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EXTRA

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(Max van Kelegom has abandoned Verkeer-Zien on March 2nd 2018.)

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(Max van Kelegom heeft Verkeer-Zien op 2 maart 2018 in de steek gelaten.)

Babel or babble?

by Ruurd Groot (with help from Mieke Groot, Max van Kelegom and Jur Groot)

part one
Words about mind and brain, a dangerous confusion of tongues

Introduction

We talk about our behaviour, thoughts and feelings using everyday language. It works fine for just sharing our daily experience. Some use the same words for analysis and explanation, but that doesn't work so well. Still others prefer to draw from what they've gathered by browsing serious, perhaps obsolete articles and such. From that they distil their own, perhaps rather simplified ideas about the composition and functioning of our brain, to explain all and sundry. Scholars like psychologists, facing professionals from fields like engineering, may also conveniently choose such simple ideas and words. It doesn't seem to occur to them that those words and explanations may lead to mistaken insights in brain and behaviour – with corresponding results. And sometimes they fall into their own trap…

This first part tackles some aspects of this problem. The discussion is kept as compact as possible; figures and examples may help. For those who think it useful, more elaborate notes *(note 1 to note 8)* are added to expand on certain details. A small number of references *(reference a to reference i)* is included after the notes. Finally, sources for the three illustrations are given at the end.

Discussion

When sensing the world, an array of incoming information is filtered by a sensory apparatus *(note 1)* and then spreads out into the rest of the brain. The state of this brain is never static: the cerebral configuration at any moment might be described as a hustle and bustle of ever changing neural sensitivities or 'priorities' *(note 2)*. Different aspects of the input are distributed over many distinct cerebral regions, every one of which may be populated with cells of a more or less specialized nature. These 'aspects' should not be understood as completely divided or divisible into mutually exclusive 'categories' or 'properties', especially if we suppose that these 'categories' or 'properties' somehow exactly coincide with intuitive concepts like 'place' or 'roughness' etc. Nor should we think that the distribution can be represented by separate, more or less isolated channels or threads that are only recombined near the end of a perceptual rendering process. The situation is far more complex and dynamic than that.

Consider vision, as a case in point. First, a stream of electromagnetic signals enters the eye. Around 1950, James J. Gibson *(reference a)* labelled this stream the *optic array*, assuming that what happened next was a completely bottom-up process, like a sort of one-way traffic originating with the contents of this array. (A bit further on I'll show that there must be more to it.)

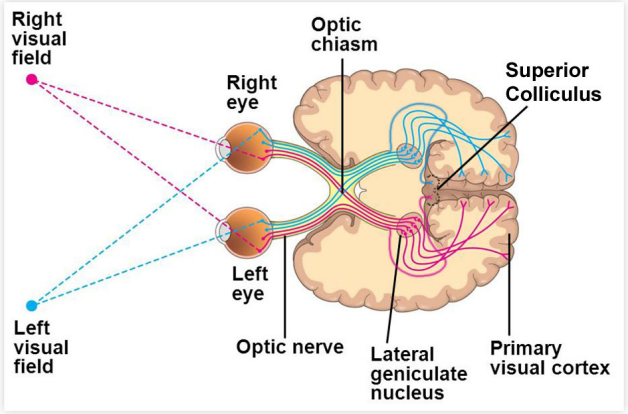

fig. 1-1 Principle of neural sorting at the optic chiasm

After entering the eyes, this array causes a profusion of activities of many different interacting neurons and networks in each of the two retinas. This again results in two neural broad band signal streams in the left and right branches of the optic nerve. Each neural stream consists of a torrent of signals, the coding format of which is still far removed from being understood. Then, converging and being split again in the optic chiasm *(note 3, fig. 1-1)*, the re-ordered signal streams start to reach many cerebral structures, like the lateral geniculate nuclei. From

these structures new signal streams branch off to other parts of the brain, while other signal streams returning from these parts or coming from different other parts in the brain may contact the original structures again, and so on and on and on *(note 4)*.

In the first sentence of this discussion I indicated that the initial incoming signal stream enters a pre-existing cerebral configuration. The information contained in this configuration effectively merges dynamically with the information of the incoming signal stream. Around 1975, Ulric Neisser *(reference b)* expressed this notion in his concept of the *perceptual cycle*, by which he emphasized that the incoming stream and the preexisting configuration interact in the perceptual process. In this process, top-down and bottom-up actions must be equally important. In this way, newly incoming information is met by a cerebral configuration that is re-adjusted by the previous stream, etc. At present, there is no way to describe all the intricacies involved.

