Design without a designer?—the unsolved problem of coordination

Richard W. Toosey

The essential nature of design can be defined as the generation of organized functional systems. Central to this process must be the active coordination of independent variables, these being principally the form and materials of each component part, and the relationship of components. Coordination is required at all levels of design—whether of individual elements, systems of parts, or the integration of whole systems. Natural selection theory, however, must assume coordinated improvements as already given. This is illustrated here with particular reference to the classic vertebrate eye sequence. At each stage this can be shown to fail Darwin's own test of full functional gradualism, the basic premise of evolution. Both empirical design experience and analysis show that only some basic design properties are continuously variable; even these require coordination for function. An equal number, however, are inherently systemic; i.e., inherently incompatible with evolution. It is also explained why functional systems cannot ever be generated by scientific laws of regularity.

Coordination is both the process and result of design

All design necessarily consists of matter coordinated in both form and appropriate material properties, and the relationship between parts (structure in its more general sense). Timing or sequence of construction also requires coordination. The same form can be made in different materials, though, and form and materials are themselves effectively infinitely variable. There is no physically necessary relationship between the two. Living systems are composed of up to trillions of cells, which could each be of thousands of different material specifications. The need for active coordination will be immediately apparent, as will the impossibility of achieving it by fully random variations.

As one example, in the knee joint the form of the end of the femur with its two condyles must be coordinated with the form of corresponding depressions in the upper tibia. The bones must be consistently of one material, separated by a different cartilage material to avoid friction. The connecting cruciate ligaments must be accurately placed and composed of another material specified for tensile strength (collagen/elastin). If any of these correspondences were missing, the knee would not function, making it inaccessible by a series of gradual steps.[1] Continuity of function is essential not only in Darwinian theory, but in life itself. Richard Dawkins includes the knee among the "living wonders that Darwinism uniquely does solve ... by breaking the improbability up into small, manageable parts";[2] but, oddly, he omits to expand on this claim.

Coordination and irreducible complexity

The term 'irreducibly complex' (ic) was introduced by microbiologist Michael Behe as describing "a single system composed of several well-matched, interacting parts that contribute to the basic function, wherein the removal of any one of the parts causes the system to effectively cease functioning."[3] 'Well-matched' here is synonymous with coordinated, but his focus was on dimensional/geometrical coordination (as also in his mousetrap illustration), and on the irreducible number of parts. In larger scale anatomy the matching of numerous different material specifications with functional requirement is a further aspect of coordination, which I would wish to highlight here.

He also limits the definition to a single system, which at this smallest of biological scales (the nano-scale motor) is valid. The knee though is not a single system. Its function is dependent on the thigh muscles, their blood supply and nervous control by the brain, and indeed cellular functions down to those nano-scale 'machines'. Life thus requires the coordination not only of the parts within systems, but of systems with other systems. There are eleven such major systems in the body; respiratory, cardiovascular, nervous, muscular, skeletal, gastrointestinal (digestive), renal/urinary, integumentary (skin), immune/lymphatic, endocrine (hormonal) and reproductive. This total coordination argues *a fortiori* against evolutionary gradualism.

In a far simpler human design this principle can be seen in the motor car (which, significantly, appeared at a defined time in history). It needed *simultaneously* coordinated but individually ic systems. The ic combustion engine, the ic steering system, the ic transmission system (and wheels), the ic braking system, the ic chassis: all must be coordinated dimensionally and spatially. Here, the removal of any one of the *systems* causes the whole to effectively cease functioning; although some subsequently added sub-systems could be lost and are therefore 'reducible'—(instrumentation, say). Here, though, one may suspect that analogies must not be pushed

