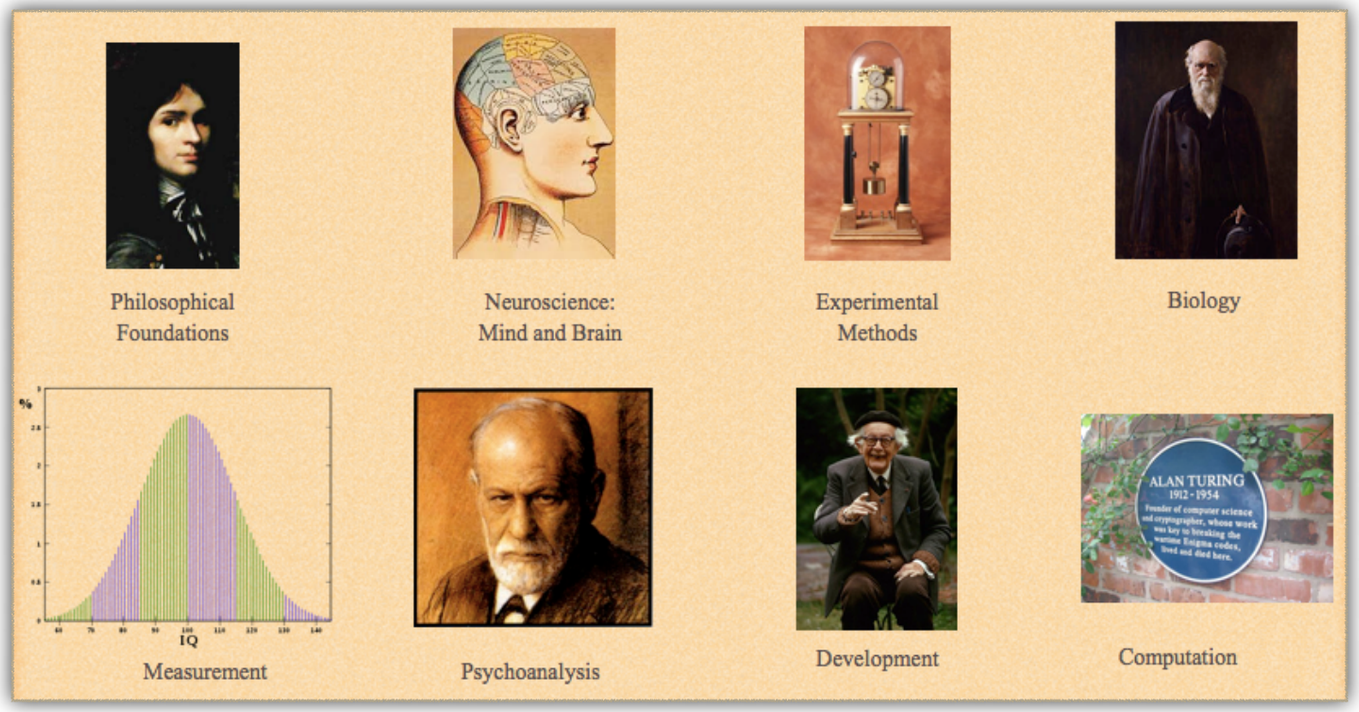
CONCEPTUAL FOUNDATIONS OF PSYCHOLOGY



DANIEL N BUB

Preliminary Remarks

This book is about the influence of past ideas in the history of psychology on our present thinking. A careful analysis of how these ideas have developed over time gives us important clues on current approaches to the analysis of mind, brain and behavior. For example, modern neuroscientists all share a basic assumption: complex abilities like language and memory are actually the result of many simpler (and mindless) physical computations carried out by neural systems in the brain. The history of neuroscience provides a good opportunity to familiarize ourselves with this modern idea that many now take for granted but that required an enormous break with past intellectual traditions before people were able to think in such terms. Here's another example, which shows a less positive influence of the past. If you look at virtually all introductory textbooks on cognition, you will find chapters on perception, memory, attention, decision making but almost nothing on motor processes, nor on the relationship between perception and action. This is really odd if you think about it. Why does modern psychology somehow relegate action to the back burner? I will give you a hint of the answer that will emerge as we analyze the history of attempts to understand how intentions lead to voluntary actions. If we assume that behavior begins with perception, which then gives rise to thoughts about what we are seeing, followed by a decision to act and then finally a particular response, we might assume that little can be learned about mental events like attention or reasoning by investigating the details of how an action itself is produced. This view is entrenched in modern psychology, but it's not based on very good assumptions. Learning about the history of what is actually an unrealistic view of action can provide us with a better understanding of past influences that have biased our modern approach to certain fundamental questions. In this example the crucial issue is: Should we be thinking of action as the end-point of our decisions, or is this the wrong way to consider how the brain translates ideas or percepts into goal-directed behavior?

Each chapter in this book will explore a number of such questions from a historical perspective. How did these core ideas originate and how did they influence our current understanding? The book includes a multimedia format, so that you will need access to the internet to view all the content. Of course, you can read the text without such access but

none of the links will work. It is, however, very important that you spend enough time on the multimedia components of the text. They are signaled by the following device. If the border is green, you need to be especially clear on what is being presented. *The material is fundamental to your understanding of the lectures and lecture notes*. If there is no green border, then the picture simply provides a static accompaniment to the text.

Because this course requires you to develop an understanding of the relationship between theoretical constructs and supporting evidence, it is very important that you do not approach the content by trying to memorize facts. It will not be enough to know, for example, the gist or a summary of arguments in the 19th century on the representation of language in the brain. Rather, you will need to understand the *logic* of these arguments in detail, the evidence that led to them, and the weaknesses in these accounts as well as their influence on modern thought. Be very clear on the distinction between simply memorizing facts and understanding ideas. The mastery of an idea means that you should be able to actively think about its meaning and *apply the logic behind the idea* to questions occurring in a variety of different contexts. The purpose of the book and of the course in general is to encourage you to think actively about the development of core theoretical constructs in psychology, and not simply to engage in the memorization of facts.

If you click on the link below, I will describe in more detail the kind of intellectual effort demanded by this textbook and the course on which it is based.

Given that we are interested in the relationship between the past and the present, each chapter will usually include a number of interesting cases in which we discuss a modern idea or experiment that bears directly on issues raised in the text.



The border is green so this link is important!

Ideas not facts

These are labelled as *case studies* and they may include discussion of an argument in a popular book or the evaluation of a modern development that places an older idea in a new context. Each case study is an opportunity for you to think analytically about the issues raised in the chapter and to see the link between past and present developments in psychology.



Study the past if you would define the future (Confucius)

Chapter 1.1: The Advent of Mechanism



Descartes as a young man -- the fourth musketeer?

