



1753-1759. «Las Ciencias Matemáticas» («The Mathematical Sciences»), Andrés de los Helgueros (1705-?) © Museo del Prado, Madrid (Spain)

The life cycle and learning in an 18th century work in the Prado Museum

In any human society, matrimonial and family systems determine that their members establish bonds superior to merely biological ones, as is also the case with any other aspect of human relationships, more precisely in those regarding the transmission of knowledge. We grow so slowly because we need time to learn in society while our brain develops: the brain tissue matures thanks to external experience, which builds the network of neuronal interconnections and thickens the myelin which covers the axons which connect neurones, which makes the transmission of information from outside more efficient and also our response to its stimuli.

Learning to talk, read and write, count, read a musical score and play an instrument, all of these are based, undoubtedly, on our large brain, which trebled in size over two million years. But our large brain is useless if we don't have time to grow and learn in a social environment suited to this end. During a biocultural cycle, we learn and teach throughout our lives, as the work which illustrates this exhibit shows: a work in marble by Andrés de los Helgueros from the mid-18th century which was part of the project for decorating the Royal Palace in Madrid. Cesare Ripa's (1555-1622) *Iconology, a Description of Universal Images* (first edition 1593) helps us recognise in this relief several scientific disciplines, which, in classical representation, are women as are also most abstract qualities (reason, perspicacity, wisdom, imagination, invention...) as Londa Schiebinger has pointed out.

The woman on the left represents Arithmetic who, as Ripa explains in his work, holds a numerical table, although in Helgueros's marble it is a man with a turban, maybe Pythagoras, holding it. On the floor or held by men we can see instruments (set square, ruler, spheres, compass, possibly an astrolabe...) which may correspond to Measurement and Astronomy, which in the 1645 edition of Ripa's work are described and drawn as women.

But let us focus on the central, female figure, representing Mathematics, a woman with a girl or a boy. Following Ripa, we see that in her left hand she has an armillary sphere (the Earth in the middle surrounded by the areas and circles which make up the celestial sphere) and in her right hand she holds a compass with which to measure or draw a circumference on a tablet or slate with numbers and figures that the child holds, and whom she is teaching according to iconographic tradition. To her right, on the floor, two children are playing with a Pythagoras table, a 9×9 squares square showing the multiplication tables.

Ripa points out in his work that «knowing these [mathematical] principles should not be delayed to an age beyond childhood because, even for slower and less suited minds, it opens a door to a beautiful palace or garden which you enter in the next years of life, and it is also an instrument which marks our intellect, which is like a blank page or bare board, with nearly all the things we will encounter in the future, be it from teachers or be it from books.» (1645: 389). Let us remember Ripa's idea: learning models our intellect as we grow, a literal verification of modern neurobiology.

Our primate relatives also have cultural habits which are passed on socially and from generation to generation. But an adult never bothers to actively teach another adult, nor a mother her own child. In this sense, human beings are exceptional primates: from an early age we are interested in what others do, be they our age or older and whether they are members of our family or not. Andrés de los Helgueros's work shows this with the children in the middle of the relief and also the two youngsters who are on the right with a couple of adults.

We learn especially when we share experiences with our peers or elders, what is known as «collaborative learning». And, obviously, we learn so efficiently because we are taught actively through language, not just by members of our biological family, but also by many other people depending on the prevailing socio-cultural systems of the time. This process of cultural learning has proved extremely efficient during our evolutionary history as it allows for the faithful transmission of knowledge or techniques but also allows for innovation through the involvement and cooperation of members of a group. This is what we call «accumulative culture» and explains the gradual cultural and technological change since two million years ago, which has now become very fast.

Michael Tomasello and his team at the Max Planck Institute of Evolutionary Anthropology have shown that baby chimpanzees and orang-outangs and human babies score the same in tests designed to evaluate general non-linguistic reasoning and traditional cognitive faculties (such as spatial and quantitative intelligence), but that we humans are far superior in social skills such as the ability to learn from others and evaluate the perceptions and wishes of others, and also to collaborate for common goals.

Many of the qualities we associate with the evasive concept of «intelligence» are really those that enable cultural learning within a large and stable social group: patience and perseverance, imitation and emulation, curiosity and attention. This spread of pro-social human qualities allows us to learn from older people and from our playmates, and constitutes what we call «cultural intelligence», so magnificently depicted in the work of Andrés de los Helgueros.

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Further reading:

Ripa C. 1593, *Iconologia overo Descrittione dell'Imagini universali*. Available in its 1645 edition in the [BNE's Hispanic Digital Library](#), from which Pere Planesas has translated the included quotation (p. 389). English translation (partial): *Iconologia, or, Moral Emblems by Caesar Ripa, illustrated with three hundred and twenty-six humane figures, with their explanations; newly design'd and engraven on copper, by Isaac Fuller, painter, and other masters: by the care and at the charge of Pierce Tempest, printed by B. Motte, MDCCIX, London (available in Internet Archive.)*

Herrmann E, Call J, Hernández-Lloreda MV, Hare B, Tomasello M. 2007. [Humans have evolved specialized skills of social cognition: The cultural intelligence hypothesis](#). *Science*, 317(5843), 1360-1366.

Schiebinger L. 1988. [Feminine Icons: The Face of Early Modern Science](#). *Critical Inquiry*, 14, 4:661-691. By this author, also on this subject, is available the book *The mind has no sex? Women in the origins of the scientific revolution* (1989). Cambridge, MA: Harvard University Press.