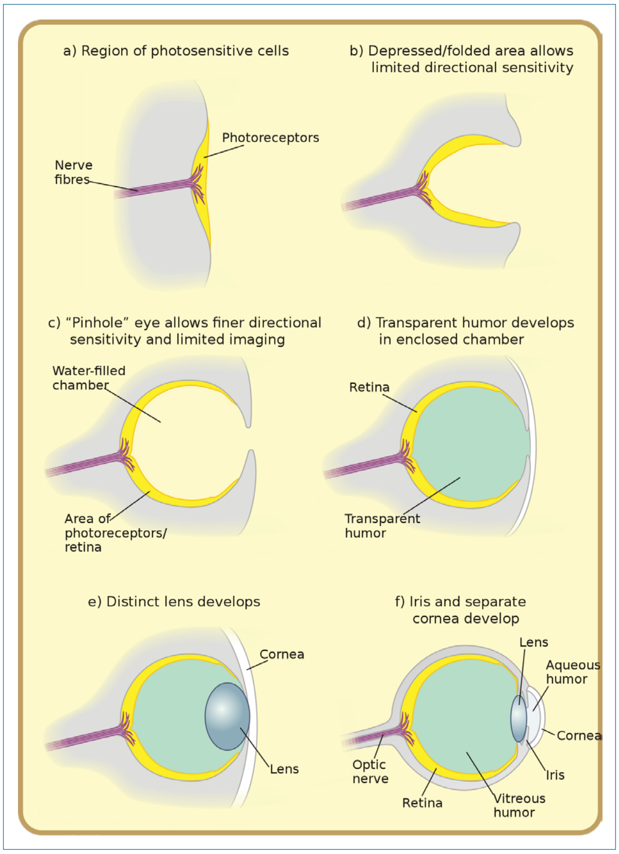

Figure 1. The evolutionary vertebrate eye sequences

too far; it does not follow that creation, too, followed any additive path over time.

A biological example is that of vision. This is an irreducibly complex system, even with only a few photoreceptor cells (themselves ic). That is because its usefulness is dependent also on a central information receiving and decision-making centre, controlling a further mechanism enabling the organism to react accordingly. However, we can theorize the progressive addition of further photoreceptors—providing they are correctly located and integrated with the brain. There can clearly be degrees of visual acuity—degrees of complexity—but the *sine qua non* of design is coordination. The problems besetting gradual eye evolution (discussed below) are in any case so extensive that there is no reason to suppose that it occurred at all.

Our own design experience illuminates the considerable challenge of integrating different systems. A building's structure for instance must be integrated with various services (heating, ventilation, plumbing, electrical) while avoiding clashes between them. This requires an overall design strategy or awareness of the irreducible requirements of each system. It is certainly seen in anatomy; as in the way the spinal cord nerves are accommodated by holes in the structural vertebrae, branching laterally to the rest of the body, while the vertebrae have extensions to link with the muscular system. It is this overall coordinating role that is central to design.

Reducible complexity

The problem for general evolution is to explain the origin of systems—'uphill' development, with continuity of function. Creation in total contrast, starts from an initial fully functional point, or rather points (kinds), which include the availability of variations in form and colour. These *already existing* traits can be 'selected' from, which is essentially a reductive process.

It is such processes that turn out to underlie what is commonly termed evolution—as Michael Behe himself further illuminates in his book *Darwin Devolves*.[4]

Another form of reduction involves the slow loss of genetic information by small reproductive errors which accumulate in the genome, described by geneticist John Sanford in *Genetic Entropy*.[5] He compares it to small losses by corrosion, again commencing from a perfect starting point.

The need for a design safety factor or initial 'overdesign' may be in view here. In any case if irreducibility disproves Darwinism, it does not follow that *every* useful feature must be indispensable.

Self organization'?

Evolutionary theorists sometimes seek an alternative to creation in ideas of 'self organization'. On the face of it, this is logically incoherent, equivalent to 'self creation'. The examples proposed do little to dispel that conclusion. One such is the ripple patterns 'emergent' in sand grains following the action of wind and waves. It is quite illogical to describe the sand grains themselves as *self* organizing though. Another is the coordinated *movement* in shoals of fish or flocks of birds, resulting from each intelligently or instinctively following a 'rule' relative to its neighbour without requiring any external coordinating agent. But patterns are not analogous to functional systems.

