

On Light Pollution, Passive Pleasures, and the Instrumental Value of Beauty

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Abstract: The night sky is a unique and exquisitely valuable cultural asset that is being lost to humanity. Light pollution obscures the heavens, interferes with wildlife, and wastes billions of dollars in energy annually. Light pollution can be easily mitigated, but unfortunately, it has gone largely unnoticed as a preventable environmental problem. This paper examines light pollution as well as the value of the night sky. The paper focuses on society's disregard for the loss of a cultural asset that has been a part of art, science, and culture for as long as these things have existed. It argues that the blame lies largely in an inability to articulate adequately the value of natural beauty. It is further argued that such beauty has instrumental value, and the explicit recognition of this value is an important step toward preserving the night sky and other objects of natural beauty.

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Of all the phaenomena of nature, the celestial appearances are, by their greatness and beauty, the most universal objects of the curiosity of mankind.

— Adam Smith

The heavens are, as Adam Smith suggested, synonymous with greatness, beauty and wonder. Paradoxically, they are being lost to mankind. Equally curious, this needless degradation of a superlative resource is largely ignored by economists. This paper surveys damages from light pollution and examines why humanity's lost view of the

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cosmos sparks more indifference than outrage. The loss of the night sky is placed in the broader context of society's difficulty in fully articulating non-consumptive values such as natural beauty.

Artificial light blinds as well as reveals, clutters as well as accents, and obstructs as well as displays. The unintended consequences of poorly designed and injudiciously used artificial lighting are known as light pollution. Many of us are blinded to the fact that we are severely damaging the darker half of our shared time on this planet. It is as if we believe Nature is on pause between sunset and sunrise. Yet, the truth is that the night is full of life, and activity, and beauty, and all of it is increasingly threatened by light pollution. Accordingly, architects, astronomers, biologists, and others have been concerned with light pollution for years. Economists, however, have largely ignored this issue.

In this paper, we examine light pollution's effects and place this "externality" in context by discussing the cultural significance of the night sky and examining why economists, and non-economists alike, have paid insufficient attention to the tragic loss of the night. We begin with a brief overview of light pollution issues. Next, we examine the value of the night sky and then show that its loss is not instrumentally warranted by the benefits of artificial lighting. After this overview of light pollution and the value of the night, we change our trajectory a bit and examine what is really a second, complementary theme of this paper, namely the crucial and undervalued role of passive pleasures in promoting social welfare. We argue that the difficulty of valuing passive pleasures helps explain the striking ambivalence toward the loss of the night. Specifically, the passive enjoyment of beauty is fundamental to the value of dark skies, and prevailing economic doctrines make it difficult to appreciate and articulate the importance of beauty and other passive pleasures. To correct this problem, we highlight the instrumental value of beauty by surveying writers who have emphasized the critical and inspirational role beauty plays in society. The paper's conclusion argues that emphasizing the instrumental value of beauty can both address light pollution and correct the enabling shortcomings of economic theory.

Damages from Light Pollution

Like other pollutants, the damage from light pollution ranges from being a nuisance to threatening human health. For example, in Britain, 80% of local councils have received complaints about the nuisance of light trespassing from neighboring homes and businesses (Borg 1996, 56). Similarly, the majority of people in developed countries now reside under an opaque blanket of sky glow that conceals the heavens from astronomers and sky gazers (Cinzano, Falchi and Elvidge 2001a). Light pollution is associated with increased cancer rates in developed countries, presumably through its affect on melatonin production (Kerenyi, Pandula and Feuer 1990; Davis, Mirick and Stevens 2001).

Light pollution and air pollution are complementary problems that exacerbate each other. The degree of sky glow depends on the level of artificial light and how this light is scattered by small particles in the atmosphere. This scattering effect can be

caused by naturally occurring levels of humidity and dust, but it is made worse by aerosols from artificial sources. Also, energy used for lighting – including light pollution – contributes significantly to air pollution. A rough estimate shows that light pollution in the United States wastes \$6.9 billion worth of energy per year, generating 66 million metric tons of CO₂ (Gallaway, Olsen and Mitchell 2009).

Wildlife and Environmental Effects

F. J. Verheijen (1985, 1) suggests using the term “photopollution” for the adverse effects of artificial light on wildlife. These effects are widespread and harm everything from plants to invertebrates to mammals and birds; light pollution can interfere with feeding, growth, reproduction, and migration (see, e.g., Rich and Longcore 2006). For example, experimental evidence suggests some nocturnally migrating birds use stellar navigation. While the precise nature of their orienting ability is uncertain, many birds suffer from misorientation (heading in the wrong direction) and disorientation (a general lack of direction) as a result of artificial light. Decades ago, it was estimated that TV towers topped with warning lights kill over a million birds a year in the United States (Verheijen 1985, 3).

Sea turtles, including endangered species, are also affected by light pollution. Loggerheads, for example, usually emerge from their nests at night then crawl to the sea. This seafinding ability is highly accurate in dark, remote locations. Beachfront development, however, is an increasing problem. Hatchlings scurrying to the sea often become misoriented and disoriented from nearby lights. It is widely believed this is a result of positive phototaxis (instinctual locomotion toward light). Alternatively, hatchlings may discriminate between the low, flat view toward the sea and the high, uneven silhouette of inland dunes. The highly directional and uneven nature of artificial light blinds turtles to these subtle clues (Salmon and Witherington 1995; Salmon, Tolbert, et al. 1995). Whatever the causal chain, the effect is that turtles unable to find the sea die from a variety of factors such as cars and predators.¹

Aesthetic Losses

Aesthetic damages are, perhaps, the largest costs of light pollution. Economists have studied how air pollution reduces the visibility of scenic assets. For a single scenic asset, such as the Grand Canyon, estimated damages total several billion dollars annually, though it is accessible to comparatively few people (Shulze et al. 1983; Rowe and Chestnut 1983). Significantly, the majority of people in developed countries have lost the ability to see most of the seemingly innumerable stars visible from a dark location (Cinzano, Falchi and Elvidge 2001a). Of these stars, perhaps only 5 or 10% are bright enough to shine through the glow of suburban settings. Many people enjoy seeing Orion’s belt, even from some cities. Yet the urban dweller who realizes these stars are brighter than over 98% of the stars visible under dark skies might feel cheated. The appeal of dark skies, however, is not simply the ability to see 10, 20, or 50 times the number of individual stars. Many other objects, once visible to the naked

eye, are obscured by sky glow. These include the Andromeda galaxy, meteors, comets, the Milky Way, and star clusters such as the double cluster in Perseus.

