanical circles and were considered to be a yugānta. We saw above how this term was used in the Mahābhārata for the moment of cosmic destruction, but in these narratives (MBh. 3.186–189) it carries a different meaning, alluding mainly to a social and moral catastrophe, even if some form of cosmic crisis is often included. In this restricted sense, the yugānta is the culmination of the gradual decay of dharma through the four yugas that make up the mahāyuga.

The four descending ages, the yugas, were not named after metals, as were their Greek counterparts, by which they could have been influenced. Instead, the names come from throws of dice. It
is a fourfold classification that, conveniently, included a numerical gradation from best to worst. The names are kṛta, the best throw, followed in descending order by tretā, dvāpara, and kāli, the losing throw. The system of yugas thus appears as a scale that descends from the prosperous kṛtayuga – when dharma is followed, and morality is at an all-time high. According to the nāstika foreign invaders appear, the social order is upset, and morality is at an all-time low. Everyone – down to the most prosperous – is affected.

Prosperity thus appears as a scale that descends from the kṛtayuga to the kāliyuga, but their lifespan is gradually reduced to 10,000 and 1,000 in the subsequent tretāyuga and dvāparayuga. Although not stated, it would presumably be 100 years in the kāliyuga. This decimal numerical sequence was abandoned, however, and the numbers connected to the dice throws (4–3–2–1) prevailed as the numerical values for the yugas. The human lifespan was then considered to be 400 years in kṛtayuga, 300 in tretāyuga, 200 in dvāparayuga, and 100 in kāliyuga. Note that in both systems the duration of life in the kāliyuga coincides with the ideal lifespan of Vedic literature.

The 4–3–2–1 sequence determined by the dice game was also applied to the yugas in other ways. Dharma was metaphorically said to be a cow that stands firmly on four legs in kṛtayuga, on three in tretāyuga, on two in dvāparayuga, and on only one in the kāliyuga. As the yugas decline, human beings’ understanding, strength, and virtue also decrease proportionately (MBh. 3.188.13). More importantly, in the Mahābhārata (3.186.17–23; 12.224.19–20) and Manusmṛti (1.68–73; ŚBr. 1.68–73; ŚSatapathabrāhmaṇa, the duration of the yugas was deemed to be four thousand, three thousand, two thousand, and one thousand years, respectively. The Vedic notion of transitional periods was also applied, so that each yuga would be preceded by a dawn and followed by a dusk, each lasting one-tenth of the duration of the yuga itself. These transitions are called samdhis. The total number of years for the mahāyuga was then 12 thousand, a figure that elicits a correspondence with the 12 months of the solar year. Furthermore, one thousand of these great yugas are said to constitute one kalpa, or Day of Brahmā, while his night has an equal duration.

There is yet another stage in the numerical development of the yuga theory. Although these early sources do not say so, the duration of the yugas was soon considered to be reckoned in divine years. One human year was equal to one day of the gods, thus requiring the length of the yugas to be multiplied by 360 in order to calculate them in human terms. In doing so, the duration of the yugas was extended to the astronomical numbers of the classical system (table 1). The equation of a human year with a day of the gods goes back to the Brāhmaṇa (TaiBr. 3.9.22.1) and was taken up in the Mahābhārata (12.224.16) and Manusmṛti (1.67). A likely reason for the application of this equivalence to the duration of the yugas – besides the common epic and puranic tendency to increase numbers – is the possibility that the end of the kaliyuga and the ensuing return of the kṛtayuga were awaited in some circles around the beginning of the Common Era.

There is probable evidence for this in the Yugapurāṇa as well as in the Mahābhārata (3.188), where the notion has been tailored to suit the epic’s narrative. As there was no indication that the kāliyuga had ended and the kṛtayuga had started, interpreting the duration of the yugas in divine years allowed postponing its expected arrival into the distant future.

