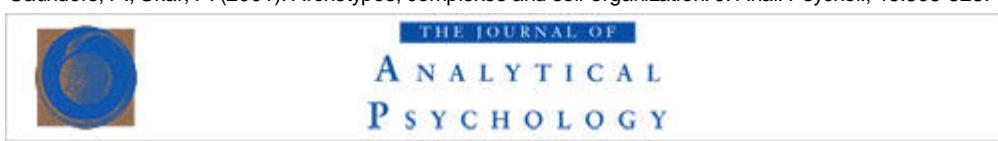


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## Archetypes, complexes and self-organization

*Peter Saunders and Patricia Skar, MFA* ⓘ

There has always been confusion and disagreement about the nature of the terms *archetype* and *complex* in Jungian circles, not to mention non-Jungian ones. Another ongoing concern is whether Jung's concept of the archetype and complex can be justified in terms of current scientific research, most notably that of neurophysiologists and others interested in the brain and consciousness. This paper proposes a theory of the formation of complexes, namely, that they are created through self-organization within the brain/mind.

Self-organization is a process typical of large complex systems, and is generally accepted to operate within the brain and to be important in its functioning. Examples of self-organization in biology are related to the psychic processes that form the complexes. It is then natural to define the archetype in terms of the complex, and the authors propose a definition of the archetype as an equivalence class of complexes. On this view, the archetype is an emergent property of the activity of the brain/mind, and is, appropriately, defined at the level at which it emerges. This definition is in line with the original development of Jung's ideas, in that he derived the concept of the archetype from his earlier discovery of the feeling-toned complex.

In 1956, in the Foreword to Jolande Jacobi's book, *Complex/Archetype/Symbol in the Psychology of C. G. Jung*, Jung wrote:

*It is now exactly fifty years since I learned, thanks to the association experiment, the role which complexes play in our conscious life. The thing that most impressed me was the peculiar autonomy the complexes display as compared with the other contents of consciousness. Whereas the latter are under the control of the will, coming or going at its command, complexes either force themselves on our consciousness by breaking through its inhibiting effect, or else, just as suddenly, they obstinately resist our conscious intention to reproduce them. Complexes have not only an obsessive, but very often a possessive, character, behaving like imps and giving rise to all sorts of annoying, ridiculous, and revealing actions, slips of the tongue, and falsifications of memory and judgment. They cut across the adapted performance of consciousness.*

*It was not difficult to see that while complexes owe their relative autonomy to their emotional nature, their expression is always dependent on a network of associations grouped round a center charged with affect. The central emotion generally proved to be individually acquired, and therefore an exclusively personal matter.*

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*Increasing experience showed, however, that the complexes are not infinitely variable, but mostly belong to definite categories, which soon began to acquire their popular, and by now hackneyed, designations - inferiority complex, power complex, father complex, mother complex, anxiety complex, and all the rest. This fact, that there are well-characterized and easily recognizable types of complex, suggests that they rest on equally typical foundations, that is, on emotional aptitudes or instincts. In human beings instincts express themselves in the form of unreflected, involuntary fantasy images, attitudes, and actions, which bear an inner resemblance to one another and yet are identical with the instinctive reactions specific of Homo sapiens. They have a dynamic and a formal aspect. Their formal aspect expresses itself, among other things, in fantasy images that are surprisingly alike and can be found practically everywhere and at all epochs, as might have been expected. Like the instincts, these images have a relatively autonomous character; that is to say they are 'numinous' and can be found above all in the realm of numinous or religious ideas.*

*For reasons that I cannot enter into here, I have chosen the term 'archetype' for this formal aspect of the instinct ... The concept of the archetype has given rise to the greatest misunderstandings and - if one may judge by the adverse criticisms - must be presumed to be very difficult to comprehend ... My critics, with but few exceptions, usually do not take the trouble to read over what I have to say on the subject, but impute to me, among other things, the opinion that the archetype is an inherited representation. Prejudices seem to be more convenient than seeking the truth.*

Jung concludes his Foreword by expressing the fervent wish that Jacobi may be able to 'shed a little illumination' on the subject, and in doing so, spare him 'the labor of having constantly to refer my readers to my own writings' (Jacobi 1959, pp. ix-xi).

Another half-century on, Jungians are still arguing about the meaning of the term archetype, struggling to remain faithful to Jung's conception while increasingly attempting to ground the concept in examples from other fields, notably ethology and evolutionary psychology (see, for example, Stevens & Price, *Evolutionary Psychiatry* and Stevens, *Archetype: A Natural*

*History of the Self).* However, while Jungians can find analogies for the theory of archetypes in other fields, these fields have shown little interest in adopting the Jungian terminology in return. Reasons for this might include the fact that the theory of archetypes (like so much else in Jungian theory) has not been consistently and clearly defined by Jung or his followers, and therefore has not succeeded in attracting the interest of those in other contexts who could lend new dimensions to our understanding of the efficacy of the concept.

