

THE IMPORTANCE OF PROTECTING THE NIGHT SKY

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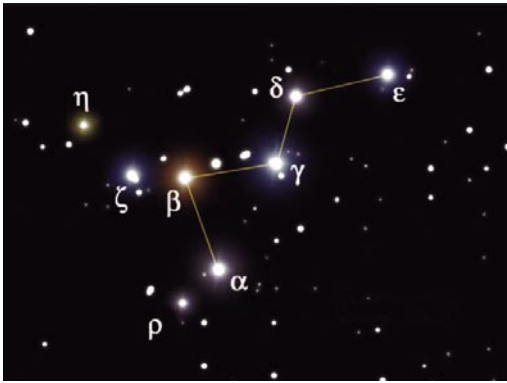
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Fear of the dark is firmly, almost instinctively rooted in human nature. This is logical, as, in strictly evolutionary terms, we are a diurnal species with eyes that have formed and specialised to work best in conditions of sunlight. The sunlight comforts us and makes us feel safe. In the sunlight, we can clearly see potential threats and we can easily identify the food that guarantees our survival. In comparison with the beneficent clarity of daylight, the night lays like a threatening atmosphere in which we are subjected to a state of defencelessness that makes us prone to become the victims of all kinds of dangers.

For millions of years, these were the conditions in which our hominid forefathers had to survive, evolving to the point where they took on a corporal morphology that was adapted to walking on two legs and a brain that was increasingly capable of carrying out complex functions, different from those that were driven stubbornly by instinct. In these circumstances, a fear of the night was something that was rooted in our instinctive behaviour. When man developed sufficient intellectual capacity to take an objective view and to represent his anxieties figuratively and verbally through myths, he left the stamp of his desires, and his most profound fears too, on them with his representations of the gods.

Thus, in the ancient Greek myths that lie at the origin of our western culture, narrated in the *Theogony*, a long cosmogonic poem attributed to poet Hesiod, the Night is Nyx, emerged from Chaos and the sister of Erebus (the infernal shadows). Mother of Hypnos (Sleep), of Thanatos (Death), of Oneiros (Fantasy), of Eris (Discord), of Nemesis (Revenge), the Hesperides and Moira (Fate). In the heart of Chaos, Nyx lived with her brother Erebus. They gradually separated and while Erebus descended into the dark of the subterranean world, where the shadows reigned in the dwelling place of the dead, Nyx (the Night) is liberated. Finally, Nyx joined Erebus and lit up Aether (the bright sky) and Hemera (the Day).

What is striking about this mythical characterisation of the Night, is that it is initially presented as a divinity with a terrible character – the mere mention of which must have struck fear into the hearts of men because of the fact that that this was associated with what we most fear: death – before she become a mother that incestuously gives birth to her maximum antagonists: the luminous day and the bright sky. Hence, establishing an unbreakable family tie between them, the poet expressed the fact that day and night, light and dark, are inseparable in the natural order of things. In its later evolution, the culture forged by the Greeks ended up establishing a close bond of association whereby light was assimilated with good and knowledge, and darkness with evil and ignorance. Philosophical language soon reflected this: from “phos”, meaning light, came “phainestai”, to



appear, to manifest oneself, become visible; and from there, “phenomenon”, something that manifests itself, that becomes visible, that is a phenomenon. Thus, this association remains just as firmly rooted in our psyche and regularly shines through, even in colloquial language: for example, we commonly talk of “bright ideas”, of “dark intentions” and with use other similar expressions quite naturally.

I believe that all of this is driven, even today, by our forefathers’ fear of the night that millennia of evolution have not managed to eradicate. It has to be admitted: although we have recently started to colonise the night, our instinct continues to tell us that we are still strangers in the night. It should not be surprising. In the end, as I said at the beginning, our sense of sight, essential to guarantee our safety, is designed by evolution to be more efficient in conditions of daylight, which is when we engage in the activities that our survival depends on (especially seeking food). In the dark of the night, on the other hand, when we sleep and we do not need our vision, it is more efficient to have other senses (hearing and smell), which are better for warning us of the dangers that stalk us in the dark. It is an unquestioned fact that, with civilisation and the consequent decline in their use, because they are no longer essential for survival in our natural environment, we have lost the former sharpness of these other senses: we no longer smell or hear as efficiently as our forefathers, because we do not need these senses as much as they did. If our civilisation continues to illuminate the night sky, who knows whether the man of the future will end up losing much of his current night vision capacity....