Why would the same cell type (bone generating, for example) self organize into many radically *different* bone morphologies, each specifically adapted to its particular location? The application of rules can certainly generate some kinds of regularity, or patterns, but a universal feature of functional design is that it is always highly specific and, at some point, *irregular* (though often within an overall general symmetry). This differs from the coordinated but non-functional regularity of a crystal lattice, for example. No rule could specify the highly varying and irregular but functional shape of each bone. *No functional design can be generated by rules alone.*

In truth it must be admitted that the actual process of morphogenesis and the way it is coded are still not well

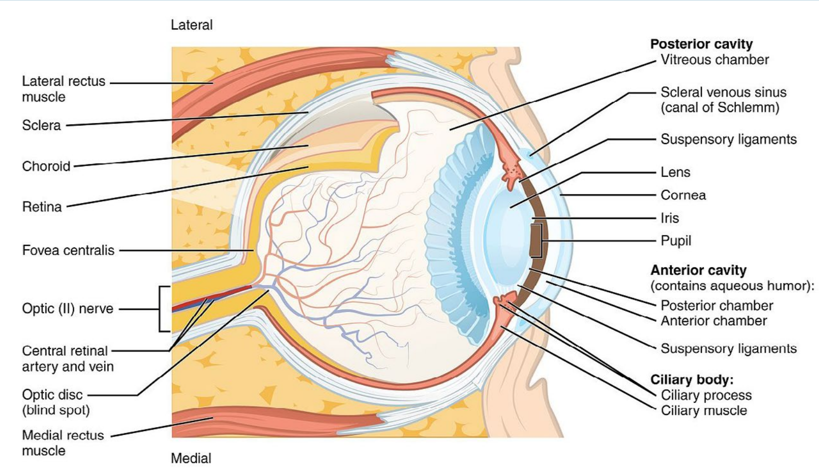

Figure 2. The eye in section

understood;[6] although the information must clearly be present to enable reproduction. It must also be very remarkable to extend even to the small details and precise shapes of anatomy. Wherever the information resides, it must yet again be closely coordinated with the coding for material specification. We do know that under 2% of the genome codes for proteins.

The denial of intelligence

Darwin's hope was to provide a fully naturalistic or materialist theory of evolution, precluding any intelligent input. As he wrote in a letter to Charles Lyell dated 11 October 1859:

> "I would give absolutely nothing for theory of nat. selection, if it require miraculous additions at any one stage of descent."[7]

This was in reply to a letter from Lyell (a deist) of 4 October 1859, whose comments on the soon to be published *Origin* included the suggestion that:

> "… it would be better to put more broadly and fairly how little it explains, and how much of the mysterious intervention of some other & higher & what we call creative power is required … ."[8]

It seems that even Lyell (uniformitarian as a geologist) appreciated better than Darwin the inadequacy of natural selection alone to account for true origins. Genetics would eventually prove him right.

Darwin's assumption that selection theory provides a radical alternative to design has for long been uncritically bought into. Even in 2007, biologist Francisco Ayala wrote that Darwin's 'discovery' was 'design without a designer'.[9] Yet Darwin himself admitted repeatedly in the *Origin of Species* that he had no idea where the variations he studied actually came from,[10] and that natural selection could 'do' nothing without them. (Here he did acknowledge the doubt expressed by Lyell). In reality though, because natural selection is not an 'agent', differential survival is built in to his key assumption of beneficial 'uphill' or constructive advances. He was ultimately taking for granted the same gradual evolution with common descent as had various philosophers writing decades earlier.[11]

The development of genetics left no obvious alternative for naturalistic theory but to appeal to chance alone as the true origin of variation. Mathematician Sir Fred Hoyle described this as "the real plunge into a logical abyss ... taken by his followers rather than by Darwin himself."[12] Chance has no power to coordinate widely different materials according to function; or even to generate the lengths of protein coding required to specify those materials in the first place, as Hoyle showed mathematically.