In the 17th century, Descartes, produced detailed arguments that many aspects of cognition, such as memory and perception, could be fully accounted for in terms of physical mechanisms. At that time, most scholars were not so much interested in discovering new knowledge as they were intent on combining the ideas of Aristotle with Christian belief. Skepticism and independence, valuable attributes today, were considered character defects in the Middle Ages. In the 14th century, for example, students at Oxford University were fined for expressing any ideas that departed from Aristotle's philosophy (five shillings for every point of divergence, a substantial amount in those days). At the same time, what counted as scientific knowledge when Descartes was a young man in the early part of the 17th century, consisted of a mixture of both reason and bizarre superstition. For example, according to Aristotle, the European bison regularly hunted for its meat, and defended itself by discharging excrement over a distance of eight yards, and this discharge was so toxic it burnt the hair of pursuing animals.



I will briefly describe the outlines of Aristotle's view of the mind, to provide you with an idea of the kind of radical departure from tradition that Descartes wished to undertake when he wrote:

I entirely abandoned the study of letters. Resolving to seek no knowledge other than that of which could be found in myself or else in the great book of the world, I spent the rest of my youth traveling, visiting courts and armies, mixing with people of diverse temperaments and ranks, gathering various experiences, testing myself in the situations which fortune offered me, and at all times reflecting upon whatever came my way so as to derive some profit from it. (Descartes, Discourse on Method).

A short overview of Aristotle's psychology

The word *psuché* in ancient Greek (from which the word *psychology* derives), is widely taken to mean 'soul' but according to Aristotle, dogs and dandelions have psuché as well as human beings. *Psuché is what animates or sustains living things* so the word 'soul' as a translation isn't really adequate. These animators are sets of capacities or faculties; having a soul is like having a particular skill. A *vegetative* 'soul' allows plants and animals to nourish themselves and reproduce, and an *animal* or *sensitive* soul enables the more complex functions of locomotion, sensation, memory and imagination (yes, even animals, according to Aristotle, have imagination, which he assumed was a form of internally driven perception). Vegetative and sensitive faculties cannot exist apart from the body they animate, any more than the skill of a guitarist can exist outside his or her body. The rational soul of human beings *enables* them to reason consciously and be self reflective. On the question of rational thought, Aristotle deviated from his view that mind and body were inseparable.

He wrote:

Hence it remains that thought alone comes in from the outside, and that it alone is divine; for corporeal actuality has no connection at all with the actuality of thought (Meaning, the physical body has nothing to do with the capacity for rational thought).

Aristotle's view of nature was based on a preconception that nature is governed by purposeful design in the same way that human beings build tools or other objects to serve a particular function. We refer to this kind of view as *teleological*. A teleological account would be valid, of course, if you were asked to explain what the intention is behind the structure of a man-made object like a musical instrument. A flute is purposefully designed to allow us to produce musical sounds. The historical development of this object may be complex and have many steps along the way, but still it makes perfectly good sense to say that a particular purpose or function is *the primary reason for the existence of anything explicitly invented by human beings*. The term *telic* (from *telos*, meaning end, purpose or goal in Greek) is still used in linguistic theories of word meaning. For example, if I say *the lawyer enjoyed his new expensive briefcase,* I typically mean that he or she enjoyed the telic (functional) properties of this object.

Now think about this quote from Aristotle:

Anaxagoras says that men are the most intelligent of animals because they possess hands; but it is reasonable to think that they possess hands because they are most intelligent. For hands are a tool, and nature,

like an intelligent man, always assigns each thing to something that can use it (it is better to give a flute to someone who is actually a flute-player than to provide a man who owns a flute the skill of flute-playing); for she has provided the greater and superior thing with that which is less, and not the less with that which is more honorable and greater. Thus, if this is better, and if nature does what is the best in the circumstances, man is not most intelligent because of his hands but has hands because he is the most intelligent of animals.

The core idea behind Aristotle's view of nature is in the analogy he provides of the flute-player. A flutist should be given a flute because he already knows how to play. Likewise, we possess hands to use as specialized devices because we are already intelligent enough by nature to use them. He rejects the reverse idea -- that we developed intelligence as a result of the abilities given us by our hands.

Of course, there is nothing intrinsically wrong with the idea of analyzing biological systems in terms of their function. It is true that hands evolved and so provided a specialized ability to human beings. The problem lies in the assumption that the human hand emerged as the *target* of a definite goal or *telos* that nature was aiming for. Aristotle claimed that nature intended us to have hands *because* we possess the intelligence to use them. We no longer hold this view in modern science. We cannot say legitimately, for example, that ducks evolved webbed feet *in order to* allow them to swim better (this way of putting it, implies that webbed feet were intended in advance of the fact, as a goal). We *can* say that ducks swim well *because* they have developed webbed feet -- plus other attributes like a boat-shaped torso -- but nature did not somehow strive or intend this in advance of its occurrence. *Biology*, to paraphrase Richard Dawkins, i*s blind to the future.*

Aristotle's teleological approach to cognition is best understood by considering his theory of perception, which includes the idea that nature has designed each sense organ to be sensitive to a particular part of the world. There are *five* senses -- vision, smell, taste, touch and hearing -- according to Aristotle, because these are enough to respond to the four elements making up the world (earth, air, fire and water). When a sense organ functions normally, it is designed by nature to accurately reflect the physical attributes of an object. We see color because there is a substance in our eyes which literally takes on the color of the object we perceive. So color is a genuine property of objects in the world, not a construction by the human mind. Indeed, Aristotle argued that it is not shape that directly affects the eye but color. We see the form of an object only because we are sensitive to the color that is bounded by its shape.

Descartes's analysis of perception was closer to our modern approach than the theory developed by Aristotle. His intention was to produce a theory of vision -- and ultimately, a theory of as much of cognition as possible -- *based entirely on physical mechanisms*, without having to appeal to the Aristotelian view that perception is driven by a type of soul or animating force. Descartes' approach included the assumption that *the shape of an object is a more fundamental aspect of perceptual cognition than the color.*

The concept of shape is so simple, wrote Descartes, *that it is involved in everything perceivable by the senses. For example, whatever you may suppose color to be, you will not deny that it is extended and so has shape.*

How did Descartes arrive at this idea?

The doctrine of clear and distinct ideas

He argued that we need a definite method of thinking if we are to develop a proper understanding of the world. For Descartes, mathematical reasoning was the gold standard that could be applied to all other forms of problem-solving, including the question of how an image on the retina leads to the perception of an object. Like geometers attempting to prove a theorem, we should always begin a scientific explanation with a claim that is so self-evident that nobody in their right mind would doubt that it is true. Such claims were described by Descartes as *clear* and *distinct*.