One thing has become clear to us: there is no central sub organ conducting the orchestra of our brain. As the original input stream fans out in the brain arena, it dissolves in a jumble of feed-back and feed-forward connections, nowhere to end in a destination and never to pass a central court of judgement.

Of course, science already has some local, partial knowledge of what's happening in some places, but we have to accept the fact that insight into the whole of this complex and dynamic process is still non-existent. We seem to be incapable to attribute a definite 'meaning' to parts of the process, at least in the same natural terms and logic with which we are used to speak about the mental world. In fact, this seems to become more and more impossible. It is far from certain whether we'll ever have any simple understanding of how and where this seemingly anarchic brain activity results in what we think we mean by 'cognition', 'emotion', 'mind' or 'consciousness'.

We do have some negative insights, like there being no central court: certainly we are getting some ideas of what our brain *doesn't* do, how it *doesn't* work, what it can't *be*. Many intuitively developed ideas about the workings of the 'mind' and many of the intuitive concepts we use to discuss perception or thought, apparently do not have a clearly delineated counterpart in the organization or workings of the brain. Some specialized regions for instance are found to play a crucial part in the spatial ordering of one's surroundings. They contribute to our ability to track or imagine the position of things. Researchers of the hippocampus loosely talk about 'place cells'. But this 'place' function itself does not seem to be localized: other parts of the brain are also involved. Some apparently are crucial for the experience of direction, which to us is almost impossible to separate from position when we have the experience of 'place'. Weirder still, parts like this, involved in what to us seem very similar aspects, may differ in location, organization and evolutionary history *(note 5)*.

The moral is that we should be very wary indeed of identifying concepts from natural language (or traditional psychological theory *(note 6)*) about mind etc. with brain parts or functions. Still, we can't but suppose that the brain is where it all happens. And mental experience might be considered as something resulting from these happenings. It follows that the natural (or traditional psychological) concepts, however convenient they seem to be for talking about our mental experience *(note 7)*, will nonetheless mostly turn out to be very unsuitable for analyzing how perception and behaviour come about. Below I'll give two very different examples of how the words of natural language can muddle things up.

Example 1 of part one

My first example in this part of *Babel or babble?* is about a deep-rooted muddle: the use of the term 'image'. This word may have all kinds of meaning. Often we use it for a portrait or some other physical record or imitation of a scene or object. Another use is for an indirect rendering of such a record or its original: projections and such. These instances all refer to something *we can look at*.

The intended meaning may also be quite abstract: words and stories can 'paint an image'. In optics, the physics of light and lenses etc., one can speak about virtual images we still can look at, intangible phenomena that seem to hover in the air and can't be projected (the simplest way to produce them is with a diverging lens or a convex mirror).

In everyday context, the most basic meaning is a sort of physical 'copy' of a real object or scene, which can be used to produce a mental, visual experience – by 'looking' at it and then 'seeing' it. Trouble starts when we then also use the word for the mental experience itself, or its content. Of course, then we are speaking figuratively: the 'image' in our mind doesn't really fit any of the meanings mentioned above.

Still, this use – or rather abuse – of the word is ineradicable, as much in psychology as in the lofty circles of neuroscience and so on. Indeed, the lenses of our eyes project an *image* on our retina (which a tiny creature in our eyeball might look at – but we can't). Seems simple, but after that it's a stampede of informational activity all the way. How in heaven's name we get to enjoy the visual experience from this is a complete enigma – science has nothing to say about it. In fact, science can't shed any light on what we mean by consciousness at all. Science just hobbles on in natural language *(note 8)*. A while ago I read a very technical report which in its introduction said something like: "The image on the retina then is transmitted through the optic nerve to the rest of the brain, where it results in the image we see" *(fig. 1-2)*.

