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Alphabets are as simple as...
Writing systems may look very different, but they all use the same basic building blocks of familiar natural shapes, reports **Roger Highfield**.

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(Filed: 18/04/2006)

Writing systems may look very different, but they all use the same basic building blocks of familiar natural shapes, reports Roger Highfield

If there is one quality that marks out the scientific mind, it is an unquenchable curiosity. Even when it comes to things that are everyday and so familiar they seem beyond question, scientists see puzzles and mysteries.

**Familiar form: letters have been shaped by everyday sights such as the crescent moon**

Look at the letters in the words of this sentence, for example. Why are they shaped the way that they are? Why did we come up with As, Ms and Zs and the other characters of the alphabet? And is there any underlying similarity between the many kinds of alphabet used on the planet?

To find out, scientists have pooled the common features of 100 different writing systems, including true alphabets such as Cyrillic, Korean Hangul and our own; so-called abjads that include Arabic and others that only use characters for consonants; Sanskrit, Tamil and other "abugidas", which use characters for consonants and accents for vowels; and Japanese and other syllabaries, which use symbols that approximate syllables, which make up words.

Remarkably, the study has concluded that the letters we use can be viewed as a mirror of the features of the natural world, from trees and mountains to meandering streams and urban cityscapes.

The shapes of letters are not dictated by the ease of writing them, economy of pen strokes and so on, but their underlying familiarity and the ease of recognising them. We use certain letters because our brains are particularly good at seeing them, even if our hands find it hard to write them down. In turn, we are good at seeing certain shapes because they reflect common facets of the natural world.

This, the underlying logic of letters, will be explored next month in *The American Naturalist*, by Mark Changizi, Qiang Zhang, Hao Ye, and Shinsuke Shimojo from the California Institute of Technology in Pasadena. The analysis is simplistic but, none the less, offers an intriguing glimpse into why we tend to prefer some shapes over others when we communicate by writing.

The team set out to explore the idea that the visual signs we use have been selected, whatever the culture, to reflect common contours, landscapes and shapes in natural scenes

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that human brains have evolved to be good at seeing.

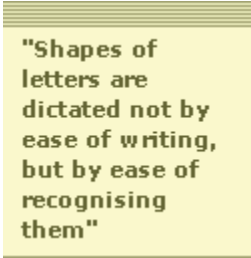
"Writing should look like nature, in a way," said Dr Changizi, explaining how similar reasoning has been used to explain the sounds, signs and colours that animals, insects and so on use to tell each other they are, for example, receptive to sex.

To be able to compare Cyrillic, Arabic or whatever, they turned to the mathematics of topology, which focuses on the way elements are connected together in a letter rather than overall shape, so that fonts do not matter and nor does handwriting, whether neat calligraphy or crudely written with a crayon grasped in a clenched fist.

For example, each time you see a T, geometrical features and frills such as serifs may differ according to the font or handwriting but the topology remains the same. By the same token, L, T, and X represent the three topologically distinct configurations that can be built with exactly two segments. And, to a topological mind, an L is the same as a V. In this way, the team could classify different configurations of strokes, or segments, to boil an alphabet of alphabets down to their essentials.

Across 115 writing systems to emerge over human history, varying in number of characters from about 10 to 200, the average number of strokes per character is approximately three and does not appear to vary as a function of writing system size. Sticking to letters that can be drawn with three strokes or fewer, the team found that about 36 distinct characters is the universe of letters in a theoretical alphabet.

Remarkably, the study revealed regularities in the distribution of (topological) shapes across approximately 100 phonemic (non-logographic) writing systems, where characters stand for sounds, and across symbols. "Whether you use Chinese or physics symbols, the shapes that are common in one are common in the others," said Dr Changizi.



"Shapes of letters are dictated not by ease of writing, but by ease of recognising them"

For comparison, the team studied the shapes found in the real world, such as the Y shapes seen at the corner of a cube, or the simpler L and T shapes found in the branches of trees, yurts, huts, tepees and simple dwellings and so on.

They analysed the frequency of the shapes in 27 photographs of savannas and tribal life, 40 miscellaneous photographs of rural and small-town life and 40 computer-generated images of buildings. Much to their surprise, whether analysing the shapes in an urban landscape, or those in a leafy wilderness, they had very similar distributions of configurations and shapes.

Most striking of all, the team found a high correlation between the most common contour combinations found in nature and the most common contours found in letters and symbols across cultures. For example, contours resembling an "L" or "X" are more common in both human visual signs and natural scenes than anything resembling an asterisk (*).

When the popularity of each shape was plotted, a wiggly curve emerged that closely matched that of the popularity of the forms and architectures found in nature: the most common letter shapes mirrored common real-world shapes.

As a check that they had found something truly significant, they looked at the distribution of shapes found in trademark symbols. Once again, they follow the same plot, again suggesting that it is looks that matter, as one would expect for a logo, not ease of writing. The idealised flower used by

BP may be hard to write but is easy to recognise because it mirrors a natural shape.

For comparison, they applied the same analysis to the shapes found in the scribbles of children and six kinds of shorthand, where it is ease of writing that is paramount. Now the distribution of shapes is not the same as found in nature. The easiest shapes to scribble are not the most common. Thus, the reason the letters of the alphabet are shaped as they are is to be in harmony with the mental machinery we have evolved to analyse the patterns of the natural world, not for ease of writing, said Dr Changizi.

"Vertebrates have evolved for tens of millions of years with their visual systems having to be good at recognising the configurations that are common out there in nature," he said. "We don't have really good mechanisms for recognising shapes that don't often occur in nature." As a result, letters and symbols based on rare natural shapes are themselves rarities.

Given how the distribution of features in our world is so similar, whether from an urban or a rural environment, the team would not expect writing systems that evolved among peoples who lived in desert regions to differ much from those of tribes in tropical rainforests. Nor does he expect keyboards to have much impact: "Despite the growth in the number of fonts, almost none of which is written by hand any more, they appear to possess the same shapes as they always did."

There is a cosmic dimension to this study. Dr Changizi speculates that if there is intelligent alien life in the universe, then so long as these creatures live, like us, among "macroscopic opaque objects strewn about", they will evolve writing symbols like our own. Alphabets on a planet orbiting another sun will, if materials, light and shade are similar to our own world, have features in common with those used on Earth: if ET writes home, we may think there is something familiar about his handwriting.

Not long to go...

The closing date of the 2006 Science Writer Awards for people between 16 and 28 is only days away. The judges, who include Roger Highfield, Sir David Attenborough, Bill Bryson and Adam Hart-Davies, are looking for a 700-word article on science, engineering and technology suitable for publication in this page. Thanks to the backing of Bayer, about £7,000 worth of prizes are on offer, including £500 to the school that submits the best entries. For details, consult www.science-writer.co.uk, ring the helpline 0845 634 6349 or e-mail sciencewriter@mamdal.co.uk Closing date: April 30.

The Cheltenham Science Festival will hold a session on writing science on June 8. For details of this and other events during the festival, from June 7-11, see www.cheltenhamfestivals.com or ring 01242 227979.

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