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A PICTURE IS WORTH A THOUSAND WORDS

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Martin Gardner in his article 'Is Nature Ambidextrous?' [1] discusses the difficulty of explaining 'right' and 'left' to extraterrestrial creatures - assumed for simplicity's sake to be English-speaking humans 'exactly like us' - over a radio link. It's not too hard to explain the *difference* between right and left (mirror-images, stereoisomers, etc) but it's much harder to explain which is which, which is right and which is left. Because the fundamental laws of nature are completely 'ambidextrous,' he argues, there turns out to be simply no way we can do this.

(A few years later Lee and Yang won the Nobel Prize for showing that the laws of nature aren't completely ambidextrous after all, though in a very subtle and abstruse respect. This came as an enormous surprise not only to Gardner but to the whole scientific community, and Gardner wrote a whole book about the subject. [2])

Neither Gardner nor any of the other authors he mentions, so far as I know, seem to have realised that the difficulty in explaining 'handedness' is firmly rooted in the nature of the communication medium - a radio signal. If we could send a postcard to the planet Faroffia there would be no problem. Just draw three arrows at right angles to each other, labelled 'top,' 'left,' and 'right,' and the thing is done.

Unfortunately the postcard must be sent by 'snail mail'; faxing it or sending a TV image won't do. The Faroffians might use fax machines and TVs which draw their pictures starting in the top right-hand corner, not as we do in the top left-hand corner. Then their image of the postcard would come out reversed.

Alternatively, if the Faroffians have extremely powerful telescopes, we could send them by radio a map of the Earth (or of our galaxy) marked to show which is left and which is right, and tell them to look at our planet through their telescopes and compare it with the map.

Statues and models are three-dimensional, pictures (including postcards, images seen through a telescope, photographs taken with a camera, and diagrams) are two-dimensional, all other forms of communication are one-dimensional. A perspective drawing maps three dimensions into two, and various dodges which one can lump together as 'scanning' map two dimensions into one - or even three dimensions into one. But something is lost in the mapping: handedness in the case of one-dimensional scanning. Think also of the well-known optical illusion produced by drawing a cube with the perspectival 'vanishing point' at infinity. If you look at it long enough you see it jump back and forward into apparent reversals of its orientation. M C Escher exploits this effect in some of his etchings. You can't do it with a real, three-dimensional cube; it's a result of the mapping into two dimensions.

Computer programs are also one-dimensional, at least the 'conventional' kind which run on IBM PCs. The program is a string of instructions which the computer carries out one at a time, at enormous speed. The 'line' of the program is not a 'straight' one, it invariably contains many loops and jumps to another place in the string of instructions, but it's still one-dimensional. A

piece of thread is one-dimensional in this way, however knotted and tangled the thread becomes. Programs can 'paint' two-dimensional pictures on the screen of the computer, and these of course have a handedness, but the handedness is in the hardware, not in the program. If you built a computer of the Faroffian type, scanning the screen from right to left, the same program would paint the pictures in reverse.

(Writers of Semitic languages would very much like to have a switch on their computers which would 'turn it round' like this. Then they could use a word processor to write Arabic or Hebrew from right to left, which is very difficult indeed with Earthly computers.)

Our minds are rather like computer programs in some ways, and our main channel of communication with each other, language, is one-dimensional like a radio signal: it's one damned word after another. No one can talk with two voices at the same time, or sing quartets all by themselves (though I believe some people can whistle and hum tunes at the same time, allowing them to produce a two-part harmony). This is a limitation of our vocal organs, not of our brains. Many people have learned to play counterpoint music on the piano, like Bach partitas or fugues, fingering three or four or more different melodies going on at the same time, and (with a little practice) we can hear all the tunes separately, as well as enjoying the harmony they make together. To listen to two people talking at the same time (or to read two books at the same time) is much more difficult, though it can be done. Language on the whole is a one-track one-dimensional medium of communication. It gives a new meaning to the phrase 'a line of talk.'

But even contrapuntal music is bilinear or multilinear communication, not two-dimensional; even a hundred-piece symphony orchestra can be recorded on tape or transmitted by radio, strictly one-dimensional media. (But think about stereo and quadraphonic sound systems!)

When we are thinking in language, as many people do most of the time, our thoughts are similarly one-dimensional, and our brains may well be acting rather like computers - possibly with bilinear or multilinear programming, which ordinary computers can't do. ('Supercomputers' do already operate with multilinear programming; and experimental 'neural network' computers have been built which are not linear in their programming at all. But these latter are still, as I understand it, at the Frankenstein's monster stage, minds with a bolt through their neck.)

