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Dunér, David

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The Language of Cosmos

The Cosmopolitan Endeavour of Universal Languages

David Dunér

Abasaba, abosobo, abusubu, abösöbö
News from the Moon. There are forests, lakes and plains on the Moon, and animals, birds, fish and people. There is a language, totally perfect and crystal clear. And the mechanic Christopher Polhem (1661–1751) knows its grammar. In the manuscript *Nyia tiender uthur månan* ("New tidings from the Moon"), which could have been written at the middle of the 1710s at the earliest, Polhem, the Swedish inventor known for his mining machines and his pre-industrial activities, tells about a Saami with magical knowledge who travels to the Moon, and how he there talks to the Moon inhabitants and learns their language.[1] The strange thing about the language on the Moon is that it is completely regular and easy to learn. We do not have to use an infinite number of words; instead each word in the lunar language contains entire sentences and phrases in concentrate. Nor are we forced to plod through irregular and complicated grammar, as in Latin. This language can be learnt by anyone, irrespective of origin, and whether people come from the Moon, the Earth or the most far-flung environs of the Universe. It is a universal language, the language of the Universe, the Cosmos, a truly cosmopolitan language that can be understood by all rational beings, independent of culture and nationality.

Learned people, writes Polhem the inventor, have investigated and observed the strange figures and shapes of the planets using telescopes. The Moon, which is the closest and apparently largest celestial body, has been particularly scrutinised and been seen to be covered by forests, lakes and plains. As it has forests and lakes, Polhem further reasons, there must also be animals, birds and fish. And as there are plains, there must be people, as no plains can exist without people having cleared the forests. Polhem was not the only person in the world of learning to hold the idea of life on the Moon. It was also held by many contemporary scientists and philosophers not unknown to him, such as Bernard de Fontenelle in *Entretiens sur la pluralité des mondes* (1686) or Christiaan Huygens in *Cosmotheoros* (1698) and many others. Once, following Nicolaus Copernicus, the Earth was no

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[1] Christopher Polhem, "Nyia tiender uthur månan", *Christopher Polhems efterlämnade skrifter IV. Varia*, ed. Bengt Löw (Uppsala, 1954), 338–342.

longer the centre of the Universe, once Galileo Galilei had aimed his telescope towards the Moon and found it a rough globe with mountains and seas, once physico-theologists were convinced that the all-powerful Creator must have filled the entire Universe with life, then the assumption of life on other planets was not too far-fetched. Surely there should be people on the Moon. Or are we quite alone in the enormous Universe?

The trip to the Moon happened as follows, Polhem relates: A Saami, who had been given the task thanks to his knowledge of magic, tied his magic drum on his back, flung himself flat on the ground and asked that no-one touched him until he rose again. Some hours passed. When he woke up, he started to tell what he had seen on the Moon. It turned out to be a country almost like here, with animals, birds and people. The wise men who had witnessed the event were not entirely satisfied with the tale, as they suspected that it might be a fabrication. So they asked him if he could not travel there again, but this time against a greater payment. They particularly requested him to learn their language, and to stay there a longer time and in this way acquire more knowledge and give a more detailed description. The Saami did not have to think long about the offer. Soon, he started his second trip to the Moon. This time he was gone for all of seven months. When he came back, he gave such a detailed description that it was difficult to think that all could be pure lies and invention. Whatever the facts of the matter was, he soon started telling about the language of the lunar inhabitants.

"It was impossible for me," said the flying Saami, "to learn their language in their company, as they were frightened of me as of a troll or a ghost". They had never seen anything like his body, face or clothes. "I therefore made myself invisible, in order to listen to their conversations unnoticed. I flew from one place to another, and finally arrived at a school, where the lunar children were being taught a language that their learned people used." One of the curious gentlemen then interrupted and asked whether it could have been Latin? "I do not know whether it was Latin or any other language, as I do not understand Latin," answered the Saami. "But I have heard that it takes a long time to learn Latin, but this language of the Moon you could learn quickly, nor do you need as many words, as each word expresses a whole sentence." Here, the Saami's account started to be slightly unclear, continues Polhem. It was a pity that he had never studied or understood grammar, as this would have made it possible to learn a bit more about the lunar people's language. But the curious gentlemen carefully recorded all the words the Saami had heard there on the Moon, and tried to bring order to them. It was then discovered that it was not a language like ours; a language that appears to originate among children and unlearned people; that lacks a solid foundation, and is improved a bit as

time goes by, just like when an old, irregular city is turned into a regular one without moving the old houses. The lunar language, on the other hand, originates with learned people, who have built it on a new foundation. In more detail, the lunar language is built on the following bases, according to Polhem's interpretation of the Saami's tale:

Syllables in their language correspond to whole words in our language. For example, *abasaba* means: "the great space of the universe stretches out endlessly on all sides". Or each one of the words: *ab* means "spatium" (space), *ba* "universale" (the great universe), so that *aba* means "spatium universale" (the great space of the universe). And further, *sab* is a verb and means "expendere" (stretch out), *ba* is an adverb and means "continuè or indefinite" (endlessly on all sides), and from this we get *abasaba* "spatium universum expandit se indenfinitè". From this, we find that the general rule is that when a consonant and a vowel are put together, this takes on a special meaning, irrespective of whether it is an adjective, adverb, noun or verb. This differs from our language, considers Polhem, where words are used more metaphorically or allegorically and not in their real fundamental sense.

In *Nyia tiender uthur månan*, the journey to the Moon forms the framework story on the basis of which he describes his visions about the perfect language. The Saamian space travel is a utopian tale. He uses the literary techniques of the utopian genre, where foreign cultures or imaginary worlds are used to say something about the contemporary world, society or culture in which the writer lives. He wants to send a message or a wish for another world, express criticism of the only known existing world. Life on the Moon is cocking a snook at Earth in the satirist Cyrano de Bergerac's *Histoire comique contenant les états et empires de la Lune* (1657), for example.[2] Reality can be different. It does not have to be what it currently is. We could have another language; a language without ambiguities, difficulties, irregularities; a cosmopolitan language that bridges the chasms between cultures, peoples and countries. It is such a cosmopolitan idea that Polhem is expressing in the tale about the flying Saami. Using far-away Moon people and exotic Saami, known for their magic abilities, imagination could be given free rein and thoughts could roam off to new universes of ideas. Journeys to other worlds say more about the traveller's starting point than his destination. The traveller's world is shining through, just as with Polhem, where we can understand from the lunar language that the Moon people appear to be Cartesians in terms of natural sciences and Aristotelians

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[2] Cyrano de Bergerac, *Histoire comique contenant les états et empires de la Lune* (Paris, 1657); new ed., *L'Autre Monde. Les États et Empires de la Lune. Les États et Empires du Soleil suivi du Fragment de Physique* (Paris, 2009).

in philosophy, which can also be interpreted as the ideas of Descartes and Aristotle being permanently true and universal, and thus having to be reflected in all universal languages of the Universe.