The Extent and Mitigation of Light Pollution

Significantly, light pollution hides the night sky from rural as well as urban observers. Rural sources of light pollution are supplemented by light encroaching from the cities. It is not unusual to notice a city's glow from 100 or even 200 miles away. Astronomers have a formal model, known as Walker's Law, to estimate the extent of this interference (Walker 1977). The model estimates the increase in the sky's natural glow when looking at the sky 45 degrees above the horizon in the direction of the pollution's source. A city of 1.5 million people could increase sky glow by 25% for a location over 50 miles away. Small towns of 30,000 people can increase sky glow by the same amount from over 10 miles. This pollution is significantly more obtrusive closer to the horizon and can be made worse by dust, air pollution, and clouds. For these reasons, it is hard to find a place, even in the American West, unaffected by light pollution (Cinzano, Falchi and Elvidge 2001b; Gallaway, Olsen and Mitchell 2009).

Paradoxically, light pollution is inexpensively corrected if individuals and communities become aware of the social costs of lighting and stop treating the night as an open access resource. Simply turning off lights is a start. For example, communities across the United States have passed ordinances restricting the hours for park and stadium lighting. Security lights can be hooked up to timers or motion detectors, and lights used on billboards and store displays can be switched off during hours when few people are out. Such intermittent lighting reduces the light trapping of birds (Verheijen 1985, 13). Better exterior lighting design also helps. Astronomers object to uplighting, often used to illuminate billboards and buildings, because it is such a blatant source of sky glow. Instead, lighting an object from above is recommended as more sky and bird friendly (Verheijen 1985, 14). Full cutoff light fixtures, which allow no light to shine above the horizontal plane running through the fixture's lowest point, also greatly reduce light pollution. Low-pressure sodium street lamps are highly energy efficient and are favored by astronomers because their monochromatic light is easily filtered by observatories, and does not overlap with the most important wavelengths that astronomers observe.² The yellow light from these lamps also repels loggerhead hatchlings (Witherington and Bjorndal 1991).

Celestial Appearances

Values Embodied by the Night Sky

John Kenneth Galbraith once bitingly defined a conservationist as "a man who concerns himself with the beauties of nature in roughly inverse proportion to the number of people who can enjoy them" (Galbraith 1958, 92). The seemingly unwarranted and odd ambivalence toward light pollution is consistent with this

observation. Nevertheless, the irony and significance of Galbraith's thesis rests heavily on the premise that what is being lost is indeed valuable. Accordingly, this section of this paper argues that the night sky is exquisitely and uniquely valuable. While this claim may seem a bit subjective, the approach taken is to argue that the night sky demonstrably embodies many characteristics routinely identified as valued by society. These characteristics include scientific value, historical value, cultural value, recreational value, beauty, and inspirational or spiritual value. To be clear, this digression into the night sky's value illustrates humanity's loss from "proceeding to envelop itself in a luminous fog" (Cinzano, Falchi and Elvidge 2001b, 689). Furthermore, it is necessary because the lack of concern is curious in proportion to the value of dark skies.³

Adam Smith's essay on the History of Astronomy, for example, points to the heavens' historical use as a tool and a scientific resource. The heavens are among humanity's earliest tools. The night sky has long been used to indicate cardinal directions and an observer's latitude. Calypso, for example, instructed Odysseus to keep the Great Bear on his left. We recognize the reference to the Big Dipper, and understand she told him to head due east using stellar navigation. Similarly, for innumerable cultures, stars have been used to track the time of night and the seasons.⁴ "Few people now spend much time out of doors at night," argued Thomas Kuhn, "and, when they do, their view of the heavens is frequently obscured by tall buildings and street lighting. . . . But in antiquity the stars were an immediate part of the normal man's environment, and celestial bodies served a universal function as time reckoners and calendar keepers" (Kuhn [1957] 1985, 13). Early mathematics, such as that developed in Babylonia, coevolved with the study of the heavens – astronomy prompted mathematical developments that, in turn, allowed for better astronomy. The explanation of our seemingly odd duodecimal and sexagesimal measures of time, geography, and geometry are found in the heavens (Aveni 2002, 81).⁵ Indeed, a good part of the history of math and science around the world can be linked to the study of the heavens – monitoring the seasons, tracking Venus, predicting eclipses, and the like. From these ancient and widespread concerns, a process of discovery has evolved that continues today (cf. Smith [1758] 1980).

The night sky is somewhat like a museum of cultural and natural history. Those who care to can see the same planets, constellations, and asterisms that have been enjoyed for countless generations. With a small telescope, one can also see remnants of historic events such as the supernova of 1054. This "new star" was visible even in daylight and was recorded by Chinese, Arabic, and perhaps Anasazi observers, yet famously missed by Europe whose views of the heavens were filtered by the ideas of Plato and the Church and thereby, it is frequently argued, saw only an unchanging universe. With the same telescope, people can witness for themselves the revolutionary findings of Galileo – Jupiter's moons, Saturn's rings, lunar mountains, and Venus' phases. People often value extrema – the tallest tree, the smallest bird species, the fastest land animal. Accordingly, the night sky has its own extrema, including the most distant object visible to the naked eye, the Andromeda galaxy. At roughly 2.5 million light years distant, viewing this object allows us to peer across not just vast distances but back to a time before humanity existed.

