How grue is your valley?

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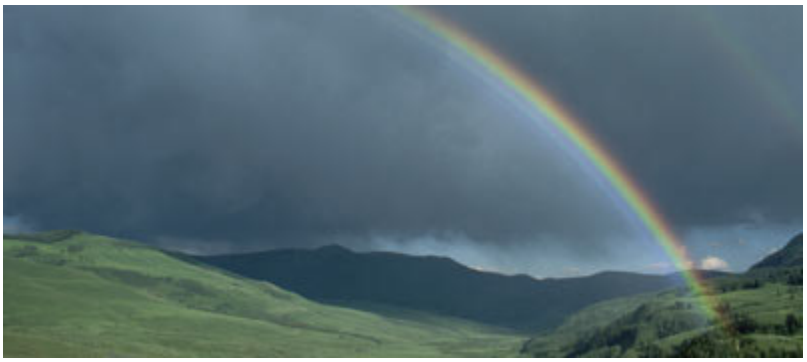
Psychologists are learning more about how colour builds language and language builds colour



LANGUAGES divide the spectrum up in different ways. Welsh speakers use “gwyrdd” (pronounced “goo-irrrth”) as a general word for green. Yet “grass” literally translates as “blue straw”. That is because the Welsh word for blue (“glas”) can accommodate all shades of green. English-speaking anthropologists affectionately squish “green” and “blue” together to call Welsh an example of a “grue” language. A few of them think grue languages are spoken by societies that live up mountains or near the equator because ultraviolet radiation, which is stronger in such places, causes a progressive yellowing of the lens. This, the theory goes, makes the eye less sensitive to short wavelengths (those that correspond to the green and blue parts of the spectrum). Unfortunately, though the Welsh do live in a hilly country, it is hardly mountainous enough—let alone sunny enough—to qualify.

The ultraviolet theory, however, is just one idea among many in the debate about the psychology of colour. Like many debates in psychology, this one pits congenital, fundamentally genetic, explanations against explanations that rely on environmental determinism. Psychologists in the former camp think people are born with ingrained ideas about how hues are grouped. They believe the brain is preconditioned to pick out the six colours on a Rubik's cube whatever tongue it is taught to think in. The other camp, by contrast, thinks that the spectrum can be chopped into categories anywhere along its length. Moreover, they suspect that the language an individual learns from his parents is the main explanation for where that chopping takes place.

As with most nature-versus-nurture debates, compromise seems in order. Two papers published in the *Proceedings of the National Academy of Sciences* suggest where the middle ground lies.

Colourful thoughts
In the more recent of the two, which appeared this week, Terry Regier, of the University of Chicago, and his colleagues, picked at the question of preconditioned language categories. They used a grid displaying all possible hues rolled into a globe, with black at the north pole and white at the south. In

this model, colours stick out from the sphere according to how sensitive the visual system is to them. Bright yellow, for instance, is easily noticed against a background of other colours, so the yellow part of the sphere bulges. Overall, the knobbly globe has exaggerated, smooth mountains with valleys in between.

If humans really are hardwired to home in on six focal colours, then all languages should assign words around those six. Dr Regier, however, tests a subtler concept. He thinks that useful languages should allot words in order to minimise the perceptual difference between colours of the same category, and maximise it between colours in different categories. Unlike national boundaries, linguistic boundaries should form only in the valleys of his colour globe, never over the hills.

Dr Regier therefore programmed his computer to find the best valley borders according to whether he told it to create three, four, five or six “countries” on the globe. Then, to judge whether people build languages around what their brains are best attuned to, he compared these theoretically best divisions with real-world dividing lines.

Since 1976, Paul Kay of the University of California, Berkeley, another of the paper's authors, has compiled a database of information about how 110 different languages assign colour adjectives to 330 different hues. When this database was compared with the theoretical optima, nature appeared important. The model closely fits some languages and points correctly to some details. For instance, three-colour language systems, which lump red and yellow together, generally exclude whitish yellow from that category—as does the model. But the results also explain where nurture gets its wiggle room. Real lexical boundaries tend to vary where Dr Regier's algorithm produced several options that were almost as good as each other.

In the second paper, published last week, Dr Regier and Dr Kay joined forces with Vicky Drivonikou, of the University of Surrey, in England, to address another way of investigating the question. This relies on the fact that brains have two hemispheres, but most language-processing is done in only one of them.

For reasons that lie deep in the evolutionary history of the vertebrates, the right hemisphere deals with sensory input from the left-hand side of the body, and vice versa. It is the left hemisphere, though, that deals with language—at least, it does in right-handed people. If language does affect colour-perception, then it is more likely to affect perceptions from the right visual field than the left.

In the first phase of the study, the researchers showed that their volunteers (Surrey university students) were slower to notice a target shade of blue when it flashed up against a blue background of a different hue than when it flashed up against a green background. Either nature or nurture (in a non-grue language) might explain that observation. But the researchers went further by presenting the test separately to the left and right visual fields of their volunteers. They found that they got the effect whichever visual field they presented the test to, but it was stronger when the presentation was to the right one (ie, to the left-hand, language-processing side of the brain), than to the left one.

That suggests both sides are correct. There is a fundamental—presumably congenital—distinction, as shown by the fact that the non-linguistic side of the brain distinguishes between blue and green. But there is also a language-mediated one, as shown by the linguistic side's greater response. The true test would be to do the experiment again—in Aberystwyth.