EVOLUTION FOR OUR TIME: A THEORY OF LEGAL MEMETICS

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by

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Abstract
The purpose of this paper is to explore the significance for legal thought of recent developments in evolutionary theory which are associated with the notion of 'memetics'. 'Memetics' aims to account for processes of cultural transmission and change using a version of the 'genetic metaphor'. This is the idea that patterns of cultural evolution are closely analogous to those which occur in the natural world as a result of the interaction between genes, organisms and environments. At a further, more ambitious level, the initial metaphor gives way to a search for mechanisms which unite biological and cultural evolution. Identifying these general evolutionary mechanisms is part of a wide-ranging, interdisciplinary research agenda.

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The case for looking closely at evolutionary theory from the viewpoint of law lies in part in the recent growth of interest in the idea of the 'meme' as an analogue to the gene in the social or cultural sphere. The notion originates in the works of the evolutionary biologist Richard Dawkins, in particular *The Selfish Gene*[1] and *The Blind Watchmaker*,[2] but its diffusion owes much to Daniel Dennett's philosophical work, *Darwin's Dangerous Idea*.[3] A 'meme' is understood to be a unit of cultural information, that is to say, a concept or idea that is shared within a population of individuals through social (as opposed to genetic) transmission. The diffusion of memes is subject, in principle, to similar Darwinian principles of heredity, variation and selection as apply to genes. This is to argue that cultural forms develop according to a logic of cumulative evolution, through which marginal or incremental changes occur over time in a way which reflects selective, environmental pressures. The basic evolutionary 'algorithm' can thereby be applied to explain the emergence of complex social institutions as the result of an extended process of historical development.

While there are many controversial issues arising from the use of the genetic metaphor outside the biological sciences, some can and should be set aside, at least for the purposes of the present discussion. A memetic point of view does not require us to believe that human institutions, such as law, are shaped *directly* by genetic transmission. On the contrary, memetics opposes this type of genetic reductionism by raising the possibility that there are evolutionary mechanisms which are specific to the cultural realm.[4] Here, 'culture' is broadly defined to include those human practices (of which law is one) which depend upon the existence of shared knowledge and understanding among a given population of actors.[5] If cultural and genetic evolution coexist, there are implications for 'meme-gene coevolution', which are only just beginning to be explored.[6] Consideration of the claims made by 'evolutionary psychology' to have identified a genetic basis for certain human behavioural traits and social institutions[7] will be part of this research programme. However, for lawyers and social scientists, there is a prior set of questions which must be considered before we get to this point. It is the purpose of this paper to consider a number of these prior issues, within the context of debates which are specific to the social and human sciences.

The present inquiry is in a long tradition linking legal and evolutionary theory, which predates the writings of Charles Darwin. Legal doctrinal thought, along with political economy, formed part of the intellectual climate from which modern evolutionary theory emerged in the mid-nineteenth century.[8] After the appearance of *The Origin of Species* in 1859,[9] Oliver Wendell Holmes[10] and

Arthur Corbin[11] were among those who used Darwinian ideas of natural selection to explain the mutation of legal concepts and the selective survival of legal precedents. This line of thought was submerged for much of the twentieth century, but a version of it resurfaced during the 1970s in the context of the 'law and economics' movement.[12] More recently, legal change has again been described in explicitly evolutionary terms, through the notions of autopoiesis[13] and path dependence.[14]

Law, then, offers a potentially fruitful field in which to test the recent claims of memetics. Nor is this about the simple transplantation of ideas from biology to the social sciences. The notions of *bounded rationality* and *conventions*, which originated in organization theory and the economics of law, are increasingly being used by biologists to explain the persistence of behavioural traits and regularities.[15] There is every possibility of developing a genuinely cross-disciplinary exchange and synthesis of ideas.

Against this background, the present paper will argue in favour of an evolutionary theory of legal change which rests on three related propositions. The first is that legal evolution is *cumulative*: incremental mutations in legal forms, when coupled with the selective effect of environmental pressures, can give rise to complex, multi-functional legal institutions. Secondly, legal forms are *adaptive* without being optimal. They reflect an internal dynamic of change which is shaped by historical conditions, rather than predestined convergence on a single, uniquely efficient form or 'evolutionary peak'. Thirdly, legal evolution operates through a process analogous to *inheritance* in the biological sphere, which involves the vertical transmission of stored information. More specifically, it will be argued that it is useful to think of legal *concepts* as memes which store and 'code' information about social adaptations in a way which parallels the form and function of the genetic code, and that, by doing so, we will be able to throw new light on some enduring questions in the legal evolution debate.

The argument will proceed as follows. The next section outlines the meaning of the 'evolutionary algorithm' of natural selection and discusses how it may operate in a social or cultural context. Some illustrations of evolutionary effects such as 'frozen accidents' and 'QWERTY phenomena' within legal doctrine are then presented, drawing on studies of the historical development of the legal institution of the contract of employment. Next, the argument is extended beyond an internal legal account, in an attempt to explain the link between social conventions and legal norms in evolutionary terms. Theoretical claims are supported by further examples drawn from the law governing employment and

commercial contracts. A basis for applying the genetic metaphor to law is then suggested, and some implications are drawn out in terms of the social ontology of law, the methodology of 'law and economics' and socio-legal studies, and the consequences for the conduct of public policy. The paper ends with a wider reflection on the future of evolutionary thought in the social and human sciences.

The Evolutionary Algorithm

Darwin's objective in *The Origin of Species* was to show how speciation, or diversity in the natural world, occurs spontaneously through natural selection. Scarcity of resources leads to a competitive 'struggle for life'. Where there is variation in the characteristics or traits which organisms inherit from their parents, those characteristics which aid survival and reproduction are more likely to be passed on to the next generation in their turn:

'Owing to this struggle for life, any variation, however slight and from whatever cause proceeding, if it be in any degree profitable to an individual of any species, in its infinitely complex relations to other organic beings and to external nature, will tend to the preservation of that individual. The offspring, also, will thus have a better chance of surviving'.[16]

With differential survival rates across successive generations, traits which are advantageous in this sense accumulate. By these means, an 'invisible', selective pressure is applied:

> 'natural selection is daily and hourly scrutinizing, throughout the world, every variation, even the slightest; rejecting that which is bad, preserving and adding up all that is good; silently and insensibly working, whenever and wherever opportunity offers, at the improvement of each organic being in relation to its organic, and inorganic, conditions of life'. [17]

Speciation typically occurs when differences in environmental conditions act on the selective process to bring about divergencies in the line of descent. The 'environment', for this purpose, consists of the physical features of the natural world (topography, weather, and so on) and the activities of other organisms. Separation of the members of a single species, the result of migration or of changes in the landscape, can lead over time to the emergence of new species as each group adapts to new conditions. This type of selection, unless unchecked, will carry on producing greater diversity over time, in part because, once two separate lines of descent have emerged, it is not normally possible for them to

recombine.[18] Moreover, diversity across species is self-reinforcing since it allows more efficient use of the limited resources available for life: 'more living beings can be supported on the same area the more they diverge in structure, habits and constitution'. The distinctive forms which emerge in this way are all 'fitted' or 'adapted' to their environment, in the sense that the features which they possess have co-evolved with those of their surroundings (which, in the case of any one species, includes the relevant features of others with which it co-exists). This coexistence of different species suggests that multiple 'solutions' to the problem of adaptation to environmental conditions are possible.

The contribution of modern genetics to evolutionary theory has been to identify the precise way in which inheritance and variation occur. Inheritance takes place through the copying of the genetic code from parent to offspring. Genetic material has a particular chemical composition (DNA) which makes this cross-generational copying possible. Genes are therefore 'replicators' or self-replicating entities which copy themselves with an extremely high degree of fidelity. At the same time, some mistakes in the copying process are possible. It is through random mutations in the genetic composition of individual organisms and their recombination through reproduction that variation in inherited traits across a population of individuals takes place.

Genetic material is literally a form of stored and coded information.[19] The genetic code – the 'genotype' (the term 'genome' is used to refer to a complex of genes) – contains information which is 'encoded' in sense of embodying previous adaptations or successful 'survival strategies'. It is then 'read' by an organism in the particular environment in which it finds itself. More precisely, the DNA 'code' transmits information to proteins in such a way as to enable them to 'build' the organism which then becomes the carrier or vehicle for the further replication of the genetic material through reproduction (the term 'phenotype' refers to the physical characteristics of organisms in this sense). As this process continues, the effect of natural selection is expressed through shifts in the genetic composition of particular species. As a result, it has been said that 'the process of natural selection is one of extracting useful information from the environment and encoding it in the genes'.[20]

In place of the initial two-fold distinction between organism and environment, we now have a three-fold distinction between genotype ('code'), phenotype ('organism') and environment. The introduction of the first element vitally clarifies the nature of the links between the other two. Information concerning the environment's past is embedded in the organism through the presence of the

code. It is in this sense that the organism and the environment are 'fitted' to each other. Selective pressures from the environment lead over time to changes in the composition of the code which in turn informs the structure of the organism. However, this occurs through the differential survival rates of the individual organisms which carry the code and make it possible for it to be reproduced. The 'instructions' contained in the code can only be altered 'blindly' or non-teleologically, through the incremental processes of inter-generational transmission and selective retention.

It follows that observed variations in the characteristics of different organisms do not represent the impact of immediate environmental pressures; rather, they are the consequence of the inherited, cumulative effects of environmental change over successive generations. This is the essence of the distinction between 'Lamarckian' and 'Darwinian' conceptions of evolutionary change.[21] In Lamarckian accounts of evolution, individual organisms respond with varying degree of effectiveness to environmental conditions. Traits which are 'acquired' in this way are passed on by the more successful individuals to their offspring in such a way as to ensure that these more efficient characteristics endure. In the Darwinian account, by contrast, variation precedes selection. In the modern neo-Darwinian synthesis, variation is understood to be the result of essentially random mutations in the genetic code, 'errors' in the copying process. Those individual organisms which *happen to be* best fitted for adaptation in a given environment, as result of their genetic inheritance, are the most likely to survive and reproduce.

The basic building blocks of evolutionary methodology are therefore the three-fold division between code, organism, and environment, and the attribution of functional or adaptive properties to characteristics which persist through time. This methodology is not specific to biology. Within the context of the social sciences, it is possible to substitute 'social system' for 'organism', and the 'institutional' or 'cultural' environment for the natural one.[22] Moreover, the 'evolutionary algorithm' of natural selection can also be stated at a sufficiently general level to apply to the social sphere. The algorithm predicts that where four conditions are observed – (1) self-replicating entities, (2) a mechanism of variation, (3) a mechanism for inheritance, or the inter-generational transmission of entities, and (4) differential survival rates brought about through environmental pressures – a process of cumulative evolution, leading to the emergence of complex, diverse forms, will occur. How far is this algorithm applicable to legal evolution?