Nature and culture are intertwined. Consider the importance of Mt. Fuji in Japan or the land bordered by the Navajo's Four Sacred Mountains in the American Southwest, or Egypt's Nile River. While it may be difficult for one to visit Mt. Fuji, we can enjoy seeing Japan's Subaru – our Pleiades and the Navajo's *Dilyéhé*. Indeed, asterisms, such as the Pleiades and Orion's belt, are culturally significant to many different peoples. The heavens have cultural-symbolic value that transcends regions and time (cf. Rolston 1988, 15). The attached significance may be culturally variable, but the objects themselves are shared. These common objects of disparate symbologies create opportunities for cross-cultural appreciation and comparison. As Smith points out, celestial objects are universal in their appeal. Indeed, the cross-cultural significance of the heavens has a long history; the very nomenclature of stars and constellations reflects Greek, Arabic, Dutch, Mesopotamian, and other influences.

Like other natural resources, the night sky also has great recreational value. Stargazing is not just the purview of lovers and poets. Stargazing and amateur astronomy are enjoyed all around the world. Accordingly, there are the accompanying magazines, equipment manufacturers, retailers, clubs, conventions (known as star parties), and even specialized bed and breakfasts.

Though commonly recognized, it is prudent to mention that Smith's celestial appearances are widely considered exquisitely beautiful. A shooting star, the crescent moon, and the aurora are each singular in their beauty. Likewise, a starry nightscape is beautiful and visible on any night, save for clouds and light pollution. We argue below that the relative difficulty in articulating the importance of beauty is a major factor contributing to the degradation of objects of natural beauty such as the night sky.

Finally, the night sky has inspirational and spiritual value. While these values may be even more nebulous and idiosyncratically personal than aesthetic values, it would be difficult to find a more universal object of inspiration and spiritual import than the heavens. The heavens' grandeur and mystery account for part of their spiritual weight. However, the rhythms of the heavens are also seen as a metaphor for life and death. There are day and night and the seasons, whose timing is heralded and progress monitored by the heliacal rising of various stars or asterisms. The birth of spring, flourishing of summer, decline of autumn, death of winter, and rebirth around the next vernal equinox are widely and anciently observed. This universal symbolism lends itself, for example, to Christianity's Easter celebration. The weighty metaphor is given additional import by the very real annual life cycles of a vast array of plant and animal species as well as the annual economic activity of sowing and harvesting. And for all of this, all around the world, the night sky has served as a herald and guide (Krupp 1994). In short, the night sky is associated with a wide range of values and has a unique position in society's various histories and cultures.

An Instrumental Evaluation of the Heavens

Even granting that the night sky is a valuable and unique resource, one might argue that the night's value is, nevertheless, less than that of such things as

streetlights, security lights, and illuminated billboards. A taxonomy of values does not address this argument. A way of ordinal ranking these values is needed. In evaluating the relative merits of dark skies and artificial lighting, there are two important questions. The first asks how society ranks their relative merits; the second is explicitly normative: how should society rank these merits? On the first question, the empirical evidence certainly suggests society favors light over night. We argue later that circumstance prevents society from making such a considered, explicit decision. For now, however, we concede the point and jump right to the stickier issue of whether society ought to give greater preference to dark skies.

The conventional approach avoids scrutiny of motivations and competitive-market outcomes. Mises, for example, argued all ends are equally legitimate (Hickerson 1988, 176). With such a presumption, it is no surprise that the loss of the night from wasteful, harmful lighting is not scrutinized more closely. In neoclassical economics, “[n]othing . . . that carries a positive price tag . . . can be classified as wasteful production” (Hickerson 1988, 185). While this may be overstating the case a bit, it does point to a fundamental bias – the presumption that society ought to accept market judgments. That is, the market itself is the *de facto* criteria for evaluating social choices. By contrast, institutionalists use an external set of criteria to evaluate the performance of markets and other institutions. “We use the instrumental criteria to judge the adequacy of institutions, we do not use institutions [e.g., the market] themselves as the criteria” (Larkin 1986, 49).

Institutionalist value theory is rooted in the Veblenian distinction between things that are instrumental and those that are ceremonial. Thorstein Veblen identified certain propensities, or “instincts” that tended to either promote or hinder human progress. His instrumental instincts add to “the fullness of life and the continuity of culture and are, therefore, to be encouraged” (Hickerson 1988, 177; Tool 1977). “In clear contradistinction to these proclivities, however, are those that threaten to obstruct and perhaps even destroy that continuity” (Hickerson 1988, 177). Building on Veblen and Fagg Foster, Marc Tool articulated his well-known social-value principal, which “provides for the continuity of human life and the noninvidious re-creation of community through the instrumental use of knowledge” (1979, 293).

Instrumental value theory is useful for evaluating how society utilizes artificial lighting. Instrumental efficiency, a corollary to Tool’s social value principal, is used to evaluate “the level, character and distribution of production” (1979, 301). It requires that production be used for “inclusive human and humane purposes” and focuses on “the appropriateness of means or tools used in achieving ends or results,” specifically asking if the desired results were achieved and the consequences compatible with instrumental value theory (1979, 301-2). On all these counts, the present level and methods of artificial lighting are unwarranted.

