**KNOWLEDGE**

 The other great question of philosophy is, how can we know that our beliefs are true? (We can use the pretentious word “epistemology” for this, if we feel a need to impress.)

**Rules of inference from natural selection**

 The implications of Darwin’s Theory for philosophy are immense. If it is true that our bodies and our minds are the product of evolution by natural selection (and there is not, in my view, any realistic doubt that it is true), it has great consequences for the philosophy of knowledge as much as for the philosophy of values. Information has come into our brains by two routes – observation through the senses and prior information installed by natural selection and coded in our genes. There are no other sources.

 Natural selection has built into our brains information describing the world of the past and describing the nature of natural selection itself. We must look to natural selection to find the origin of our rules of logic and basic values which we “just know” without evidence. Natural selection has also built some general facts into our brains such as the belief that the world is three dimensional, that time passes in one direction only and that solid objects tend to have an enduring existence. It has also put some quite specific information into our brains such as the ideas that snakes, spiders and the edges of cliffs could be dangerous.

**Representation of outside world**

 It seems to us by introspection that we have in our minds representations of the world that is external to ourselves. It also seems that these are sometimes accurate, sometimes incomplete and sometimes even wrong. We have an ability to make deductions in which certain conclusions follow logically from certain starting premises. We cannot “prove” that these logical processes are right; if we try, we would be using our system of logic to construct the proof. We can train our minds to do what seems better by, for example avoiding contradiction. It is one of our innate beliefs that contradiction is incorrect.

 We have these, together with the system of induction, in which we believe that if a set of circumstances produce the same outcome many times, it is likely, although not certain, that when the same circumstances arise, the same outcome will happen again. This mental principle is immensely useful although we can understand that it is not necessarily true. But it seems to have been true often enough for humans and other animals that use it to have had a selective advantage.

 These mental abilities just seem right to us. Although we cannot say why, they seem to be totally beyond dispute. But all that we can hope is that the process of natural selection, which has brought our mental equipment into existence, has got it right.

**Circularity risk**

 There is, of course, the problem that we have discovered what we know about evolution by using the brains, sense organs and a priori beliefs and rules of logic that evolution has produced. There is danger of circularity, but we have no other way to make our investigations. We can only be careful and do our best.

 Whatever we can discover about this question must always be qualified by this big limitation. We are using these imperfect, evolved decision making devices to study their own actions. While we hope that evolution has provided us with the right tools, we must accept that absolute certainty will forever elude us. No amount of philosophising can change that.

 So we can only study our rules of logic by deriving them from our own inner feelings. We look carefully and decide what is right, what makes sense to us. Perhaps millions of years of hunting and gathering followed by thousands of years of agriculture, and the other activities that agriculture made possible, will have equipped us to find the truth.

**Decision makers**

 Our brains did not evolve as truth-finding machines; they evolved as decision makers to optimise survival and reproduction. These brains did not need to know that survival and reproduction was their ultimate objective; they only needed to have instincts that would serve that objective in the environment in which they evolved. So it may be equally true that they did not need to have a true representation of the external world either; only what would generate the “right” decision. Yet it does seem likely that a true representation of reality would be part of making successful decisions, although we can think of exceptions.

**The brain**

 Our evolutionary history has provided us with brains where it seems that most of our information processing takes place. The human brain is superior to those of any other species (in our humble opinion). We do not know for sure that the inner workings of our brains are really better, but we are aware that our senses are mediocre. Some species have sharper eyesight. We have three-colour vision; some others have four while others have only two. The dog outclasses us in its olfactory sense. But despite all that, we seem to do much cleverer things than other animals.

 The human brain is an extraordinary organ. To the ancients it just looked like a kind of jelly, but today we know much more. It contains perhaps 100 billion neurons and these are interspersed with 10 times that number of glial cells. Each neuron consists of a cell body and outgoing and incoming fibres. The outgoing fibres are typically axons and the incoming fibres are dendrites. The axons typically finish at one or more synapses where they transmit impulses to the dendrites of other nerve cells. When a neuron “fires” an electro-chemical signal travels along the axon and causes transmitter chemicals to be emitted from the synapse, stimulating the target neuron.