As can be seen in table 1, the number 432,000 is central to the system. It marks the length of the kāliyuga and – with the addition of zeroes – also that of the mahāyuga and kalpa (which consists of one thousand mahāyugas). Equally important is one-fourth of the cycle, 108,000 years, with its own addition of zeroes. D. Pingree (1963, 238–240) points to the Babylonian origin of these numbers in the context of large time periods. However, they are also Vedic numbers connected to the year and the ritual in the Satapatha-brāhmaṇa, where, as we have seen, the 10,800 bricks of the agnicayana altar (yajñā) represent the mukārtas of the year. In addition, the Satapathabrāhmaṇa computes the number of syllables contained in the Rgveda as 432,000, with an equal number for the Yajurveda and Sāmaveda taken together (ŚBr. 10.4.2.23–24; for further analysis, see González-Reimann, 1988, 101–112). The use of such figures for cosmic cycles could well be the result of an amalgamation of local traditions with external influences.

The destructive aspect of time plays a central role in the Mahābhārata, where kāla is an inexorable force that drives everything towards its conclusion and is virtually synonymous with destiny (González-Reimann, 2002, 20–32). Vyāsa, the purported author of the Mahābhārata, is said to be a kālavādin, a proponent of the
Cosmic Cycles, Cosmology, and Cosmography

regarded as the father of mankind and the first man to have performed the Vedic sacrifice. However, as traditions and lineages multiplied, in the early centuries of the Common Era, the notion emerged that there had been several Manus instead of only one. In this scheme, the Manu of the Rgveda—known as the son of Vivasvat—becomes Manuvaivasvata, only one of many Manus, each of whom presides over a different manvantara. Additionally, according to the Purānas, in every manvantara there is a new Indra (Vedic gods) and a distinct group of seven rṣis (sages), whose task it is to teach the Vedas. There is an incipient version of the manvantaras in late sections of the Mahābhārata, but no well-developed theory (12.321.9; 12.323.51; 12.329.15; 12.337.40–41; 12.337.52; 13.14.22). The manvantaras are first outlined in the Manusmṛti (1.61–62), where six Manus are listed before Manuvaivasvata, the current one. These are Svāyambhuva, Svārociṣa, Aumtami, Tāmasa, Raivata, and Cākṣuṣa. The Purāṇas would place seven more Manus in the future, thus bringing the total number to 14. In order to incorporate the manvantaras into the system of yugas and kalpas, these 14 manvantaras were said to make up one kalpa. This presented a mathematical problem because the number of mahāyugas in a kalpa is one thousand, and, consequently, each manvantara must include 71.4286 mahāyugas. This prompted puranic authors to say that every manvantara contained 71 mahāyugas plus an

The Classical Period (after 400 CE)

The Manvantaras
By the beginning of the 5th century, the kalpas and yugas were probably firmly in place and widely accepted, despite some disagreements concerning their exact measurement. There is a third cycle that emerged separately and was eventually combined with them. This is the “period of Manu” (Manu-antara). In the Rgveda, Manu was regarded as the father of mankind and the first man to have performed the Vedic sacrifice. However, as traditions and lineages multiplied, in the early centuries of the Common Era, the notion emerged that there had been several Manus instead of only one. In this scheme, the Manu of the Rgveda—known as the son of Vivasvat—becomes Manuvaivasvata, only one of many Manus, each of whom presides over a different manvantara. Additionally, according to the Purāṇas, in every manvantara there is a new Indra (Vedic gods) and a distinct group of seven rṣis (sages), whose task it is to teach the Vedas. There is an incipient version of the manvantaras in late sections of the Mahābhārata, but no well-developed theory (12.321.9; 12.323.51; 12.329.15; 12.337.40–41; 12.337.52; 13.14.22). The manvantaras are first outlined in the Manusmṛti (1.61–62), where six Manus are listed before Manuvaivasvata, the current one. These are Svāyambhuva, Svārociṣa, Aumtami, Tāmasa, Raivata, and Cākṣuṣa. The Purāṇas would place seven more Manus in the future, thus bringing the total number to 14. In order to incorporate the manvantaras into the system of yugas and kalpas, these 14 manvantaras were said to make up one kalpa. This presented a mathematical problem because the number of mahāyugas in a kalpa is one thousand, and, consequently, each manvantara must include 71.4286 mahāyugas. This prompted puranic authors to say that every manvantara contained 71 mahāyugas plus an

<table>
<thead>
<tr>
<th>yuga</th>
<th>duration</th>
<th>one samdhis</th>
<th>two samdhis</th>
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Table 1: The length of the yugas according to classical Hinduism

