# SURFISM

The fluid foundation of consciousness

Dan Webber

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## The fluid foundation of consciousness

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# Metaphor

Many scientific discoveries have been inspired by metaphors.[1] They feature prominently in religion. Metaphors are also commonplace in ordinary language, such as when you 'grasp' an idea. We are so used to metaphors, they can be difficult to discern, as in the case of time 'passing'. Drawing analogies could be the most basic form of cognition. As a result, they have a profound influence on how we view reality. We might, for example, see God as an entity, not only separated from us, but mirroring our own consciousness, even taking the form of a man. He might be old and wise, or in the case of Jesus, young and perfect. The Holy Trinity personifies God as both Father and Son, with the Holy Ghost alluding to something else, beyond comprehension. For some, this formulation strains credulity. But, philosophers have also examined the relational character of the trinity. So, we should probably keep an open mind.

This essay draws a radical connection between surfing and the perception of spatial relations, to show how the mind becomes trapped within its own frames of reference. This predicament has been likened to an artist who is so focused on applying paint to a canvas that he neglects the overall composition.[2] Self-mastery has been likened to riding a horse[3]; such as Freud's description of the psyche, in which the ego is "like a man on horseback, who has to hold in check the superior strength of the horse", which represents the id.[4] A parallel can be drawn here between riding a horse and riding a wave, since both convey the raw power of nature. Similarly, the artist's paintbrush can be likened to a surfboard, since both engage a surface in the act of self-expression.

# Articulation

The interaction of surfboard, wave and seabed provides a dynamic framework for modeling how the mind operates. For example, we can imagine language riding the mind like a surfer riding a wave. According to this analogy, the act of surfing represents linguistic expression, with the shape of the wave representing the range of meanings that can be expressed.

Characterising the various sounds that form speech, the penetration and release phases in surfing are analogous to obstruents and sonorants. Obstruents are produced by obstructing the airflow against a range of articulation points within the vocal tract, e.g. p-, t-, k-, b- & g-. By contrast, sonorants are produced without obstructing airflow through the vocal tract, e.g. l-, m-, n-, y- & w-. Since obstruents and sonorants alternate like the penetration and release phases of surfing, speech is analogous to the surfer's repertoire of manoeuvres, with each angle of resistance corresponding to a particular sound.

Numerous sounds remind us of shapes. This is classically demonstrated by the Kiki and Bouba experiment.[5] In this experiment, a drawing of two aliens is presented (see fig.1). The subject is asked to identify which alien is Kiki and which is Bouba.

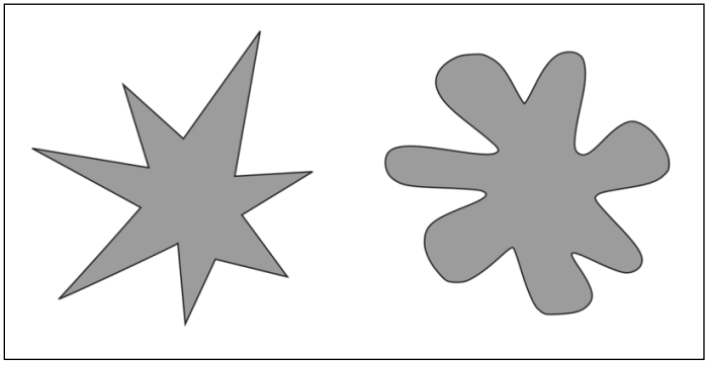

Figure 1. Kiki & Bouba.

The vast majority of respondents identify Kiki as the pointy shaped alien and Bouba as the rounded one—indicating that our perception of sound and shape overlaps. This form of cross modal perception is analogous to the surfboard designer's ability to associate the shape of a surfboard with its response during surfing manoeuvres. The sound of the word "kiki" is more closely associated with sudden changes in direction, as depicted by the drawing of a spiky figure. By contrast, the sound of the word "bouba" is more closely associated with long, drawn out turns, as depicted by the drawing of a curvaceous figure.

The stimulation in one modality that triggers sensations in another is called synaesthesia. For example, a synaesthete may consistently experience a specific colour when hearing a particular tone or looking at a certain numeral. Mild forms of synaesthesia permeate consciousness, as revealed by the sounds Kiki and Bouba, which invoke an association with shape. Colours are also mixed with sounds, as indicated by the polysemous word "tone", with low pitch sounds linked to dark colours and high pitch with light colours.[6] Dance could be regarded as a form of synaesthesia, in this case sensory-to-motor, where the rhythm of physical movement mimics the auditory rhythm.[7] Even the design skills of a surfboard shaper could be regarded as sensing a synaesthetic link, in this case, between surfing manoeuvres and the shape of the surfboard.

As a form of motor-to-sensory synaesthesia, the surfboard shaper's skill is probably underpinned by mirror-neurons; so-named because they fire in response to movements that share a common trajectory,[8] whether performed by you or someone else. Mirror neurons are believed to be implicated in learning to speak. They facilitate the transfer of skills, e.g. from parent to child, by coding movements in terms of their purpose. As a result, the mind learns how to deal with objects through their use, which is fundamentally different to their spatial presence, since the use of an object extends the self beyond its physical limits.

To design a surfboard as an extension of the self, the surfboard shaper has to decipher surfing manoeuvres in terms of spatial and

temporal relations. The various axes of penetration and release represent the set of alternatives from which manoeuvres are composed, just as the letters of an alphabet are combined to form words. The similarity between the movements of surfing and the movements of speech is evident in passages that employ onomatopoeia, where the sound of a word, or group of words, seems to characterise its meaning. For example, the following passage demonstrates the perceptual overlapping of sound and movement:

> True ease in writing comes from art, not chance,
> As those move easiest who have learned to dance,
> 'Tis not enough no harshness gives offense,
> The sound must seem an echo to the sense.
> Soft is the strain when Zephyr gently blows,
> And the smooth stream in smoother numbers flows,
> But when loud surges lash the sounding shore,
> The hoarse, rough verse should like the torrent roar,
> When Ajax strives some rock's vast weight to throw,
> The line too labors, and the words move slow;
> Not so, when swift Camilla scours the plain,
> Flies o'er the unbending corn, and skims along the main.
>
> Alexander Pope (1711)

The sense of movement invoked by onomatopoeia is analogous to the perceptual overlapping required to design a surfboard. Firstly, the set of speech sounds is analogous to the set of curves present in a surfboard. Secondly, the sense of movement induced by the speech sounds is analogous to manoeuvring the surfboard. In both language and surfing, the (temporal) sequence connects the components that are (spatially) separated from alternatives. Just as the components of language are assembled to generate speech sounds in the vocal tract, the components of surfboard design are assembled to generate manoeuvres on a wave. Moreover, the meaning of the poem is analogous to the order of execution, since this displays the surfer's understanding of the wave, which is

analogous to our understanding of context.

## Syntax

Of course, reality can be experienced and represented in various modalities. But, there is always a tension between spatial and temporal relations.[9] This tension can be revealed by distorting the spatial and temporal relations, so that the perceptual structures become increasingly nonsensical. Consider, for example:

(1) Colourless green ideas sleep furiously.

This sentence is as nonsensical as a visual scene of a distant object appearing to be supported by a near object—such as the tiny man standing on an outstretched hand in figure 2.

Figure 2. A distant object appearing to be connected to a near object.

Although the objects are suitably positioned to produce the illusion, we know that tiny men do not exist, just as "Colourless green ideas sleep furiously" does not make sense. The gap in

space between these objects corresponds to the gap in meaning between these words. Although they appear together, they do not belong together. The failure to choose suitable words in language corresponds to the failure to perceive depth in space.