 Knowledge of how the 100 billion or so neurons combine to produce the intelligence we observe is far from complete, but a great deal is known. With modern scanning equipment the electric fields generated by the brain’s information processing can be detected. We cannot yet understand it in detail, but it clear that different mental processes are associated with activity in different parts of the brain.

**Effect of injury and disease**

 It is also known that the mind can be changed by injury to the brain. Phineas Gage was the famous American railway worker who was using an iron tamping rod on some explosive when it detonated, driving the rod through his skull.

 Remarkably he survived, but as he made a recovery it was noticed that his personality had changed drastically, so much so that some of his acquaintances said “this is not Gage”. He was described as “fitful, irreverent … capricious and vacillating in one report and gross, profane, coarse and vulgar to such an extent that his society was intolerable to decent people”. Yet as the years progressed, it seems that he regained his social skills to a large extent. After his death, the family donated his skull, together with the iron bar that had penetrated it, to the Harvard Medical School in whose museum they can be seen to this day.

 The mind can be altered by injury, but also in other ways. Our mental behaviour and experience can be changed by alcohol and drugs, usually on a temporary basis and for some of these it is known how the drug interferes with neurotransmitter chemicals in the brain.

 The brain can also be changed by deterioration and disease. Sadly it is by no means rare that different functions of mind can decay completely while the subject remains alive. This is so common that many of us will have known relatives or friends who have suffered in this way. It sometimes seems that the person we knew is “no longer there”

**Duality is unlikely**

 These observations, together with the understanding that 100 billion nerve cells are sending electrochemical signals to each other, add up to a vast amount of data processing. This information was not available to Rene Descartes or other pre-1800 thinkers when they pondered the relationship of mind to body. But today it has become very difficult to maintain the idea that mind is some kind of immaterial soul which simply inhabits the body, In Gilbert Ryle’s term, a ghost in the machine.

 If we separate our desires from an evaluation of the evidence, we must conclude that the operation of the mind is the information processing function of these billions of nerve cells. This must inform our ideas of consciousness, free will and life after death.

**The Scientific Method**

 In the centuries that followed 1600 CE, the ideas of science developed and seemed to give a better way of arriving at the truth. These ideas certainly led to many spectacular and seemingly magical achievements by engineers. Yet they were not magical and that was their strength.

 The scientific method is hard to define, but it consists of little more than trying to arrive at beliefs very carefully and making the greatest effort not to accept false beliefs. Some of the elements might be:

a) Do not unquestioningly accept authority or ancient texts.

b) Be guarded against sources of bias, exert rigorous scepticism.

c) Be curious about matters which “everybody knows” or appear obvious or trivial.

d) Observe methodically and record results.

e) Do not accept a reported observation, unless it can be repeated by others.

f) Form a hypothesis of the underlying reality which has caused the observed facts.

g) Deduce predictions from the hypothesis. If the predictions do not appear, the hypothesis fails. If they do, the hypothesis is only provisionally confirmed.

h) Perform experiments. These can obtain more information that passive observation and where correlations have been observed, they can identify the direction of causality.

i) Do not construct a more complex explanation that the observed evidence implies.

 How do we know that this is the best method of thinking? After all, most of it was only invented in the centuries following 1600 CE. Before then it would have been considered completely wrong to have impudently denied ancient authority or the opinions of one’s elders and to question traditional ideas about the universe were considered blasphemy and a mortal sin.

 Let us consider the elements listed above.

a) *Do not accept authority or ancient texts*.

In the past, it was considered impudent or even blasphemous to question the “greats” of ancient history or even senior people in academia. At a time when technology had changed little in the preceding thousand years, this seemed much more plausible than today. We now have many examples of old texts which are hopelessly in error.

b) *Be guarded against sources of bias, exert rigorous scepticism*.

We observe many examples of bias and some people who hold beliefs which (at least in my opinion) clearly do not correspond with reality. The danger of accepting false beliefs is real.

c) *Be curious about matters which “everybody knows” or appear obvious or trivial*.

