

transfer of experience from the past to the future, to predict and control events and to invent new futures (*The Mind*, “knowledge” *q.v.*). While this offers insight at a more practical level, the *Concise Oxford Dictionary* conveys understanding at a perceptive level. In the latter the word “know” is described as, “be aware of through observation, inquiry or information”.

The Indian Context

In the Indian context, and this found an echo in Goa, the term, information, can be put into the primary category of “revealed”, constituting the defining moment. The secondary aspect would then comprise subsequent evolution from this base. The “revealed” category would thus constitute the points from which there would be progressive departure and return in response to societal developments and aspirations. Unlike the disjunctions characteristic of European society, there has been a remarkable continuity in the Indian sub-continent. This is because society has evolved on the basis of acceptance of heterogeneity rather than homogeneity. Thought processes have been non-linear and cultural transmission has taken place through non-verbal and oral means.¹ Codification leading to rigid enunciation of accepted norms, dogma and issuance of *ex cathedra* rulings were not a part of the Hindu way of life as moulded by the *Bhagavadgita* and *Upanishads*. Salvation could be attained not through divine grace and observance of creed but solely by individual effort. Another aspect of crucial importance was the amazing heritage of specialized knowledge and skill perfected and transmitted through the much maligned Indian caste system. The institutionalization of transmission in Europe dominated by the Graeco-Roman mould was very different.

A considerable part of Indian thought was devoted to the question of consciousness. Vedic theory dated to at least BC 2000 showed an awareness of the self. This approach allowed the separation of the tools of awareness – vision, hearing, and mind from the person who obtains this awareness.² Among the

¹ All information was rendered in forms which would facilitate memorization. Metre was inbuilt so that discrepancies could be easily detected in recitation. Three literary forms emerged: the *sūtra*, *bhāṣya* and sloka. The *sūtra* was couched in an extremely succinct aphoristic tone sometimes in the form of a dialogue between teacher and student. The *bhāṣya* was aimed at elucidating the *sūtra* while the sloka, used extensively in the *Dharmaśāstras*, medical, mathematical and astronomical works as also encyclopaedic treatises such as the *Brhatsamhitā* and others dealing with the arts. This facilitated memorisation and as well as the written form. S. N. Sen, “A Survey of Source Materials” in D. M. Bose *et al.*, *A Concise History of Science in India*, Indian National Academy of Science, New Delhi, 1971, pp. 23-24. For the dating of the texts see *Ibidem*, p. 25.

² Subhash Kak, “On the Science of Consciousness in Ancient India”, in T. R. N. Rao, Subhash Kak, *Computing Science in Ancient India*, Center for Advanced Computer Studies, University of Southwestern Louisiana, Lafayette, Louisiana 70504, 1971, p. 92.

words used for “mind” were *manas* from *man*, to think, *citta* from *cit* to perceive or attend *viññāna*, from *jñā*, to know or be conscious, *antaḥkāraṇa*, inner activity or inner organ, used to refer collectively to a variety of perceptual, intentional and cognitive functions or agencies. In a religious context the real self can be seen as an impersonal cosmic spirit or essence usually called *Brahman* as in Vedanta. It can be a separate eternally monadic soul or person as in Jainism and *Sāṃkhya* or be related devotionally to a god (*The Mind: Indian Ideas of the Mind*, *q.v.*). There was also the concept of *Ṛta*, responsible for the orderly functioning of universal laws such as fixity of the stars and movements of the celestial bodies. *Ṛta*, was also operative in the terrestrial and spiritual domains.³ A body of rationalist thinkers associated with the *Nyāya-Vaiśeṣika* school further developed a methodology for the acquisition of knowledge⁴. In course of time since such thought systems were translated into societal moorings among heterogeneous groups, a rich and colourful mythology, lending itself to hermeneutic transmission, began to accrue around the abstract kernel. We can find an example in the recognition given to *kāla*, time, as the first cause of all existence in the *Atharvaveda*.⁵