There is an increasing feeling that the social sciences, including psychology, cannot be free-standing: they must be connected in some way with the natural sciences. Just as biologists became dissatisfied with their concept of an archetype except in so far as they could interpret it in terms of evolutionary theory, so social scientists are also seeking to ground their concepts in biology. Jung, of course, was very interested in the biological nature of human beings. He often connects his ideas about the archetype to animal behaviour, as in the following:

*Of course this term [archetype] is not meant to denote an inherited idea, but rather an inherited mode of psychic functioning, corresponding to the inborn way in which the chick emerges from the egg, the bird builds its nest, a certain kind of wasp stings*

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*the motor ganglion of the caterpillar, and eels find their way to the Bermudas. In other words, it is a ‘pattern of behaviour’. This aspect of the archetype, the purely biological one, is the proper concern of scientific psychology.*

(Jung 1949/1977, para. 1228)

In a lecture given in 1957, Jung explains how his work with schizophrenics contributed to his formation of the concept of the archetype (and of course, led him to expand Freud's idea of the unconscious):

*It was this frequent reversion to archaic forms of association found in schizophrenia that first gave me the idea of an unconscious not consisting only of originally conscious contents that have got lost, but having a deeper layer of the same universal character as the mythological motifs which typify human fantasy in general. These motifs are not invented so much as they are discovered; they are typical forms that appear spontaneously all over the world, independently of tradition, in myths, fairy-tales, fantasies, dream, visions and the delusional systems of the insane. On closer examination they prove to be typical attitudes, modes of action - thought-processes and impulses which must be regarded as constituting the instinctive behavior typical of the human species. The term I chose for this, namely ‘archetype’, therefore coincides with the biological concept of the ‘pattern of behaviour’. In no sense is it a question of inherited ideas, but of inherited, instinctive impulses and forms that can be observed in all living creatures.*

(Jung 1958/1972, para. 565)

But Jung was concerned to explain the archetype as possessing both a somatic and a spiritual pole:

*Since psyche and matter are contained in one and the same world, and moreover are in continuous contact with one another and ultimately rest on irrepresentable, transcendental factors, it is not only possible but fairly probable, even, that psyche and matter are two different aspects of the same thing.*

*... the position of the archetype would be located beyond the psychic sphere, analogous to the position of physiological instinct, which ... forms the bridge to matter in general. In archetypal conceptions and instinctual perceptions, spirit and matter confront one another on the psychic plane. The ultimate nature of both is transcendental, that is, irrepresentable, since the psyche and its contents are the only reality which is given to us without a medium.*

(Italics in original; Jung 1954b/1969, paras. 418 & 420)

The last sentence of this quotation is an example of where the confusion about the term archetype begins. For Jung, the archetype is ‘irrepresentable’ and ‘transcendental’ - it doesn't ‘exist’ anywhere in a concrete sense. However, Jung clarifies that the archetype is connected to process:<sup>1</sup>

*Contents of an archetypal character are manifestations of processes of the collective unconscious. Hence they do not refer to anything that is or has been conscious, but to something essentially unconscious. In the last analysis, therefore, it is impossible to say what they refer to. Every interpretation necessarily remains an ‘as-if’. The ultimate core of meaning may be circumscribed, but not described.*

(Jung 1963/1980, para. 265)

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And further:

*As to the psychology of our theme I must point out that every statement going beyond the purely phenomenal aspects of an archetype lays itself open to the criticism we have expressed above. Not for a moment dare we succumb to the illusion that an archetype can be finally explained and disposed of ... Hence the ‘explanation’ should always be such that the functional significance of the archetype remains unimpaired, so that an adequate and meaningful connection*

*between the conscious mind and the archetypes is assured. For the archetype is an element of our psychic structure and thus a vital and necessary component in our psychic economy. It represents or personifies certain instinctive data of the dark, primitive psyche, the real but invisible roots of consciousness.*

(Italics in original; ibid., para. 271)

For our purposes, the key phrases in this paragraph are ‘the functional significance of the archetype’ and ‘the real but invisible roots of consciousness’. Jung reminds us that the archetype is a *dynamic* entity - not something static. In ‘the real but invisible roots of consciousness’, he refers to the idea, expounded at greater length in the article containing this quotation, that consciousness has arisen out of a *participation mystique* of identification with the world. As humankind has evolved, the important experiences and symbols that have emerged help us to function and make meaning and order out of the chaos of our experience:

*The forms we use for assigning meaning are historical categories that reach back into the mists of time - a fact we do not take sufficiently into account. Interpretations make use of certain linguistic matrices that are themselves derived from primordial images. From whatever side we approach this question, everywhere we find ourselves confronted with the history of language, with images and motifs that lead straight back to the primitive wonder-world.*

*... Ultimately they are all founded on primordial archetypal forms whose concreteness dates from a time when consciousness did not think, but only perceived.*

(Italics in original; Jung 1954a/1980, paras. 67 & 69)

With the use of the word ‘concreteness’ we are now back on dangerous ground in terms of the aforementioned confusion about the nature of the archetype. We find ourselves in the territory of transcendental forms as Jung traces the word ‘idea’ to the

ειδος

concept of Plato, saying that ‘the eternal ideas are primordial images stored up

εν ουπερουρανιω τοπῳ

(in a supracelestial place) as eternal transcendent forms’ (ibid., para. 68).