At the other end of the spatio-temporal continuum, sentences are composed of words that are semantically connected, but poorly arranged. For example:

(2) Dogs harmlessly young bark friendly.

This sentence could be likened to a portrait that repositions facial features in bizarre, yet still face-like assemblages, such as in figure 3. The elements seem to belong together, to the extent that they are semantically related. But, their order is distorted.

Since (1) lacks spatial integrity and (2) lacks temporal integrity, they each sit at opposite ends of the continuum. Of course, spatial and temporal relations are usually deployed to produce sensible utterances, by interacting to varying degrees, as per the notion of a continuum. The purpose of distorting them is to highlight the variables that serve to situate the mind within language.

Figure 3. The temporal distortion of facial features.

The distortion of spatial relations, depicted by the miniature person illusion, demonstrates how contexts bind to objects. The distant figure is drawn into the context of the girl holding out her hand. The context carries the object, like a wave carries a surfer. The interpretation of information depends on the co-ordination of spatial and temporal relations, which the brain registers in the

form of different frequencies becoming phase-locked together.[10] By contrast, the distorted portrait depicts a context failing to bind to objects, which could be likened to a bumpy ride, caused by an irregular seabed.

If we equate spatial distortion with neurosis, we can see why neurotics are so convinced of their troubles: the illusion of a tiny man is compelling. Likewise, if we equate temporal distortion with psychosis, we can see why psychotics are so confused by their perception of reality: it is hard to read such a distorted face. Consequently, the difference between psychosis and neurosis – long thought to be a dichotomy – might be due to the mind grappling with opposite ends of the spatio-temporal continuum.

## Presence

The most basic assumption we have about objective reality is our own spatially derived presence, whereby our surroundings provide the context for our own presence.[11] Neurologists point to the posterior superior parietal lobe–the portion of the brain Newberg and D'Aquili have dubbed the orientation association area, or OAA:

> "The primary job of the OAA is to orient the individual in physical space-it keeps track of which end is up, helps us judge angles and distances, and allows us to negotiate safely the dangerous physical landscape around us. To perform this crucial function, it must first generate a clear, consistent cognition of the physical limits of the self. In simpler terms, it must draw a sharp distinction between the individual and everything else, to sort out the you from the infinite not-you that makes up the rest of the universe." [12]

In their best-seller, *Why God Won't Go Away*, they suggest that reduced neural activity in the OAA during transcendence indicates a deficit condition resulting from a lack of information

processing:

> "Would the orientation area interpret its failure to find the borderline between the self and the outside world to mean that such a distinction doesn't exist? In that case, the brain would have no choice but to perceive that the self is endless and intimately interwoven with everyone and everything the mind senses. And this perception would feel utterly and unquestionably real." [13]

However, by assuming that the spatial limits of the self are the *absolute* limits of the self, they overlook the key attribute of transcendence, which is the heightened sense of immediacy. They fail to acknowledge that the brain has to first generate a perspective from which to interpret the spatial boundary of the self.[14]

One's perspective emerges from optic flow; those movements in the scenery that are attributed to one's own movement. Newborn babies detect optic flow in a simulated setting, moving their legs[15] as if they are stepping into the world. So, we obviously have an innate understanding of spatio-temporal relations. In essence, the mind uses these movements for the sake of determining one's moving perspective. Since the correlation between these movements and one's own motion is immediate, the relationship between them contributes to one's sense of immediacy. However, while our perspective resides in the present moment, the interpretation of space suppresses our experience of the present moment by harnessing our perspective to navigate space. The mechanism that renders the world as spatial does so at the expense of our own immediacy.[16]

We use a variety of cues to perceive depth; motion is only one of many. One of the most powerful cues to depth, especially at short distances, is binocular disparity–the difference in the images received by each eye. We also use accommodation, which concerns the thickening and thinning of the lens of the eye to better focus on near and far objects respectively. And then there

are pictorial cues to depth, such as the fact that nearer objects occlude further objects (occlusion), nearer objects are larger than further objects (relative size) and are further from the horizon (relative position).

Although motion is not the only means by which depth is interpreted, it distinguishes itself from all other depth cues by virtue of its temporality. Depth variations revealed by motion are determined across time. The mind determines the shape of an object, or an empty space, based on how its appearance changes over time. These changes in appearance only make sense to the extent that they are relative to the observer's perspective.[17] So, the process of determining depth through motion effectively harnesses the observer's perspective, with the result that our sense of immediacy is dulled.

Space seems like a solid foundation for presence, however, it is not as fundamental as it seems. As far as perception is concerned, it is a façade that masks the fluidity of one's perspective. Paradoxically, this fluidity is more resilient than space, because it is the foundation for spatial perception. Through meditation it is possible to retract one's awareness from the world, and in so doing dissolve the division between one's perspective and the object of one's attention, such that one's very perspective becomes the object.[18] Then, one does not see the surroundings so much as the movements in the surroundings that indicate one's own motion. Subject and object merge and the here-and-now becomes palpable.

The "sharp distinction between the individual and everything else" only applies to our spatial presence. Our immediacy extends beyond this boundary. The so-called inner and outer worlds are intertwined within our consciousness.[19] One's perspective emerges from the changing appearance of *one's surroundings* and the so-called "outer" reality only gains its spatial character from the projection of *one's own presence*. What emerges from this discussion, however, is the distinction between spatial and temporal relations, where space is in fact 'imagined' and the nature of transcendence extends beyond our physical boundary.

While it is perfectly sensible to treat the world as objectively present, the spatial paradigm is by definition divisive. By contrast, the temporal paradigm is inclusive. However, the nature of this connection is not to be understood in spatial terms. It sounds absurd to say that: "the self is endless and intimately interwoven with everyone and everything the mind senses" without first dissolving the spatial paradigm. It infers that the mind is misinterpreting its relationship to the world. On the contrary, during transcendence, the mind perceives the foundation of its own presence. The extraordinary connection felt during meditation doesn't just feel real it is real. But it is a connection to the present moment, rather than the physical world as such.

Spatial perception *takes shape* within the fluid movement of one's own visual perspective. Just as a wave changes shape as it enters shallow water, vision converges with the visible to render spatial relations. The confluence of movements coalesces to give us the impression of form in our surroundings. Motion determines the observer's perspective, which detects the spatial relations that situate the observer.[20] There are thus two directions of causation: a feed-forward from motion to space and a feedback from space to motion. The observer's perspective rides the interface between space and motion.

The interface between surfboard and wave exhibits the same dynamic structure as spatial perception. Firstly, the shape of the wave represents optic flow, in the sense that waves respond to the shape of the reef in the same way optic flow responds to the shape of one's surroundings. Secondly, the penetration of the surfboard corresponds to depth perception, in the sense that the interplay between wave and surfboard is analogous to the interplay between movements that reveal the depth of space to the observer. In effect, the surfboard penetrating the surface of the wave can be likened to spatial features penetrating the apparent motion of optic flow.

By emphasising the temporal component of situated presence, the surfing analogy lays the ontological groundwork for a functional model of the psyche, characterising the spatio-temporal

structure of experience as a subliminal template for how we see the world.

## Emergence

Portrayed metaphorically as a breaking wave, the mind emerges from optic flow–the confluence of spatial and temporal relations that constantly transforms the appearance of one's immediate surroundings. While its basic function is to situate the agent in space, the observer's perspective vacillates between the spatial and temporal paradigms.[21] Too much of the spatial paradigm causes the individual to see himself as an object. Too much of the temporal paradigm makes him oblivious to his circumstances. The individual needs to balance the two paradigms, to be able to act decisively in circumstances that continually change.[22]

Since the shape of the wave is influenced by both the depth and shape of the reef, these two factors represent either end of a spatio-temporal continuum; the reef inducing spatial relations and water temporal relations. Consequently, fluctuation in the tide represents the relative proportions of each, with low tide triggering more spatial than temporal relations and high tide triggering more temporal than spatial relations. At high tide, waves break less intensely, reflecting the reduced influence of the reef on wave shape. Somewhere between these two extremes, spatial and temporal relations blend in such a way as to produce an optimal shape for surfing, which can thus serve as a metaphor for psychological stability.