Legal Genealogies: QWERTY Phenomena and 'Frozen Accidents'

A widely-followed approach in applying the evolutionary algorithm in the social or cultural sphere is to try to identify potential candidates for individual 'memes' in the sense of units or entities which are equivalent to the gene. According to some authors, a 'meme' must be capable of copying itself with near-complete accuracy, with errors occurring in a manner similar to the random mutations which occur in the genetic code as a consequence of transmission through inheritance. Changes in memetic material must also occur 'blindly' or spontaneously, rather than as the consequence of the volition of individual agents. Even some of the principal supporters of memetics find it difficult to envisage these conditions being met.[23] In *The Blind Watchmaker*,[24] Dawkins identified memes as *memory items* stored in the human brain, such as fashions, tunes, catch phrases and other, more complex verbal formulae, which were transmitted principally through *imitation*.[25] If memes were *only* memory items in this sense, it would seem that cultural evolution would have few of the features of biological evolution; change, rather than being slow and incremental, would potentially be extremely rapid; the copying of memes through imitation would be highly inaccurate (at least by comparison to genes), thereby threatening to bring about the disintegration of any 'memetic code'; individual volition and intention would play a major part in the process of transmission, thereby giving it a Lamarckian aspect; and cultural change would be free of the features which confer upon biological evolution its genealogical character, in particular the unlikelihood of recombining different lines of descent once they have separated.[26]

If these speculations have been discouraging for the emergent discipline of memetics, they stand in contrast to associations which have long been made between Darwinian evolution and processes akin to lineal descent within legal doctrine. The best known of these is Holmes's account of legal mutations in the first few pages of *The Common Law*, published in 1881. Holmes was concerned with the disjuncture between form and substance in the common law, and specifically with the different speeds at which the two appeared to evolve. Holmes argued that legal forms or concepts tend to persist long after the justification for them has been lost or forgotten, a process which he thought required 'ingenious minds' to discover new rationales for their existence. Once a new ground of policy was found, 'the rule adapts itself to the new reasons which have been found for it, and enters upon a new career. The old form receives a new content, and in time even the form modifies itself to fit the meaning which it has received'.[27] Holmes, like Darwin, was writing at a time when the nature of genetic processes of transmission was not understood.

However, the process he describes in *The Common Law* is not dissimilar to aspects of the modern neo-Darwinian synthesis in its account of 'blind' legal evolution occurring in an incremental, cumulative (but *not* necessarily progressive) fashion as the result of selective inheritance.

The opportunistic adaptation of existing legal forms to new ends which Holmes highlighted has parallels in the concept of 'bricolage' which has entered the biological literature from social anthropology.[28] 'Bricolage' implies that innovation in design, rather than involving the construction of a new model from scratch, tends to make use of structures or devices which lie immediately to hand. When a design feature is adapted from one use to another in this way, it remains embodied in the relevant structure long after its original function has disappeared. It is also possible that a design feature which is an essentially accidental by-product of an earlier adaptation finds a new use in a changed environment. The evolutionary biologist Stephen Jay Gould has coined the term 'exaptation' to convey this second type of feature. In both cases, 'adaptations' and 'exaptations', evolution involves moving away from an existing, inherited set of capabilities, rather than moving towards a predestined, optimal state.[29] The power of history to shape the direction of evolution is also captured by the idea of 'path dependence' which derives from new institutional economics. This stresses the sense in which structural features of an 'exapted' technology or practice may be 'locked in' by the high costs of switching to what appears to be a more efficient alternative.[30]

The QWERTY typewriter keyboard (to take the most discussed example) is thought to have acquired its distinctive layout as the result of the circumstances which accompanied the introduction and widespread use of manual typewriters in the late nineteenth century. The keys on some of the early manual machines tended to jam when operated quickly. As typists' speeds increased, designers hit upon the idea of using a layout which would slow them down. The QWERTY layout, with its awkward features (the much-used letter 'a' being designated for the little finger of the left hand, for example), was the solution. With the advent of more advanced keyboard technology, culminating in electronic keyboards of today's word processors, this aspect of the layout became otiose. However, after a while, the QWERTY configuration acquired usefulness form the simple fact of its near-universal adoption as the standard English-language keyboard. Users benefited from the existence of a single layout which had to be learned just once. At the same time the keyboard has certain ergonomic disadvantages; apparently more efficient alternatives have been tested and attempts made from time to time to market them. However, these have not caught on. In part, the QWERTY is maintained by virtue of the

network effects of having become a standard: the costs of switching, for any individual user, are considerable, as long as all other users are continuing to use the existing model. If a new model or standard were to be developed, it is possible that its use would quickly spread, once a critical mass of users made the change. But for the time being, at least, the QWERTY seems to be just good enough to survive; it has at best a *qualified* efficiency.[31]

QWERTY phenomena are extremely widespread in legal doctrine.[32] One example is the legal institution or concept of vicarious liability, in the context of the liability of employers for torts of their employees.[33] It is generally accepted that the function of vicarious liability is to shift the responsibility for injuries and other losses arising from economic production on to the enterprise, which is not only better able to bear this risk than the individual worker (either directly or through insurance) but is also in a position to take steps to minimize future harms through the power of management to coordinate the production process. At the same time, it is clear that the institution of vicarious liability, at least as it operates in the English common law, is a far from ideal mechanism for performing this task. What is needed is a form of 'enterprise liability' which attaches legal claims to the enterprise, understood as the productive entity.

However, no such notion exists. While the precise origins of vicarious liability are somewhat obscure, it seems that it is an adaptation or exaptation of the ancient legal maxim of 'he who acts through another is taken to have acted himself (*qui facit per alium facit per se*)'; that is, the employer, on whose behalf the employee is acting, is taken to have committed the tort which the employee also commits. Most of the time, this works well enough in achieving the risk-shifting and incentivising functions of an enterprise liability doctrine, but it breaks down completely in the situation where the employer chooses to join the employee to the action as a joint tortfeasor, and then seeks contribution from the employee. In order for the employer to be vicariously as opposed to personally liable, the employee must commit a tort; and it follows that the employer can, if it chooses to (or, more precisely, its liability insurer chooses to), shift most of the relevant liability back on to the employee. When this happened, in *Lister* v. *Romford Ice and Cold Storage Co. Ltd*.,[34] the House of Lords declined to take the necessary remedial step, and bar the employer's action by reference to an implied term in the contract of employment; as a result, the whole structure of employers' liability law was placed in jeopardy. It was only saved by the expedient of a 'gentlemen's agreement' among insurance companies not to seek contribution from employees in these circumstances.[35]

The example of vicarious liability indicates the 'qualified efficiency' or sub-optimal nature of opportunistic adaptations or exaptations; there is a potential cost to making do with what lies to hand. Another example from the law of employers' liability illustrates the potential for what in biology are called 'frozen accidents'.[36] These are structural features which are difficult to explain by reference to existing environmental conditions, but which can be seen to reflect adaptations to previous environments. The functional approach of Darwinism implies that the persistence of certain traits at the expense of others is a product of adaptation to environmental change. In principle, 'any *functioning* structure carries *implicit* information about the environment in which its function works'.[37] But when we take account of the principle of lineal descent, this means that structures embody information not so much about the environment of the present, as those of the *past*.

In English law, the tort of breach of statutory duty appears to be an anomalous addendum to the general law of negligence.[38] An employer is taken to have committed a tort where it breaks a duty imposed by a regulatory and/or criminal statute, under circumstances where damage results to a person who is within the range of the 'class of plaintiffs' protected by the statute. The tests for divining when a particular statute tacitly gives rise to this form of civil liability are notoriously unclear. The case law can be read as implying that no duty will arise unless the relationship between the parties, and the type of damage suffered, bring the case within the scope of the concept of duty of care in the law of general negligence. In other systems it is more clearly recognized that the purpose of the statute is to clarify what amounts to breach of duty, that is, what amounts to careless conduct, in circumstances where the law separately admits the existence of a duty of care (or its equivalent).[39] However, this is not the test which the English courts have articulated. Nor are they in a position to do so, given the insistence that breach of statutory duty is a tort in its own right, apart from the tort of negligence.

This anomaly occurs because the tort of breach of statute is an historical accident. The modern tort of breach of statutory duty was a late nineteenth century innovation which emerged as a way round an otherwise impassable obstacle to workers suing their employers for injuries sustained at work. This was the defence of 'common employment'. From the 1830s onwards, the higher courts had insisted that in an action based on the employer's vicarious liability for the tort of one worker against another, the plaintiff would be defeated by the defence that he impliedly consented to run the risk of negligence by a fellow worker. This defence was held to have no application, however, to the situation in which the employer's wrong was not based upon his vicarious liability for the

tort of one of his workers, but upon his own 'personal' breach of a statute imposing obligations to have regard to the health and safety of workers. In 1948, the defence of common employment was abolished by statute.[40] However, it was too late by then to re-integrate the tort of breach of statutory duty into that of general negligence, and the separation of the two torts remains in place to this day.

It may be objected that the legal doctrines of vicarious liability and breach of statutory duty are to some degree, at least, the product of intentional, ordered design. It is true that they appear to us now to have certain qualities of systematic organization, and that individual judges can, in some instances, lay claim to the authorship of particular doctrinal innovations. However, a generally accepted assessment is that 'vicarious liability is the creation of many judges who have had different ideas of its justification or social policy, or no idea at all'.[41] The appearance of order is largely the work of treatise writers and others whose job is precisely to systematise and classify what would otherwise be a disparate body of legal materials. Moreover, this process of systematization takes place almost entirely after the event.

The widespread and unavoidable practice of providing after-the-event rationalizations to doctrinal innovations often obscures the historical process by which they were formed. A 'genealogical' analysis, by revealing this process, can also throw light on the inherited constraints, but also the capabilities, of legal concepts. An analysis of the origins of the concept of the contract of employment indicates what is possible from this kind of methodology.[42] The modern contract of employment has a complex, multi-functional character. On the one hand, it provides a doctrinal basis for the exercise of many of those powers of the employer which in an extra-legal sense are described as 'managerial prerogative', that is to say, the power to coordinate the activities of a group of workers and to direct and control the pace of production. On the other hand, the same concept of the contract of employment is used in the context of modern social legislation to define those employment relationships which are regulated by employment protection law, and which are subjected to specialized regimes of fiscal and social security law. The device may therefore be thought of as serving a dual function: it underpins the hierarchical structure of the enterprise, while also providing the basis for the risk-shifting and redistributive functions of the welfare state.