But there are several reasons for believing that our minds can operate in two or even three dimensions, perhaps not quite so effectively: that when we look at a drawing or a model, or visualize it in our imagination, our minds are not like computers at all, scanning them or painting the screen along a one-dimensional channel, but can actually operate with two- or three-dimensional 'gestalts' (a term of psychology, German for 'shapes') taken as wholes.

1. How would you explain optical illusions like the drawing of the cube in terms of one-dimensional scanning?

2. When you see or imagine a smiling or scowling face, you see it all at once, you don't inventory it: 'eyes? hmm,' 'mouth? hmm,' 'forehead? hmm,' and so on. It's true that our eyes, though they're a bit like cameras, only make a sharp image in quite a small part of the centre of the visual field; all the rest is fuzzy and out of focus ('peripheral vision'). (The 'clear spot' is about the size of the yolk of a fried egg on the table in front of you, as you can check any time at breakfast.) So actually when we see a face we must be scanning it to some extent; nevertheless, two- or three-dimensional gestalts are formed in our minds from this visual scan.

3. Not all our communication is one-dimensional language. We very often supplement it with three-dimensional gestures. Can you describe a spiral staircase without using your hands?

Our three-dimensional gestalts are much less assured than our two-dimensional ones. Three-dimensional geometry and calculus really demand diagrams, much more than two-dimensional. Imagine a cube. How many corners has it? OK, that's an easy one. How many long diagonals has it, ones that go through the centre of the cube? Are they at right angles to each other? Not so easy. Now imagine sawing it in two pieces. Is there a way of doing this so that the exposed faces have *five* sides and five angles? Diagrams are not allowed! (There is a way, but it's not easy to visualize; and personally I can hardly visualize it at

all without muttering a commentary to myself in words.)

Even two-dimensional gestalts are insecure compared with one-dimensional thinking, as is shown by the existence of optical illusions; there's nothing quite corresponding to them in verbal thinking.

But computers can't really do this *at all*. They can simulate it of course, computers can simulate almost anything. But I don't believe anyone has yet managed to program a computer to recognise faces - not several hundred different known faces, equally instantly whether they're laughing, frowning, sneezing, etc, which all of us do every day without thinking about it. And the computer simulation depends on a one-dimensional program and a one-dimensional data store; it's impossible to believe that our minds do. Somehow they must be able to store pictures and three-dimensional models as such. Anyone who can think of a way to program a computer to do this will get richer than Bill Gates. (Perhaps something analogous to stereo sound recording would do the trick?)

Reading and writing are interesting, and a little confusing. A written text is one-dimensional, like speech: one damned word after another. But it consists of letters and words, and the letters at least are two-dimensional gestalts. When we've learned to read fluently, it's fairly obvious that we read whole words as gestalts, at least to a certain extent; but also that we take only a general view of them, and often guess at the details. My son was once driving on a country road, thinking about something else, when he saw a sign outside a house which he read as 'Boarding Kennels and Cannery.' He just had time for a second look, and of course it was 'Cattery.' There ought to be a name for this kind of misreading (like 'spoonerism') because it's not at all unusual. I think it shows that rapid reading includes quite a lot of guessing, or at least jumping to conclusions.

I have always been interested in languages and perhaps especially in alphabets; I can 'word read' in the Greek, Russian, and Hebrew alphabets as well as in our own. I mean by this that (even though I don't know any of these languages very well) when I see a text in any of them I can read a whole word at once, without having to spell it out letter by letter. And of course anyone can do this in any language which uses our Latin alphabet, even if you don't know the language at all - Finnish, for example. It helps if you have some notion of how the language is pronounced.

I know the Arabic alphabet, but I've never got up to 'word reading,' I'm still at the stage of 'letter reading.' The transition seems to come about quite quickly, after you've been puzzling over texts for a few weeks. It's not easy to understand: obviously you don't have word gestalts stored in your mind for completely unknown languages like Finnish, so what exactly has happened to your mind when you move from letter reading to word reading?