There are many useful scientific results that have begun as acts of simple curiosity about things that might seem trivial or obscure to many people. Questioning what “everybody knows” has the same justification as questioning ancient authority.

d) *Observe methodically and record results*.

Our brains are able to learn from experience, but this ability is approximate. We forget some information; and we have a number of sources of unconscious bias. We selectively remember the observations which we find more pleasant or interesting. Careful treatment of observed data has been found to be much more reliable.

e) *Do not accept a reported observation, unless it can be repeated by others*.

There have been many examples of mistaken observations. In 1989 two scientists announced that they had discovered a process for generating energy by fusion of atomic nuclei at room temperature. It would have been a fantastic achievement, but others failed to reproduce the result. The idea is now mostly discounted.

f) *Form a hypothesis of the underlying reality which has caused the observed facts*.

This is the creative part of science. It is the forming of an explanation of what is really happening which has led to the observations. These are products of the imagination and can not be the basis of belief until they are tested.

g) *Deduce predictions from the hypothesis. If the predictions do not appear, the hypothesis fails. If they do, the hypothesis is only provisionally confirmed*.

Testing is the critical element. A hypothesis that would be true no matter what is observed, gives us no testable information; it is mere assertion. To be useful, a hypothesis must be falsifiable (in Popper’s terms). If there are no conceivable observations which could prove it false, then none can confirm it either. When a hypothesis has been repeatedly confirmed, it is called a theory which is a fact for all practical purposes, but which remains open to challenge if new evidence appears.

h) *Perform experiments. These can obtain more information than passive observation and where correlations have been observed, they can identify the direction of causality*.

Experimentation is one of the great discoveries of science and experience has shown that much more information can be found that way. Passive observation is useful, but it can be better when the investigator interferes. We may observe that A and B always occur together. But, if we artificially cause A and B does not happen, then we artificially cause B and then A happens, this tells us something.

i) *Do not construct a more complex explanation that the observed evidence implies* *(Occam’s Razor).*

The idea was set down by a Franciscan Friar in the 14th century, although it may have been obvious to some before that. Suppose that we observe a tree lying horizontally across the road after a windy night. We might make a hypothesis that its roots had been weak and the force of the wind had caused it to fall. It would be equally consistent with the observation to say that a spacecraft from another planet had landed and mischievous little green men had pushed it over for their amusement before departing again. But clearly there is nothing in the observation to suggest this fantastic explanation. The simpler hypothesis should be proposed. The important thing to recognise is that a scientific theory can only be as good as the observations that support it. Anything that goes far beyond that could be true, but is not supported by the evidence.

**It works but that is not proof**

 Perhaps the thing that sets the scientific approach apart is that it works. Until 1600 CE or so, beliefs and technology had changed little for a thousand years. It is rather different today. Science is steadily advancing as new discoveries are made. But the fact that this new way of thinking works is not absolute proof.

 The Montgolfier Brothers were well read in the science of their day and were aware of the discovery of different gases by Black, Cavendish and Priestley. They suspected that combustion was releasing various gases and by this means they achieved the first successful flight in 1783. In fact, the gases produced by the fire were not particularly useful; it was the expansion of the air due to heat that was giving the buoyancy. Yet, without knowing the truth, it worked. So the fact that it works is helpful, but is not a guarantee that we have the truth. Of course, in that matter, a better understanding was soon achieved, using a scientific approach.

**There is no unanimity - ancestors**

 Despite these valid reasons to doubt, it does strongly appear to me that science is the best principle to enable us to discover the truth, because science works on evidence alone. But the problem is that not everyone agrees.

 Our own ancestors in the 1600s lived in a magical world. It was full of spiritual and occult forces which were thought to have a profound bearing upon people’s lives. A mixture of Christian and Pagan ideas was believed with total certainty by many. Medicine was undeveloped and life expectancy was short. Misfortune was not believed to come from mechanical causes or pure bad luck, but was ascribed to the agency of some mind. God or Satan could have acted, or, worst of all, innocent people could be blamed and branded as witches. During the century, many people, usually harmless old ladies, were hanged or burned to death due to this superstition.