Important indicators of the knowledge base are to be found in the two texts, *Nāmalingānuśāsana* of Amarasimha, often referred to as *Amakośa*, dated to between the sixth and eighth centuries AD and the sixth century text, the *Brhatsamhitā* by Varāhamihira. In the first work the subjects treated include the sky, celestial space (including the atmosphere, planets and stars), regions, divisions of time, phases of the moon, eclipses, the oceans, fish, animals, human beings and their anatomical peculiarities, diseases, plants (together with several botanical terms and names of medicinal plants), forests as well as agriculture and commerce. The second provides much information, among others, on astronomy [planetary motions, asterisms, zodiacal divisions, *tithis*, *karāṇa* (both being calendrical computations of time)],⁶ geography, medicine, chemistry, perfumery, botany, zoology, agriculture, architecture and psychology and prosody.⁷ It would be important to keep in mind that such advances need to be related to concurrent urban developments in progress.⁸

³ S. N. Sen, “A Survey of Source Materials...”, p. 16.

⁴ For dating see S. N. Sen, “A Survey of Source Materials”..., pp. 30-31.

⁵ S. N. Sen, “A Survey of Source Materials”..., p. 20.

⁶ Sen draws attention to the Chinese *po-lo-mên* literature dealing with Brahmanical astronomy, mathematics and pharmacy found in the Uiger manuscripts in Central Asia. S. N. Sen, “A Survey of Source Materials”..., p. 38.

⁷ S. N. Sen, “A Survey of Source Materials”..., pp. 32-33, 37-38.

⁸ M. C. Joshi, “Urbanization as an Economic Movement – Making a Case for Reinterpreting Historical Urbanization in Ancient India”, paper presented at Seminar on, *A Search for Urban Culture in Ancient India*, Kansai University, Japan, 2004, pp. 121-129.

Portuguese Parameters

Portugal, no less than India, was bound by its own history. It could not escape from the thrall of its Graeco-Roman past nor the shaping of identity through the process of the *Reconquista*. In the ancient Indian context the individual sought to gain an understanding of the self so that equilibrium could be maintained between the self, the cosmos and the material world. The process of socialization was equally important in the Graeco-Roman as also its successor Christian cultures in Europe. However, the means adopted differed. For the purposes of this paper the stress that was laid in European cultures on formal educational endeavour is the aspect which is of direct relevance. The Greek word for the upbringing of a child was *pais* or *paidos* from which the term *paideia* was derived. The term *Paideia* came to signify the complete pedagogical course of study necessary to produce a well rounded and fully educated citizen. Inner perfection was to be realized through disciplined education. Later Christian teachers particularly those in Alexandria developed the concept to serve the ends of a Christian community.⁹

Evolution then followed through the Patristic Period, second to ninth centuries AD, to that of Scholasticism, ninth to fifteenth centuries AD. When the University of Paris came into existence scholastic learning came to be associated with it.¹⁰ The University of Bologna, in existence since AD 1088, had received a charter from Frederick of Barbarossa in 1158 and excelled in the field of law. The University of Salamanca, where Galen and Hippocrates were taught in the centre for Medicine, had been founded by King Alfonso IX of Leon in 1218. Montpellier, renowned for Medicine, was in existence since early times but received its first formal charter in 1220. The Arabs through their institutions of *madradas* had also established their own nucleus of the university system.¹¹

⁹ Davey Naugle, "Paideia", DBU Summer Institute in Christian Scholarship, Dallas Baptist University; also see E. B. Castle, *Ancient Education and Today*, Penguin, 196; Wikipedia, *Paideia* q.v. All these sources were downloaded from Internet.

¹⁰ For further details see the website: <http://radicalacademy.com/prcmnicourseindex.htm>. There is an association between the functioning of the University of Paris and the interest taken by the Emperor Charlemagne (AD 768-814) in the establishment of places of instruction within the ambits of the cathedral. In the beginning cathedral schools which attracted students from all over Europe became known as *stadium generale*. However, when such an institution was granted an official charter by a royal or ecclesiastical authority along with powers of self governance and a set of statutory provisions it could be called a University. The cathedral school of Paris was granted such a charter in the year 1200. The most common faculties in all universities could be those disciplines chosen from among the combination of arts, law, medicine and theology.

¹¹ Françoise Micheau, "Scientific institutions in the medieval Near East", in Roshdi Rashed, *Encyclopedia of the History of Arabic Science*, Vol. 3, Technology, Alchemy and Life Sciences, Routledge, London, New York, 1996, pp. 996-997; *Amir Temur in World History*, The Printing House of Polygraphic Concern "Sharq", Tashkent, 1996, pp. 97-98.