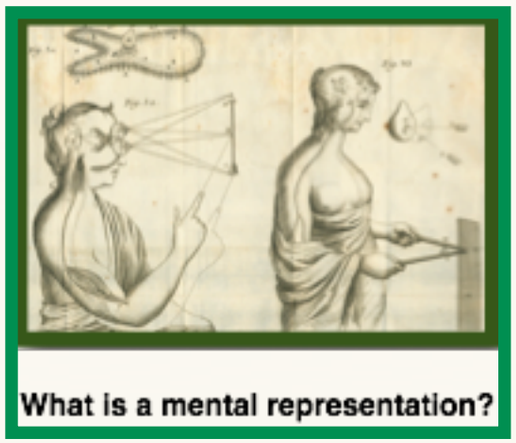
By "*clear*", Descartes meant that the truth of the idea has to be as obvious and present in our minds as physical objects that we see clearly with our eyes. An object in vision is *distinct* (in addition to being clear) when it can be precisely separated from other objects. Descartes argued that a distinct *idea* similarly occurs when there are no fuzzy boundaries between this and some other idea. The idea of a *straight line* is *distinct* because there is a precise intuition of the concept that distinguishes it from all other geometric concepts, and we have a *clear* idea of a straight line because all its properties are immediately available to us when we think of it. Once we have generated clear and distinct ideas, we further develop our understanding by building up more elaborate arguments given the facts at our disposal (these may include empirical facts about the world, for example that the image on the retina is upside down), in just the way mathematicians produce complex proofs from first principles.

Are there really clear and distinct ideas *outside* of mathematical reasoning? Descartes argued that humans beings are inherently rational creatures with powerful *intuitions* (the term he used was "intuitus' in Latin) that, if properly used, would guarantee we build up not only a very sophisticated and accurate knowledge of mathematics but also that we develop a correct understanding of the workings of nature. Intuition has two key features: *it acts instantaneously and it is made up of clear and distinct ideas*. So intuition, if used correctly, will automatically grant us immediate access to the truth. We are deceived by our experiences or thoughts not because we lack the gift of intuition, or because clear and distinct ideas will ever lead us astray, but because we do not correctly use this special human ability. Descartes wrote: *In fact, none of the errors to which men -- men I say, not brutes -- are liable is ever due to faulty inference. They are due only to the fact that men take for granted certain poorly understood experiences, or lay down rash or groundless judgments.*

I wonder what you make of this claim by Descartes, that the human mind holds within it certain ideas that -- if only we knew how to access them correctly -- would never lead us astray? How do we ever know, in fact, that as scientists our thinking is on the right track? It is of course unlikely

to be the notion that Descartes conceived of, that there are clear and distinct ideas that the mind can inherently intuit, that if correctly pursued will lead directly to the truth. Indeed, Descartes himself applied the doctrine of clear and distinct ideas in different ways at different times in his work, so that there appears to be no definite or consistent method underlying his criterion.

Nevertheless, Descartes' claim that whatever we perceive must be directly represented by shapes rather than color entailed three considerations linked to his emphasis on clear and distinct ideas. He proceeded as follows. (i) The image on the retina is a two-dimensional geometrical object, and the best way to mathematically represent a two-dimensional image is in terms of lines and their lengths. (ii) Lines and their length (or in other words, their physical magnitude) are both clear and distinct ideas. (iii) Finally, perception is the result of a physical mechanism in the brain, and this mechanism actually functions by representing three dimensional objects in terms of line lengths.


What is a mental representation?

The first assumption is reasonable, at least in the sense that the task of the visual system is to find edges in the patterns of light and dark falling on the retina. From these edges, a representation of the three-dimensional structure of the object has to be computed. The second assumption we will grant to Descartes as a world-class mathematician who believed (it turned out, incorrectly) that scientific truths about nature can be understood using the same methodology he applied to developing mathematical proofs. The third assumption is especially interesting but is difficult. The case study (*What is mental representation?*) will introduce you further to the idea of the *mental representation* of an object and what Descartes meant by arguing that *the way the brain represents objects is best understood in terms of linear patterns*. You will see in this case study that he was ultimately forced to abandon the idea, after realizing that it was computationally unworkable.

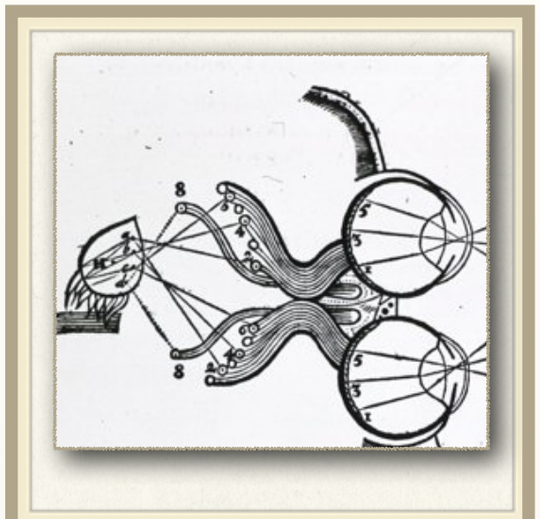
A mechanistic theory of perception

In his treatise, entitled "L'Homme" (the Human Being). Descartes imagined a world populated by animated humanoid statues that are built to see and respond to objects (as well as to engage in a host of other activities like sleeping, eating and digesting food and breathing). His aim was to prove that if we compare these imaginary creatures to ourselves, we will find that both function in the same way. Indeed, Descartes wrote in a letter to an influential colleague, his extensive neuroanatomical research encouraged him to assume that what previously was explained by assuming the existence of animal and vegetative souls, could instead be accounted for strictly in terms of physical mechanisms.

The neurophysiological theory of perception that Descartes proposed is hopelessly wrong, of course, in many ways. Yet we can still say that his approach to the problem closely

resembled the methodology used by modern researchers interested in the very difficult question of how the electrochemical changes in the retina end up as an organized percept in the brain.

We have already noted that Descartes conceived of the problem in terms of abstract geometry and optics, and in fact, Descartes had previously made fundamental contributions to both these domains. The task of the visual system was correctly understood as follows: there is a physical image of a shape with geometric properties on the retina, and the visual system must reconstruct an internal description of the object that has produced this image. You can see the general idea expressed in the accompanying diagram on the left. The object produces activation of the nerves in the retina, and the neural activity of the brain reconstructs that image to yield the perception of an object. Descartes did not have any notion that neurons produce electrical activity and his ideas were driven more by the preconception in that era that the body carries a very refined kind of fluid termed "animal spirits", which is separated from the blood and enters the brain through the pineal gland. The external object emits light energy that displaces the ends of the nerve fibers, and the optic nerves carry the signal by means of the flow of animal spirits to the brain. This signal in turn changes the pattern of animal spirits in the pineal gland to produce a representation of the external object.

