Chapter 2
Evolution

2.1 A Selective Overview

When we think of evolution, we might think of the evolution of the universe, from the Big Bang and then the creation of the stars and their planets, of which the Earth is just one of an extremely large number, but we are probably more likely to think about an evolution much closer to us: the evolution of life on Earth and how humans came into existence, the evolution connected with the name of Darwin. Consider, for a moment, a very simplified view of the evolution of life on Earth in terms of three overlapping phases. In the first phase, which started maybe 3.5 billion years ago, life developed from the simplest, single-cell forms to a myriad of increasingly complex and widely differing forms, with new species emerging and existing species becoming extinct in a relentless process of experimentation and survival in a continually changing environment. However, at any one time during this phase, there was a complex web of interactions between the species, in the form of food chains and various interactions between animals and plants, such as certain plants forming the habitats for certain animals, and so on. The result was the existence of a continuously evolving ecosystem, with mutual dependence and a lack of dominance between species; a sort of natural democracy.

This all changed with the emergence of the genus *homo* at the beginning of Phase Two, 2–3 million years ago. However the emergence of this one, very different genus took place, the evolution of the genus started to progress at an accelerating rate that soon set it apart from the other genera and liberated it from its role as just another component of the ecosystem. The development of this genus, with its various species and sub-species, is still somewhat open to speculation and disagreement, but just to put our endeavour into a time frame, we might adopt the picture presented by Stringer (2012), and shown in Fig. 2.1. (Some very recent information is presented in Hublig et al. 2017; Richter et al. 2017; and Stringer and Galway-Witham 2017).

E.W. Aslaksen, *The Social Bond*, https://doi.org/10.1007/978-3-319-68741-4_2

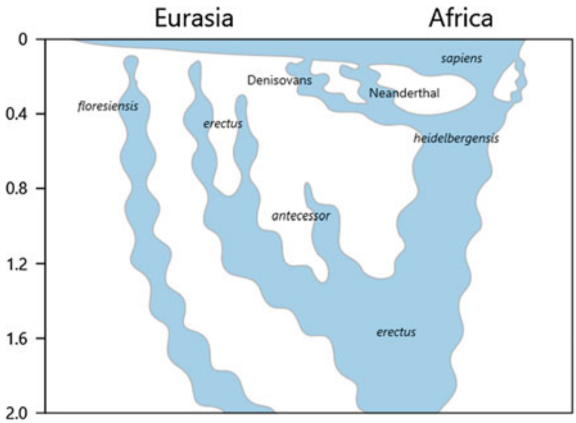


Fig. 2.1 Schematic representation of the emergence of *H. sapiens* from earlier species of *Homo*. The horizontal axis represents geographic location; the vertical axis represents time in millions of years ago. Blue areas denote the presence of a certain species at a given time and place. Early modern humans spread from Africa across different regions of the globe and interbred with other descendants of *Homo heidelbergensis*, namely Neanderthals, Denisovans and unknown archaic African hominins (top right) (Stringer 2012)

The development was one of increasing capability rather than a change of external form; capability that manifested itself in manual dexterity, speech and cognitive processes, and which allowed humans to exploit the rest of the ecosystem as a resource and to isolate themselves to a large extent from the fluctuations in that ecosystem. This evolution then continued to modern man, *Homo sapiens*, which appeared a couple of hundred thousand years ago. This development of the genus *Homo*, which was characterised by functionally important, but outwardly relatively minor physical changes, and by very significant mental changes, was also characterised by a rate of development more than an order of magnitude greater than that of the first phase.

The third phase, which started, say, a hundred thousand years ago (although, as I argue in the next chapter, there is no need to go further back than 10,000 years ago), is characterised by the formation of groups of mutually interacting and interdependent individuals, and it is now these groups, or *societies*, that are the individuals of the new 'species', *Homo conglomeraensis* (or something like that). Just like cells combined to form more complex organisms, humans combine to form entities that far surpass the individual in functionality and capability, and this evolution is not one of the physical forms of the individual, but of the interactions between individuals and of the structures resulting from these interactions. What is being transmitted from one generation to the next is not genes, but the knowledge of the social structure and how to survive in this environment. And if we say that a characteristic time for change in the first phase might be something like ten million years, and in the second phase perhaps a couple of hundred thousand years, then the corresponding time in the third phase is, say, a thousand years and rapidly decreasing. Our society is currently the most advanced ‘species’ in this evolution, the end product of a process of trial-and-error (and it might, of course, turn out to be an error).

If we now conceive of evolution as being characterised by two coordinates, with the Darwinian species along the x-coordinate and for each species a second coordinate, the y-coordinate, identifying the entities being created by the interactions within the species, which we might call societies, then, in the case of our species, there is a progression in strength and complexity of the interactions along the y-axis, which we take to be the measure of the societies. Other species may also display entities along their y-axes; some show at least the organisation into families consisting of parents and children, and some show more complex societies, such as those of ants and bees. In most cases, the knowledge of the structure is genetically transmitted, but in some cases there is a learning process involved. To what extent this learning process is itself genetically based, or open to change through experience, is not certain. The two-dimensional characterisation of evolution is illustrated in Fig. 2.2.

The *x*- and *y*-axes in Fig. 2.2 are labelled by the entities (species and societies) that have appeared, and so there is an implied time dependence, to which we shall return shortly. But there is also another measure that can be attached to these entities—their complexity. It is difficult to give an exact definition of this measure, but intuitively we recognise that it is a combination of the complexity of the species, measured, e.g. by the amount of information contained in the DNA, and the complexity of the social structure, measured somehow by the strength (frequency?) and number of types of interactions between members of the society. This gives me an opportunity to take the analogy between chemistry and society a step further (or too far?), by observing that the progress along the *x*-axis in Fig. 2.2 involved increasingly complex molecules of a small set of different atoms. In the case of

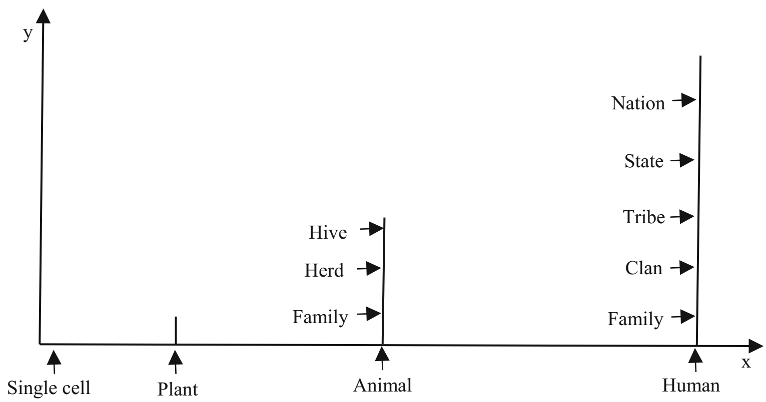


Fig. 2.2 A two-dimensional characterisation of evolution of society, with the *x*-axis representing the development of the individual, and the *y*-axis representing the development of the interactions in terms of the resulting structures

humans, the whole ‘blueprint’ for the construction is contained in a macromolecule (or what Schrodinger called ‘an aperiodic crystal’), the DNA, which is made up of combinations of only three types of atoms: oxygen, hydrogen and nitrogen. The complexity lies in the structure, which can be seen as a hierarchical structure, starting with atoms of the three types combining to form relatively simple molecules—the four bases—which are then combined in a particular order to form genes, which finally make up the complete DNA molecule with its helical structure. Progressing along the *y*-axis in Fig. 2.2, the development was also reflected in an increase in structural complexity, starting with the nuclear family and culminating in today’s world society with its highly complex structure, made up of numerous interacting public and private entities, and presenting a division of labour (or functionality) in analogy with that of the molecules in the cell.

There is a variation on this view, to which we shall refer in a couple of places later on, and it is based on the idea that, in a collection of bodies (elementary particles, atoms, molecules, people, planets), there are two forms of energy: kinetic energy and structural energy. The kinetic energy is a property of the individual bodies, and the kinetic energy of the collection is the sum of the kinetic energies of the bodies. The level of kinetic energy can be expressed as a *temperature* of the collection. The structural energy is a property of the collection; it is an expression of the relationship between the bodies, and while the ability to enter into such relationships is a property of the individual bodies, the structural energy is a measure of the extent to which those abilities are realised in the collection. As we shall see in the next section, the structural energy is the difference between a collection and a system.

The evolution of such a collection of bodies consists of the combination of the bodies into more complex bodies, and the dynamics of the process is determined by two competing effects of the kinetic energy; the creation of more complex bodies, and the decomposition of such bodies into simpler bodies. At high temperatures, the decomposition is dominant, and at low temperature, no complex bodies are created; there is only a relatively narrow temperature range in which there is a net creation of more complex bodies, and it is a function of the complexity level; in principle as shown in Fig. 2.3.