What are these ‘eternal transcendent forms’? And what does ‘transcendent’ mean here? Two dictionary definitions of ‘transcendent’ which seem relevant to this passage are: ‘beyond consciousness or direct apprehension’ or ‘free from the limitations inherent in matter’ (Hanks 1986, p. 1614). In a psychological sense, these definitions point to the realm of the unconscious. And of course, Jung confirms this:

*We must rather suppose that they [the archetypes] are something like universally existent constituents of the unconscious psyche, which form, as it were, a deeper*

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*stratum of a collective nature, in contradistinction to the personally acquired contents of the more superficial layers, or what one may call the personal unconscious. I consider these archetypal patterns to be the matrix of all mythological statements. They not only occur in highly emotional conditions but also very often seem to be their cause. It would be a mistake to regard them as inherited ideas, as they are merely conditions for the forming of representations in general, just as the instincts are the dynamic conditions for various modes of behavior. It is even probable that archetypes are the psychic expressions or manifestations of instinct.*

*... The individual mind cannot be understood by and out of itself. For this purpose a far more comprehensive frame of reference is needed; in other words, investigation of the deeper-lying psychic strata can be carried out only with the aid of other disciplines.*

(Jung 1957/1972, paras. 550 & 551)

What are these other disciplines? In terms of his own research, they included for Jung: religion, mythology, alchemy, history, philosophy, linguistics, biology and physics, to name a few. It would be safe to say that the concept of the archetype, inferred from his observations of complexes and his extensive study and researches into human behaviour and culture, formed the centre of Jung’s ideas. But because of the wide-ranging application of the term ‘archetype’ in Jung’s writings, it is no wonder that confusion about its meaning has been one of the results. We hope to clear up some of this confusion by focusing on the concept from a biological standpoint, while continuing to recognize the importance of the spiritual ‘pole’ of the archetype as well.

## Historical considerations

In biological thought, it was towards the end of the eighteenth century that what was known as the archetype became an important issue. There was at the time a great interest in classifying organisms, especially after Linnaeus had established the hierarchical system which bears his name. Present day biologists are so accustomed to the idea that species can be arranged in a hierarchical order that they generally take it for granted. If they think about it at all, they see it as an obvious consequence of evolution: species resemble each other because they are descended from common ancestors. A few basic body plans (*Baupläne*) became established early on, through a combination of suitability for function on the one hand and chance on the other, and these

have persisted. For example, it is held that most animals have four limbs because they have evolved from fish, and fish need at least four fins for stable motion through water, just as aircrafts need two wings and two tail planes for stable flight.

Pre-Darwinian biologists, however, did not have such explanations, and like Jung a century or so later, they were struck by the way that the phenomena they were studying seemed to divide naturally into categories when there seemed no obvious reason why they should. The basic forms, the archetypes, were therefore seen as significant in their own right.

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One of the best known of the ‘rational morphologists’ was Goethe. He believed that all plants and animals are manifestations of archetypes, the *Urpflanze* and the *Urtier*, respectively. He also believed that the different parts of a plant - petals, sepals, leaves and so on - are manifestations of a single archetype. He wrote, ‘... in the plant organ which we ordinarily call the leaf a true Proteus is concealed, who can hide and reveal himself in all sorts of configurations. From top to bottom, a plant is all leaf ...’ (Miller 1988, p. 327). He did not, however, mean that the leaf itself was the basic form of which the others were modifications:

*Here we would obviously need a general term to describe this organ which meta-morphosed into such a variety of forms, a term descriptive of the standard against which to compare the various manifestations of its form. For the present however, we must be satisfied with learning to relate these manifestations both forward and backward. Thus we can say that a stamen is a contracted petal or, with equal justification, that a petal is a stamen in a state of expansion; that a sepal is a contracted stem leaf with a certain degree of refinement, or that a stem leaf is a sepal expanded by an influx of cruder juices.*

(Miller 1988, p. 96)<sup>2</sup>

Note that while Goethe accepted that he did not (yet) know the nature of the archetype itself, he still considered it a useful concept not only in trying to understand the common properties of the parts of a plant but also in discussing how different conditions operate to produce the various different actual forms.

