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SPENCER AND DEWEY ON LIFE AND MIND

PETER GODFREY-SMITH

1. INTRODUCTION

If it were possible to bring a collection of dead, famous philosophers into the present, and ask them what they thought of artificial life, I think few of them would have as much to say as Herbert Spencer and John Dewey. This chapter is an attempt to work out some of what they might say. It is also an attempt to show how some of the differences between research programmes and explanatory styles which exist in and around A-Life are manifestations of some old and basic oppositions within science and philosophy. These oppositions have to do with the general nature of causal and explanatory relations between organic systems and their environments. Thirdly, this chapter will discuss the relations between life and mind, and hence the relations between artificial life and artificial intelligence.

2. SPENCER

Herbert Spencer (1820–1903) was a wide-ranging, speculative thinker who had a great influence on the intellectual scene in Victorian Britain. He wrote large-scale works in philosophy, psychology, biology, and sociology. He also supported strongly *laissez-faire* economic and political views, and is often associated with the label 'social Darwinism' (but see Bowler 1989). Spencer first published his evolutionary approach to psychology in 1855, several years before Darwin's *Origin of Species* (1859). Although he was a major figure in the late 1800s, soon after the turn of the century Spencer's reputation fell like a stone and has barely shifted since. (See Richards 1987 for a detailed account.) In fact, one of the few places where his name has tended to come up in recent years

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is in discussions of A-Life and complexity (Farmer and Belin 1992; McShea 1991; Lewin 1992; Levy 1992).

Spencer's work is indeed highly relevant to A-Life. In this section I shall briefly outline Spencer's overall view of the world, and then look at some of his ideas on the origins of complexity.

Spencer claimed to have found a general 'law of evolution' which applies to the evolution of solar systems, planets, species, individuals, cultural artefacts, and human social organizations. According to this law there is a universal trend of change from a state of 'indefinite, incoherent homogeneity' towards a state of 'definite, coherent, heterogeneity' (1872: 396). That is, every system tends to change from a state where the system has little differentiation of parts, little concentration of matter, and everything is much the same in structure, towards a state in which there is a variety of clearly distinguishable parts, where the individual parts differ from each other and are densely structured.

This trend appears to be 'negentropic': it tends towards increased organization. Spencer struggled with the consequences of the second law of thermodynamics, which was being formulated and investigated around the same time as his work (Kennedy 1978: 43). He accepted that the universe as a whole must run down. But though the eventual fate of the universe is 'omnipresent death', as long as the processes of organic and social evolution have the required resources there will be a growth in organization and differentiation. This process 'can end only in the establishment of the greatest perfection and the most complete happiness' (1872: 517). And once the universe has run down to death, it might start up again, produce life, and cycle this way indefinitely.

Spencer thought that a system like a galaxy will become more organized as a consequence of the fundamental properties of its constituents. However, once we reach the realms of biology and psychology, increases in complexity are the result of *external* factors. For Spencer, complexity in organic systems is explained in terms of complexity in the systems' environments.

Spencer has elsewhere been labelled an 'internalist' with respect to the explanation of biological complexity (McShea 1991; Lewin 1992). This is misleading, in my view. Spencer certainly thought that on the global scale complexity will inevitably develop by itself, but the manifestation of this trend in organic change is not 'internalist'. When he is concerned with the properties of organic systems, most of the explanatory weight is borne by the environments of these systems. Internal properties of organic systems explain why these systems are the types of things which respond to their environments so sensitively, but the *particular* changes that any system undergoes are explained in terms of the specificities of its environment.

In fact, even when Spencer is discussing physical systems, and is not making use of biological mechanisms, his explanations for the trend towards complexity

often have a roughly externalist character. For example, he thought that any homogeneous system is unstable, as any new influence on the system will affect different parts of it differently. Parts on the inside of the system will experience the force differently from parts on the outside. The parts will thus respond differently and the whole system will become more heterogeneously structured.

In the remainder of this chapter, the term 'externalist' will be used specifically for explanations of internal properties of organic systems in terms of properties of their environments. Explanations of organic properties in terms of other internal or intrinsic properties of the organic system will be called 'internalist'.

