Emergence of the Internal Perspective in Western Science

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1. Introduction
A major characteristic of modern thought is the pervading tension between the objective and the subjective, the universal and the particular, the eternal and the temporal, the global and the local, and the ultimate and the immediate. Although these conceptual polarities are not identical, they converge when they are considered as a related set of archetypes. These archetypes are further related to other archetypical polarities such as Heaven and Earth, Nature and Humanity, and Outer and Inner. Scientific internalism is connected to this system of archetypes through its relation to the second component, Inner, of the last archetypal polarity mentioned. It thus inherits the pervading tension in modern thought. This tension shows up in conflicting ways that internalism is evaluated.

In order to characterise the internal perspective, I am going to give a “potted history” of its recent emergence in Western thought. This history will emphasise the tension in modern Western culture, which has dual roots in Greek pluralism and Judeo-Christian-Muslim monotheism. The tensions created by this confluence of opposites are arguably responsible for the rise of western science; at the very least, they made it possible by problematising the archetypical tensions between the Universal and the Particular in a way that would have been difficult to sustain in a unified culture. Internalism is fundamentally a move in the effort to resolve these tensions as they appear within science itself. It has become necessary because of a complex combination of metaphysical, epistemological, scientific and practical developments in modern history that have come to a culmination in this century, but as are yet unresolved. Before I turn to this history, however, I would like to more carefully characterise the problem.

2. The tensions
The general nature of the tensions should be apparent to most people merely from the mention of the names of the archetypes. This is a legacy of our nature as a rational social animal. Unlike the pure consciousness of angels, we are embodied concrete particulars. Unlike many other animals, we can generalise and abstract to grasp at the universal. Furthermore, our sociality requires that we integrate our immediate and particular interests with the requirements for the preservation of the society we depend on for our life and biological propagation. Human nature (and here I speak of our collective nature, not some essence of humanity distributed in each individual) requires that we find some way to live with the tensions. Perhaps not surprisingly, it has also resulted in a yearning within us for a resolution of the tension. This yearning is so strong that it can account for much addictive and compulsive behaviour. Addictions, such as drugs, gambling and sex, present a compelling illusion of a solution to the problem. (Truly, an addict’s immediate needs are focussed eternally on satisfying the addiction.)
The most poignant philosophical expositor of the tension at the personal level is Søren Kierkegaard, in *Either/Or* and *The Concept of Anxiety*. His solution, in *Fear and Trembling*, is characteristic of his Protestant Christianity. He believed that the two parts of human nature could be unified through a “defining relation”, a loving relation with some person, profession or idea, that could provide immediate gratification through the satisfaction of the eternal requirements of the beloved. Since falling in love is a chance thing (or a product of divine grace), this solution is not accessible to everyone, but only to Knights of Faith (the original Danish plays on the etymological relations in Danish between “knight” and “slave”). Kierkegaard called people who accept the problem as fundamental, and therefore accept the human foibles in themselves and others that result, but who do not expect a personal solution, Knights of Resignation. Other possible “solutions” include submission to power, authority or dogma, or the sort of rugged individualism that tries to find all spiritual resources within the person or family. The problems and possible solutions are echoed at the social level in interactions among societies, organisations, cultural groups and nations.

In Western science, unlike modern Western politics, the balance has been on the side of the Universal. This leads to a distancing of science from the individual, leading to a distrust and fear of science (not necessarily unfounded), and a diminution of the importance of the individual (Burckhardt, 1975). Not surprisingly, the sciences that are closest to humans, the social sciences and biology, have trouble satisfying both the requirements of scientific objectivity and the immediate needs of people. This suggests that the introduction of an internalist perspective into science could lead to more satisfying scientific theories in these disciplines. The perspective will not be successful, however, unless it can be extended into physics. Otherwise, the best confirmed and tested part of science will remain disjoint from the rest.

