Tabula Rasa – Reductio Ad Absurdum

Steve Mastrianni
stevmas@comcast.net

Abstract

In this paper, I present some empirical evidence that refutes the empiricist theory of Tabula Rasa (Latin: *blank slate*), that the mind at birth represents a blank slate.

While watching the crows in my back yard one morning, I noticed when I threw out a piece of bread for them to eat they did not quickly fly over to it and pick it up. Instead, they walked around the bread, occasionally glancing at it, pretending not to be interested but never flying away. They looked around cautiously as if fearing a trap while several squirrels and chipmunks played nearby.

The birds were clearly suspicious, yet they were not at all bothered by the rodents that passed within a few inches of them. I wondered how they knew that these furry beings did not represent a threat to their safety. The birds must have some innate knowledge to be able to distinguish friend from foe. They also knew how to appear indifferent, even nonchalant, while never losing their focus on the prize. I doubt that the bird's mother took them aside and explained which animals to fear or how to appear casual while all the time eyeing their next meal.

I began to wonder what children might know. I wondered if, for example, a child is scared of spiders before ever seeing one, if a child knows how to smile or grin before seeing someone do it, or how a child knows how to get nutrition from their mother's breast. Newborn children quickly learn how to interact with their environment. They learn how to reach and grasp what they want and quickly achieve the ability to communicate with those around them, including adults. The knowledge that these young children acquire in such a short period of time is remarkable. What is more remarkable, however, is the level of understanding of objects and situations for which they have no prior experience or knowledge. This is substantial proof that some form of a priori knowledge and understanding exists, rendering Tabula Rasa as outmoded as Ptolemy's geocentric theories.

The History of Tabula Rasa

Tabula Rasa, or the 'blank slate' has been debated for centuries. Although the theory of the blank slate first appeared in ancient Greece, it is most frequently associated with the British philosopher John Locke (1632-1704). Locke posited that humans are born with a 'clean sheet', that there is nothing innate or built in to the mind at birth. Locke claimed that everything we learn in life is a result of things we observe using our senses. He concluded that humans have the ability to control their own development and character, although nothing could separate this development from man's identity as a member of the human race.

John Locke (1632-1704)

Aristotle (384 BC--322 BC), in his treatise titled *De Anima*, referred to the mind as an *unscribed tablet*. Over 1000 years later in the 11th century, the theory of Tabula Rasa appeared in ancient Persia in the writings of Ibn Sina (Avicenna), a Persian philosopher. Avicenna claimed that the mind at birth was a blank slate and that knowledge was gained through experience with real objects, and that the knowledge gained from those experiences was then used to develop abstract concepts concerning those objects, rather than the other way around.

Later in the 12th century, an Islamic philosopher known as Abubacer penned a philosophical novel titled *Hayy ibn Yaqzan* where he described the development of a child on a desert island with no

teachers. The child was forced to learn on their own, and using their own experiences. Later, St Thomas Aquinas introduced the concept of Tabula Rasa to Christianity, and in the 17th century, Locke published his controversial treatise on the subject of Tabula Rasa in *An Essay Concerning Human Understanding*. The famous passage from this essay:

> Let us then suppose the mind to be, as we say, white paper void of all characters, without any ideas. How comes it to be furnished? Whence comes it by that vast store which the busy and boundless fancy of man has painted on it with an almost endless variety? Whence has it all the materials of reason and knowledge? To this I answer in one word, from EXPERIENCE (Locke).

Locke's theory of Tabula Rasa was supported by Jean-Jacques Rousseau (1712-1778). In 1775, Rousseau wrote:

> So many authors have hastily concluded that man is naturally cruel, and requires a regular system of police to be reclaimed; whereas nothing can be more gentle than him in his primitive state, when placed by nature at an equal distance from the stupidity of brutes and the pernicious good sense of civilized man…

Rousseau believed that human nature was the direct result of experience and the environment, that given different circumstances, men would develop differently, the noble savage. This was in contrast to Hobbes, who posited that men are inherently savage, that they are only kept in line by police and the army. Rene Descartes (1596-1650) also supported the notion of Tabula Rasa, as did Gilbert Ryle (1900-1976). Ryle is best known for his description of the mind as a separate, non-organic entity, referring to it as the Ghost in the Machine. "The doctrines of the Blank Slate, the Noble Savage, and the Ghost in the Machine – or, as philosophers call them, empiricism, romanticism, and dualism – are logically independent, but in practice they are often found together (Pinker 10)."