The *Reconquista* played a very important role in the shaping of Portuguese identity. There was contiguity between the Christian faith and Portuguese distinctiveness and it was this personality which the Portuguese projected in India. The Portuguese warriors led by their King had simultaneously to expel the Moors and nurture a well rooted Christian presence throughout the domain. The institutional fabric which now came into being¹² could serve as a model when the Discoveries opened new vistas in trade and settlement. In 1319, coinciding with the eclipse of the Knights Templars, the Pope created the *Ordem de Cristo* and conferred the power of *padroado* on the Portuguese King. This authorized Portuguese bishops to appoint to local priests. Unlike other feudal societies in Europe in Portugal the military and religious orders were provided with very specific and specialized roles. Agriculture was used as a tool whereby demonstrated prosperity could maintain a Christian community within its fold. The Augustinians of Alcobaca pursued activities in agriculture, mining and commerce. The Franciscans and Dominicans dedicated themselves to religion, charity and culture.¹³ In view of such precedents set it need elicit no surprise that the Jesuits should have participated so successfully in commercial activities in India.

In view of the orientation of this paper it is necessary to focus on the subject of medicine as aspects of liminality and convergence are easily discernible if Portuguese understanding and practice is juxtaposed against that of their Indian counterparts. In Portugal there was a clear distinction between universities¹⁴ where the teaching of medicine existed as a discipline,¹⁵ pharmacies where *materia medica* could be compounded and purchased¹⁶ along with the creation of hospitals and hospices emerging from the amalgamation of some of the pre-existing charitable endeavours.¹⁷ In India, on the other hand, the practice of medicine could be subsumed under the heading of practitioners of *Āyurveda*. This spanned several categories of knowledge: health, food¹⁸ and plant resources.

¹² See Joaquim V. Serrão, *História de Portugal*, vol. I, Editorial Verbo, Lisboa, 1979, pp. 151, 154, 156-157.

¹³ J. V. Serrão, *História de Portugal*, vol. I, pp. 164, 166, 174, 176.

¹⁴ For further details see de Joaquim de Carvalho "Instituições de cultura", in Damião Peres, Eleutério Cardeira, *História de Portugal*, vol. II, capítulo III, Quinta Parte, Portucalense Editora, Barcelos, 1929, pp. 599, 601-602, 606, 610, 612-614.

¹⁵ See de Aarão de Lacerda "Ciência" in Damião Peres, Eleutério Cardeira, *História de Portugal*, Vol. VI, Capítulo IV, Portucalense Editora, Barcelos, 1934, pp. 501-510.

¹⁶ See de A. Lacerda, "Ciência"..., pp. 497, 504.

¹⁷ See A. Lacerda, "Ciência"..., p. 494; Angelo Ribeiro, Hospiteis Reais-Misericórdias", in Damião Peres, Eleutério Cardeira, *História de Portugal*, Vol. IV, Capítulo III, Portucalense Editora, Barcelos, 1932, pp. 557-560, 563-564, 566-567, 569.

¹⁸ Lotika Varadarajan, "Health, Food and Fish – Indian Perception and Ayurvedic Design", in Aliette Geistdoerfer et al, *La Mer Dévorée, Le poisson bon à manger, Le poisson bon à penser*, Anthropologie maritime/CCSTI-Lorient, Collection Kétos, Paris, 2003, pp. 187-19.

The reason why a newcomer like Garcia da Orta could produce a magisterial work such as the *Colóquios de simples e drogas da Índia*, published in Goa in 1563, was because he could benefit from existing well labelled sources.¹⁹

Āyurveda

At the mythological level the god Varuna, as guardian of *Rta*, was associated with healing.²⁰ At the philosophical level the *Upaniṣads*, couched in dialogue form, refers to a group of inorganic bodies called *mahābhūtāni* in which the concept of the five elements comprising water, earth, fire, wind and ether are found embedded.²¹ In the medical text, *Caraka-Saṃhitā*, the main thrust is in the direction of therapeutic medicine, while that in the *Suśruta Saṃhitā*, is more towards the subject of surgery. These two texts constitute the bedrock of the system to which later accretions were added.