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<tr>
<td>mahāyuga</td>
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<td>kṛta</td>
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<td>kali</td>
<td>360,000</td>
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<td>mahāyuga</td>
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Cosmic Cycles and Traditional History

The involvement of astronomers resulted in the establishment of a correlation between the yugas and historical dates. They concluded, probably in the 5th century, that the kaliyuga had to begin with a conjunction of all the known planets at the beginning of meṣa (Aries), which was the first constellation in the newly acquired division of the zodiac into 12 solar constellations, the raśis (as opposed to the 27–28 Vedic lunar constellations, the nakṣatras). While Āryabhaṭa’s system of equal yugas allowed for major conjunctions at the beginning of each yuga within the mahāyuga, the dominant puranic system did not, prompting astronomers to find a way to place a conjunction at the beginning of the kaliyuga. The Śṛṇaṅgeśvara’s (1.24; c. 800 CE) solved the problem by positing a period of creation of 17,064,000 human years at the beginning of the kalpa. The link between cosmic cycles and chronology was achieved by calculating the date of the most recent major conjunction. Using the mathematical parameters at their disposal, astronomers concluded that the last major conjunction – and the beginning of the present kaliyuga – took place on Feb 18, 3102 BCE. This date provided an anchor that became very influential. It was linked to traditional history because the Mahābhārata war was, by then, widely regarded as having taken place around the beginning of the kaliyuga. Although the connection between the start of the kaliyuga and the events of the Mahābhārata is quite certainly late in the epic itself, it was widely accepted in the Purāṇas. The Viṣṇupurāṇa (4.24.113), for instance, declares that the kaliyuga began precisely on the day Kṛṣṇa passed away. In terms of traditional genealogy, this means that all descendants of Parīkṣit, the heir to the throne of the Pāṇḍavas (the heroes of the Mahābhārata), were rulers of the present kaliyuga. It also means that the end of the kaliyuga is more than 400,000 years away in the future.

The Purāṇas further refined the placing of mythical and historical events within cosmic cycles by asserting that Kṛṣṇadaivaśeṣa-Vyāsa – the traditional author of the Mahābhārata and the purported arranger of the Vedas into four collections – was the 28th Vyāsa (“Arranger”) to appear..

**Fig. 1:** The number of mahāyugas in a manvantara and a kalpa (after González-Reimann, 1988).
in the current vaivasvatamanvantara. This places us in the 28th mahāyuga of the manvantara (figure 2). The texts also state that a Vyāsa is born in every dvāparayuga (ViP. 3.3.9–10; VāP. 1.23.111–214).

The kalpa s, the current one is the kalpa of the boar (varāha), said to have started when Viṣṇu rescued the earth from the bottom of the ocean. The previous one was the kalpa of the lotus (padma) when Brahmā emerged from the lotus in Viṣṇu’s navel. There is one further stage of development before we reach the complete puranic system of time cycles. If there are days of Brahmā, there must also be years of Brahmā; and if Brahmā had a birth, it is logical to assume he will also die. Thus, puranic theory adds the life of Brahmā as a larger cycle. In consonance with the well-established human life span of 100 years, the life span of Brahmā is said to be 100 of his years. This means that he lives for an unwieldy $3.1104 \times 10^{14}$ human years. To put this in perspective, (12.336.13–45), where he is born seven times, but there is no evidence there of the life of Brahmā as a well-defined cycle. The Purānas agree in stating that one-half of Brahmā’s life has elapsed and that we are in the first kalpa of the second half (figure 3).