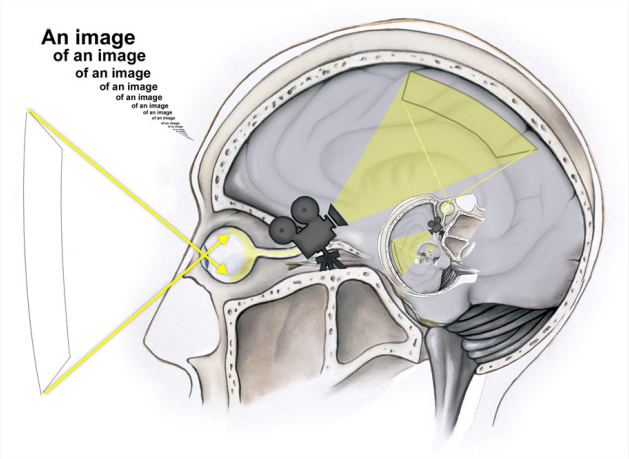

fig. 1-2 An image in your head will need another head to look at it, which'll need another head to look at it, etc. etc.

As long as we're aware of the fact that we're jumping from one clear meaning to another one that isn't clear at all, there's not much of a problem. But we've noticed that in traffic science and engineering a similar sloppiness with 'images' contributes to the sloppy way one deals with the visual: for instance mostly judging road designs from flat plans, instead of from large wide-angle picture views from a person's real point of view, or – at a 'higher' level, how the enigmatic nature of how seeing a scene comes about is simply ignored *(references d,e)*.

Example 2 of part one

A simpler, but socially deadlier tangle happens when using the word 'dangerous'. Here opposite meanings are mixed together with dire consequences for the victims. In traffic safety discussions trees along the road are blamed for being dangerous, as indeed it's not uncommon that some drunken driver may find their suicidal end by colliding with one. Consequently traffic theorists brand such trees – *not* the drivers – as too dangerous, and fit to be cut down. This, while in many cases trees along the road, provided they're not planted too close together or to the road, may well contribute to the perception of drivers and hence to safety.

A similar fate is befalling bicyclists in the Netherlands, though maybe not as terminal. Although the country is proud of its reputation as being an exemplary bicycle-friendly one, that often isn't much more than just that: a reputation. In modern traffic, with its density, high speeds and a dominance of massive vehicles, bicycling is indeed a risky business.

In daily parlance, 'risky' can be interchanged with 'dangerous', although object and subject – who does what to whom – are then silently interchanged as well. So the subconscious reasoning now goes: bicycling is risky and therefore dangerous, which apparently means that bicyclists are dangerous too.

So while at the one hand bicycling is applauded and there's incessant talk about promoting bicycling, at the same time bicycle crossings are suddenly closed, bicyclists have to make weird and considerable detours, are banned from traditional routes and have to follow spaghetti-like alternatives.

As a final blow, official traffic theorists recently proposed to take both farm tractors and bicyclists out of the traffic mix and confine them to a single common parallel road. In our country at least, these tractors are often equipped with special attachments of almost three meters wide. To make matters worse, these attachments often resemble a collection of murderous super knives. Certainly, they are supposed to go at a limited maximum speed, but they never do; their speed is generally more than three times the normal speed of a bicycle. Oh well, what do those cyclists expect? Serves them right for being so dangerous.

Of course, I don't mean to say that the experts and officials involved are so stupid that they don't see the difference between the two meanings of risky and dangerous. But the fact that in natural language these meanings are interchangeable does seem to contribute to the easy way the two sides are silently switched around. The difference isn't as conspicuous as it should be.

Concluding remarks for part one

This was all about what we can't do and shouldn't do, but what *can* we do? Surely neuroscience's findings must be very useful for the psychological side of things? The end of the Discussion part shows my belief: "We can't but suppose that the brain is where it all happens." Well, one thing we always can and should do is to use the insights gained from the 'physics' of the brain for eliminating from our theorizing anything that would be impossible neuronwise. But that's not very creative, it doesn't *lead* us anywhere.

There *is* another way, and it's very prominently available and practised. That is to use this knowledge for guiding our creative conjectures. But – and this is a very large BUT – this can only be done if we rely on well-accepted neuroscientific theory and – and this is an even larger AND – if we make sure to be sufficiently familiar with contemporary neuroscientific work and aware of the pitfalls of terminology and parlance.

A very important caution might be useful here. Mental phenomena are *real* on their own merits. Correlated physical phenomena are not needed to *make* them real, or *more* real. By the eagerness with which they are on the prowl for neuroscientific evidence, some psychologists can give people the impression that they're inclined to think that way. But we should just be very careful about how to describe mental phenomena. This *can* be done without either talking like a new age shaman, or talking like a mechanic.