The imaginary journeys of the time went to the Moon and the planets, to the country of Erehwon, to the lands of the Antipodeans, countries beyond the sea, unknown islands, to underground worlds, worlds that were usually peopled by rational beings with highly developed cultures. The actual journeys within Earthly geography gave rise to meetings with the unusual, the strange, different ways of living and speaking were discovered, and strange and wonderful languages heard. The meetings became self-reflecting, gave opportunities for comparisons between habits, religions and languages. On the imaginary journeys, there are nearly always descriptions of languages, which were also easy to learn and superior to all existing languages. For example, the seafarer Lemuel Gulliver learnt to understand the nasal and throat sounds of the Houyhnhnms in ten weeks.[3]

Among the more well-known moon journeys is Francis Goodwin's utopian novel *The Man in the Moone. Or a Discovrse of a Voyage Thither* (1638), where the lunarnaut Domingo Gonsales, "The speedy Messenger", journeyed to the Moon with a flock of large birds trained for the purpose on the way to their winter quarters on the Moon. He talks about the tones of the lunar language, which is reminiscent of the tonal system and musical ciphers of Chinese. There was a form of cipher-like universal writing, denoted with musical notes, "the lunatique language", a language not in words and letters, but in tones. The universal language constructor John Wilkins also wrote about journeys to the Moon, reflected further on Domingo Gonsales' discovery of musical lunar language and also on the possibility of communicating with friends who are far away.[4] Conversations and discussions became a musical experience, like a concert in tones. The imaginary languages could also be based on gestures, on hands and fingers, or on objects, like in Jonathan Swift's *Gulliver's Travels* (1726). Often, the starting point is concrete objects in nature. For example, Gabriel de Foigny, in *La terre australe connue* (1676) starts from the five elements.[5] Learning the foreign languages, and constructing your own language, was at the same

[3] Jonathan Swift, *Travels into Several Remote Nations of the World. In Four Parts. By Lemuel Gulliver, First a Surgeon, and then a Captain of Several Ships* (London, 1726), IV, 36.
[4] John Wilkins, *The Discovery of a World in the Moone: Or, A Discourse Tending to Prove, that 'tis Probable there May Be Another Habitable World in that Planet* (London, 1638); John Wilkins, *Mercury: Or, the Secret and Swift Messenger: Shewing how a Man May with Privacy and Speed Communicate his Thoughts to a Friend at any Distance* (London, 1641).
[5] Gabriel de Foigny, *La terre australe connue (1676)*, ed. Pierre Ronzeaud (Paris, 1990), 162.

time a way of learning something about the world, bridging the gap between the language and the world, the words and the objects, the inner and outer.

Polhem's journey to the Moon was probably written down in conjunction with the learned society Collegium curiosorum, "the society of the eager to learn", in the Swedish university town of Uppsala, who met at the beginning of 1711, in the middle of the plague epidemic that was sweeping through the country. The society of the eager to learn had a great interest in Lapland, its mountains, nature, inhabitants and language. One of the members, the botanist and philologist Olof Rudbeck the Younger, had himself carried out an expedition to Lapland in 1695 and, as a language researcher, thought to have found a relationship between Saami and Hebrew, as mentioned in a letter to the learned Englishman John Wallis, among others.[6] In the circle around Bokwettsgillet ("The Book Learning Guild"), there was also a fascination for the Chinese language, for manuscripts from Tartary, runes and other sign systems. The university librarian and philologist Eric Benzelius the Younger was an expert in Gothic, corresponded with Leibniz about issues of philology and also collected Swedish dialect words. In spring 1711, the librarian's brother Henric was sent off on an expedition to Lapland on behalf of the Guild.[7] At home in Uppsala, the Guild may very well have come into contact with one or two future Lapland priests of Saami origins.

The universal language
Polhem constantly returned to the idea of a "universal language", that is to say a perfect language that can be spoken and understood by everybody irrespective of education or origin. The preoccupation with a universal language has to do with his own faltering educational history, his own difficulties in reading books, understanding Latin and writing correctly. But this did not stop him from writing masses of drafts on every subject from technology and physics to economics, pedagogics and philosophy of language. Christopher Polhem was born on the Swedish island of Gotland

[6] Olof Rudbeck the Younger, *Epistola ad Johannem Wallisium continens fasciculum vocum Lapo-Hebraicarum, data Upsaliae ad d. 23 Junii 1703* (Uppsala, 1703); Asta Ekenvall, "Eric Benzelius d.y. och G. W. Leibniz", *Linköpings biblioteks handlingar*, ny serie 4:3, (Linköping, 1953), 52; Carl-Otto von Sydow (ed.), "Rudbeck d.y:s dagbok från Lapplandsresan 1695: Med inledning och anmärkningar. I", *Svenska Linnésällskapets årsskrift* 1968–1969, 91; *Bokwetts Gillets protokoll*, ed. Henrik Schück (Uppsala, 1918), 15 May 1724, 106; see also 28 September, 5 & 26 October 1722, 72–74.
[7] Henric Benzelius, "Henric Benzelius' brev till Eric Benzelius d.y. från Lapplandsresan 1711", ed. Carl-Otto von Sydow, *Lychnos* 1962, 154–161; Christopher Polhem, "Förtekning på några experimenter som på LappFiällen och i des Dahlar wore nödige att werkställas". Polhem to Upmarck, Stjärnsund 15 April 1711. *Christopher Polhems brev*, ed. Axel Liljencrantz (Uppsala, 1941–46), 71–74.

in 1661. At an early age he became fatherless, and had to take care of himself. His technological skills were discovered in his late twenties, and he then begun an astonishingly successful career as a mining engineer, inventor and manufacturer. He travelled throughout Europe, his technical solutions were to be used within the mining industry in Germany and Norway as well as in Sweden, and he received flattering offers from England and Russia. Polhem's projects are quite different from the early seventeenth century's linguistic mystery and kabbalah, or the rune research and searching for the Gothic language that fascinated the Swedish language researchers Johannes Bureus and Georg Stiernhielm. Instead, Polhem started with the contemporary interest in the universally valid, the unambiguous, in logic, in order and classification. Fundamental problems at this time concerned the logical method, the systematic classification of knowledge, and the construction of an encyclopaedia of knowledge. It is also a cosmopolitan project that tries to breach the borders between natural languages, peoples, countries and nations.

In general, we can speak of both universal language and universal mathematics. If the former emphasises the linguistic, communicative character of universality, the latter emphasises the algebraic, the deductive. The idea was to create a kind of formal language or a calculation that would be unambiguous and independent of national languages and with which you could work out all knowledge. My contribution to the research into the history of universal language is to introduce a cognitive semantic analysis of their construction and function.[8] As opposed to the traditional view of universal languages, I wish to show that they have their origin in human cognitive prerequisites, such as our ability to categorise and to use metaphors in our thinking. They all unite the cognitive ability to categorise reality with the interpretation of signs of the baroque period. The idea of universal language is a typical example of category thinking, where each object and concept was to be directed to its particular and only correct container. The immeasurable depth of existence, the world's infinite number of objects, concepts and ideas, cannot, must not constitute a chaos, but a cosmos.

The starting point of the idea of universal language was that each object

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[8] Paul Cornelius, *Languages in Seventeenth- and Early Eighteenth-century Imaginary Voyages* (Genève, 1965); Frances A. Yates, *The Art of Memory* (1966; new ed., London, 2001); James Knowlson, *Universal Language Schemes in England and France 1600–1800* (Toronto & Buffalo NY, 1975); Mary M. Slaughter, *Universal Languages and Scientific Taxonomy in the Seventeenth Century* (Cambridge, 1982); Gerhard F. Strasser, *Lingua Universalis: Kryptologie und Theorie der Universalsprachen im 16. und 17. Jahrhundert* (Wiesbaden, 1988); Umberto Eco, *The Search for the Perfect Language* (1995; new ed., Oxford, 1997); Paolo Rossi, *Logic and the Art of Memory: The Quest for a Universal Language* (Chicago IL, 2000).