We can now determine our precise position in time. We find ourselves in the vārāhakalpa (the first kalpa) of the second half of the life of Brahmā, in the vaivasvatamanvantara (the seventh of the current vārāhakalpa), in the kaliyuga of the 28th mahāyuga of the manvantara. Because a kalpa is a day of Brahmā, we can say we are near noon in his day (figure 4). In modern terms, the time is now precisely 11h 28m 49s of the current day of Brahmā. It is evident that in terms of the life of Brahmā, as well as of his day, we are at the center of several births of Brahmā in the Nārāyanīya section of the Mahābhārata.
of time, although this is not the case with respect to the mahāyugas.
Once Brahmā’s life was added to the list of cosmic cycles, another adjustment became necessary. The destruction of the world (pralaya), which takes place at the end of his day, cannot be the same as the one at the end of his life. The Purāṇas therefore distinguish between a minor, “occasional” (naimittika) destruction at the end of Brahmā’s day, and a total one, called elemental or primordial (prākṛtika, prākṛta), at the end of his life. The naimittikapralaya is partial, and it mainly involves natural catastrophes. It gives way to the cosmic night, when the god sleeps. The prākṛtikapralaya is total, and all the elements return to their source. Two kinds of creation are then posited as counterparts to these two types of destruction. The prākṛta creation takes place when Brahmā’s life begins, and the daily (dainandina) creation occurs every morning of Brahmā’s day. Puranic accounts of the prākṛta creation and destruction are heavily influenced by the Sāmkhya school of philosophy, and they include the natural elements that had already appeared in the Upanisads. In this rendering, the world evolves out of prakṛti, primordial matter, into mahat, ahamkara, and the elements. The descending order of creation with respect to the elements is space (ākāśa), air (or wind), fire (or light), and finally water and earth (mahābhūtas), while destruction occurs in the reverse order. The natural calamities associated with the destruction at the end of the Day of Brahmā are also related to these elements: earth corresponds to earthquakes, water to flooding, fire to intense heat from seven suns, and air to strong winds. The Purāṇas describe another type of complete destruction, the aṭyatikapralaya, which is nothing more than individual spiritual liberation (ViP. 1.7.41–45), thus bringing us full circle regarding the intimate connection between the yogic experience of return to the source and world destruction.

In this complex system of cosmic cycles, the kalpas and the life of Brahmā pertain mainly to cosmogony and are closely linked to ontology and eschatology. The manvantaras, however, are especially concerned with genealogy and lineage, often providing a linkage to Vedic tradition. But it is the yugas that acquire great relevance with respect to social circumstances and everyday life. They provide a mythological and historical framework that places puranic and shastric Hinduism at a well-defined moment in traditional time. The kaliyuga becomes the focal point of the system, as it represents the present, and its negative characteristics explain the difficult world we live in. The Mahābhārata (12.224.26–27) had put forth the notion of yugadharma by saying that dharma changes according to the yuga. It stated that the foremost activities for each yuga are asceticism (tapas) in kṛtayuga, knowledge (jñāna; wisdom and knowledge) in tretāyuga, ritual sacrifice (yajña) in dvāparayuga, and giving (dāna) in kaliyuga. This list would be repeated with some
variants in later texts, but the placement of sacrifice in the dvāparayuga must be emphasized as it situates the Vedic tradition in a bygone era. This served to explain why the Vedic ritual had lost importance and was no longer followed by many. The concept of yugadharma also explained changes in social customs, as in the later lists of kalivarjas, the practices that are forbidden in the kāliyuga. On the religious front, it opened the door for advocating different paths as the best suited for the present kāliyuga. Vaiṣṇava devotional traditions pointed to bhakti (devotion), especially the recitation of the name of god, as the best path to liberation in the kāliyuga. Śaivism claimed Śiva to be the supreme god in the kāliyuga (KāP. 1.28.32), and other traditions did the same with respect to their own divinities and teachings.

The rise of nāstika (nonbeliever) traditions and the presence of foreign invaders around the beginning of the Common Era were attributed to the effects of the kāliyuga. As stated above, at the time there were probably expectations that the kāliyuga would end and a new krtyayuga would commence, although they never materialized. The central passages of the Mahābhārata that deal with the dreadful conditions of the kāliyuga (3.186–189) close with the announcement of the coming birth of a prominent Brāhmaṇa (Brahman) in a village called Sambhala, who will take up arms and become king. He will destroy the foreigners and restore the Brahmanical social order by celebrating the Vedic horse sacrifice (aśvamedha). His name will be Kalki, and he will inaugurate a new krtyayuga. In subsequent centuries – and up to the present – the theory of the yugas and the expectation of Kalki’s arrival often acquired a more general, moral import. Kalki was soon appropriated as an āvatāra (descent) of Viṣṇu, and the krtyayuga became known more commonly as the satyayuga, the yuga of truth, while its original connection to the game of dice was largely lost. Expectations of the arrival of Kalki and a new satyayuga are current even in modern times, usually with a universalistic tone no longer restricted to Brahmanical traditions or to the Indian subcontinent. From Vivekananda and Aurobindo to many popular movements today, a new satyayuga for all of humanity is proclaimed as imminent despite the fact that puranic chronology places such an event in the very distant future. The puranic durations of the yugas are reinterpreted, or even dismissed, in order to announce this new satyayuga (González-Reimann, 2002, 180–187). In addition, the yuga theory – as that of the kalpa – has been appropriated by modern Western esoteric authors and New Age movements.