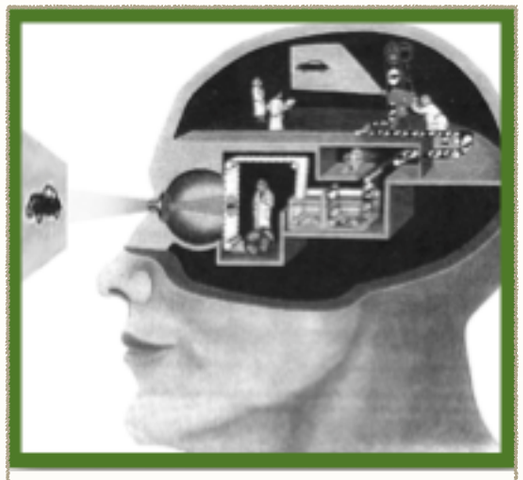


Cortical images are abstract

It's important to note that Descartes did not argue that the neural "image" actually should be thought of as a literal copy of the object inside the brain. The drawing is symbolic because if you look closely, you will see numbers tagged to parts of the retina which are then mapped to produce a string of numbers in the activity of the optic nerve. Descartes, whose mathematical work was instrumental in bridging the gap between algebra and geometry, was depicting an assumption that the *patterns of activation* in the pineal gland would yield an abstract numerical representation of a particular object. Why the pineal gland, of all structures? Descartes explains:

> *"The reason I believe this is that I cannot find any part of the brain, except this, which is not double. Since we see only one thing with two eyes, and hear only one voice with two ears, and in short have never more than one thought at a time, it must necessarily be the case that the impressions which enter by the two eyes or by the two ears, and so on, unite with each other in some part of the body before being considered by the soul. Now it is impossible to find any such place in the whole head except this gland; moreover it is situated in the most suitable possible place for this purpose, in the middle of all the concavities; and it is supported and surrounded by the little branches of the carotid arteries which bring the spirits into the brain".*

This commitment to finding a place (or time) in the brain where everything comes together to yield a perceptual event



The Cartesian Theatre

might seem hopelessly naive. Yet a disguised version of the claim continues to haunt modern psychology. We will discuss this issue in our second case study, entitled the *Cartesian Theatre.*

From perception to action

There is a common misunderstanding that Descartes believed that only human beings and not animals have ideas. This view is misleading. Descartes in fact wrote in L'Homme that "figures traced in the spirits on the pineal gland, where the seat of imagination and common sense is, should be taken to be *ideas*" (italics are mine). Animals have pineal glands, so they must have *some* form of ideation though not in the same way that humans have ideas. We will return to Descartes' view of the difference between humans and animals in more detail at a later point, but for now, we should note that his claim that animals were automata did not imply that they were insensate machines in the way that a clock or a bicycle is a machine (*insensate* means "lacking awareness or sensation"). The term "automaton" in the 17th century referred to a "self-moving thing". Descartes assumed that animals were capable of perceptual cognition, in the form of internal representations of visible objects. Again, the phrase "figures traced in the spirits of the pineal gland" should not be taken to mean, of course, that the brain is producing a literal internal image of an external object, in the way that a camera yields a photograph. The "figures" are patterns of activity in the brain that compute the form of the object in the same way that numbers in mathematics can be used to represent a straight line or curve or even a complex three-dimensional object. Descartes argued that the functioning of animals could be accounted for completely in mechanical terms. In this sense, animals were automata, but they were not like clockwork machines, given their level of complexity.

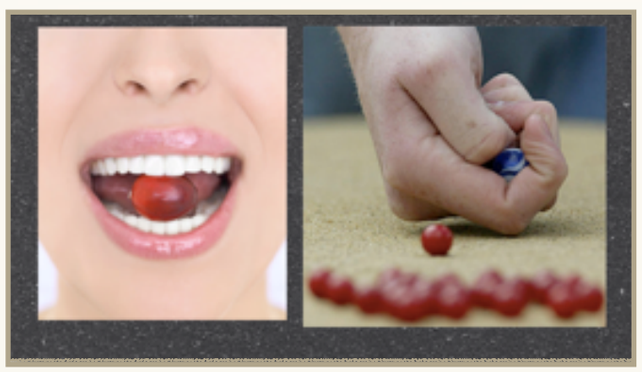
Animals have *two* different ways of moving. In the first, perception leads directly to an automatic action with no recognition of the stimulus, very much in the same way that modern physiology considers some responses to be spinal reflexes that can occur even before there is enough time for sensation to reach the cortex. For example, the rapid withdrawal of a limb from a flame can occur a split second before we actually experience any pain. In the figure showing a "human-machine" withdrawing a foot from the heat of a fire, the sequence of events was construed by Descartes as follows: The fire in contact with the skin is moving very swiftly and displaces the area of the skin it touches, pulling on nerve fibers. This event immediately results in pores opening in the



brain to which the nerve fibers are attached. This releases animal spirits from the cortical cavity marked F in the diagram, which then enter '*part into the muscles that serve to withdraw this foot from the fire, part into those that serve to turn the eyes and head to look at it, and part into those that serve to advance the hands and bend the whole body to protect it*'.

Automatic movements, on this account, can be an orchestrated sequence of actions designed to serve a particular function, without first requiring stimulus identification. A further clue to interpreting Descartes' argument is that F in the brain is not the pineal gland and in fact he tells us explicitly that F is a cavity. Since the pineal gland is the *seat of ideas*, we should infer that the response to a flame (depicted in the figure) is immediate, automatic and does not require a mental representation of any sensory event before the orchestrated action occurs. So we can refer to this kind of movement as *an action that occurs without cognition*, in the sense that the foot moves without the brain working to first classify or interpret the sensation.

A second way of generating a movement is by responding to a perceived object or event. Now we have the problem of how an animal or man-machine recognizes an external object before engaging in an action. I have already described in the case study entitled "*What is a mental representation*" that Descartes struggled to develop the assumption that visual objects were abstracted in the brain as mathematical quantities, and that such quantities could be represented in term of lines and their lengths, an argument that if correct, he thought, would be based on a clear and simple idea. He later turned to another hypothesis.



Descartes was interested in the following question, one that continues to lie at the heart of modern research on visual cognition. *How does the brain relate its own internal events to objects in the real world that we perceive?* (Be sure you understand this question; read it a few times if necessary).

Let me put the question another way: If an object, say a grape, produces a given pattern of activity in the visual system, how does this pattern actually enable me, the observer, to act correctly on the object (I might reach out, for example, pick the object up and bring it to my mouth) whereas another pattern in the visual system, say produced by a marble having a very similar size and shape to a grape, will afford a completely different response (I might pick the object up, and instead of bringing it to my mouth, flick it across the floor). The visual patterns inside the brain must surely be quite similar for a marble and a grape, how do they lead to such different responses?

Aristotle as we have seen, gave a teleological answer to this fundamental question. He believed we must have the sense organs we do because they are designed by nature to correctly display to us certain facts about the world. In his work entitled *Regulae* (Latin for rules), Descartes tried to ad-

dress the problem by assuming that a perceptual representation leading to action has the form of etched lines on a two-dimensional surface. In *Le Monde*, he attempted a different approach to the problem.