Indeed, if the continuity of human life is to mean something more than perpetual breeding, then there is a strong case for preserving easy access to a cultural asset that has been a part of art, math, science, and culture for as long as these things have existed. Moreover, the night sky is an inclusive, community-building good. In

the absence of light pollution, it is exceptionally non-invidious. Nightscapes are freely available to virtually all people.⁶ By contrast, night lighting typically relies on inappropriate means. Artificial lighting is commonly poorly directed, poorly placed, or poorly timed. Such lighting does little or nothing to enhance visibility or safety; it is waste that prevents hundreds of millions of people from seeing an important part of their shared history, converting a public good into one available only to those fortunate to live under dark skies or with income sufficient to travel to remote locations.

Crucially, dark sky advocates emphasize improving lighting, not eliminating it. That is, it is frequently possible to simultaneously improve visibility and reduce light pollution with better lighting design. Often, the compulsion for more lights reflects habits of thought rather than facts. While this propensity is a good fit with the “more is better” convention of industrial society, little thought is given to what is lost or to verifying supposed gains. For example, constant lighting often does little to deter crime, and people tend to overlook the fact that the human eye is better able to adjust to lighting that is uniformly dim than it is to see objects or people hidden in the stark shadows created by bright lights. Similarly, commercial lighting is often a ceremonial zero-sum race to attract consumers’ attention with more and more garishly lit signs (Galbraith [1967] 1985, 425-6).⁷ For these reasons, the tradeoff between night and light is instrumentally inefficient and incompatible with the social-value principal. We turn next to the issue of why the night sky is so casually obscured by light pollution.

Questioning the Night Sky’s Value

One might use the diamond-water paradox to deny the night sky’s exceptional value. Perhaps diminishing marginal utility explains the widespread ambivalence toward the heavens. While this is plausible, the heavens have too much nightly variability for the boredom of familiarity to explain everything. Certainly, the stars visible from night to night change very slowly over the course of a year. However, the subjective experience of a nightly observer is dominated and altered by the moon’s phases as well as its nightly and monthly changes in position. A full moon may be beautiful, but makes it difficult to see fainter spectacles ranging from chance occurrences of the aurora to a seasonally favorable apparition of the zodiacal light. Add to this conjunctions, comets, annual meteor showers, random shooting stars, and eclipses, and there is a continual supply of novelty. In the heavens we find predictability coupled with spontaneity, and timeless constancy coupled with surprise (cf. Rolston 1988, 19-22).

Moreover, the diminishing marginal utility argument does not explain the night sky’s popularity in such places where clear, dark skies are relatively common. When people can see dark skies, there has been a pervasive and widespread interest in the heavens throughout history and across the globe. This anecdotal counterpoint to diminishing marginal utility is more consistent with Tibor Scitovsky (1976) who reminds us that familiarity can breed enjoyment rather than contempt. Indeed, we

argue below that the *lack* of experience with dark skies is a key explanation for their being undervalued.

Another possible explanation for light pollution's tacit acceptance is that the night sky is not really lost. The crux of many classic environmental problems, such as extinction, is irreversibility. This is not the case with light pollution. A temporary blackout or a permanent switch to cleaner technology is sufficient to restore the night to most of its aboriginal glory. In that sense, it is comforting that this resource is not facing permanent destruction. Nevertheless, the ongoing loss of dark skies is a concern for two reasons. First, the fact that we do not have to be overly worried about the discounted costs of light pollution n generations into the future does not preclude the fact that there are substantial costs incurred today. As mentioned above, these costs include wasted energy, ecological concerns, and the loss of utility of those who would otherwise enjoy the heavens.

Moreover, there is likely a significant level of path dependency when it comes to the loss of the night sky. That is, with the night sky, irreversibility is a function of culture. Simply put, those who have never seen a night sky ablaze with stars will lack sufficient information to judge the magnitude of their loss. Those who have never seen the Milky Way clear and distinct and the Sagittarius Star Cloud almost flamboyantly luminescent are not likely to regret their concealment. In contrast, many astronomers and other dark sky advocates grew up enjoying nightscapes. Unlike other forms of pollution, the rising level of light pollution does not lead to calls for its amelioration. Instead, there is a growing level of acquiescence, as "[t]he subjective mental constructs of the participants will evolve an ideology that not only rationalizes the society's structure but accounts for its poor performance" (North 1990, 99).

Beauty and Wonder: Why We Overlook the Dark

So far we have argued that light pollution is a common problem, fixing it is cost-effective, and dark skies are considerably valuable and instrumentally worth preserving. Arguments minimizing the value of dark skies have been considered and rejected. This leads one to wonder what accounts for such systemic irrationality. Shouldn't the market, or the political system for that matter, fix serious problems if reasonable solutions are available? If dark skies are to be successfully protected and restored, we must address why the loss of the night has been largely unnoticed by economists and the general population.⁸ We argue, below, that the issue rests on understanding the importance of the passive enjoyment of natural beauty. Accordingly, this section of the paper evaluates our capacities for being receptive to the enjoyment of beauty by briefly surveying mainstream, institutionalist, and ecological economics. We argue that that they all do a poor job addressing the importance of passive pleasures and beauty. Next, we turn to individuals who have addressed these issues specifically. We draw on their ideas to highlight the instrumental value of beauty.

Some Limitations of Economic Theories

Institutional and neoclassical economics both handle passivity poorly. Certainly, both approaches are flexible, but at heart they are geared toward more dynamic concerns and tend to overlook the importance of passive pleasures. Both paradigms do a poor job articulating the importance of simply preserving and passively enjoying natural beauty. This bias reflects industrial society itself – a production/consumption juggernaut where capital is best understood as a social process “using material things as moments in its continuously dynamic existence” (Heilbroner 1985, 36-37). Neoclassical economics is fundamentally about the activities of production and exchange. As for institutionalists, the icon of instrumental value theory is the engineer, not the aesthete. While we would not want to make too strong of a point here, preservation is substantially past-oriented – the quintessential kind of activity institutionalists label as ceremonial. That is, with ceremonial values “their principal function is not that of getting things done but rather that of preventing change” (Ayers 1961, 126).