Ever since fire was invented, man has always felt the need to light up the night. Around the protective flames, our forefathers learned to cook and to protect themselves from the cold and from the dangerous animals that lurked in the dark. This was the start of one of the first technological revolutions in history that helped to make the growth of the first human settlements possible. Lighting up the night was unquestionably progress. So what was wrong with spreading the use of artificial illumination during the night? While this was uncertain and the growth of human settlements and urban habitats was kept within reasonable limits, the use of lighting was not a problem for anybody. But after the industrial revolution, the accelerated growth of the population, the growing expansion of cities and the appearance of the big cities with more efficient lighting technology, based, first of all on gas and later on the incandescent bulb, started to change the situation. The humble and salutary light that to this point had helped to prolong the duration of human activities to a reasonable extent and to protect us from the dangers of the environment, started to become a danger for other inhabitants of this environment, the ones that, unlike us, need the darkness to survive. Light pollution had just been born, and has not ceased to grow and spread ever since.

Its expansion has been unstoppable ever since. First of all, in the big cities, where the growing population and the new economic and leisure demands generated a need to extend the scope of working activity to include the night, which together with the increase in law and order problems, lead first to the extensive spread of lighting and, then to an increase in the intensity of the lighting used. As a result of this, night started to imitate day in the cities. Later, towns and villages in the countryside, where the need for lighting was not as great as in the cities, also started to demand lighting because they felt discriminated against and because of a natural desire for promotion, so they also wanted the same kind of lighting systems. The coincidence of these factors with the financial interests of building companies, the manufacturers of the components of lighting systems, electricity companies and politicians who saw the chance to win votes by meeting the demands for more light, without considering its negative consequences, did the rest. Nobody saw anything wrong with this. After all, what is wrong with progress? Because that is what we are talking about aren't we? Progress. Some people did start to realise that, as time went by, they could no longer see as many stars as before, but very few were aware of the importance of this fact, and even fewer realised that what was really happening was that the night was in its last throws and its inhabitants were going into decline. Man, with his proverbial anthropocentric blindness, was thus modifying an essential aspect of our world: the alternating cycle of day and night. And, as usual, man did not have the slightest awareness of doing anything wrong. This total lack of awareness continues to be the norm.

For people for whom Astronomy is neither a profession nor a hobby, hearing about the phenomenon of light pollution for the first time comes as a surprise. It is not the subject of normal conversation. Nor is it an issue that is often covered in the media, except for when a district decides to change the lighting and announces that the new lighting “will not cause light pollution”, or when a regional government announces that they are going to introduce legislation dealing with this. Ecological groups do not protest against the installation of polluting lighting systems. In fact, it is a phenomenon that everybody living in cities lives with and very few people believe that it is very prejudicial. There is no wide spread awareness of just how serious the problem is, and this is also due to the aforementioned anthropocentric attitude of contemporary societies, among other causes. We tend to think that if something is good for us, it must be good for every living species on the planet. On the other hand, when somebody talks about the need to protect the night sky, people are even more perplexed: Protect the night sky? From what? What for?

We rarely stop to think that the night is necessary and good for life. Therefore, we do not realise that protecting the night sky is a valuable step to conserving bio-diversity. Most people think that, as we sleep at