Descartes turned to the fact that there are *signs* for events and objects -- both invented and natural signs -- that do not resemble the object itself but which we nevertheless interpret correctly. For example, the spoken word *grape* is a linguistic sign human beings have invented. The sound does not bear any resemblance to the grape itself, but as a sign it produces in each of us an idea that corresponds unambiguously to the object. The word *crepe* sounds very much like *grape* but the subtle difference is identified by us to signal a completely different object. Signs, even very similar signs, can be associated in the brain with quite distinct objects.

The internal codes generated by the visual system in response to an object cannot be thought of as *invented* signs like words, of course, but perhaps, argued Descartes, there is a *natural* "vocabulary" of signs that the visual system develops to identify objects. Consider Descartes' original statement of his argument.

You well know that words bear no resemblance to the things they signify, and yet they do not cease for that reason to cause us to conceive of those things, indeed often without our paying attention to the sound of the words or to their syllables. Thus it can happen that, after having heard an utterance, the sense of which we have very well understood, we might not be able to say in what language it was produced. Now, if words, which signify nothing except by human convention, suffice to cause us to conceive of things to which they bear no resemblance, why could not nature also have established a certain sign that would cause us to have the sensation of light, even though that sign in itself bore no similarity to that sensation? Is it not thus that she has established laughter and tears, to cause us to read joy and sorrow on the faces of men?

Analyze the paragraph you just read

The quotation you have just read is included as an opportunity for you to analyze its content given what I have already communicated about the nature of signs in the world. Take some time to read it over again and identify the key points, then I'll summarize them for you (no fair peeking without first doing this exercise yourself).

Here is the structure of Descartes' argument:

1) Words that are arbitrary (invented) signs for external objects immediately evoke in us the idea of the signified object.

2) This process is very rapid and automatic and doesn't even require that we pay attention. (Why is this important?)

3) The previous point is important because objects immediately evoke in us their identity without requiring any effort on our part. If signs function as the intermediary step between external objects and our internal response to them, they had better work quickly and automatically as well (and they do).

4) Words are invented by human beings but perhaps nature has herself placed in us certain signs that evoke the same immediate and automatic identification of an external object or event as do the words we have invented. After all, laughter is a *natural* response that signals mirth (even a very small baby

who is blind and so has never seen the action will smile or laugh when tickled).

5) These signs are no less arbitrary than words. We could imagine quite easily a world in which tears signaled merriment while laughter signaled unhappiness.

6) So if nature herself invented behavioral -- that is, external -- signs to indicate internal states like joy or sorrow why should she not have also given the brain its own signs to read (each sign represented by a particular internal action of the visual system) so as to elicit in the observer the ideas corresponding to particular objects?

But how does the brain actually *acquire* internal signs that match the objects and other visual properties in the word like color or motion? These correspondences, Descartes believed, must be innate. We do not learn them, they are built into our visual systems at birth. At least in this sense, then, there is no difference between the perceptual and motor abilities of animals and humans, given that both depend on *innately determined* associations between signs (these signs would be internally generated patterns produced by neural activity) and physical aspects of the world (movement, color, shapes, and so on).

The difference between human and animal minds

Are human beings then, just very complicated machines whose mental organs enable them -- unlike other animals -- to analyze and talk about what they see, and engage in complex decision making? This possibility would have been unthinkable to Descartes, despite his generally mechanistic approach to cognition. He argued that no degree of physical complexity in the organization of the brain could account for the intellectual ability of a human being *to reflect on his or her own mental representations*. In other words, not only do we perceive and act on the world, we are aware that we are doing so, and this self-reflective ability (i) categorically divides us from other animals and (ii) cannot be fully explained by appealing to physical mechanisms in the brain. Few modern neuroscientists would agree with the second part of Descartes' view, of course, though as we have seen in the case study entitled the *Cartesian Theatre*, many are still quite at ease with the assumption that self awareness is determined by neural systems in the brain that "inspect" or "make decisions" about the content of perceptual representations. Descartes' understanding of perception rests on a theater metaphor which is not as far removed from modern approaches to higher level perception as we might think.

Of particular interest to modern researchers interested in the psychology of language (psycholinguists) is Descartes' views that the uniqueness of human beings can be seen in the way they communicate their thoughts. Humans use words to indicate a huge variety of ideas, and they generate new words, if need be, on demand. How does this ability differ from communication in animals?

The following segment from Descartes (*Meditations* published around 1637) is worth considering in detail.

In fact, none of our external actions can show anyone who examines them that our body is not just a self-moving machine but contains a

soul with thoughts, with the exception of words, or other signs that are relevant to particular topics without expressing any passion. I say words or other signs, because deaf-mutes use signs as we use spoken words; and I say that these signs must be relevant, to exclude the speech of parrots, without excluding the speech of madmen, which is relevant to particular topics even though it does not follow reason. I add also that these words or signs must not express any passion, to rule out not only cries of joy or sadness and the like, but also whatever can be taught by training to animals. If you teach a magpie to say good-day to its mistress, when it sees her approach, this can only be by making the utterance of this word the expression of one of its passions. For instance it will be an expression of the hope of eating, if it has always been given a tidbit when it says it. Similarly, all the things which dogs, horses, and monkeys are taught to perform are only expressions of their fear, their hope, or their joy; and consequently they can be performed without any thought. Now it seems to me very striking that the use of words, so defined, is something peculiar to human beings. Montaigne and Charron may have said that there is more difference between one human being and another than between a human being and an animal; but there has never been known an animal so perfect as to use a sign to make other animals understand something which expressed no passion; and there is no human being so imperfect as not to do so, since even deaf-mutes invent special signs to express their thoughts. This seems to me a very strong argument to prove that the reason why animals do not speak as we do is not that they lack the organs but that they have no thoughts. It cannot be said that they speak to each other and that we cannot understand them; because since dogs and some other animals express their passions to us, they would express their thoughts also if they had any.



The case study entitled "*Language and Intelligence*" discusses in some detail the importance of language for Descartes as the factor the differentiates humans from other animals. Before you turn to viewing this discussion, read the quotation over a few times and ask yourself: What are the components of Descartes' arguments that language differentiates humans qualitatively from other animals? Take careful notice that Descartes introduces his ideas on language by first stating that for him, language deals with abstract *signs* (these could be words or other abstract symbols) that provide information on mental states other than what he refers to as "passions". This word as used in the context of 17th century culture, does not have quite the same meaning as it does today. A passion referred to a feeling caused by an object *external* to the animal or person (in other words, a *passion* is a *passive* experience evoked by an object or event; indeed it is no coincidence that the route of the two words -- passion and passive -- is the same). By contrast, emotion referred to a feeling that was generated or produced internally by one's own thoughts. Descartes is making the remarkable claim that any communicative signal that an animal can produce -- either spontaneously or by learning -- must refer to external events that have some positive or negative reward value; an expression of its fears, hopes or joys. Human language in contrast, often com-

municates ideas that are "stimulus-free". Words can reflect *internally* generated mental states (as opposed to *externally* evoked passions) reflected in a sentence like: *I doubt that the mind is distinct from the body.* A feeling like doubt, and the ability to produce a sequence of words expressing this experience, according to Descartes, is unique to human beings. For animals, objects evoke responses indicating positive or negative reactions to external events (like or dislike, in effect) and the signs they acquire can only reflect those internal states.

