The Bicycle Story

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Present day science and technology is increasingly focussing attention on biological phenomena to extend life and reduce human suffering. Bio-science and bio-technology seem to offer the most exciting research prospects today. It is rather paradoxical that we hardly know anything about ourselves! This ignorance has unleashed many science and technology related problems to our physical and mental health. In favour of bicycling for improving our health, it is hard to surpass the profound eloquence of 1912 Medicine Nobel Laureate Dr. Alexis Carrel in The Man, Unknown, first published way back in 1935.

The elasticity, strength and adaptiveness of the lower limbs, whose pendulum-like oscillations determine walking and running, have never been equalled by our machines, which only make use of the principle of the wheel. The three levers, articulated on the pelvis, adapt themselves with marvellous suppleness to all postures, efforts, and movements. They carry us on the polished floor of the ballroom and in the chaos of the ice fields, upon the sidewalks of Park Avenue and on the slopes of the Rocky Mountains. They enable us to walk, to run, to fall, to climb, to swim, to wander all over the earth under all conditions ...

... It seems that the work of the mind is helped by the rhythmic contractions of the muscles. Certain exercises appear to stimulate thought. For this reason, perhaps, Aristotle and his disciples were in the habit of walking while discussing the fundamental problems of philosophy and science...

Perhaps, Carrel was not thinking about the bicycle. Perhaps, Aristotle and his disciples would have given up their habit of walking if they had some bicycles! Perhaps it is a good idea for school children to learn more about walking, swimming, gardening, bicycling, etc., and perhaps learn less about cars, computers, planes, rockets etc. There is no question that computers and rockets provide great excitement and inspiration for young minds, and that activities like swimming and bicycling cause a lot of perspiration. But, let us not forget the famous Edison formula popularized by Einstein: Genius is 99% perspiration and 1% inspiration!!!

Vijay Gupta's The Bicycle Story is a mix of some history (10 pages with 16 illustrations), some structural design (15 pages with 24 illustrations), and some bicycling science (11 pages with 7 graphs and 9 illustrations). The history of the bicycle begins with a 1791 French toy made of wood and ends around 1890 with Rover Safety. The basic design of the bicycle has changed little ever since. The second part dealing with bicycle structure
includes wheels, tyres, bearings, chain, freewheel, brakes, gears and frames. The last part is a discussion on the forces involved during different riding situations such as air drag, braking and balancing actions (stability). Thus, this booklet is an essay on the essential bicycle facts and factors that all school children ought to learn as a part of their education.

In summary, the historical facts gathered and the scientific factors discussed make Vijay Gupta's book interesting. But some additional specific information on typical Indian bicycles could make this booklet more useful. Finally, this booklet includes a list of some internet sites, but, sadly and ominously, there is no mention of other bicycle books and articles!

This is rather a disturbing trend in publishing protocol. The internet is ill-advised for elementary education as this medium is fast acquiring all the undesirable qualities of mass media like films and television. Uncensored promotion of the internet has already become a major source of concern in schools and universities. Further, there are serious doubts about the originality and authenticity of internet information. It is indeed high time that the need for internet use for primary education is seriously debated and discussed by teachers, parents and the general public. Of course, some occasional demonstration of internet power is certainly beneficial on young minds. Again turning to Carrel, in The Man, Unknown:

*There is, indeed, an enormous diversity in the quantity and quality of the intelligence possessed by each one...incomplete and superficial observations, a rapid succession of impressions, multiplicity of images and lack of intellectual discipline hinder the development of mind. We know how unintelligent the children are who live in a crowded city, among multitudes of people and events, in trains and automobiles, in the confusion of the streets, among the absurdities of the cinemas, in schools where intellectual concentration is not required...We are almost totally ignorant of the genesis of intelligence. And we believe that the mind of the children can be developed by the mere training of their memory and by the exercises practised in modern schools!*

The value of the days of early childhood is very great. Every moment should be utilised for education. The waste of this period of life can never be compensated. Instead of being allowed to grow like plants or little animals, children should be the object of the most enlightened training. But this training calls for a profound knowledge of physiology and psychology, which modern educators have not yet been given the opportunity of acquiring.

Perhaps the new generation of health- and environment-conscious parents and educators will heed Carrel's advice to rekindle the pursuit of true intelligence in school children, and guard them from superficial 'intelligence' contests conducted by dubious 'quiz masters' for promoting vulgar products and ideas. Perhaps then we can hope to see more of the great minds like Shakespeare, Newton, Einstein, Gandhi, Raman and Ramanujan. Let us hope that school children will continue
In an article for the *Scientific American*, the author (Wilson) compared the mechanical efficiency of the bicycle with that of a man walking and found that the cyclist needs only one fifth of the walker’s expenditure of energy to travel three or four times faster. In fact this improves on nature to such an extent that it makes the cyclist the most efficient of all moving animals and machines (Penguin Book, p.79).

