

function' ($P_r \sim 1/r^a$) with the exponent a close to unity (but not necessary 1, as in Zipf's original law). Shortly after his death, Zipf's law attracted the attention of scientists working in the emerging research discipline of Information Theory (Shannon, 1951). The famous mathematician B. Mandelbrot generalized it to $P_r = P_0 \cdot (r + \alpha)^{-1/\beta}$, where α and β are constants, assuming that the frequencies of occurrence are determined so as to maximize the number of bits of information transmitted per symbol (Mandelbrot, 1954).

Two main objections have been raised against Zipf's law. The first argues, on mathematical grounds, that Zipf's law is a consequence of the properties of the formulas themselves, indicating that every randomly generated text will inevitably produce Zipf's law (Herdan, 1960; Li, 1992). The second group of objections is based on the argument that Zipf's law is 'linguistically shallow' and misses all the more fine-grained structures of language (Miller and Chomsky, 1963). The debate over the correctness of Zipf's law is still ongoing, and several schools of linguists continue to use Zipf's idea of language as a self-regulating system in their research (see esp. the *Journal of Quantitative Linguistics* and *Glottometrics*).

See also: Chomsky, Noam (b. 1928); Port-Royal Tradition of Grammar.

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Zoquean See: Mixe-Zoquean Languages.

Zoroastrianism

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Zoroastrianism is the ancient religious tradition, otherwise known as 'Mazdaism' or 'Zarathuštrianism,' founded by the Iranian prophet Zarathuštra. Precise dating of Zarathuštra is impossible, but it is widely thought that he must have flourished before 1000 B.C. and probably around 1200 B.C. in the area northeast of present-day Iran. The religion has been transmitted in a faithful form down to the 20th century

thanks to the highly conservative priesthood who have maintained both a scriptural and a liturgical tradition of high antiquity. There are currently ~140 000 Zoroastrians in the world, belonging to two language groups: the Persian-speaking Iranian Zoroastrians and the Gujarati- and English-speaking Parsis of India.

The scriptures preserved as supremely holy by Zoroastrians throughout history are the *Gāthās*, 17 metrical 'hymns' composed in an otherwise unattested Eastern Iranian language known as 'Gathic Avestan' (see *Avestan*). This is an archaic form of Younger Avestan in which the rest of the Avesta was transmitted orally for centuries and which was eventually

committed to writing, probably in the 5th century A.D. The *Gāthās* are a small part of the surviving canon in Avestan, but that too is only a fraction of the original Great Avesta of 21 divisions (Avestan *nask*), which has been lost since the Arab conquest of Iran in the 7th century A.D.

The *Gāthās* are believed to be the inspired compositions of Zarathuštra himself. They are lyrical, poetic dialogues and meditations between the supreme divinity Ahura Mazdā, ‘the Wise Lord,’ and himself. They are difficult to translate, not least because they are highly condensed in expression and cryptic in metaphorical allusion. Linguistic and content interpretation is helped by comparison with the contemporary Indian *Rig Veda*. The *Gāthās* are arranged according only to their metrical schemes and it is thus impossible to be certain of the evolution of Zarathuštra’s thought from a straightforward reading. The prophet’s teachings, which inform all the Zoroastrian religion, are moral and ethical in character, with a strong spiritual urgency exhorting humankind to follow divinely created ‘truth,’ or ‘righteousness’ (Avestan *Aša*), rather than the demonically created ‘lie’ (Avestan *druj*). Ahura Mazdā created all good creatures, both spiritual beings (his ‘blessed immortals,’ Avestan *aməša spənta* and ‘worshipful beings,’ Avestan *yazata*) and physical creations (humankind, benevolent animals, plants, water, fire, and sky). An entity wholly other than Ahura Mazdā, known as Angra Mainyu ‘the hostile spirit,’ perpetrates evil in the universe, having invaded it and brought death to the world with his own evil creation of spiritual demons (Avestan *daēva*) and evil physical agents corrupted by him, evil men (Avestan *dragvant*), the wolf species and noxious creatures (Avestan *xrafstra*). Through worship and through cultivation of the spiritual qualities exemplified in the ‘blessed immortals,’ men and women may cultivate their own righteousness and thereby help Ahura Mazdā to overcome the forces of Angra Mainyu in the physical world. The religion is strongly eschatological in character, from the *Gāthās* onward, as it looks forward to the complete victory of goodness and wisdom over Angra Mainyu and all his evil brood at a time called ‘the making wonderful’ (Avestan *frašō.kərəti*). This is a regeneration of the whole cosmos, whereafter evil will have been expelled forever, and it is preceded by a resurrection and last judgment of all souls. In the present time before the end, each soul is judged soon after it leaves the physical state, and according to its accumulation of merit it goes either to a heavenly or to a hellish state to await the final judgment and *Frašōkərəti*. The individual human soul is seen to be directly engaged in the cosmic struggle against evil and the

ethos of the religion is one of valiant and active participation in a corporate endeavor for the sake of truth.