Circa seventh century AD Vāgbhaṭa compiled the *Aṣṭāṅgahṛdaya*, which is stated to be the most concise and scientific exposition of Āyurvedic knowledge to which Mādhavakara, in the eighth to ninth century added his clinical guide, the *Mādhava Nidāna*. The subjects covered in these texts include *Kaumārabhṛtya* or pediatrics and *Rasāyana*, knowledge of tonics and methods for arresting physical and mental deterioration including that associated with aging. The concept of hygiene and self-discipline is inbuilt within the system.²²

Extension of Āyurveda to the Animal Kingdom

Taken that the Portuguese were being exposed to several species of oriental animals for the first time their success in transporting these exotic animals over large distances is quite surprising. It is important to remember that a considerable body of information had already been accumulated in India pertaining to the animal kingdom. The *Rājamārtaṇḍa*, an encyclopaedic work by Bhojarāja, contains extracts from other treatises, some extant others lost, on cows, water buffaloes, deer, dogs, falcons, pigeons and so on. The *Agnipurāṇa* contains passages from the *Saṃhitā* of Śālihotra a treatise devoted exclusively to horses.

¹⁹ The main source for da Orta is said to have been Unani practices to which he had been exposed at the Adilshahi court in Bijapur. For Unani in India and the contiguity between Unani and Āyurveda see M. Z. Siddiqui, "The *Unani Tibb* (Greek Medicine) in India" in D. M. Bose *et al.*, *A Concise History...*, pp.268-272; K. Raghunathan, "Garcia da Orta and his work in the field of Drugs and Medicinal Plants", A. Salema (ed.), *Ayurveda at the Crossroads of Care and Cure*, Centro de História de Além-Mar, Universidade Nova de Lisboa, Lisboa, 2002, pp. 31-44.

²⁰ S. N. Sen, "A Survey of Source Materials"... , p. 16.

²¹ S. N. Sen, "A Survey of Source Materials"... , p. 22.

²² R. C. Majumdar, "Medicine", D. M. Bose *et al.*, 1971, pp. 223-238.

A translation of this made by the Caliphs of Baghdad is found in the work entitled, *Sālātor*. The work, *Aśvavaidyaka* by Jayadattasurī is a redaction of the Śālihotra treatise running into sixty-eight chapters. The major work on elephants, this category being called *Hastyāyurveda*, and attributed to the sage Pālakāpya, is the *Pālakāpya Saṃhitā*. The work deals with all aspects of pachyderm care and treatment of their ailments.²³ It would be surprising if the Portuguese had remained ignorant of this category of information.

Āyurvedic Materia Medica

The *material medica* found in the *Caraka Saṃhitā* comprises three hundred and forty-one plant substances, one hundred and seventy-seven drugs of animal origin and sixty-four mineral and metal substances. The corresponding numbers in the *Suśruta Saṃhitā* are three hundred and ninety-five, fifty-seven and sixty-four. Mineral and metal substances depended on local availability. There were accompanying instructions for the compounding and extraction of drugs from crude materials.²⁴

Plant Science

The beginning of plant science have been traced in dispersed references to the external and internal structure of plants, some of the physiological processes involved in manuring, as also to plant classification and evolution.²⁵ In early texts such as the *Arthaśāstra*, *Agnipurāṇa* and *Bṛhatsaṃhitā* three terms have been mentioned, *vrkṣāyurveda* (science of the life of trees), *gulmavrkṣāyurveda* (science of plant life), *bheṣajavidyā* (science of medicinal plants). The subjects treated include selection and procurement of viable seeds, choice of proper soil, irrigation, manuring, sowing and germination of seeds, planting, seasonal care, cultivation, rotation of crops, climatic conditions in relation to proper growth, classification and identification of plants, aesthetic and hygienic values of gardens, construction of herbariums and the treatment of plants both in their healthy as well as diseased conditions. This scattered material was collated in the thirteenth century work, *Upavanavinoda* by Śārṅgadhara which mentions the pruning (*skandhaja*), grafting and layering (*skandharopanīya*) operations. In view of the dating of this text it is possible that these had been absorbed from the Arabs. The classification was based on the external floral characteristics and the medicinal or dietetic values of the plants.²⁶

²³ R. C. Majumdar, "Medicine", pp. 254-255.

²⁴ R. C. Majumdar, "Medicine", pp. 251-252.