Tidal variation affects the surf in a similar way to how serotonin affects the mind. At low tide, waves encounter an abrupt incline in bathymetry, causing the crest of each wave to rise suddenly, just as low levels of serotonin result in hypersensitivity, causing sudden over-reactions. Serotonin promotes patience[23], which ensures that memories have time to reach the surface, where they can help shape current experience; like waves that break more slowly in response to a gradual incline in the seabed.

The role of serotonin is opposed by dopamine[24], which promotes action. These two neurotransmitters interact in ways that correspond to the interaction between surfboard and wave. Basically, dopamine triggers the impulse to pursue a reward, like the shape of a surfboard affects directional changes; some designs being more or less responsive than others. The relationship between serotonin and dopamine determines the appropriate timing of a response. Where reward is concerned, a rapid response is not always beneficial, since patience might be needed to assess the situation before advancing toward an object. Similarly, where risk of injury is concerned, the timing of one's response is critical to the outcome. The interplay between serotonin and dopamine is akin to surfing insofar as reaction times are encoded, like the shape of the surfboard and the bathymetry of the surf break, to facilitate performance.

The task of designing a surfboard requires insight into how this tension between surfboard and wave influences surfing performance. Since the response of the surfboard is derived simultaneously from the surfboard and the wave, the act of surfing represents a further spatio-temporal continuum, in this case with the surfboard inducing spatial relations and the wave temporal relations.

The difference between the surfboard and the wave corresponds to the difference between how the left and right hemispheres of the brain process information. Each hemisphere has its own cognitive style: the left being more linear, the right, more global. The path of the surfboard is therefore analogous to the sequential processing of information that is characteristic of the left hemisphere; while the multiplicity of complex curves in the shape of a wave is analogous to the global style of processing characteristic of the right hemisphere. Moreover, the subordinate position of the surfboard is analogous to the subordinate role played by the left hemisphere.[25]

Representing the intellect, the penetration and release phases of a manoeuvre are analogous to concentration and contemplation; in the sense that concentration is active, while

contemplation is passive. Actively engaging the wave invokes spatial relations, because the surfboard—its shape and motion—is the primary factor influencing where it is going. This is the penetration phase of a manoeuvre, when the surfboard rotates into the water. Passively engaging the wave invokes temporal relations, because the surfboard follows a track determined more by the shape and motion of the wave than by the shape and motion of the surfboard. This is the release phase of a manoeuvre, when the surfboard rotates out of the water.

In terms of neural activity, the release phase of a manoeuvre corresponds to low frequency rhythms disengaging the high frequency rhythms associated with focused attention.[26-27] Brain waves interact in a way that can be likened to surfing, with higher frequencies riding lower frequencies.[28-29-30] While different frequencies generally correlate with different states of mind, it is the interaction between frequencies that determines how the mind actually makes sense of the world. Since the wake of a surfboard is a higher frequency than the wave being ridden, the activity of surfing mirrors the activity of the mind.

Alternating phases of concentration and contemplation generate ideas, in the same way that surfing manoeuvres are composed of alternating phases of penetration and release. Imagination can thus be said to negotiate a tension between reason and perception[31] in the same way surfing manoeuvres negotiate a tension between the shape of the surfboard and the shape of the wave.

The ability to shift one's perspective toward the spatial end of the scale might have evolved for self-defence. A clear sense of your own physical presence is vital when faced by danger. But, not all dangers threaten physical harm, especially in the modern world, where reputation stands for so much. If we subscribe to a mask and that mask is removed, we are confronted by an existential void. It can be terrifying to peer into the abyss. But, it only feels threatening when we look at it objectively.[32] As paradoxical as it seems, the fluid present is the only truly stable perspective. In essence, the problem is not the void, but the

perspective that renders it objectively.

## Reality

Spatial perception sets motion in the context of space, to provide a sense of motionlessness – a sort of reference to show how motion differs to it. For example, we typically regard motion as a change of position, a reference to something fixed. But as a consequence, motion is seen as a movement *in* space when it is actually a movement *of* space – a space in motion.[33]

The spatially derived model of reality is based on how the dimensions differ to each other. Space is characterised by the difference between a plane and space. The planes set the context for the idea of space. The edges of a plane provide a context by showing the line where the plane ceases to be a plane. The difference between a line and a plane is what the concept of a plane is based on. To visualise a line, we give it ends. Each end of the line is a point and together they serve as the context for the line. They show the difference between a line and a point, and in this way they define the point at which a line ceases to be a line.

Successive dimensions build on lesser dimensions; for example, a line as a series of points. So, each dimension can be 'placed' within dimensions higher than itself, but not lower than itself. However, while this is clear for each of the dimensions leading up to the three dimensions of space, it is not so clear how time 'contains' its lesser dimensions. The problem is the spatially derived model of reality. We understand the passing of time to be in relation to the present moment, as if the 'now' has no duration. We supposedly experience a string of nows. However, it is only for sake of the concept that the passage of time differs to the present. The contrast does not reflect reality, but the setting of a context.

What the concept of time fails to take into account is that successive dimensions merge. They are not discrete. Each dimension carries within it the dimensions lesser than it. So,

instead of focusing on how the dimensions differ to each other, we should look at how they differ in themselves. This reveals that the essence of a point is its location, the essence of a line is its alignment, the essence of a plane is its form, and the essence of a space is its density.

In considering how a motion differs in itself, one is tempted to describe it in linear terms: i.e. the path it follows. But this is not its essential quality, since a line has just one dimension, not four. Neither can we narrow it down to its location, form or density, though that which moves certainly has these characteristics too. But all these things being equal (imagine two identical movements side by side), there remains one characteristic which belongs solely to motion: its speed. This is how motion differs in itself – making speed the essence of motion.

The variable of speed is beyond the ordinary conception of motion, so we tend to regard it as inconsequential. But motion in the sense of speed is precisely how it ties in to reality. This can be observed in the shape of a wave. It is not simply that the form would not exist without motion, but that the variable of speed determines the variety of curves in a wave. A standing wave behind a rock in a stream is a good example of this principle: the water flows through the wave while the form expresses the various speeds at which the water is moving.

The whirlpool is a particularly good example because the dimensions are seen to be variables linked in a unified system. There is the alignment of its axis, the form of its surface, the matter it draws inward and, since a vortex rotates progressively faster toward its centre, the variable of speed. Placing a tiny pointer in a whirlpool can show the part played by motion. The pointer remains parallel to its original alignment, despite being carried around and around. This indicates that motion, rather than content, determines the form.[34]

The concept of time fails to account for the diversity of change, since the division of time and space implies that change is restricted to the 4$^{th}$ dimension. However, assuming that change is the very essence of reality, rather than a mere aspect of it, it

follows that the essence of each dimension is how that dimension changes. By setting each dimension in the context of change, the concept of time subsequently loses its significance as one of the dimensions, as such, separated from space. To subordinate the dimensions to the concept of time ignores the crucial point that each dimension finds its expression in change and that change is, moreover, what holds them together.