should have a designation; that there are a limited number of concepts that exist in fixed relationships with each other, in a hierarchy where they are inferior or superior to each other. Substances were divided into classes, in a hierarchy from the highest to the lowest. This subdivision of classes was used within Aristotelian philosophy, and not least in the dichotomy tables of Ramism, which are called "Porphyrian trees" after Porphyry's *Isagoge* (200 AD).[9] A Porphyrian tree was an attempt at reducing the labyrinth of reality to a two-dimensional tree, a way of taming the labyrinth of the world. The categorisation and classification of objects and concepts gained particular importance in the encyclopaedic tradition, a time of lists, lexicons, a striving for universality and totality. Johann Heinrich Alsted, Athanasius Kircher and Gaspar Schott categorised and searched for a systematic classification of the world and human knowledge. By placing objects in their correct categories, a syllogistic logic could be applied in order to create new knowledge. Others who dreamt of a universal language were Francis Bacon, Johann Joachim Becher, René Descartes and Johann Christopher Sturm.[10]

The success of symbolic mathematics, algebra and arithmetic, in manipulating symbols in order to reach new knowledge about reality, became a precept for universal mathematics. Inspired by differential and integral calculus and probability calculation, the idea of the universal calculus was developed, which was to calculate all knowledge, even that which fell outside the domains of mathematics. Among the foremost examples of this was Gottfried Wilhelm von Leibniz, one of those who developed infinitesimal calculus.[11] What he does, apart from a categorisation of reality, is to add the idea that the universal language should also express the *relationships* between the ideas in order to form the basis for the art of invention, a calculus. Following him we find the German philosopher Christian von Wolff's "ars characteristica combinatoria". With

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[9] Aristoteles, *Analytikon ysteron*, 2.13.96b25–97b14; ed. Hugh Tredennick & Edward S. Forster, *Posterior Analytics; Topica* (Cambridge MA & London, 1966); Umberto Eco, *Semiotics and the Philosophy of Language* (Bloomington IN, 1986), 80, 84.

[10] Johann Joachim Becher, *Character, pro notitia linguarum universali. Inventum steganographicum hac tenus in auditum quo quilibet suam legendo vernaculam diversas imò omnes linguas, unius etiam diei informatione, explicare ac intelligeri potest* (Frankfurt, 1661); Descartes to Mersenne, 20 November 1629. René Descartes, *Oeuvres de Descartes. 1, Correspondance: Avril 1622–Février 1638*, ed. Charles Adam & Paul Tannery (Paris, 1897), 80 ff.; Gaspar Schott, *Technica curiosa, sive mirabilia artis, libris XII. comprehensa; ...* (Würzburg & Nürnberg, 1664), VII, 483 ff.; Johann C. Sturm, "Specimens edens novi artificii, scribendi quidvis in quavis lingua quod à quarumlibet linguarum nationibus legatur ac intelligatur: & legendi atque intelligendi quodlibet in qualibet lingua scriptum hoc eodem artificio", *Collegium experimentale, sive curiosum...* I (Nürnberg, 1676), 74–99.

[11] Eco 1997, 281; Yates 2001, 370.

its signs for objects and perceptions we could calculate new learning, create new knowledge and discover hidden truths. I would say that the universal mathematics is based on an underlying basic metaphor that thinking is mathematically calculating, *to think is to calculate.* Like compound numbers can be broken down into ten digits, compound concepts and ideas could be broken down into individual ideas.

The concordance between the languages, words, objects, sounds, signs and images was one of the corner stones of the Czech pedagogue Jan Amos Komenský's pedagogy, as in *Orbis sensualium pictus* (1658). In order to learn the sounds of the letters, the bear mumbles moo, moo, the horse fly snores dss, dss, and the cat miaows na nau.[12] In his pansophy, Komenský, who has become more known under the name Comenius, searched for a universal method, a logic, a language for the universal wisdom, a philosophical alphabet, a total encyclopaedia in his conviction that reality can be reduced to some few basic elements, that there is a harmony between creation, the materia, and the intellect and language.[13] The encyclopaedia was to be a mirror image of nature. The perfect language, Comenius considered, aimed to unite the idea with the structure of the Universe, constitute a correspondence between words and objects, and be a way of achieving human reconciliation and peace between religions. The idea of the universal language was not just about semantic problems, but could also be a way of deciphering the divine alphabet with which nature is written. But Polhem totally lacks the religious arguments for the universal language. His universal language is not an appeal for peace in order to overcome religious disputes, and perhaps more unexpectedly, his universal language does not start from any expressed idea of the divine order as the foundation for the objects, the words and the concepts.

Language had the capacity to obscure and deceive thought, but could also clarify it. The universal language was a revolt against the unclear, ungraspable idea. As such, it was linked to rhetoric, the art of memory, the theory of translation and the interest in polyglot lexicons. English language philosophers led the way. Perhaps Polhem's and his travelling companion surveyor Samuel Buschenfelt's meeting with John Wallis in Oxford in 1695 led to a conversation about a universal language.[14] Polhem would probably had difficulty making himself understood, as he knew neither Latin nor

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[12] Jan Amos Comenius, *Orbis sensualium pictus: Die sichtbare Welt*, Nürnberg 1658; Sw. ed., *Orbis sensualium pictus in quo res omnes sensibus expositae, singularibus schematibus depinguntur … cum versione Sveca*, Turku 1682; *Orbis senualium pictus: Den synliga världen*, ed. Lars Lindström (Stockholm, 2006), 31; Christopher Polhem, "Discours om ungdomens första information", *Polhems skrifter* IV, 306 f.

[13] Rossi 2000, 133–138, 146, 154.

[14] Samuel Buschenfelt, *Reseanteckningar 1694–1697*. Uppsala University Library (UUB), X 366, 61 f.; Slaughter 1982, 123.

English. Apart from mathematics, Wallis was also occupied with linguistics and cryptography, and had discussed the achievability of a universal language with George Dalgarno and John Wilkins, two of the foremost advocates of the idea of a universal language. In England there was also Francis Lodwick, who wrote an essay on a universal alphabet; an alphabet that would include all sounds and letters in all languages.[15] There was also Thomas Urquhart, who wrote works with the enigmatic titles *Ekskubalauron* (1652) and *Logopandecteision* (1653), and furthermore Cave Beck's *The Universal Character* (1657). This searching for a universal language can be understood against the background of Bacon's new science, the scientific revolution's experimental and mathematical physics and Comenius' utopian teachings and their influence on philosophical, political and religious culture. The foundation also includes the classification system of Aristotelian philosophy. The perfect artificial language would create a system of characters, communicable and independent of the natural languages, which presumed that the inner understanding of objects was the same for all people, while the names of the natural languages were random and arbitrary. The language would alleviate all the ambiguous and irrational expressions of the Babylonian confusion of tongues. It would be a more efficient way of communicating and facilitate the conveyance of ideas. Each character would correspond to a particular object, which would lead to the total encyclopaedia; a complete and ordered listing and classification of all objects and concepts that exist in the Universe. In particular, they were looking for the simple concepts that could be combined in different ways to create compound concepts.