Spencer's externalism is seen clearly in the specific mechanisms he used to explain biological and psychological properties. First, his biology was strongly adaptationist. He made use of both the inheritance of acquired characteristics, along the lines of Lamarck, and also Darwinian evolutionary mechanisms—the 'survival of the fittest'. He viewed these two processes as different specific ways in which organisms respond adaptively to conditions in their environments (1866: pt. 3, chs. 9–13). Spencer's psychology (1855) was associationist, in the English tradition. This is also an externalist programme of explanation; complexity in the mind is explained in terms of complexity in sensory experience. In fact, Spencer saw evolution and individual learning as basically the same type of thing: they are both modes of 'equilibration' between organism and environment.

This recognition of an underlying similarity between learning and adaptive evolution made it possible for Spencer to make an unusual move in his theory of mind, given what had gone before him. During the seventeenth and eighteenth centuries epistemological discussion was deeply concerned with the issue of whether the mind has intrinsic, innate structure, or whatever is in the mind has come in through the senses. 'Rationalists' such as Leibniz took the former view and 'empiricists' such as Locke took the latter. Spencer was basically an empiricist, but unlike empiricists before him he had no problem with the idea that the mind has rich innate structure, as rationalists claimed it did. He in fact embraced this idea. Spencer did not regard this as a concession as long as the mind's innate structure has an adaptationist evolutionary explanation. Evolution is like a population-level learning process, so the basic empiricist pattern of explanation still applies (1855: pt. 4, ch. 7).

Spencer is often compared with Lamarck (1809), and it is sometimes said that Spencer's evolutionary views are unoriginal because they are largely derived from Lamarck. It is true that Spencer learned a lot from Lamarck's ideas (which he first encountered second-hand though the criticisms of Lyell). But the relation between Spencer's ideas and Lamarck's is more interesting than mere imitation. Lamarck is remembered now for his claim that there can be evolution by the inheritance of characteristics which individuals acquire during

their lifetimes in response to their environments. But this is only one of two mechanisms in Lamarck's account. The other mechanism for evolution, and the thing which explains complexity in particular, is a tendency in all living things which generates increases in the complexity of organization. This tendency is a consequence of the actions of fluids moving through the body's tissues.

The phenomenon Lamarck explains in terms of the environment and the inheritance of acquired characteristics is the fact that the pattern in nature which shows the inevitable increase in complexity is an *imperfect* pattern. Adaptation to different environments is used by Lamarck to explain departures from an orderly progression of increases in complexity. In particular, in a perfectly static and homogeneous environment Lamarck thought there would be a clear linear scale with respect to complexity (1809: 69). Spencer would predict the exact opposite: in a perfectly constant and simple environment there would be nothing that could generate increases in complexity (1866: 83). He would probably have added that if there ever was an environment like this, it would not last long. Spencer thought that environments inevitably tend to become more complex.

So Lamarck explained things other than progressive increases in complexity in terms of the environment, and had a largely internalist view of organic complexity. Spencer had an intrinsic mechanism for directional change in the environment, and an externalist account of almost all organic properties, especially complexity.

3. SPENCER ON LIFE AND MIND

The key to Spencer's conception of the organic world is his definition of life and mind. A single definition applies to both. For Spencer, life and mind are distinguished mainly by matters of degree and detail. Having a mind is an advanced mode of living. In a sense, for Spencer people are not just smarter than prawns, but also more alive than prawns.

Spencer thought that living systems are distinguished from inanimate ones by the existence of certain complex processes inside the system, and (more importantly) a special set of relations between internal processes and conditions in the systems' environments. The simplest formula he gave as an account of life was: 'the continuous adjustment of internal relations to external relations' (1855: 374; 1866: 80).

Spencer was heading, I think, towards a view of life that we now might call 'systems-theoretic' or cybernetic (Ashby 1956). Living systems are self-preserving. They maintain their organization, and the discontinuity between system and environment. They do this by responding in particular ways to

environmental events which, left to themselves, would tend to disrupt the organization of the living system. Living systems actively resist disruption and decay.

> All vital actions . . . have for their final purpose the balancing of certain outer processes by certain inner processes. There are unceasing external forces which tend to bring the matter of which organic bodies consist, into that state of stable equilibrium displayed by inorganic bodies; there are internal forces by which this tendency is constantly antagonized; and the perpetual changes which constitute Life, may be regarded as incidental to the maintenance of the antagonism. (1872: 82)

Here Spencer uses the term 'purpose', which is of course a suspicious one. But in my view the term 'purpose' can simply be dropped from this account, and replaced with something as simple as 'tendency', and Spencer's general intent is retained.

So Spencer anticipated a conception of life which has become quite popular during this century, a conception based upon the idea of self-preserving functional organization as fundamental to life.