Passions and the embodied mind

It is often assumed that Descartes wished to argue that our thinking has little to do with our bodies. In fact, he attempted to provide a detailed account of how mind and body interact. Human mental and physical worlds (though distinct) were conjoined:

That there is a particular body that is more closely conjoined with our mind than any other body is obvious from the fact of our clear awareness that pain and other sensations come to us quite unexpectedly. The mind is aware that these sensations do not come from itself alone, and that they cannot belong to it in virtue of its being a thinking thing.

In other words, our minds are united with our bodies because we feel pain and other sensations in an immediate, direct way, not as a remote, intellectual experience. The mind, according to Descartes, depends on the body for its existence, but at the same time, *transforms our physical experience*. Consciousness of our own mental states and the ability to exercise judgment and free will, make us aware of and responsible for our behavior in ways that do not apply to animals.

Of special interest is Descartes' attempt to explain *contradictory emotional states happening at the same time.* That is, the experience we all have when we are both sad and happy at once, or both terrified and yet somehow also thrilled by a horror movie or a roller-coaster ride. The examples given by Descartes is particularly evocative.

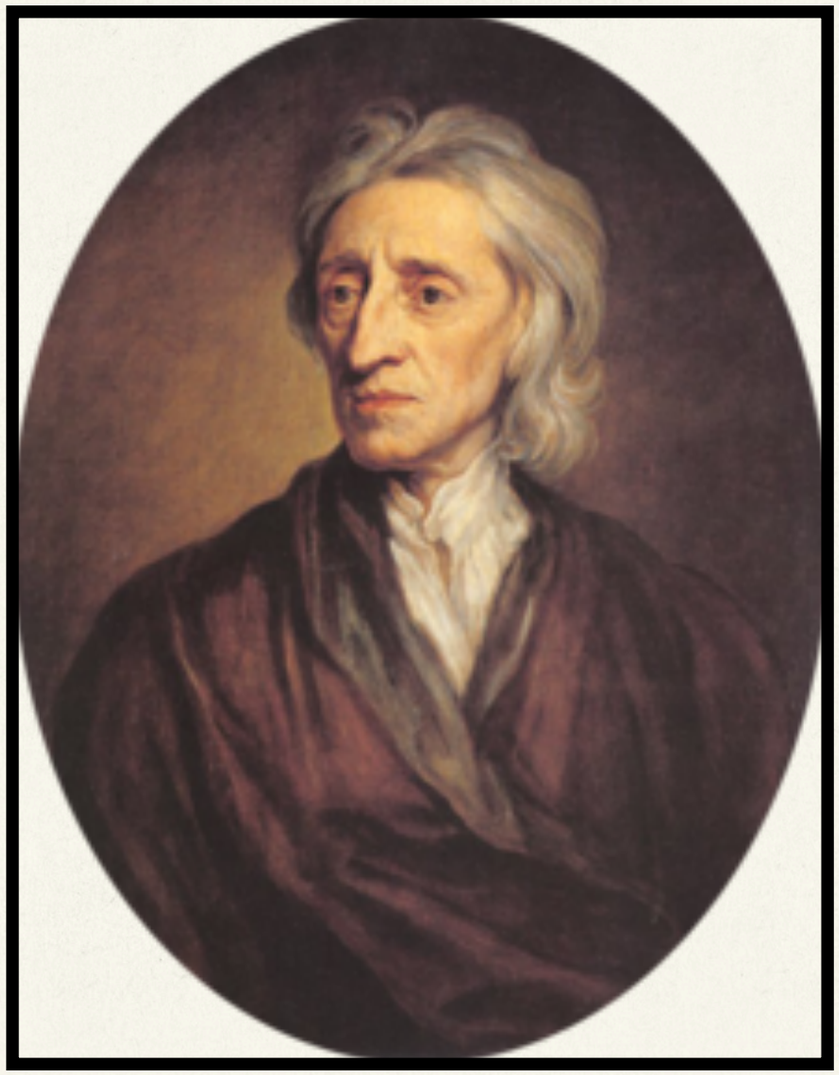
When a husband mourns his dead wife, it sometimes happens that he would be sorry to see her brought to life again. It may be that his heart is constricted by the sadness excited in him by the funeral display and by the absence of a person to whose company he was accustomed. And it may be that some remnants of love or pity occur in his imagination and draw genuine tears from his eyes, in spite of the fact that he feels at the same time a secret joy in his innermost soul, and the excitation of this joy has such power that the concomitant sadness and tears can do nothing to diminish its force. Again, when we read of strange adventures in a book, or see them represented on stage, this sometimes arouses sadness in us, sometimes joy, or love, or hatred, and generally any of the passions, depending on which objects are presented to our imagination. But along with this we have pleasure of feeling them aroused in us, and this pleasure is an intellectual joy which can just as easily originate in sadness as in any other passions.

The first part of this quote is a remarkable description of the kind of emotional conflict that centuries later occupied the analytic skills of Sigmund Freud. In the case of the Rat Man, for example, who was obsessed with a horrific fantasy of his father being devoured by starving rodents, Freud noticed that when talking about the fantasy, the patient's expression portrayed "a very strange composite expression"

that included both horror and yet at the same time, some hidden, secret pleasure. Astonishingly, Descartes in the 17th century raised questions that would later be confronted by modern psychoanalysts!

The second part of the quote from Descartes deals with the more commonplace experience that mixed emotions can occur when we are being entertained by theatrical or literary events that we know are imaginary. The source of competing emotions for Descartes was never within the rational mind itself, which for him could not generate internal conflict. Rather, passions can arise from external objects or events acting on our senses, or they can be felt as occurring spontaneously within the mind itself, in which case they are "passions of the soul". These are triggered by the brain ('*caused, maintained and strengthened by the movement of the spirits*') and so unlike willed or voluntary thoughts or feelings, they do not have their origin in the soul, even though they are referred to as passions of the soul. Conflict occurs in two ways: (i) The spirits in the *brain* will move the pineal gland in a particular way, exciting a desire for something, and the will might oppose this feeling so that the *mind* can be impelled almost at the same time to desire and not desire something. The phrase "almost at the same time" is important because the desire is occurring in spite of one's conscious will which can represent an intention strongly enough to gradually halt the movement of the spirits. (ii) A second way of experiencing conflict occurs in the *body* when passions force the limbs to behave in a certain way and the rational soul attempts to stop this action.