Jung was dealing with a problem very similar to that which had faced Goethe many years before. He had recognized that the complexes he had identified came in categories, just as species come in *genera*, and so on. He considered this a significant observation and one that contributed to his task of understanding the phenomena, and yet he could see no mechanism that was responsible. So like the rational morphologists, he chose to work closer to the level of the phenomena themselves, and to speak of archetypes. He may well have taken the idea and term directly from Goethe,<sup>3</sup> since it was no longer common in the scientific literature. In science, the word ‘archetype’ seems to be used only when no mechanical explanation can be found for the similarities to which it refers. Biologists stopped writing of archetypes after Darwin, while physicists have hardly used the term at all: no one speaks of the conic section as the ‘archetypal’ orbit of a planet (see Saunders 1988).

Jung could not, however, take the idea over unchanged, because there are important differences. Physiological form is comparatively stable. A leaf or an arm is formed during the development of the organism and it keeps that form until it dies. In contrast, complexes are dynamic. They continue to change during life, and can even undergo significant alteration. They are also associated with powerful forces; something which touches a complex is likely to have a profound effect on an individual.

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What appear to be universal in the psyche are more than just forms or patterns of behaviour, and so Jung used the term archetype more broadly than the rational morphologists had. Sometimes, to be sure, he wrote of it as a form, or rather as a potential form:

*There are as many archetypes as there are typical situations in life. Endless repetition has engraved these experiences into our psychic constitution, not in the form of images filled with content, but at first only as forms without content, representing only the possibility of a certain type of perception or action'.*

(Italics in original; Jung 1936/1980, para. 99)

However, in defining ‘primordial image’ (a precursor of the concept of the archetype in Jung’s writings) Jung describes it as ‘a self-activating organism’, ‘endowed with generative power’ (Jung 1921/1971, para. 754).

## The archetype

In this paper, we are putting forward a hypothesis about the process that forms the complex, namely, that it is self-organization within the brain/mind. We describe self-organization below, but to avoid confusion we should explain at the outset that the term is used by mathematicians and physicists to denote a process that is typical of large complex systems of many kinds. The prefix ‘self’ is used to indicate that there is no pre-existing template or external directing force and has nothing directly to do with the concept of self in psychology.

It is generally accepted by neurophysiologists and others interested in the brain and consciousness that self-organization (in this sense) occurs within the brain and is important in its functioning. On this view, therefore, the core of Jungian thought is consistent with current scientific ideas about how the brain works and is therefore as firmly rooted in biology as it needs to be.

To establish this, we must be more precise than Jung and Jungians have been in the past. In effect, Jung was conflating form

with the process which brings it into being.<sup>4</sup> Now for most purposes there has been no pressing need to make the distinction, because very little has been known about the processes themselves beyond what can be inferred from the complexes they produce. If the only known properties of the processes are actually the properties of their products, then there is little practical disadvantage in identifying the two, though it can lead to some confusion in theoretical discussions if we do not realize what we have done. What can appear contradictory if read as definitions of an archetype can be consistent if taken as descriptions of different aspects of those things that are common to all individuals.

In this paper, however, we are arguing that it is possible to have independent knowledge about the processes that are responsible for complexes, *i.e.*, that we can know more about the processes than can be inferred from the study of complexes. In that case we cannot identify the process with the set of complexes it produces. The two concepts must be separated. We must decide

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what it is that we will refer to as the archetype, and reserve the word for that. Now the analyst can recognize individual complexes. In contrast, while we know that the right sorts of processes exist, we cannot associate a particular neurophysiological process with a given pattern of behaviour. It seems natural, therefore, to define the archetype in terms of the complexes, not the processes, and this is what we shall do.

We will take an archetype to be a class of complexes which are considered to fall into the same ‘category’, as Jung put it. In mathematical language, we can say that an archetype is an equivalence class of complexes. This definition does not provide criteria for determining the equivalence classes; the point is that it expresses the key observation that Jung describes in the quotation with which we began this paper, *viz.* there are discrete categories of complexes rather than infinite variation.

Archetypes can therefore exist as biological entities without our having to postulate anything beyond the organizational capability that the brain is generally agreed to possess.<sup>5</sup> Nor do we have to decide when they appeared in evolution or, indeed, whether they were always there. They came into existence as the brain and consciousness evolved and as societies developed. They were always there in the sense that the laws of physics and chemistry on which they ultimately depend were always there, but they remained latent until there were brains sufficiently complex for them to become manifest.

While archetypal forces do not form part of our *definition*, they remain as typical properties of archetypes. We must not, however, be misled by the name, because while the forces are indeed associated with the archetype, they arise out of the complexes. In the early, crucial stages, it may require only a relatively small bias to set in motion the self-organization that will produce one of the complexes associated with the given archetype, just as a very small vortex can lead to a tornado or hurricane. As the complex develops, the ideas and experiences that are incorporated into it make it very much stronger. A new idea or experience that is (in a metaphorical sense) aligned with the complex will be drawn into it, generally being modified in the process. If it happens to be very strongly aligned with the complex to begin with, it can be drawn in immediately and directly, and the individual in whose mind this occurs will feel this as a very strong force indeed, what we sometimes refer to as a ‘numinous experience’.