In fact this general idea comes in several forms. It can appear in an externalist form, in which there is a focus on self-maintaining responses to a structured environment. And it can also appear in a more internalist form, as exemplified by the 'autopoietic' conception of life given by Maturana and Varela (1980). In this second form the focus is on self-*production* as characteristic of life, and the role of environmental structure is greatly reduced. Spencer, with his perpetual focus on the environment, exemplifies the externalist form of this view. He also anticipated some other central ideas of this account, such as the important roles played by (what we would call) negative feedback and homeostasis.

> [T]o keep up the temperature at a particular point, the external process of radiation and absorption of heat by the surrounding medium, must be met by a corresponding internal process of combination, whereby more heat may be evolved; to which add, that if from atmospheric changes the loss becomes greater or less, the production must become greater or less. And similarly throughout the organic actions in general. (1872: 82–3)

In stressing this cybernetic side of Spencer I am downplaying another vocabulary he uses to talk about the basic properties of life. Spencer also says that life and mind are characterized by relations of *correspondence* between internal and external. He also defined life in terms of a correspondence between internal relations and external relations.

The talk of correspondence in Spencer is much more problematic than the discussions of (what we would call) feedback and self-preserving responses to the environment. It was also controversial in his own day, and played an interesting role in the development of some aspects of the philosophical movement known as *pragmatism*. William James (the most famous pragmatist) published his first essay in philosophy on Spencer's view of mind (1878). John Dewey also used Spencer's talk of correspondence as an illustration of the type of position he was opposed to. We shall look at Dewey's view later.

In my view, though Spencer talked a lot about correspondence as the mark of life and mind, this was actually less central to his picture than the idea that living systems are self-preserving. For Spencer, the *ways* in which living systems succeed in preserving the discontinuities between organism and environment involve relations of correspondence and 'concord' between inner and outer. That is how they succeed in responding to environmental events in a way which prevents their dissolution and disruption. For example, having inner states which correspond to the environment's structure makes possible the prediction and anticipation of environmental events.

How close is Spencer's account of life to contemporary views? There is no consensus view on what makes something alive. Many writers are very sceptical about the possibility of giving a definition of life or anything even close to a definition. Perhaps the closest thing to a consensus is the view that life is what philosophers call a 'cluster concept'. There is a list of properties that are associated with life, but to be alive a system does not have to have *all* of them. It only has to have some reasonable number of them. This is deliberately supposed to be vague, and there will be a 'grey area'. That is certainly the impression one gets from the opening pages of many biology textbooks (see e.g. Curtis and Barnes 1989, which lists seven distinct basic properties; see also Mayr 1982, ch. 2; Farmer and Belin 1992).

For many modern writers, however, there are at least two *types* of properties which are important in understanding what life is. Living systems firstly have a set of broadly 'metabolic' properties, which involve the organization of the individual living system and its relations to the environment. Homeostasis is an example of this type of property. Secondly, they have a set of properties involving reproduction, and the relations between individuals. Some take this second family of properties to be more fundamental than the first, in fact. The strongest versions of this idea claim that life can be understood in terms of the capacity to evolve (Maynard Smith 1993), or that life is a property of a population rather than an individual (Bedau and Packard 1992).

Spencer's view of life is based more on individually self-maintaining properties, but he did not neglect reproduction. His view of reproduction and how it fits into life-history properties of organisms is interesting. Spencer thought that organisms come to a 'moving equilibrium' with their environments—all evolution and development has this character. But an individual organism can go only so far in this process before it runs out of the internal properties of plasticity that are needed for further development and adaptation. Reproduction acts to jolt the organic system out of its temporary and imperfect equilibrium. It frees up each component of the system for further evolution by recombining

these components into a new individual (1866: pt. 2, ch. 10). Sexual reproduction is the most effective means for this, as organic material from two dissimilar individuals is united and this union will be much more plastic and less static in its properties than the two adults are individually.

In some ways this is quite a modern idea. Reproduction plays a role similar to the role played by the injection of noise into a hill-climbing system to prevent it sticking too readily on a local maximum. (Spencer even mentions physical processes of annealing when developing this view (1866: 274).) On this account there are not two distinct types of properties involved in life, individual-level and population-level properties. Rather, a single set of organism/environment relations is attained and maintained as a consequence of *both* individual-level and population-level activities.