Polhem's universal language is closest to Dalgarno's and Wilkins' encyclopaedic language constructions. They tried to put together an entire encyclopaedia, which included creating a new alphabet where each letter was to signify a simple concept. Among other things, they made detailed classifications of the elements, the stones, the metals, the plants and the animals. Dalgarno, in *Ars signorum, vulgo character universalis et lingua philosophica* (1661), classifies all ideas and objects, divided into different classes. In *An Essay towards a Real Character and a Philosophical Language* (1668), Wilkins explains that the objects are better than words; that real knowledge must exist beyond linguistic elegance, just like the general well-being of humanity is beyond the well-being of a particular country or national. A new language, he considers, would facilitate trade between the countries of the world, improve our knowledge about nature, and disseminate knowledge about the true religion. As for all universal

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[15] Francis Lodwick, "An Essay towards an Universal Alphabet", *Philosophical Transactions*, vol. 16, no. 182 (1686), 126–137.

languages, one of the goals was to get away from the confusion of tongues that had arisen during the building of the Tower of Babel (Genesis 11:1–9). The variation in letters is, furthermore, an appendage to the confusion in Babel. Wilkins' universal language characters, "a real universal character", shall not denote words, but objects and concepts. A first step towards establishing such a philosophical language is exactly listing all objects and concepts that are to be denoted. The starting point is therefore that all people have the same inner concepts and understanding of the objects, but that they differ in how they express them. The names consist of temporary sounds and words that have been agreed on. The characters shall have *relationships* with each other, shall *represent* the objects, they shall be *ordered*, shall help *memory* and *understanding*. After a regular listing and description of the objects and characters, a grammar is needed. The next step is to select suitable characters, and to construct a language. The point is to create "a real character", which can be read by all irrespective of their mother tongue. The name of objects should consist of sounds that are analogous with their nature, and the characters of these names should have a similarity with these sounds.

The universal language in Wilkins' version, and likewise for Polhem, was *one* language for all people, where the words correspond to the inner images, not as arbitrary names in the national languages. It should consist of character combinations that did not signify words, but objects and concepts. The author and antiquarian Thomas Baker polemised in one chapter of his popular book *Reflections upon Learning* (1699) against the idea of "a Real Character and Philosophical Language", i.e. Wilkins' attempt at a universal language. Baker finds this as high-flown and impossible as Wilkins' flying wagon and journey to the Moon.[16]

The natural scientist and later spiritualist Emanuel Swedenborg is the best and only known concrete example of anyone in Sweden, apart from Polhem, to have tried to construct a universal language. One further person could be added to these two; a name to which I will have reason to return – Carl Linnaeus. Swedenborg made drafts of a universal language in conjunction with his studies in anatomy and physiology while seeking to find the abode of the soul. In the manuscript *Philosophia universalium characteristica et mathematica* (1740), he tries to construct a philosophical language with letters or characters for general concepts. *S* represents blood, *A* artery, *M* muscle and *N* nerve. In addition, there are the following characters: *a* for a continuous compound, *nc* for continuous substances such

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[16] Thomas Baker, *Reflections upon Learning, wherein is Shewn the Insufficiency thereof, in its Several Particulars: In Order to Evince the Usefulness and Necessity of Revelation*, 5th ed. (London, 1714), 19 f.; 4th ed. (London, 1708), 21 f.

as fibres, muscles and membranes and *nf* for adjoining compounds through contact, as in liquids, water, oil, blood and air. Quantity is of two kinds; size (continuous quantity) *Qc*, and number (discrete quantity) *Qd.* In terms of the maximum and minimum quantities, the smallest has the unit 1, medium size 2 and the largest 3. Finally, Swedenborg provides an example: *AAAQc3* designates the large artery or the powerful heart.[17] Swedenborg's posthumous work *De anima* (1742), which is an investigation of the pure intellect, provides an attempt at universal mathematics, with the help of which it should be possible to calculate all scientific propositions.[18] We know that the ideas are a kind of change of state in the brain cells. If we can describe these changes geometrically as circular and spiral forms, it should also be possible to use a calculus to carry out calculations with these ideas. In the end, the search for a universal language concludes in his correspondence theory, which provides a key to the Word. In the spiritual world, it is possible to understand each other irrespective of where we are from, whether we are from Europe or Asia, or from another time. He travels to the Moon and the planets in the spiritual world, converses with Martians, Venusians and other Extraterrestrials using a language of correspondences, a speech that flows from thought and consists of concepts.[19] The reason is that their language does not consist of words, but of thought concepts. It is a universal language.[20]

The seventeenth and early eighteenth century was an era for interpreting signs, symbols, emblems, musical notes, Arabic and Roman digits, signs for measures and weights, metals and liquids, stars and planets. There was choreography, body language, gestures, the facial expressions of deaf people, sign language, the movements of hands and fingers, pointing with the finger and counting on fingers and toes. The universal language arose in the transition from an oral to a written culture. It was not just a question of listening, but also of seeing; seeing the structure of the language, seeing the thought. Characters referred to something beyond themselves. Everything is

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[17] Emanuel Swedenborg, *Em. Svedenborgii autographa ed:photolith* VI, ed. Rudolph L. Tafel (Stockholm, 1869–70), 265–269; Emanuel Swedenborg, *Scientific and Philosophical Treatises (1716–1740)*, ed. William R. Woofenden (Bryn Athyn PA, 1992), 165–171.
[18] Emanuel Swedenborg, *Regnum animale anatomice, physice et philosophice perlustratum, cujus pars septima de anima agit*, ed. Immanuel Tafel (Tübingen & London, 1849), 255–258; transl. Norbert H. Rogers & Alfred Acton, *Rational Psychology* (Bryn Athyn PA, 2001), n. 562–567; Emanuel Swedenborg, *Oeconomia regni animalis in transactiones divisa* II (Amsterdam, 1741), n. 206, 211; transl. Augustus Clissold, *The Economy of the Animal Kingdom, Considered Anatomically, Physically, and Philosophically* II (New York NY, 1955).
[19] Emanuel Swedenborg, *De telluribus in mundo nostri solari, quæ vocantur planetæ* (London, 1758), n. 95.
[20] Emanuel Swedenborg, *Arcana celestia quæ in Scriptura Sacra seu Verbo Domini sunt detecta* I (London, 1749), n. 1637.

a weave of character relationships. Something represents something else. During the baroque period, the world was a representation. Not only the mathematical and chemical symbols were of importance for the calculus of thinking. One of the models for the universal language was also the Egyptian hieroglyphics, which fascinated many through their ambiguity and enigma, but which were assumed to be characters that represented an entire concept, that is to say they were ideographic. The hieroglyphic ideograms were images in the mind, graphic representations of ideas and concepts. Kircher, like Leibniz, wanted to see clues to a universal language in the assumed ideographic nature of Chinese characters. In *Polygraphia nova et universalis ex combinatoria arte detecta* (1663), Kircher attempted to develop an image or symbol language, a pasigraphy that could be read by all.

The dream was to rise above the actual reality to the formal, law-bound world. The universal language would apply for all of humanity, be independent of national languages, cultures and humankind's cognitive prerequisites. What is slightly ironic in the circumstances is that their attempts at a universal language to a great degree became dependent on how their own Eurocentric culture arranged the world. The universal languages were constructed by Europeans in the belief that they were making a classification of objects that was valid for all of humanity, irrespective of culture and origin. However, the categorisation of the world and concepts is often bound by culture and is not really about the "true" classification of actual objects. But this was not at all how they saw it. The division into classes and concepts was not anything arbitrary. In fact, the concepts and characters of the universal language were to correspond to the objects in reality, in the same way as the hands on a clock corresponded to the movements of the Universe. It was therefore assumed to be a similarity between the structure of the Universe and human thinking, an analogy between the order of the world and the grammatical order between the symbols in language. The concepts were a reflection of the Universe, and the ordered classification reflected the cosmic harmony. The designations and relationships of the universal language corresponded with, was isomorphous with, the inherent characteristics and relationships of the objects.

Spectacles for the blind
Language researchers in Sweden, as in other countries in Europe, were looking for a common language, the original language, the language that had once been spoken by the first humans. Adam's name for the objects should be what reflected the true nature of the objects. Then the Tower of

Babel was built, after which all languages became distortions of the true, original meaning, which led to misunderstandings and discord. But was it Hebrew that was this true original language, or was it Swedish? The Swedish physician and historian Olof Rudbeck the Older, who has become known for his identification of Sweden as Atlantis, had his own theory about the origin of letters and the art of writing. They originated in the runes in Swedish copses of aspen.