Despite common misconceptions that Descartes believed in the virtues of a passionless, analytic mind and that he considered emotions to be a disruptive influence on rational thought, he in fact argued that emotions played an important role in sustained acts of will and that certain passions, for example a feeling of wonder, were essential for intellectual development.



Locke

CHAPTER 1.2

On Human Understanding

How is knowledge acquired, and what principles shape our thinking? If we could understand these principles to some degree, might we hope to lead more productive and sensible lives? Descartes gave one particular answer which emphasizes the rational qualities of human beings; in fact he believed we are innately equipped with certain aptitudes and ideas that act as the building blocks of our intellect. This point of view is associated with *Rationalism,* the claim that at least a part of our concepts and knowledge is acquired independently of sensory experience. *Empiricists* deny that any ideas are innately predetermined; all knowledge is built entirely on sensory experience.

To what extent are the mental capacities of human beings innate and how might we seek evidence that provides the beginning of an answer to this question? You can see just how topical the issue remains by viewing a TED talk given by a prominent cognitive scientist, Steven Pinker. In this talk, Pinker presents a modern defense of the claim that certain human attributes and intellectual abilities (such as the capacity for language) are innate. Please note that this video is optionally included for your own interest and will not be included in any examination. Clicking on the underlined Steven Pinker will access the TED talk.

It is common in introductory textbooks (especially on the history of psychology) to find that Locke and Descartes are classified, respectively, as holding empiricist and rational viewpoints which are diametrically opposed. This is a misleading description of their continuing influence on psychology. Locke, for example, argued that mathematical and moral abilities depended to some extent on intuition and reason that could not be completely developed through experience alone. In this respect, his views were very similar to those articulated by Descartes.

Nevertheless, John Locke's *Essay on Human Understanding*, written in the 17th century, raised fundamental questions about human minds that continue to influence the research agenda of modern experimental psychology. The essay included a sophisticated analysis of the basic constituents of perception, action, language, our sense of identity and the relationship between mental and physical worlds. Unlike Descartes, Locke was less interested in the details of a mechanistic treatment of human cognition than, as he put it, working as a humble laborer to clear the ground of intellectual baggage that stood in the way of scientific progress. Of special interest to him was the nature of human ideas and how they are acquired; for example, how do we come to understand that the following statement is true or false? *It is impossible for something to both exist and not exist at the same time*. Locke argued that we assume too often that human conceptual abilities are innately determined; a great deal of our thinking, he maintained, is guided simply by experience.

Against innate ideas

Locke classified ideas into two categories: *simple* and *complex*[1]. A simple idea is one that cannot be analyzed further; the quality of redness, for example, cannot be analyzed further into simpler elements. A complex idea, like *horse*, is made of simpler components. Note that *simple* is being used to refer to our *mental* world. Scientists can of course analyze red light into more basic *physical* constituents (particles having a particular energy and wavelength) but we are talking here about the contents of our perceptual experience.

Simple ideas are learned by directly perceiving them; Complex ideas do not have to be acquired through perception, because they can be synthesized from simpler ideas that we have perceived directly, or if not, these simpler ideas can themselves be further analyzed into constituents which have been thus experienced.

Locke argued that innateness plays no role in the acquisition of ideas. His argument needs to be clearly understood, because the discussion serves as a background to the modern tension between rationalist and empiricist views of cognitive development.

Descartes argued that innate ideas or principles could generate a *predisposition* to acquire certain kinds of knowledge, in much the same way that congenital factors at birth may predispose someone to acquire a particular medical condition that develops over time. Locke noted that merely suggesting that humans have a predisposition to readily acquire ideas does not help us distinguish between an innate *capacity* for

[1] *please take note: these two categories have nothing to do with Descartes' view that scientific problem-solving should begin with ideas that are clear and distinct.*

knowledge (which is a rather general possibility that he did not dispute) and the more interesting possibility that infants come into the world already equipped with some form of knowledge.

A further objection Locke raised against arguments in favor of innate ideas is the following: We often conclude that any idea universally present in all cultures must be innate. Yet how secure is this inference, assuming that it is possible to show that 'universal consent' (as Locke put it) might occur for some other reason than innate ways of thought? Here is the relevant quote from Locke:

(Even) if it were true... that there were certain truths wherein all human beings agree, it would not prove them innate if there can be any other way shown how people may come to this universal agreement.

It is of interest in regard to this passage written in the 17th century that the TED talk by Steven Pinker lists exactly this principle (the Principle of Universality) as evidence (albeit only suggestive) that some of our cognitive attributes are innate. He mentions that all cultures studied (more than 6000 of them) share an interest in, for example, aesthetics, affection, weaponry, weaning of children and a long list of other universal concepts.

Locke's criticism, however, remains valid; for example, the fact that all cultures develop the concept "weaning a child" may simply reflect the fact that every child begins life as a suckling infant and progresses as he or she grows to eating solid foods. It seems hardly surprising that all cultures would recognize the existence of this developmental milestone.

Finally, Locke pointed out that principles we might assume should be universally understood are not assented to by very young children. For example, no four year old would be able to understand and so consent to the abstract notion that it is impossible for something to both exist and not exist at the same time. This criticism that children cannot acknowledge ideas that are supposedly innate is unfair, though, and too facile (i.e. superficial). Children may be incapable of *assenting* to principles or ideas but they may nevertheless represent them *tacitly* or *implicitly* (i.e. unconsciously) as part of their understanding.

What evidence would a modern scientist bring to bear on Locke's skepticism of the possibility that some ideas or cognitive states are innate, putting aside the ambiguous issue of universal consent? Imagine I tacitly understand something to be true or false but am quite incapable of indicating the nature of my belief by verbal means. You can still obtain information on my cognitive state by carefully analyzing my intentional behavior. For example, if a baby crawls after a toy behind a chair, we can reasonably assume he or she understands the toy is there and wishes to obtain it. When, though, are we able to infer that the knowledge -- albeit tacit or unconscious -- guiding intentional behavior must be innate? It is surely not enough to show that an infant is in possession of such knowledge at a very early age; there is always a possibility that the knowledge has been rapidly learned. An

[1]An opportunity to check your understanding: Why "ambiguous"?

additional piece of evidence is needed: namely that a careful analysis of the situation guarantees that there is *no way the knowledge could have been learned given the information available to the child.*

A classic modern argument of this form (the infant's behavior indicates knowledge of a particular sort *and* it cannot be the case, given the limited information available to the child, that this knowledge was learned) is the claim that children have an innate grasp of a universal grammar that allows them to very quickly represent the rules of their own language. According to nativist arguments, grammatical principles must be genetically encoded in the language cortex of newborn infants, to allow such rapid acquisition of the rules for constructing sentences, given the fragmented and often ambiguous samples that babies are exposed to in the conversations of adults.