Having reinstated motion as the 4th dimension, it becomes apparent that time is also a *generalisation* of change. Just as we tend to regard motion in terms of its lesser characteristics, so too do we have an inferior perception of that other form of change called growth. Since growth depends on but is more than motion, it might be a higher dimension, with evolution as its essence. After all, information is not physical. In effect, life rides the material properties of chemicals, using instructions stored in DNA to direct cell growth. Incredibly, the coding for our own heart beat might have evolved from the pulsing motion of jelly fish.[35]

While we naturally feel our own motion relative to a spatial frame of reference, it is possible to mobilise the frame and ultimately dissolve its function. This can occur during meditation when the upper torso moves in an orbit around its central axis, forming a vortex grounded at its fulcrum point. Absorbed by the motion, the meditator begins to sense the fulcrum point rising vertically, as a second vortex, pivoting on the same point, emerges from below. The deeper the trance, the higher the fulcrum point rises, until it reaches the upper limit of the motion, where it finally becomes detached from the motion, which subsequently disintegrates into undirected awareness.

## Evolution

Only actively moving creatures evolved a nervous system. So, the evolution of consciousness might have resulted from the brain internalising movement.[36] The process of internalisation can be seen in shark embryos, which undulate rhythmically inside the

egg to ensure the even distribution of oxygen necessary for tissue development. At this stage of development, the movement is generated solely by the muscle cells, which have not yet been innervated by motoneurons. When the motoneurons migrate from the spinal cord to the muscles, the electrotonic coupling of muscle cells ceases, so that the brain can take control of motricity. Then the motility properties of the muscles become embedded into the neuronal circuits of the spinal cord, where they are integrated into the vestibular system, which monitors the effects of inertia acting on the organism through gravity and momentum.

Rhythmic movement is coordinated by central pattern generators, which alter the interneuronal pathways.[37] Simply visualising a motor skill can modify the neural substrates for its physical performance.[38] Mental practice is encoded into the neural networks, strengthening the same activation patterns triggered by the physical training. Visualisation is frequently used by performers to hone their skills. Even muscle strength increases, i.e. without the physical activity you would think was necessary for muscle growth.[39] This undermines the notion of a metaphysical plane of consciousness, suggesting instead that the mind has evolved out of the structural coherence of consciousness and physiology.

The development of spatial structure in the embryo has been found to involve a chemical reaction that is analogous to standing waves.[40] Using a staining technique, morphogenesis can be seen in the early embryo, in the form of a periodic banded pattern. This pattern indicates alternating concentrations of morphogens, which chemically mark the tissue, identifying which cells belong together. The mechanism, known as reaction diffusion, involves a continuous process whereby morphogen P catalyses the production of more morphogen P, plus morphogen S, which inhibits morphogen P. The physiological development of the organism is thus marked out, distinguishing bones, muscles, internal organs, etc. Camouflage patterns have also been attributed to reaction diffusion.[41] The stripes of the zebra and the spots of the leopard show how morphogenesis exploits periodicity

for evolutionary advantage. The extent to which this process is analogous to standing waves is easily appreciated when comparing patterns of animal skin colouration and sand vibrating on a steel plate. The sand accumulates at the nodes of vibration, to reveal the geometric character of the harmonic resonance. Many patterns found in living organisms can be replicated in this way.

The underlying argument is that the evolution of biological form is founded on generic physical forces, which presumably served as morphological templates within which genetic selection could operate. While the similarity between so many physical and organic forms suggests such a connection, the case is rather more compelling if one considers that many organisms have morphological features that are similar to physical forms despite being genetically unrelated. For example, a 3D logarithmic spiral found in seashells is also evident in tidal-washed kelp fronds and in the shape of our own skin pores.[42]

Natural patterns and processes are often applied to the development of new technology. This approach to design, called Biomimicry, enables designers to take advantage of the millions of years of incremental variations that have been made through biological evolution, to gain insight into the underlying principles determining naturally evolved shapes. For example, a highly efficient fan blade has been designed using the 3D logarithmic spiral, common throughout the natural world, because this shape optimises the flow of water or gas across its surfaces.[43]

As with naturally evolved shapes, the activity of design draws on the spatio-temporal structure of being, to produce something new that extends the experience of being.[44] On this basis, the surfboard designer's ability to invoke the link between spatial and temporal relations validates the surfing metaphor as a tool for visualising the spatio-temporal structure of experience.

# Intellect

It's hard to describe to non-surfers how it feels to carve across a wave, to push the limits of your surfing ability and to surf even better than you thought you could. One surfs *with* the wave, drawing on experience to manoeuvre the surfboard in synchrony with the wave, all the while anticipating how it will change shape.[45] As a nexus of past, present and future experience, surfing corresponds to Kant's model of the intellect, which portrays information as the product of three types of synthesis: the apprehension of raw perceptual input, the recognition of concepts and the reproduction of each in imagination.[46] Viewed in these terms, the principles of surfboard design show how the spatio-temporal structure of surfing can represent the spatio-temporal structure of experience.

To analyse how a surfboard responds to a surfer's movements, the designer reduces the surfer's influence to a set of rotational axes. Focusing on the surfboard, he ignores the shape and motion of the wave, which is subsequently reduced to a flat plane. At this level of abstraction, the surfer's influence can be represented diagrammatically, enabling the designer to more easily visualise the different phases of a manoeuvre, as well as the transitions between them. By visualising each phase in terms of its rotational axis, or sequence of axes, the designer can identify which portions of the surfboard come into play for a given manoeuvre.

We can visualise rotational axes in terms of lines of latitude and longitude encircling the globe:

1. The first rotational axis traces a circle on the horizontal plane, which can be thought of as the Equator.
2. The second rotational axis traces a circle on any vertical plane; which can be visualised as the lines of longitude encircling the globe from north to south.
3. The third rotational axis traces a circle at right angles to each of the other two.

So long as the surfboard rotates on the first axis, its interaction with the wave has no effect. This is a monadic relation, defined solely by the wave, which represents perception. Rotating on the second axis causes the surfboard to penetrate the wave, which produces a dyadic relation between the surfboard and the wave, with their intersection representing the recognition of concepts. When all three rotational axes combine, monadic and dyadic relations are absorbed into triadic relations–representing their synthesis in imagination–expressed as the variable of direction, in the sense of the surfboard traversing the surface of the wave.

The surfboard shaper is the Sufi of naval architects; adjusting the shape of the surfboard while simultaneously invoking the sensation of its movement through the water. This connection between shape and motion is key to the surfboard being absorbed into the surfer's movements. A poorly designed surfboard makes it hard to read the wave, which is akin to the failure of mirror neurons to read the intention behind an action, as occurs in autism.[47] Unable to engage meaningfully with other people, autistic individuals struggle to make sense of the world. And yet, autistic savants seem to perceive the very fabric of the universe! So, in terms of the surfing analogy, the autistic savant surfs within the wave, like a dolphin, experiencing 'reality' directly, instead of through the medium of a surfboard. By contrast, the non-autistic mind adopts a detached perspective, which the surfing analogy equates with riding on the surface of the wave. Moreover, we are able to detect the intention behind an action, because it is encoded by mirror neurons, like the various trajectories of surfing manoeuvres encoded into the design of a surfboard.

## Psychology

Everything we encounter presents some sort of obstruction to the flow of consciousness, which responds by drawing on past experience to confirm whatever is happening. The invisible mapping of memories onto present experience is revealed by the

Perky Effect; according to which, people are unaware that they are looking at a faint image of an object, when asked to picture the object in their mind's eye, while staring at a supposedly blank screen. This overlapping of mental and visual sources of information can be visualised as a wave that owes its shape to two forms of obstruction; one being the contours of the reef, the other a current of water flowing through the wave. Waves can actually break in deep water if their wavelengths are sufficiently compressed by an opposing current. The obstruction doesn't need to be solid, like a reef. Indeed, waves are often shaped by a combination of reef shape and water movement. So, using this distinction, we can equate the physically sensed world with solid reef, and any associated memories with flowing water. Percepts are thus shaped by both of these factors, with the relative proportions of each reflecting the familiarity of the object.