Notes for part one

note 1 – The filtering by a sensory apparatus, as e.g. the eye, is itself heavily influenced by a) the historically determined neural/cerebral priorities/sensitivities *(note 2)* and by b) the physical condition of the particular sensory apparatus, which is adapted (normalized) to the range of preceding signal inputs.

note 2 – This refers to the concept of perceptual priorities *(reference f)*, which we introduced some thirty years ago. In every situation some possible perceptions (and actions based on them) will be more likely than others; in this context, it's customary to speak of the conspicuousness or salience of features. But this salience of features not only depends on their physical nature. Naturally, it's also determined by something like the prevailing setup of the brain. Perceptual priorities are just as much brought about by a combination of the quality of the present environment with the nature of our preceding or prior experiences, and of many other aspects. The resulting perceptual priority may be described as an enhanced sensitivity for certain incoming information and/or an enhanced proclivity for certain interpretations thereof.

note 3 – In the optic chiasm *(fig. 1-1)*, the optic nerve branches from the two eyes seem to cross. And indeed the branch from the left eye seems to go to the right half of the brain, and vice versa. *Actually*, at the very point where the branches seem to 'cross', only the nerve fibres originating from the left eye's retinal half adjacent to the nose, 'cross over' to the optic nerve branch that continues to the right half of the brain. Nerve fibres originating from the left eye's retinal half on the far side of the head continue on to the left half of the brain.

In their turn, only nerve fibres originating from the right eye's retinal half adjacent to the nose, 'cross over' to the optic nerve branch that continues to the left half of the brain. Nerve fibres originating from the right eye's retinal half on the far side continue on to the right half of the brain.

This way, signals from the *right half* of each retina are combined in the *rightmost branch*, and signals from the *left half* of each retina are combined in the *leftmost branch*. In each eye, the *left* side of the world is projected through the pupil and the lens to the *right* half of its retina. So signals from this *left* side of the world stay together, to be processed in the *right* half of the brain. Similarly, signals from the *right* side of the world stay together, to be processed in the *left* half of the brain. (And yes, this means that the left half of the brain occupies itself with the right half of the world, and vice versa. And that's not just the visual world. It also goes for our arms, our legs and everything.)

note 4 – What's really going on can't be described in simple terms, as this piece itself tries to explain. The complexity and dynamics involved should even prevent easy use of terms like 'connections'. Words like that might lead to an overly simple understanding. By 'connections' we normally mean things like a wire between points A and B, or (strangely enough) a point between wire 1 and wire 2. Such connections are passive. But in the brain barely anything is truly passive. We should even be wary of words like *switch* and *circuit*.

Such terms refer to electricity and electronics: transistors, diodes, capacitors, coils etc. When you switch off the computer, or when it goes into hibernation, such parts revert to default conditions. More: every part's condition at any moment can be defined in relation to some default condition. In the brain, *nothing* behaves like that! Just like the brain does not allow for a division into 'memory' and other hardware, or into data and code, as is the hallmark of present computer technology, we can't assign any clearly definable 'default conditions' to any part of our brain. After all, it's alive.

note 5 – In the functioning of the so-called place cells, apart from the hippocampus, a neighbouring structure called the entorhinal cortex with its *grid cells* is involved. But there are also things happening in the very different superior colliculus, which used to be seen as the main sub organ for 'place' and is still found to be much involved in 'direction'. In amphibians like frogs, which lack a modern cortex, this is considered to be the main visual brain structure. In humans, with their vast visual cortex and its specialized outlying districts, the superior colliculus still seems to be important for the directional aspect. In mice it was recently even found *(reference c)* to function like the most important brain part resulting in the ordering of the visual environment in terms of something like 'place'.

(Actually, 'visual' cortex is a bit of a misnomer – 'spatial' cortex might be a better name. In congenitally blind people, who have no – and never had any – visual input, this brain area is quite active with contributing to a spatially ordered sense of their surroundings. People loosing their sight in later life, adjust to this condition by having more and more activity in cortical parts normally found to be mainly involved with visual experience. And even with people who're not blind at all, some auditory information appears to be directly shunted to the lowest levels of the 'visual' cortex!)

note 6 – By traditional psychology I mean the type that historically derives its basic concepts and assumptions from natural language and literary sources. The problem is that such concepts and assumptions refer to the phenomenology of behaviour and the mental, and not necessarily to the hidden causes thereof. This is a common problem: concepts describing a resulting phenomenon are supposed to apply to its cause as well. This is seldom useful or even correct at all. It is as if some owner

of a sluggish automobile would open the bonnet (in American: the 'hood') of their car to look for the speed, to see whether there's any visible damage to it… (fig. 1-3)