Spencer, as I said, had a single definition of life and mind. He wanted to see even the highest cognitive capacities of humans as continuous with the most basic forms of organic action. Spencer and Dewey both saw cognition as something which emerges out of simpler modes of interaction with the world. Dewey sometimes called this an assumption of 'continuity' (1938). In my view it is important to distinguish several different possible claims of 'continuity' between life and mind:

Weak Continuity: Anything that has a mind is alive, although not everything that is alive has a mind. Cognition is an activity of living systems.

Strong Continuity: Life and mind have a common abstract pattern or set of basic organizational properties. The functional properties characteristic of mind are an enriched version of the functional properties that are fundamental to life in general. Mind is literally life-*like*.

These are both constitutive or ontological principles, principles about what life and mind *are*. There is also a continuity principle which has a purely methodological character:

Methodological Continuity: Understanding mind requires understanding the role it plays within entire living systems. Cognition should be investigated within a 'whole organism' context.

Strong continuity, as I understand it, implies weak continuity. If the pattern of organization characteristic of mind includes the pattern characteristic of life, then anything which thinks must have a lot of what it takes to be alive. The principle of methodological continuity is supported by both weak and strong continuity, though it is not strictly implied by either of them. It is also important that methodological continuity does not imply either of the constitutive principles.

It is a consequence of weak continuity that artificial life must precede artificial intelligence (or in the limit, be simultaneous with it). The same is true under strong continuity, and in addition to this, the strong continuity principle claims that once we have artificial life we also have the raw material, or an unrefined form, of artificial intelligence. We just need to get more of the same sort of properties. Spencer is a clear example of someone who held the strong continuity thesis, and the methodological continuity thesis as well. He would have said that to build a living system you need to build a system that maintains itself in its environment, in the face of possible decay, by adjusting its internal processes and actions to deal with external events and relations. He also would have said that once you have a system that does a lot of this, and does it in a particular way, you have an intelligent system.

What is the 'particular way' characteristic of intelligence? For Spencer, the most distinctive property of intelligent internal processing is (what we would call) its *serial* nature. A transition from parallel processing to serial processing, a transition which is never complete, marks the transition from merely living activity to real intelligence (1855: pt. 4, ch. 1). The contents of thought make up a single complex series. That is not to say that intelligent systems stop dealing with problems in parallel. The point is that only the serially structured part of the system's activities is the intelligent part. In addition, adaptation to conditions in the environment that are (i) highly changeable, (ii) spatially or temporally distal, (iii) compound, (iv) hard to discriminate, and (v) abstract, involving superficially heterogeneous classes of events, all tend to demand the complex types of organic response characteristic of cognition.

So then: Spencer would have given a fairly simple recipe for artificial life, and one which is essentially the same as his recipe for artificial intelligence. I conjecture that he would have had no qualms about the idea that systems which satisfy his criteria could be realized in software. For Spencer, life and mind are patterns of interaction which systems have to their environments. He might insist that an artificial-life creature live in an environment that has the capacity to lead to the disruption and dissolution of the living system. But I do not think this would preclude environments realized inside computers.

If Spencer were to look at some current work in and around artificial life, the work which would best exemplify his conception of biology would probably be work on classifier systems, 'animats', systems constructed using genetic algorithms, and other environment-oriented work (Booker *et al.* 1989; Wilson 1991; Todd and Miller 1991). This is work which is directed at the chief focus of Spencer's biological thought—the relation between internal complexity and environmental complexity. In this work simple artificial organisms are placed in environments that have intrinsic structure or pattern. The organism's role is to adapt itself to these environmental patterns. So often, for example, an organism

will have to discriminate food from poison, or devise a way to move through its world and find food while avoiding predators and obstacles. When an organism of this type is well trained, or highly evolved, it would be appropriate to describe its condition in Spencerian terms: its internal processes are adjusted to external processes. It seems to me to be a guiding idea in classifier work, animats, and in genetic algorithm work more broadly, to think that the fuel for the development of organic complexity is environmental complexity. The underlying assumption is that complex systems arise as solutions to complex environmental problems. Spencer would nod vigorously.

This family of ideas can be regarded as the externalist side of artificial-life research. My conjecture is that Spencer would certainly approve of it as a way of modelling biological phenomena. Whether or not he would regard any systems of this type as actually living might depend on which, if any, of these systems would be regarded by him as *realizations* of a pattern of organism/environment relations, as opposed to representations of those relations. This is a familiar problem with the interpretation of many A-Life systems.