In a way, there was already a universal language – Latin. But it was not perfect. The artificial universal languages can be seen as an attempt at breaking the dominance of Latin as the lingua franca, its socially exclusive character. Latin constituted a chasm that was difficult to bridge between elite culture and popular culture, and locked out women, craftsmen, farmers and a smith and carpenter like Polhem. He often criticised Latin as an obstacle to thinking and the sciences. Also, Latin rhymed badly with his cult of utility, and his eagerness to disseminate new findings and inventions to the broader population. Much because of his own wavering educational path, he had great concern for the teaching of young people. Learning Latin or other subjects by reeling off texts by heart he thought was not worth much. It was like giving a book to someone who could not read, or spectacles to a blind person.[21] Instead, he advocated teaching in Swedish with Swedish books and with practical exercises. To this was added a new educational ideal. It was not the classical, handed-down education garnered from books written by the wise men of antiquity in which he found any meaning. Polhem does not represent book learning, but particularly empirical knowledge appropriated through the senses and the hands. And he often emphasised the necessity of both practical and theoretical knowledge.

During Polhem's time, battles for and against Latin, the own and the foreign were being fought. The criticism was often that Latin took too long to learn, and that it was of no use in everyday life, combined with a patriotic streak and a striving for educating the population. In France, England and Germany there was a gradual move away from Latin to the national languages in a scientific context during the second half of the seventeenth century. Swedish also rose up as a scientific language, not least through the efforts of the Royal Swedish Academy of Sciences in the middle of the eighteenth century, whose publications were being disseminated in Swedish, and where preservation of the Swedish language was keenly supported. However, there was a lack of abstract terms in the national languages. New scientific words were taken primarily from Latin. Latin was

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[21] Samuel E. Bring, "A Contribution to the Biography of Christopher Polhem", in *Christopher Polhem: The Father of Swedish Technology*, transl. William A. Johnson (Hartford CT, 1963), 83.

a living language, and still had power over thought. The interest in a universal language therefore coincides with the weakening of Latin, combined with a striving for universality beyond the barriers of national interests.

Many also considered Latin to be unpedagogic; an obstacle to learning in the classroom, constituting psychological and physical maltreatment of the little school boys. Grammar was literally banged into them. The heartless tyranny of the language of the Romans was surely felt by the probably dyslexic Christopher Polhem during his brief time at Tyska Skolan, the German School in Stockholm. Latin hindered him from reaching that which he really wanted to learn. As junior farmhand at Vansta Manor outside Stockholm, he dreamed about studying. He realised he would have to learn Latin in order to develop his knowledge of mechanics. Therefore he made an agreement with a priest, bartering lessons in Latin against the construction of a wall clock.[22] But he never really managed to learn Latin. There is not one single manuscript in Latin in Polhem's writing. Instead, he invented his own language.

a e i o u å ä ö y b d g v p t k f j l n m r s h

Polhem made his drafts for a universal language at a time of interest in language, national languages, the sounds, the connections between words and objects, the character and the characterised. In the artificial languages of the time, there is also a striving towards the cosmopolitan. Linguistically, both semantically and phonetically, Polhem's universal language emphasises a number of advantages. The universal language should be pedagogic, more efficient, shorter than the ordinary language, regular and based on a firm foundation. The manuscript *Nomina rerum naturalium per philosophiam novam* (undated), which despite its title is written in Swedish, provides a fairly good picture of what such a universal language could look like.[23] Apart from the arguments for a universal language, also notable is the starting point in language sounds, such as vowels, consonants and what he calls "semi-vowels", as well as "hard" and "soft" consonants. Thereafter follows a grammar and a lexicon. At expressive level, a lexicon, a phonology and a syntax are necessary. As in most universal languages, great emphasis is placed on nouns, thereafter verbs, after which adjectives are added. The senses and the elements play a central role in Polhem's universal language.

The craving to learn different things in natural sciences tempts many to

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[22] Christopher Polhem, "Commercie-rådets herr Christ: Polhems lefvernes lopp i korthet af honom sielf uppsatt", *Polhems skrifter* IV, 397 f.
[23] Christopher Polhem, "Nomina rerum naturalium per philosophiam novam", *Polhems skrifter* IV, 333–338.

start reading, begins Polhem. But the difficulties soon make us tire, so that we often stop half way. This is because we have to eye through an innumerable amount of letters and words that are irrelevant, and which merely tire the eyes and the brain and put a strain on health. Instead, he speculates, we could invent a new way of writing books, where words and sentences were concentrated, so that an entire book could be summarised on a sheet or two "because then a large book would not so easily frighten many from reading it, as now usually happens, and then people would gain knowledge quicker than otherwise. This I have thought for a long time", says Polhem, but it has always proved to be difficult and tiring, particularly when other orders and problems have interrupted. But then I have still considered this further, "as a thing that would be no less useful and desirable than finding perpetuum mobile and lapis philosophorum which surely are impossible in themselves, but none the less has led many to spend both time and welfare upon". Many learned men have "put their brains to work thereon, but like me, have stopped half way". But like all gold-makers who have lived and died with the idea that it should be possible some time in the future, "therefore I also do the same".

What gives me hope, says Polhem, of the possibility of creating a new language is "if adult men and philosophers wanted to take the trouble of forging a language" that would have a better foundation than those that have their beginning in children and common people. The language is like a city, with blocks, buildings and lanes. To begin with, nobody bothered about streets and lanes, but placed the houses on suitable stones anchored in the ground, which has made cities "so bewildering to find the way home that Nero was forced to burn down Rome entirely".[24] Now it is clear, that in the same way as irregular cities and forests make us lose our way it is with an irregular language, which is more difficult to remember than a completely regular one. Laying a foundation is necessary before house can be built, and not just a visible foundation above ground level, but also an invisible one underneath the ground. And so Polhem started to lay the foundations on which such a language must rest. He starts with the letters in our alphabet. There is nothing in nature that is not based on a certain letter, he states. In the same way that "the stones in the wall do not stick together well without mud, chalk and sand", so consonants must also be linked together with vowels. The consonants are divided up into four pairs, which he call "hard" and "smooth" respectively (that is to say unvoiced and voiced), *p b, t d, k g, f v.* The various letters represent different natural objects: *p* stands for plebs or populus (people), *b* for bruta (animals), *t* for

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[24] Cf. Gaius Suetonius Tranquillus, "Nero", *De vita Caesarum*, chapt. 38; ed. J. C. Rolfe, *Suetonius* I (Cambridge MA & London, 1979).

terra (earth), i.e. hard materials, *d* for the soft earth, *k* for growing bodies such as trees and shrubs, *g* for grass and spices, *f* for all heavenly phenomena and tangible objects, and *v* for everything that is pure stories and invention. All things must therefore start from these letters. To these can then be added the "semi-vowels" (which most closely can be understood as "long" consonant sounds that link together plosives or closed consonants), *s, l, n, m, r*, which represent our five outward senses, i.e. *s* sight, *l* hearing, *n* smell, *m* taste and *r* touch. Vowels placed before the semi-vowels signify various quality or quantity degrees, for example *a* is the first, greatest or most prominent, while *u* represents the worst, least, or least prominent. The degrees become *A, ä, E, y, I, ö, O, å, V.*

As we have now got the stones and chalk for this the first foundation under the ground, we can now begin to put the letters together into syllables. Painters and dyers say that they have 80 different kinds of colours. These could now be named with three, at most four, letters. As the colours are distinguished by sight, the first letter of the colours is *S*. The shade of the colour is denoted by the next following vowel, *a* white, *e* yellow, *i* blue and *o* red. A mixture of white and yellow is *ä*, green which is a mixture of blue and yellow becomes *y*, *ö* stands for violet and *å* for liver brown. These colours are then graded using the nine different degrees of vowels that can be placed before *S*. In this way, 81 different colours can be denoted. In the same way, a musician can also find his designations in terms of hearing, the pharmacist in terms of smell, a cook or a chemist in terms of taste and a mechanic in terms of touch. Therefore, in this way it can soon be seen to what extent an object is useful or useless, whether it is to be seen, heard, smelled or tasted, etcetera, or which virtue or vice it has. In summary, by using this method you can use only four syllables to produce 262 410 words or names, but "so many will surely never be needed". A person searching for a certain word can refer to a lexicon in five parts "where a painter, a musician, an apothecary, a master chef and a mathematician can get the greatest insight hereinto".