Needless to say, these two roles do not always operate in harmony with each other, and much of the dissatisfaction which is expressed in relation to the doctrinal structure of the contract of employment derives from precisely this

tension.[43] The doctrinal shortcomings of the concept are easier to understand when the concept's 'line of descent' is reconstructed. It then becomes clear that the modern employment contract has been superimposed on top of an older notion, the 'master-servant' relation, which had few of the features which compensate today's employee for entering into a situation of personal and economic dependence upon the employer.[44] The key to understanding this process lies in the analysis of the legislation and case-law surrounding the terms 'servant' and 'employee'.

At the mid-point of the twentieth century, it was believed that the prevailing legal concept for defining the employment relationship during the nineteenth century had been the 'control' test. Otto Kahn-Freund influentially suggested that the control test developed in the context of the common law relating to the employer's vicarious liability for torts of a servant acting in the course of employment.[45] It is certainly true that, in the post-1945 period, this was one of the contexts in which the control test was still being applied. However, the nineteenth-century authorities which were (and are) cited for the 'control' test were not concerned with the issue of tortious liability. In part this was because, as we have already seen, actions by workers against their employers under the common law of tort were highly likely to fail because of the application of the defence of common employment, or through one of its allied defences, contributory negligence and consent.

Close examination of origins of the concept of the contract of employment suggests that it was not the common law of vicarious liability which provided the context for the emergence of that concept, but, rather, social legislation dealing with taxation and national insurance. One of the most widely cited cases for the control test, *Yewens* v. *Noakes*,[46] concerned the definition of a live-in servant under tax legislation. This case did not turn on the distinction between 'employees' and the 'self-employed' which is familiar to modern employment lawyers and which Kahn-Freund was writing about in the 1960s, nor even to the roughly equivalent nineteenth century distinction between 'servants' and 'independent contractors'. The court's decision was based on its refusal to believe that a salaried clerk earning a substantial salary could be a 'servant', since, according to the court, such a person was more clearly akin to 'the manager of a bank, a foreman with high wages, persons in the position almost of gentlemen'. *Yewens* v. *Noakes*, then, was not concerned with the modern distinction between employment and self-employment for which it is still, even today, being cited. Rather, it was concerned with a completely different status-based divide, that between 'servants' and labourers in manual employment, on the one hand, and those employed in higher-level occupations and managerial and clerical work, on

the other. To see why this distinction was more important at that point than it is today, a now-vanished feature of the nineteenth century legal landscape must be borne in mind. The distinction between manual and non-manual work had been central to the operation of the nineteenth century master-servant legislation; only 'servants' were subject to fines and imprisonment for breach of service contracts. This same distinction was carried over as a kind of 'frozen accident' into early social legislation concerning workmen's compensation and social insurance. It was in this context of the law of the emerging welfare state that the 'control' test was established in a series of early twentieth-century decisions.[47]

Why did twentieth-century courts light upon the otherwise obscure decision in *Yewens* v. *Noakes*? The (re)discovery and adaptation of the control test in the 1900s and 1910s was a doctrinal innovation which was introduced at the same time as the courts were being called on to define the boundaries of what was then regulatory legislation of a wholly novel type. Nor was this judicial innovation particularly welcoming to the new legislation. The element of compulsion in social legislation went strongly against the grain of prevailing common law values. As a result, the courts regularly held that professional and managerial workers were outside the scope of these new laws.[48] The control test, as applied by twentieth century courts, was also linked to disputes about employer's liability in the context of the widespread practice of internal contracting. The contract system of hiring labour through an intermediary was still the predominant form of industrial organisation in road building, construction, shipbuilding, mining and quarrying, and iron and steel.[49] The adoption of the control test enabled employers to avoid responsibility for the social risks of illness, injury and unemployment which it had been the aim of social legislation to impose, at least in part, upon them. In short, the rise of the control test in the early years of the twentieth century tells us much about prevalent employment disputes at that time, about the clash between freedom of contract and the welfare state, and about shifts in the structure of the business enterprise which were also going on then.

The 'unitary' model of the contract of employment which came to extend to all categories of wage-earners, including salaried and clerical workers, was only clearly adopted when further reforms were enacted to social legislation, in particular the extension of social insurance which took place in the National Insurance Act 1946,[50] and when the internal contracting system gave way to integrated management, a development which in some industries, such as coal mining, occurred as late as the post-war nationalization process. A major aspect of the Beveridge Report of 1944 was the abolition of distinctions between different categories of employees: henceforth, all wage or salary earners,

regardless of their annual income or of their professional status, would come under the same contributory classification.[51] It was in the context of this new situation that the courts abandoned the old distinction between low status and high status employees when seeking to define the contract of service.[52] The control test itself came to be regarded as excessively artificial, and gave way to the more recognizably modern tests of 'integration' and 'business reality'. At around the same time, the term 'servant' mutated into the modern 'employee'. By these means, a more inclusive notion of the employment relationship came to be established for the purposes of determining the scope of employers' liabilities in respect of personal injuries, employment protection and social insurance.

The interpretation of terms in now-repealed statutes on employers' liability and workmen's compensation reveals at the micro-level of doctrinal analysis how changing labour market conventions were reflected in the law in the period from the rise of the modern industrial economy to the advent of the welfare state. This occurred in a way which was very far from removed from the linear movement of status to contract which Maine had influentially suggested as the basis for legal evolution at the high point of mid-Victorian laissez faire;[53] nor is the more recent metaphor of the 'rise and fall of freedom of contract'[54] any more appropriate in this context. What is striking is the continuity of contract throughout this period as a point of reference as a series of mutations occurred in legal definitions of the employment relationship. Through shifts in conceptual form, the notion of the contract of employment emerged by way of response to the rise of the welfare state and integrated business enterprise. Mutations in legal forms were therefore the result of a complex interplay of social, economic and political forces. Long periods of relative stasis alternated with intervals of rapid innovation, often triggered by legislative intervention in a pattern reminiscent of 'punctuated equilibrium'.[55] Uneven rates of development and discontinuities brought about by exogenous shocks, rather than continuous, linear adjustment to an external environment, characterized the path of legal change.

There is a resonance here with what we know about the genetic code. The genome has been described as 'an information-processing computer that extracts useful information from the world by natural selection and embodies that information in its design… you can look on the human genome as four billion years' worth of accumulated learning'.[56] In the same way, legal concepts – the linguistic formulae which provide the basis for the systematisation of legal material – can be thought of as embodying in shorthand form information about the social world which is filtered through the processes of legal argument and

exposition. Like the genetic code, legal concepts change slowly, by comparison to the more rapid rate of change in the substance of legal rules, and in a way which is often only apparent in retrospect, mirroring the non-teleological and path-dependent aspect of genetic change. Just as the genome's ability to copy itself faithfully provides the necessary condition for inheritance of the information contained in the genetic code, so it is the relative continuity of the 'legal code' which makes it possible for the vertical, inter-temporal transmission of the information which it contains to take place. If, in general, 'cultural evolution is not possible until there are sufficiently powerful information-processing devices capable of storing information and reliably transmitting it to or replicating it in other information-processing devices',[57] then legal doctrine is one such repository.

Conventions, Social Learning, and Legal 'Coding'

So far we have been looking at mutations within the internal discourse of legal concepts. A wider perspective makes it possible to examine the processes by which information from the social realm is embedded in the legal 'code' in the first place. This involves a consideration of evolutionary theories concerning the emergence of social norms and conventions, and their link to law.

'Conventions' have been defined as units of shared information which provide a basis for coordinating the actions of individual agents,[58] a definition which, for present purposes, usefully stresses their potentially memetic character. The function of conventions in facilitating coordination is illustrated in game theory by simple models of games of *pure coordination* and *equilibrium selection*. In a game of pure coordination, for either party, achieving a high pay off depends entirely on being able to predict what the other party will do. However, the environment is such that the criterion of individual rationality provides no reliable guide to action.

The paradigm case is that of two drivers facing each other on the road in a foreign country for the first time. There are two possible equilibria here: (left, left) and (right, right). They are both as good as each other in terms of the pay-offs to the players as individuals, and in terms of the aggregate well being of the players. Neither driver has any grounds for knowing whether the other will choose to drive on the left or on the right. If, however, the convention 'drive on the left' (or, as the case may be, 'drive on the right') is known to both, the parties can achieve a high (coordinated) pay-off and avoid a low (uncoordinated) one (see figure 1).

Figure 1: *game of pure coordination (the pay-offs to each player are expressed as (row, column))*

	Left	*Right*
Left	1, 1	0, 0
Right	0, 0	1, 1

By contrast, other games present multiple equilibria with differing properties. The function of conventions here is to shift the parties' strategies from a sub-optimal outcome to one which enhances their joint well being. In the well-known prisoners' dilemma game (figure 2),[59] it is individually rational for each party to 'defect', that is, to decline to cooperate.

Figure 2: *prisoners' dilemma (the players' pay-offs are expressed as (row, column))*

	Cooperate	*Defect*
Cooperate	2, 2	0, 3
Defect	3, 0	1, 1

This expectation is rational since, for any given player, the strategy 'defect' results in a superior individual pay-off to the strategy 'cooperate', *whatever the other player does*. This is the inevitable result of the way in which the prisoners' dilemma game is set up. The environment in which the players find themselves is such that a sub-optimal outcome is sure to occur if each individual acts according to his or her own self-interest; hence, the outcome of mutual defection is said to embody a unique 'Nash equilibrium' or stable state.[60] Other games can be imagined in which no such single strategy is dominant; outcomes necessarily depend on how the pay-offs are arranged. The prisoners' dilemma is no more 'realistic' than these alternative games. The interest of the prisoners' dilemma lies not in any realism which it may possess, but in the possibility it

provides for exploring the dynamics of a situation in which the expression of individual self-interest is radically opposed to the collective good.

It is futile to insist that the players in the prisoners' dilemma surely must cooperate, since by doing so they could shift the outcome from a sub-optimal equilibrium (defect, defect) to a manifestly superior one (cooperate, cooperate). This would simply represent a different, and arguably less interesting, game, one in which the conflict between individual and collective well being had been somehow abolished. This could be achieved by changing the background assumptions in some way, for example by making it possible for the parties to make a legally binding contract which was perfectly enforceable, or by altering their preferences so that the well being of each one was interdependent with that of the other. These changes could be incorporated into the game by changes to the structure of pay-offs.