There are two fundamental scientific reasons for taking an internal perspective. In order to preserve generality, I will talk in terms of systems, which are the logical closure of causally connected elements (sub-systems) such that the causal connections among the elements are stronger than those commonly established with other elements. A system has external relations and internal relations. The internalist perspective portrays external relations as resources and capacities, while the internal relations generate needs and motivations, which are framed in terms of the preservation of system autonomy. The first reason for taking the internal perspective is that it can help to identify the dynamical interactions that are relevant to the system, and distinguish them from those that are not. Unless we view dynamics from the system’s point of view, it is very difficult to make this distinction. The main tendency from the external perspective is to reduce all dynamics, leading to a loss of the particularity of the system dynamics and the inclusion of many dynamical considerations that are irrelevant to the system’s functioning. The second reason for taking the internalist perspective is more subtle. A satisfactory science should be able to account for spatio-temporally extended dynamically organised autonomous entities such as ourselves. As we shall see, a purely external perspective has trouble reconciling extended, self organising particulars with its universal laws.

3. The schizophrenic culture of the West

Science originated with the Greeks, particularly in the democratic culture of Athens and the imperial culture of Alexander. The Greeks, with their heritage of multiple warring gods, much more Earthly than the omnipotent, omniscient God of monotheism, prided autonomy in both the individual and the state. This produced a flowering of pluralism, including views of Nature and Humanity, the
like of which we probably haven’t seen since. Ancient Greek intellectuals, however, shared in common a devotion to reason and universalisation which has left its stamp on science in the view of Aristotle that all scientific explanation should be demonstrative and repeatable. This rationalism, if satisfied, ensures that the universal can be grasped and applied to particular circumstances. The vestiges of the gods appear only in the Platonic forms, especially of the Good, and in Aristotle’s Prime Mover, both highly rational and universal, and very, very abstract.

The other root of Western culture is the monotheistic religion of the Middle East. This tradition prides obedience and faith, and tends to regard reason as deceptive, and autonomy as illusory, or at least risky. Alternative views are evaluated moralistically as well as descriptively, according to God’s perceived wishes. The God is personal, omnipresent, and is revealed to Chosen individuals in particular (non-repeatable) circumstances. Although there are many names for God, the best that the God can do to identify its own nature in words is “I am that I am.” God’s nature is revealed primarily through acts, and Will takes predominance over Reason. The Heavenly power and authority is summed up in the rubric, “As Above, so below.”

4. Divine command theory of laws

The first successful science was astronomy. Its success was enabled by the regular dynamics of what we now call the Solar System, which are in turn a consequence of the self-organising properties of dissipative systems, the relatively small number of component systems of the Solar System, and the long time since it originated. When a system dissipates energy, it tends to reorganise itself so as minimise dissipation (friction). This is most efficient when components are in regular, harmonic relations to each other (i.e., so tuned that they do not tend to disrupt each other). The Greeks knew nothing of dissipation and evolutionary dynamics, but they did recognise the harmonies, and were satisfied with phenomenally accurate laws couched in the language of circular (harmonic) motion, a language appropriate to the perceived eternity of the Heavens, in distinction to the irregular finiteness of linear motion on Earth.

In order to reconcile God’s will with temporal observations, the “divine command” theory of laws was developed. According to this theory, regularities and harmony are a consequence of God’s dictatorship of natural laws, with independent human striving outside of God’s laws being responsible for chaos and suffering. Human autonomy is thereby limited to the choice of following God’s laws, or risking chaos and suffering through the assertion of the individual will. The central importance of laws, therefore, was derivative from God’s will, and the discovery of God’s laws became a way to discover God’s will. Newton subscribed to this view, and spent about one third of his research time on natural laws, while one third was spent with alchemy and another third with Biblical prophecy (Dobbs, 1975). Each of these was equally likely to lead to an understanding of God’s will. The divine command approach to scientific law places all dynamics under the ultimate control of an external, God, and there is no clear justification for adopting an internal perspective.

