

Sundials tell "sun time". Clocks and watches tell "clock time". Neither kind of time is intrinsically "better" than the other - they are both useful and interesting for their separate purposes.

"Sun time" is anchored around the idea that when the sun reaches its highest point (when it crosses the meridian), it is **noon** and, next day, when the sun again crosses the meridian, it will be noon again. The time which has elapsed between successive noons is sometimes more and sometimes less than 24 hours of clock time. In the middle months of the year, the length of the day is quite close to 24 hours, but around 15 September the days are only some 23 hours, 59 minutes and 40 seconds long while around Christmas, the days are 24 hours and 20 seconds long.

"Clock time" is anchored around the idea that each day is exactly 24 hours long. This is not actually true, but it is obviously much more convenient to have a "mean sun" which takes exactly 24 hours for each day, since it means that mechanical clocks and watches, and, more recently, electronic ones can be made to measure these exactly equal time intervals.

The seasonal correction is known as the "equation of time" and must obviously be taken into account if we want our sundial to be exact to the minute.

If the gnomon (the shadow casting object) is not an edge but a point (e.g., a hole in a plate), the shadow (or spot of light) will trace out a curve during the course of a day. If the shadow is cast on a plane surface, this curve will (usually) be a hyperbola, since the circle of the sun's motion together with the gnomon point define a cone, and a plane intersects a cone in a conic section (hyperbola, parabola, ellipse, or circle). At the spring and fall equinox, the cone degenerates to a plane and the hyperbola to a line. With a different hyperbola for each day, hour marks can be put on each hyperbola which include any necessary corrections. Unfortunately, each hyperbola corresponds to two different days, one in the first half and one in the second half of the year, and these two days will require different corrections. A convenient compromise is to draw the line for the "mean time" and add a curve showing the exact position of the shadow points at noon during the course of the year. This curve will take the form of a figure eight and is known as an "analemma". By comparing the analemma to the mean noon line, the amount of correction to be applied generally on that day can be determined. At the equinox, we found that the solar day is closer to the sidereal day than average, that is, it is shorter, so the sundial is running fast. That means in fall and spring the correct time will be earlier than the shadow indicates, by an amount given by the curve. In summer and winter the correct time will be later than indicated.

<http://www.sundials.co.uk/newdials.htm>

The sundials at Jaipur, **India**

<http://www.photonetal.com/stock.indiantms>

also lots of information about the sundial and Jaipur Observatory at

<http://www.jiva.org/observe/jaipur/life3.html>

<http://www.sundials.co.uk/mottoes.htm>

(Taken from the net).

It is the year 1900.

The shadow of the sunflower plant cast a lazy hyperbola on the damp red earth as the day progressed. Karna observed this everyday by fixing thin twigs every hour at the exact point of the end of the shadow. He had never believed that sunflowers were really true in their adoration of the sun but this simple exercise convinced him more than books or anecdote would. He had the mind of an investigator and a never say die attitude which wormed its way into his mind, his instinct, his gut, his spleen, the very heart of his being. Having just moved to Baroda with its beautiful public parks and surrounding farmlands, observing nature had become one of his obsessions. An inner darkness haunted him and he found shadows fascinating. He wondered if he could devise a way of reading a shadow. Like dreams, he was convinced, shadows too had meaning. The darker side of the psyche perhaps or a constant warning that as with time things were always in flux but came round again to the same beginning and then the same end – the eternal cyclical construct of life. Light and dark, the corporeal and the shadow lived like ghosts in a certain twilight zone of his mind.

Baroda, home to the conquering Marathas now was ruled by Maharaja Sayajirao. A visionary and polymath and educationist with a deep humanistic streak, his policies fascinated Karna. The scientific bent of mind that he, Karna, had inherited from centuries of random genetic distillation was coupled with a powerful drive to create and express himself. His sunflower experiment he felt would interest the erstwhile king but he needed another dimension to gain entry into the royal darbar. Karna was a polymath too and a master in many crafts and arts and was receiving excellent guidance and inspiration from his teachers at the Baroda university (established by none other than M Sayajirao).