However, the point of the prisoner's dilemma is precisely that it asks us to consider whether cooperation can arise in a state of nature where the possibility of legal enforcement does not exist. Under these unpromising circumstances, can it be shown that conventions which support cooperation are capable of emerging endogenously, that is to say, on the basis of nothing more than the bare ingredients of the interaction inscribed by the 'rules' of that particular game? The basic insight here is that spontaneous cooperation can emerge if the game is played more than once, thereby giving rise to the possibility of defection in one round being punished in the next. More precisely, if the game is played *indefinitely*, a fragile but stable basis for cooperation may be established. If, on the other hand, both parties know the end point of the game, this form of cooperation begins to fall apart, since, by backwards induction, it becomes rational to defect not only in the final round (when the threat of retaliatory punishment has become meaningless) but, in anticipation of what will happen then, in all previous rounds.

Cooperation is not inevitable in the repeated prisoners' dilemma. On the contrary, it is just one of a number of equilibria which have been identified as being technically possible when this game is played.[61] Which equilibrium the parties arrive at depends on how far they play 'mixed strategies' (randomly altering their strategies over time), on the degree of error in their responses, and in the timing of these variations. To make further progress in understanding the origins of cooperation, it is necessary to introduce the notion of 'bounded rationality' which is at the heart of evolutionary game theory. In the model of the prisoners' dilemma which we have been considering so far, the actors have been endowed with 'hyper-rationality' or an unconstrained ability to foresee and

predict each other's behavioural responses. In bounded rationality models, by contrast, their ability to foresee the future is assumed to be constrained by limits upon their knowledge and computational capacity. The purpose of making this assumption is to model games in which strategies can be learned through processes of imitation, observation and social interaction.

An essential part of these models is the idea of the 'evolutionarily stable strategy' or ESS. An ESS is a type of Nash equilibrium that sustains itself against alternatives under particular conditions. When the strategy is played by a certain critical mass of a given population of players, it becomes impervious to 'invasion'.[62] Robert Axelrod's computer simulations, described in his 1984 book *The Evolution of Cooperation*,[63] found that the 'naïve reciprocator' strategy of tit-for-tat was an ESS which thrived against alternative strategies in the sense just described. In tit-for-tat, one player cooperates until such time as the other player defects, and then subsequently binds his or her strategy to whatever their opponent has just done. Once this pattern becomes established, the players' expectations become self-reinforcing, and a convention is established. Tit-for-tat is not a *unique* ESS in the repeated prisoners' dilemma, and studies have shown that it is almost certainly not the best conceivable strategy for that game.[64] However, the fundamental insight that reciprocity holds one of the keys to understanding the emergence and persistence of cooperation and hence, in an extended sense, of social order, has an obvious resonance with empirical studies in a number of disciplines ranging from the study of animal behaviour to human anthropology. It also has clear importance for the study of contract law, where the importance of reciprocity has long been recognised in both the empirical and theoretical strands of relational contract writing.[65]

The term 'reciprocal altruism', which was originally applied in evolutionary biology but has since entered wider use, describes a range of behaviour embodying tit-for-tat and related strategies.[66] The term is somewhat misleading, since its conception of 'altruism' is firmly rooted in individual self interest. Equally, the idea of 'gift exchange' with which it is associated can give the false impression that the process of transfer of resources is in some way gratuitous, when the opposite is the case. 'Reciprocal altruism', so-called, implies that one party incurs a cost in order to confer a benefit on another, in the expectation that he or she will receive a benefit back in return at some future point. Repeated interactions and stable relations through time thus provide the basic conditions for the practice to develop. In addition, there must be the possibility of 'punishment' for those who do not reciprocate the gains they have received, if only in the form of their exclusion from future trades.

The argument that reciprocal altruism generates a surplus which confers an evolutionary advantage on those groups which pursue this practice lies at the basis of the claim that some species, including human beings, are 'hard wired' to engage in this practice.[67] However, an alternative (if possibly complementary) hypothesis must be considered, namely that the emergence of reciprocal altruism and similar practices has been informed by a memetic process operating at the level of social evolution. Viewed from a memetic perspective, the effectiveness of a convention is a function of how widely it is observed and imitated, and this, in turn, depends on how well the practice which it embodies can be copied. A purely behavioural explanation may take us part of the way in understanding how it is that certain conventions become established and, in turn, how they are destabilised. This is the case with H. Peyton Young's pared down model for the emergence of road traffic conventions.[68] In a world of agents acting with bounded rationality, an individual's decision to drive on the left or the right hand side of the road is a function of what he or she observes other drivers doing. On this basis, a well established practice can tip over to its opposite, depending on the extent of the memory of individual drivers and their propensity for random error. This is an illustration of the role played by information and norm 'cascades': the persistence of conventions is linked to the number of agents following them because the pay-off increases the more agents follow the convention.[69]

Social learning, then, involves a feedback mechanism through which particular practices become self-reinforcing. Through copying what others do, agents move towards conventions which are more successful without the need to know exactly why the practice in question works for the best. In a positive transaction cost world, conventions save on the transactions costs of continually searching for the 'right' solution.[70] The process is one of 'blind' evolution because no one knows in advance that they are setting off on a 'superior path'; by definition, the path becomes 'superior' only in the light of what happens later.[71]

Empirical studies have apparently shown that a form of social learning of this sort, involving 'order without law', can emerge on the basis of shared understandings among a relatively stable and homogenous group of actors, to the extent of rendering formal legal rules redundant or ineffective.[72] However, the diffusion of information concerning solutions to coordination problems on the basis of imitation and observation alone is a slow and often haphazard process. In this context, it seem that an important function of the legal system is to standardise and transmit complex information in such a way as to make it possible to widen the basis for trade beyond localised communities, thereby extending the scope of the division of labour. The impact of legal rules and

sanctions may not necessarily be felt directly by the majority of economic agents, but comparative, empirical evidence suggests that the legal framework or 'architecture' of norms[73] may play a role in shaping the environment within which particular forms of economic cooperation emerge, to the extent that differences between systems at the level of legal norms are reflected in variations in contractual practice and vice versa.

This was one of the findings of the Cambridge study of inter-firm contracting which was carried out in the mid-1990s and which compared, among other things, legal and commercial practice in Britain and Germany.[74] In Germany, a major role is played at the doctrinal level by article 242 of the German Civil Code, which embodies a principle of good faith (*Trau und Glauben*) in contracts, including 'arms-length', commercial transactions. Article 242 acquired its current meaning largely as a result of shifts in judicial interpretation of commercial contracts, the most important of which occurred during the 1920s when the courts had to deal with the consequence of hyper-inflation on long-term agreements. It was in this context that article 242 was interpreted as requiring parties to renegotiate long-term contracts which are subject to an unanticipated event, such as an unexpected rise in prices or fall in demand, in such a way as to go far beyond what would normally be permitted by the common law doctrine of frustration, which relieves the parties from future performance but only in a much more restricted range of circumstances.[75] Article 242 and the good faith principle which it embodies represent a particularly explicit and elaborated formulation of the values of reciprocity in commercial relations. A commentator on article 242 has said that it has the role of 'giving legal force to broad ethical values'.[76] By contrast, the English courts have, notoriously, refused to countenance a general principle of good faith in commercial contracts, preferring to stress the autonomy of parties dealing 'at arms' length'.[77]

The Cambridge study found that the role of article 242 is not a purely rhetorical one; its influence is felt at the level of contractual practice. Three levels of contractual regulation are relevant here: the body of commercial contract law, which in infused by the values of reciprocity derived from article 242; the standard form agreements for commercial dealing which are laid down at industry level in Germany; and inter-party agreements at micro-level. The different levels are closely linked.[78] Standard forms follow closely the guidance of the law on what amounted to performance in good faith; individual contracts, in turn, tend not to depart radically from the template set at industry level. This is not to imply that the process of transmission is just one way, from the law down to the level of individual contracting; the process of litigation, which over a number of decades has resulted in several thousand decisions which have reported and digested,

ensures that information about what is occurring in commercial practice flows back up to the legal system, albeit in a form which is subject to selective pressures.

There is a considerable contrast here with English commercial law and practice. Parties are very much 'free to make their own agreements' in the absence of an overarching principle of good faith and relatively weak industry-level standard terms. During the period of the research referred to, in the mid-1990s, standard form contracts were disintegrating in the industries being studied, as a result of the privatisation of coal, gas and electricity. Monopsony buyers, in the form of the old nationalised state corporations, had performed a similar role to trade associations in Germany in ensuring that standardised contract terms were followed. With their departure from the scene, long-established terms dealing with the allocation of risk between main contractors and sub-contractors were swept aside in favour of agreements which shifted the risk almost entirely on to the latter, reflecting the new balance of economic power.

In the German context, article 242 embodies an equilibrium-shifting convention which seeks to inform the process of contractual coordination across a wide range of commercial and consumer transactions. Its persistence through time implies that it has become adapted to certain features of the legal and commercial environment in Germany; it is both a reflection of widespread contractual practice, *and* a framing influence on the development of contractual behaviour in that jurisdiction. Information circulates between the legal system and the economic system in such a way as to create a form of 'feedback' or reciprocal reinforcement. This leads in turn to a type of institutional lock-in in which economic relations of a certain type – generally those involving a long time horizon – tend to prevail over others. In the English context, by contrast, the lack of a legal principle similar in nature to Article 242 does not mean that there is no lock-in effect; there is an effect, but it simply has a different content. The notion of 'arms-length dealing' between commercial parties becomes a norm in practice, as well as a focal point for judicial pronouncements. Short-term time horizons are common, with the parties exploiting shifts in the terms of trade to press home a contractual advantage. In each jurisdiction, then, a particular form of economic behaviour has *co-evolved* with a certain type of legal discourse.

Thus in the case of rules of commercial law governing inter-firm contracting, legal concepts 'code for' information relating to means of solving coordination problems in this particular setting. Both litigation and legislation are means by which this information is collected. Litigants, in the context of case law, and interest groups pressing for statutory change, are akin to 'norm entrepreneurs'

who subsidise the process of discovery of new rules for the benefit of society as a whole, in return for the possibility of being the first to exploit a novel principle, or 'repeat players' who amortise current costs against expected future gains.[79] Both adjudication and legislation, in addition to holding out the prospect of immediate returns, create public goods in the sense of providing guidance for conduct in the future. An essential step in this process is the kind of *encoding* which occurs through *abstraction*, or the translation of particular rules ('pay on time') into broader conceptual or dogmatic legal categories ('good faith'). The process also works in reverse: the principles contained in concepts are applied in concrete settings through a form of contextual *decoding* which informs the content of particular rules.[80] In both cases, the task is not confined to judges and drafters, but is shared by the entire legal community, including practitioners responsible for developing the terms of standard-from agreements and precedents. In this context *interpretation*, rather than imitation, is the essence of legal transmission. With this emergence of law as a specific interpretive practice, legal doctrine acquires the autonomous and self-referential character which it needs to ensure its own replication, or self-reproduction.[81]

Moving beyond Metaphor?