The reconciliation of Heaven and Earth in this cosmology requires the unification of celestial and terrestrial dynamics. This requirement underlies the importance of squaring the circle and of discovering the Philosophers’ Stone, which could transmute substances, and thereby give access to the quintessence underlying the earthly substances. Galileo thought that all motion was intrinsically circular, and that our inability to see this was due to the deception of the senses. Newton, on the other hand, was able to extend earthly laws to the heavens, which had the end result of reducing the special status of that realm.
5. Newton’s laws and determinism

The success of Newton’s laws of motion and the associated mechanical philosophy led eventually to a locally deterministic naturalism. This position is best summed up by Laplace’s boast that if he knew the location and motion of every particle at some time, he could predict the future of the universe (no miracles or divine intervention allowed!) We now suspect that this boast is unrealisable because of quantum mechanics, and know it because of recent work on dissipative, self-organising systems with chaotic regimes.

In mechanical systems, however, local dynamics are entirely predictable, and systems can be logically decomposed into elements without loss of explanatory power. There is no need for the internal perspective in the mechanical philosophy. In fact, it is potentially incomplete and misleading. The role of God in the mechanical view recedes to at best that of Aristotle’s Prime Mover (this is implicit in the failings of Aquinas’ Five Ways to Prove the Existence of God). Local Laplacean determinism makes both the externalist and internalist perspectives irrelevant. With the success of this view, naturalism came to dominate in science and the humanities, which stimulated the Enlightenment. The mechanical world-view has dominated Western science, especially physics, in modern times until very recently.

6. Rationalism and Empiricism

The first modern philosophers were rationalists, like the Greeks whose scientific tradition we have inherited. They believed that the fundamental principles of the world were restricted in number, and could be arrived at a priori. The empiricists, however, believed that this was contrary to human psychology. From Locke through Hume to Mach, Duhem and the Logical Empiricists, they adopted a subjective, or internal, approach to the theory of knowledge, and left the nature of scientific laws to metaphysics, which they regarded as outside science, and probably incomprehensible.

The object of science, however, remained largely mechanical, and the empiricists developed a view of mind as a logical or computational process, and ideas as logical constructions that mirrored the mechanical nature of the world. Thus, the first step towards internalism did not take us very far.

The subject-centred empiricist epistemology, together with mechanistic naturalism led to what Thomas Nagel (1986) has called “the view from nowhere”. This is an inevitable result of a naturalism in which the laws of nature are universal, and thus independent of their epistemic roots, and are not the product of some divine omniscient mind (however benign or horribly and insanely jealous). An unfortunate side effect of this progression is an increasing distance between science and immediate human interests. At least God cared about us, each individually. With the dissipation of God, mechanistic science presents a cold and inhuman world, without values or purpose. This has potentiated the increasing subjectivism and nihilism with respect to values that we have observed this century, as well as the proliferating distrust of science and reactionary appeals to “traditional values”.

7. Autonomy and Self organisation

The physics of this century have led to the demise of the mechanical world view and resulting re-evaluations of modernism. Relativity theory has been cited as justifying a non-objective world-view, but it is really a classical theory, and says nothing that contradicts mechanism. Quantum mechanics, on the other hand, does introduce what are apparently indeterministic elements into the world, but its laws are entirely deterministic, and the indeterminacies are incomprehensible and uncontrollable, on the standard interpretation of the theory. If anything, it
makes the world even more cold and impersonal.

The ideologically significant advances in physics this century are the discoveries of self-organising systems and systems with deterministic but chaotic regimes. Self-organising systems are dissipative systems that generate information internally at the expense of the available energy in their environment. They are autonomous to the extent that the regularity they generate arises from conditions internal to the system. Taking a mechanistic perspective can miss this self-generating aspect, while the external perspective in general risks missing the correct causal description of the system. In any case, dissipative systems, especially those that are far from equilibrium, are mathematically intractable unless they are simplified. The internal perspective can introduce stable aspects of the system as constraints on the whole system dynamics, and thereby make the required simplification. This requires treating the system as a holistic spatio-temporally extended particular, in distinction to the mechanical philosophy.

In deterministic systems with chaotic regimes, arbitrarily small shifts in starting conditions can lead to arbitrarily large changes in later states of the system trajectory in chaotic regions of the system phase space². This means that a random sampling of the trajectory in a chaotic region will (in principle) provide no information about the laws governing the system. No sampling consistent with good and effective sampling procedure can distinguish a system in its chaotic regime from a random system. This undermines the inductive methodology that underlies empiricism. The only way to recover system dynamics is to either observe the system in its non-chaotic region (assuming the system is the same system in the chaotic regions), or to make non-random measurements, e.g., a time series. Both require assuming a spatio-temporally extended system prior to the measurements.