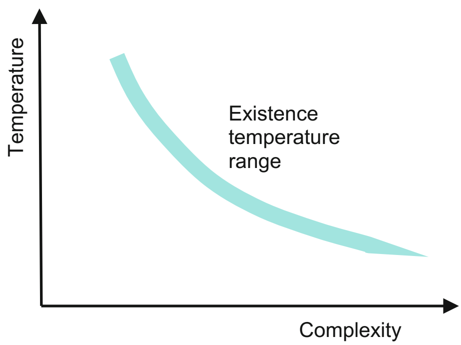


Fig. 2.3 The temperature range in which a collection of bodies of a given complexity can exist

The next step in characterising these two forms of energy is to separate the collections into two groups according to the *state of animation* of the bodies: inanimate or alive. In the case of inanimate bodies, the kinetic energy is the energy arising from the movement of the bodies, i.e. the change in their spatial locations, and depends on the mass of the bodies. The structural energy is the energy arising from the spatial relationship between the bodies, which is established by the force between them. This force can be characterised by its spatial *scale*: at the smallest scale we have the nuclear force, at the atomic/molecular scale we have the electromagnetic force, and at the greatest scale we have the gravitational force.

In the case of living bodies, the kinetic energy is represented by the activities performed by the individual bodies without regard to or involvement of other bodies; it is an expression of the capabilities of the individual body. The structural energy arises from the relationships established by the interaction between the bodies, in the form of an exchange of information, or communication, and the scale is given by the strength of the interaction. As both of these energies are now represented by dissipative processes, collections of living bodies, or organisms, cannot be isolated systems, but must be immersed in an environment from which they can extract energy (metabolism). If we now want to apply this view to Fig. 2.2, we have to divide the progression along the x-axis into three segments. At the very left end, the collection is a cell, and the bodies are increasingly complex and differentiated molecules. In the second segment, the collection is a multicellular organism, and the bodies are cells of increasing complexity and differentiation, interacting through structured chemical processes, forming sub-collections (organs). At some point within this segment, the organism includes processes that control the internal temperature (homeostasis), which allows the organism to be exposed to a range of temperatures far exceeding that indicated in Fig. 2.3. The third segment starts when organisms develop the ability to interact indirectly; that is, not through direct chemical interaction, but by using signs (dance/bees), chemical markers (pheromones/ants) or sounds (most animals), and it reaches its culmination in *homo sapiens* with language as the means of interaction. The collection is now a society, and its existence requires a balance between the kinetic and structural energies, which is achieved through internal processes, such as provided by the legal system and law enforcement.

The purpose of presenting this view is twofold. First, to counteract the common view that humans are the final product of evolution. We are just the building blocks of the next level of complexity, societies. Second, to emphasise that society is a living organism, subject to the same issues as all organisms—health, sickness and death.

There is a further analogy—with computers—that becomes apparent if we plot the development of computers on an *x*-*y* coordinate system, as in Fig. 2.2, with the evolution of the hardware plotted along the *x*-axis, and for each generation of hardware, plot the development of software that could run on it in the *y* direction. Once a new generation of hardware came on the market, new software applications would appear, and through interaction between software developers this evolution of software would accelerate. And as the body of software grew in size and complexity, it became increasingly structured, both into different programming languages, different areas of application and reusable applications, each with its own techniques and algorithms. Reflecting this analogy onto the current state of our development, the state of the ‘hardware’ is represented by our DNA, and the state of the ‘software’ is represented by our culture, which is maintained by the interaction between its members. We have strict rules for modifying the human genome, but do we have correspondingly strict rules for modifying the information exchange? The thought underlying this book is that tampering with the information exchange is to ‘software’ what tampering with the genome is to the ‘hardware’.

We might expect that the value of any measure of complexity would increase on a diagonal axis from the lower left to the upper right, but that is not necessarily the case; species that appeared later may have simpler social structures than some that appeared earlier. However, while this is an interesting issue, it is not relevant to the subject matter of this book, as we shall be exclusively concerned with the evolution of our subspecies along the y-axis in Fig. 2.2. The evolution of human society has been the subject of study for many centuries, often under the title of sociocultural evolution and focused on the process of structural reorganisation. During the Enlightenment and well into the nineteenth century, the dominant view of social or cultural evolution was as a steady progression in a unilineal fashion through a set of stages, from a state of barbarism to our modern (Western) industrial society. Different societies were just seen as being at different stages of this evolution, and various theories were developed within this view. Some of the well-known authors include Hegel, August Comte, Herbert Spencer and Adam Smith. From the second half of the nineteenth century onward, the field work of anthropologists started to provide an increasing body of empirical data, and while this was first fitted into the prevailing theoretical framework, it soon became apparent that the simple unilineal progression was at best a high-level approximation, and the interests of sociologists turned from society in general to particular societies, both less developed indigenous ones and various more developed, industrial societies, by considering specific, local conditions, such as natural resources and the level of knowledge. It was also inevitable that, as the twentieth century progressed, there would be an increasing emphasis on the influence of technology and on society as a complex, self-organising system. Already the importance of the division of labour (as a result of technology) and of the means of production (and associated class structure), as described by Émile Durkheim and Karl Marx, respectively, and reflected in the critical assessment of Max Weber, showed the direction in which the understanding of social evolution was developing, and these themes (technology and system) were developed further by such authors as Lewis Henry Morgan, Leslie White, Talcott Parsons, Gerhard Lenski, Nicholas Luhmann and Edward Goldsmith. I must emphasise that this book is not concerned with any such work, nor does it aim to contribute to sociocultural theories. The current work is focused on the interaction between individuals as one of the two basic components of any society (the other component being the individual) and, in particular, on the current state of that interaction under the influence of applications of technology within the framework of our political/economic system. However, it does connect with the sociocultural body of knowledge in the two areas of technology and systems, and I shall make reference to it where relevant (and where I am aware of it). And a first reference can be made already here, in that the picture presented in Fig. 2.2 has a counterpart in the Dual Inheritance Theory, as it is set out in the book *Not by Genes Alone*, by Richerson and Boyd (2004). Our *x*-axis represents the genetic evolution, and the *y*-axis the cultural evolution, and the authors emphasise that the latter is more dynamic, rapid and influential on human society than the former. They also give the following definition of culture:

> Culture is information capable of affecting individuals' behaviour that they acquire from other members of their species through teaching, imitation, and other forms of social transmission (p. 5).

and this is almost exactly what we shall call *identity* in the next chapter; the only difference being that the identity is not only (although mostly) acquired through social interaction, but also through observation and introspection. The book gives a compelling picture of the cooperation of genetic and cultural processes in the evolution of humanity, and gives a detailed account, supported by numerous examples, of the operation of cultural evolution over the last 10,000 years or so, to which we shall refer in a couple of places further on.

The evolution of society is driven by human intelligence, as the ability to take goal-oriented adaptive action, and by the ability of humans to interact by means of language and symbols, thereby forming relationships and increasingly complex social structures. There are many measures that characterise this evolution, such as the size of individual societies, the division of labour, the level of education and economic activity, but the one that occupies a particular position in the picture of a society is the use and development of technology. This is because of the strong positive feedback effect of technology on the development of society and, indeed, on the smallest elements of society—the individuals—and it has led to what is a paradoxical situation. On the one hand, the behaviour of the individuals as stand-alone entities has very little relevance as the elements of a modern society, much as the study of a single ant under the microscope would give little indication of its purpose and behaviour as a member of an ant colony. Intrinsic human characteristics are so intertwined with technological artefacts and their operation that their separation, in terms of the behaviour of the individual in society, becomes artificial. But, on the other hand, the features and evolution of society are completely determined by exactly the intrinsic abilities and behaviour of the individual; society is what it is because we made it so. Technology has no mind or will of its own.

The solution to this conundrum lies in, on the one hand, developing a model of individual behaviour—effectively a simple model of intelligence, which is the subject of Chap. 3—that reflects this intertwining by introducing the concept of the individual's *identity*—the things that matter to the individual, the things the individual is willing to make a sacrifice for—and on the other hand by recognising that this identity is a social product, formed by the ongoing and technology-mediated immersion in society through interactions with other individuals, which is introduced in Chap. 4 and then developed further in Chap. 5. The concept of absolute values, unrelated to the society in which they are to apply, is no more relevant than the above concept of the stand-alone individual.

2.2 Society as a System

Throughout this monograph, we shall make use of the *system concept*. The system concept is a *mode of description*; any aspect of an entity can be described in terms of three sets:

- a set of elements;
- a set of interactions between these element; and
- a set of interaction with the outside world (which may be simply an observer).