In these dreams about a more compressed language, we notice the pressurised, busy Polhem who was short on time. It is too much work and takes much too long to read books. His own invented language is reminiscent of a kind of speed writing for a busy civil servant, which leads the thought to the abbreviated or speed writing, stenography and tachygraphy that was developed particularly in England during the seventeenth century. Schott's *Technica curiosa* (1664) and the Swedish civil servant Åke Rålamb's *Adelig öfning* (1690) teach the art of writing as fast as we speak, and writing everything on one sheet of paper when others

need twenty.[25] In a true Rudbeckian spirit, Rålamb finds that this art has its origin in the Swedish region of Hälsingland. But it is not just the pressurised councillor of commerce who gets to speak in Polhem's universal manuscript. It is also the engineer that is speaking. All languages, he says, originate from the mouths of children, from chance and mix-ups by unlearned and simple people. Even if learned men had made the effort to improve their language, it would have been the same as trying to correct an old, irregular and poorly planned city. In the same way as an engineer could do more if he constructed a city in an empty and unbuilt location, so a philosopher could try to construct a language on an entirely new foundation and bring it all together with greater regularity "like a wild forest compared to a regular garden".

Therefore, says Polhem in a new draft, I have started to think about a new language, which is far from being as difficult as the simplest national languages, or Latin, which on its own requires half a lifetime.[26] We should therefore avoid all the effort, grief and tiredness of learning the instrument that obstructs us from what we are really intending to study. "Well, if I dare to speak freely, the study of Latin serves more often as an obstacle to that which could and should be studied in youth than being of general use, for which reason study of the own language is used in many places, although this is not nor can be on a good foundation." All languages need a grammar and a lexicon. At the same time, Polhem's universal language is becoming a form of simplified Latin, where the grammatical terms of Latin are taken over rather more than those of Swedish, not unlike the French Jesuit Father Philippe Labbe, who was working just on a simplified Latin that could function as a universal language.[27] Language is not something we are born with, explains Polhem, but comes from "art", practice and culture. Philosophers are needed to construct a new universal language, regular like a baroque city.

Spavilafk ikav Sve
"In the beginning, God created heaven and earth, and the earth was empty and void, and the spirit of God hovered over the depths." In a collection of fragments titled *Försök till en ny och kort skrifkonst* (undated), Polhem applies his universal language to the Book of Genesis. As the greatest and

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[25] Åke Rålamb, *Utaf adelig öfning Thacheographia eller en kånst at skrifwa så fort som man talar: Så och på ett ark papper skrifwa så mycket som en annan på 20 ...* (Stockholm, [1690]).
[26] Christopher Polhem, "Project till ett nytt universalt språk huar igenom alla slagz meningar kuna med bettre tydelighet och mindre ord utföras, så och med mindre möda och tijdspillan läras än elliest vanligen", *Polhems skrifter* IV, 342–316.
[27] Knowlson 1975, 137.

most complete of spirits, God must be called *Spav,* and if we say he created or executed it, we say *ila,* and then heaven *f* and the earth *k.* The the earth was *ika,* empty and void, *v.* The spirit of God must be called Sve, and "Hovering is a movement that must be done with the help of the body and arms".[28] Therefore: Spavilafk ikav Sve. Trying out a universal language on a religious text was common, as with Dalgarno and Wilkins, as with other linguistic comparisons between natural languages. For example, Dalgarno's Genesis starts like this: "Dan semu, Sava samesa Nam τη Nom. Tη nom avesa sof-shana τη draga, τη gromu avesa ben mem sηf bafu: τη υν sηf Sava damesa ben mem sηf nimmi."[29]

The universal language was intended to capture the world, nature, heaven and creation. The world is a language, a system of signs that can be combined and deciphered. Objects can be made into lists of everything in existence. By classifying nature, we can get a grip on it, create order out of chaos, and find the gaps in our knowledge. There is a constant dichotomy between art and nature, usefulness and uselessness, virtue and sin in Polhem's thinking. A soft consonant represents nature and a hard consonant art and human culture. The five senses are particularly central to the classification of objects. Objects are graded according to light and dark, number, size, time, use, virtue, agreeableness and superiority.

Polhem's *Orda teckn på naturens materialer och dess egenskaper* (1710–1711) forms a theory of general physics in a single system, where the physical principles could be classified using a deductive method.[30] (Fig. 1). This is Polhem's longest universal language draft, and it goes through his entire theory of physics, not least his theories of materials and of particles. This language should be no more difficult to learn than other foreign and unknown languages. As is well known, he said, no book knowledge could be learnt simply through the mother tongue, nor could anyone be called learned without understanding at least some languages more than one. He imagines a cosmopolitan language independent of the national languages, "almost as is done with digits, which all national can learn easily, so long as all numbers are written using the digits, but if they were written with letters using the proper names in their own languages, such as One thousand seven hundred and thirty five, a foreigner would not understand it as easily as 1735". The character system forces him to think hard, to work out what the

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[28] Christopher Polhem, *Försök till en ny och kort skrifkonst.* Royal Library, Stockholm (KB), N 60, fol. 37 f.

[29] George Dalgarno, *Ars signorum, vulgo character universalis et lingua philosophica* (London, 1661), 118; reprinted in *George Dalgarno on Universal Language: The Art of Signs (1661), The Deaf and Dumb Man's Tutor (1680), and the Unpublished Papers*, ed. David Cram & Jaap Maat (Oxford, 2001), 276.

[30] Christopher Polhem, *Orda teckn på naturens materialer och dess egenskaper.* KB, X 519, fol. 1–61; transcribed by Jacob Troilius. KB, X 521, p. 1–62.

various character combinations represent. With the word character system, he can also fill in the gaps in knowledge. It is a way of thinking, a way of remembering. He can say quite a lot about *ilo*, the air in the water, *oli*, the water in the air and *olo*, the characteristic of water in itself. It is more difficult to say anything about *eli*, the characteristic of ether in the air, and even more difficult to do the opposite, say something about *ile*, the characteristic of air in the ether.