Concepts differ to percepts, in that they are formed through language, which is like riding a surfboard. Since language also involves physically sensed input combined with associated memories, these attributes can be represented by the wake of the surfboard; which is also a wave formed by a solid obstruction and flowing water. But, in this case, the wave is taking place within the context of another wave: the wave being ridden. Of course, this other wave need not represent a percept, since utterances provide the context for subsequent utterances: each utterance riding within the context of the previous utterance. So, a conversation might be portrayed as two surfers taking turns at generating a wake to be ridden by the one listening.

The suitability of a surfboard design for the surfing conditions would thus represent our ability to communicate and, hence, to function in the social world. The resulting ease of surfing would correspond to familiar circumstances, when the characteristics of a situation can be inferred without having to interpret every detail.[48] By contrast, when circumstances are unpredictable, the mind relies more on observation than expectation. The unfamiliarity of the situation demands more effort, because the individual is not suitably equipped to deal with the circumstances,

which is like a surfer who struggles to ride an unsuitable surfboard. Ideally, the surfer adjusts his approach to the wave by reducing penetration, which reduces the influence of the surfboard upon direction. This is like trusting one's intuition—the surfer choosing to go with the wave instead of against it. No matter how successfully we reason our way through life, we cannot expect that 'our design' will meet every contingency.[49] There will be occasions when we require a deeper sense of direction, so that we can let go of reason and feel at ease with how ever things unfold.

As habitual animals, we tend to identify with familiar circumstances, because their relational structure provides stability; like riding a suitably shaped surfboard on suitably shaped waves. But, the essence of being is not confined by spatial relations; so it is like a wave in the open ocean, travelling free of obstruction. If you sometimes find yourself in 'a bad place', it is comforting to know that the swell—like God—is always 'out there', somewhere. The only problem is you won't be able to 'locate' it through rational means. It seems counter-intuitive, but the rational mind is actually preventing you from finding your true self.

If you see yourself primarily as a spatial object, then you inadvertently deny the essential fluidity of your being. Meditation helps you to become reacquainted with the fluid foundation of your own mind by disengaging the mental tools that navigate spatial relations. As with surfing, it takes discipline to get all the variables working together. So, it is not surprising that we struggle. But, the more you surf, the better you get at figuring out how to approach challenging situations.

Faith could even be characterised by free-falling down the face of a wave on take-off, when one's attention is momentarily suspended between interpreting the situation and anticipating what's about to happen. The body knows what to do and responds accordingly. It has an innate relationship with the wave, which is like a relationship with God. The mind becomes disengaged from the task of making sense,[50] just like the surfboard becomes disengaged from the wave during a late take-off.

By contrast, the spatial frame of reference can be rendered as

the surfer's visual perspective in tension with how the surfboard feels under his feet. Both play a role. But, the ego tends to place more value in the visual mode, and subsequently neglects the more relevant source of information streaming through the legs. What the ego can't see, and obviously takes for granted, is the deep relationship between the surfboard and the wave; which speaks to the primal relationship between body and mind.

# References

[1] Taylor, C. & Dewsbury, B.M. (2018). On the Problem and Promise of Metaphor Use in Science and Science Communication, *Journal of Microbiology and Biology Education*; 19 (1): 19.1.46.

> "Though the use of metaphorical language in science has been historically criticized by some philosophers of science and scientists on the grounds that metaphors are figurative, ambiguous, and imprecise, their generative potential cannot be ignored. It is, in fact, metaphor that makes theory possible, and a great number of scientific revolutions have been initiated through novel comparisons between natural phenomena and everyday experiences."

[2] Wilson, C. (1965). Beyond the outsider: a philosophy of the future, Pan Books Ltd. London, p.82.

> "Man is in the position of a painter painting a gigantic canvas. If he is close enough to be able to work, he is too close to see it as a whole. If he stands back to see it as a whole, he is too far away to use his paint-brush. The natural solution for the painter would be to move back and forth as often as possible."

[3] Trungpa, C. (1984/2007). Shambala: The Sacred Path of the Warrior. Shambala Publications, Inc. Boston & London, p.72.

> "From the echo of meditative awareness, you develop a sense of balance, which is a step toward taking command of your world. You feel that you are riding in the saddle, riding the fickle horse of mind. Even though the horse underneath you may move, you can still maintain your seat. As long as you have good posture in the saddle, you can overcome any startling or unexpected moves. And whenever you slip because you have a bad seat, you simply regain your posture; you don't fall off the horse. In the process of losing your awareness, you regain it because of the process of losing it."

[4] Freud, S., Strachey, J., Freud, A., Rothgeb, C. L. & Richards, A. (1978). The standard edition of the complete psychological works of Sigmund Freud. Volume XIX (1923-26) The Ego and the Id and Other Works. Scientific Literature Corporation, London, Hogarth Press, p.19.

> "The functional importance of the ego is manifested in the fact that normally control over the approaches to motility devolves upon it. Thus in its relation to the id it is like a man on horseback, who has to hold in check the superior strength of the horse; with this difference, that the rider tries to do so with his own strength while the ego uses borrowed forces. The analogy may be carried a little further. Often a rider, if he is not to be parted from his horse, is obliged to guide it where it wants to go; so in the same way the ego is in the habit of transforming the id's will into action as if it were its own."

[5] Ramachandran, V.S., & Hubbard, E.M. (2001). Synaesthesia – A window into perception, thought and language. *Journal of Consciousness Studies*, 8 (12), p.19.

> "If you show [the picture] to people and say 'In Martian language, one of these two figures is a "bouba" and the other is a "kiki", try to guess which is which', 95% of people pick the left as kiki and the right as bouba, even though they have never seen these stimuli before. The reason is that the sharp changes in visual direction of the lines in the right-hand figure mimics the sharp phonemic inflections of the sound kiki, as well as the sharp inflection of the tongue on the palate. The bouba/kiki example provides our first vital clue for understanding the origins of proto-language, for it suggests that there may be natural constraints on the ways in which sounds are mapped on to objects."

[6] Ward, J., Huckstep, B. and Tsakanikos, E. (2006). Sound-colour synaesthesia: To what extent does it use cross-modal mechanisms common to us all? *Cortex*, 42, p.279.

> "In sum, our conclusion is that the type of sound-colour synaesthesia reported here is a genuine phenomenon in which

pitch heights map on to colours as a function of the lightness. We suggest that this variety of synaesthesia recruits normal mechanisms of cross-modal perception and attention and can therefore be used to speak to theories of normal cognition."

[7] Ramachandran, V.S., & Hubbard, E.M. (2001). Synaesthesia – A window into perception, thought and language. *Journal of Consciousness Studies*, 8 (12), p.19.

"Second, we propose the existence of a kind of sensory-to-motor synaesthesia, which may have played a pivotal role in the evolution of language. A familiar example of this is dance, where the rhythm of movements synaesthetically mimics the auditory rhythm. This type of synaesthesia may be based on cross- activation not between two sensory maps but between a sensory (i.e., auditory) and a motor map (i.e., Broca's area). This means that there would be a natural bias towards mapping certain sound contours onto certain vocalizations."

[8] Arbib, M.A. (2005). From monkey-like action recognition to human language: An evolutionary framework for neurolinguistics. *Behavioural and Brain Sciences*, 28 (2), p.112.