We are now in a position to return to the genetic metaphor with which we began, and to see how legal evolution can be effectively understood in memetic terms. In this context, legal doctrine can be thought of as a particular *mechanism of cultural transmission which works by coding information into conceptual form, thereby assisting its inter-temporal dissemination*. The mechanism involved is essentially 'Darwinian' in nature, in the sense of operating through a cycle of inheritance, variation and selection. Legal discourse possesses elements of autonomy and self-reference which provide it with the capacity for self-replication, while at the same time that it is linked to wider social and biological processes through co-evolution. Legal *concepts* are the equivalent of genetic replicators, with substantive *rules or norms* operating as interactors.[82] This division mirrors a broader one in the social realm: memetic material (shared values, assumptions and heuristic categories) is embodied in the practice of *institutions*, understood as assemblages of rules, norms and conventions (see figure 3).

Figure 3: *units of biological, social and legal evolution*

Replicator	*Interactor*	*Environment*
Gene	Organism	Natural world
Meme (corporate culture)	Institution (enterprise)	Social world
Concept (contract of employment)	Rule or norm (duty of mutual trust and confidence)	Normative world

Inheritance occurs through the replication of concepts over time. The *unit of inheritance* is the abstract concept or 'legal meme' which is carried forward at the point when one legal rule succeeds another. The same process allows for a limited degree of *variation*. Variation in legal memes can be thought of as the result of experimentation by legal actors when faced with the need to adapt an existing rule to new circumstances. In genetic evolution, small variations in the inherited characters of organisms are said to be the result of random errors in the copying of the genetic code. In cultural evolution, the process is less clearly random; it could be said to be 'smart' in the sense of being guided by experience and precedent.[83] This idea helps to explain at one and the same time both the possibility of mutation through experimentation or error, and the high degree of fidelity which normally attends the copying process. As we have seen from reviewing the history of the contract of employment, while the content of legal rules in an area such as employment may shift considerably from one period to another, below the surface there is a surprisingly high degree of conceptual continuity. The conceptual form of the contract of employment has been reproduced in the context of successive statutes and judicial precedents, maintaining a continuing presence while the content of the rules themselves has in many cases been completely transformed. To illustrate this point with a further example: the most recent example of this process is the radical transformation of the employee's 'duty of obedience' into a 'duty of mutual trust and confidence' between employer and employee, a process which, while stimulated by statutory change, has occurred entirely through the language of implied contract terms.[84] What is to account for conceptual continuity of this kind? It would seem that the *mechanism of inheritance* is the legal system's self-imposed rule of internal conceptual order, which requires that new legal norms refer back to known conceptual forms. The conceptual content of the norm endows it with legitimacy in the context of the 'self-referential' operation of the legal order. There are many illustrations of this principle of legal

consistency, the most obvious being the rules of precedent which confine the scope of legitimate judicial interpretations, and which it is the particular task of the appellate courts to monitor and enforce. It is precisely such principles as the instruction that 'like cases should be decided alike' that ensure faithful copying most of the time, while also allowing certain scope for variations to emerge in response to novel fact situations.

Legal concepts are of course replicated through the means of human agency. Judges and statutory drafters, among other legal actors, are key agents within this process. But legal continuity of this kind is not simply a function of individual volition. The options available to the judge or drafter are both informed and constrained by the existing 'meme pool' of legal forms. The aim of adjudication or legislation is not to reproduce the concept as such; it is used only as a means to an end, that is, to develop a workable rule. Yet this has the effect that a version of the 'copy me' instruction is written into the form of those highly abstract legal concepts (such as 'contract' or 'employee') whose very generality serves to make them essential at the point when innovation in the content of substantive rules occurs.

The *unit of selection* is the legal rule and the *mechanisms* through which selection operates are what Luhmann and Teubner refer to in a generic sense as legal procedures or processes.[85] The mechanism is 'Darwinian' in that variation precedes selection. Variation in legal rules (the 'phenotype') is possible within the constraints posed by the search for coherence and continuity within legal doctrine (the 'genotype'). The rules which emerge from this process are subjected to selective pressures. Lobbying, interest group activities, litigation strategies, and other forms of concerted intervention in the law-making process all have a potential role to play here. The strongly selective effect of legal procedures ensures that in the case of litigation, for example, only certain disputes are litigated, only a fraction of these come before a court for decision, and only a further fraction in turn are reported and analysed in such a way as to establish precedents. At every stage, those norms which do not 'fit' with their environment are implicitly selected against. These procedures make it possible for the legal system to receive information about the attitudes, beliefs and values of members of a society on what passes for conventional or 'reasonable' behaviour. Because the legal system then transmits this information back to society in the form of legal norms, there is a powerful 'feedback loop' operating between the legal order and the wider economic and social environment. It is in this sense that the legal system and the wider institutions of the economy and society become 'fitted' to one another through co-evolution.

In itself, this presentation of the genetic metaphor, while suggestive, is only useful if it offers new insights on legal evolution. Three such insights may be suggested; they are concerned, respectively, with the ontological, methodological, and normative dimensions of this issue.

The *ontological* dimension concerns the nature of legal reality and the status of legal norms, concepts, and processes as objects of study. A purely internal, legal perspective does not offer, for this purpose, a viable account of how norms operate in the social or economic realm. The law's 'self-description' of its own operation (the explicit or implicit assumptions made in the form of legal norms about their own application) is of course no more than that.[86] Although this self-description is of interest in its own right, from both an internal, doctrinal and an external, sociological point of view, it does not provide a secure foundation for a socio-legal understanding of how law and society inter-relate. However, attempts to describe law in terms which are exclusively economic, for example, run the opposite risk of imposing an inappropriate conceptual framework which denies the distinctive social reality of legal phenomena. This is characteristic of the traditional law and economics analysis, which sees legal norms *exclusively* in terms of implicit 'signals' or 'prices', or of game theoretical approaches which view the application of norms as *nothing more than* stable equilibria.[87] The evolutionary approach suggested here seems at first sight to imply an even more extreme form of reductionism in which legal forms are seen as driven by a sub-individual unit, a 'selfish meme', and in which biological laws dictate the nature of social institutions.

On reflection, this criticism can be seen to be unjustified. A memetic perspective should see social structures in general, and legal systems in particular, as 'emergent' orders with distinctive evolutionary dynamics of self-reproduction and replication. Emergence is a property according to which there is 'a relationship between two features or aspects such that one arises out of the other and yet, while perhaps being capable of reacting back on it, remains causally and taxonomically irreducible to it'.[88] The evolutionary theory presented here offers us a way of thinking about law as emerging from the interactions of individual agents, in this sense, without being reducible to them. Memetic structures – shared information, conventions, 'culture' – cannot exist without human agency. More specifically, it is self-evident that there can be no legal system without the conscious participation of human actors in its establishment and functioning. However, the legal order represents more than the sum total of these interactions, at the same time as it represents more than the aggregated intentions of human actors involved in or affected by its operation. This is because, once the legal order is established, it frames the

conditions for the exercise of human agency, just as much as it is framed by them. This feedback effect provides the basis for the distinctive social ontology of law, and of memetic structures more generally.[89]

It further follows that, while the pattern and path of legal change may be subject to evolutionary mechanisms which share elements in common with those which govern biological evolution, legal evolution is not reducible to those same biological evolutionary processes. Evolutionary psychology's claim to have identified a direct link between genetic evolution and social structure must be seen in this light. The existence of an evolutionary dynamic within human culture is not, *without more*, evidence that human beings are 'hard wired' through their genetic code in favour of certain behavioural dispositions, since part at least of this dynamic may equally well be explained by memetic, social-structural processes which are distinct from (if at some level linked to) those of genetics. The relationship between the genetic and cultural spheres should be understood as one of co-evolution, rather than linear cause and effect.[90]
Certain *methodological* implications follow from this point. The evolutionary perspective presented here is necessarily functionalist, in the sense of seeing a link between function and form. However, this is functionalism with an important qualification: existing forms contain significant elements of adaptation to *past* environments. The information which is encoded in genes is information about how to build structures which were adaptive in environments encountered by our ancestors. Likewise with memes. Under these circumstances, the all-too-common step of imputing optimality to observed institutions simply on the basis of their persistence is not warranted.[91] As we have seen, to speak of fitness or even of the 'survival of the fittest' in the context of social institutions is simply to observe that these institutions have become 'fitted to' their environments over time. It does not follow that these institutions are the best available; if anything, is strongly implies the opposite, namely that, through the amplifying effects of feedback between institutions and their environment, certain other paths, some of them beneficial, have been closed off.

Under these circumstances, it is incorrect to assume that existing forms are fully functional with regard to existing environments. They may possess enough functionality to survive, but they have not acquired the features which they now have by way of adaptation to current conditions; these have been inherited as a result of past adaptations. Under these circumstances, a close inspection of the historical record – a 'genealogical methodology' – is required, with the aim of reconstructing the line of descent of institutional forms from an examination of the circumstances of their origins. As we have seen from the examples given of

the evolution of the contract of employment earlier in this paper, such a reconstruction would often show that the development of forms is dependent upon contingencies and chance configurations of events. It is interesting to note that, in this respect, studies of cultural evolution can afford to be more empirically orientated than their biological counterparts. This is because 'a fossil record of cultural change exists for our species that puts the biological fossil record to shame'; such a perspective implies, at the very least, 'empirical research programmes in cultural evolution [which] must become as ambitious as research in biological evolution'.[92]

This in turn leads on to *normative* issues. As we have noted at numerous points in this discussion, selection can only work through the feedback mechanism which operates through the code to link system and environment. Mechanisms of social learning which provide for the *horizontal* transmission of knowledge undoubtedly exist. It is evident, for example, that legal models are very frequently diffused by direct copying of concepts, as well as the content of rules. The results are rarely straightforward, as a long tradition in comparative law has demonstrated.[93] Nor does the prevalence of this form of horizontal transmission undermine the suggestion that the *vertical* transmission of stored information through the legal system is subject to Darwinian processes; the *inheritance* of the adaptive knowledge contained in legal norms depends upon their being coded in conceptual forms. Conversely, the capacity of the code to assimilate new information is limited by the need to ensure a high consistency in the copying process. This is a condition of its continued existence. Just as mechanisms have developed in the biological sphere for insulating the genetic code from external influences which would lead to its dilution and disintegration,[94] so 'boundary conditions' and 'rules of recognition' which determine which acts, processes and norms count as 'legal'[95] perform the same function with regard to the legal system. But the relative stability and continuity of legal concepts mean that legal evolution is, at any given point, out of synch with the process of social and economic change.