Polhem made several drafts of similar character systems and tables.[31] In two essays submitted to the Royal Swedish Academy of Sciences around 1740, Polhem tries to create a universal language for flowers, as an expressed alternative to Linnaeus' taxonomy.[32] The botanists, pharmacists and cooks were to be spared long plant names, spared reading thick folios, but could still find out all about the characteristics of a plant. But Polhem's botanical system does not say much about the morphology of plants. Stamens and pisti, entire or pinnate leaves he does not bother about. Instead, he concentrates on what the senses can say about the plants – not least what pharmacists smell and cooks taste – what use, virtue and pleasure they can provide. It is the patriotic cult of utility in the anthropocentric utilitarianism of the Swedish Age of Liberty that provides the categories. Plants are classified according to whether they grow in the wild forest, in vegetable plots or botanical gardens, whether they are sold by the load, the pound or the ounce. For Linnaeus, as opposed to Polhem, the virtues, smell, taste or the practical use are worthless characteristics. Instead, Linnaeus searches for the ideally typical, not the realistic. Leaves can be divided up into ideally typical shapes, such as orbiculate, ovate, lanceolate, cordate, reniform and so on. As the same time, we can regard Linnaeus' sexual system and nomenclature as an outrunner of the universal languages' classification of reality. There is the category thinking, the labelling, the connection between name and object. The binary nomenclature is a universal language, a more efficient, more economical way of expressing oneself than the previous phrasal names; a nomenclature that supports labelling rather than diagnosing, contains words that refer to fixed ideas and

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[31] Polhem's manuscripts on universal language are collected in *Anteckningar och utkast rörande ett af honom uppfunnet "Universalspråk"*. KB, N 60.

[32] Christopher Polhem, "Förslag till nyia namn uti botanicen", *Polhems skrifter* IV, 346–349; Christopher Polhem, "Förslag till sådana tillnamn på örter och gräs som kuna i korthet utmerka deras dygd och egenskaper i gemen", *Polhems skrifter* IV, 349–351; cf. Christopher Polhem, *Naturliga kännetecken på nytt maner*. KB, X 260:1, fol. 28–34; Carl von Linné, "Professor C. Linnæi. Samling af et hundrade wäxter upfundne på Gothland, Öland och Småland", *Kongl. swenska wetenskaps academiens handlingar, för månaderna julius, august. ock september 1741* (Stockholm, 1741), 179–210; cf. Gunnar Broberg, "The broken circle", *The Quantifying Spirit in the 18th Century*, ed. Tore Frängsmyr, John L. Heilbron & Robin E. Rider (Berkeley, Los Angeles CA & Oxford, 1990), 56.

is international and valid everywhere. The language of flowers is a cosmopolitan project, a universal language.

During the eighteenth century, all of reality was subjected to classification and division. The science of the time was about order, irrespective of whether it concerned the constituents of materials, flowers, words or angels. Order constituted a significant part of Western culture, as the *episteme* of the era.[33] Contrary to Michel Foucault's power perspective, I would like to underline the cognitive basis for the search for order. The classification of plants is part of the categorisation of the living environment in human thinking, as a way of handling the surroundings, of understanding them.

The mechanical alphabet
The idea of the universal language is based on an "atomisation" of reality, or seeing the concepts as distinct, divided up in a void. The ideas, the words, can be broken down, analysed into atoms and parts, as small particles of information. In the mechanistic view of the world, there is a far-going atomisation of reality, within nearly all fields, from the corpuscular theories within chemistry to universal mathematics. People thought with the help of the metaphor that *the world is a construction kit.* In the case of Polhem, *machines consist of letters* expresses the same cognitive thought pattern. Everything was thought to consist of building blocks; blocks that were put together into a world machine. Thoughts consisted of simple ideas, words of letters, music of notes, nature of numbers. Machines and mechanical movements also had their own, simple parts.

Polhem's teaching included "the mechanical alphabet", which consisted of a large number of simple, educational wooden models showing the fundamental laws of mechanics.[34] The models represented the simple and indivisible elements of mechanics, quite simply the building blocks of all engineering. These might be a steel spring, a cogwheel, the ratchet wheel mechanism, a windlass or other mechanical elements that each represented a "letter" in the mechanical alphabet. They described different types of mechanical movements, such as the transfer of one type of movement into another, from rotating movement into straight line movement, and other rotating and forwards-backwards movements. Polhem's mechanical alphabet became a pedagogic system, easy to learn, see and try out.

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[33] Michel Foucault, *Les mots et les choses: Une archéologie des sciences humaines* (Paris, 1966), 71.
[34] Christopher Polhem, *Kort berättelse om de förnämsta mechaniska inventioner som tid efter annan af commercie-rådet Christopher Polhem blifwit påfundne och til publici goda nytta och tienst inrättade, sampt om det öde, som en del af dem hafft genom tidernas oblida förändringar. ...* (Stockholm, 1729), 75–77.

With knowledge about these mechanical letters, a mechanic could build any machine he wished. Just like a poet can write the most beautiful poetry with the help of the ordinary alphabet, an engineer could learn the mechanical alphabet and form "sentences" of the mechanical letters, that is to say construct complicated machines that could carry out useful work. The machines became like words and sentences. It was just as important, Polhem claimed, for a mechanic to know all the cogs, levers and catches in a machine as it was for a person with book learning to know the letters of the alphabet and the meaning of words.[35] (Fig. 2) There were certain particularly important mechanical letters that corresponded to the vowels in the ordinary spoken language. In the same way as we could not write words without vowels, it was also not possible to build a machine without any of the five mechanical vowels, namely the lever, the wheel, the screw, the block and the wedge. The most important was the lever. Cog wheels, chains, bearings, joints and springs were probably to be regarded as consonants, not as necessary to include in each machine. In a letter, Polhem writes that the mechanical alphabet was like Chinese characters. "The same difference that exists between Chinese writing without letters and our European writing with letters, so it is between the machines or their inventions that must be looked for without their key or such certain principles of motion on which all movements are based with their practicable compositions, and where all this is accessible like letters to all words."[36] The important point is to learn the right way of writing. With a mechanical alphabet, he had found many new, functioning inventions. The mechanical alphabet was based on the idea of the world as a construction kit, like a character system with infinite combination possibilities. The world consisted of small parts that could be put together into units, small atoms, corpuscles, that create bodies and objects, consonants and vowels that create words and sentences, digits and numbers, simple geometric figures that create the movements of the Universe, small mechanical letters that create mechanical words and books. Polhem's mechanical alphabet became a celebrity, which was followed by other technical machine systematicians. The German technologist Johann Beckman saw this ABC, as did the future Venezuelan freedom hero Francisco de Miranda during his visit to Stockholm in 1787.[37]

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[35] Carl Cronstedt, *Machiner, som till största dehlen äro uti wärket stelte [av Polhem] och af Ehrensverd och mig afritade åhr 1729: tillika med andra tilökningar som iag sielf giort tid effter annan*. Swedish National Museum of Science and Technology, Stockholm (TM), 7405, p. 2.

[36] Polhem to Benzelius, Stjärnsund 5 November 1722. *Polhems brev*, 162.

[37] Johann Beckmann, *Schwedische Reise nach dem Tagebuch der Jahre 1765–1766* (Lengwil, 1995), 131; Francisco de Miranda, *Archivo del general Miranda* III (Caracas, 1929), 40 f.

In the mechanistic view of the world, mankind, thinking, language and machines linked into each other. The view was that *thinking is a machine*. Reason is a machine, ideas are its raw materials and conclusions are its products. Step by step, the thought machine puts together its thoughts into a finished product, and if everything has gone right, it spits out a well-worked out and irrefutable truth. The knowledge machine had been a dream since the rotating concentric circles of the medieval Spanish Franciscan Ramón Llull some 400 years earlier, where new combinations of concepts could be produced. During the seventeenth century, Blaise Pascal and Leibniz constructed counting machines that in their way tried to imitate human counting. The Swedish chemist and linguist Urban Hiärne tried, as had Wilkins and other before him, to construct a speaking head, an artificial speaking machine.[38] Polhem himself constructed a cipher machine in his eighties, together with his ten-year-old grandchild Fredrik.[39] Polhem's idea was most closely related to Kircher's *abacus numeralis*, but perhaps also to his acquaintance John Wallis. The machine is based on a type of substitution cipher, where letters and figures are exchanged. Later, in 1786, the Swedish Forester Royal, Baron Fredrik Gripenstierna constructed an encryption machine according to his grandfather Christopher's instructions, probably the world's first mechanical device for facilitating the construction of ciphers.[40] The widely held idea of the thought machine was parodied in *Gulliver's Travels*.[41] On the flying island of Laputa, a professor had constructed a machine that avoided the old, ordinary and laborious way of acquiring knowledge. With this fantastic machine, even the most uneducated person could now, without any effort, write thick tomes on anything from philosophy to mathematics or theology.

