Jurnal Medical Aradean (Arad Medical Journal)
Vol. XIV, issue 3-4, 2011, pp. 70-74

THE STUFF ILLUSIONS ARE MADE

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ABSTRACT. Optical illusions are the price to pay for making sense of our visual representation of the world. The mechanisms underlying the purpose of our visual brain - the generation of signification - are hinted by the careful cultural analysis of illusions. Viewing and understanding reality are generated on a statistical basis as a means of contending with the inherent ambiguity of the world and is hindered by the past experience of human observers. From this we infer that the utilitarian 'view' floods all the other cognitive attributes of our brain. The way we understand anything is inextricably linked to the way our brain perceives information. So our 'intuitive' understanding is predisposing to the same illusions. The fact that the 'great leaps forward' of our postmodern science are basically counter-intuitive (Darwinism, Einstein relativity, puzzling gődelian theorems, and quantum theory) demonstrates this eloquently. What we see and what we understand is the legacy of eons of evolution. Memetics give an attractive way of understanding human culture from this perspective.

Keywords: optical illusions, illusions, brain, memetics

INTRODUCTION

"… There is nothing more deceptive than an obvious fact" Sherlock Holmes in Conan's Doyle's "The Boscombe Valley Mystery"

According to one account philosophy began on May 28, 585 BCE, at 3:15 in the afternoon. At that time an ancient Greek thinker named Thales confirmed his theory of a solar eclipse. He noticed a regularity that allowed him to predict that darkness would cover the earth at midday. From the midst of chaos, of seemingly unrelated and arbitrary events, the world got purpose; the reality revealed the underlying principles and the need to find that hidden order started a revolution that is still undergoing: science. Philosophy begins where acceptance ends. Science, in this regard, begins where the shadows of ignorance ends (Porter, What the tortoise taught us: the story of philosophy / Burton Porter).

The hidden regularities emerged also from the practice of technology— and, remarkably, of art. The design of stringed musical instruments is a beautiful and historically important example. Around 600 b.c.e., Pythagoras observed that the tones of a lyre sound most harmonious when the ratio of string lengths forms a simple whole number fraction. Inspired by such hints, Pythagoras and his followers made a remarkable intuitive leap. They foresaw the possibility of a different kind of world-model, less dependent on the accident of our senses but more in tune with Nature's hidden harmonies, and ultimately more faithful to reality. That is the meaning of the Pythagorean Brotherhood's credo: "All things are number". Pythagoras's mathematical approach to nature yielded stunning successes. The ratios responsible for these consonant sounds seemed to be repeated by the positions of heavenly bodies. In addition to the mathematical relationships discovered in natural phenomena, Pythagoras believed that they existed in ethics. Mathematics gains a foothold in morality through notions of reciprocity, equality, and balance.

From the Aristotelian/Ptolemaic view of a central heavy earth, a mundane mixture of 'elements', there is the Copernican revolution (' De revolutionibus orbium coelestium'1543) which casts the earth away from the center of the Universe. Then, by 1609 news swept across Europe: an Italian mathematics professor named Galileo Galilei makes wonderful discoveries using a spyglass device, which he names perspicillum. In December 1609 he discerns craters, mountains and plains on the Moon and by January 1610 he found four bright moons of the planet Jupiter (later, his contemporary Johannes Kepler names them satellites). The heliocentric view of the world began. When Antonie van Leeuwenhoek looked at the living world through the first good microscopes in the 1670s, he saw totally unsuspected, hidden orders of being. In short order he discovered bacteria, spermatozoa, and the banded structure of muscle fibers. Galileo and van Leeuwenhoek augmented the world with orders of magnitude.

And then Darwin comes along with evolution by natural selection – the idea to which the philosopher Daniel Dennett would grant the prize 'for the single best idea anyone has ever had'. The random mutations in a nonrandom sequence, the descent with modification could finally explain the highly statistical improbable and awe-inspiring beauty of life. There is no canonical genetic text and the pejorative meaning of the word mutation melts post-hoc in the domain of consequences: the 'original sin' that set in motion all the variability and richness of life it's a mutation. The copying error accounts for progress. What seems to be

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Article received: September 2011; published: November 2011

impossible or improbable in thousands or millions of years it's inevitable in billions to paraphrase Carl Sagan.