A simple example of how experiences can be shaped by a complex and then, having been suitably shaped, make it even stronger, is provided by a story told by the philosopher Karl Popper (Popper 1969, p. 35). As a young man in 1919, Popper reported to Alfred Adler ‘a case which did not seem to me to be particularly Adlerian but which he found no difficulty in analysing in terms of his theory of inferiority feelings, although he had not seen the child. Slightly shocked, I asked him how he could be sure of all this. “Because of my thousand-fold experience”, he replied. Whereupon I could not help saying: “And with this new case, I suppose, your experience is now even thousand-and-one fold”’.

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Archetypal forces do not act only as a complex is first being formed, because if an experience is sufficiently strong to affect the complex, then self-organization can shape it into a somewhat different form. Moreover, if a complex is altered significantly, this can affect other complexes that depend on it, especially those that were formed later and whose own organization reflects in some way that of the earlier one.

For example, developmentally, the mother complex is formed before anima/animus complexes, which usually begin in adolescence.<sup>6</sup> We generally speak of a man’s early relationship with his mother having an effect on his later relationships with women, and the women he is attracted to later in life are thought to embody qualities of his inner anima, or the contrasexual archetype in the unconscious.<sup>7</sup> It is easy to see how the nature of the original mother complex will have a strong effect on the development of the anima complex. For example, a son who has not been able to separate from a dominant mother may choose a partner who is also quite dominant or mothering, and simply transfer his dependency onto her. In effect, the anima has been thwarted in her archetypal task of inspiring the hero to slay the dragon, *i.e.*, leave his mother. Instead, an unconscious contract between the couple is formed to perpetuate the childhood situation. The anima, which archetypally carried the potential for liberation from dependent-son status, now is symbolically subsumed by the mother complex.

Developmentally, the man still needs to separate from mother and may find himself attracted to women outside the marriage. These new anima images carry the potential for liberation from his wife, now symbolically become mother. But what really needs to be faced is the general dependency on women, either in the compulsive fascination of new anima images, or in their mothering function. Usually a man like this is terrified of being alone, *i.e.*, without a woman. When this dependency can be faced

and suffered through in the containment of the analytic relationship, there is a possibility for a symbolic separation from mother to be negotiated, and the way cleared for a mature relationship to the anima.

## Self-organization

A large shallow container is filled with water and then heated evenly from below. After a while, the water begins to move, as warmer water rises from the bottom and cooler, denser water sinks. Eventually, and spontaneously, this motion organizes itself into a regular pattern of cells, looking something like a honeycomb. The pattern does not reflect either the way in which the water was heated or the shape of the container. It is an emergent property arising out of the dynamic. A similar pattern can be observed in the formation of thermals (the rising air currents used by glider pilots and large birds), in the behaviour of large schools of the aquatic micro-organism, *Euglena viridis*, and in many other contexts.

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This phenomenon, known as Bénard convection after the French physicist who first studied it, is the classical example of self-organization, the phenomenon in which order and pattern arise spontaneously and apparently out of nothing. There is no template, and neither are the forces applied in such a way as to induce the pattern. It comes about through the action of the dynamic of the system itself; it is, we may say, latent in the nature of that sort of system.

Mathematicians and physicists have known about and analysed examples of self-organization for a long time, but it is only comparatively recently that it has become a major research topic. As more examples are studied, self-organization is more and more being seen as the typical behaviour of complex systems, rather than as an exceptional phenomenon. The ordinary laws of physics and chemistry, acting in all but the very simplest of systems, are capable of far more than we thought they were. In particular, when we consider a system as complicated as the human brain, we should not be surprised to encounter self-organization; on the contrary we should look for instances of it and expect to find them.

It is also becoming clear that self organized systems have a number of important typical properties. Not every such system will have all of them, but most will, and it is those that do not that should be seen as the exceptions. Conversely, and more crucially from the point of view of this paper, if we observe these properties in a complex system, our first assumption should be that they arise through self-organization. If we can see some other origin, well and good, but there is no need to postulate special causes, previously unknown fields, separate but invisible guiding or directing forces, or specific genes (**Saunders 1993**).

One of the most important properties of self-organizing systems is that they are typically robust, in two distinct though connected senses. First, it is not necessary to specify the conditions precisely to obtain the usual form. In Bénard convection, the container should be shallow and not too small, and the temperature should be raised fairly slowly, but the precise details are not important. As an example at a quite different level of complexity, all human beings (apart from identical twins) are different genetically, and all experience somewhat different environments in the womb, yet we are all quite similar when we are born.

Moreover, once produced, the form will persist. It can recover from even a fairly large perturbation. Even a permanent change in the environment, if not too large, will have surprisingly little effect. Self-organized systems also typically have a repertoire of configurations. If the conditions are such that a form which is not the expected one appears, then the alternative will be one of a predictable set.

