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What and Where

If the visual manifestation of a chair occurs across the room, there remains the question of how production sites in the brain manage to create a chair and give it a spatial framework. There has to be something about the brain that determines what the object is and where it appears in the perceived space of the observer. When discussing location and identity in this chapter, I mean the location and identity of an object as determined by the production centers of the brain.

The Location Problem

If one looks at a horizontal stick that is red on one end and blue on the other, then as was pointed out in the last chapter, there will be a neurological site in the cortex that registers “red,” another site that registers “blue,” and still another that registers “horizontal stick.” We know that these three things are related to each other through a binding code, but the question is, “How will the *location* of this stick be represented by the brain? *Where* in the brain will the stick come together?” The manifestation site of a conscious experience must be associated one-to-one with a production site in the brain. But how is that location represented in the case of anchor experiences?

Is it possible that the production site of location is itself a location in the brain? If that were true, the question would be, “Is it at the site of the red neuron, the blue neuron, or the horizontal neuron?” Or maybe the stick’s location representation would be spread out over the brain in a way that covers all three sites. If that were the case, and if the conscious person becomes aware of another stick (e.g., a vertical one with yellow and green ends), then it would be represented by much of the same space in the brain. The two sticks would then overlap. It may be that their binding

codes can formally distinguish the two sticks from one another, but on the above premise the sticks would *not* appear in distinctly different places in the awareness of the subject, because their production sites would intersect one another.

Perhaps the conscious individual has internalized a three-dimensional space in the form of a separate neurological site for each point in the space, thereby forming the three-dimensional Cartesian theater that was discussed in the previous chapter. The red/blue stick would then be associated with the neurological site that corresponds to its location in space, and the yellow/green stick would be associated with another neurological site that corresponds to its location. As previously noted, there is a long history associated with this idea, and there has been a long and futile search for a place in the brain where that screening might occur [Dennett 1991 pp. 107–8, O'Regan 2001 sect. 8.2]. Neurologists have generally discarded the Cartesian theater, so we will give it no further attention.

I would like to propose another possibility. If an object's location in someone's brain is not determined by the location of activated neurological sites, then something else must determine it. I suggest that there are two mechanisms: One for anchor experiences, and another for non-anchor experiences.

Anchor Locations

I propose that there is *no genetically fixed* way of representing anchor locations in the brain because these locations are *learned*.

A newborn infant may have many vague and uncertain experiences during its initial encounter with the world, but pleasure and pain are no doubt immediate and unambiguous, affecting clear responses from the infant [Lipsitt 1984, Anand 1987]. These initial experiences and their responses are not learned but are genetically given. The infant has a *built-in* call-up code for pleasure and pain that responds to certain given stimuli. Other anchors, like fear and desire, are also genetically built in for a wide range of stimuli. However, older and more sophisticated individuals can also learn to use these neurological devices in ways that are psychologically or culturally determined. For example, the amygdala is genetically programmed to

produce fear in the infant in response to certain threatening stimuli, but this organ also alerts older children and adults to learned fears [LeDoux 1996]. It follows that particular anchor experiences can be genetically given, learned, or some combination of the two.

On the other hand, there is no clear built-in physiological mechanism for locating a pain or associating it with an abused part of the body. While anchor experiences may be crystal clear to the newborn, it is possible that the child does not know what to make of its location or its relationship to anything else. Organic sites for calling up pain are presumably in the nociceptive terminals of the parietal neocortex. Pain cannot otherwise be felt [Oshiro 2007]. But its location representation is not genetically determined. Instead we say that the *location of pain is learned* [Vesey 1967]. A newborn experiences pain from the start, but it takes time and many encounters with reality to connect it to body parts.

These pains may be associated with bumps and bruises on any part of the body. They may finally be identified with internal distresses in the stomach or the bowels. For older children and adults, psychological pain may also become associated with body parts such as the stomach or the chest. Much the same may be said of pleasurable experiences, like taste and touch, that can become identified with fingers and lips. These locations are not confined to the body, for emotions such as love or hate can become associated with other people or with iconic symbols. These are clearly learned affiliations. It is the claim here that *all* anchor experiences that acquire location do so through a learning process.

Non-anchor Locations

Sight and sound are non-anchor experiences. They are defined to be causally non-effective components of consciousness that only inform the viewer. I maintain that the spatial aspects of non-anchor experiences are determined by a property of the brain that allows it to generate gestalts. A *gestalt* is an interpretive construction. The meaning of this is demonstrated in the following for the case for vision.

The Necker Cube in Figure 5.1 can be seen in three different ways. The plane containing points a may appear to be in the foreground of the figure with the plane containing points b in the background. In the second way of looking at the cube, the b plane appears in the foreground with the a plane in the background.