The work in A-Life which I regard as furthest from Spencer's approach is work on cellular automata (Langton 1992). This is because, as I understand it, this work is virtually environment-free. The 'environment' for a cellular automaton is just the space it is in, a lattice of cells which can be in various states. The system changes via the local interactions of cells. It can display complex dynamical behaviour in which specific patterns or structures are preserved, but it does not generate these patterns as a response to a structured environment. Neither does it respond to potentially disruptive environmental events. The environment does not contain a set of intrinsic patterns which the organic system must adapt to or contend with. Work on cellular automata is one of the more internalist domains within A-Life.

When I say that cellular automata do not contend with a structured environment, I assume that the entire cellular automaton is analogous to the organism and the space is analogous to the environment. Another way to look at these systems would be to view the system as comprising a number of individual 'organisms'. One part of the whole system can interact with other parts, with an environment of its fellows, and may succeed or fail in producing self-preserving responses. I am assuming here that this is not the appropriate way to view cellular automata.

It is also important to recognize that some research on cellular automata is not directly aimed at producing artificial life by producing a complicated cellular automaton. The stated aim in Langton (1992), for example, is to investigate the conditions under which 'a dynamics of information' will emerge and 'dominate the behavior of a physical system' (1992: 42). So we need not regard all these systems as artificial-life systems in their own right. On the other hand,

cellular automata are very often intended to at least model or cast light on basic properties of the living. Langton does regard the existence of a 'dynamics of information' as a very basic property of life. For Spencer, however, the basic properties of the living are a set of organism/environment relations, not a set of complicated internal properties or processes.

So in my view Spencer would not regard cellular automata as on the road to artificial life. But he might regard them as important models for a different reason. He might see them as illustrations of some parts of his view of the *inorganic* world. Spencer held that organic complexity is a response to environmental complexity. But he also thought that environments can get more complex under their own steam. The most basic laws of matter have the consequence that homogeneous physical systems are not stable, but will constantly generate new complexities of pattern. So cellular automata specifically, and some parts of the environment-free side of A-Life work generally, might be illustrations of the possibility of heterogeneity in structure and activity arising as a consequence of local and intrinsic properties of basic elements of a physical system.

Lastly, what might Spencer think of systems like Tom Ray's 'Tierra'? Tierra is an artificial ecology in which individual organisms do contend with an 'environment', but the chief contents of this environment are other competing individuals, both of the same type or lineage and of other types. The 'abiotic' aspects of the environment are just the fixed constraints exerted by the properties of the CPU, the operating system, and the memory of the computer (see above, Ch. 3). Most environmental features are 'biotic'. Spencer would perhaps regard this as an unusual balance of biotic and abiotic, but as I understand Spencer's understanding of the concept of 'environment' this may well qualify as a simple but genuine case of lifelike interaction between organic system and environment (1891: 416). Or at least, it would be lifelike to the extent that the 'organisms' successfully interacted with these external features in a way which maintained their organization.

4. DEWEY

John Dewey (1859–1952) is, on the face of it, a philosopher with little in common with Spencer. Spencer was a science-worshipper who none the less speculated from the armchair about factual matters, and an advocate of *laissez-faire* economic libertarianism. He believed in timeless laws of nature and the inevitability of universal progress, and built one of the more elaborate systems in English-speaking philosophy.

Dewey, on the other hand, was one of the great American liberal thinkers of the early and mid-twentieth century, especially in the domains of education and

the theory of democracy. He knew a lot of science but also kept science in its place. He thought that metaphysical system-building is generally a sort of pseudo-inquiry which diverts people from addressing the real, concrete problems that beset us. He rejected guarantees of universal progress as attempts to falsely promise in advance the goods that can only be gained by hard work and practical problem-solving, and which can never be guaranteed. So Spencer and Dewey differed about a lot.

It is not my goal here to say that deep down they were in agreement. But I do think the differences between them are often misunderstood, and it is possible to sharpen our understanding of the relations between them by focusing, as I am focusing here, on what they say about life, and the relation between life and mind.

Dewey is, along with Spencer, one of the very few major philosophers in the recent English-speaking tradition to think that a theory of life is of general philosophical importance—to think that our theories of knowledge and inquiry, for example, should be linked to a general theory of living organization. For Dewey, making this link between inquiry and life was a way to overcome a 'dualistic' view of the relations between mind and nature. He established a picture of the relations between organism and environment in his theory of life, and was then able to make use of these relations in his theory of thought and inquiry. He sought to use his general position on organism/environment relations to avoid the artificial separations between mind and world which so often arise in epistemology.