Darwin was named 'the father of existentialism', 'the stepfather of nihilism', he was demonized, ridiculed or adulated but no one remained indifferent and no one should be. And the theory of evolution cuts deep in all domains of existence. The heart of the problem, I believe, is to explain how it might be that we, a product of evolution, possess an overwhelming sense of purpose and moral identity, yet arose by processes that were seemingly without meaning. The welcome antidote to the bleak nihilism of the ultra-Darwinists is convergent evolution, the fact that nature stumbles across the same solutions over and over again (Life's Solution: Inevitable Humans in a Lonely Universe Cambridge University Press). The loneliness of being seems shared at least, this way.

The latin maxim ignoramus et ignorabimus, meaning "we do not know and will not know", stood for a position on the limits of scientific knowlege in the thought of the nineteenth century. It was given credibility by Emil du Bois-Reymond, a german physiologist, in his Über die Grenzen des Naturerkennens ("On the limits of our understanding of nature") of 1872.

On the 8th of September 1930, the mathematician David Hilbert pronounced his disagreement in a celebrated address to the Society of German Scientists and Physicians, in Königsberg: "We must not believe those, who today, with philosophical bearing and deliberative tone, prophesy the fall of culture and accept the ignorabimus. For us there is no ignorabimus, and in my opinion none whatever in natural science. In opposition to the foolish ignorabimus our slogan shall be: Wir müssen wissen — wir werden wissen! ('We must know — we will know!')".

But the study of logic itself revealed that the scope of logical deduction as ameans of discovering the truth is severely limited. Given substantive assumptions about the world, one can deduce conclusions, but the conclusions are no more secure than the assumptions. The only propositions that logic can prove without recourse to assumptions are tautologies. The frightening Incompleteness Theorem of Gödel (www.en.wikipedia.org) proves that proof is a much weaker notion than truth. It sets an intrinsic limit to knowledge and drove the great physicist Richard Feynman to his famous dictum "A great deal more is known than has been proved" The fact that many scientific discoveries are counterintuitive stems from the fact that the human brain evolved in a three dimensional world and molded to serve the inner logic of this very world: with medium speeds and medium size objects within a narrow window of magnitudes. The objective feeling of perception meets the subjectivity of error (type I mostly) If we would have evolved in vacuum probably we would have found intuitive that a heavy object and a light object would hit the ground at the same instant. But air friction is always there in our world and intimately vowed in our models of perception and we find counterintuitive the fact that objects with different weights fall at the same speed. Here it may worth recalling Wittgenstein remark on the revolution of heliocentric vision. Intuitively the Earth seems large and motionless and the Sun small and mobile after all. "Tell me" he asked a friend, "why do people always say, it was natural for man to assume that the Sun went round the Earth rather than the Earth was rotating?" His friend replied: "Well, obviously because it just looks as though the Sun is going round the Earth. Wittgenstein replied:" Well, what it would have looked like if it had looked as though the Earth was rotating?" Exactly the same may I add. But our brain never thought of the later model of representation as intuitive. The deep structure of the world is quite different from its surface structure. The senses we are born with are not attuned to our most complete and accurate world-models. Illusion is the price that must be paid to evolve perceptions that can keep up with a dynamic environment. Our senses reveal a world in chaos and flux, a world that overflows the dams and channels erected by reason. Real life throws us borderline cases, chance happenings, and developments without beginnings or endings. So our brain must develop models of the world that are not necessary accurate and scientific but efficient. The vastness of geological time and astronomical space are alien and uncomfortable notions for our inner models. The commonsense idea that there is an objective reality 'out there all the time' is a fallacy also. When reality and knowledge are entangled, the question of when something becomes real cannot be answered in a straightforward manner. The famous biologist J.B. Haldane said: "Now, my own suspicion is that the universe is not only queerer than we suppose, but queerer than we can suppose. I suspect that there are more things in heaven and earth than are dreamed of, or can be dreamed of, in any philosophy. That is the reason why I have no philosophy myself, and must be my excuse for dreaming." The bottom line being that the fabric of reality might elude forever our understanding because the insurmountable hiatus between our brains inner workings and the paradigmatic different substance of the world. This is the other intrinsic limit to knowledge.

We even dissect nature along lines laid down by our native language like the linguist Benjamin L. Whorf asserts in his famous Sapir-Whorf hypothesis of linguistic relativity – the hypothesis that language influences thought. Wittgenstein again: "The limits of our knowledge are the limits of our language." The ability of our brain to bridge the abstract realm of words with the dynamics of the world confines our mental constructions and models. But all this started eons ago on the planes of Africa.