"During training, the output of the F5 canonical neurons, acting as a code for the grasp being executed by the monkey at that time, was used as the training signal for the F5 mirror neurons to enable them to learn which hand-object trajectories corresponded to the canonically encoded grasps. Moreover, the input to the F5 mirror neurons encodes the trajectory of the relation of parts of the hand to the object rather than the visual appearance of the hand in the visual field. As a result of this training, the appropriate mirror neurons come to fire in response to viewing the appropriate trajectories even when the trajectory is not accompanied by F5 canonical firing."

[9] Kierkegaard, S. ([1843] 1987). Either/Or, Part II, Trans. Howard V. Hong & Edna H. Hong, Princeton University Press, p.136.

"If one traces dialectically and just as much historically the development of the esthetically beautiful, one will find that the

direction of this movement is from spatial categories to temporal categories, and that the perfecting of art is contingent upon the possibility of gradually detaching itself more and more from space and aiming toward time. This constitutes the transition and the significance of the transition from sculpture to painting, as Schelling early pointed out. Music has time as its element but has no continuance in time; its significance is the continual vanishing in time; it sounds in time, but it also fades and has no continuance. Ultimately poetry is the highest of all the arts and therefore also the art that best knows how to affirm the meaning of time. It does not need to limit itself to the moment in the sense that painting does; neither does it disappear without a trace in the sense that music does. But despite all this, it, too, is compelled, as we have seen, to concentrate in the moment. It has, therefore, its limitation and cannot, as shown above, portray that of which the truth is precisely the temporal sequence. And yet this, that time is affirmed, is not a disparagement of the esthetic; on the contrary, the more this occurs, the richer and fuller the esthetic ideal becomes."

[10] Singer, W. (2007). Binding by synchrony, *Scholarpedia*, 2 (12), p.1657.

"Cells oscillating at low frequencies are able to integrate over longer time windows and this does in principle allow for the nesting of relations: Slowly oscillating cell groups can integrate activity from fast oscillating cell groups even if these are oscillating at different frequencies. Thus, while the features represented by fast oscillating groups remain segregated, they may be bound together by more slowly oscillating groups. In principle, this allows for the encoding of hierarchically structured relational graphs and the encoding of nested relations."

[11] Todes, S. (2001). Body and World. MIT Press, pp.168-9.

"On our phenomenological account, however, the self-activity of the percipient is felt as the self-movement of his substantive. The fields in which this self-movement is directed are therefore

felt as the fields of direction of the very body that is self moving."

[12] Newberg, A.B. & D'Aquili, E.G. (2001). Why God Won't Go Away: Brain Science and the Biology of Belief. New York: Ballantine Books, p.4.

[13] Ibid.

[14] Todes, S. (2001). Body and World. MIT Press, p.175.

"Our general sense of activity is of something-or-other taking place in the field of our experience; and in practical perception, as we have seen, this field is a function of our sense of self-movement."

[15] Barbu-Roth, M., Anderson, D., Desprès, A., Provasi, J., Cabrol, D. & Campos, J.J. (2009). Neonatal Stepping in Relation to Terrestrial Optic Flow, *Child Development*, 80 (1), p.13.

"The apparent ability of the newborn to discriminate an optic flow pattern specifying self-motion from one specifying stasis (the static pattern), or motion of an object in space (the pinwheel), suggests that a capacity for recognition of an implicit ecological self, as opposed to an interpersonal self (Neisser, 1991), is present from birth. In other words, the infant's behavior is relational; it is directed at a specific environmental demand, and the infant's behavior is differentiated in accordance with the task demand."

[16] Todes, S. (2001). Body and World. MIT Press, p.171.

"In all empirical determination, therefore, we somehow make ourselves passive objects of our own spontaneity."

"By *active* self-movement, the percipient first generates his spatiotemporal field. But, as soon as he does so, he is *passively* thrown into the middle of it as an arena in which he must fend for himself as vulnerable, and seek to find himself, though subject to failure."

[17] Ibid., p.206.

> "We can have an object in perception only by becoming circumstantially self-aware. And we become circumstantially self-aware by becoming aware of the existence of our active body in the center of our perceptual field of objects."

[18] Bergson, H. (1910). Time and Free Will: An Essay on the Immediate Data of Consciousness, Allen and Unwin, p.90.

> "Representative sensation, looked at in itself, is pure quality; but seen through the medium of extensity, this quality becomes in a certain sense quantity, and is called intensity. In the same way, our projection of our psychic states into space in order to form a discrete multiplicity is likely to influence these states themselves and to give them in reflective consciousness a new form, which immediate perception did not attribute to them. Now, let us notice that when we speak of *time*, we generally think of a homogenous medium in which our conscious states are ranged alongside one another in space, so as to form a discrete multiplicity. Would not time, thus understood, be to the multiplicity of our psychic states what intensity is to certain of them, a sign, a symbol, absolutely distinct from true duration? Let us ask consciousness to isolate itself from the external world, and, by a vigorous effort of abstraction, to become itself again."

[19] Merleau-Ponty, M. (2002). Phenomenology of Perception. *Psychology Press*, p.474.

> "Inside and outside are wholly inseparable. The world is wholly inside and I am wholly outside myself."

[20] Todes, S. (2001). Body and World. MIT Press, p.128.

> "The percipient begins empty of content, lost in the world, having only the need for content. The percipient has to achieve fullness. He does this by determining a passing object. His activity in doing so acquires unity and specificity from the concrete unity of the object that he skilfully determines in this

way. In the completed perceptual object, the percipient perceives a reflection of his own momentarily completed activity."

[21] Bergson, H. (1912). An Introduction to Metaphysics. G.P. Putnam's Son's, p.63.

"[...] the intuition of our duration, far from leaving us suspended in the void, as pure analysis would do, brings us into contact with a whole continuity of durations which we must try to follow, whether downwards or upwards; in both cases we can extend ourselves indefinitely by an increasingly violent effort, in both cases we transcend ourselves. In the first we advance towards a more and more attenuated duration, the pulsations of which, being rapider than ours, and dividing our simple sensation, dilute its quality into quantity; at the limit would be pure homogeneity, that pure repetition by which we define materiality. Advancing in the other direction, we approach a duration which strains, contracts, and intensifies itself more and more; at the limit would be eternity. No longer conceptual eternity, which is an eternity of death, but an eternity of life. A living, and therefore still moving eternity in which our own particular duration would be included as the vibrations are in light; an eternity which would be the concentration of all duration, as materiality is its dispersion. Between these two extreme limits intuition moves, and this movement is the very essence of metaphysics."

[22] Tuan, Yi-Fu (1979). Space and place: Humanistic perspective, in Philosophy in Geography, Theory and Decision Library, Springer Netherlands, 20, p.419.

"We owe our sense of being not only to supportive forces but also to those that pose a threat. Being has a centre and an edge: supportive forces nurture the centre while threatening forces strengthen the edge. In theological language, hell bristles with places that have sharply drawn – indeed fortified – boundaries but no centre worthy of defence; heaven is full of glowing centres with the vaguest boundaries; earth is an uneasy compromise of the two realms."

[23] Cools, R., Nakamura, K. & Daw, N.D. (2011). Serotonin and Dopamine: Unifying Affective, Activational, and Decision Functions, Neuropsychopharmacology Reviews, 36, p.105.

> "Time discounting is the subject of another prominent computational theory of serotonergic function (Doya, 2002), which posits that 5-HT [serotonin] controls (im)patience in intertemporal choice: the degree of preference for immediate rewards over delayed rewards. Specifically, Doya proposed that 5-HT controls a parameter common to many decision models known as the temporal discount factor according to which delayed rewards are viewed as less valuable than immediate ones, with higher 5-HT promoting greater patience."