In the 20th century, Tabula Rasa once again rose to prominence with eugenics, the idea that the population could be improved if it were cleansed of those individuals who did not meet certain standards of intelligence and breeding. This was the policy adopted by the Nazis in World War II that led to the extermination of six million Jews, and thus fell out of favor following the war. Eugenics and its practices were originated and promoted by Sir Francis Galton

(1822-1911). In Galton's *Inquiries into Human Faculty and Its Development*, he states:

> "We greatly want a brief word to express the science of improving stock, which is by no means confined to questions of judicious mating, but which, especially in the case of man, takes cognizance of all influences that tend in however remote a degree to give to the more suitable races or strains of blood a better chance of prevailing speedily over the less suitable than they otherwise would have had. The word *eugenics* would sufficiently express the idea; it is at least a neater word and a more generalized one than *viticulture* which I once ventured to use. (Galton)"

While eugenics suffers from the stigma attributed to it, there is some evidence that intelligence and genetics could be related. Charles Spearman (1863-1945) developed a statistical technique to measure intelligence called factor analysis. Spearman concluded that individuals with a high level of general intelligence, *g*, have an advantage in every intellectual endeavor (Gleitman, Reisberg and Gross 529).

Spearman suggested that there were two types of intelligence which he called *fluid g* and *crystallized g*. Fluid g refers to the ability to deal with new and unusual problems which is an indication of mental speed and flexibility. Crystallized g is the knowledge that has been accumulated from experience. Because crystalized g is based on past experiences, it is most useful for dealing with experiences that are the same or similar as those already experienced (Gleitman, Reisberg and Gross 530; Cattel 54:1-22).

The nature-nurture debate has continued since Galton coined the phrase. It has been the subject of many books and papers, and continues to be a source of contention on both sides of the argument. As we learn more about the mind, we are learning that the nurture assumption is not as credible as it once was. According to Dr. Judith Harris, the nurture assumption is "a product of our culture – a cherished cultural myth" (Harris).

The Young Mind

Recent scientific studies show that babies are much smarter than we thought and are able to learn complex ideas and relationships very early in their lives having never experienced any of them.

Steve Mastrianni

The idea that humans are born with some built-in knowledge was described in Plato's dialogue called *Meno*. Plato's character Socrates takes a boy who has no experience in geometry or mathematics through a series of proofs. The boy is able to prove the theorem, proving that some knowledge must be built in to the mind (Gopnik, Meltzoff and Kuhl 11).

From the moment they are born, children begin learning. Babies are able to learn at a remarkable pace. They quickly learn how to smile, laugh, speak and understand language. What is really amazing is that they acquire personality, a character of their own, and understand that the blobs they are communicating with have feelings also. There is evidence that the child's character development is based on some predetermined factors. "Evidence suggest that personality traits grow out of the individuals temperament, a characteristic emotion or behavior pattern that is evident from an early age and is thought to be largely genetically determnined" (Kagan; Rothbart and Ahadi 103:55-66).

The ability of young children to quickly learn a language appears to be based on some preprogrammed logic. Very young babies are able to discriminate sounds from not only their own language but from every language, including languages they have never heard. They make these distinctions no matter who is talking – a man or woman, a person with a high squeaky voice or one with a deep resonant voice (Gopnik, Meltzoff and Kuhl 106).

More than the aspects of the language, babies learn things from the sounds and words, they learn ideas. In the 1960s Noam Chomsky stated that we have an implicit set of rules that allows us to transform the sequences of sounds we hear into sequences of ideas (Chomsky). The ability to form ideas from sounds and words must be based on some type of built-in logic because babies can do it having never experienced it.

Babies seem to learn about the external world in much the same way they learn about other minds. They start out with some crucial assumptions, assumptions that seem to be built in. Scientists have observed that babies can tell understand abstract concepts such as distance and trajectory. If a baby is shown a ball, they reach for it and can judge fairly accurately where they should put their hands in order to grasp it. If the ball is then rolled 10 feet away, babies can tell that it's the same ball just farther away, even though the ball now appears smaller in size

because of the distance. If the balled is rolled across a table, the baby's eyes are repeatedly drawn to the point where the ball will stop, indication that they have some understanding of the trajectory of the ball. If they are shown a movie of a ball coming toward them, they duck to avoid it.