The universal order
Polhem's thoughts about a universal language were guided by a number of fundamental metaphors. These metaphors were more or less unconscious, or such as he seldom or never reflected on, in particular that *categories are containers* and that *the world is a construction kit.* It is not necessary the case that these metaphors were used exactly as worded. In the late baroque

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[38] Urban Hiärne, *Orthographia Svecana, eller den retta swenska bookstafweringen stelt i ett samtal emellan Neophilum och Eustathium* (Stockholm, 1717), 60; reprinted in Stig Örjan Ohlsson, *Urban Hiärne and Cartesian Phonetics* (Lund, 1997), xxxvii, 60.

[39] Christopher Polhem, *Några Mechaniska Inventioner, som fuller icke änu blifvit practicen wär[k]stälte och försökte; men likwäll på god grund byggde att de man tar sitt försök*. KB, X 267:1, fol. 58.

[40] Fredrik Gripenstierna, *Beskrifning som utvisar, huruledes den af undertecknad inrättade Chiffre-maskinen, kan nyttias till Chiffrering och Dechiffrering*. National Archives, Stockholm (RA), Utrikesdepartementet, huvudarkivet, F 5 C:7.

[41] Swift 1726, III, 71 f.

era, they could have special formulations, such as with the machine metaphor. What is indicated is instead the cognitive thought patterns with which they, like us, think.[42] These metaphors also capture two central problems in baroque thinking; on the one hand the classification and atomisation of objects and concepts, and on the other the issue of the secure method for conveying and absorbing knowledge or creating new knowledge. Fundamentally, it was about *order* – and this was the very starting point for the universal languages. The point was to bring order to the language and the world. The starting point was the belief that nature had an order; that this order could be discovered and described; that the objects had fixed essences; that words are or should be isomorphic with the objects. The system and order of creation had its guarantor in the infinite wisdom and infinite benevolence of the Christian God.

The categorisation of reality is a fundamental cognitive ability in human thinking and perception. We have to create order, control the world and our surroundings with concepts, categories, names and classes. Classification also becomes an exercise of power, where the definitions exclude, disqualify phenomena or people from belonging to a certain category. By dividing and linking the categories with each other, we achieve greater order in the chaos of reality. With the categorising perception, the blurred transitions of reality are converted into distinct pigeon holes. Thinking adds borders that do not exist, fills in incomplete patterns. The categories, the borders and limitations are to a great extent learnt and culture-dependent, that is to say they do not just correspond to the reality outside, but rather arise in the meeting between a person's consciousness and his surroundings. Ordering is also about seeing likenesses between objects, which likenesses we consider to be the most important and which objects belong together. In other words, the category system determines what we see and what we do not see. That which falls outside the categories we do not see. Categorising is about humankind's constant search for order in chaos – an ordered world is easier to live in that a chaotic one. Humankind is faced with something greater than itself, something that is incomprehensible to its limited reason. One way of making the world comprehensible is to try to make it logical, mathematical and geometric. This is needed for people's interpretation of the world, and therefore they more often talk about people themselves that the world itself.

The views on categories Polhem comprises is of a classical kind, in which the categories are seen as defined by the objectively given characteristics shared by the members within a category. The categorisation

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[42] George Lakoff & Mark Johnson, *Philosophy in the Flesh: The Embodied Mind and its Challenge to Western Thought* (New York NY, 1999), 36, 51.

is therefore dependent upon knowledge about the significant characteristics of a category. In the geometric view of the world, which Polhem comprises to a high degree, the essence of the objects can be determined in the geometric shape. Particles with a certain shape, rounded or angular, give rise to differing characteristics which are dependent upon exactly the shape of the particles. What Polhem follows is the informal "theory" of human thinking about essences, that is to say that people regard each object as a type of object, that it belongs to a certain category, that all objects have a collection of essence-determining characteristics that make the various objects into the type of objects they are, and that this essence is an inherent part of the object. That which sets the tone for this way of thinking is Aristotle's definition of "definition" as a list of characteristics that are both necessary and sufficient for something to be of the type of object it is, and from which all the characteristics of the object originate.[43]

In order to construct an artificial language, the words must be isolated from the living language context, the words must be objectified, analysed and divided up into their simple constituents. The words are assumed to have a meaning in themselves, independent of the context – the language is decontextualised. The meaning of words does not arise in interaction between people, as the opposite relativist or functionalist view dictates, where language, words are regarded as coins that are exchanged, worn out and lose value, in accordance with the coin metaphor used by Quintilian and Horace.[44] Instead, the universal language constructors seek the fixed, eternal meanings. At the same time, the universal languages are based on the idea that the words or the symbols can represent the world, and do not, as could be claimed instead, represent inner conceptions. There is a constant idea of a link between the language and the objects in the world; that the words refer to different objects. From a cognitive semantic perspective, the meaning of a word is not the material object in the outer world; instead the meaning is inside the head. Therefore, by studying categories in historical sources, we can make out the thinking and inner conceptions of the time.

The concepts can be placed into different, clearly separated pigeon holes, just like different types of coins, stones or shells. By understanding our experiences with the help of objects and substances, we can categorise and group them, quantify and reason about them. The universal language is the dream of a language with fixed meanings; the search for the unchangeability of concepts; a longing for lucidity and the closed, absolute system. It was thought that the categories existed outside the human

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[43] Aristoteles, *Analytikon ysteron*, 2.3.90b30–31; George Lakoff & Rafael E. Núñez, *Where Mathematics Comes from: How the Embodied Mind Brings Mathematics into Being* (New York NY, 2000), 107.

[44] Francis Bacon, *De dignitate et augmentis scientiarum* (London, 1623), book 6, chapt. 1.

consciousness, which at the same time meant that a universal, transcendental logic was assumed, which reaches outside the human being. The universal language was conceived to reflect the true structure of reality. The tables of the universal language showed where the objects belonged, their special place in the universal order. The construction of an artificial universal language was a cosmopolitan project, a search for a language beyond nationality, ethnic and cultural background, which links the rational beings in a common, true and everywhere valid classification of the world. The people on the Moon classify the objects in the same way as we do. An understanding of the cosmopolitan universal language idea is largely just about finding such underlying cognitive purposes, finding out the "containers" or categories into which they classified the world. These catagorisations of the human mind are dependent on experiences, conceptions, perceptions, movements in space, and the culture around them, but also of metaphors and mental images. The universal language constructors division of the world into categories says something about themselves, and their cosmopolitan endeavours. The categories, it was thought, were common for all people, irrespective of from which corner of the cosmos they originated.

Captions

Fig. 1. *El*, a swinging ball under water or a turning planet in the ether. Christopher Polhem, *Orda teckn på naturens materialer och dess egenskaper* (ca 1710–1711), fol. 7v. Photography: National Library of Sweden, Stockholm.

Fig. 2. Polhem's mechanical alphabet. To begin with, this alphabet had 80 letters. But in 1729, when Polhem's pupil, the architect Carl Johan Cronstedt, wrote them down in his notebook, they amounted to 103 different machine elements. Photography: National Museum of Science and Technology, Stockholm.