Ecological economics has a similar dynamic bias, given its emphasis on entropy, throughput, and the ecosystem’s life-support services. Consider Herman Daly ([1977] 1991, 49-251), who laments the under appreciation of natural capital while himself emphasizing only that part of it that actively supports life or the economy – not that which is inspiring or beautiful.

Daly (1993) also overlooks the value of nature *as it exists*. For example, he argues throughput must “first be accumulated into a stock of artifacts” before yielding service (326-7). Likewise, he states that psychic income comes from stock, which he defines as “the total inventory of producers’ goods, consumers’ goods, and human bodies” (Daly [1977] 1991, 35). His focus on the entropic costs of material transformation leads him to overlook the importance of scenic stock, like the Grand Canyon or Delicate Arch, which needs preservation, not creation and accumulation. He also overlooks natural fluxes, such as the light from sunsets or a starry sky, that yield service directly.⁹ Daly does not deny the importance of scenic stocks or their passive enjoyment. More subtly, he tends to overlook them because of a methodological bias focusing on action – a bias shared by institutionalists and neoclassical economists.

This shared propensity to overlook passive values has its complement in a propensity to disregard the importance of beauty. The economic literature on the role of beauty *per se* (and we’re not talking about labor markets here) is disappointingly scarce. Certainly, *beauty* is a challengingly idiosyncratic concept. More importantly, however, many of the best examples of beauty come from nature and require preservation rather than production. Their enjoyment requires being receptive rather than consumptive. That is, the enjoyment of beauty is an example of a passive pleasure that tends to be disregarded by economic theory. The limits of economic theory contribute to a broader imbalance as society finds some values easier to articulate and act upon than others.

For example, even dark sky advocates emphasize the cost-saving potential of reducing light pollution. This, rather than natural heritage and aesthetics, is the

“economic” consideration deemed most likely to convince lawmakers. Yet changing technology and the income effect from cost savings threatens to muddle the picture. At some point the link between more efficient lighting, lower costs, and reduced light pollution may start to weaken. Moreover, utility bills do not well reflect what is culturally special about dark skies – the beauty that is the night’s true comparative advantage. It is hard to imagine, therefore, a long-term solution to light pollution that does not explicitly recognize the fundamental role natural beauty plays in social welfare.

Augmenting Instrumental Value Theory

To explain society’s propensity to disregard light pollution, we have argued that conventional wisdom, stemming from multiple economic doctrines, tends to overlook the importance of passive pleasures, in general, and of beauty, in particular. Now we try to correct this bias by turning to authors who have emphasized their importance. One of the keenest pleasures the night offers is the passive enjoyment of the beauty of the cosmos. This particular good has little to do with building, acting, producing, consuming, or problem solving. It comes from the challenging task of being receptive to what already exists. Accordingly, we need an explicit examination of the importance of beauty to society.

It would be useful to have an extension of instrumental value theory that addresses passive pursuits and the role of beauty. James Swaney has taken a step in this direction by adding, essentially, Aldo Leopold’s Land Ethic to Tool’s instrumental value theory (Swaney 1987). The Land Ethic does refer to beauty: “A thing is right when it tends to preserve the integrity, stability, and beauty of the biotic community. It is wrong when it tends otherwise” (Leopold [1949] 1989, 224-225). However, both Swaney and Leopold were primarily concerned with the biotic community.¹⁰ Yet, what about the beauty of the physical environment, what of landscapes and nightscapes? Even for these less utilitarian, more passive concerns, it seems possible to outline criteria that are consistent with instrumental value theory.

While rarely examined by economists, the idea that beauty is crucial to individuals and society is not entirely alien, especially if one takes a pluralistic, expansive view of what it is to be human.¹¹ That is, beauty is a fundamental part of “the fullness of human life” mentioned earlier. Nevertheless, the writings of John Stuart Mill, Adam Smith, the essayist Edward Abbey, and others help bring the crucial role of beauty into sharper focus. Let’s see whether the myopia of economic theory can be corrected by looking through the eyes of those who have thought extensively about precisely these issues.

Mill, when he was young and suffering from depression, worried that a high level of material progress would fail to guarantee human happiness because, he realized, such happiness often springs from struggle and anticipation. He suspected that, compared to action and accumulation, beauty and passive pleasures might be more permanent sources of happiness. He argued that “passive susceptibilities needed to be cultivated as well as the active capacities,” and concluded that “a due

balance among the faculties” was crucial for happiness (Mill [1873] 1961, 88-89). It is this due balance that is missing from economic theory and society’s ability to articulate values.

After a long struggle, Mill was rescued from depression by reading Wordsworth, who appealed to him because of their shared love of natural beauty and because Wordsworth’s poems “expressed not mere outward beauty, but states of feeling, and of thought coloured by feeling, under the excitement of beauty” (Mill [1873] 1961, 91). These poems exemplified a sustainable source of happiness for which Mill was looking. “In them,” wrote Mill, “I seemed to draw from a sense of inward joy, of sympathetic and imaginative pleasure, which could be shared in by all human beings; which had no connexion with struggle or imperfection, but would be made richer by every improvement in the physical or social condition of mankind” ([1873] 1961, 91).

In short, Mill was looking for a “perennial source of happiness when all the greater evils of life shall have been removed” ([1873] 1961, 91). Unlike orthodox economists who emphasize the value of commodities or institutionalists who emphasize the value of problem solving, Mill saw enduring potential in beauty and passive susceptibilities. Keynes made similar arguments. In speculating on humanity’s growing affluence forcing society to address our “permanent problem” of occupying leisure and determining how best to “live wisely and agreeably, and well,” Keynes argued the task will be difficult and frightening because “we have been trained too long to strive and not to enjoy” (Keynes 1932, 367-8; cf. Galbraith [1967] 1985, 496).