> We've discovered exotic new phenomena like the fact that babies know what their tongues look like (Gopnik, Meltzoff and Kuhl 22).

> The new developmental research tells us the Baby 0.0 must have some pretty special features. First, it must already have a great deal of knowledge built into its original program (Gopnik, Meltzoff and Kuhl 7).

Babies show that they understand a lot more than we thought. When we show a baby an object several times, then hide the object, babies will go exploring, looking for the object behind other objects. How do they know that the object is hidden and has not just disappeared? Why do they assume that the object has been placed out of view, and not just removed?

Size Matters

The notion that knowledge and logic are programmed into the brain can be phsycially demonstrated by viewing the size and shape of the brain. Intelligence can be correlated by the amount of gray matter in the frontal lobes (Thompson, Cannon and Narr 1-6). Gay men tend to have a smaller third interstitial nucleus in the anterior hypothalmus, indicating that this is an area associated with sex differences (LeVay). Violent individuals such as murders and rapists have a smaller and less active prefrontal cortex, the part of the brain that controls decision making and inhitbits violent impulses (Davidson, Putnam and Larson 591-594; Raine, Lencz and Bihrle).

The Hybrid Mind

It seems likely that the mind is a hybrid model that consists of some level of innate knowledge and logic, but also contains a scratchpad of sorts, a blank area that is used for incremental storage – knowledge, logic, and experiences gained during life.

People often split the mind into two parts: a "natural" neurologically determined part that is shaped by evolution and a "cultural" socially determined part that is shaped by learning (Gopnik, Meltzoff and Kuhl 7). It seems likely that the mind consists of a set of innate

Steve Mastrianni

logic, rules, and knowledge with which to process the many types of information received by the senses. This is the information in the neurological part, the set of data that is hard-wired, innate, and provides a foundation on which to operate on the data taken in by the senses.

The second part is a scratchpad, a set of storage, pointers, links, lists, and electrical paths that can be dynamically altered and modified to accommodate the logic goals of the first part.

An analogy to modern computer systems is that the first part is the set of instructions or programs that allows the computer to run, to execute programs and produce results. The second part is analogous to the memory and hard disk drive of the computer which initially would be blank. As data is read and processed, the results are placed on the hard drive in a database which contains links or references to the data so the data can be easily located. The data can be replaced, moved, aggregated, or deleted based on the innate logic of the first part.

Applying this model, it is easy to see why some brains develop differently than others, and why some people are able to remember even the minutest details of an experience that may have taken place years ago. It may also explain why some people exhibit violent behavior, or why some people are able to remember the names and numbers in an entire phonebook. If the logic encoded in the first part is defective or contains an error, the data associated with that logic will be handled incorrectly. Thus if the algorithm responsible for storing images is defective, the person may not be able to easily recognize faces of someone they know. If the logic that links the image and the metadata is defective, the person may recognize the face but not be able to associate it with a name,

A Computational Model of the Mind

Much has been said about the similarities of computers and the human brain. The mind has been compared to the computer, and described as an organic counterpart of the computer. Scientists refer to this comparison as the computational theory of the mind (Pinker 32). Modern computers have a processor, storage, and programs that are executed. The brain has similar functions, and there is mounting evidence that the brain processes data much like the computer, using deductions that obey the laws of logic. Scientists have been able to duplicate some of the simple functions of the brain using computers,

although we are a long way off from duplicating the mind's speed and capacity. Long before computers, Hobbes described mental activity as mechanical in nature, the result of tiny motions that are analogous to the instructions executed by the computer.

There have been numerous attempts by computer scientists to duplicate some rudimentary brain functions. Most of the efforts have focused on creating artificial neural nets, artificial intelligence, and massively parallel processing. The brain is known to consist of an elaborate network of electrical and chemical connections that form a labyrinth of knowledge, memories, and logic. It has been suggested that the connections in the brain are similar to the connections found in computers, and it therefore may be possible to duplicate the functionality of the brain using powerful computers. Many scientists believe that emotion, creativity, and character will ultimately be found to reside in the many synaptic connections. Some suggest that consciousness itself will also be found in those connections, and they have attempted to express consciousness using the formula $C = f_1(n)f_2(s)$ where n is the neural cell number and s is connectivity. John vonNeumann estimated that it would take approximately 280 quintillion (2.8×10^{20}) bits to store all the memories of an average lifetime.