 If we could time travel back to that period and speak with people, we would feel in a very foreign land indeed. And if we told them that their distant ancestor was a monkey, that Satan did not exist and that it would come to be that people would make long-distance journeys in a machine that carried them six miles above the earth’s surface, they would have considered us dangerously mad.

 Yet who are we to be so sure that we are right and they are wrong? Is it possible that our descendants in four hundred years time will consider us to be as deluded as we now consider our forebears? How can we know what is true?

**Not all agree – dissenting world views**

 Yet we still have people who have other views. The scientific methods described above are only justified ultimately by our feelings of what is a logical deduction and what is reasonably sound induction. But others may claim the same justification. There seems to be a lot of wrong thinking in the world, but how can we prove which kind of thinking is right?

**Extreme scepticism**

 It has been suggested that we cannot know that an object, such as a tree which we have observed, continues to exist when we take our eyes off it. A scientific approach would exclude this because we can revisit the object as often as we like to confirm the theory that it is still there. Occam’s razor would also have something to say because a mechanism to cause it to wink out of existence when no-one is watching, only to swiftly reappear, is a construction that goes well beyond the observed evidence.

 Bishop Berkeley (1685-1753) proposed that objects could only exist when they are perceived by someone. But in common experience, things seem to have a continuous existence. His solution was that this was explained because everything is perceived by God, whose existence he considered thereby proven!

 I believe the extreme sceptical idea can be safely ignored.

**Scientism**

 There are some who dislike the scientific approach and who have coined the derogatory term “scientism” for the arguments of those who point out that their cherished beliefs do not hold up against the evidence.

**New Age**

 What can we say to someone who says, “when I am standing by these ancient stones I can feel the energy of the earth rising through them and infusing my spirit”? I might answer, “I appreciate that you may not mean by energy what I mean, a quantity measurable in kilowatt-hours, but even so, I cannot see that you have evidence that anything at all is rising from the earth through the stones. All you can really claim is that you are experiencing an emotion.”

**Postmodernists**

 Then another person might say “As a follower of postmodernism, I do not think that science should be privileged over any other way of finding the truth”. Some suggest that science is just a myth system with no claim to be privileged over the other myth systems that have been believed by pre-scientific people throughout the world’s history. (And, some say that science is just the superstition of rich people who are probably old, male and white.) Why, they would ask, should we believe earth scientists any more than the natives of an island where their tradition is that the earth and the sky were made by their ancestors from two halves of a coconut?

 We can only say that the scientific approach, based on our innate feelings of reasoning, is enquiry made with the greatest care and investigation of the evidence. But for some, that will never be convincing.

**Religion**

 There are many people who say, “It is our duty to believe as a matter of faith without evidence. I believe the world is only about six thousand years old and all life was created in less than a week by an invisible creator. Every word in the Bible is true.” (Presumably including those that contradict each other.) This approach breaches the condition that observation should take precedence over ancient texts. Yet there are many people in the world who would say this.

**Holists**

 And some might say that those who try to break a complex situation down into elements that can be dealt with by detailed observation and reasoning are to be labeled “reductionists” and deplored. Much better to simply look at the situation as a whole and adopt a belief which follows fashion, or a charismatic teacher, or maybe one which most appeals to the emotions.

 We must accept that there are many views about the best way of arriving at the truth and those of us, who believe that the careful methods of science are the best, must be aware that we do not have the platform to ourselves. We must reflect carefully on our justification.

**Believing falsehoods through speech**

 One important thing that distinguishes us from other animals is the power of speech. It brings us tremendous advantages, almost too much to enumerate. In childhood we absorb vast amounts of useful information from our parents and other elders. Throughout life, we receive information on much that we could not observe for ourselves. This wealth of knowledge is of great use to us and it is the reason why our species has become dominant on the planet, even to the extent pushing many others to extinction.