Beauty has a fundamental, instrumental role in inspiring individuals and allowing them to develop Mill’s “internal culture of the individual.” These internal strategies for pursuing happiness, are precisely the ones devalued by economic theory and popular culture, in favor of external strategies like obtaining commodities or status. Unfortunately, the opportunity cost of external strategies is high. Psychological research shows that internal strategies are more effective and lead to more enduring results (Kasser 2002). At the same time, external strategies are not ecologically sustainable on a global scale. Economists like Robert Heilbroner have suggested a shift toward internal pursuits might be society’s best hope, speculating that a post industrial society may “turn in the direction of many pre-industrial societies – toward the exploration of inner states of experience rather than the outer world of fact and material accomplishment” ([1974] 1991, 166). Indeed, the malaise of affluence suggested by Mill and the concerns raised by Heilbroner, Daly and many others regarding capitalism’s ecological unsustainability suggest that natural beauty is increasingly important and therefore needs to be protected all the more aggressively.

Edward Abbey also offers important insights on the role of beauty. When discussing the beauty of Delicate Arch in Arches National Monument, Abbey argued that “[i]f Delicate Arch has any significance it lies, I will venture, in the power of the odd and unexpected to startle the senses and surprise the mind out of their ruts of habit, to compel us into a reawakened awareness of the wonderful – that which is full of wonder” (1971, 41). That is, natural beauty can serve the instrumental function of jarring us from our past-binding habits of thought and convention. There is a bit of Tool’s instrumental concept of *continuity* in Abbey’s writing. It is the continuity of

humanity and nature, of civilization and natural history. “A weird, lovely, fantastic object out of nature like Delicate Arch,” Abbey goes on to write, “has the curious ability to remind us – like rock and sunlight and wind and wilderness – that *out there* is a different world, older and greater and deeper by far than ours, a world which surrounds and sustains the little world of men as the sea and sky surround and sustain a ship” (1971, 41-42).

Interestingly, this passage from Abbey is reminiscent of Adam Smith’s essay on the role of wonder in *The History of Astronomy*. Smith ([1758] 1980) starts by distinguishing between wonder, surprise, and admiration. Wonder, he argues, is a reaction to something “new or singular” (33). “We wonder at the extraordinary and uncommon objects, at the rare phaenomena of nature, at meteors, comets, eclipses . . .” (33). Surprise is a reaction to the unexpected and admiration is what we feel toward that which is “great or beautiful” (33). Certainly there is a bit of wiggle room in how these terms are used. Abbey, for examples, talks about both *wonder* and *surprise* while being consistent with Smith’s *admiration*.

Smith concedes this imprecision but uses his taxonomy to focus on the importance of wonder in the evolution of philosophy (broadly defined) and science ([1758] 1980, 33-34). We try to make sense of singular things by making connections and placing them in the context of more familiar things.¹² Significantly, wonder is not Smith’s only explanation for intellectual inquiry (5, 9).¹³ He argued, for example, that the beauty of celestial appearances sparks universal curiosity, and observed that early astronomers (misguidedly) favored models whose beauty reflected that of the cosmos.

Abbey and Smith are both consistent with Mill’s passive susceptibilities. For all three, natural beauty can excite thought and wonder. Smith outlined how this has led to cultural and scientific advance. Additionally, scenic stock promotes social welfare by facilitating internal growth by promoting contemplation, awe, and humility. In short, scenic stocks, generally, and the night sky, in particular, are crucial in the evolution of society.

As an extension to instrumental value theory, the land ethic should be about more than simply acknowledging the way human consumption depends on a wide range of ecosystemic services. Tool, Daly, Leopold and, by extension, Swaney, all mention beauty only to go on to build their arguments on more concrete, active concerns such as life-support services. It is, perhaps, easier to intuit than to articulate the importance of beauty. Nature supports the recreation of community not just with food, carbon cycling, and medicinal compounds. It also provides the impetus and inspiration for contemplation and discovery. This inspirational role is precisely the instrumental value of beauty. “The hands have evolved for grasping natural things,” quips the environmental ethicist Holmes Rolston, “but so has the brain . . .” (Rolston 1988, 22). He goes on to observe that “nature is the most fundamental foil and foundation for the mind” and further argues that nature is similarly fundamental to the evolution of culture (Rolston 1988, 22).

Taken together, Smith, Abbey, Mill and Rolston are a good fit with what Hickerson says about instrumental value theory: “Humans, in effect, build culture

through a trial and error process of intellectual adaptation to their environment. . . . The continuity of this culture-building process,” he goes on to say “and the consequential valuing central to that process is seen as the locus and source of value” (Hickerson 1988, 182). Hickerson and Rolston were both emphasizing the challenges presented by nature. However, nature inspires as well as challenges. The push of climate, hunger, and countless dangers have their counterpart in the pull of beauty, grandeur, marvel, and the many other positive, overlapping, aspects of nature (cf. McCormick 1986, 85). Among the reasons natural beauty is to be valued is that, in the evolution of our various cultures, beauty has always been fundamental to the continuity of human life, the re-creation of community, and the accumulation and use of knowledge.