Indian cosmic cycles provided puranic authors with a means for solving contradictions by placing conflicting versions of events in different periods. Early on, the manvantaras allowed for divergent lists of seven rṣis to be situated in various manvantaras (Mitchiner, 1978), while alternate versions of creation were assigned to separate kalpas. This was sometimes achieved by using the term kalpabheda (kalpa difference) in the sense of “in a different kalpa.” The Śīvapurāṇa (2.4.13.5–6), for instance, acknowledges the existence of two distinct versions of the birth of the god Gaṇeśa (Gaṇapatī/Gaṇeṣa), and it explains them through kalpabheda: they refer to different kalpas. Some commentators, both of the Purāṇas and of astronomical texts, use the same procedure. Śrīdharasvamin (c. 13th cent.) elucidates textual problems in the Bhāgavatapurāṇa (5.16.28; 12.11.39) by resorting to kalpabheda; and the astronomer Jñānārāja (16th cent.) explains that discrepancies between the Purāṇas and astronomical Siddhāantas with respect to the planets are due to kalpabheda (Minkowski, 2004, 355). More recently, Bhaktivinoda Swami (20th cent.; Bhaktivinoda Prabhupad) allocates two supposedly separate fish incarnations of Viṣṇu to different kalpas when commenting on Bhāgavatapurāṇa 8.24.10.

Space

Cosmology and Cosmography

Vertical Space and the Egg of Brahmā

The dominant Rgvedic view of the physical world is uncomplicated. There exist three realms: earth (prthivi), sky (dyaus), and the intermediate region between them (antarkṣa). Hymn 1.160.1 describes earth and sky as two bowls facing each other, with the sun traveling between them. Rgveda 10.89.4 visualizes sky and earth as the two wheels of Indra’s chariot, held in place by the axe, an image similar to that of sky and earth kept in place by a pillar after being separated at the time of creation. There is also mention of a threefold subdivision of the three regions, resulting in a
total of nine realms (RV. 4.53.5). In the Brāhmaṇas, earth, sky, and the intermediate region are often invoked with the ritual formula “bhūr (earth) bhuvah (intermediate region) svār (sky).” The Atharvaveda (12.3.20) uses the term loka, world, to designate these three main regions, and it also alludes to other lokas, without specifying their number (10.7.7; 19.54.5). The text includes what is probably the earliest mention of the Brahmaloka, the world of the brahman (19.71.1), which, according to the Taittirīyabrāhmaṇa (3.12.9.8), can be reached by means of a soma sacrificial ritual. The Brāhmaṇa list several lokas, usually seven. The Jainiṇyabrāhmaṇa (1.334) has the worlds of Agni, Vāyu, Āditya, Varuṇa, mṛtyu (death), asayā (hunger), and brahman. The Kauśitakibrāhmaṇa (20.1.5–13) names those of Agni, Vāyu, Indra, Varuṇa, mṛtyu, brahman, and nāka (vault of the sky), while the Mūndakopaniṣad (1.2.3, 2.1.8) simply alludes to seven lokas, without providing any details. Although some texts give other numbers, such as the 33 of Mahābhārata 3.247.25, the standard number of lokas in the Purāṇas is seven. They include the three Vedic levels, now often called the trailokya (triple world), plus a further four above them. The puranic list is as follows, in ascending order: Bhūrloka, Bhuvan-loka, Svarloka, Maharloka, Janaloka, Tapoloka, and Satyaloka, with the Satyaloka generally identified with the Brahmaloka (VāP. 2.39.27, 39).