THE BELIEVING PRIMATE

Imagine that you are an australopithecines walking the Pliocene planes of eastern Africa 3 to 3.5 million years ago; bipedal, unsure, on the path of becoming the master of the universe. Suddenly, as you pass by, you here a rustle in the tall grass. Could be a dangerous predator hiding or it could be just the wind. You have to make an important decision, maybe the most important decision in your life. Your decision could be wrong, but it's of extreme importance the type of error that you're making.

Neuroscientists point out the two types of errors that could be made:

- Type I error- a false positive – believing a pattern is real when it is not, finding a non-existent pattern.
- Type II error – a false negative – not believing a pattern is real when it is, not recognizing a real pattern.

If you choose to believe that the rustle in the grass it's a predator and run, and it turns out that was just the wind you made a type I error, a cognitive one, a false positive; no harm done, you survived. But if you choose the other way around- that the rustle is just the wind and it turns out that is a predator it's all over. You won the Darwin award: you were removed from the gene pool of your species.

Actually natural selection favored type I errors in our behavior. The cost of making type I errors is way less than the cost of making type II errors. In split-second, life and death situations, the default position is to assume that all patterns are real. Our brain is a very powerful pattern seeking engine naturally selected to have biases. We are the descendants of type I error making primates – the successful ones, the primates who developed the perceptual grammar to break the camouflage of the world. The propensity to always find meaningful patterns is built in our brains, and the area responsible for this constant looking for patternicity is in the anterior cingulated cortex in the temporal lobe. That's where we also recognize faces (in a more specialized division of this area called the fusiform gyrus), which is maybe the most powerful feature of this pattern seeking engine. Damage to this area is associated with prosopagnosia, the inability to recognize faces.

This bias of our brain has a very interesting by product: our propensity to see illusion, to be deluded, to have superstitions, to make basic assumptions that could be wrong. That's also built-in. We have a tendency to confer an intentional stance to all moving objects (the base for animism). We infuse all the patterns with predatory or intentional agencies (Dennett 2006) (Michael Shermer - The believing brain From Ghosts and Gods to Politics and Conspiracies,-How We Construct Beliefs and Reinforce Them as Truths St. Martin's Griffin).

There is an experiment in which Jennifer Whitson at U.T. Austin demonstrates that illusory patterns perception is augmented in lacking of control situations (Daniel C. Dennett, 1995, Darwin's dangerous idea – Evolution and the meaning of life). The experiment was done in corporate environments and involves a series of splotches, black and white images some with hidden patterns in it, some allegedly patternless. The identification of a coherent and meaningful interrelationship among a set of random or unrelated stimuli is correlated also with the propensity to believe in supernatural phenomena. Susan Blackmore, a British psychologist has done an experiment involving finding patterns in degraded images (Susan Blackmore Consciousness Oxford University Press) In 70% degraded images people who found patterns but incorrectly identified it also scored high on an ESP test (ESP= extra sensorial perception). There is a price to pay for a very effective relationship with a massively complex world. Brugger and Mohr (Susan Blackmore Consciousness Oxford University Press) demonstrated a direct link between patternicity and the level of dopamine in the brain. The administration of L-dopa increased the likelihood of finding patterns. In fact amphetamines and cocaine, which are dopamine agonists, generate a euphoric state in which there is more creativity and rapid finding patterns. Neuroleptic drugs that decrease the amount of dopamine, used to reduce or eliminate psychotic behavior (paranoia delusions or hallucinations) in fact decrease the false patternicity associated with this diseases.

There is also another powerful mechanism responsible for finding patterns: filling inn mechanism. This mechanism it's active all the time but we hardly notice it. On our retina there is the optic disc a patch where the optic nerve enters the brain. This is a blind spot and should generate a natural occurring scotoma in your visual field. But it doesn't. Instead your visual brain fills in the image by virtually generating what should be there. The mind abhors any vacuum and will supply whatever information is needed to complete the scene. It will increase the signal to noise ratio in order to break camouflage. We construct the image bridging 'internally' any gaps and extract patterns even from low information content images. There are filling in mechanisms at all levels of visual processing that generate a whole range of optical illusions (www.en.wikipedia.org).