Karna lived in a small room by the river. The room was cluttered with the paraphernalia of someone who was obsessed with making things. There were carpenters tools, old iron parts that looked like they had seen the last of their days, gears and cogs and metal drums and crushed bicycle wheels and springs and even a collection of old cameras. There were shapeless lumps of glass, glass beads and marbles of every hue and colour. Amidst all this clutter as we might choose to see it were blossoming forth forms of complex mechanical objects that looked like prehistoric robots. Cranked gear wheels made up the faces, they had limbs that moved when a key turned a spring in the back but the exact purpose of these inventions elude us until we see that each object is meticulously placed somewhere in the room where they receive varying light from the sun pouring in through the window. The reality of his inventions for him was their shadow. The spaces through that were asymmetric blobs of light, the distorted gear wheel that lengthened and

shortened as the sun transited the sky. His knowledge of photography and experiments with the light and the dark and his faithful old camera were his tools of the moment.

Each of these momentous shadow images was captured, neatly labeled and stored in a box by his bed which was a mattress on the floor. But soon he had to learn some craft that would bring in some money to pay for his experiments and living expenses. One of his professors at college mentioned to him that there was a visiting anthropologist from England who was doing studies of the people of urban cities. Karna had just recently learned of the Magic Lantern shows of James Edwards. The photographs intrigued him and he specially liked the one of the mother and child running from the camera, as it were running from their own shadow.

The anthropologist required a photographer to accompany him and document his findings. Karna jumped at the opportunity. In the library he had seen a number of illustrated books filled with photographs of far away lands and exotic and strange people. There were also books about princes of India, portraits that had been actually coloured in. But what fascinated him most were the black and white images which seemed to him the absolute perfection of resolution of light on object. In darkness and in light.

One of the books had an image of an Indian prince sitting on his throne. At his feet lay a tiger skin and on the tiger skin was placed a sundial. There was a north facing window to the right of the image and the light through the window on the gnome cast a rippled shadow on the stripes of the tiger skin. Was this some metaphor of the king's mortality, did it locate the photograph or the incident. The king's figure too cast a shadow. It was longer than that cast by the largish sundial. Was this an intentional symbolism of the king's invincibility, or was the king a gadget freak and the image a simple coincidence. He examined all the shadows closely almost losing sight of the photograph and then the idea hit him.

He would make a living sunflower sundial for the king – a lover of nature, science and investigation. He would place him in the midst of the Italian fountain in the palace grounds surrounded by the manicured, topiaried gardens that surrounded it. He would then photograph him. For, it had suddenly struck him that we are all gnomes of a sundial. Being three dimensional, a part of us, in the open, would always be North facing. That problem surmounted, he knew enough about sundials to know that the orientation of the gnome needed to be at an angle equal to the latitude of the place he was at. How do I get the king to remain in a slanted position, he pondered. Several experiments followed of finely carpentered king-gnome bases that would precariously bear the weight and dimensions of the king. He wanted the truest, slanted image of the king looking straight into the camera while the sunflower sundial (with the angled sunflower gnome) in front of him while the fountains played merrily in the air casting rainbow colours that would resolve themselves as arbitrary shades of grey and black on his image. All a shadowland. He would then take many photos of the king turned this way and that and then develop them and study the shadow formations closely.

This study would let him make meaning of the king's substance, his mortality, his aspirations, his inner self and he could then tempt the king with his findings and have a more private and intimate audience with the king. Voila! He now had his plan. But these

are his mental machinations as he starts to make progress with the project of the anthropologist. His brief is to walk the streets of Baroda looking for both the typical and the atypical face. What does such a project mean he asked himself. How does one remove a subjectivity from such an endeavor? He starts to roam the streets. His camera is bulky so he has sometimes to set it up in one place and wait for the chance passerby whom he can lure into his world of trapping light and shade. The curious stop and look but many are scared of this man and his contraption. He finds himself having to look at faces, body types and the living being rather than the shadow. He starts to notice eyes. He stares hard into the eyes of those who pass by often imagining reflections of himself in those eyes. He starts to get sucked into those very beings. What would the king's eyes be like? How would they suck him in, he wonders. But, he has to stop his day dreaming and get on with his assignment. He starts to take photographs of people quite arbitrarily. After all there is an arbitrariness in how we come about to be what we are and look how we look. Only the shadow is not arbitrary. It is a consequence and it is true.