An enthusiastic and entertaining article in the *British Medical Journal* by a Medical doctor (Williams) writes: (Penguin Book, p.81) says:

Our patients, the long-suffering and generally under-exercised British public, continue to show such massive unawareness of the bicycle that it becomes a therapeutic duty to contrast for them that this clean, quick, quiet and civilized machine with that oxygen-eating, air-defiling dissipater of energy – my faithful motor car. I say faithful because anything less would be churlish, and it is with real reluctance that I expose to public gaze the imperfections of a family friend. But already the clouds are gathering round the internal combustion engine as we have used it, and we are being forced to consider less wasteful ways of getting ourselves about. For a car uses only 20% of the combustible energy of its fuel in moving forward: 4% goes to essentials such as transmission, dynamo, fan, and water pump, but over 75% is lost as heat – 40% through the exhaust and most of the remaining 35% by conduction and convection through misleadingly called a radiator (the only thing it does hardly at all). The cyclist is altogether more temperate. Indeed from the standpoint of physics, he is not a heat engine at all, but a constant temperature energy converter more analogous to a fuel cell; and his contribution to the increasing entropy of our solar system is commendably small (Penguin Book, p.81).

In the past three years I have traveled 6,000 miles (9660 km) on my bicycle which otherwise I should have done in my car – an average of 8 miles (12.9 km) per working day. The saving in time has been more hours than I can count, in petrol more than 240 gallons (1090 liters), and to the atmosphere 2,000,000 liters of oxygen, 13,000,000 liters of carbon dioxide and 3,000,000 liters of carbon monoxide at NTP. Now, 2,000,000 of oxygen sounds a lot but you well say Why the fuss? The earth is large and its atmosphere miles deep; 2,000,000 liters per car compounded for a city the amounts are disturbing. At continental levels they require at least some thought (Penguin Book, p.81).

Transportation beyond bicycle speeds demands power inputs from the environment. Velocity translates directly into power, and soon power needs increase exponentially. In the United States, 22 per cent of the energy converted drives vehicles, and another 10 per cent keeps roads open for them. The amount of energy is comparable to the total energy-except for domestic heating-required for combined economies of India and China. The energy used in the United States for the sole purpose of driving vehicles built to accelerate beyond bicycle speeds would suffice to add auxiliary motors to about twenty times that many vehicles for the people all over the world who want to move at bicycle speeds and do not or cannot push the pedals because they are sick or old, or because they want to transport a heavy load or move over a great distance, or because they just want to relax. Simply on the basis of equal distribution on a world wide scale, speeds above those obtained by bicycles could be ruled out. It is of course mere fantasy to assume an egalitarian consensus sufficiently
strong to accept such a proposal. At closer inspection though, many communities will find that the very same speed limit necessary for equal distribution of mobility is also very close to the optimum velocity giving maximum value to community life. At 20 mph constant speed Phineas Fogg could have made his trip around the world in half of 80 days. Simulation studies would be useful for exploring imaginative policies that seek optimal liberty with convivial power tools. To whose advantage would Calcutta’s traffic flow stabilize if speeds are limited to 10 mph? What price would Peru’s military pay for limiting the speed to 20 mph? What gains in equality, activity, health and freedom would result from limiting all other vehicles to the speed of bicycles and sailing ships? (Penguin Book p. 281).

The typical American male devotes more than 1,600 hours a year to his car. He sits in it while it goes and while it stands idling. He parks it and searches for it. He earns the money to put down on it and meet the monthly installments. He works to pay for petrol, tolls, insurance, taxes and tickets. He spends four of his sixteen waking hours on the road or gathering his resources for it. And this figure does not take into account the time consumed by other activities dictated by transport: time spent watching automobile commercials or attending consumer education meetings to improve the quality of the next buy. The model American puts in 1,600 hours to get 7,500 miles: less than five miles per hour. In countries deprived of a transportation industry people manage to do the same walking wherever they want to go and they allocate only 3 to 8 per cent of their society’s time budget to traffic instead of 28 per cent. What distinguishes traffic in rich countries from the traffic in poor countries is not more mileage per hour of lifetime for the majority, but more hours of compulsory consumption of high doses of energy, packaged and unequally distributed by the transportation industry. (Penguin Book, p. 283)

to enjoy playing with their innocent toys, bicycles and enjoy reading some bicycle books as well. Vijay Gupta’s bicycle book is a good start indeed.

There are quite a few interesting bicycle books, but the Penguin book by Watson and Gray is a great inspiration. There is another classic book on bicycle science by Whitt and Wilson. The Penguin book includes interesting anecdotes and excerpts from experienced western writers, but their concerns are rapidly becoming equally relevant and applicable to India as well; some samples are given in Box 1.

Suggested Reading


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