Thus Dewey, like Spencer, conceived of life not as an intrinsic property of a system, but as something that involves certain relations to an environment. Life is a 'transaction extending beyond the spatial limits of the organism' (1938: 25). This transaction involves an exchange of energies between the system and the environment, in which states of disturbed equilibrium in the organism are changed back into states of equilibrium. Dewey admits that there are inanimate systems in which an external change causes disequilibrium followed by a restoration to equilibrium. The distinctive properties of living systems are the *ways* in which equilibrium is restored, and the consequences of this restoration (1929*a*: 253–4). Living systems reach this equilibrium in a way which tends to maintain the organization of the system. The living system acts to preserve its organization and integrity in the face of disturbances.

Iron as such displays or exhibits characteristics of bias or selective reactions, but it shows no bias in favor of remaining simple iron; it had just as soon, so to speak, become iron-oxide. It shows no tendency in its interactions with water to modify the interaction so that consequences will perpetuate the characteristics of pure iron. If it did, it would have the marks of a living body, and would be called an organism. (1929*a*: 254. See also 1929*b*: 179)

So far this is not such a long way from Spencer's view, as I interpret it. It is a view of life based upon self-maintenance of organizational properties. One difference, which is especially visible in his 1938 presentation, is that Dewey is more inclined to regard the organism plus environment as constituting a single system. Organic activities tend to preserve the *pattern of interaction* between organism and environment, rather than just preserving the organism itself (1938: 26–8).

Dewey also asserted 'continuity' between life and mind, but earlier I distinguished several different continuity theses, and it is not easy to work out which ones Dewey held.

Dewey is certainly committed at least to the weak continuity thesis. He says: 'The distinction between physical, psycho-physical [living], and mental is thus one of levels of increasing complexity and intimacy of interaction among natural events' (1929*a*: 261). It is harder to state where he stands on strong continuity. He says the general pattern of inquiry is 'foreshadowed' by the general pattern of life (1938: 34). This suggests strong continuity. All living systems respond to environmental dangers by acting on the world; intelligent inquiry is a specific *way* of approaching this basic aspect of life. However, Dewey also says that mind has a special relationship to language and communication. Only a communicating system in a social environment can literally think, because thinking is symbolic and symbolism is social (1929*a*: 211, 230; 1938: 43–4). I take all views on which having a language is necessary for thought to be views which deny strong continuity between life and mind (unless a very unusual view of the nature of life is taken). According to the strong continuity thesis, life is 'proto-cognitive' or 'proto-mental'. But life is *not* proto-linguistic.

It is probably fair to say that Dewey did not accept strong continuity in a wholesale way, as Spencer did, but that he did think that *some* basic properties of cognition are formally similar to the basic properties of life. Living activity in general can be viewed as formally similar to problem-solving, although there is also more to genuine cognition than this.

In the discussion of Spencer I said that as a consequence of his holding the strong continuity thesis, Spencer would give basically the same recipe for artificial life and for artificial intelligence. To make a system which thinks, you do not need to add something wholly new to a living system; you just need to increase the magnitude of certain properties it already has. If Dewey's view is that a complex living system becomes a thinking system only in virtue of its relations to other systems in a social context, the way to create real artificial intelligence is via creating a *society* of artificial-life creatures, and having them deal with problems interactively.

I said that Dewey has a view of life which is not too far from Spencer's, and I supported this claim with the quotation above about iron. But Dewey in fact

thought there was a great difference between his view and Spencer's, indeed that Spencer was part of the problem. Dewey thought this in part because he focused on a side of Spencer which I downplayed in my discussion—the side in which Spencer says that life involves a relation of 'correspondence' between the internal and the external. Dewey thought that corresponding to the external was not a good way of staying alive.

> If the organism merely repeats in the series of its own self-enclosed acts the order already given from without, death speedily closes its career. Fire for instance consumes tissue; that is the sequence in the external order. Being burned to death is the order of 'inner' events which corresponds to this 'outer' order. . . . [A]ll schemes of psycho-physical parallelism, traditional theories of truth as correspondence, etc., are really elaborations of the same sort of assumptions as those made by Spencer: assumptions which first make a division [between organism and environment] where none exists, and then resort to an artifice to restore the connection which has been willfully destroyed. (1929*a*: 283)

Dewey's point is that Spencer's view of life enforces a false separation between organism and environment, and then invents a magical new relation of 'correspondence' to overcome this artificial problem. Dewey holds this view about the role of concepts of 'correspondence' in theories of life in general and also in theories of mind. The idea that the purpose of thought is to 'correspond' to an independent external realm is, for Dewey, a way to get around a problem which never existed. The false problem is the idea that mind and nature are completely different from one another and hence that there cannot be any straightforward, natural interactions between them.