Conclusion

Light pollution is a serious, yet preventable, problem that wastes energy while doing substantial harm to wildlife and to human health and welfare. By washing out the night sky, it also seriously degrades an unsurpassed cultural asset. Like the supernova of 1054, this loss of the night sky has gone largely unnoticed. In both cases, the prevailing mindsets are largely the explanation. In the former case, Europeans were blinded by an ecclesiastical and Aristotelian belief in an unchanging universe. In the latter case, economists, and those influenced by the conventional wisdom, are blinded by a strong propensity to think utility must come from the consumption of commodities rather than from being passively receptive to existing goods needing only conservation. The importance of natural beauty to individual wellbeing and the recreation of community is poorly articulated and inadequately understood. Consequently, our ability to preserve objects of great natural beauty has atrophied. To avoid abandoning aesthetic judgments to pecuniary cannons of taste and industrial expedience, economists and others, need to place greater emphasis on the crucial role natural beauty plays in society.

The problem, of course, is that things like contemplation and beauty are not as straightforward as the production of commodities. The market can coordinate work done by man, beast, and machine into the production of commodities, and the progress made in this regard can be quantified, scrutinized, and reproduced. The same cannot be said about Mill's prescription. It is possible to make a coordinated effort to promote contemplation and beauty, but it would be a difficult task, approachable only indirectly, and progress would be hard to measure. More cars, more computers, more microwavable food, these desires are readily conveyed and acted upon. Objects, products, and services lend themselves to action. Subjective states of being and feeling, however, are inherently idiosyncratic. Their articulation and coordination is difficult and imprecise. It is *easier* to concentrate on external desires. In fact, that is precisely the point. Inward joys are a promising alternative to materialism, but the relative straightforwardness of production prevents due balance.¹⁴

The instrumental use of knowledge requires that “economic and political problems be identified and approached as a matter of a difference between what our reliable knowledge indicates is possible and desirable and what current practice shows is going on instead” (Tool 1977, 296-7). With regard to the night sky, this paper has contrasted what is possible and desirable against current practice. There are simple technologies, such as off switches, timers and full cut-off light fixtures, that can reduce light pollution greatly. Failure to take full advantage of these technologies stems, in large part, from the difficulty of articulating what is desirable. A variety of different approaches to economics share the same blind spots toward the importance of beauty and of passive susceptibilities. Indeed, this reflects a second cleft between current practice and that which is desirable. Contrary to current practice, it is possible and desirable to promote social welfare through greater reliance on internal, non-consumptive pleasures. Hopefully, highlighting the instrumental role of beauty helps bridge both of these gaps and promotes due balance in our lives and our economic theories.

This paper provided an overview of light pollution and the value of the night sky. It argued that the night sky is uniquely valuable and worth conserving. The paper also discussed beauty and argued a) that beauty is fundamental to the night sky’s value, b) that beauty is also fundamental to human welfare and the recreation of community, and c) that the prevailing economic doctrines make it fundamentally difficult to articulate the importance of beauty. Taken together, these points suggest that society’s poor handling of passive pleasures, such as the enjoyment of beauty, helps explain the largely un-mourned loss of dark skies. While beauty is a more difficult and nebulous concept than elasticity, for example, one simply cannot adequately address natural resource issues, such as the loss of dark skies, without some attempt to tackle the issue of beauty. Preserving the night sky, therefore, demands understanding light pollution and mitigating technologies, while adopting a more explicit and developed way of articulating the importance of beauty. This paper is offered as a modest step in that direction.

Notes

1. In a good example of the protective response running out ahead of the economics profession, policies to protect sea turtles, including special low-lying street lights, regulations, and the voluntary dimming of lights when turtles are hatching, are now quite common.
2. Technological advances are creating opportunities and challenges. LED streetlamps are even more efficient and long lasting than low-pressure sodium ones. They also open possibilities such as dimming or the ability to turn them on and off more frequently, as needed. The multi-spectrum light is perceived as brighter, so a lower level can be used. However, such multi-spectrum light interferes with astronomy and the shorter wavelengths on the blue side of the spectrum tend to reflect off the ground and contribute to sky glow even from full cutoff light fixtures. Alternatively, streetlights with a mix of red, blue, and green LEDs appear white and are more easily filtered by astronomers. It is important to note that energy-saving technologies also create an income effect that may increase the overall level of lighting – more lights and more spectra are both likely threats to dark skies.

3. One does not want to overlook existing concern. Astronomers and biologists have researched light pollution for decades. The International Dark Sky Association is more than 20 years old and has over 11,000 members in 70 countries. Nevertheless, economists have all but completely ignored the issues, and millions of Americans experience light pollution on a nightly basis but are not at all familiar with the term *light pollution*.
4. Hesiod's *Works and Days*, for example, mentions a variety of events timed by the heliacal rising or setting of celestial objects like the Pleiades, Orion, or Arcturus (Aveni 2002, 36-46).
5. Part of the explanation also lies in the fact that 12 and 60 both have a large number of factors, including prime factors, giving duodecimal and sexagesimal number systems certain advantages over other number systems.
6. While certain locales and climates are better than others, scenic nightscapes are visible to all in the absence of clouds or light pollution.
7. We cannot expand on common lighting myths here, but an abundance of information on these topics is available on the International Dark Sky website: www.darksky.org.
8. Catherine Rich and Travis Longcore suggest that, as a species, we have a diurnal bias that allows us to "ignore the obvious" damages from light pollution (2006, 1). In economic terms, our information set is skewed toward daytime, not nighttime, concerns. This is doubtlessly true. For the discipline of economics, however, a stronger explanation is needed. We expect sciences to be more proactive in identifying problems. With other environmental problems, economics was not years or even decades behind other disciplines in studying the issues.
9. In fairness, Daly is elsewhere not so rigid in defining his service-comes-from-artificial-stock model. "Service," he says flat out, "comes from two sources: the stock of artifacts and the natural ecosystem" (Daly [1977] 1991, 34). However, he emphasizes "life support services" when talking about direct service from nature (1993, 327). Despite the ambiguity, his dynamic model showing the entropic costs of maintaining stocks necessary to yield psychic income, or "service," is an important insight.
10. Swaney's focus was on "nonhuman resources, with emphasis on other life forms and physical elements useful to humans" (Swaney 1987, 1740).
11. Galbraith, for example, consistently pointed to the fundamental value of beauty and championed its preservation and production. "That one must pause to affirm that beauty is worth the sacrifice of some increase in the Gross National Product shows how effectively our beliefs have been accommodated to the needs of the planning system" ([1967] 1985, 428).
12. By contrast, primitive people explained unusual events – storms, droughts, comets – with mysticism, often attributing the extraordinary to magical beings with human caprice. Ordinary events needed no explanation, no appeal to "the invisible hand of Jupiter," argued Smith, coining a phrase he would have occasion to use again (Smith [1758] 1980; Ahmad 1990, 49).
13. William P.D. Wightman points out that, in Smith's model, *surprise*, *wonder*, and *admiration* are sequential elements that each promote the process of inquiry (Smith [1758] 1980). Francesco Luna points to Smith's emphasis on *imagination* as fueled by beauty and wonder (1993,7).
14. "Yet professional convenience and vested interests are not the safest guides in social thought. The questions that are beyond the reach of economists – the beauty, dignity, pleasure, and durability of life – may be inconvenient but they are important" (Galbraith [1967] 1985, 499).