Sectarian elaborations often place an additional world above all others, such as the Goloka (world of cows) for followers of → Kṛṣṇa (HV. 62.18), the Rudraloka for Śaivas (KūP. 1.35.8), or the Vaikuṇṭha for Vaiṣṇavas (BhāgP. 8.5.5); but these are usually not part of the general cosmological plan of the Purāṇas.

As a counterpart to the seven lokas, there are seven netherworlds called pātāla. They are inhabited by various kinds of demons (dānavas, daityas; → asuras and daityas), supernatural beings (→ yakṣas), and snakes, who live luxuriously in grand palaces. According to the Harivaṃśa (62.24), snakes or elephants support the earth from below, an idea that found expression in the puranic notion that the serpent Śesā lies below the pātāla upholding them and the earth (ViP. 2.5.1–27). There are also many hells, called narakas, which are apparently to be located above the pātāla, although this is not always clear. The variant word nāraka appears already in the Atharvaveda (12.4.36) as the designation of an undesirable loka.

The conception that will bring all cosmological ideas together in the Purāṇas is a reworked version of the Ṛgvedic hiranyagarbha, the golden embryo. In the Brāhmaṇas, Prajāpati was sometimes said to have been born from a golden egg (anda) that floated on the cosmic waters (ŚBr. 11.1.6.1–2), and Brahmā is explicitly identi-
The Svarloka includes, in ascending order, the moon, stars or constellations (nakṣatras), five planets (Mercury, Venus, Mars, Jupiter, Saturn; → navagrahas), constellation of the Big Dipper (known as the “Seven Sages,” saptarṣi), and Pole Star (figure 6). As for their dimensions, the Bhuvarloka is 14 times higher than that. The length of a yojana is not certain, but D. Pingree (2001) suggests approximately 11 km.

Above the triple world lie the remaining four lokaś, with ever-increasing sizes. Maharloka measures 10 million yojanas, Janaloka 20 million, Tapoloka 40 million, and Satyaloka 60 million (figure 7). The Vāyupurāṇa (2.39.142) includes an additional distance of 15 million yojanas from the Svarloka to the shell of the cosmic egg.

In the puranic system, the physical world is located in the three lower lokaś, the Vedic realms. It extends from the surface of the earth to the Pole Star (dhrūva). The first world, Bhūrloka, is the surface of the earth itself. The second world, Bhuvarloka, reaches from the earth’s surface to the sun, the lowest of the celestial bodies. Above it, the Svarloka includes, in ascending order, the moon, stars or constellations (nakṣatras), five planets (Mercury, Venus, Mars, Jupiter, Saturn; → navagrahas), constellation of the Big Dipper (known as the “Seven Sages,” saptarṣi), and Pole Star (figure 6). As for their dimensions, the Bhuvarloka is 100 thousand yojanas high, while the Svarloka is 14 times higher than that. The length of a yojana is not certain, but D. Pingree (2001) suggests approximately 11 km.

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The cosmic egg itself is then enveloped by the elements. The egg takes the place of the element earth, and it is surrounded by layers of water, fire, wind, space, and the Śāṅkhya principles of mahat,
Horizontal Space
As in the case of cosmogony, water plays an important role in the cosmology of the Brāhmaṇas, according to which the waters are the foundation or resting place (pratiṣṭhā) of the earth and, indeed, of everything (ŚBr. 6.7.1.17; 12.5.2.14). The earth is also surrounded by the ocean (samudra; AitBr. 8.15). The prominent role of water continues in the Purāṇas, but this time the earth is not simply surrounded by one ocean. On the horizontal plane – the earth’s surface – there are seven concentric circular continents called dvīpas, with oceans separating them (see figure 8). The central continent in this vast cosmic circle is the Jambudvīpa, followed by the Plaksādvīpa, Śālmalidvīpa, Kuśadvīpa, Krauṅcadvīpa, Śākadvīpa, and Puṣkaradvīpa, although the order of the five central ones varies depending on the text. The oceans that separate them, also arranged concentrically, are the oceans of salt, sugarcane juice, liquor, clarified butter, curd, milk, and (in the outermost ring) the ocean of water. Beyond it lies a mountain range called lokāloka (world-nonworld) situated in a golden realm, followed by a region of darkness (tamas). Finally, after the dark region stands the shell of...
the cosmic egg. The width of each continent is twice that of the previous one, and the ocean surrounding each continent has the same width as the continent it encircles. The central Jambudvipa measures 100 thousand yojanas, while the width of the seventh, the Puśkaradvipa, is 6,400,000 yojanas. The total distance from the center of the disk to the shell of Brahmā’s egg is 500 million yojanas. This includes the golden realm and the region of darkness. Continents two through six are said to each contain seven mountains and seven rivers, and their inhabitants live for five thousand years. There are no rivers in the seventh and outermost continent, Puśkaradvipa, and in it is found a lofty mountain named Mānasottara. The life span of its inhabitants is ten thousand years. Some similarities with elements of the theory of cosmic cycles are evident, such as the presence of transitional regions (the oceans), which are the equivalent of the samādhis of time cycles, and the varying length of human life. In addition, this scheme of concentric continents situates South Asia at the center of horizontal space, while the arrangement of lokas and pātālas puts the earth in the middle of vertical space, just like the theory of kalpas and manvantaras places the puranic authors at the center of time.