[24] Dawa, N.D., Kakadeb, S. & Dayanb, P. (2002). Opponent interactions between serotonin and dopamine, *Neural Networks* 15, pp.603–616.

[25] McGilchrist, I. (2009). The Master and His Emissary: The Divided Brain and the Making of the Western World, p.192. Yale University Press. Kindle Edition.

> "Thus it is the right hemisphere that permits a living world to come into being, and it is from this that the re-presented world of the left hemisphere is derived."

[26] Miller, E.K. and Buschman, T.J. (2013). Cortical circuits for the control of attention. *Current Opinion in Neurobiology*, 23, p.219.

> "..., neurons representing an unattended stimulus showed increased low frequency (<17 Hz) synchronization. One explanation for this is that low frequency synchrony may reflect common and thus uninformative inputs to the neurons. Thus, the negative correlation between low frequency synchrony and attention may reflect a mechanism that improves information transmission by removing these common 'noise' sources."

[27] Miller, E.K. and Buschman, T.J. (2013). Brain Rhythms for

cognition and consciousness, Neurosciences and the Human Person: New Perspectives on Human Activities, *Scripta Varia*, 121, p.3.

> "Visual cortical neurons that process a stimulus under attentional focus show increased synchronized gamma band (30-90 Hz) oscillations (P. Fries et al. 2001). By contrast, neurons representing an unattended stimulus showed increased low frequency (<17 Hz) synchronization. A variety of evidence suggests that low frequencies may help deselect or inhibit the corresponding ensembles (Buschman et al. 2012; Vijayan and Kopell 2012; Palva and Palva 2011; Ray and Cole 1985)."

[28] Miller, E.K. and Buschman, T.J. (2013) Cortical circuits for the control of attention. *Current Opinion in Neurobiology*, 23, p.219.

> "…during visual attention there are increases in higher frequency synchrony between cortical areas along with an increase in low frequency synchrony between the thalamus and cortex. These low frequencies may provide a 'carrier wave' on which higher frequency oscillations across cortex can become entrained."

[29] Dürschmid, S., Zaehle, T., Kopitzki, K., Voges, J., Schmitt, F.C., Heinze, H., Robert, T., Knight, R.T. and Hinrichs, H. (2013). Phase-amplitude cross-frequency coupling in the human nucleus accumbens tracks action monitoring during cognitive control, *Frontiers in Human Neuroscience*, 7, p.11.

> "We investigated the dynamics of PAC in the human NAcc and show, that in the NAcc contralateral to a movement the θ phase modulates the high gamma amplitude (≈100–140Hz) following a motor response. Importantly, this previously undescribed oscillatory pattern in the human NAcc increases with cognitive control and predicts behavioral adaptation as reflected in the reduction in error rates."

[30] Buzsáki, G., and Draguhn, A. (2004). Neuronal oscillations in cortical networks. *Science*, 304, p.1929.

"Slow rhythms synchronize large spatial domains and can bind together specific assemblies by the appropriate timing of higher frequency localized oscillations."

[31] Gabora, L. & Aerts, D. (2009). A model of the emergence and evolution of integrated worldviews. *Journal of Mathematical Psychology*, 53, pp.434-451.

"The modern human mind has the ability to shift between analytic thought, conducive primarily to realizing relationships amongst states of a known concept, and associative thought, conducive primarily to forging new concepts through the formation of conjunctions, which are entangled states that result through application of the tensor product of the Hilbert spaces of the two constituent concepts. It is proposed that the penultimate step toward achieving an integrated worldview was to acquire the capacity to spontaneously focus attention (conducive to analytic thought) or defocus attention (conducive to associative thought) depending on the circumstance. This is modelled as onset of the modulation of $\mu$, the transition probabilities using a variable we called $\Phi$. Once the capacity has evolved to alter $\Phi$ according to the situation, analytic thought and associative thought can work in concert to organize and reorganize conceptual structure. Analytic thought enables the identification of causal relationships, while associative thought facilitates recognition of items in memory that are correlated, *i.e.* that share properties, which in turn provides more ingredients for analytic thought."

[32] Young, J. (2001). Heidegger's Philosophy of Art. Cambridge University Press, pp.132-133.

"Understanding one's (in Kantian language) 'membership' [in] the mystical realm of 'plenitude' abolishes anxiety, establishes one as ultimately secure in one's world because one understands, now, that that which surrounds the clearing is no longer abysmal but is, rather, the richness of all those

concealed (and unintelligible) possibilities of disclosure which, in addition to one's ego, one is."

[33] Bergson, H. (1912). An Introduction to Metaphysics. G.P. Putnam's Son's, p.48.

"Consider, [...] movement in space. Along the whole of this movement we can imagine possible stoppages; these are what we call the positions of the moving body, or the points by which it passes. But with these positions, even with an infinite number of them, we shall never make movement. They are not parts of the movement, they are so many snapshots of it; they are, one might say, only supposed stopping-places. The moving body is never really *in* any of the points; the most we can say is that it passes through them."

[34] Schwenk, T. (1996). Sensitive Chaos: The creation of flowing forms in water and air (Second Edition). Rudolf Steiner Press, p.45.

"The vortex has yet another quality that suggests cosmic connections. If a very small floating object with a fixed pointer is allowed to circle in a vortex, it always points in the direction in which it was originally placed, that is it always remains parallel to itself! In other words, it is always directed to the same point at infinity. It can of course be started off pointing in any direction and it will then remain pointing in this direction while circling in the vortex. This shows how a vortex is oriented-as though by invisible threads-with respect to the entire firmament of fixed stars."

[35] Martinsona, A.S., van Rossuma, D.B., Diattaa, F.H., Laydenb, M.J., Rhodesa, S.A., Martindaleb, M.Q. and Jeglaa, T. (2014). Functional evolution of Erg potassium channel gating reveals an ancient origin for $I_{Kr}$, *Proceedings of the National Academy of Sciences of the United States of America (PNAS)*, 111/15, 5712–5717.

[36] Llinas, R.R. (2001). I of the vortex: From neurons to self. A Bradford Book, MIT Press, p.18.

> "The nervous system has evolved to provide a plan, one composed of goal-oriented, mostly short-lived predictions, verified by moment-to-moment sensory input. This allows a creature to move actively in a direction according to an internal reckoning-a transient sensorimotor image-of what may be outside."

[37] Zehr, E.P. (2005). Neural control of rhythmic human movement: the Common Core Hypothesis. *Exercise and Sport Sciences Reviews*, 33 (1), p.56.

> "Extensive reorganization of neuronal circuits involved in the generation of many rhythmic motor patterns (e.g. chewing, gastric mill, pylorus, etc.) has been well documented, and is altered extensively by various neuromodulators. That is, neuromodulators alter the activation and synaptic efficacy in various interneuronal pathways, and allow for the expression of different motor patterns with essentially the same neurons."

[38] Pascual-Leone, A., Nguyet, D., Cohen, L.G., Brasil-Neto, J.P., Cammarota, A. & Hallett, M. (1995). Modulation of muscle responses evoked by transcranial magnetic stimulation during the acquisition of new fine motor skills. *Journal of Neurophysiology*, 74, p.1043.

> "Therefore, mental stimulation of movements activates some of the same central neural structures required for the performance of the actual movements. In doing so, mental practice alone seems to be sufficient to promote the modulation of neural circuits involved in the early stages of motor skill learning."

[39] Ranganathan, V.K., Siemionowa, V., Liu J.Z., Sahgal, V. & Yue, G.H. (2004). From mental power to muscle power—gaining strength by using the mind. *Neuropsychologia*, 42, p.953.