In systems theory, the separation of the legal and social systems is expressed in a particularly radical form: the law is 'operatively closed' to the external environment, while being 'cognitively open'. Operative closure is the consequence of law's autonomy and self-referentiality; without it, the legal system would lack the capacity for evolutionary change. It is the inevitable consequence of the existence of legal boundary conditions. At the same time, cognitive openness implies the possibility that events occurring outside the legal systems can impact upon it *if* they are first translated into juridical language and processed through distinctively legal acts and procedures. However, the

immediate priority for the legal system is to produce a rule which ensures the need for consistency and order in the internal conceptual code, not one which conforms to external conditions. The legal system's capacity for 'translation' is constrained by the inherited technology of existing conceptual structures.

As Gunther Teubner insists, 'autopoietic closure does not mean that the system is independent of its environment'.[96] What it does mean is that the legal order cannot be expected to respond *directly* to shifts in the social and economic environment. This implies a degree of 'asynchronic' evolution at the level of the law-economy relation which goes beyond the predictions of path dependence theory, which suggests that cases of true 'strong-form path dependence', in which sub-optimal legal forms persist in the face of external environmental change, will be rare.[97] On the contrary, we should expect to find that close alignment between the state of the law and that of the economy is the exception, not the rule.

For this reason, we should be extremely sceptical of claims that spontaneous processes are likely to lead to the production of more efficient rules. But equally, the emphasis on 'random' mutation and 'blind' evolution in the legal system inevitably raises fears that an evolutionary conception of law must rule out certain types of active policy intervention. Associated with this view is the critical account of legislative change which derives from the work of Hayek. Robert Sugden,[98] echoing Hayek,[99] suggests that 'the system of common law is a spontaneous order, in which laws evolve as a result of the decisions of many different judges'. The body of doctrine created by this process is more effective in adjusting to changing social circumstances, Sugden suggests, than is the case with explicitly worded legislation. Not only can legislation not ensure its own permanence (since bodies empowered to change laws by these means can also repeal them), but very precise legislation is more likely to need revision since 'no legislator can foresee all circumstances'.[100]

Yet this is plainly not the whole story. Legislation also encodes information about solutions to coordination problems. The legislative process collects information through processes of interest-group lobbying, public investigation, and parliamentary debate. Like litigation, it contains elements of spontaneous order and is subject to selective processes by which certain rules are taken up and persist while others are discarded. In addition, legal rules derived from legislation also change over time without necessarily being formally repealed, thanks to judicial interpretations of statutes and codes. The widely-held misconception of the role of legislation among adherents of spontaneous order owes much to the belief that statutory rules are the product of conscious or

planned intervention, while those of the common law derive from the 'blind' interplay of litigation and adjudication. This contrast is too strongly drawn. In both cases, conscious human agency is combined with elements of emergence. In many respects, legislation provides a form of information retrieval which is more broadly-based and open to a plurality of influence than the judge-made law has available through litigation, as the following example suggests:

the prohibition on the use of land-mines has been under discussion world-wide. An international conference that convened to discuss this subject decided to propose a treaty banning such weapons, and the treaty might soon come into effect. The movement that launched this new rule of International Law was surely innovative, and must have involved deliberate foresight, but the process by which such potential innovation was transformed into international practice was one of extended social selection, involving information campaigns, social organisation and coalition-building, conference bargaining and negotiation, and has been and will be followed by voting in national assemblies and, ultimately, in national elections (an election campaign is the paradigmatic social-political selection process)…The fact of origin of such memes in individual or collective experience does not preclude the operation of social selection processes that ultimately add to, or subtract from, the world stock of memes.[101]

More generally, we may say that the use of evolutionary theory to minimise the role of active policy making is the result of too readily assuming that the state of the environment is exogenously determined and that existing forms *must*, therefore have adapted themselves efficiently to it. This view is undermined once it is realised that the relationship between environment, system and code is not linear but *cyclical*.[102] In other words, the environment is constituted by the presence of the systems within it, and coevolves with them. In the case of memetic or cultural evolution, this implies that there is a complex relationship between conscious attempts to shape or construct the environment, the resulting selective pressures, and what are often unpredicted and unintended outcomes. It also means getting away from a deterministic 'meme's eye view' of the world, in favour of a focus on the complex, multi-causal relations *between* systems and their environments.

In evolutionary biology, this approach is associated with the concept of niche construction, which 'occurs when an organism modifies the functional relationship between itself and its environment by actively changing one or more of the factors in its environment, either by physically perturbing these factors at its current address, or by relocating to a different address, thereby exposing itself to different factors'.[103] In the legal debate, this finds an echo in

the development of techniques which seek consciously to shape the environmental framework, with the aim of inducing desired 'second-order effects' on the part of social and economic actors. This so-called 'reflexive law' has increasingly come to the fore in the context of economic regulation over the past decade.[104] A technique which involves the legal rule 'thinking about' the conditions for its own application marks an advance on more traditional 'command and control' mechanisms. It would seem that in the social sphere, as in the biological one, 'evolvability', or the capacity of systems to co-evolve in line with their environment, is itself an emergent property. With the advent of reflexive law, the possibility arises that learning about evolution itself will become a property of the legal code.

Conclusion

This paper has laid out the foundations of a memetic approach to law in which legal evolution is seen as a particular type of the general evolutionary algorithm first explained by Darwin and later developed into the foundation for modern evolutionary biology. The application of the genetic metaphor to law is plausible, if the search for memes focuses on the internal legal discourse of abstract concepts and forms. Legal concepts serve as a repository for information about social adaptation which is transmitted through the replication of forms in substantive legal rules. The continuity of the legal 'code' serves as both a capability and a constraint for judges, drafters and policy makers. The lag between conceptual evolution and changes in social values means that concepts often appear to be ill-suited to contemporary circumstances. At the same time, legal innovation almost invariably takes the form of the adaptation or 'exaptation', to new contexts, of existing concepts. The result is a degree of lock-in and sub-optimality in legal form and substance which produces discontinuities in the process of legal change, with legislative intervention frequently serving as a catalyst for periods of innovation in judge-made law. The outcome of such a process, in advance, is uncertain and unpredictable; it is only in retrospect, or from a comparative perspective, that it may be seen to result in a degree of 'fit' between legal rules and the wider social, economic and political environment.

The normative implications of 'fitness', in this sense, need to be cautiously assessed. Because code, systems and environment influence each other in a cyclical fashion, it is inappropriate to speak of institutions having survived because they have undergone a process of adjustment to an external environment. Rather, legal rules co-evolve with other elements in the wider environment. While they may therefore reflect, in part, current social values and

economic forms, they also influence them. Thanks to reciprocal reinforcement, contingent events can shape the path of legal and social evolution in ways which lead to sub-optimal outcomes.

This paper has made a set of claims for evolutionary theory in the context of law which perhaps raise more questions than they answer. This is appropriate for a preliminary investigation of this type, which envisages a process of deepening of understanding as more precise questions are identified for investigation. As things stand, it is possible to map out a research programme in which these issues would be addressed. This would include a search for a more complete understanding of the implicit structure of the legal conceptual 'code'; historical studies tracing, more accurately than hitherto, the line of descent of legal forms; and more systematic inquiries into the interplay between legal development and economic change, with a view to understanding better the potential role of institutions of 'structural coupling' between systems.

Beyond these objectives, there is the question of the wider implications of the growing use of evolutionary theory across the social and human sciences. In the mid-nineteenth century, legal writers associated evolution with the idea of society's progress through successive stages, culminating in the transition 'from status to contract';[105] in the second half of the twentieth century, evolutionary metaphors were used to attack the regulatory state and argue for a return to contract.[106] Neither of these views had much more than a very tenuous link with Darwinian thought. At the beginning of a new century, as Darwin's insights are being reassessed in a wide range of contexts, it is appropriate to ask what the wider normative significance of this process will turn out to be. When claims can be made for the 'end of history' against a backdrop of legal globalisation,[107] it is all too easy to associate the apparent convergence of regulatory systems with mechanisms of economic selection. By contrast, Darwin's view, in *The Origin of Species*, was that the 'grandeur' of natural life lies in the 'elaborately constructed forms, so different from each other, and dependent on each other in so complex a manner'[108] which are produced through natural selection. For Darwin, diversity and interdependence were the basis for sustainability. Perhaps here we will find the core of a humanistic theory of evolution for our own times.

Notes

[1] Oxford, 1976; 2nd. ed. 1989.

[2] London, 1986.

[3] Harmondsworth, 1995. Antecedents of memetics are also found in theories of cultural inheritance and in particular the work of Luca Cavalli-Sforza and Marcus Feldman (*Cultural Evolution and Transmission: A Quantitative Approach* (Princeton, 1981) and Robert Boyd and Peter Richerson (*Culture and the Evolutionary Process* (Chicago, 1985). For present purposes, a wide meaning is ascribed to the term 'memetics' which includes this body of work, although it is recognised that there are potentially significant differences between gene-culture coevolution theory and certain versions of memetics (see Kevin Laland and Gillian Brown, *Sense and Nonsense: Evolutionary Perspectives on Human Behaviour (*Oxford, 2002), chs. 5 and 6), consideration of which lies outside the scope of this article.

[4] Robert Boyd and Peter Richerson, 'Memes: universal acid or a better mousetrap?', in Robert Aunger (ed.) *Darwinizing Culture. The Status of Memetics as a Science* (Oxford, 2000).

[5] See Henry Plotkin, 'Culture and Psychological Mechanisms', in Aunger (ed.), *Darwinizing Culture*, n.4, above, p. 74.

[6] See Kevin Laland, John Odling-Smee and Marcus Feldman, 'Niche construction, biological evolution, and cultural change' (2000) 23 *Behavioral and Brain Sciences* 131. Meme-gene coevolution also goes under the names of gene-culture coevolution and dual inheritance theory.

[7] This is based on the claim that the human brain evolved to meet the conditions of the 'environment of evolutionary adaptiveness' of the Pleistocene era, with the result that human psychology is ill-fitted to the very different social environment of today. See John Barkow, Leda Cosmides and John Tooby (eds.), *The Adapted Mind. Evolutionary Psychology and the Generation of Culture* (Oxford, 1992).