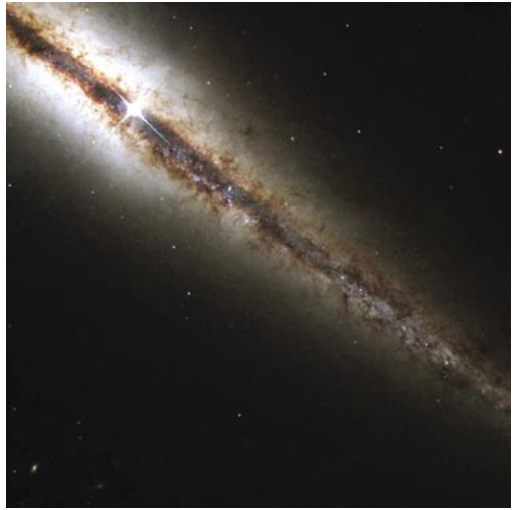
night, the rest of the species do the same, with a few exceptions, so it is of no concern if we send out a little light into the night time environment. A crass error. Naturalists know (and it would help if they said so more often) that the biological activity of our fauna is more intense at night than during the day and that this fauna needs the night for their normal activities. Many animals have sensory perception systems that have slowly adapted to the conditions of darkness of night life and they experience serious distortions when light is introduced in their dark environment. For example, some animals need the dark to find their way effectively; when the intensity of the ambient light rises above normal levels, it creates a distortion to their way of life. Those who are familiar with the effects of light pollution on the nocturnal fauna will be used to seeing the alteration that this causes to the activities of insects and birds that fly at night. But the man in the street could wonder: Is it worth worrying about a handful of pesky mosquitos or a few confused birds?

The answer is yes, because, to start with, and talking just of mosquitos, thousands of them perish every summer night around the lamps of the public lighting system (especially the mercury vapour lamps) of any city, and that is only the tip of the iceberg of negative effects of light pollution on insect populations. Most of them suffer these effects in a more subtle way: they are devoured by their natural predators when they are lit up without realising, or they cannot reproduce because they cannot find a mate, due to the “light barriers” between male and female. Insects account for two thirds of the animal protein on the whole planet and they are at the bottom of the food chain. If we alter the base, this will affect the entire chain. Moreover, many insects play an important role in the life of plants by favouring pollination, to quote the best known example. It is an undeniable fact that the biodiversity of the nocturnal flora and fauna is depleted if darkness is reduced in a natural nocturnal habitat. The best example of this can be seen in the areas around cities, which suffer the dispersion of city lighting more directly.

As for the birds, the first thing that should be pointed out is that they are not the only remaining victims, after insects: the list also includes amphibians, reptiles and mammals. In order not to turn this article into a treatise on nocturnal biology, the only thing that I will say on the subject is that, despite that fact that there is still much that we do not know about how light pollution distorts the natural cycle of these species, we can



summarise the effects of this distortion in a series of categories that are applicable to the different kinds of fauna. These are: a) orientation/disorientation problems b) the extension of diurnal behaviour to night time (artificial increase of crepuscular biological activity) c) attraction/rejection phenomena d) alteration of reproductive behaviour and e) alteration of predator/prey relations. There are enough proven cases in each of these different categories to show beyond doubt that this is probably a major phenomenon that will cause us surprises in the future. One final point on this subject:



very little, if anything is known about the modification of nocturnal biological activity in the sea. But the little knowledge that we have seems to indicate that the same process is taking place in the marine environment, because the level of ambient light in the sea is the factor that determines the ascent and descent of plankton. Illuminating beaches, harbours and sea front promenades modifies the opening times of the marine “restaurant”. These diners, of course, cannot resort to filling in a complaint form. Some mayors of coastal towns are proud of the fact that they have turned their beaches into an extension of their discotheques, without realising, or caring that their coastal waters hence become biologically barren lands.

We are not aware of the fact that living on a planet with a night as long as ours is quite exceptional in comparison with other places in the universe. For example, there would be practically no night in planetary systems with double or triple stars, because there would almost always be a star close by in the sky. A similar situation would occur if our solar system formed part of a globular cumulus consisting of hundreds of thousands of crowded stars. But this is not the case on Earth: the Sun is a single star and this fact, along with the 24 hour duration of the planet’s rotation, provides enough darkness for the Earth to absorb the heat it needs during the day and to loose this heat at night, at the distance the Earth is from the Sun, to the exact extent as to make it habitable. Our planet is an exceptional case in the sense that the appearance of life here seems to have been dependent upon a series of circumstances that have made it almost a miracle, and one of these circumstances is the existence of night as we know it here on Earth.