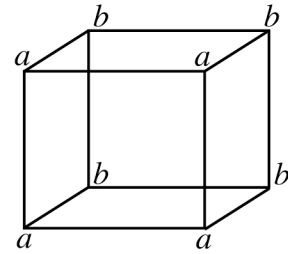


Figure 5.1: Necker Cube

And the third way sees all the points on one plane. So points a and b have three entirely different locations with respect to one another, depending on how the viewer understands the cube. However, the *same neurons are activated* in the primary visual cortex in all three cases, so the neuronal pattern in that part of the brain is not determinant. Also, the binding code of these eight points and twelve straight lines is no doubt *unchanged* by this perceptual transformation. The a plane nonetheless changes position with respect to the b plane, and brain plasticity has nothing to do with it. The differences among the three experiences have entirely to do with the way that the brain organizes this neuronal information in areas of the brain *beyond* the primary visual cortex. The picking out of a self-consistent pattern or gestalt is a switching process that is a characteristic of the brain that I will refer to as the *gestalt pattern recognition and choice* capability of the brain.

The brain somehow assembles all three of the possible Necker Cube gestalts and chooses one of them to appear in consciousness. With a little effort on the part of the viewer, another choice is subsequently possible. No doubt the brain makes use of all available visual data when making these choices, but it primarily makes choices that are based on a background of present or remembered anchor experiences involving feelings or emotions. Choices that seem to occur automatically may very well have begun in response to implicit or explicit motivations. After a time, they may seem to be programmatic. I reflexively choose the line ba in Figure 5.1 to coincide with the direction of the positive z axis in conventional three-dimensional Cartesian coordinates. Evidently, I was motivated in my student years to adopt a socially recommended habit that guided my present “spontaneous” choice of Necker Cube gestalts. So even when they seem automatic,

human gestalts are probably based on immediate, or remembered, or long-forgotten choices that involve anchor-based feelings or emotions. More controversial gestalts, like patterns of social or political thinking, surely have these attributes. In any case, the *process* of gestalt formation applied to vision is inborn. It is *not* a learning process. It is a genetic characteristic of our species, but its neurological basis is little understood.

Object Gestalts

If a person's primary visual cortex is intact, they will see well enough. However, other parts of the brain, such as areas in the occipital, parietal, and temporal lobes, also process visual input, and if these areas are damaged, the visual experience is incomplete. The person will still see things, but there is often a loss of knowledge that is referred to as *agnosia*. There is, for instance, *object agnosia*. The affected individual can see a common object, like a brown coat button, but cannot identify it. He may be able to identify it by touch, but although he sees the button his brain cannot process the visual input in a way that allows it to be recognized. His brain cannot organize these visual bits into a decipherable pattern, or *object gestalt*.

There is every reason to think that the binding code is working in these cases. That is, roundness and brownness and pin-holeness of the button are associated together by a synchronous code that makes them a single object of visual perception. But they are not associated together in a way that is identifiable until they are organized into an intelligible pattern. If the pattern recognition properties of the brain are missing or damaged, then the button cannot be seen as such. The object-identification processes of the brain are therefore handled by neural networks that are specialized to that task. The visual ingredients comprising the "chair across the room" are brought together by a binding code, but they do not become a "chair" until they have been identified as such by the appropriate gestalt-producing parts of the brain.

There is a disorder called *prosopagnosia* that refers to an inability to recognize faces. Again, the person may see all the separate parts of a face before

him, and these parts might share a synchronous binding that brings them together in consciousness. But if these parts are not organized into an identifiable pattern, then the face will not be decipherable. Victims of this disorder may even fail to recognize themselves in a mirror.

How these neural networks go about gestalt formation is one of the great mysteries of the brain. This is not a relatively easy computer task, like comparing one pattern with another (e.g., fingerprint comparisons). This is a matter of taking disorganized input and *creating* an organization that makes the whole *comprehensible*. That's some trick.

There are other affected modalities. A person whose somatosensory cortex is intact might have higher-order damage that results in *tactual object agnosia*. That person can see and identify a button as well as feel the button in his hand. But he cannot identify the button with his hand because he lacks the ability to form a tactual gestalt.

Location Gestalt

Pattern recognition plays a much wider role in ordinary perception than the recognition and identification of individual objects, for there is the matter of how these objects are related to each other in space. There is a pattern in that relationship – a *spatial pattern* that includes the space between each of these objects and the perceiver's own body. It is perhaps the most pervasive pattern of our lives in that it places every physical object we know into a vast spatial reference frame that assigns each a unique location. It's a giant gestalt. The question is, "What is the nature of this *location gestalt*?" Is it learned, starting from birth? Or is the gestalt itself genetically given?

My own take on this is that *object gestalts* are generated by neurological networks that are genetically given, but that the patterns that they generate are not themselves inherently determined. They are dependent on the sensory input that needs to be organized into a pattern of some kind. Similarly, the gestalt that establishes location is largely given at birth. The newborn has an innate spatial

orientation that may be primitive (i.e., it's a long way from adult spatial sophistication), but it is sufficient to give the child an initial sendoff into physical space. This means that the location gestalt is part genetic and part learned. It has a nascent form at birth that experience can further fashion.