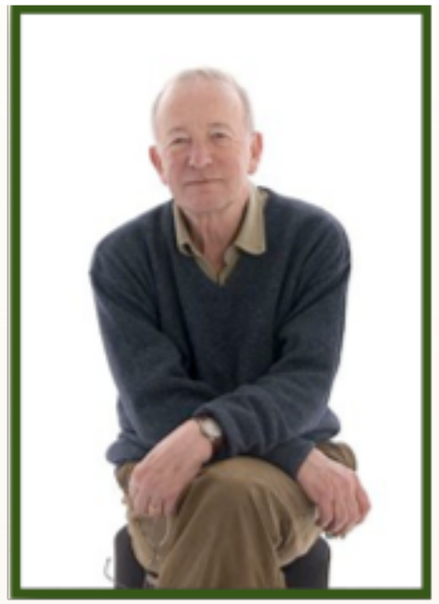
Perception

Locke's analysis of perception is intimately linked to his argument that ideas are built on sensory experience. What he meant by the term *idea* is worth noting because it is rather counterintuitive. An idea according to Locke is:

Whatsoever the mind perceives in itself, or is the immediate object of perception, thought or understanding.

This definition is surprising. In what way is an 'immediate object of perception' an idea? Locke is in fact deliberately blurring the distinction between percepts and concepts; the experience of *seeing* the color red is as much a kind of idea (a *simple idea*, in fact) as is the thought "I am now experiencing a particular kind of color" or for that matter "Apples are red and sometimes green". Because Locke's aim was to justify an empiricist approach to cognition, he wished to show that the contents of our thinking all have their origin in perception. It makes good sense, then, for him to assume that concepts and percepts are intimately related.

But what is meant by the claim that we *see* an object only if we have an *idea* of the object? Do we mean the following: An idea is a mental image that we "perceive" and this image is caused by the object and represents the object in some way by resembling it. The case study entitled "*Redding*" will discuss this issue in more detail. It will come as a surprise to you that relevant to this discussion is a remarkable neuropsychological disorder known as blindsight, in which the patient denies having any conscious impression of a visual object yet can demonstrate that he or she has nevertheless perceived it. Can we say that such patients really have not formed an *idea* of the object? If so, to what are they responding?

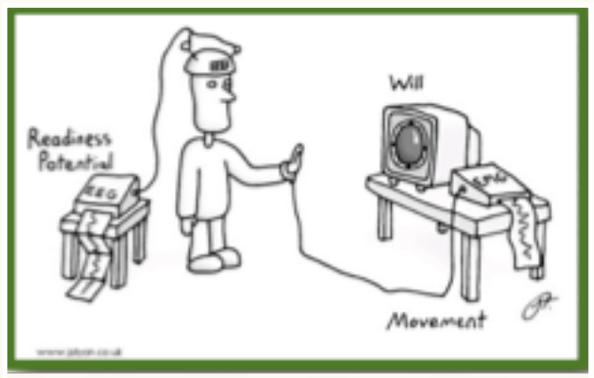


Redding

Action

Locke argued that voluntary actions require a special kind of mental/brain event associated with a willed intention. An example of a willed action would be a conscious intention that leads you to deliberately raise your arm. The same action experienced as involuntary would occur if you felt that your arm was lifting on its own without any accompanying intention on your part to carry out the movement. This kind of feeling is rare but has been documented in neurosurgery when the motor cortex of an awake patient is electrically stimulated. The stimulation of this cortical region will produce a movement which the patient will say he or she had no intention of producing.

A willed action is made up of the conscious intention to produce an action (I have the intention to raise my arm) and the actual result of that intention (the arm is raised). So we can say that there is a *causal link* between the intention behind an action and the action itself.



Is free will an illusion?

What more did Locke have to say about the special nature of intended actions, and how seriously should we take his arguments? The question is remarkably cogent at the present time because neuroscience has recently offered some evidence suggesting that the feeling we have that our actions are consciously willed is in fact an illusion! On this evidence, taken at face value, there is no way that the mental state of having a conscious intention to act plays a genuinely causal role in the action itself. A widely discussed modern experiment that has been interpreted along these lines is presented in the case study "*Is free will an illusion?*".

Locke would undoubtedly have disputed this evidence and would have argued instead that there really are mental states that give rise to intended actions which should be distinguished from automatic involuntary responses like an eye blink (for example, you blink unintentionally when someone waves a hand towards your face). He raised a further crucial question about willed action: What is it that determines our will? In other words, what happens *just before* we form a conscious intention to act? Locke was not asking a question about physical mechanisms in the brain but about the psychological events that immediately precede a conscious act.

The answer he gave is perhaps too vague to be of much use, especially to neurophysiologists interested in understanding how neural events produce willed actions, and whether the experience we have of *willing* has any causal role to play in the action itself. According to Locke, '*...the true and proper answer is... always some uneasiness...This uneasiness we may call....desire*'. The suggestion is that volitional acts are needed when we as embodied agents respond to *choices* that differ in terms of their positive or negative outcomes. The competition between different choices may occur *unconsciously* but at some point, our will is determined by '*the most.....urgent uneasi-*

ness' we in fact perceive. So a *conscious intention* is a particular kind of mental state that emerges after competing possible desires are resolved in favor of one dominant goal.

Although there is not much depth to this answer (because of course it is trivially the case that a voluntary action is the one we have opted for at a particular moment in time), the fact that the precursor (*a precursor refers to something that comes just before a subsequent event*) to an action may involve the resolution of unconscious needs raises a further question. To what extent can we legitimately say that we freely make a decision to engage in a particular action when in fact the desire (or urge) arises (perhaps unconsciously) *before* the intention to act ?

As Locke pointed out, the fact that we experience voluntary action does not mean that we are free to *will* what we will. Think about this for a moment. Suppose I have the urge to smoke a cigarette. What I cannot do is simply will this urge to disappear the way I typically engage in a voluntary action. So my will -- in the sense of having an urge to act -- is driven by factors that are not themselves under voluntary control. Of course, I can engage in all kinds of indirect ways to negate the urge to smoke (call these '*second-order volitions*') but what I cannot do is simply to *will* that I do not have the desire to smoke.

In what way, then, are the actions of human agents voluntary if we are not free to *will* what we will? Our freedom, according to Locke, lies precisely in this second-order activity that we engage in to prevent the fulfillment of wishes that we deem could be harmful to ourselves or others.

'*For during this suspension of any desire, before the will be determined to action....we have the opportunity to.... judge of the good or evil of what we are going to do*'.

Locke's attempt to unpack some of the elements of willed actions appeals perhaps to common sense; we can 'second guess' ourselves to prevent the occurrence of actions that we have an urge to carry out but that we know will produce a disagreeable outcome. The central problem remains, though. How the brain generates a willed action remains a fundamental challenge to modern cognitive science, and recent work in neuroscience has only added to the mystery.