The ability to, and means of, interacting are contained completely within the elements, and the set of interactions determines the *structure* of the system, as the bonds between atoms determine the structure of a molecule. The interactions with the outside world are basically what we would think of as the contribution of the aspect in question to the behaviour of the system. That behaviour is therefore dependent on both the properties of the elements and on the interactions between them, and can be very much more complex than the behaviour of any of the elements, exhibiting so-called emergent behaviour. But as a system is a mode of description, we can choose what we identify as elements; there are normally several possible descriptions of an entity as a system, depending on what aspect of the entity we are interested in examining. For example, if we are only interested in what the entity *does*, but not in what it *is*, we develop a functional description, or view, of the entity, without any concern for its physical realisation. And we develop this view in a top-down fashion, by first finding the most general, or *abstract*, description of the functionality (which may often be simply to provide the greatest possible return on investment) and increase the level of detail in a step-wise fashion until all functional requirements are met. In this manner, we are hiding the complexity that is not relevant to the aspect of interest, and so the system approach is a methodology for handling complexity. (For a detailed description, see (Aslaksen 2013a). It may also be worthwhile to note that the meaning of abstraction here is essentially the same as the one used by Georg W.F. Hegel in his essay *Who Thinks Abstractly* (Hegel 1966) and developed further by Andrew Feenberg as 'instrumentalization theory' (Feenberg 2013).

The word 'society' can have a wide range of meanings. Here, we shall understand it to have its most encompassing meaning and consist of the people in a defined group, such as a nation or the whole world, and their institutions, technology and other artefacts; essentially everything these people have created. Through the interactions between these elements, they form a system, and due to the number and diversity of both the elements and the interactions, this is indeed a very complex system. It is also obviously a self-organising system, unless one admits some form of divine guidance.

In order to make this view of society as a system as clear as possible, it might be useful to compare it with a definition by an influential author who we shall encounter a couple of times later on, Jürgen Habermas. In his book, *The Theory of Communicative Action*, he states

> I use the term culture for the stock of knowledge from which participants in communication supply themselves with interpretations as they come to an understanding about something in the world. I use the term society for the legitimate orders through which participants regulate their memberships in social groups and thereby secure solidarity. By personality I understand the competences that make a subject capable of speaking and acting, that put him in a position to take part in processes of reaching understanding and thereby to assert his own identity (Habermas 1984, v2, 184).

So, for him society is what we would identify as the *structure* of society, and what he calls culture is close to what we call *identity*, and his 'personality' is close to the processes we include in our model of intelligence in Sect. 3.2.

As a brief digression, two very different structures have been prominent in the social and political science literature. The first emphasises the importance of the individual as a social actor, with its interpersonal relations and motivations of personal conduct. The second, identified with the work of Karl Marx, emphasises the importance of classes within society, in which the individuals are *members* (German 'Träger') due to their common circumstances (which we would say is reflected in their *alignment*, to be defined in Sect. 3.9). The significant interactions are between these classes, in the form of conflicts and class struggle, leading to structural determinism as the dynamics of society. In this sense, the Marxist view of society represents a system approach to handling the complexity of society.

A society is complex, so if we want to describe it as a system, the above general definition needs to be developed somewhat further. First, only in the most primitive of societies is the interaction between individuals limited to direct, person-to-person interaction via speech, gestures, or physical contact. In all other societies there are additional forms of interaction that involve a medium, such as pen and paper, a telephone, a gun, etc.; in short, some *application of technology*. These media could become additional elements in the system, with their own descriptions of their behaviour, and contribute to the behaviour of the system, i.e. of the society. However, in the following, we shall view these applications of technology as extensions of the human interaction capabilities, so that the human becomes a *hybrid* of purely human characteristics and technological characteristics.

Second, and again in all but the utopian case of a completely homogeneous society, the interactions result in a structuring of the society, i.e. the system consists of identifiable subsystems, and depending on in which of these subsystems an individual finds itself, it displays different properties. That is, it is not individuals that are elements of society as a system, but individuals performing particular *roles*, with one individual able to perform many roles (e.g. husband, father, club member, worker, etc.).

Third, the choice, as far as describing a particular aspect of society is concerned, lies in choosing a suitable description of the behaviour of the individual. That is, selecting a subset of the set of the individual's interactions with the 'outside world', but without any concern for the internal structure of the individual, or, in other words, adopting the view of a psychologist or sociologist rather than that of a biologist or neuroscientist. This treatment of the individual is fundamental to understanding society as a system of individuals, and to emphasise this point, I will give an analogy with systems engineering. Consider a very well-known element of many technical systems: an M6 $\times$ 20 bolt with hexagonal head. As an individual element, it is defined in great detail in a standard, such as a DIN standard, where all its physical characteristics, including its dimensions, the tolerances on these dimensions, its material composition and grain structure and its surface finish are specified, together with some functional requirements, such as load capacity. This element could be used in numerous applications (i.e. systems), from a sewing machine to a space craft, and within each of these to perform various functions, such as that of a fastener, or to adjust the tension of a spring, or the position of a lever, and so on. In the description of the behaviour (functionality) of any one of these systems, none of the individual characteristics of the bolt listed above appear; the element is described solely in terms of its functionality, its purpose as an element of that particular system. Reflected onto our treatment of society as a system, this means that the individual as a stand-alone entity is of little interest; it is only the behaviour of the individual *embedded in the particular view of society* that is relevant. This can create a barrier to acceptance of the idea of a system view for some people, in particular, philosophers, who like to view humans mainly based on ideas going back to Plato and Aristotle; persons who did not have (and could not have) any idea of what modern society would look like.

Fourth, and perhaps most importantly, society displays a particular kind of dynamics, resulting from the fact that the behaviour of an individual is not time-independent, nor even a known function of time, as is the case with most technical systems; the behaviour of an individual is a function of its previous experience. Starting at birth, the experience accumulated through interaction with parents, siblings, friends, teachers, colleagues, etc., forms the behaviour of the individual. That is, the *ability* to take adaptive action as a result of sensory inputs is an intrinsic feature of the species; it is part of what is expressed by the x-coordinate in Fig. 2.2. But the *basis* on which the action is taken is the accumulated experience. What changes from generation to generation is the nature of the interaction, both its form and its intensity, and this change is driven by technology. Direct, face-to-face interaction through increased mobility, and other forms of interaction mediated by information technology, but also through the increase in education, as enabled by the surplus generated by applications of technology. Again, the *ability* to communicate—the ability to speak and the development of language—is an intrinsic feature of the species; it is the other part of what is expressed by the x-coordinate. But the *utilisation* of this ability is being greatly enhanced by technology, so that one measure of the progression along the y-coordinate—the evolution of society—is the development and application of technology.

Without drawing too long a bow, we can discern an analogy between how the interaction between individuals evolved into ever larger societies with complex structures, culminating in nations, and how now the interaction between nations is evolving into a world society with its own structures. In the former case, the structuring led, in many cases, to violent struggles between the structural elements within nations; in the latter case, it is not difficult to see the potential for similar struggles, just with enormously increased destructive capability, and some aspects of this possibility are discussed in Sects. 5.3 and 6.3.

As stated in the Introduction, our primary purpose is to develop an understanding of the interaction between individuals, and one way of looking at interactions is as a correlation of actions of individuals. That is, we shall be looking at society, as a system, at the most detailed level, at the level at which the system elements are individuals, analogous to studying an ant colony at the level of the activities of individual ants. The activities people are engaged in are so manyfold and varied that they do not fit into any single taxonomy or ordering, but there are some questions that are useful in thinking about these activities, and the first of these is, obviously, to ask if the activity involves any interaction with other individuals or not. If yes, then a second question is: How direct is the interaction? The most direct is the face-to-face interaction between two individuals; somewhat less direct is the real-time interaction via a medium, such as telephone or Skype, less again through a medium such as writing (letter, email). Further down the scale come such one-way interactions as broadcasting, TV, books, etc., and finally there are indirect, and much more subtle interactions that take place in any activity where we employ some application of technology, from using a toothbrush to driving a car; we are interacting with the creators of those devices; their views and intentions regarding those activities are expressed in the devices.

A related question regarding an activity is then the degree to which technology enters into performing the activity. Take, for example, washing the body by taking a shower. Although supplying cold and warm water on demand involves a significant application of technology, the activity of washing is much as it has been for thousands of years, But, take as another example the activity of travelling by aircraft; it is an activity that is totally dependent on, and an expression of, the application of technology. And, of increasing importance, and central to our development of the Social Bond, are the applications of technology that enhance, or even supplant, our cognitive abilities, such as information processing and interacting with our peers; that is, the numerous applications of information technology, or IT.