[8] Peter Stein, *Legal Evolution: The Story of an Idea* (Cambridge, 1980).

[9] Charles Darwin, *On the Origin of Species by Means of Natural Selection* (London, 1859).

[10] *The Common Law* (first published 1881; ed. Mark DeWolfe Howe, London, 1968); see also Holmes's further elaboration of these ideas in 'Law in science and science in law' (1899) 12 *Harvard Law Review* 433.

[11] Arthur Corbin, 'The law and the judges' (1914) 3 *Yale Review* 234. On Corbin's evolutionary approach, see Friedrich Kessler, 'Arthur Linton Corbin' (1969) 78 *Yale Law Journal* 571; E. Donald Elliot, 'The evolutionary tradition in jurisprudence' (1985) 85 *Columbia Law Review*

38; Michael S. Fried, 'The evolution of legal concepts: the memetic perspective' (1999) 39 *Jurimetrics* 291-316.

[12] Early and influential contributions include: Richard A. Posner, *Economic Analysis of Law* (Boston: Little, Brown, 1972); Paul Rubin, 'Why is the common law efficient?' (1977) 5 *Journal of Legal Studies* 51; G. Priest, 'The common law process and the selection of efficient rules' (1977) 5 *Journal of Legal Studies* 65.

[13] Gunther Teubner, *Law as an Autopoietic System* (Oxford, 1993).

[14] Mark Roe, 'Chaos and Evolution in Law and Economics' (1996) 109 *Harvard Law Review* 641.

[15] See Laland *et al*., 'Niche construction', n.6, above.

[16] *On the Origin of Species by Means of Natural Selection*, in Duncan Porter and Peter Graham (eds.) *The Portable Darwin* (Harmondsworth, 1993), at p. 147 (subsequent references are to this text).

[17] *Ibid*, p. 162.

[18] On the degree to which the transfer of genetic material across species is possible, and the implications of this for the genetic metaphor, see Kevin Laland and Gillian Brown, *Sense and Nonsense: Evolutionary Perspectives on Human Behaviour*, op. cit. n.3 above, at pp. 227-228.

[19] In addition to the technical literature expounding this idea there is a growing body of work exploring its wider theoretical and philosophical implications and seeking to bridge the divide between the biological and human sciences. See in particular Kim Sterelny and Paul Griffiths, *Sex and Death: An Introduction to the Philosophy of Biology* (Chicago, 1999) and Matt Ridley, *Genome* (London, 1999).

[20] Ridley, n.19, above, 221.

[21] See generally Geoffrey Hodgson, 'Is social evolution Lamarckian or Darwinian?', in John Laurent and John Nightingale (eds.), *Darwinism and Evolutionary Economics* (Cheltenham, 2001).

[22] See Teubner, *Law as an Autopoietic System*, n.13, above.

[23] See Dennett, *Darwin's Dangerous Idea*, n.3 above, 352-30.

[24] N.2, above, 194.

[25] For attempted applications of this conception of the meme, see Susan Blakemore, *The Meme Machine* (Oxford) and Jack Balkin, *Cultural Software* (New Haven, 1998), chs. 3 and 4. On reasons to prefer a behavioural account of memetics to a purely neural one, see Dan Gatherer, 'Why the thought contagion metaphor is retarding the progress of memetics' (1998) 3 *Journal of Memetics – Evolutionary Mechanisms of Information Transmission* http://www.cpm.mmu.ac.uk/jom-emit.1998/vol2/gatherer_d.htlm.

[26] See Robert Aunger, 'Introduction', in Aunger (ed.) *Darwinizing Culture*, n.4, above, 305.

[27] *The Common Law*, n.10, above, 8.

[28] The idea originates with Claude Lévi-Strauss, *The Savage Mind* (Chicago, 1966); its links to the biological literature are explored by Dennett, *Darwin's Dangerous Idea*, n. 3 above, 225-6.

[29] Stephen Jay Gould and Elizabeth Vrba, 'Exaptation: a missing term in the science of form' (1981) 8 *Paleobiology* 4; Stephen Jay Gould and Richard Lewontin, 'The spandrels of San Marco and the Panglossian paradigm: a critique of the adaptationist programme' (1979) B205 *Proceedings of the Royal Society* 581; Stephen Jay Gould, *The Structure of Evolutionary Theory* (Cambridge, MA, 2002), ch. 11; and for extended discussion, Dennett, *Darwin's Dangerous Idea*, n. 3, above, 267-282.

[30] Paul David, 'Clio and the economics of QWERTY' (1985) 75 *American Economic Review* 332; Brian Arthur, 'Competing technologies, increasing returns, and lock-in by historical events' (1989) 99 *Economic Journal* 116; Douglass North, *Institutions, Institutional Change, and Economic Performance* (Cambridge, 1990); Roe, 'Chaos and evolution', n.14, above.

[31] It should also be noted that the idea that the QWERTY keyboard is not ergonomically efficient has not gone completely unchallenged: see Steven Margolis and Stanley Liebowitz, 'Path dependence', in Peter Newman (ed.) *The New Palgrave Dictionary of Economics and the Law* Vol. III (London, 1998).

[32] On the prevalence of QWERTY phenomena and bricolage effects in legal doctrine, see Balkin, Cultural *Software*, n. 24 above, ch. 3; Michael Whincop, *An Economic and Jurisprudential Genealogy of Corporate Law* (Aldershot, 2001).

[33] See Basil Markesinis and Simon Deakin, *Tort Law* 4th. ed. (Oxford, 1999), 532-554.

[34] [1957] AC 555.

[35] Tony Weir, 'Subrogation and indemnity – a note on *Morris* v. *Ford Motor Co. Ltd.* [1973] QB 792' (1973), privately published case note; Markesinis and Deakin, *Tort Law*, n.33, above, 553-554.

[36] This idea originates with Francis Crick, 'The origin of the genetic code' (1968) 38 *Journal of Molecular Biology* 367, and is discussed by Dennett, *Darwin's Dangerous Idea*, n.3 above, chs. 7-8.

[37] Dennett, *Darwin's Dangerous Idea*, n.3 above, 197.

[38] See generally Markesinis and Deakin, *Tort Law*, n.33 above, 336-353.

[39] This is the case, for example, in German law (BGB Art. 828-II); *ibid*., at p. 338.

[40] See Markesinis and Deakin, *Tort Law*, n.33, above, 693-696.

[41] Glanville Williams, 'Vicarious liability and the master's indemnity' (1957) 20 *Modern Law Review* 220, 231.

[42] For a more extended account of the argument made in the text, see Simon Deakin, 'The contract of employment: a study in legal evolution" (2001) 11 *Historical Studies in Industrial Relations* 1.

[43] See Simon Deakin, 'The many futures of the contract of employment', in Joanne Conaghan, Michael Fischl and Karl Klare (eds.) *Labour Law in an Era of Globalisation: Transformative Practices and Possibilities* (Oxford, 2002).

[44] See Deakin, 'A study in legal evolution', n.42, above. John Howe and Richard Mitchell have shown that the same process occurred in Australian labour law: 'The evolution of the contract of employment in Australia: a discussion' (1999) 12 *Australian Journal of Labour Law* 113.

[45] 'The personal scope of English labour law: "servant", "employee", "workman"' [1966] *Rivista di diritto di lavoro* 512.

[46] (1880) 6 QBD 530.

[47] *Simmons* v. *Heath Laundry* [1910] 1 KB 543; *Scottish Insurance Commissioners* v. *Edinburgh Royal Infirmary* 1913 SC 751; *Hill* v *Beckett* [1915] 1 KB 578; *Underwood* v. *Perry* [1923] WC & I Rep. 63. The relevant statutes were the Workmen's Compensation Acts of 1897 and 1906 and the National Insurance Act 1911.

[48] See, *Waites* v. *Franco-British Exhibition* (1909) 25 TLR 441; *Bagnall* v. *Levinstein* [1907] 1 KB 531; *Dow* v. *McNeil* [1925] WC & I Rep. 32; *re South Dublin Union Officers* [1913] WC&I Rep. 245.

[49] On the internal contracting system generally, see S. Pollard, *The Genesis of Modern Management* (Harmondsworth: 1968); C. Littler, *The Development of the Labour Process in Capitalist Societies* (Aldershot: 1986), in particular ch. 6; R. Biernacki, *The Fabrication of Labor: Germany and Britain, 1640-1914* (Berkeley: 1995), in particular ch. 2; P. Cappelli, 'Market-Mediated Employment: The Historical Context', in M. Blair and T. Kochan (eds.) *The New Relationship: Human Capital in the American Corpora*tion (Washington DC: 2000).

[50] There are some antecedents in the law relating to industrial action: see the Industrial Courts Act 1919, discussed by Kahn-Freund, op. cit. n.45.

[51] *Social Insurance and Allied Services* Cmd. 6404, November 1942, at para. 314.

[52] See, in particular, *Stevenson, Jordan & Harrison* v. *McDonald & Evans* [1952] 1 TLR 101.

[53] Henry Sumner Maine, *Ancient Law. Its connection with the early history of society and its relation to modern ideas* (London, 1866). See Stein, *Legal*

Evolution, n.8, above, ch. 5, for discussion of Maine's work and influence.

[54] P.S. Atiyah, *The Rise and Fall of Freedom of Contract* (Oxford, 1979).

[55] On punctuated equilibrium, see Niles Eldredge and Stephen Jay Gould, 'Punctuated equilibria: an alternative to phyletic gradualism', in Eldredge, *Time Frames: The Rethinking of Darwinian Evolution and the Theory of Punctuated Equilibria* (New York, 1985) (originally published in 1972); Niles Eldredge, *Reinventing Darwin* (London, 1995); Stephen Jay Gould, *The Structure of Evolutionary Theory*, op. cit., n. 29, ch. 9. It should be noted that the status of the theory of punctuated equilibrium in biological evolution is controversial (see, for example, Dawkins, *The Blind Watchmaker*, n.2, above, ch. 9. The evidence for punctuated equilibrium in social or cultural evolution can be taken to mean that social evolution and biological evolution are subject to distinct evolutionary processes; alternatively, its presence in the social sphere may be used to cast light on biological processes, on the assumption that they share some common elements with social evolution, but to do so would be beyond the scope of the present paper.

[56] Ridley, *Genome*, n.18, above, 220.

[57] Balkin, *Cultural Software*, n.24, above, 55.