Thus a self-organizing system has the characteristic properties which we associate with an archetype. The archetype it defines, however, is neither a template nor a separate directing force. The characteristic honeycomb pattern of Bénard convection does not exist, except as an abstraction, until it is realized

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in a tray of water or some other appropriate system. To be sure, a tray of water is much simpler than the psyche and so we can write down the relevant dynamical equations and see how the pattern arises. There is, however, still nothing that can be picked out and identified as the archetype. There is only the system, its dynamic, and the surrounding environment. The pattern is an emergent phenomenon.

While Bénard convection is the classical example of self-organization, it is especially simple and must seem a very long way from the archetypes in the psyche. We therefore describe here two somewhat more complex examples which illustrate more of what is possible.

### 1. Taylor-Couette Flow

Imagine two long glass cylinders of slightly different diameters, mounted on the same vertical axis and with the small volume between them filled with water. The cylinders can be rotated independently. When they are both stationary, the water is, of course, at rest. If we rotate the outer cylinder slowly, the fluid is dragged along by it and so starts to move steadily about the axis, faster near the outer cylinder and more slowly near the inner one. If we increase the speed of rotation, the fluid moves faster, but that is about all that happens. This is what we usually observe in simple physical systems: the effect is related in an obvious way to the cause and roughly proportional to it.

If, however, we keep the outer cylinder fixed and rotate the inner one, something far more interesting happens. At low speeds, the fluid moves steadily, just as before, but if we increase the speed of rotation of the inner cylinder sufficiently, there is

an abrupt qualitative change, or, as mathematicians call it, a bifurcation. The flow breaks up into a regular series of horizontal layers, with the fluid in each tracing out wavy paths. The particular speed at which this happens is called the bifurcation point. It depends on the details of the apparatus we are using, but if we repeat the experiment using precisely the same set up, the bifurcation point will be the same.

If we continue to increase the speed, a second bifurcation occurs. There are still layers, but the boundaries between them are now wavy instead of flat. As the speed increases further, more qualitative changes occur, until finally turbulence is reached and we can see no regularity at all in the flow.

Each of these configurations is robust. If you alter the speed of the cylinder, then unless you happen to pass through one of the bifurcation points, the water moves slightly faster or slightly more slowly, nothing more. The transition from one type of flow to another is abrupt, not gradual.

While rotating the outer cylinder by itself produces nothing so interesting, it turns out that the repertoire of different forms is very much increased if we allow both cylinders to rotate, either in the same or in opposite directions (see **Stewart & Golubitsky 1992** for an accessible account of this phenomenon).

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The phenomenon is stable in the sense that for a given pair of cylinders, if we specify the speeds of rotation of both, we can predict which kind of flow we should observe. If we use a different pair of cylinders, the speeds at which the bifurcations occur will be different, as will the fine details of the flow, but we will observe the same forms and in the same sequence.

Mathematicians and physicists are not in the habit of speaking of archetypes, and indeed that is not how they would describe this situation. Nevertheless, this is in effect what we have. A system of two concentric cylinders, of appropriate dimensions and with a suitable fluid between them, will produce not a single form but, depending on the conditions, a whole repertoire. The repertoire is the same for all such systems, as are the changes in conditions that cause one rather than another to be produced. There is no separate entity that can be identified as the archetype, yet the fact that its many different manifestations are common to a wide class of similar systems surely justifies us in speaking of an archetype if we find it helpful so to do.

## 2. Segmentation

Anyone studying the psyche is bound to look to embryology for parallels, and indeed there are many instances of archetypes in development. One that has been extensively studied is segmentation, a phenomenon observed in the development of many organisms, including humans. The most detailed work has been done using one of the biologists' standard test organisms, the common fruit fly *Drosophila melanogaster*. Early in its development, the embryo divides into 16 segments. These will later become the structures that make up the adult fly. The first four will form the head, the next three the thorax, and the remainder the abdomen.

An obvious first step towards understanding how this happens is to see under what conditions the process goes wrong, and what happens when it does. Most such experiments are carried out using genetic mutants. This is in keeping with the currently widespread view that biology is primarily about genes rather than organisms, but it has the disadvantage that it says nothing at all about the process that links the gene products on the one hand to the segments on the other, i.e., development.

Ho and her colleagues (e.g., Ho et al., 1983a, b) therefore worked with genetically normal fruit flies, perturbing their development by immersing them for a short time in ether vapour. The aim was to concentrate on the process rather than on the genes. This is closer to the situation in psychology, because the analyst is usually concerned with the effects of different experiences on basically similar individuals, rather than problems caused by genetic or other innate defects.

The results of the experiments were striking. In many of the embryos, some or all of the segments failed to appear.<sup>8</sup> As there are 16 segments, and in

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principle each of them could be present or not, there are  $2^{16}=65536$  possible outcomes. Of these, Ho et al. (1983a) observed only 30.