The *Gāthās* are enclosed in the manuscripts and in the liturgical rites (Avestan *Yasna*) by the *Yasna Haptanhaiti* (‘Worship of the Seven Sections’), which is also in Gathic Avestan (see Avestan). The Younger Avesta comprises liturgical texts and prayers, the *Yašts*, hymns to the *yazatas*; *Vīdāēvadāta*, ‘Law Against the Demons’; *Visperad*, ‘Worship of All the Masters’; *Nyāyeš* and *Gāh*, regular prayers; *Xorda Avesta*, prayer book. All these texts, except the *Yašts*, have traditionally been interpreted in the light of the *Zand*, ‘scriptural elucidation,’ in a Middle Iranian language, Pahlavi (see Pahlavi). Some lost Avestan texts survive only in their Pahlavi *Zand*. There was originally a *Zand* in the Avestan language and in other Iranian languages, but these were replaced by the imposition of the Pahlavi *Zand* by the last Zoroastrian dynasty, the Sasanians (224–651 A.D.). The Pahlavi books are the principal sources for knowledge of Zoroastrian cosmology and eschatology, mythology, philosophy, ritual, and theology, composed between the 6th and 10th centuries A.D. on the basis of the much older, oral religious tradition and knowledge of the Avesta. The main record for Zoroastrian cosmology and religious mythology is the so-called ‘*Bundahišn*,’ ‘Creation.’ For theology and philosophy, there is the voluminous *Dēnkard*, ‘Acts of the Religion,’ in seven extant books. Many other smaller texts in Pahlavi survive, most of which have now appeared in scholarly editions and translations.

After the 10th century, Zoroastrians abandoned writing in Pahlavi in a favor of New Persian in Arabic script. The Zoroastrians of Iran were subjected to forcible conversion and oppression by Islam until the 20th century. In the 10th century A.D., a group of the faithful migrated to western India, where they settled and became known as ‘Parsis’ (i.e., ‘Persians’), enjoying religious freedom and material success in trade and, in modern times, in commerce and industry. They adopted Gujarati as their language, and from the 12th century translated the Avestan texts, and some of the Pahlavi texts, into Sanskrit and Old Gujarati. Other texts were transcribed, and hence interpreted, from the cryptic Pahlavi script into the clearer Avestan alphabet: in this form they are known as ‘Pazand’ texts (literally ‘by interpretation’). There is also a group of texts known as the ‘Persian *Rivāyats*’ dating from the 15th to 18th centuries, which were Irani Zoroastrian written answers to Parsi questions on matters of religious ritual, observance, and morality.

In modern times, the main population center of the Zoroastrian community has been in urban Bombay and, to a lesser extent, Tehran, although

small rural communities do survive in India and Iran. The Parsi and Irani Zoroastrians (the latter since the declaration of the Islamic Republic of Iran) have formed diaspora communities abroad on all five continents. The religion continues to be a mainstay of identity for Zoroastrians, although change in the structure of the community, through education and economic improvement, has brought with it a polarization of 'orthodox' and 'reformist' tendencies into disharmonious sectarian divisions.

See also: Avestan; Pahlavi.

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Zulu

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Introduction

Zulu, also known as isiZulu, is a Southern Bantu language, and is one of the 11 official languages of South Africa. With over nine million speakers, it is one of the country's major languages, and is used in broadcasting, journalism, and the national and provincial parliaments. Famous as the language of the Zulu empire of the 19th century, it has a growing literature, and there are efforts to develop a technical vocabulary for use in the teaching of mathematics and other sciences.

The language has been the subject of a considerable number of grammatical and linguistic studies, dating back to works of 19th-century pioneers such as Grout (1859). Zulu is closely allied to Xhosa, Swati, and Ndebele, and there is a high degree of mutual intelligibility between these languages, to the extent that it could be argued that they are all varieties of one language, Nguni. The findings of linguistic studies of the other Nguni languages are very frequently applicable to Zulu as well.

Morphology

Zulu displays the typical Bantu morphological features: it is highly agglutinative, and its nouns are

divided into various classes, which command distinctive agreement morphology (see 'Syntax' below). Most of the noun classes occur in singular/plural pairs, for example, a noun such as *inja* 'dog' (class 9) will have a plural in class 10, *izinja* 'dogs.' Older studies classified the noun classes according to this pairing (e.g., Doke, 1927), but Canonici (1990) has proposed a classification according to agreement characteristics. From this point of view there are 12 noun classes. There is an elaborate tense and aspect system, and verbs may take valency-changing suffixes (known as 'extensions,' e.g., causative *-is-* in *fund-is-a* 'cause to learn, teach'; passive *-w-* in *fund-w-a* 'be learnt'; reciprocal *-an-* in *fund-is-an-a*, 'teach each other').

The morphology of the language and the semantics of the various grammatical forms have been the focus of linguistic research into Zulu for the past 80 years. Dominating most studies has been Doke's model (1927), which sought to describe Bantu languages in terms appropriate to that family, rather than according to established Latin, Greek, or English terminology. Subsequent accounts have largely been refinements of the Dokean model, e.g., Cope (1984) and Poulos and Msimang (1998).

Phonology

Zulu phonology has been described in a number of works, most notably and comprehensively in Khumalo (1987). Like many Bantu languages, it