I think Spencer is not *as* guilty of this charge as Dewey thinks. It is true that Spencer's official theory of knowledge did have a gulf between mind and nature of the sort that Dewey despised (see early chapters of Spencer 1872). It is also true that Spencer said that 'correspondence' was basic to life and mind, and was not clear about what correspondence is. But in my view, the central idea for Spencer was the idea that living systems act to preserve their organization in the face of environmental threats. The 'division' between the living system and the world on this account is the set of physical discontinuities which mark the distinction between inside and outside, and which the organism's actions maintain. Spencer's talk of correspondence is supposed to be part of an account of how this physical relation is maintained.

So what *is* the basic difference between Spencer's and Dewey's views of life?

5. ASYMMETRIC EXTERNALISM

The difference which I think is most fundamental, the one on which many of their detailed disagreements depend, concerns their relations to a perspective

which I will call 'asymmetric externalism'. Spencer exhibits this attitude, and Dewey was against it.

As outlined earlier, I understand an *externalist* explanation of some property of an organic system as an explanation in terms of properties of the environment of the system. Adaptationist explanations of biological traits are often externalist, as are classical empiricist explanations of thought and knowledge. Empiricism explains what is believed or known in terms of what is experienced, in terms of what comes into the mind from outside.

An asymmetric externalist view is something stronger than this. It is a program of explanation that explains internal properties in terms of external, and also explicitly or implicitly denies that these external properties are to be explained in terms of internal properties of the organic system. So what is denied is any significant level of feedback from the organic system on its environment. The organic system has its nature or trajectory determined by the environment, but the environment goes its own way. It is dynamically self-contained, rather than 'coupled' to the organic system.

I said that classical empiricism is an externalist picture of thought. Is this also an asymmetric externalist view? It is hard to say. Most of the famous empiricists like Locke and Hume did not *deny* that the thinking agent can act on the world and hence affect the future course of experience. They just did not discuss this very much. The important point is that Dewey did think, in effect, that many orthodox epistemological views are asymmetrically externalist. He saw these views as holding that the business of thought is conforming to the world but leaving it untouched (1929*b*: 110). This tradition views the ideal knower as a spectator who does not interfere with the course of the game. Dewey, on the other hand, thought that effective inquiry and problem-solving do involve interfering with the world, transforming and reconstructing it. He was still basically an empiricist thinker, accepting that thought is a response to experience. To that extent Dewey had an externalist conception of mind (although a far more moderate one than Spencer's). But Dewey also held that the agent's response to experience typically involves making changes to the world, and hence changing the future course of experience.

I also said that adaptationism in biology is externalist. Is it asymmetrically externalist? Again, it is hard to say in many cases, but one of the most important recent critiques of the adaptationist programme can be understood as claiming that adaptationism *is* asymmetrically externalist. This critique is due to Lewontin (1983, 1993). Lewontin claims that orthodox adaptationist thought views organisms as the passive 'objects' of evolution, when in fact they are subjects as well as objects. Organisms impact upon their environments, and hence alter the future course of the selection pressures to which they will have to respond. I understand Lewontin's attack on adaptationism as closely analogous to Dewey's

attack on orthodox empiricist epistemology. Both argue that asymmetric externalist views have to be replaced by views that recognize two-way interactions between organisms and environments.

Dewey prepares the way for his view of thought in his general view of life. And though his biological discussion is not as sophisticated as Lewontin's, the view of organism/environment relations which he develops in his view of life is designed to set up basically the same two-way or feedback-oriented picture that Lewontin supports. 'Adjustment to the environment means not passive acceptance of the latter, but acting so that the environing changes take a certain turn' (Dewey 1917: 62). Dewey's view of the 'transactions' between organism and environment which constitute life is a view based upon organic intervention in the world, as well as organic reaction to what the world does. Dewey sets up this 'interactive' picture in his view of life, and his view of inquiry follows the same pattern. Thought and inquiry are responses to environmental problems, but their goal is not to generate internal states that merely correspond or conform to external things, but rather to make a change to environmental conditions, to adapt *them* to the goals of the organism.