²⁵ S. N. Sen, "A Survey of Source Materials"... , p. 16.

²⁶ R. C. Majumdar, "Medicine", pp. 256-257.

Botany

The work, *Vṛkṣāyurveda* by Parāśara, dated to between the first century BC and first century AD, is an extremely important botanical source. It is divided into six parts. The contents of the first part, *vījotpattikāṇḍa*, further sub-divided into eight chapters, provides an indication of the richness of its contents. These comprise *vījotpattisūtrīyādhyāya* (an outline of plant morphology), *bhūmivargādhyāya* (nature and properties of soil), *vanavargādhyāya* (description and distribution of forests), *vṛkṣāṅgasūtrīyādhyāya* (more detailed treatment of the morphology of plant members), *puṣpāṅgasūtrīyādhyāya* (the flower, its parts, functions and classification), *phalāṅgasūtrīyādhyāya* (definition, function and classification of fruits), *aṣṭāṅgasūtrīyādhyāya* (discussion of eight plant limbs – root, stem, bark, heartwood, sap, excretions, oleaginous products, spines and prickles) and *dvigaṇīyādhyāya* (seeds and embryonic plants). The *Vṛkṣāyurveda* formed the basis of botanical teaching preparatory to pharmaceutical studies in ancient India. Parāśara's method of botanical nomenclature was largely followed by Caraka, Suśruta and other authors in preparing chapters on Āyurvedic pharmacopoeias.²⁷

Piloting and Methods of Charting

Prior to the rounding of the Gulf of Guinea and that of the Cape of Good Hope the Portuguese utilized the Mediterranean repertoire of piloting and charting. This centred around tidal movement, dead reckoning, the wind rose and use of the *portulan* chart. Such charts were not provided with parallel or meridian. After the 15th century the coastline was indicated in terms of thirty-two rhumb lines. Circa AD 1200 the sailors of Amalfi introduced the innovation of a magnetized needle into the existing thirty-two rhumb wind rose. The navigator would now plan the course with the help of compass and chart.²⁸ While navigating its course the ship could deviate from the set direction because of currents or exigencies of tacking against an adverse wind. The *Toleta de Marteloio* provided tables with the help of which such deviations could be taken into account while the ship continued on its course.²⁹ With the advent of Atlantic navigation in the first decades of the fourteenth century astronomical navigation developed

²⁷ K. A. Chowdhury, "Botany", in D. M. Bose *et al.*, *A Concise History...*, pp. 379-380. For further details relating to the botanical knowledge of the period see *Ibidem*, pp. 380-391.

²⁸ A. Teixeira da Mota, "Méthodes de Navigation et Cartographie Nautique dans l'Océan Indien avant le XVI^e Siècle", *Svadia* II (1966), p. 61.

²⁹ E. G. R. Taylor, *The Haven Finding Art*, London, 1971, pp. 117-121; Luís de Albuquerque, *Instruments of Navigation*, Lisboa, 1988, pp. 82-83; J. Cortesão, *Obras Completas, Os Descobrimientos Portugueses*, I, Lisboa, 1975, p. 294.

and was to be perfected during the navigation to the south after crossing the equator off the coast of Africa. Circa AD 1480-1485 nautical charts began to show parallels of latitude in addition to rhumb lines.

With regard to the Indian tradition cognizance has to be taken of the advances made in astronomy and mathematics since early times. As early a text as the Rgveda contains references to the threefold division of the heavens, the sun, moon, their motions through stellar constellations, solar eclipse, division of time in days, months, years, intercalation, all of which portray the beginnings of astronomy and the calendrical sciences. The *Sāmaveda* along with its associated *Brāhmaṇas* and *Sūras* are useful for calendrical insights because of their notice of various ceremonies to be performed during the daily progress of the sun.³⁰

The basic interest comprised plotting the stars which lay along or near the ecliptic. By a selection of suitable stars and constellations it was possible to constitute a stellar fame of reference to follow the paths of the sun and moon. Circa BC 1200-800 it was stated that the moon visited twenty-seven lunar mansions in the course of the lunar year. These lunar mansions were called *nakṣatra* and were also used in relation to the sun. Each *nakṣatra* had a lead star called *yoga tārā* which was connected with the first point on the ecliptic of the division or was located near to it either to the north or south. According to the *Sūryasiddhantā*, first codified circa AD 305, each of the lunar mansions, *nakṣatras*, was assigned a value of 800'.³¹ This astronomical information was integrated with tables of star elevation and memorized through mnemonic recitation. Much of the information which now follows was gathered as a living tradition in Lakshadweep and this is directly relevant in the aspect of integration of Indian Ocean navigational methods into Portuguese instrumentation which formed the backdrop to further refinement, development and evolution until they formed the basis European navigational instrumentation in the pre-Industrial Revolution era.