Of course, this is something of a worst case scenario. Still, some modern psychologists may show a remnant of the old attitude, treating the technical jargon of neuroscience in rather the same offhand way as their predecessors used to do with the words from natural language. This isn't helped by the short-hand way the neuroscientists in their turn use psychological terms, for instance by saying things like "the amygdala is where emotion is located" or similar. And so: "Ah, there it is," says the innocent psychologist, who'd been wondering: "The emotion… Where'd that be?"

fig. 1-3 Quite a puzzle

note 7 – Our natural concepts aren't necessarily *wrong*. They are perfectly convenient for *describing* mental and behavioural phenomena in such a way, that we can convey and understand what's being talked about. But 'understanding' here only means *recognizing* the shared experience of a subjective phenomenon. This doesn't automatically make these terms appropriate for analyzing the mechanism underlying the phenomena involved.

Our language is a socially evolved system of symbols, with sounds, gestures etc. for giving and asking for directions and instructions, and for sharing our experiences. If we want to use it for analytical purposes or for communicating about insights from scientific research, it has to be expanded with technical terms that have a very specific and limited meaning. Sometimes we use originally 'natural' words for this purpose, often by first using them 'in a manner of speaking'. This is OK as long as we're aware of the new meaning of this now technical term, and don't confuse it with the original reference. More about this aspect in *Babel or babble?* part two.

note 8 – A similar predicament crops up when physicists have to talk about the fundamental aspects of quantum physics. The intractability of the problem how to understand the dual nature of fundamental particles – particle *and* wave – soon led to so much bickering that some physicist commented: "Shut up and calculate!" However, the quantum problem pales in comparison to the universal bewilderment that reigns when it comes to being clear about consciousness. The comparison between these two problems is not all that arbitrary, physicists like Erwin Schrödinger (1887 – 1961) already were of the opininion that the two problems are somehow related, and the number of physicists that have the same view has only grown. In fact, many modern physicists see the problem of consciousness as related not just to the very small as in particle physics, but also to the very big as in cosmology, and finally to the problem of how to tackle 'reality' *(references g and h)*. Publications like the *Journal of Cosmology* are a typical example. This is not to say that we'll find any answers there…

For our purposes, I imagine that more perspective may be offered by the direction explored in Vandenbroucke 2013 *(reference i)*, not just for the consciousness problem (which is often referred to as 'the hard problem'), but more practical also to the way we have to think about vision, especially about seeing a scene.

References in part one

(reference a) J. J. Gibson; The perception of the visual world, 1950
(reference b) Ulric Neisser; Cognition and Reality, 1976
(reference c) Evan H. Feinberg & Markus Meister; Orientation columns in the mouse superior colliculus; Nature, 2014
(reference d) Ruurd Groot and Max van Kelegom; Look who's driving – a learned investigation into the how of the model tableau in terms of driving; 2012
http://www.verkeerzien.nl/verhalen/Blij_Dat_Ik_Kijk.pdf
(reference e) Ruurd en Mieke Groot; Ruimtebesef en Modeltafereel, 2014
http://www.verkeerzien.nl/pub/download.php?file=Ruimtebesef%26Modeltafereel.pdf
(reference f) Max van Kelegom, Ruurd & Mieke Groot; Uitgangspunten van Natuurlijk Sturen *NS*, 2014
http://www.verkeerzien.nl/pub/download.php?file=UitgangspuntenNS.pdf
(reference g) http://www.starstuffs.com/physcon/science.html;
http://en.wikiquote.org/wiki/Erwin_Schr%C3%B6dinger
(reference h) Quantum Physics, Advanced Waves and Consciousness; Antonella Vannini e.a. 2011; Cosmological Foundations of Consciousness; Chris King 2011
(reference i) Annelinde R. E. Vandenbroucke; The quality of perception without attention; University of Amsterdam, 2013
http://dare.uva.nl/record/1/399396

Illustrations in part one

fig. 1-1 author's sketch, partially based on various sources
fig. 1-2 author's sketch, partially based on various sources
fig. 1-3

(A Dutch translation of this text is available as:
Babel of gebazel? deel een Woorden over geest en brein, een riskante spraakverwarring)

This text has been provisionally edited for rendering by Text to Speech software
Comments are welcome

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