A further complication for mechanism appears when self-organisation and chaoticness are combined. Systems have certain regions in their phase space that are attractors (viz., without external perturbation, they end up in the attractors). In dissipative systems, the attractors are much more restricted than the whole phase space of the system, and capture in an attractor is order producing. A self-organising system with multiple attractors that is in a chaotic regime between attractors will determine which attractor(s) is (are) selected in the self-organising process in a way that is intrinsically unpredictable. Probably most, if not all, real self-organising systems are of this sort. If this is so, then an analytic reduction of self-organising systems is impossible, and we must be willing to accept un-reducible spatio-temporally extended particulars (Collier, 1993).

As I have argued, this makes the internal perspective both non-redundant and useful. The sort of systems that will most benefit from an internal perspective are autonomous adaptive systems like ourselves and our social creations, though biological and functional systems in general will benefit to some extent.

8. Where do we go from here?

The internalist perspective has appeared in a scientifically acceptable form only recently. Its appearance is in part due to the influence of systems theory, but it is also due to the new recognition that the mechanistic world-view is doomed by recent discoveries in mathematical physics, and an increasing realisation that an empathic approach to organisms, people and social systems need not be unscientific. On the other hand, there is still considerable resistance to the approach, due in part to the deep entrenchment of mechanism in modern scientific culture. For this reason (and I speak from personal experience), it is probably best

²The system phase space is the abstract mathematical space determined by the system variables, e.g., the possible positions and momenta of each particle. An ideal gas of N particles has a 6N dimensional phase space (3 position and 3 momentum values for each particle).
to introduce the ideas with considerable rigour, because they will be attacked with prejudice.

Interestingly, much of the work on the internalist perspective has been carried out in Europe, Japan and Australia rather than in the United States. I would guess that this is in part because the United States is a child of the Enlightenment that has not yet been presented with sufficient reason to grow up. Even the workers at the noted Santa Fe Institute for the Study of Complex Systems tend to take a very abstract, artificial and “bottom up” approach that is an attempt to make minimal revisions to the established strategy of mechanistic science. There are certainly versions of internalism emanating from the United States. The computational approach to cognitive science typified by Fodor and Pylyshyn (xx) is certainly one. However, that approach is strictly logical and dualistic, with dynamics entering only as physical realisations of computationally analysable systems. The radical internalism advocated in the papers in this journal volume focuses on internal dynamics, not computation (though I believe the two can be reconciled through Schrödinger’s Negentropy Principle of Information).

The range of work that involves the internal perspective includes the evolutionary and developmental biology of the Unified Theory of Dan Brooks and Ed Wiley (Brooks and Wiley 1988, especially pp Chapter 7), the hierarchical and developmental views of Stan Salthe (1985, 1993), the endophysics and psychology of O.E. Rössler and George Kampis (Kampis 1991), work on the dynamics of self knowledge by Koichiro Matsuno (1989, Matsuno and Salthe 1995), and attempts to reconcile global laws with local dynamics by Yukio Gunji (1993) and his and my former student, Tokufumi Yamamoto (1995), who is now working in Australia with artificial life researcher David Green. Another locus of research is in Spain, where Tim Smithers is researching dynamical approaches to the solution of problems for robots, and Arantza Etxebberia is doing some interesting philosophical work. My own group in Newcastle is headed by Cliff Hooker, who is interested in informal and dynamical approaches to control theory and mind (Hooker 1995). Each of these researchers or research groups is locally isolated, but they have produced a large amount of theoretical clarification of the internal approach, and an increasing number of applications across biological, psychological and control systems.

The internalist perspective cannot be true, because perspectives are not the sort of thing that can be true. Nonetheless, it is useful and productive where traditional externalist or dualist approaches fail. A better understanding will have implications for biology, psychology, engineering design, sociology and political theory.

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References