We have therefore a clear example of a dynamic which under normal conditions reliably produces the same form in each embryo, i.e., sixteen segments. If, however, the process is interfered with during development, then the abnormal forms that are actually observed are only a very small subset of all those that could conceivably occur.

The mechanism of segmentation is still not known. Nevertheless, it is still possible to make further inferences about the archetype. For example, Ho (1990) pointed out that her results could be explained by assuming that segmentation in *Drosophila* occurs by successive bifurcations. The embryo divides into two, then each half divides into two, and so on. If any division fails to occur, then no further segments can form in that part of the embryo, though other parts may continue to divide normally. On this model, the number of possible forms is reduced from 65,536 to 676, and these include the 30 that were actually observed.

Because segmentation is self-organizing, the form arises naturally from the dynamic. There is no need for something extra, driving the embryo towards 16 segments. What is more, because the archetype is essentially the dynamic itself, not only the normal form but also all the abnormalities are contained within it and can be understood in terms of it. There is also a very restricted repertoire of abnormalities: just over 1 % of the conceivable abnormal forms are allowed, and we expect we could

restrict the number further if we knew more about the process.

The archetype is robust. The embryo does not have to be exactly the right shape or length for the correct number of segments to form; anything reasonably close will do. This is typical of complex systems: they generally have a stability that ensures that they produce much the same result over a wide range of conditions. Outside this range, if the system survives at all, the outcome may be something quite different.

Note that to narrow down the set of possible abnormalities and to see the connection between this and the problem of getting the correct number of segments to form almost all the time, we do not actually have to know what the dynamic is (**Saunders & Ho 1995**). There are, in fact, a number of plausible mathematical models for the process, but we do not know which - if any - is the right one. Fortunately, this does not matter for the problems we have been discussing, because the features we have mentioned are common to all of them. This should encourage us when we are trying to understand situations in which we have little hope of discovering in any detail the physical and chemical basis of the phenomena.

## Archetypes in the psyche

In most of the systems with which we are familiar, the storage of information is static. Even in a library, considerable thought may be given to how a book

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should be classified, but once this has been decided it is given a single reference number and location which it keeps indefinitely, barring a large scale reorganization of the library.

The brain is different. We do not yet know how it stores and retrieves information, or whether it is even meaningful to speak of the 'location' of a particular piece of information at all. We do know, however, that there are complex networks of links, and that there is a constant process of organization going on (cf. **Freeman 1990**). This suggests that the brain is likely to produce the phenomena that are associated with complex, non-linear systems. This will include self-organization and we therefore agree with Tresan (**1996**) that there is no need to suppose that archetypes are *a priori* structures.

More than that, however, we can ask how archetypes arise and what properties they can have. The self-organization will be of instincts and experiences which are in some way associated, because they occur or first occur at the same time, because they relate to similar things, or in some other way (cf. **Freeman & Scarda 1991; Freeman & Barrie 1994**). We would expect these to form into structures, i.e., complexes, and that where the instincts and experiences that are involved are common to most individuals, the complexes will also be similar. In other words, we actually *expect* there will be archetypes.

We would also expect to observe the other features we have described above. The complex will take similar forms in most individuals, even if the experiences are not exactly the same. We do not have to have precisely the same sort of mothering as infants and children to develop an adequate and reasonably well-integrated mother complex. On the other hand, if there were serious deficiencies in the mothering, or an extremely 'bad fit' between mother and child, the complex may not develop normally. In that case, we would expect to observe one of a fairly restricted repertoire of behavioural outcomes, not a more or less random deviation from the norm. Moreover, it should be possible to link the type of complex that is formed to the sort of deprivation that was experienced, though not necessarily in an obvious way and not necessarily in a one-to-one relationship: different effects may have similar causes, and the same effect may result from different causes.

For example, all clinicians are familiar with the fact that clients presenting with symptoms which we might broadly define as a 'negative mother complex' may have experienced quite opposite conditions in their real relationship with their mothers. The two 'poles' of this negative mother complex are, generally speaking, either deprivation or 'suffocation' in terms of mother's interaction with the child. In both cases, while the behaviour of the mother is radically different, the resulting 'frustration of archetypal intent' (**Stevens 1992**) can and often does produce a similar result. Why is this? As we have seen from the illustrations from self-organizing systems in biology, there is an underlying 'programme' which is operating in the functioning of the system. When this programme is disturbed, significant changes can occur, but the same outcome can arise from radically different types of disturbance. The key seems to be the

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point *in time* that the disturbance occurs. The question we need to ask with regard to the mother complex is: what generally needs to happen between mother and baby for a 'good enough' mother complex to form; i.e., one that enables baby to get what (s)he needs in an archetypal sense to develop normally?