In the 1970s, work began in earnest to use computers to model the brain's logic in an attempt to duplicate the simple analytical logic demonstrated by humans. Computer languages such as Prolog were created to model relationships and to act upon them to prove them true or false. For example, if Tom is the father of Bob and Tom is the father of Bill, and sons of Tom are brothers, then Bob and Bill are brothers. To most of us, this logic seems quite primitive, but programming a computer to perform this task is non-trivial. Still computers using artificial intelligence have been able to write short stories, composed music, and have drawn human figures, suggesting that intelligence and creativity are actually a form of information processing.

Neural nets have been designed in an attempt to model certain functions of biological neurons that perform certain physiological functions in the human body. Duplicating even the simplest function requires very powerful computers with lots of storage and is not very cost effective. Although some simple neural nets are used for applications such as credit card fraud, their use is primarily limited to research.

Massively parallel systems are those that utilize hundreds or even thousands of processors to mimic the parallel computational functions of the human brain. Such a system, called Deep Blue, was used to defeat chess champion Gary Kasparov in 1997. The computer was able to defeat Kasparov by analyzing over 200 million possible moves per second (Saunders). *Newsweek* referred to the match as "The Brain's Last Stand". Although these systems are indeed powerful, they still pale in comparison to the brain. John Dase (1824-1861) was able to calculate pi correctly to 200 places in less than 60 days (Pickover 220).

While these applications provide some level of insight into the functionality of the brain, they cannot be executed without some type of run-time environment which we call an *operating system*. The operating system provides computer resources to the application to allow it to function. The application cannot be loaded into the computer's memory or executed without the operating system in place. The operating system itself cannot be executed until it is loaded into the computer's memory. The operating system is loaded by a set of instructions which are "hard-wired", preprogrammed into the computer hardware. If you turn a computer on without first loading a program, it will do nothing. It is this property that helps support the premise that the mind cannot function without some level of intrinsic logic.

When we think about the simple act of observing another person, we see a figure with a shape which exhibits certain characteristics such as color, movement, and sound. The color that comes into our brain through the rods and cones in our eyes actually means something to us. The shape we see is not some amorphous blob, but another person. When we look at a flower we receive color and shape information to our brain, but we are able to discern that the object is indeed a flower and not just a burst of color. As Gottfried Wilhelm Leibniz (1646-1716) said, "There is nothing in the intellect that was not first in the senses except the intellect itself" (Leibniz 111).

Most modern philosophers believe that some knowledge and logic must be built in to allow humans to learn. There must exist a base set of rules that act as a framework for handling the various types of learning. Two prominent philosophers, Bates and Elman, posit in their manifesto *Rethinking Innateness*, "No learning rule can be entirely devoid of theoretical content nor can the *tabula* ever be completely *rasa*." They further explain:

> There is a widespread belief that connectionist models (and modelers) are committed to an extreme form of empiricism; and that any form of inate knowledge is to be avoided like the plague…We obviously do not subscriber to this point of view…There are good reasons to believe that some kinds of prior constraints [on learning models] are necessary. In fact, all connectionist models necessarily make some assumptions which must be regarded as constituting innate constraints (Elman, Bates and Johnson 99-100).

Conclusions

The theory of Tabula Rasa remains extremely controversial. If humans are indeed born with a blank slate, then their development could be significantly affected by their environment. For example, children with angry parents would likely grow up angry, and children of parents with low IQs would likely grow up with a low IQ as well. Children that grow up in a drug-infested housing development likely would grow up learning to be drug dealers and gang members. The consequences of such a condition could be far-reaching, and would likely lead to some form of social upheaval.

It would be difficult, for example, to put a criminal to death for committing murder, as they could claim that they are a victim of circumstance and that they are not inherently violent. They could blame their parents for spanking them when they misbehaved, or blame the teacher that flunked them in Algebra. They could claim that everything they learned, good or bad, was directly controlled or influenced by their surroundings and beyond their control.

Tabula Rasa was a theory that was developed primarily by observation. It was conceived without the aid of neurological diagnostic imaging equipment. Today, neurologists can use a PET or SPECT scan to provide early information about many neurologicalz disorders. Functional Magnetic Resonance Imaging (FMRI) produces images at a higher resolution than PET and is based on differences in the magnetic resonance of certain atomic nuclei in areas of neuronal activity. FMRI can be used to map sites of brain activity. It is possible that Locke's theories may have looked significantly different had these tools existed.