A further characteristic is the degree to which an activity requires conscious assessment and decision-making. Most of our daily activities are performed more or less automatically; not only such simple activities as tying shoe laces or paying the bus fare, but also much more complex activities, such as many of our interactions with other people (small talk, gestures, such as shaking hands, etc.). These activities respond to situations that are identified as fitting a known pattern, and are executed according to preconceived rules, acquired through education, training and observation. Rules that are well founded in experience, as well as some that are not, such as prejudices and superstition. The subdivision of our thought processes into two clearly discernible groups—intuitive and deliberate (or fast and slow) is taken up again in Sect. 3.8.

At the other end of the scale of this characteristic are the activities of interest to us, the ones that result from situations or information that do not fit into any preconceived pattern; these are the actions that potentially change society. These actions represent a person's judgement based on a set of accepted principles or beliefs that constitute the person's *identity*; they are the result of the person applying its *intelligence*, and this is the subject matter of the next chapter. Here, we just note that there is a degree of interaction involved, in the sense that these principles were developed and/or presented by other individuals at some previous time, and that this time dependence, or *propagation* in time, becomes an important aspect of interactions.

However, already at this point in our development, it is clear that we cannot hope to describe or model the effect of this immense collection of interrelated processes on the evolution of society in any detail; we need to approach them in an analogy with thermodynamics or statistical mechanics. A volume of gas is a very large system, but instead of considering it at a microscopic level, i.e. the level of individual molecules, we usually consider it at a macroscopic level, i.e. as an entity characterised by a few macroscopic parameters, viz. pressure, temperature and volume, that are related to the parameters describing the motions of the molecules through statistics. To find similar 'macroscopic' parameters for society, it is necessary to first recognise a significant difference between gas molecules and the elements of society: the latter are active, whereas molecules are passive. The activities make up the processes that describe what the society does, what takes place within the society. Society is 'alive', and these processes are the equivalent of the processes taking place within a living organism. The evolution of society is due to the combined actions of all its members; or, as we shall say, to the application of society's *collective intelligence*.

The concept of collective intelligence has, in various contexts and formulations, been around for a long time, going back at least to the ancient Greeks. It finds expression in Plato's *Protagoras* and the myth of how Zeus ordered political wisdom to be evenly distributed among men (Plato, *Dialogues*); in Aristotle's *Politics*, where in the opening of Chapter XI of Book 3 he says:

> The principle that the multitude ought to be supreme rather than the few best is one that is maintained, and, though not free from difficulty, yet seems to contain an element of truth. For the many, of whom each individual is but an ordinary person, when they meet together may very likely be better than the few good, if regarded not individually but collectively, just as a feast to which many contribute is better than a dinner provided out of a single purse (Aristotle, *Politics*).

And, again, in Chapter XV, 'a multitude is a better judge of many things than any individual'.

Cicero ascribes the following to Cato The Elder:

> Cato used to say that the government of Rome was superior to that of other states; because in them the great men were mere isolated individuals, who regulated their constitutions according to their own *ipse dixits*, their own laws, and their own ordinances. Such was Minos in Crete, Lycurgus in Sparta; and in Athens, which experienced so many revolutions, first Theseus, then Draco, then Solon, then Clisthenes, afterwards many others; and lastly, to support the Athenian state in its exhaustion and prostration, that great and wise man, Demetrius Phalereus.
>
> Our Roman constitution, on the contrary, did not spring from the genius of an individual, but of many; and it was established, not in the lifetime of a man, but in the course of ages and centuries. For (added he) there never yet existed a genius so vast and comprehensive as to allow nothing to escape its attention, and all the geniuses in the world united in a single mind, could never, within the limits of a single life, exert a foresight sufficiently extensive to embrace and harmonize all, without the aid of experience and practice (Cicero, *De re publica*).

The concept of a collective intelligence is the foundation of our normative commitment to democracy as the preferred form of government, and has also found its expression in a number of fields and related concepts, as described in Malone and Bernstein (2015). The introduction to that book contains both definitions of collective intelligence and a large number of references to the relevant literature. In recent times, the focus has been on collective intelligence as a factor in the performance of groups (Woolley et al. 2010), and in Pentland (2014) it is explored in the context of what the author calls Social Physics, an approach to understanding social processes and dynamics using Big Data (In contrast with the reliance on Big Data in Social Physics, our approach could be said to rely on No Data).

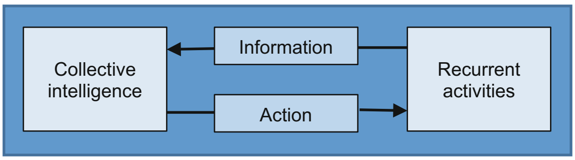
The relevance of the concept to politics and to the evolution of society is indisputable—after all, it is what got us from the cave to where we are today—but it is not as well supported by empirical research (for the obvious reasons of the magnitude and complexity of the task). In this regard, we can note that the book (Malone and Bernstein 2015), with the title of *Handbook of Collective Intelligence*, does not actually consider the presence of collective intelligence in the political process, or to what extent it supports democracy. The relationship between collective intelligence and democracy is treated in numerous articles, and constitutes part of the body of knowledge dedicated to the various forms of political systems and assessments of their relative efficiency; many references can be found in Farrell and Shalizi (2012). That is not an issue of any relevance to the developments in this book, for the following reason: I consider society as a system made up of individuals and the interactions between them, with the emergent behaviour determined by these two sets. In particular, the structure of the interactions will have a major impact on the evolution of the system, and without entering into any arguments about this, the work presented here takes as given, i.e. as an axiom, that the free, unrestricted exchange of information yields the best result, and that any restriction or manipulation of the information exchange will result in a detrimental\change to the process of evolution. However, a recent book by Hélène Landemore, *Democratic Reason: Politics, Collective Intelligence and the Rule of the Many*

(Landemore 2017), deserves special mention. Leaving aside such justifications as justice, equality, fairness and consent, she presents a strong argument for democracy on epistemic, or outcome-based, grounds. The history and current status of both explicit and implicit objections to democracy are given careful consideration and countered in a convincing fashion, and her treatment of the two democratic processes—deliberation and agglomeration, or majority rule—will be referenced again in Sect. 6.2, where we return to this under the heading of participatory and deliberative democracy in our discussion of the role of political parties.

In Sect. 5.3.2, we shall introduce a very simple view of society as a system with two main functional elements—Government and Life—with the latter representing all the activities taking place in society outside of Government. To develop an understanding of our use of the term 'collective intelligence' already at this early point in the investigation, we can start with a simple picture or model of Life, as shown in Fig. 2.4. On the right is a box labelled 'Recurrent activities'; they comprise the majority of the activities individuals are engaged in. They are the combined actions of the individuals making up the society, but as these individuals display more or less different behaviours, the collective behaviour is fluctuating. The box on the left, labelled 'Collective intelligence', observes these activities and, in particular, assesses the fluctuations and takes an adaptive actions to either promote them as changes to society or suppress them as undesirable. This *collective evaluation process*, which we shall discuss again in Sect. 6.2.2, can be interpreted as society's *immune system*.

A superficial consideration of collective intelligence might perceive a contradiction, in that, on the one hand, the process suppresses fluctuations and seems to lead to a consensus and what one might think would be an optimised steady state of society. Whereas, on the other hand, it is exactly fluctuations, in the form of ideas and actions, that are essential for the process to function. This contradiction only arises if we confuse collective intelligence with a means of achieving conformity, and fail to understand the function of collective intelligence in controlling the evolution of society as an ongoing process. What guides this control process of assessment and adaptive action; is it random or is it goal-oriented, in which case, what is the goal? In Sect. 3.6, we will put forward the belief (and it is a belief, in the sense that can only be made plausible, but not proven) that the goal has always been the same: survival. It is only that what survives, and our strategy for achieving it, have developed and become very much more complex and sophisticated, in line with the increasing complexity of society. One example of this, which is also detailed in (Richerson and Boyd 2004, 169–187) as 'the demographic transition', is the reduction in fertility rate in affluent societies. Survival is no longer seen in the

Fig. 2.4 Life, as a combination of recurrent activities and actions driven by the collective intelligence



quantity of offspring, but in their education and professional standing, and the cost of attaining that leads to a reduction in the number of children.

Society does not evolve towards a goal—a fixed state, some future ideal society, a heavenly kingdom—as much as some would like this to be the case. And when we speak of progress, it must be in the sense of change, not in the sense of getting closer to a goal. What we can observe is the evolution of society over historical times, and with whatever measure we use to characterise the state of society, say, X, we can determine dX/dt. In terms of the wording of the contradiction, the consensus is not about any end state, but about how to ensure the stability of the evolution of society over the next time increment.