There is a wealth of literature on this subject, so we need not go into any examples in detail. Some of the more obvious factors are that mother is sufficiently available and empathic to her child's needs, while not being overly needy herself in relation to the child. A depressed mother may ignore or resent her baby, thereby thwarting the child's need to experience containment and empathy, so vital to the formation of a healthy ego. The developing ego is then forced into a defensive posture from the necessity to protect the primal self in infancy. Because of the disturbed archetypal relationship with mother, the 'mutation' that occurs in ego development is that the ego does not become a relatively independent centre of consciousness. This could later manifest in the personality as a sense of self-value which is mostly unrealistic and distorted: we could say that the borders between ego and self do not become differentiated enough. Similarly, a 'suffocating' mother overwhelms the child, causing him/her to form premature defences against intimacy, and also thwarting the healthy development of the ego. Instead of creating a safe space for

the child to discover who (s)he is, mother's implicit demand that (s)he fulfil her needs results in the formation of an ego which has learned that survival depends on being what the significant other wants one to be. Again, the borders between ego and Self *within* are not clearly differentiated, in the sense that the significant other now carries the Self.

## Conclusion

Our chief aim in this paper has been to show that the concept of the archetype, as put forward by Jung and as used by many analysts since, is consistent with what we know of how the brain works. Nevertheless, to assume that the archetype resides in the dynamic does lead to predictions about what should be observed. For example, if the archetype has a separate existence, either as a heritable structure in the brain or as a gene, or indeed in any other way, then the only complexes that can form will be centred on those pre-existing archetypes. If, however, the archetype is simply a property of the dynamic, then if there are sufficiently strong influences from outside, a different complex can form, and by our definition of the archetype as an emergent property of the complex, we cannot rule out the formation of new archetypes. This is consistent with many of Jung's statements about the archetype, such as the following:

*If one holds the view that a particular anatomical structure is a product of environmental conditions working on living matter, then the primordial image (or archetype), in its constant and universal distribution, would be the product of equally constant and universal influences from without, which must, therefore, act like a natural law.*

(Jung 1921/1971, para. 748)

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In thinking about the implications of this passage, we must always remember to differentiate between the archetypal image and the archetype itself, as Jung constantly reminds us to do. So, while we can easily see that there are a myriad of images that can relate to one archetype, there are relatively few typical life experiences and predispositions, in a developmental sense, that we all share. But if we do not assume that these predispositions to typical life experiences (the archetypes) are fixed forms somewhere within us, but rather, that they *emerge* from the self organizing systems (complexes) that are formed as we move through life, then we must remain open to the possibility that new archetypes can be born into our constantly evolving experience of life.

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## Notes

<sup>1</sup> The process aspect of the archetypes with special reference to the Self was recently discussed in an article by Sherry Salman in the *J. Anal. Psychol.* (1999), 44, 1, 69-85.

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<sup>2</sup> Goethe's observation that so many of the parts of a plant are fundamentally similar and his explanation that the differences are due to different conditions during development are both in line with the modern view.

<sup>3</sup> As Jung reminds us many times in his writings, Goethe's work, particularly *Faust*, was a formative influence on him from childhood onwards. Jung remarks that in Part II of *Faust*, he found the link between philosophical alchemy and Gnosticism down to Nietzsche's *Zarathustra*. Jung speaks of his lifelong 'inner relationship' to Goethe, and goes on to say that 'Goethe's secret was that he was in the grip of that process of archetypal transformation which has gone on through the centuries ... I myself am haunted by the same dream ...' (Jung 1961, p. 189; 206).

<sup>4</sup> Biologists avoid this problem by assuming that forms are created by genes and so are directly inherited. The process by which they are brought into being in an individual, i.e., development, is seen as having no influence on them. See, e.g., Ho (1990) for a different view.

<sup>5</sup> Note that we disagree both with Pietikainen's (1998) insistence that they cannot be 'quasi biological' and also Stevens's (1998) response that they can be explained in terms of evolutionary psychology. Our view on this point is close to that of Hogenson (1999), who writes, 'But the archetypes do not exist some place. Rather, they are the emergent properties of the dynamic developmental system of brain and narrative'.

<sup>6</sup> Some Jungian writers would describe the mother complex as a subset of the anima. As C.A. Meier observed: 'Initially it must be assumed that the anima will be projected onto the mother as the central feminine figure. This is the source of the so-called mother complex' (Meier 1995, pp. 104-5).

<sup>7</sup> This example and the other general example which follows later are for illustrative purposes only and are not meant to be complete analyses of the entire situation that contributes to the development of an individual. In the same vein, when we speak of the anima/animus, we are not limiting the concept to a biological or heterosexual definition.

<sup>8</sup> The same effect can be observed in flies with certain specific mutations. This phenomenon, the production by perturbation of the same effect that can be caused by mutation, is called phenocopying. It is very common and has been known for a long time, but is largely ignored by evolutionists and even developmental biologists, who tend to concentrate on genes and gene products. Phenocopying is further evidence that the archetype resides in the developmental process, not in the genes.

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