It appears likely that some level of knowledge and understanding exists in the mind prior to birth. Nobody ever explicitly teaches us that the magician's tricks are impossible: no one tells us that the rabbit can't be

in the hat. Yet it doesn't seem feasible that we could learn these principles directly from our sensory experience either, from the bombardment of photons and sound waves (Gopnik, Meltzoff and Kuhl 62).

But how does this knowledge get there in the first place? It is likely that this data is genetically-encoded and passed down to the fetus through the mother's bloodstream. The data is likely used to 'bootstrap' the brain, providing a base set of logic and knowledge to use as a basis for processing sensory data acquired during life.

Research into how the mind works is continuing. When we finally unlock the secrets of the way the way the mind works, will we like what we find? "Man will become better when you show him what he is like," wrote Chekhov. But what if we find out that the notion of God is a remnant memorized from an ancient civilization? Or a Crick wrote, "It's magnificent, Alyosha, this science! A new man's arising – that I understand…And yet I am sorry to lose God! (Crick)".

What if we find out that good character, that immaterial quality that Aristotle said was so virtuous, was simply a specific code stored in the brain? Perhaps those questions are better left unanswered. In 1926, H.P. Lovecraft wrote in The Call of Cthulhu:

> "The most merciful thing in the world, I think, is the ability of the human mind to correlate all its contents. We live on the placid island of ignorance in the midst of black seas of infinity, and it was not meant that we should voyage far. The sciences, each straining in its own direction have hitherto harmed us little; but some day the piecing together of disassociated knowledge will open up such terrifying vistas of reality, and our frightful position therein, that we shall either go mad from the revelation or flee from the deadly light into the peace and safety of a new dark age." (Lovecraft).

Steve Mastrianni

Works Cited

Cattell, R. B. "Theory of fluid and crystaillized intelligence: A critical experiment." Journal of Educational Psychology, 54 (1963): 1-22.

Chomsky, Noam. Aspects of the theory of syntax. Cambridge: MIT Press, 1965.

Crick, F. The astonishing hypothesis: The scientific search for the soul. New York: Simon & Shuster, 1994.

Davidson, R. J., K. M. Putnam and C. L. Larson. "Dysfunction in the neural circuitry of emotion regulation: a possible prelude to violence." Science, 289 2000: 591-594.

Dehaene, S, et al. "Core knowledge of geometry in an Amazonian indigene group." Science, 311 (2006): 381-384.

Elman, J. L., et al. Rethinking innateness: A connectionist perspective on development. Cambridge: MIT Press, 1996.

Gleitman, Henry, Daniel Reisberg and James Gross. Psychology - Severnth Edition. New York: W. W. Norton & Company, Inc., 2007.

Gopnik, Alison. "What every baby knows." New Science, 2395 17 May 2003: 2-3.

Gopnik, Allison, Andrew Meltzoff and Patricia Kuhl. The scientist in the crib. New York: William Morrow and Company, Inc., 1999.

Harris, J. R. The nurture assumption. New York: Simon & Schuster, 1998.

Kagan, J. Galen's prophecy: Temperament in human nature. New York: Basic Books, 1994.

Leibniz, G. W. New essays on human understanding. New York: Cambridge University Press, 1996.

LeVay, S. The sexual brain. Cambridge: MIT Press, 1993.

Locke, J. "An Essay Concerning Human Understanding." Book II Chapter 1 (1690/1947): 26.

Lovecraft, H. P. "The Call of Cthulhu." Weird Tales 1926: 1-2.

Pickover, Cliff. Strange Brains and Genius. New York: Plenum Press, 1998.

Pinker, Steven. The blank slate. New York: Penguin Group, 2002.

Raine, A., et al. "Reduvced prefontal gray matter volume and reduced autonomic activity in antisocial personality disorder." Archives of General Pyschology, 57 2000: 119-127.

Rothbart, M. K. and S. A. Ahadi. "Temperament and the development of personality." Journal of Abnormal Pyschology, 103 (1994): 55-66.

Saunders, Fenella. "Deeper Blue?" Discover January 1997.

Thomas, A and S Chess. Temperament and development. New York: Brunner/Mazel, 1977.

Thompson, P. M., et al. "Genetic influences on brain structure." Nature Neuroscience, 4 2001: 1-6.