Eyes, shadows, light, dark, sundials, kings and this potpourri of metaphorical allusions dominate his life. The anthropologist is at first puzzled by the photographs and finds that Karna's cityscape is made up of a multiplicity of ideals. He has no locus and the typical eludes him. They have long discussions about what it means to sift and sort from the menagerie we live in – he particularly alludes to the photographs that Karna has taken of monkeys in the zoo and interspersed with photographs of people. The project seems to be going out of control. Karna cannot be the true zookeeper of the human zoo. He is floundering in the eyes and shadows of his subjects. His inability to control such an experiment and make a definition of form and image of his subjects perplexes both his teacher and the anthropologist. They decide that he perhaps is not the right person for the task at hand so he is jobless and perhaps relieved that he can get on with his sundial project and his mission to befriend the king. His life seems to be lived in a non reality of illusion and a self created fiction.

It is a market day in the walled city of Baroda. Karna and camera wander aimlessly through the narrow streets overrun by vendors selling their plunder from people's homes. The streets are noisy with the cries of hawkers and vendors and the heated bargaining that goes on. As he continues to walk he suddenly notices he has entered an oasis of silence. There is a crowd of people standing in a circle. They seem to be intently focused. He is curious for once. He pushes his way through to see what they are all looking at. At the center of the circle he sees a young woman sitting cross legged. She is dressed in a saree with her head covered and there is not much he can see of her face. She is playing the snake charmers flute. The sun is at its eight am position and she casts a strange shadow on the ground. In front of her there is a basket with a cobra. The cobra is swaying to the movement of the flute. In contrast to the still shadow of the woman the snake's extended shadow glides sensuously away and towards the woman's shadow. He is enthralled. He needs to see her eyes but the show ends abruptly. People throw money into her bowl and she starts to pack up her snake, basket and flute. Never once does the veil fall from her head. He can't forget the sinuous movement of the snake which seems to adore her shadow-body. He follows her through the streets until they arrive at a small house near the edge of the market. As she enters her door he calls out in greeting. She turns in surprise and her saree falls off her head. Her eyes are the most piercing eyes he has ever seen. They are as dark as a moonless night and no light seems to enter them. He can't see

her irises. But they reflect him clearly. He feels that she does not see him but is simply mirroring him, deflecting him. An agony perhaps of years lived on the fringes of life condemned to a life of a shadowy entwinement with a snake. A deep feeling like he has never felt before stirs within him and he moves towards her as though drawn by some strange force. He needs those eyes to let him in. He is the charmed and the charmer too. He is not content with being a reflection or not even a shadow. His feeling of omnipotence over the shadow world does not extend to his own shadow and the fear of being that to her once she stops reflecting him compels him yet more towards her. She retreats through the door and it closes. The sun is now behind him and for the first time he notices his shadow on her door.

A few days pass of him living in a dreamy reverie. Flashes of her, of eyes, shadows, reflections punctuate this time. He needs now to get on with his king-sundial experiment. He starts to grow sunflowers in a small patch of ground by the river behind his house. He uses support sticks to trace out various inclinations for the plant. Days go by. The plants are growing. He is completely absorbed. He does not notice that the days are sometimes cloudier than normal. It is the sign of the impending monsoons. He is woken up early one morning to the sounds of thunder and intense flashes of lightening that send strange momentary shadows flickering around his room. He rushes out to his sunflowers and finds that they are bent over in the torrential rain and winds. He maniacally tries to restore them to their positions but it is all in vain. The rains continue to lash the city. He watches the river fill up slowly. The overcast skies leave no chance for shadows to survive. He misses the sun. The circularity of night and day, of shadow and noon-day no shadow cease to exist and for him with that ceases to exist the very core of his meaning of life.

He is oblivious now even to the rising river. One day soon the waters start to enter his house. At first slowly and then with no warning at all it has risen a few feet. His mechanical contraptions are submerged. He is frantically trying to save whatever he can but it is too late. The inexorable march of nature is consuming him. For him it is a metaphor for a kind of dying. He wonders what he will be reborn as. He watches helplessly as the water takes with it his precious box of photographs. The box breaks into bits and the photographs float around the room and are sucked out into the raging torrent of the river. His room is now almost half filled with water and is continuing to rise. His instincts start to take over as he sees his life's work ebb away from him. He stumbles through the water and is forced through the door by the current. It is the tide of life – one last photograph floats after him. It is an image of the maharaja with a sundial.

Leela Mayor, Baroda, 27th August 2006