> "The key findings of this study were that mental training increases voluntary strength of both distal and proximal muscles of human upper extremities and the strength improvements accompanied elevations of time-locked (to MVC trials) cortical potential (MRCP). Based on the MRCP data, we

> are confident that the primary mechanism underlying the strength increase is a mental training-induced enhancement in the central command to muscle. The data suggest that repetitive mental attempts to maximal muscle activation trained and enabled the brain to generate stronger signals to muscle."

[40] Lehar, S. (2003). Harmonic Resonance Theory: An alternative to the "Neuron Doctrine" paradigm of neurocomputation to address gestalt properties of perception. *The Behavioral and Brain Sciences*, 26 (4), p.15.

> "The utility of standing wave patterns as a representation of spatial form is demonstrated by the fact that nature makes use of a resonance representation in another unrelated aspect of biological function, that of embryological morphogenesis, or the development of spatial structure in the embryo."

[41] Ibid.

> "After the initial cell divisions following fertilization, the embryo develops into an ellipsoid of essentially undifferentiated tissue. Then, at some critical point a periodic banded pattern is seen to emerge as revealed by appropriate staining techniques, shown in figure 3A. This pattern indicates an alternating pattern of concentration of morphogens, i.e. chemicals that permanently mark the underlying tissue for future development. This pattern is sustained despite the fact that the morphogens are free to diffuse through the embryo. The mechanism behind the emergence of this periodic pattern is a chemical harmonic resonance known as reaction diffusion (Turing 1952, Prigogine & Nicolis 1967, Winfree 1974, Welsh et al. 1983) in which a continuous chemical reaction involving a morphogen P catalyzes the production of more morphogen P as well as of a morphogen S, but the concentration of morphogen S in turn inhibits production of morphogen P (see Gilbert 1988 pp 655-661 for a summary)."

[42] Pronk, A.D.C., Blacha, M. & Bots, A. (2008). Nature's Experiences for Building Technology, p.4.

[43] Ibid.

> "Example of use of the pattern found in snail-shells, like the mollusk shells are the fans, propellers, impellers, and aerators designed by PAX Scientific (USA), see [1]. A three-dimensional logarithmic spiral is found in the shells of mollusks, in the spiraling of tidal-washed kelp fronds, and in the shape of our own skin pores, through which water vapor escapes. Liquids and gases flow centripetally through these geometrically consistent flow forms with far less friction and more efficiency."

[44] Palmer, K. (2006). On the Ontology of Emergent Design and General Schemas Theory: Research into The Deep Structure of Design, p.1.

> "Dasein reacts to what has Being and produces something new, which extends and expands on what Being covers. In other words what Being covers is changed by the activity of Design."

[45] Flynn, P.J. (1987). Waves of Semiosis: Surfing's Iconic Progression. *The American Journal of Semiotics*. 5 (3), 398-418.

> "[The surfer] employs perceptive prolepsis and analepsis to unify past surfing experience, present immediate interpretation, and projections of possible future unfoldings of the wave based on a reading of natural signs, such as the wave's speed, shape, degree of breaking angle, steepness, and local contingencies, like other surfers on the wave or in the wave path. The surfer dances with the wave in a state of what Heidegger (1962:324) calls "anticipatory resoluteness" (past, present, future are unified). Manoeuvers and stylistic improvisations are accomplished in synchrony with the wave's movements, linked together artfully to create a completed narrative or a spatio-temporally synchronized "radical ride", e.g. a skilled cut-back is executed at the precise moment when the wave's speed begins to slacken. A tube ride is achieved by riding as far back as possible in the breaking wave. An off the lip manoeuver is carried out just as the breaking lip comes down. Contemporary "radical" surfing is the result of the surfer "pushing the limits"

of performance while achieving semiotic synchrony with the wave's flow as it is perceived and interpreted by the wave rider."

[46] Kant, I. (1781). Critique of Pure Reason. (A97).

"If each representation were completely foreign to every other, as it were standing apart in isolation, there would be no such thing as knowledge; because knowledge is ·essentially· a whole in which representations stand compared and connected. what Kant wrote next, conservatively translated: When I ascribe to sense a synopsis [from Greek meaning 'view together'], because sense contains a manifold in its intuition, then there is always, corresponding to this synopsis, a synthesis [from Greek meaning 'put together']. Thus, receptivity can make knowledge possible only when combined with spontaneity. what he meant, more plainly put: Every sensory state contains a variety of different elements, which leads me to say that each such state involves a seeing-together. And corresponding to every seeing-together there is a putting-together. Thus, passive intake can make knowledge possible only when it is combined with something active. This activeness is exercised in three acts of synthesis that must occur in all knowledge:

a) apprehending representations as states of the mind in intuition,
b) reproducing them in imagination, and
c) recognizing them in a concept.

These three syntheses point to three subjective sources of knowledge which make possible the understanding itself—and consequently all experience as its empirical product."

[47] Gallese, V., Rochat, M. Cossu, G. & Sinigaglia, C. (2009). Motor Cognition and Its Role in the Phylogeny and Ontogeny of Action Understanding, *Developmental Psychology*, 45 (1), p.109.

"These results indicate that children with autism are impaired in smoothly chaining sequential motor acts within a reaching-to-grasp-to-eat intentional action sequence. This impairment is

then mirrored in the action observation condition and most likely accounts for their difficulty in directly understanding the intention of the observed action when executed by others."

[48] Grush, R. (2004). The emulation theory of representation: Motor control, imagery and perception. *The Behavioral and Brain Sciences*, 27, p.381.

"To the extent that the process noise is small compared to the sensor noise, the a priori estimate will be more reliable than the observed signal, and so a smaller portion of the residual correction is applied to the a priori estimate. To the extent that the sensor noise is small compared to the process noise, the observed signal is more reliable than the a priori estimate, and so a greater portion of the residual correction is applied."

[49] Todes, S. (2001). Body and World. MIT Press, p.228.

"...[T]he very rationality of our theoretical reason is a representation of a hoped-for-world, better than the one we live in. Reason is not just facilitated by hope; it is itself a way of hoping. We are vulnerable in the perceptual world we find ourselves in. The possibilities of disappearance, dissatisfaction, destruction and disillusion can never be entirely driven away; we can never do more than hold them at bay, for the time being. Our knowledge is that of a precariously balanced judgement, which has to shift with shifting circumstances."

[50] Inzlicht, M., *et al.* (2011). The need to believe: a neuroscience account of religion as a motivated process, *Religion, Brain & Behavior*, 1 (3), p.205.

"So primes of order resulted in reduced states of distress. Importantly, order was all that mattered; whether this order was personally scrutable or not did not affect subsequent states of error-related distress. In other words, our two order conditions capture two kinds of epistemologies, one where order is personally known, and one where it is exclusively known to some external force (or agent). The fact that incomprehensible order also relieved states of distress suggests that what is

important is the existence of a “master-plan,” and that personal knowledge of this plan is almost superfluous. This is consistent with research indicating that people seek to increase feelings of control, even if that means it is someone (or something) else that is doing the controlling.”

# SURFISM

The fluid foundation of consciousness

Surfism is a philosophy that views existence in terms that correspond to surfing.

The perceptual link between surfing and surfboard design provides a way into the mind by showing how spatial perception underpins consciousness.

'Dan writes for us surfers, though his concepts will be understood and debated by existential philosophers.'

Pierce Flynn, Ph.D

'I think the greatest minds are those who can draw the broadest analogies and metaphors between apparently unrelated stuff. In fact, it is pretty amazing that the mind is capable of such things! In this regard, *Surfism* is a veritable *tour de force!*'

Steven Lehar, Ph.D

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