But that does not allow us to determine the future course of $x(t)$, except perhaps over a very short time interval. Rather than being concerned about the state of society and its evolution, we should focus on what drives the evolution. Discounting any divine or supernatural force, the driving force can only be found in us. It is our intelligence, the ability to perceive our environment and to take goal-oriented adaptive action, and the goal is the survival of the evolution process itself.

With this, we have arrived at what is an underlying premise of the present work: The evolution of society is good to the extent that it is determined by the exercise of the collective intelligence. It is, essentially, an affirmation of our trust in ourselves, in the human species, and with this, The Good Society becomes the society that provides the conditions for the exercise of the collective intelligence.

2.3 Technology and Its Influence on the Evolution of Society

The use and meaning of the word 'technology' are broad and highly context dependent, as can be seen by looking up the word in Wikipedia. The word relates to the field of human activity that may be described as the modification of elements of the natural surroundings in order to meet a need; what we might call a *purposeful* modification. It started when humans developed the mental ability to recognise the possibility of such a modification and the physical dexterity to realise it, and the purpose included giving visual pleasure or increasing one's self-esteem (painting, ornaments, sculptures), worshipping a deity (monuments, temples), providing shelter (dwellings), increasing mobility (roads, bridges, boats), providing food (traps, weapons, agriculture), preparing, serving, and storing food (bowls, pots, plates) and so on. This is roughly what the ancient Greeks identified as *techné*, any creative manual activity and the products that arose from it, and in this sense we can say that the start of technology is identical to the start of our Phase Three.

As we already discussed briefly in the previous chapter, technology has been one of the major measures of evolution throughout Phase Three, and today its impact on our society is both undisputed and very obvious. Just take a look around you, and almost everything you see owes its existence to applications of technology. If you are reading this book in a printed version, the paper on which it is printed was produced by a highly sophisticated process that converts woodchips into a fibrous ‘soup’, which is spread out as a thin layer on a moving cloth that drains off most of the moisture and delivers a continuous sheet of felt-like material to a highly sophisticated machine, where it is pressed and dried by passing through numerous hot pairs of rollers at high speed. The steel used in this machine was produced in a complex process using iron ore and coal as its raw materials, and by many individual pieces of equipment, each one itself the product of a long development and improvement process. These raw materials were excavated, crushed, washed and transported by numerous, high performance machines and so on; a chain that goes on almost without limit. Or take an ordinary drinking glass; the numerous applications of technology involved in converting quartz sand into a finished product at a cost of a dollar or less per glass are each based on a huge body of knowledge. Or the incredible precision required in the manufacturing and operation of the weaving machines that produce the cloth we wear. The involvement of technology in our daily existence has become so ubiquitous that it is no longer given much thought, in the same way that we take our natural environment for granted; as something that is simply there.

In addition to this direct influence of technology on our daily lives, there is another, more subtle aspect of how applications of technology influence us—how we think of ourselves, of the world around us, and of our place in it, and how this again influences our behaviour. This was one of Martin Heidegger’s concerns with technology, that the ease with which applications allow us to exploit our environment changes our relationship to it (Heidegger 1977). We consider it solely as something to be exploited, and value it only as a commodity and for how we can use it, rather than recognising it as an element of the larger system—Planet Earth—of which humanity is just one of the other elements. It is the evolution of that system, with its emergent properties, that should be our concern. Another well-known investigation of how technology can influence our behaviour is Michel Foucault’s study of the Panopticon; a prison design by Jeremy Bentham that allowed any of its inmates to be observed at any time (Foucault 1977). The knowledge that they might be observed would enough to modify the prisoners’ behaviour; a psychological effect enabled by technology. Though Bentham’s design was never realised, the idea behind it has been influential in prison design ever since, and is, of course, alive and well in our society today. And the simplest example of technology modifying our behaviour is the speed bump.

Furthermore, in a recent book, Cohen (2014) discusses how the appearance of several technologies in the period around the Renaissance had a significant effect on how people changed both their perception of themselves and of their relationship to Nature. The development of mechanical clocks introduced a discipline into our behaviour, which Cohen exemplifies by the rituals of monastic life, as well as an increased understanding and appreciation of the value of time, as exemplified by Darwin’s dictum ‘a man who dares waste one hour has not discovered the value of life’ (Darwin 1887). The development of optics, in the form of telescopes and microscopes, allowed people to see features of Nature, both very small and very large, that not only furthered their knowledge and understanding of Nature, but made them see their own position in the world under a new perspective, realising that our concepts of small and large are not absolute, but relative to our own size. Finally, the development of printing with movable type changed our perception of our personal ‘self’ as a component of society, and made us aware of the importance of reflecting this ‘self’ in print, giving rise to literary ambition.

This indirect influence of technology should be contrasted with the direct influence arising out of interacting with, or using, applications of technology, about which there is an extensive body of philosophical as well as sociological/empirical knowledge, and which interaction leads, in its most intimate extent, to the concept of a techno-human hybrid. The indirect influence is a significant factor in what a human is—how we perceive the world around us, the criteria we use in processing the information we receive, how we perceive ourselves, and the like—but it is also a factor that is difficult to define and quantify. And it is certainly something that is way outside my competence and background, hence it will not feature in the further developments in this book, except in Sect. 4.6, where I look at the influence of information technology, and perhaps in the form of an occasional peripheral comment. However, I should say that I am very aware of this influence, and experience it every day in the interaction with my wife, who grew up with minimal exposure to technology. There are so many areas where the presence of absence of an exposure to technology makes a very definite difference to how the two of us understand them, with art being perhaps the most obvious, but more generally with a spiritual and emotional view of the world as opposed to a more mechanistic one.

And it is exactly this ubiquitousness that is the core of the problem when it comes to considering both technology and the environment. But while there is a great deal of discussion about the extent to which we are responsible for changes to the environment, there is no doubt about that we are solely responsible for every development and application of technology. Technology does not harbour any inherent force that determines its development and that makes its increasing influence in our lives inevitable. We control that development, the problem is that our view of the effects of technology have been superficial, in the sense of concentrating on the immediately visible effects, such as the economic effects, or the effects on power projection, or the effects on physical health and so on. What has had much less scrutiny is the effect on the structure and fabric of society itself. As an example, we have now seen a number of cases where military superiority is used as a means of suppressing a problem, starting perhaps with Palestine/Israel, followed by Vietnam, Iraq, Afghanistan and now the whole Middle East. (And the use of technology as a means of suppression is now creeping into our own societies in the form of surveillance, enforcement and an associated legal framework.) Technology is increasingly allowing one side to inflict grievous losses on the other side with minor own losses, and so this is seen as a relatively easy and, unfortunately, also popular approach to suppressing a problem without having to address the much more difficult task of reducing or eliminating the cause of the problem.

The lack of understanding of, and concern with, the influence of the application of technology on the evolution of society displayed by the general population does not mean that there has not been a significant amount of thought and effort expended on this issue. As we mentioned briefly in the previous chapter, the concern with what might be broadly subsumed under the concept of technology goes back to the Greek philosophers, and from about 1800 onwards, there was a slowly increasing awareness of the applications of technology as significant factors in society. A good review of this developing awareness and of the major issues under discussion is given in the book *Streit um die Technik*, by Friedrich Dessauer, most of which was first published in 1926 under the title *Philosophie der Technik*, and in its final form in 1956 (Dessauer 1956). It is, unfortunately, only available in German, as is much of the literature on this subject in the years before World War II, but reviews can also be found in some of the works listed in References. The main point, as far as our investigation is concerned, is that most of this work was concerned with the effect of mechanisation on the role of workers, transforming artisans and craftsmen into operators of machinery, without addressing the impact of technology on the development of the fundamental nature of society. There were, certainly, exceptions, such as Marx (1976), Veblen (1921), but it was only after the appearance and explosive growth of information technology (IT) in the years following World War II that the influence of technology on the evolution of society became an object of study in its own right, with contributions from philosophy and various branches of social science. A substantial body of work has evolved, and for those readers that would like to examine this further, a few useful references are given in References (Philosophy). Here, we shall only give a brief overview, and reserve a more detailed discussion of particular interest to our purpose for Sect. 4.6.