Chinese characters, which are also used for writing Japanese and Korean (the Japanese call them Kanji) are different from alphabetic letters in many ways. There are far more of them (maybe 30,000 in a big dictionary, though very few people will actually be able to recognise that many), and although many of them are quite simple - written with say six strokes of the brush or less - some are very complicated indeed. There are 214 'radicals,' one of which must be used as an element in each more complicated Kanji. The 214th radical, the 'flute' radical, is written with 17 strokes, and a few of the compound Kanji are written with 22 strokes. (In the Latin alphabet only E and W need as many as four strokes.)

But Kanji differ from letters in a more fundamental way: each of them has a meaning as well as a pronunciation. 'Kanji' is written with two Kanji, one for 'kan' meaning China and the second for 'ji' meaning 'character.' Some words can be written with a single Kanji, but many use two or more.

Literate Chinese, Japanese and Koreans, amazingly, can word read in Kanji, and because they spell the meaning not the pronunciation it doesn't matter too much whether the language they were written in was originally Chinese, Japanese or Korean. Chinese films are often made with Kanji subtitles, because the dialects or languages of different parts of China are mutually incomprehensible; they're often shown in Japan with the original subtitles, and most of the audience can follow them, more or less.

I believe it's true that Kanji readers actually use the right side of their brains for reading, unlike us alphabetic readers who use the left. This isn't genetic or 'racial,' it's just the nature of the script. Whether it's because there's more storage space on the right side of the brain, or because it's more concerned with pictorial, 'synthetic' thinking than with literal, 'analytic' thinking, I don't think anyone knows.

Would a two-dimensional communication channel be more efficient than our one-dimensional language? It's a little difficult to

pin this question down. A printed page is a two-dimensional communication, in a sense, and indeed each letter of the print is a two-dimensional gestalt. But it isn't a two-dimensional communication in the way that a diagram, a portrait or a landscape painting is; it's intended to be read sequentially, from left to right and top to bottom (unless it's in Arabic or Chinese), and mapped into a one-dimensional string of words and sounds. (And signing language, what the politically incorrect call deaf-and-dumb language, uses *three-dimensional* 'letters' or 'words,' but the communication is similarly sequential and one-dimensional.)

Suppose for a moment that the Faroffians, though like us in most respects, have a visual display unit on their chests, of biological materials and operated directly by their minds like our vocal chords, and that they converse by showing pictures. What sort of pictures could they be? The fundamental use of language, as I've argued elsewhere, is for chat:

'Hallo, Mr Brown, haven't seen you for months. How are you keeping?'

'Nicely, thank you, Mavis. And you? Goodness, how your little girl has grown! How old are you now, sweetheart?'

This sort of thing, though not important in itself, is of great theoretical importance because it's 'ordinary language,' as the logicians say. We aren't inclined to call anything 'a language' unless it can be used for chat of this kind. Notice that the sample contains as many questions and exclamations as informative 'statements'; this is typical of chat.

The Faroffians might have established conventions for questions and exclamations, perhaps showing the picture upside-down for a question and reversing it rhythmically to its mirror image and back for exclamations. But it's still not clear what their pictures, to carry on a conversation of this kind, could be like; and *whatever* form they take, I can't avoid the conclusion that conversation at least, if not the individual pictures, must be more or less sequential - and so one-dimensional, much as the printed page is one-dimensional though its individual symbols are two-dimensional.

Do they show one picture for each complete speech? If so, how could you picture a speech like

All the world's a stage,

And all the men and women merely players;

They have their exits and their entrances;

And one man in his time plays many parts,

His acts being seven ages.

First the infant, mewling and puking in his nurse's arms, etc.[3]

Perhaps it would be like a comic strip, with a *sequence* of smaller pictures arranged on the screen in some conventional way. But even a comic strip is a one-dimensional communication channel like print, except that its two-dimensional elements are much more elaborate.

Or perhaps they show one picture for each sentence, or phrase; then the display would be like a silent film. Whatever mode they use, their communication is *sequential* - unlike a portrait or landscape painting - and my tentative conclusion is that one-dimensional speech, for chat and chat-like communication, is a more efficient medium than pictures. Every picture tells a story, they say; but you can't chat with pictures alone.

Perhaps this is all rather superficial, but it seems to me that such a biological VDU might be a useful *aid* to communication, for showing diagrams and gestures, but can't seriously replace speech as the medium for the ordinary uses of language.

[1] (*Philosophy and Phenomenological Research*, December 1952, reprinted in *Order and Surprise*, OUP 1983.)

[2] *The Ambidextrous Universe,* Scribner's 1979.

[3] Shakespeare, *As You Like It,* Act II scene 7.