70% of our brain is involved in visual processing – a step by step process. From the primary visual area in the occipital lobe the information is sent to over 30 different areas: from fusiform girus to the amigdala – the gateway to limbic system, our emotional core where the emotional stamp of what we see it's attached. A very important stage is taking place in parietal lobes where spatial representation is done. The natural Cartesian bisection of space in left-right, and up-down is realized here. A stroke in the right parietal lobe could lead to left hemi- spatial neglect syndrome – a deficit in awareness and attention to the left side of the visual field. The result is so profound that the concept of leftness is lost. For the patient the world has just the right side in spite the fact that vision in both

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visual fields is preserved. He ignores the left side of the world: eats just from the right side of the plate, shaves just the right side of the face a.s.o. They describe the walk from home to work for example using the landmarks on the right side of the road. The opposite walk is described using the opposite landmarks which were ignored in the anterior description.

A special form of hemi-spatial neglect is mirror agnosia. Patients with hemi-spatial neglect (www.en.wikipedia.org) were placed so that an object was in their neglected visual field but a mirror reflecting that object was visible in their non-neglected field. Patients could not acknowledge the existence of objects in the neglected field and so attempted to reach into the mirror to grasp the object. He knows that he's looking to a mirror but the neglect of the leftness of the world it's so deep that this brain captive in a strange sensorial world distorts a lifetime of experiences with mirrors and reflexions so to make sense. For him the objects are more likely to be inside the mirror than in the 'non-existent' left.

Another fascinating example of the complexity of the process of vision is Capgras syndrome. The patient has a posttraumatic disconnection between the visual brain and the amigdala so he can't attach the emotional stamp on what he sees. He sees he's mother as a person who is identical with her, speaks and behaves exactly like her but it's not her. It's an impostor. The final rationalization is that it couldn't be her if the emotional feedback of seeing her, developed over years and deeply entrenched in him, is lacking (Porter, Burton Frederick. What the tortoise taught us: the story of philosophy / Burton Porter.)

The final integration of the perceived world is also tributary to the mixing of senses. Synestesia is a neurologically based condition in which stimulation of one sensory or cognitive pathway leads to automatic, involuntary experiences in a second sensory or cognitive pathway. In synestets there is a cross-wiring between specific areas. The most common form is color-graphemic synesthesia, in which letters or numbers are perceived as inherently colored. But in some people specific days of the week or some months of the year evoke specific colors: Monday is red, Tuesday is indigo, and December is yellow. Days, months and numbers have in common the abstract idea of sequence or ordinality which is believed to be represented higher up in the temporal-parietal-occipital junction (TPO) on a crossroad. But in 2001 Vilayanur S. Ramachandran and Edward Hubbard in an experiment showed that the human brain, in general, is somehow able to extract abstract properties from the shapes and sounds and synestesia it's not just an oddity. In this experiment they used two simple geometrical images, one curvy shaped and the other with jagged features and asked American graduates students "which of these shapes is 'Bouba' and which one is'Kiki'?" in order to associate obvious visual features with sounds. 95% to 98% selected the curvy shape as "bouba" and the jagged one as "kiki". The experiment was then replicated in Tamil populations with a different alphabet all together. It's known as "bouba-kiki" effect and demonstrates the brain's ability to engage in cross-modal abstraction of properties such as curviness and jaggedness. It's not surprising that our language is littered with cross-sensorial metaphors from "hot babes" to "sharp cheese.

It's not surprising that our language is littered with cross-sensorial metaphors from "hot babes" to "sharp cheese" in all languages. In fact synestesia is seven times more common between artists, poets and novelists. The generation of metaphors and powerful abstractions is easier. The excessive wiring and inter-connectivity inherent in our rapid growing brain has 'side effects'. From it could have sprung our most highly regarded features, what means to be human.

Even consciousness, the holy grail of neuroscience, was thought to be just a post-hoc rationalization of things that you really do for other reasons; it's just a byproduct of the complex interrelation between brain areas and mixed senses. What is called in evolutionary biology a spandrel: biological features that are not adaptations. It's a term borrowed from architectural terminology where it means: a necessary architectural byproducts of mounting a dome on rounded arches. Spandrels must exist once a blueprint specifies that a dome shall rest on rounded arches. In Gould's and Lewontin's seminal paper: "The Spandrels of San Marco and the Panglossian Paradigm: A Critique of the Adaptationist Programme" the term exaptation was coined for this characteristics that enhance fitness in their present role but were not built for this role by natural selection but later co-opted for their present role; like spandrels for sustaining the dome that later on are given esthetic means. In some elite evolutionary circles language and even consciousness are spandrels, exaptations.

So my dear Watson "If you would be a real seeker after truth, it is necessary that at least once in your life you doubt, as far as possible, all things." (René Descartes).

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