The interaction between technology and society is a complex subject, with numerous components and aspects, and one on which the view has changed significantly over time. Much of the early work on the influence of technology regarded it as taking part between two separate spheres of existence; a genuine (or intrinsically, or unsullied) human sphere and a sphere in which technology is prevalent. Technology was seen as developing under its own imperative, and so the interaction was a one-way process, with conflicts arising at the interface between the two, and with humans sometimes seen as the 'victims' of technology. More recent work sees the interaction as a process that is both two-way and so dynamic that it is not possible to make a clear-cut distinction between humans and technology. Humans are always hybrids of supposedly human and technical aspects, and what is of interest are the different kinds of human–technology interactions. This is treated in an article by Dorrestijn (2012), and in the present context it is interesting to note how this two-way process is reflected in the system introduced in the beginning of this section. All of the actors in this system (or actor–network, as it is also called) become hybrids, and so there is a feedback between technology and society that makes the relationship between them take on a dynamic character.

This can be seen, for example, in the importance of a collective readiness to accept and try out new ideas when they become available. This sensitivity to invention is a compound of many social, political and cultural factors, sustained by tradition and passed on by education and training. A well-known example is the stagnation of technological development in Chinese civilisation under the control of the mandarins (see, e.g. Buchanan 1992, Chap. 11). Up until, say, 1400, Chinese technology and its applications were on a par with, if not superior to, technology in Europe, but in the following centuries European technology developed rapidly, whereas in China a veneration of tradition and ritual by a centralised government stifled development. Some measure of political liberty, a degree of freedom from the constraints of class and conformity, a tolerance towards unfamiliar and even apparently bizarre points of view are all parts of the 'social package' required for technology to develop. This was again demonstrated in the relative rates of industrial development in France and England during the period 1600–1800, when an entrepreneurial middle class in England had considerable freedom to develop new industries, whereas in France such development was mainly the prerogative of the nobility, under the control of a powerful monarch.

A distinct body of research is what is identified as the social shaping of technology (SST), and a seminal work here is the book *The social shaping of technology*, edited by MacKenzie and Wajcman (1999). The point of departure of SST is to acknowledge the much greater complexity of the sociotechnical interface that is recognised by either technological determinism, which saw technology developing according to an inner logic, or social determinism, which saw technology development as reflecting a single influence, such as an economic imperative. Central to SST is the concept that there are choices (although not necessarily conscious choices) inherent in both the design of individual artefacts and systems, and in the direction or trajectory of innovation programmes. Different routes are available, potentially leading to different technological outcomes, and they could have differing implications for society and for particular social groups. Rather than merely assessing the social impacts of a given technology, SST examines what shapes the technology which is having these impacts—its artefacts and practices—and draws together views from different areas of sociology and economics to form a deeper understanding of the innovation process and the social factors influencing it.

An important critical strand within SST has highlighted the politics of technology. Technologies can be viewed as 'politics pursued by other means' or as the outcome of social conflict; in either case, technologies are not neutral, but are fostered by groups to preserve or alter social relations. Of particular interest to our investigation is the promotion of the Weberian class conflict perspective by proposing that the ability of a society to favour technical change is enhanced by conflicts taking place in a large number of arenas. The nature of the conflicts may be economic competition or social conflicts, and the arena might be industry, a profession, or a neighbourhood, but in any case, in a totally homogeneous society new technology will not be easily introduced, and technical change is more likely to occur in a society or an arena in which power and influence are unequally distributed among a relatively large number of agents.

Closely related to SST is what is known as Social Construction of Technology (SCOT). It is based on an approach called the Sociology of Scientific Knowledge (SSK), which considered scientific knowledge as arising from the socially influenced interpretation of scientific discoveries. SCOT studies technological artefacts and explains how social factors entered into the particular choices among a number of possible ones. One aspect of this social constructivist programme, and which is relevant to our story, is that a problem is closed when the relevant social groups see it as being solved. But this is certainly not true in general; in many cases, closure simply means that the differences between social groups have been reduced to the point where power relations of a political or economic nature make any further development futile. Thus, closure does not mean the elimination of conflict, and it is the suppression of latent conflicts through power relations that reduce the stability of a society, as we mentioned above.

Philosophers and most sociologists have a broad concept of technology, and would accept such a definition as ‘artefacts and their development, production and use’. Philosophers have produced a substantial body of work under the heading of ‘Philosophy of Technology’. It is concerned with ethical aspects of technology, with the nature of technological knowledge and with fundamental issues regarding the impact of technology on the human condition. Sociologists have likewise taken an increasing interest in technology, studying technology as a social activity and how social issues influence the development and application of technology. However, in both philosophy and sociology, there has been a tendency to confuse technology with science, and engineers with scientists; many publications on the philosophy of technology make no mention of engineering at all, and such concepts as ‘technoscientist’ and ‘technologist’ tend to confuse the issue even more. One reason for this is probably that the philosophy of science was already well established and provided the point of departure for work on technology. This is reflected in the implicit or explicit view of most philosophers and sociologists that technology is driven by scientists, rather than engineers, as evidenced by the common reference to ‘Science and Technology’ and ‘technoscience’. A typical example of this is the proceedings of the 21st Nobel Conference, which is entitled *Responsible Science—The Impact of Technology on Society*. It considers questions of judgement and values that permeate issues relating to science-based technology, and states that these demand the attention of the entire society: business leaders, politicians, scientists and citizens (Byrne 1985). What happened to engineering and the engineers?

Science provides the basis for developing new technology, but the main creators of new technology, as well as the creators of new applications of technology, are engineers. And engineering is very different to science, both in its approach and in its relationship to society. A lack of appreciation of this difference, and of the role of engineers in general, has often made publications on the relationship between technology and society seems somewhat artificial. Basically, whereas science is about discovering the truth of our understanding of Nature, engineering is about using that understanding for beneficial purposes. And whereas the paradigm within a domain of science can change relatively rapidly, caused by a single revolutionary new theory, such as the heliocentric view of the solar system, Newton’s laws, Darwin’s theory of evolution, relativity and quantum mechanics, changes within engineering are more gradual. In particular, it is not that existing engineering knowledge and works are found to be incorrect and need to be discarded; it is that new knowledge and works are added and then, over time, replace the old for reasons of greater cost-effectiveness.

One example of how philosophers and sociologists view technology can be found in the book *Autonomous Technology* by Winner (1977), where most of the Introduction is dedicated to a discussion of the history, use and meaning of 'technology'. He points out that the concept is used so frequently and in such diverse contexts that it has become amorphous in the extreme, to the point where it has come to mean everything and anything; it therefore threatens to mean nothing. He consequently proposes instead to employ the term *apparatus* for the physical objects, such as tools, instruments, machines, etc.; the term *technique* for the activities involved, and the term *organisation* for all the related social arrangements. However, while this provides a differentiation of the components of technology, it does little to sharpen the definition of the concept itself, or to replace it, as the title of the book, as well as the frequent use of 'technical', 'technics' and technological' throughout the book, demonstrates.

A useful perspective on the everyday use of the concept is given by Marx (1994), where he shows that the character and representation of 'technology' changed in the nineteenth century from discrete, easily identifiable artefacts (e.g. a steam engine) to abstract, scientific and seemingly neutral systems of production and control. As a result, the newly refurbished concept of 'technology' became invested with a host of metaphysical properties and potencies that invited a belief in it as an autonomous agent of social change, attributing to it powers that bordered on idolatry.

For our purpose of integrating technology into our description of evolution, we adopt a more specific and precise definition of technology: Technology is the resource base developed and applied by engineers in order to meet needs expressed by groups or all of society, and consists of a material base (construction elements, tools, as well as the facilities within industry for fabricating and constructing plant) and a knowledge base (textbooks, publications, standards, heuristics, etc.). Students study technology in order to become engineers. The construction elements range from cement and reinforcing steel rods to integrated circuits, and it is the existence of this vast collection of standardised elements, listed in numerous catalogues and defined in various documents, that underpin the efficiency of modern engineering. For example, if we had to design a bolt or a drill bit every time we needed one, we would get nowhere. Both of these bases are dynamic: new construction elements are continually being added and older elements are being phased out; new knowledge is being generated through research and experience, and what was advanced knowledge yesterday is tomorrow's accepted practice. Handling this continuous transformation, as well as the current exponential increase in volume, becomes an important factor in increasing the value of engineering to society (The relationship of technology to engineering is discussed in Aslaksen 2017b).

To see how the development of technology fits into Phase Three, Table 2.1 sets out a more detailed time frame and notes some of the most important characteristics of this development (A more detailed description was provided in Aslaksen 2013b).