 But there is a problem. It is not practical for us to check the origin and validity of all that we hear, so there is a risk that we accept false beliefs. Yet it would be impossible for us to reject all information which is not backed up by a full trail of the evidence. If we did that, we would lose much more than we would gain.

 We do have some defences against false beliefs. We certainly do not believe everything that we hear and some of us are better at detecting false beliefs than others. But none of us is perfect and evidence of people accepting untruth is common. Millions are lost to fraudsters who constantly develop new tricks to make their lies appear plausible to the vulnerable. Bad deals are often sold. Gullible people are persuaded to join cults. Politicians and priests gain followers with unproven promises.

 There is probably no complete remedy for this imperfection. I suspect that all of us harbour some false beliefs and even the most sceptical are unable to detect them all. It is possible to identify some of the reasons for these. Let us consider a few.

**Building a world picture and confirmation bias**

 We tend to form a number of beliefs throughout life which are made up of some ideas, some deductions, but many inductions from repeated observations. In humans many or our pieces of evidence do not come from our own observation but from the testimony of others. By accepting some ideas and rejecting others, we build a world picture which seems to us to hang together.

 As time goes on, we receive other information which confirms our world view, giving us more confidence that our beliefs are true, but perhaps we may sometimes receive contrary evidence. It is a human characteristic that we will ignore information that contradicts our world view until it becomes overwhelming. After all, a long-held picture of the world is quite an intellectual investment and it would be a great loss to go back to a blank sheet to start to build again. And new evidence, like all evidence, should always be viewed with some level of doubt. The fact that it creates a contradiction when viewed together with our own accepted beliefs is a plausible reason why it might be wrong. We are reluctant to tear down the whole edifice.

 This leads to the error known as confirmation bias. We easily accept confirmation of our world view but are reluctant to receive contrary evidence. It is easy to see how this reluctance could lead us to stubbornly stick to an idea that is wrong. Yet it is not entirely a bad way of thinking. Our world view has been confirmed many times and the new evidence could easily be wrong.

 One of the curious stories of science is that of Lord Kelvin’s objection to Darwin’s theory of evolution. Kelvin, a professor of physics at Glasgow University, had arranged for a borehole to be made, deep into the earth of a local park. The temperature gradient that he measured seemed to indicate that the Earth must be cooling rapidly from an earlier hotter state. He estimated that the Earth must have been red-hot only 20 million years or so ago. This would not have been enough time for the slow action of natural selection to take place.

 Although Darwin was worried by this evidence, he did not abandon his theory, because everything else fitted the observed facts so well. In this case, sticking to his world view and doubting the outlying evidence was correct. The solution to the puzzle was not known until after both men had died. We now have good reason to believe that the Earth is more than four and a half billion years old and that the temperature gradient is caused by heat coming from radioactive decay of certain elements deep inside the planet.

 This is a case where it was fortuitously correct to stick with the main picture and ignore the outlying counterexample, but we know that it is not always so.

 In December 2015, Professor Christopher French gave a talk at the BRLSI on the psychology of paranormal belief. He told of an experiment that he had carried out to test the efficacy of water dowsing in which a society of experienced dowsers had agreed to participate. They were very confident that their claims would be vindicated. It was carefully set up so that the dowsers could not tell where water had been placed and where it had been omitted from identical looking locations. Alas, the results were no better than random. When discussing it afterwards, none of the dowsers was willing to accept that dowsing had been shown not to work, but rather sought to find ways in which the experiment could have been wrong. In this case, I suspect rejection of the new evidence was not correct.

**Tell ‘em what they want to hear**

 Another weakness which reinforces confirmation bias is that we like good news and dislike bad. There was a sad accident a short while before the time of writing. An aeroplane was lost over the sea and the authorities searched the area for a few days and then gave up. The passenger’s sister made impassioned public appeals for them to continue searching, saying “I just know he is alive”. Sadly some time afterwards the body was retrieved from wreckage on the sea bed. It was clear that he had died in the first few minutes of the tragedy. We do not know why this instinct for denial has become a characteristic of our brains, but we might speculate that it is a way of protecting us from the shock of very bad news.