The central continent, Jambudvipa, is subdivided into seven territories or areas called varṣas. In the middle of Jambudvipa is the region of Ilāvṛta. At its center rises Mount Meru (figure 6), and atop Meru lies the city of Brahmā. The remaining six varṣas run longitudinally from east to west, three of them located to the north of Meru (Rāmāyakavarsa, Hiraṇmayavarsa, Uttarakuruvarsa) and three to its south (Harivarṣa, Kimpuruṣavarsa, Bhāratavarṣa). These six territories are separated by six mountain ranges, just as the dvīpas are separated by oceans. Within the territory of Ilāvṛta – and surrounding Mount Meru – there are four mountain ranges: Mandara to the east, Gandhamādanavarsa to the south, Vipula to the west, and Supārśivarsa to the north. The southernmost country is Bhāratavarṣa, the Indian subcontinent, measuring nine thousand yojanas from the Himavat (Himalayas) mountain range to the north, down to the Sea of Salt to the south (figure 9).

Bhāratavarṣa is, in turn, subdivided into nine regions, also called dvīpas, of one thousand yojanas each. It is at the center of Bhāratavarṣa that the four social classes live, and they are flanked by the Kirātas to the east and Yāvanas to the west. Other versions add the Andhras to the south and Turuṣkas (Turks) to the north. It is noteworthy that Bhārata is where the 14 Manus are born. It is known as Karmabhūmi (land of karma (action)) and is considered the only place where actions can lead to either further rotation in samsāra or liberation from transmigration, making it a most desirable place to be born in (ViP. 2.3.23–24). This finds a parallel in the notion that the four yugas apply only to Bhārata (MBh. 6.11.3; ViP. 1.57.22; ViP. 2.3.19). Similarly, the lower loka (earth) is the region where rituals are performed, while their results can appear in any of the three lower worlds (ViP. 2.7.11).

Some Purāṇas describe a simpler – and probably earlier – version of the continents. In this case there are only four regions around Mount Meru. To the east lies Bhadrāśva, to the south Jambu – here assimilated to Bhārata – and to the west and north are Ketumāla and Uttara (or Uttarakuru), respectively. This arrangement coincides with Buddhist cosmological notions (Sircar, 1967, 38–47). The Vāyupurāṇa (1.34.42–46, 56–57) views these continents as the four petals of the lotus that grew from Viśṇu’s navel, and on which the creator god Brahmā was born.

Mount Meru plays a fundamental role in puranic cosmology, as it stands at the center of the entire system, a feature that allowed astronomers to identify it with the axis of the earth. It is shaped like an upside-down truncated cone, with a diameter of 32 thousand yojanas at the top.
and 16 thousand at the base. Its total height is 100 thousand yojana, 84 thousand of which rise above the earth’s surface, while 16 thousand lie below it (figure 6). It is described as the calyx or pericarp (kariṇika) of the cosmic lotus (ViP. 1.34.46; ViP. 2.2.10).

There are some differences and contradictions in the different Purāṇas regarding aspects of the general cosmological scheme outlined above, but most of the accounts seem to derive from two main versions that existed between the 2nd century BCE and the 5th century CE. These two versions were reconstructed by R. Kirfel (1954).