Darwin's own stated test of what he called "my theory", meaning specifically natural selection following "successive, slight modifications", was that every such modification must be *selectable*. This requires improved function at *every* stage; i.e., function itself must be very gradually graded for all required aspects of design. This means that to test his theory as one of *design*, necessarily involves testing it against specific design problems. This requires a design analytic approach, not an abstractly theoretical one.

So what are the essential elements or properties of design?

The elements of design

Whatever their level of complexity, biological or not, functional systems share the following elemental properties:

1. material specification
2. form
3. structure (both as support, and relationship of parts) [S]
4. mechanism (moving parts) [S]
5. control and regulation systems [S]
6. colour.

To these may be added the means of specification itself, to carry the information required; i.e., coded or written information in some form, which is translated into production. Some simpler designs may not feature every one of the above properties, but they are all present in life.

The properties not labelled 'S' are in principle fully variable on a gradual basis (but still require coordination for function, being independent of each other). These may seem the most initially promising areas for gradualist theory. The remaining three, however, are intrinsically systemic (S) and thus highly problematic for evolutionists. A system, after

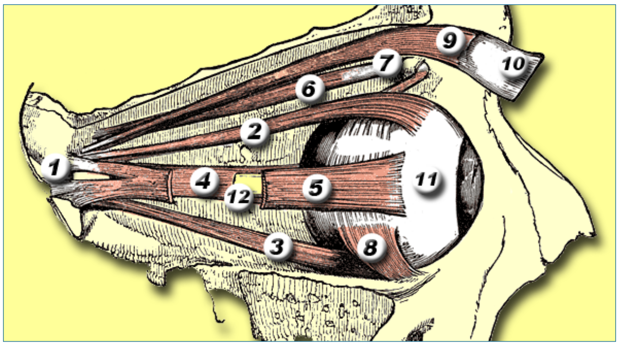

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Figure 3. Lateral view of the right human eye showing muscles and related structures: 1) sphenoid bone, 2) superior rectus, 3) inferior rectus, 4) medial rectus, 5) lateral rectus, 6) superior oblique, 7) trochlea, 8) inferior oblique, 9) levator palpebrae superior, 10) tendon, 11) sclera, 12) optic nerve.

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Figure 4. A cable stay bridge under construction

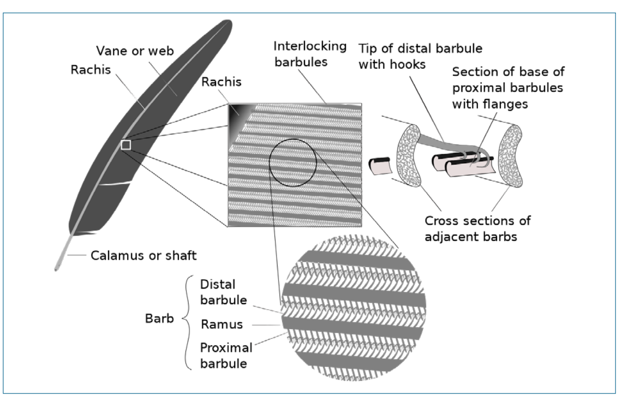

Image: Shyamal, Wikimedia / Public Domain

Figure 5. Flight feather interlocking structure

all, by definition, is "a group or combination of *interrelated, interdependent or interacting elements forming a collective entity* [emphasis added]" (Collins).

The above properties may now be looked at briefly in turn, with initial examples being taken from the classic vertebrate eye sequence (figures 1 and 2).

Material specification

The eye lens has a unique cellular architecture comprising a single layer of cuboidal cells, the transparent lens capsule which differentiates into lens fibre cells. These are tightly packed, very elongated cells, their structure somewhat resembling the rings of an onion and producing high levels of the crystallins essential for transparency. The eye contains the only tissue in the body which is truly transparent and colourless, located exactly where it is essential for function.