[58] David Lewis, *Convention: A Philosophical Study* (Cambridge, MA, 1969).

[59] Ken Binmore, *Playing Fair* (Cambridge, MA, 1994), 102, gives this account: 'The District Attorney knows that Adam and Eve are gangsters who are guilty of a major crime but is unable to convict them without a confession from one or another. He orders their arrest and separately offers each the following deal: "If you confess and your accomplice fails to confess, then you go free. If you fail to confess but your accomplice confesses, then you will be convicted and sentenced to the maximum term in jail. If you both confess, then you will both be convicted but the maximum sentence will not be imposed. If neither confesses, then you will be famed on a minor tax evasion charge for which a conviction is certain'.

[60] More precisely, mutual defection is a 'dominant strategy equilibrium' in this game, since, thanks to the structure of pay offs, 'cooperate' is strongly dominated by 'defect' for each player. See generally Sean Hargreaves Heap and Yiannis Varoufakis, *Game Theory: A Critical Introduction* (London, 1995).

[61] See Hargreaves-Heap and Varoufakis, op. cit., n.60.

[62] For this to be the case, the strategy must be at least as good a reply to itself as any other strategy; and, it must either be a better reply to itself than the alternative, or, a better reply to the alternative than the alternative is when the alternative is playing itself. See Hargreaves-Heap and Varoufakis,

n.60, above; Robert Sugden, 'Conventions', in Peter Newman (ed.) *The New Palgrave Dictionary of Economics and the Law* (London, 1998), Vol. I; Paul G. Mahoney and Chris W. Sanchirico, 'Competing norms and social evolution: is the fittest norm efficient?' (2001) 149 *University of Pennsylvania Law Review* 2027.

[63] New York, 1984.

[64] Binmore, *Playing Fair*, n.59 above, 197-203.

[65] See the classic empirical studies of Stewart Macaulay, 'Non-contractual relations in business: a preliminary study' (1963) 28 *American Sociological Review* 55, and Hugh Beale and Tony Dugdale, ''Contracts between businessmen: planning and the use of contractual remedies'(1975) 2 *British Journal of Law and Society* 45, and Ian Macneil's theoretical formulation of relational contracting in 'The many futures of contracts' (1974) 47 *Southern California Law Review* 691.

[66] Robert Trivers, *Social Evolution* (Menlo Park, CA: Benjamin Cummings, 1985); for a helpful review of this literature, see Todd Zywicki, 'Evolutionary psychology and the social sciences' Law and Economics Working Paper No. 00-35, George Mason University School of Law, 2000.

[67] Zywicki, 'Evolutionary psychology, n.62, above.

[68] 'The economics of convention' (1996) 10 *Journal of Economic Perspectives* 105.

[69] Sushil Bikhchandani, David Hirshlfeifer and Ivo Welch, 'Learning from the behaviour of others: conformity, fads, and informational cascades' (1998) 12 *Journal of Economic Perspectives* 151-170.

[70] Karl Warneryd, 'Conventions and transaction costs', in Peter Newman (ed.) n.62, above, Vol. I.

[71] Clayton Gillette, 'Lock-in effects in law and norms' (1998) 78 *Boston University Law Review* 792.

[72] Robert Ellickson, *Order without Law* (Cambridge, MA, 1988).

[73] On 'architecture' in this context, see Larry Lessig, 'The New Chicago School' (1998) 27 *Journal of Legal Studies* 661, and on the tendency for inefficient conventions or social norms to emerge from spontaneous interactions of parties, see Mahoney and Sanchirico, 'Competing norms and social evolution', op. cit. n.62.

[74] See Simon Deakin, Christel Lane and Frank Wilkinson, 'Contract law, trust relations, and incentives for cooperation: a comparative study', in Simon Deakin and Jonathan Michie (eds.) *Contracts, Cooperation and Competition. Studies in Economics, Management and Law* (Oxford, 1997).

[75] John P. Dawson, ''Judicial revision of frustrated contracts: Germany' (1983) 63 *Boston University Law Review* 1039.

[76] Hans Leser, 'The principle of good faith: Article 242 BGB' in Norbert Korn, Hein Kötz and Hans Leser (eds.) (trans. Tony Weir) *German Private and Commercial Law: An Introduction* (Oxford, 1982), 138.

[77] See Ewan McKendrick, 'The regulation of long-term contracts in English law', in Jack Beatson and Daniel Friedmann (eds) *Good Faith and Fault in Contract Law* (Oxford, 1995), discussing the House of Lords judgment in *Walford* v. *Miles* [1992] 2 AC 128.

[78] From an autopoietic perspective, it is the presence of 'intermediate' institutions such as industry-level trade associations which makes it possible for 'structural coupling' between the legal and economic systems to take place (Teubner, *Law as an Autopoietic System*, n.13, above).

[79] Gillette, 'Lock-in effects', op. cit.

[80] DNA is literally a code, in the sense that it consists of sequences made up combination of four chemical bases (adenine, guanine, cytosine and thymine) which specify particular structures of proteins. It is not implausible to think of legal material as consisting of a similar set of constituent elements or bases which can be combined in particular ways to produce results in terms of substantive rules. If the history of the discovery of the structure of DNA is any guide, the task of identifying the structure of the legal code is unlikely to be a straightforward one; Wesley Hohfeld's scheme of jural relations is generally understood to be the most successful attempt to date (*Fundamental Legal Conceptions as Applied in Judicial Reasoning* (New Haven, 1919).

[81] Teubner, n.13, above.

[82] *Ibid*, n.13, above, 51. Teubner ascribes to Luhmann the idea that 'in the legal system norms take over the function of variation, institutional structures (particularly procedures) that of selection, and dogmatic conceptual structures that of retention', referring to Niklas Luhmann, 'Evolution des Rechts' (1970) 1 *Rechtstheorie* 3.

[83] Laland et al., 'Niche construction', op. cit. n.6, above.

[84] See Simon Deakin, 'Private law, economic rationality, and the regulatory state', in P.B.H. Birks (ed.) *The Classification of Obligations* (Oxford, 1997).

[85] See the sources cited at n.82, above.

[86] Teubner, n.13, above, 79.

[87] For a critique of such approaches and an argument for an alternative 'interdisciplinary' approach to the law-economics relation, see Simon Deakin, 'Law versus economics? Reflections on the normative foundations of economic activity', in M. Richardson and G. Hadfield (eds.) *The Second Wave of Law and Economics* (Annandale, NSW, 1999).

[88] Tony Lawson, *Economics and Reality* (London, 1997), at p. 63; see also Hodgson, n.21, above.

[89] The argument that memetic structures have a distinctive social ontology does not of course imply that they are real in the same sense as human beings are, that is, in the sense of being 'living', biological subjects. Equally, the claim that structures have a 'real' existence does not depend upon them being 'living' entities. In systems theory, social systems are conceived as consisting of communications, on the basis that the latter are 'emergent unities' derived from the interactions of human agents. As explained in the text, the notion of emergence is used here to get away from the reductive tendency which sees social phenomena in exclusively biological or behavioural terms, while also avoiding the opposite danger, that of 'methodological collectivism', in which social entities are treated as if they were individuals. See Teubner, n.13, above, 29.

[90] Laland *et al,* n.6, above.

[91] How else should we regard the suggestion of Richard Epstein, for example, that 'the survival of the contract at will, and the frequency of its use in private markets, might well be taken as a sign of its suitability for employment relations' ('In defense of the contract at will' (1984) 51 *University of Chicago Law Review* 947, at p. 948), or the claim of Frank Easterbrook and Daniel Fischel that corporate law 'almost always conforms' to a model of optimal form which they associate with an 'enabling' approach (*The Economic Structure of Corporate Law* (Cambridge MA, 1991), at p. 15.

[92] David Sloan Wilson, 'The challenge of understanding complexity, commentary on Laland *et al.*: Niche construction' (2000) 23 *Behavioral and Brain Sciences* 165, at 165.

[93] Discussed by Gunther Teubner, 'Legal irritants: good faith in British law, or how unifying law ends up in new divergencies' (1998) 61 *Modern Law Review* 11.

[94] The so-called 'Weissmann barrier' which protects the genetic information contained in the cell during the lifetime of the organism: see Hodgson, n.21, above.

[95] Teubner, n.13, above, ch. 3.

[96] N.13, above, 61.

[97] See Roe, n.14, above.

[98] 'Spontaneous order', in Peter Newman, ed. *The New Palgrave Dictionary of Economics and the Law*, op. cit., n. 62, Vol. III, at p. 488.

[99] F.A. Hayek, *The Constitution of Liberty* (London, 1960); *Law, Legislation and Liberty. A new statement of the liberal principles of justice and political economy* (London, 1980).

[100] Sugden, n.62, above, 489.

[101] George Modelski, 'An evolutionary theory of culture?' (1999) 3 *Journal of Memetics – Evolutionary Models of Information Transmission* (http://jom-emit.cfpm.org/1999/vol3/modelki_g.html).

[102] Richard Lewontin, 'Gene, organism and environment', in D.S. Bendall (ed.) *Evolution from Molecules to Men* (Cambridge, 1983).

[103] Kevin Laland, John Odling-Smee and Marcus Feldman, 'Authors' response: Niche construction earns its keep' (2000) 23 *Behavioral and Brain Sciences* 166, at 166.

[104] See, on this theme, Teubner n.13, above, ch. 5 (developing the important concept of 'structural coupling'); Ralf Rogowski and Ton Wilthagen (eds.), *Reflexive Labour Law* (Deventer, 1994); Julia Black, *Rules and Regulators* (Oxford, 1998); and for an application of systems theory in the context of the economics of law, Simon Deakin and Alan Hughes, 'Economic efficiency and the proceduralisation of company law' (1999) 3 *Company, Financial and Insolvency Law Review* 169. For echoes of this debate in the institutionalist economics of J.R. Commons, see Clive Lawson, 'Holism and collectivism in the work of J.R. Commons' (1996) *Journal of Economic Issues* 967, and analogies with 'artificial selection' of the kind discussed by Darwin in *The Origin of Species*, Ynge Ramstad, 'On the nature of economic evolution: John Commons and the metaphor of artificial selection', in Lars Magnusson (ed.) *Evolutionary and Neo-Schumpeterian Approaches to Economics* (Deventer, 1994).

[105] Maine, *Ancient Law*, n.53, above.

[106] Hayek, *Law, Legislation and Liberty*, n.97, above.

[107] Henry Hansmann and Reinier Kraakman, 'The end of history for corporate law' (2001) 89 *Georgetown Law Journal* 439.

[108] *The Origin of Species*, n.16, above, 215.