This is the most fundamental difference between Spencer's and Dewey's views of life, and one which extends into their views of mind also. Dewey perceives Spencer as having what I call an asymmetric externalist view of life and mind, and Dewey wants to replace this with a view based on two-way interaction. The difference between Dewey and Spencer about the role of 'correspondence' as a feature of life and mind is a consequence of this more basic difference. Dewey saw the idea of correspondence as a relation between inner and outer as a typical philosophical product of the perspective he opposed.

Is it true that Spencer had an asymmetrically externalist picture? Is this charge justified? That is not a simple question. Spencer, like the other empiricists mentioned earlier and like many adaptationists, is more guilty of *neglecting* the phenomena of organic action on the world than he is of denying them. His picture of organic action is largely one of organic *re*-action. His discussions of life generally focus on organisms taking heed of environmental facts rather than making changes to them. On the other hand, Spencer also had a very holistic view of ecological systems. He saw ecological systems as tangled webs of relationships, and his general picture of the physical world was one in which changes in one place tend to ramify through to distant places. So changes to the composition or behaviour of one species result in 'waves of influence which spread and reverberate and re-reverberate' through the flora and fauna of the area, and this will influence in turn the future of the system behind the change. Spencer also thought that organisms play an individual role in determining how complex their experience of their environment is (1866: 417–18). So there is a holistic side to Spencer, which would make it possible for him to accept some

of Dewey's picture. But in general I would agree with Dewey that Spencer's picture is one in which organisms are far more the objects of external forces than they are subjects creating them. In particular, Spencer conceives of progress in the biological world as an inevitable consequence of basic laws governing all matter. Organic progress is achieved because all life is shackled to the inevitable advance of complexity in every environment. Dewey, on the other hand, views any progress that can be attained as something which we (and other living systems) must create and bring about ourselves. The universe is not going to do the work for us.

So with respect to specific projects within A-Life, I see Dewey finding an area of real agreement with Spencer, but also strongly disagreeing with him on other points. Dewey would agree with Spencer in seeking to place organism/environment relations as the central focus of research. Consequently, I think he would share with Spencer the view that cellular automata and other 'environment-free' systems are not models of basic properties of living organization. Dewey, like Spencer, opposes the idea that basic properties of organic self-maintenance can be understood in an internalist way, 'as a sort of unrolling push from within' (1917: 62).

On the other hand, while I think Spencer would regard classifier systems, animats, and the like as on just the right track, Dewey might see many systems of this type as suspiciously low in two-way interactions or feedback relations between organism and environment. Even within the environment-oriented conception of life, which is common to Spencer and Dewey, there is a major difference between views that are for the most part asymmetrically externalist and views based on two-way interactions between organism and environment. A-Life organisms can be placed in environments which are fixed or have their own autonomous principles of change, or alternatively they can be placed in their environments in such a way that their actions determine the future structure of their world. For Dewey, some of the activities of classifier systems, animats, and the like might be too close to mere 'spectating'. The form of intervention in environments that Dewey has in mind is something more than just eating when there is food and not eating when there is poison. A thoroughly Dewey-oriented A-Life system would feature rich connections in both directions between organism and environment. The environment would pose problems for the organism, and the organism would not just adjust and adapt itself to environmental events, but would intervene in the environment's course and alter its trajectory. This alteration would in turn bring about new problems and new possibilities for organic action and control. Co-evolutionary models have some of these properties (Kauffman and Johnsen 1992).

If Dewey did express a view such as this, some might reply to him: 'one step at a time!' In these early days of research it might be reasonable to idealize

towards a more Spencerian picture, and neglect, for a period, the complexities of two-way interaction between organism and environment. Even Dewey admits that the simplest forms of life tend to accommodate to their environments rather than intervene in them—he regards intervention in the environment as a sign of 'higher' life (1917: 62, Dewey's scare-quotes). Perhaps there is no need to build all these properties into simple systems of the type we have now. On this view, the first problems to deal with really *are* problems like when to eat, how to keep the system intact, and how to avoid poison and predators.

Others may think that research should follow Dewey's lead from the start, and self-consciously avoid generating a picture of life in which the environment calls the shots and the organism just responds. Those who are impressed with Dewey's arguments about the conceptual quagmires and dead-ends that result from accepting an asymmetric externalist perspective should perhaps prefer this latter view.[1]

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