The overall form, of course, is a biconvex lens shape. A different material specification would be functionally useless, as would indeed a different form, orientation, size, or placement in the body. Thus, the result cannot be approached by way of the right form in any of the numerous opaque possibilities, or the right material in the wrong shape, orientation, size or overall location. The lens, seemingly but a single 'element' of the system, itself requires much coordination. It also has to be a little flexible to allow focussing by the ciliary muscle, which holds it in place. If 'evolved', it would just have to stay in position while awaiting the supposedly unplanned arrival of its supporting ligaments, ciliary muscle and nerves.

Material specification is important even at the base of biological organization. Its molecular building blocks (amino acids) are almost exclusively 'left handed' (they occur in mirror images), while their synthesis always produces an undifferentiated mixture. This again represents an apparently 'artificial' selection or purification of materials, as frequently required in known design.

Form

This can be considered in relative isolation in the context of the curvature of the retina, which is theorized to have given a gain of function over a primitive flat surface by improved sideways perception. This reaches a maximum at the half sphere point (180°). Beyond this, as it moves towards circular enclosure, sideways vision becomes *worse* while still almost as far as possible from the 'pinhole' stage. By the same logic of sideways vision, it should therefore be deselected. Thus the tight correspondence between change and gain of function, required by Darwin, as above, does not actually exist.

However, form is one of the genetic variables which is selectable within a created genome (birds' beaks being a classic example). Overall somatic form is also variable, but this must remain coherent, never truly random variation.

Structure

The evolution of the structural wall of the eyeball (sclera) is another problem for gradualism. This, too, is just added to the sequence, appearing as an outline in the final cross section. What functional advantage could this provide, without its three pairs of controlling muscles? (figure 3). To repeat, Darwinian selection requires *continuity* of function.

By Darwin's own admission, "A nascent organ, though little developed, must be useful in every stage of development."[13] This is often impossible to visualize in the adult form, as against embryonic development which is free of functional demands. For example, what functional use could apply to small bone nodules developing adjacent to the thoracic vertebrae in the adult stage? They are only useful as ribs when substantially developed.

Our own experience of design shows that structures are only useful when complete. This is simply demonstrated by looking at any bridge under construction (figure 4). How is it to be crossed? Note though that the cable stay bridge is not 'absolutely' irreducible. It includes redundancy, in fact one advantage of the type is that individual stays can be replaced. It is, however, fully coordinated.

A further example of structure is the flight feather and contour feather (figure 5) which are only functional when all the many hundreds of lateral barbs and their connecting, paired (complementary) 'barbules' are in place and coordinated *in the same plane* when each could vary randomly about their origin point. Function requires them to provide a plane surface resistant to wind or water (in the latter case, completed with oil from a preening gland), repairable by preening when overstressed.

The underlying downy feathers perfectly serve a quite different function—insulation. Again there is no *functional* advantage in any halfway point. Optimal design is always specific to function. This is the fatal flaw in the idea of 'co-opting' one function for another.

Image: AlexDuarte, Wikimedia / PD-self

Figure 6. Coloured patterns in feathers

Image: TAPAS KUMAR HALDER, Wikimedia / CC BY SA 4.0

Figure 7. Colour attracts the bee to pollinate flowers.

Mechanism

The muscles controlling the eyeball (figure 3) constitute a mechanism. Muscles are often arranged in complementary pairs; in this case, three pairs to provide a full range of directional control. It hardly needs saying that they must be correctly positioned and complete between their insertions, including integration with the nervous system. Thus evolution theorists can only say something like 'enervated muscles arise', as with the ciliary muscle.

Consider, especially, the superior oblique muscle attachment (labelled '6' in figure 3). Its origin is behind the eye; its anterior attachment to the eyeball is via an elongated tendon which passes through a small U-shaped piece of cartilage attached to bone over the eye (trochlea; labelled '7' in figure 3). It thus constitutes a pulley mechanism, enabling reversal of the pulling force (from the front in other words). This represents, if it were possible, an even more severe challenge to imagining a gradual functional evolutionary pathway.