Table 2.1 A condensed view of the development of technology (Aslaksen 2013b)

Period	Approximate duration	Development of technology
Ancient	Until 500 BC	Knowledge transmitted verbally and by example. Resources limited to timber and stone, with some metals and simple hand tools
Classical	500 BC–400 AD	Written records of designs and of scientific input appear. Resources include bricks and concrete, iron/steel becomes more available
Medieval	400–1400	Slow increase in knowledge base; improvement of existing designs. Increase in mining technology
Renaissance	1400–1650	Expansion of knowledge base due to upsurge in science and printing
Enlightenment	1650–1750	Further interaction with science, improvement in fabrication methods (precision, standardisation)
Industrial Revolution	1750–1850	Rapid increase in all aspects of technology. Formalisation of the technology through education (textbooks)
Production	1850–1980	Very great expansion of the technology; in particular, of the resource base in the form of standard construction elements
Information	1980 and ongoing	An increasing proportion of technology is becoming related to software

Applications of technology have become so embedded in society and of such importance in our daily lives that we can say that technology is now a defining component of our culture, together with such other components as art, religion and the rule of law. The evolution of society is strongly influenced by the development of technology, and as we have seen that we are now in charge of this evolution, our understanding of technology, the manner in which we control the development of technology, and how we decide to apply technology, become essential factors in assessing how evolution will progress from here on.

In the Introduction to the proceedings of the Nobel conference XXI, Byrne (1985) noted that questions of judgement and values permeate issues relating to the use of science-based technology. These issues are more complicated than merely choosing between ‘good’ and ‘evil’. They involve a societal decision as to what is good, or which of competing goods to pursue. Society and its leaders, then, make decisions that determine whether technology will be used responsibly or not, to which of many responsible uses the technology will be put, and what level of undesirable effect will be tolerated. These are matters that demand the attention of the entire society: business leaders, politicians, scientists and citizens.

It is not difficult to find examples of how, in the past, technology and its application had a major influence on the evolution of society. For example, the ability to form large-scale communities, as in cities, and thereby enabling the cooperation we mentioned earlier, depended on the development of civil and structural technology: water supply (dams, aqueducts, wells), sewerage and drainage (pipes, canals, tunnels), brickwork, etc. Or, the ability to separate workplace from place of residence through mechanised transport (railway, ferry, tram, bus and car). And in the present day there are technologies that have, or will have, significant impact on the further evolution of society, such as genetics, nuclear technology and renewable energy technology. These obvious examples can also make us overlook some less obvious, but, in the long run, not less significant influences of technology, and we shall return to that in Chap. 4. The fact that many (most?) applications of technology have both a positive and a negative effect on society was described as 'the technological dilemma' in Buchanan (1992, Chap. 13), and the author emphasised the importance of a wide participation in the decision-making process in order to minimise the negative effect.

What we need to realise a this point is that technology is so closely interwoven with evolution in Phase Three that any consideration of the manifestations of evolution, or of what drives evolution, or of the interactions between individuals as the elements of evolution, must take account of technology. Technology is an expression of both our manual and intellectual abilities, but has at the same time provided the momentum for the development and exploitation of those abilities. And it is this positive feedback that has resulted in the accelerating pace of evolution in Phase Three. Without a good understanding of what technology is and of the interaction between it and society, it is not possible to comprehend how society got to where it is today and to see what our realistic options for the future are.

2.4 Some Further Thoughts on the Evolution of Society

Our focus is on the third phase; the phase in which the changes *within* humans, that is, in their physical characteristics, are negligible compared to the development of the relationships *between* humans. The third phase represents a complete change in the nature of evolution; it is so different that it is easy to overlook that it is a continuation of the same basic process—a struggle for survival. The subject of evolution has changed from the individuals of the species to entities formed by the interactions between the individuals, the pace of evolution has increased by orders of magnitude, and, above all, a great difference between the first two phases and the third one is not only in the speed of evolution, but in what drives it. In the first two it is the Darwinian process based on genetic information and change of endosomatic organs; in the third phase change is by means of exosomatic instruments, the bearers of knowledge, with education and information exchange forming the core of the process. A similar view, although in a somewhat different context, was expounded some time ago by Sir Peter Medawar in a series of BBC lectures in 1959 (Medawar 1959), and as a biologist and immunologist (and Nobel laureate), he used the evolution of *homo sapiens* and, in particular, of the human brain as the basis for his argument. (This was previously discussed in Aslaksen 2017). For this purpose, he divided the evolution of the brain into four stages: In the first stage, the brain was an organ that responded only to external stimuli by reactions that were already present in the brain. That is, a certain stimulus, which he called an *elective* stimulus, elected its corresponding reaction, but the brain would not react to stimuli that did not fall in this group. In the second stage, the brain began to be able to accept *instructive* stimuli; stimuli that contained information about how it should be processed. The development in these two stages depended entirely on a genetic heredity, whereas in the third stage, a non-genetic system of heredity evolved that allowed brains to do more than merely receive instructions; it made it possible for them to be handed on. The fourth stage is the systematic change in the nature of the instructions passed on from generation to generation; an evolution that has been progressing at an accelerating pace for the last couple of centuries. The conclusion Medawar draws from this argument is that social change is not governed by any laws other than laws which have at some time been the subject of human decisions or acts of mind, and the mechanism that supports this change process is the non-genetic heredity mediated through the transfer of information from one generation to the next.

There can no longer be any doubt about the fact that the development of humanity and our environment is driven by us. We are no longer the pawns in Nature's game of the survival of the fittest in a distribution created by random mutations; we run the game. Adam Smith's 'invisible hand' is no longer invisible; it is our hand.

Sometime in the early days of Phase Three (or perhaps earlier), humans became aware that they were different from other living organisms. They no longer saw themselves as just another creature living in and as a part of Nature, but increasingly saw the rest of Nature as the *environment* in which their individual lives took place and which could, to some extent, be manipulated and exploited to their advantage and from which they could obtain some measure of independence. This recognition and understanding was a result of the shift in the balance of capabilities from the physical to the mental. And besides the increasing ability to develop technology and apply it to modify the conditions of existence, it was accompanied by a shift in the balance between physical and mental activity. Existence had no longer just, or even mainly, a physical content, but also a mental content, and thoughts and mental images could take on a reality in a person's mind that was divorced from any physical reality. A consequence of this was that the fear of death, which all animals display, but which they presumably accept as the natural end to individual existence, could now be sublimated by a mental construct in which the individual continued to exist in some form in a mental realm, in contradiction to all physical evidence. The preoccupation with and embellishment of this construct in the form of beliefs, rituals and religious systems have been central to the evolution in Phase Three and an inseparable part of our story of how we ended up where we are today.

In the book *The Death of Forever*, Darryl Reanney explores this issue from various points of view (Reanney 1991). He gives a very good account of the importance of death, whether consciously or unconsciously, in forming our character, and gives many examples of how our desire to transcend death has manifested itself in works ranging from scratches on a cave wall to the pyramids. It shows how all art includes a desire to overcome the transient nature of existence. Now, 'transient' means 'lasting only for a short time', and this brings us to a consideration of the nature of time. Reanney sees time as the greatest barrier that Nature has erected between the structure of the human mind and reality, and death, as a marker in time, can only be transcended by a pure, universal consciousness that is freed of time. He believes that, to the highly evolved mind, which has filtered out ego noise, reality appears as a timeless continuum. Without entering into the issue of a pure consciousness, Reanney's treatment of time and its relation to the cycle of human life, both the short-term circadian cycles and the long-term one ending in death, is thought-provoking, but then, in the end it seems to miss what to me would be the proper conclusion: Rather than reality being a timeless continuum; that is, something existing unchanged *in* time, it is time that has no reality. Time is a concept we have invented as an arbitrary measure of change; the reality is change. In a universe where nothing changes, not a single elementary particle moves, there could be no concept of time. Of course, there would be no humans, either. The concept of time depends on the ability to perceive change, which is again contingent on memory. So, in a universe without organisms with memory there could not be any concept of time, either. We are so conditioned to thinking and speaking of time as an actual physical parameter; for example, we talk of something being a function of time. And when we say something happened later, we think in terms of elapsed time, rather than after something else had changed.

This is relevant to our investigation because, as we saw earlier, the time frames of the three phases are very different. In particular, we shall be concerned with how the rate of change has been, and is, accelerating in Phase Three. In the last century, the lifespan of humans has not increased dramatically when measured in normal time, but if we would use the rate of change of our environment as our 'time' scale, we would say that we are now living very much longer than a century ago. This brings us back to Fig. 2.2 and the interpretation of the y-coordinate as time. If we would put a timescale on the y-axis, it would demonstrate how the rate of change is accelerating. Without providing an exact quantitative definition of 'change', it is likely that more than 99% of all change to society in historical times have taken place since the introduction of the efficient steam engine in 1770s. We now have two related processes: changes to society from applications of technology and the associated issues arising from these applications, and the process of developing restrictions to resolve these issues, and in a qualitative manner, we can illustrate their relationship as shown in Fig. 2.5.