If you look directly at a newborn and stick out your tongue, chances are he will stick out his tongue in response. This assumes that his face-recognition network works almost from the start. Gestalts are like that. They are not learning procedures. Switching gestalts in Figure 5.1 does not require learning in the usual sense, but only an efficient operation of one's pattern-recognition neurological network. The infant's network apparently works just fine. But in order to do so, the newborn must place your face in an unambiguous spatial relationship with his own window on the world. The child uses his innate spatial gestalt for that purpose. Many say that a newborn cannot distinguish between himself and the external world. I say that he *can*, but he generally *doesn't*, inasmuch as he has no immediate need to do so. At this early stage, the child only needs to separate your face from everything else so he can form a distinct and isolated facial gestalt in order to mimic your tongue behavior. It is true that this location and identification ability will grow in sophistication as the child matures, so learning does come into it over time, but a nascent sense of "what and where" is there from the beginning.

But where in the brain does location-gestalt formation take place? Where in the brain is this built-in gestalt located? The answer appears to be in Brodman's areas five and seven in the parietal cortex. The location gestalt covering the left side of the body is located in these areas of the right hemisphere, and the location gestalt covering the right side of the body is located in these areas of the left hemisphere. With damage to these areas in the right hemisphere, an individual loses awareness of the left side of his body and the left side of the world outside of his body. This is called *left contralateral neglect*. It is not only a matter of neglect, but of denial as well. Individuals with this disorder deny the existence of *all* objects on the left, whether their left arm or a building on the left. Spatial reality is limited to the right side of their body. *Evidently, areas five and seven house the production site of the innate location gestalt that produces the physical space around us.* This is not a Cartesian

theater. It is a production site rather than a manifestation site, and it isn't even the primary production site. Its function is only to organize the binding sites in a certain way.

Into Consciousness

The qualitative properties of an object, such as the "red" of a red hat, are separately produced in the neocortex. A binding code joins all these properties together with the neural network that gives them a clear interpretive identity (an object gestalt), and another network that gives them a place in space (location gestalt). However, the red hat's manifestation in consciousness will not be at any one of these places. According to our conclusions in Chapter 4, the red hat will become manifest in consciousness at a location that is somewhere outside of the body, where that place is determined by the brain's location gestalt.

Other Modalities

In addition to vision, other non-anchor modalities that perceive location have an associated spatial gestalt. Touch is one. The touch experience has both anchor and non-anchor components. We can experience both pleasure and pain through touch, and to that extent it is an anchor experience, but touch also has a non-anchor component that enables one to locate and identify an external object. As stated above, object identification engages a gestalt-forming neural network that allows one to recognize a button when handling a button, and its location in space involves the use of an innate *tactical spatial gestalt*. If tactical space were not innate, a newborn (or the mirror neurons of the newborn) would not be able to locate his tongue in order to stick it out. Vision and touch probably share the same spatial gestalt because victims of left contralateral neglect systematically deny both visual and tactile reality on the left side of their bodies.

Sound also has anchor and non-anchor components like touch. We locate things with sound, although not with the precision of touch. It is possible that the sound spatial gestalt is not innate; but rather, it can be chosen to suit the situation

like an object gestalt. The sound on television or in a movie theater seems to be coming from the lips of the players on the screen.

As a young boy, I wondered why. I imagined that there was a crew behind the screen in our movie theater that made this happen. With a script in one hand and a loud speaker in the other, they moved adroitly over a scaffold in such a way that the voice of Clark Gable came out exactly where his lips appeared on the screen. One Saturday afternoon after the matinee, I looked behind the screen and saw only three dusty speakers of different sizes, and one was much too large to carry. There was no scaffold and no sign of a crew. Just a dusty space! I struggled with this problem for some time until I realized that *I was the one* who put the sound of Clark Gable's voice at the position of his lips on the screen. I chose a sound location gestalt that was consistent with my visual location gestalt, and I did so with ease. This would not be possible if my ability to locate sound was tied to a rigid innate scaffolding of my own. Of course other creatures, like bats, might have innate sound location capabilities. Sound is a primary location modality for bats in the way that vision and touch is primary for us. It is therefore likely that a bat's sound location gestalt is innate.

And finally there is smell. It too has anchor and non-anchor components like touch and sound. We locate things with smell, but again we do so without a great deal of precision. Smell is not a primary location device in humans so it is probably not innate; it probably follows visual and tactual clues when they are available. Dogs and other animals have perfected olfactory spatial location to a high degree, so for them smell is probably tied to an innate location gestalt.

Conclusion

The production sites of anchor experiences may occur in different parts of the body, but they feed into organic call-up sites that I presume are located in the neocortex. The resulting conscious experience manifests itself in different parts of the body that have no necessary relationship to the production or the call-up sites.

Learning determines the somatic as well as external locations of these anchor manifestations.

The call-up sites for non-anchor experience like sight and sound are also located in the neocortex, but their manifestations are generally outside the body at locations determined by gestalt forming production sites in the brain.

These experiences rely on object gestalts for the purpose of identification. The object's sensory inputs may be associated together with a binding code, but they do not make an intelligible whole until they have been organized into an identifiable pattern. That happens in neural networks of the brain that are specialized for this purpose. This object gestalt capability of the brain is innate, but particular gestalts are fashioned in the moment.

The production site for an object's location in space requires a separate spatial gestalt that is genetically given at birth, although it can be modified and expanded through experience. Both the location gestalt capacity of the brain and the three-dimensional form of each gestalt are innately given.