Let us take a quick look at our closest planetary companions and we will quickly see the privileges that we enjoy. If the Earth revolved at a slower rate, like Mercury for example, we would have nights that lasted 44 earth days, an average temperature of -170° . On Venus, we would have nights that lasted 123 earth days, with a “pleasant” average temperature of 475° due to the infernal greenhouse effect. Only on Mars would we find ourselves in a similar situation: a day that lasts 24 hours and 37 minutes and nights of varying duration, similar to ours, but the planet’s capacity to retain heat

is very low (average temperatures of -30° during a summer's day), because of the thin atmosphere. The obvious conclusion therefore, is that our planet really is the best of all possible worlds in the astronomic sense of the expression, because life would never have been able to appear as we know it and evolve to the point where it generates being like us, on any other of our neighbouring planets. So we should appreciate the night for what it is worth because we exist, in part, because of the night.

So far, I have tried to offer reasons for changing the natural tendency to ignore the importance of the night and for learning to value it. There remains one final reason, the definitive one: if we protect the night sky from light pollution, we are also protecting the planet and, in doing so, we are also helping to make our survival here possible. You already know why: the superfluous and irrational squandering of energy involved and its harmful environmental effects: the generation of greenhouse gases that produce acid rain and radioactive waste. I will not tire you by repeating the figures on reducing consumption and the consequent energy savings as you will all be well aware of them. I will just insist, without dramatising, on the fact that, in my opinion, since the alarming reports of the United Nations Inter-Governmental Panel on Climate Change were made public, energy saving has become vital for Mankind and squandering energy has become a crime against the planet.

The greenhouse effect is tremendously real and, for now, along with starvation and over-population, it is the greatest challenge that Mankind faces in the 21st century. Data on new environmental effects confirming this situation are building up day by day: gradual increase in temperature and sea level, the polar icecaps and glaciers are melting, fusion of permafrost, changes in submarine currents, migration of plants and animals to other latitudes, degradation of coral reefs because of the changing temperature and acidity of the seas. It is no longer possible to deny the evidence that climate change is in progress. The question lies in knowing if we will be capable of curbing it, and what measures will we be able to take to partially palliate its effects, but as this phenomenon is caused by the emission of gases from a growing consumption of fossil fuels, driven by increased economic development, it is obvious that we must accept the fact that the future solution will depend on extending the new concept of energy consumption, accompanied by re-defining the economic model that has been in force to date. In my opinion, we have to start thinking about shifting from a consumer predation economy based on unbridled competition, to an economy based on co-operation, built on the foundation of preserving the planet's natural resources and an equitable distribution of these resources.

We all know that the energy consumed by outside lighting is only a small part of the greenhouse effect, and that transport, for instance, has a far large impact on this problem, but this does not exempt anybody from the commitment to make a contribution, however small, to reducing the dimension of a problem that seriously mortgages the future of our children and grandchildren. We should not forget that many grains of sand make a sand dune, and many more, a mountain, which means that if we realise that changing these things lies in our hands, the sum of everybody's efforts can undoubtedly manage it. We face the enormous task of driving a profound change in the current concept of outside lighting, which will require a large dose of persuasion and education. At least

we will all now benefit from the advantages provided by the international guidelines to reduce emissions of the Kyoto Protocol, and the environmental standards of the European Union. The laudable objectives of this conference set the example to be followed.

So it would seem that we are finally moving forward decidedly in the right direction: the path that leads to protecting the night skies definitively, which in the end implicitly implies the recognition of its natural, scientific and cultural value. And this means that we will protect the essential element of the nightscape: the star-studded sky, that grandiose and moving spectacle of nature that all our forefathers have observed, but which millions of inhabitants of this planet can regrettably no longer see. It should not only be conserved for us; it should also be conserved for those who come after us. We must remember that the Earth is most certainly not a legacy that we have inherited from our fathers; it is a loan from our children, so no human generation has the right to waste this precious universal heritage that is our planetary home. I will conclude by confessing that this conference has a special meaning for me: exactly fifteen years ago, when I was on this lovely island for the first time, I decided to embark on my own personal fight against light pollution, to avoid the bitter pill of having to regret not having done anything to save the night sky in the future. When I see you all here, sharing these same ideals so enthusiastically, I know that we will achieve it.



A beautiful view of starry sky from Mauna Kea Observatory (Hawaii). On the horizon, the lava lights up the steam giving an orange glow. Photograph courtesy of Richard Wainscoat.