**Space and Time Interlocked**

Puranic cosmogony and cosmology are synchronized on a grand scale by tying the two main types of world destruction to the distribution of the lokas. The partial destruction that takes place at the end of a kalpa affects only the triple world – the three lower lokas – where physical reality resides. Catastrophic winds and fires rage, and then it rains until everything is flooded. The triple world is now covered by the water upon which Brahmā – or Viṣṇu – will sleep during his night. The tremendous heat of the fires sends the inhabitants of Maharloka, the fourth world, into the higher Janaloka, from where they can be born again in the following kalpa. By contrast, the complete dissolution in prakṛti (prākṛta), destruction that takes place at the end of the life of Brahmā reaches all the lokas and causes the elements to be sequentially reabsorbed into their source in prakṛti (primordial matter). We must point out that just as the return of the created world into prakṛti is a reflection of the process of yogic liberation, the four upper lokas (as well as the hells, narakas) have more to do with inner experiential states than with physical space, although they are included in the cosmological map. They pertain to realms where mortals reside after physical death.

The fantastic aspects of puranic cosmology were a concern for many astronomers. The first comprehensive study of this cosmology by an astronomer was carried out by Lalla (8th cent. CE), who dealt with some incongruous aspects of puranic cosmology by reinterpreting them. He placed the pātalas inside the earth, the dvīpas and oceans located beyond Jambudvīpa in the southern hemisphere, and the different features of Jambudvīpa in the northern hemisphere (Pingree, 1990, 279). He also reinterpreted the lokas to bring them in line with astronomical concepts. At the same time, however, he refuted many tenets of puranic astronomy, and his refutations were repeated by other astronomers in subsequent centuries (Pingree, 1990, 297). The astronomer Jñānaraja (16th cent. CE), and others influenced by him, showed a predilection for puranic assertions and reinterpreted them in order to render them valid (Minkowski, 2004). However, the first independent work by a non-astronomer and defender of the Purāṇas that addressed the contradictions of puranic cosmology and cosmography was authored by Nilakanṭha, the famed 17th-century commentator of the Mahābhārata. He rejected the spherical earth and tried to defend variant measurements given for it in the epic and Purāṇas. He explained conflicting accounts of the size of men by saying that the yojana had divergent values in different yugas (Minkowski, 2000, 30, 36–37). In the 18th century, Kevalarāma, Jayasimha’s court astronomer, attempted to reconcile the flat earth of puranic tradition with the round earth of astronomy by positing the existence of two earths: a large, flat one below, and a smaller, round one above, in which we live (Pingree, 2001, 721). In modern times, variant forms of the quest for reconciliation continue. They now mainly consist of attempts to find obscure and fanciful allusions to modern cosmological concepts in puranic and, especially, Vedic texts.

**Concluding Remarks**

The puranic Hindu conception of the cosmos – in both space and time – is the result of a long process of growth characterized by transformation, appropriation, reinterpretation, and adaptation. Throughout the centuries, Hinduism grew by inclusion. It absorbed both foreign and local elements by arranging them according to diverse systems of classification, often using symmetry as an organizing principle. In narratives of cosmogony and cosmology, this entailed creating expanding frameworks that would allow for every new element to be incorporated. In the case of theories of time, the kalpas served to bring together conflicting systems of cosmic cycles, while the egg of Brahmā served to encompass ideas about space. There is a tendency, evident already in
late Vedic texts (the Upanisads) but manifested strongly in post-Vedic literature, to engulf and absorb Vedic notions. The three realms of Vedic cosmology became merely the three lower worlds of the seven worlds of puranic cosmology, and the Vedic tradition of man’s descent from Manu was reduced to only one of many genealogical lines derived from different Manus in different manvantaras. Thanks to the theory of the yugas, Vedic traditions were placed in a former era, thus making it possible to respect and revere them while simultaneously considering them unsuitable for present times. The emergence of the theory of transmigration in the Upanisads resulted in the growing importance of views concerning cyclical time – especially as they apply to human-kind – and had an enormous impact on perceptions about the origin and future of the world. Inner experiences were mapped onto the cosmos, further enhancing earlier notions of correspondences between the inner and the outer, the individual and the cosmos. The end result of these processes is the complex, all-inclusive, and multi-layered world of puranic time and cosmology.

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