The vertical distance between the curves, ε, shows the issues outstanding and needing to be resolved, and we see that despite the time required to resolve issues, Δ, is decreasing, it is not decreasing fast enough to prevent the number of outstanding issues, ε, to increase. In short, society's processes for responding to change are inadequate, and we seem to be facing a potential run-away situation. This problem was identified quite some time ago by William F. Ogburn in his book *Social Change with respect to culture and original nature* (Ogburn 1922). He considered the adjustment that was required between different parts of culture (or society, in our current terminology); in particular; the adjustment of the non-material culture to changes is the material culture, where the latter included both the natural environment and industry and its products, and showed that there

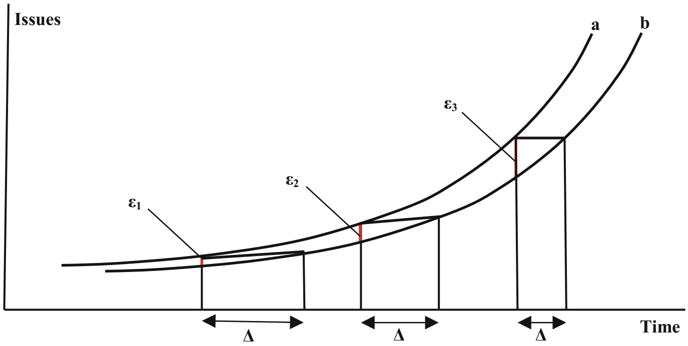


Fig. 2.5 The curve labelled **a** shows the issues that have arisen from the introduction of technology-based applications prior to any point in time, and the curve labelled **b** shows the issues that have been resolved

was generally a delay between the change and the required adjustment, which he called *the hypothesis of cultural lag*. He discussed the reasons for this lag, and in doing so, in many respects anticipated the hypothesis of Thomas Kuhn in *The Structure of Scientific Revolutions* (Kuhn 1962). And in the Summary of Part IV, he considered an outcome which we shall also take up in Sect. 5.3:

> It is thinkable that the piling up of these cultural lags may reach such a point that they may be changed in a somewhat wholesale fashion. In such a case, the word revolution probably describes what happens. There may be other limiting factors to such a course of development, and our analysis is not sufficiently comprehensive and accurate to make definitive prediction. But certain trends at the present time seem unmistakable.

When comparing the two works, of Ogburn and Kuhn, we see that there is a significant difference. Kuhn's concept of a paradigm is a belief system within a branch of science, and its revolutionary change as a result of mounting contradictory evidence takes place within this same environment; any consideration of its effect on the rest of society is secondary. Ogburn's investigation of social change includes this same effect, and identifies many of the same reasons for it, but the 'revolutionary' change takes place in another part of the social structure, particularly in government through such actions as new legislation or changes to the educational system. The main part of Ogburn's cultural lag is the additional lag resulting from this transition across the social structure, and most often predicated on political and economic factors; factors that are of minor importance to a scientific paradigm change.

A different perspective on the situation depicted in Fig. 2.5, and one that resonates with our development of the Social Bond, is the one presented by Habermas in his essay *Technology and Science as Ideology* (Habermas 1970). He identifies an underlying tension between two types of actions: a purposive rational action, which includes the relationship between technology and nature, and a communicative interaction, which aims at mutual understanding and, by implication, of the establishment of and agreed social framework. There is a balance between these two types of actions, and he sees the problem with our time as a shift in this balance towards the purposive action. That is really only a different formulation of the explanation of the increasing value of ε.

In Sect. 2.2, we introduced the concept of system as a means of handling complexity. Let us now see what this means if we want to describe a society as a system. One approach is a historical, bottom-up development. The simplest society would be a single (extended) family, living largely in isolation, as might have been the case of a family of cave dwellers some twenty thousand years ago. The system consisted only of the people in that family, they constituted the set of elements; everything else, including the cave, was the external world. The animals they hunted and the berries, fruits and the like they gathered, which were part of the external interactions, had no impact on what we would call the environment in which they lived and in which the system existed. As families became settled through starting agriculture and animal husbandry (and also forming themselves into larger groups), they did have a significant influence on the immediate part of what was previously the external world, and their dwellings, stock and field enclosures, and other constructions, such as dams or bridges, would now have to be counted as part of the society and therefore as elements of the description of that society as a system. The external world, which was still largely unaffected by the enlarged system, was outside the system boundary and formed the environment in which the enlarged system existed. The external interactions in the direction from the environment to the system were significant (rain, draught, floods, landslides, changes to river beds, etc.), but there was little impact of the system on the environment.

As populations grew and societal structures became larger and more complex and, above all, under the influence of technology, the boundary between society and the part of the rest of the world relatively unaffected by society moved further and further outwards, society is today, as a system, most appropriately taken to be the whole of Earth, including its atmosphere. There is no unaffected 'environment' of this system left; except for solar radiation and our embryonic interactions with space, which in the current context and for the time being we can safely neglect; our society is an isolated system. This is what was popularised as Spaceship Earth by Fuller (1969) and The Club of Rome in *The Limits to Growth* (Meadows 1972). In terms of the three phases of evolution and the development of species introduced above, we see that the third phase has advanced to the point where there is only one 'species'—our society—and the further development is not one of speciation, or cladogenesis, but one of evolution of that one society; that is, a case of social anagenesis.

This bottom-up approach is the classical approach to design, starting with the smallest, most detailed building blocks (in engineering, these are called construction elements or components), combining them into larger elements, then combining these into subsystems, and, finally, combining the subsystems to end up with a system that meets the requirements or, in our case, displays the observed behaviour. However, a complete, detailed description of society would be a very complex system. Not only does it contain innumerable elements and interactions, but these also change over time; it is a dynamic system. It is not possible to consider a whole society at this level of detail, but if we use an analogy with a volume of molecules and remember a bit of thermodynamics or statistical mechanics, we might take this a step further. A volume of gas is a very large system, but instead of considering it at a microscopic level, i.e. the level of individual molecules, we usually consider it at a macroscopic level, i.e. as an entity characterised by a few macroscopic parameters, viz. pressure, temperature and volume. To find similar 'macroscopic' parameters for society, we just need to keep in mind the significant difference between gas molecules and the elements of society we alluded to in Sect. 2.1: the latter are active, whereas molecules are passive. The activities make up the processes that describe what the society does, what takes place within the society. Society is 'alive', and these processes are the equivalent of the processes taking place within a living organism.

The first thing we must do is to decide what aspects of society we want to investigate and understand by describing it as a system. Do we want to understand what elements society is composed of? Do we want to understand what functions society performs? Do we want to investigate the stability or dynamics of society? Well, to some extent all of these, but above all, we want to understand how society is a result of interactions between individuals. And as individuals and their interactions are in themselves very complex, we need to develop a particular *view* of them that is simple enough to allow us to operate with them while at the same time contains enough of their essential nature to result in some valuable insights. The central part of that view is constructed by means of two concepts—intelligence and will—which we develop in the next chapter.

As somewhat of an aside, the changes to society as it evolves can be seen as being of two different orders of importance. The more important ones are the changes in the main structure of society, such as from a clan structure to a feudal structure, from a feudal structure to a nation state structure, or from independent craftsmen to factory labourers. But within each of these structures, there were many smaller changes in interpersonal relationships; in relative power, in wealth distribution, in political influence and so on. This brings to mind Noam Chomsky's two levels of structures in grammar (Chomsky 1980; Smith and Wilson 1979); the deep structures generated by the features of the processes inherent in the human brain related to cognition, and the surface structures, generated by transformation rules operating within these deep structures. The analogy in our case would be that the major structures are generated by the processes making up intelligence, and the more detailed structures are generated by the application of such emotions or cognitive biases as love, hate, envy, etc.—Food for thought, and a reminder of how inspiring Chomsky's work has always been.

In summary, the main understanding I would like you to take away from this chapter is a particular, and highly simplified, view of society, which sees society as a complex dynamic system, embedded in an environment which we might identify as Nature. The elements of this system are identified by two parameters: the individual (or person) and the role in which the individual acts as an element of society. These elements interact with each other and with Nature through inputs in the form of information and outputs in the form of actions, and the capabilities of both of these groups are hybrids of inherent human capacities and applications of technology. In response to information, each element produces actions according to an internal algorithm (or set of rules) that are in part inherent to the human and assumed identical for all elements, and in part determined by the individual's previous experience. It is essentially a 'black box' model of the individual, or a psychologist's or sociologist's view, rather than that of a biologist. The structure of society depends on what interactions are active.

http://www.springer.com/978-3-319-68740-7

The Social Bond
How the interaction between individuals drives the evolution of society
Aslaksen, E.W.
2018, VIII, 235 p. 50 illus., Hardcover
ISBN: 978-3-319-68740-7