 We prefer to believe what is nice and we shut our eyes to what we find unpleasant until the evidence becomes very great. I have heard completely intelligent people say things like, “that would be very unpleasant; I couldn’t possibly believe that”. This was a common reaction in the nineteenth century when it was first pointed out that human ancestors had probably been monkeys.

**Probability**

 Probability sometimes is used as a measure of our uncertainty, and only sometimes is this based on knowledge of frequencies. The untrained human mind is not very good at assessing probability; casinos and betting shops would not exist, if it were.

 Where there is no evidence at all for an assertion, the mind sometimes gives some likelihood to it, to be on the safe side. If you tell a child that it is bad luck to step on cracks in the pavement, he may be gullible enough to avoid doing it for some time. And, if a child is told that there is an invisible kindly old man up in the sky looking after us, but who is totally invisible, he may believe it for a lifetime. This “stay on the safe side” argument is Pascal’s wager.

**Unknown unknowns**

 A favourite quotation is that from Shakespeare in which Hamlet says “There are more things in heaven and earth, Horatio, than are dreamt of in your philosophy.” Those who have a strong wish to believe what makes them happy are fond of it, when science is pouring cold water over their beliefs.

A suitable reply from a rationalist might be as follows: It is conceivable that there is more than we have any knowledge of through evidence and reason. But we know nothing about it and we are not in a position to say anything about it. The possible existence of knowledge as yet undiscovered does not give us licence to make claims unsupported by any evidence. They are simply the “unknown unknowns”.

**Conclusion**

 So what can we conclude about our theory of knowledge? The scientific method seems to me to be superior to the others and I have seen much confirmation of this in practical results. It has produced advances in our understanding which have stood the test of sceptical examination. It avoids the contradictions and obvious non sequiturs of other ways of thinking. Above all it derives belief from evidence. I have seen many confirmations of its effectiveness and correctness. I have also seen what appear to me to be failures of the more emotional methods of acquiring belief.

 But, of course, I may be in denial in thinking that the contrary view is wrong. My belief that it is invalid to believe two contradictory things at the same time comes only from my inherited instinct formed by evolution. I can offer no proof for my belief in deductive logic. My belief that knowledge can only come from observed evidence is probably innate and we have to hope that evolution got that right. Even that has some exceptions, because some of my beliefs about facts of the external world are probably innate and not a result of evidence, such as three-dimensional space and the one-directional nature of time. But despite all of that, it does seem more secure to base one’s beliefs on proven evidence and clear reasoning.

 The journalist Leonard Lyons of the New York Post once asked Bertrand Russell whether he would be willing to die for his beliefs. He replied, “Of course not, after all, I may be wrong,”

 But another quotation from Bertrand Russell is, “To teach how to live without certainty, and yet without being paralysed by hesitation, is perhaps the chief thing that philosophy, in our age, can still do for those who have studied it.”

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 I have not invested much space in discussing the meaning of knowledge. The word has been described as Justified True Belief. The true belief part is perhaps obvious, but there can be much discussion about what constitutes justification. If you hold a belief as a result of mistaken evidence or fallacious reasoning, and if by pure chance it turns out to be true, could that be described as knowledge? An example might be a stopped clock, which as we know is correct twice every day. If you glance at it at exactly one of these times and believe it, do you really know what time it is? Further complications can arise and Simon Blackburn has said that some whole careers have been spent toiling over these questions.

 But this is a situation in philosophy that we need to recognize. When we look at the reality of the question out there in the real world, in broad terms we understand it all. There is no mystery; we are arguing about the meaning of a word. It is a waste of time and should be avoided.

 I am reminded of the so-called Sorites paradox. We are asked to consider a heap of sand and to remove one grain at a time. At what stage does it stop being a heap? Clearly one single grain cannot be called a heap. Neither could two. But let us stop – this is a waste of time. There is no mystery here; it simply depends how we would like to define the word “heap”. In common parlance it is not precisely defined, but it is perfectly useful nevertheless.