Ethnological evidence in Lakshadweep links methods of measuring star elevation through *viral*, finger units (referred to by the Portuguese as *polegada*), leading onto a set of instruments. In the Table recited in relation to the position of the Pole Star, such measurements are cited as reaching a maximum of fourteen fingers. The navigator Kunhikunhi Malmi of Kavaratti island demonstrated how the moment of exact noon, a method which could also be taken on board a ship, could be assessed through another set of body movements. Shadow measurements are integrated into methods of assessing the elevation of the sun during different periods of the year but these are related to the gnomon. Among instru-

³⁰ For astronomy see S. N. Sen, "Astronomy" in D. M. Bose *et al.*, *A Concise History...*, pp. 58-124.

³¹ S. N. Sen, "A Survey of Source Materials", pp. 58, 66, 68-69; *Report of the Calendar Reform Committee*, Council of Scientific and Industrial Research, New Delhi, 1955, pp. 100 n. 6, 212-214; S. N. Sen, K. S. Shukla, *History of Astronomy in India*, New Delhi, 1985, pp. 252 *et seq.*

ments in usage, and from the theoretical point of view the ancestry of the nautical instruments which can be traced back to classical Indian antiquity are the *Rūba al-mujayyab* (Quadrant), the *Rapalagai* (*Kamal*), the *Kolpalagai* (Davis Quadrant), and the *Kaukutty* the *Balisti* or Cross Staff). All, inclusive of *viral* measurements are mutually compatible, and in the case of the Quadrant (known in India since the seventh century AD), the *Rapalagai* and the *Kolpalagai* parallels with pre-Islamic South Asian tradition can be drawn. Moreover a degree of evolutionary linkage can be traced between the Quadrant and the *Kolpalagai*.³²

It thus becomes evident that although the cultural moorings and thought processes may have been rooted in different modes, the two sets of traditions were not mutually exclusive. This would explain why the Portuguese were able to absorb these categories of information and enrich their own capabilities in the rapidly changing frontiers of knowledge.

THE USE OF GROWING ARCHITECTURE AS PROPAGANDA – THE BENGAL COLCHA AT THE ISABELLA STEWART GARDENER MUSEUM IN BOSTON

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In October 2006 I presented a paper on the iconographic programme of the Bengal colcha from the Isabella Stewart Gardener Museum at the XII Seminar on Indo-Portuguese History in Lisbon. Soon afterwards I handed in the first version of the present article. From February to May 2008 the colcha was the core piece of an exhibition at the Isabella Stewart Gardener Museum: “Luxury for Export: Artistic Exchange between India and Portugal around 1600”. In due course Pedro Moura Carvalho published an article on the same colcha on which he had worked at the same time as me.¹ Since the publication of my article was delayed, I asked the editors whether it was possible to respond to the findings of Pedro Moura Carvalho’s article within my article. I am grateful that the editors agreed to do so. This scientific dialogue stresses the importance not only of this specific textile but of Indian textile production for export of the sixteenth and seventeenth centuries in general.

Bengal textile production in the sixteenth and seventeenth centuries was extremely rich. The most important commissioners of textiles destined for export to Europe were Portuguese private merchants residing in Hugli near modern-day Calcutta. From there they controlled a large portion of sea trade of the East

³² All these aspects form the subject of the publication, L. Varadarajan (ed.), *The Rahmani of M. P. Kunhikunhi Malmi of Kavaratti, A Sailing Manual of Lakshadweep*, Manohar, New Delhi, 2004.

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¹ P. Moura Carvalho, “Patriotism and commemoration in a Bengali embroidery” in *Luxury for Export, Artistic Exchange between India and Portugal around 1600*, exhibition catalogue, ISGM, Boston 2008, pp. 8-22.