Stephen J. Gould admitted:

> "… our inability, even in our imagination, to construct functional intermediates in many cases has been a persistent and nagging problem for gradualistic accounts of evolution."[14]

One has to ask, what would be recognized as an insoluble problem?

The same failure has attended all attempts over a quarter of a century to counter Michael Behe's demonstration of irreducible complexity in the bacterial flagellum (a miniature motor). After reviewing them at length in *A Mousetrap for Darwin*, he concludes:

> "At this point in science's investigation of life it seems like just a cruel taunt to challenge Darwinian biologists to experimentally justify the ability of random mutation and natural selection to make an irreducibly complex molecular machine."[15]

Systems of control and regulation

In life, these are governed by the nervous system, all under the control of the brain as the central coordinator and regulator of the body's interdependent systems. Each control system requires *three* essential parts—one to detect what needs to be controlled, a second to apply decision logic, and a third to change the thing being controlled. This is required for many life-critical physiological parameters which must be kept within a narrow range, such as respiratory and heart rates, blood pressure, and core temperature.[16]

An example is the response of the eye pupil, which contracts or expands in response to the level of light available. This is also a protective reflex that prevents damage. The detection is by the photoreceptor cells, the decision logic by the brain, and the active control by the two different muscles operating the iris. Similar control systems apply to the lens focussing and eyelid muscles.

Colour

In the eye, detection of colour is concentrated at the centre of the eye, each eye having about six million cone cells. Each of these makes one of three light sensitive molecules which react to specific wavelengths of visible light—either red, green, or blue. Since each cone reacts to just a single colour, this requires a fairly even distribution of each type. The photoreceptor cells pre-process the sensory information before sending the results along the optic nerve to the brain. This alone is a hugely complex biochemical process and a critical requirement for vision.

Colour in nature can be both functional and a source of added beauty. Its organization in specific locations, such as feathers or flower petals (figures 6 and 7) comprising numerous cells, poses similar problems to those already discussed. Why should colourful bird plumage be subdivided into well-defined areas, seemingly independent of function? And where such concentration does provide function, as in the flowers which attract pollinators, how would only faint colours be of help? Of course this would require that bees, etc. already had excellent colour vision, making ‘co-evolution’ meaningless. (Both being weak would be worse). Thus, even above the level of individual organisms, we find a functional interdependence between them which is hard to make sense of in terms of sequential development.

Conclusion

Natural selection enables variation based on already existent genetic information but does not enable *increases* in complexity.

Darwin’s criterion for falsification has been repeatedly met. Systemic properties are inherently only present when the system is complete, and extended time is therefore of no help.

Input of functional information must *always* be coordinated, regardless of complexity.

Functional systems are inherently irregular (aperiodic), and so cannot be generated by natural laws, which can only deal with regularities. Like art, design will always lie beyond the important realm of pure science.

Glossary (from *Collins Dictionary*)

Coordinate: “1) to integrate diverse elements in a harmonious operation” (“*integrate*: make into a whole”). Because diverse elements are not yet integrated, they must be so *at the same time* under some means of external control.

Information: a basically immaterial, or supra-material concept of knowledge that can be transmitted in different material ways. In a design context, though, it is essentially the same as “3) *specification*: a detailed description of the criteria for the constituents, construction, appearance, performance etc., of a material, apparatus, etc.”. This must of course be a fully sufficient description. In design work this stage is referred to as ‘production information’.

Structure: “1) a complex construction or entity” is the sense generally used here, especially in load bearing. “2) the arrangement and interrelationship of parts” is a secondary definition.

Mechanism: “1) a system or structure of moving parts that performs some function”.

Irreducibly complex: anything which cannot be made in small steps, each with function.

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Richard W. Toosey *B.A., Dip.Arch., RIBA (retired) is an English architect/artist whose professional life was in design practice. He has published* Design and Natural Selection: A comparative study, *Michael Terence Publishing, Amazon, 2022.*