References

- Abbey, Edward. *Desert Solitaire: A Season in the Wilderness*. New York: Ballantine Books, 1971.
- Ahmad, Syed. "Adam Smith's Four Invisible Hands." *History of Political Economy* 22, 1 (1990): 137-44.
- Aveni, Anthony. *Empires of Time: Calendars, Clocks, and Cultures*. Boulder: University Press of Colorado, 2002.
- Ayers, Clarence E. *Toward a Reasonable Society: The Values of Industrial Civilization*. Austin, TX: The University of Texas Press, 1961.
- Borg, Victor. "Death of the Night." *Geographical Magazine* 68 (1996): 56.
- Cinzano, Pierantonio, Fabio Falchi and Christopher D. Elvidge. "Naked Eye Star Visibility and Limiting Magnitude Mapped from DMSP-OLS Satellite Data." *Monthly Notices of the Royal Astronomical Society* 323 (2001a): 34-46.

- . “The First World Atlas of the Artificial Night Sky Brightness.” *Monthly Notices of the Royal Astronomical Society* 328 (2001b): 689-707.
- Daly, Herman E. *Steady-State Economics*, 2nd edition. Washington, DC: Island Press, [1977] 1991.
- . “The Steady-State Economy: Toward a Political Economy of Biophysical Equilibrium and Moral Growth.” In *Valuing the Earth*, edited by Herman E. Daly and Kenneth Townsend, pp. 325-363. Cambridge, MA The MIT Press, 1993.
- Davis, Scott, Dana Mirick and Richard Stevens. “Night Shift Work, Light at Night, and Risk of Breast Cancer.” *Journal of the National Cancer Institute* 93, 20 (2001): 1557-1562.
- Galbraith, John Kenneth. “How Much Should a Country Consume.” In *Perspectives on Conservation*, edited by Henry Jarrett, pp. 89-99. Baltimore: Johns Hopkins Press, 1958.
- . *The New Industrial State*. Princeton, NJ: Princeton University Press, [1967] 1985.
- Gallaway, Terrel, Reed Olsen and David Mitchell. “Economics of Global Light Pollution.” *Ecological Economics* (2009). doi:10.1016/j.ecolecon.2009.10.003.
- Heilbroner, Robert. *The Nature and Logic of Capitalism*. New York: W.W. Norton & Company, 1985.
- . *An Inquiry Into the Human Prospect, Looked at Again for the 1990s*. New York: W. W. Norton & Company, [1974] 1991.
- Hickerson, Steven R. “Instrumental Valuation: The Normative Compass of Institutional Economics.” In *Evolutionary Economics*, Vol. I, edited by Marc R. Tool, pp. 167-193. New York: M.E. Sharpe, 1988.
- Kasser, Tim. *The High Price of Materialism*. Cambridge, MA: MIT Press, 2002.
- Kerenyi, Norbert A., Elizabeth Pandula and George Feuer. “Why the Incidence of Cancer is Increasing: The Role of ‘Light Pollution.’” *Medical Hypotheses* 33 (1990): 75-78.
- Keynes, John Maynard. “Economic Possibilities for Our Grandchildren.” In John Maynard Keynes, *Keynes Essays in Persuasion*, pp. 358-373. New York: Harcourt, Brace and Company, 1932.
- Krupp, E.C. *Echoes of the Ancient Skies: The Astronomy of Lost Civilizations*. Mineola, NY: Dover Publications, 1994.
- Kuhn, Thomas. *The Copernican Revolution: Planetary Astronomy in the Development of Western Thought*. Cambridge, MA: Harvard University Press, [1957] 1985.
- Larkin, Andrew. “Environmental Impact and Institutional Adjustment: Application of Foster’s Principles to Solid Waste Disposal.” *Journal of Economic Issues* 20, 1 (1986): 43-61. Quoted in Steven Hickerson (1988).
- Leopold, Aldo. *A Sand County Almanac*. New York: Oxford University Press, [1949] 1989.
- Luna, Francesco. “From the History of Astronomy to the Wealth of Nations: Wonderful Wheels and Invisible Hands in Adam Smith’s Major Works.” Working Paper 691S, Department of Economics, UCLA, 1993.
- McCormick, Ken. “Towards a Definition of Waste in Economics: A Neoinstitutional Approach.” *Review of Social Economy* 40, 1 (1986): 80-92.
- Mill, John Stuart. “Autobiography.” In *Essential Works of John Stuart Mill*, edited by Max Lerner, pp. 1-182. New York: Bantam, [1873] 1961.
- North, Douglass. *Institutions, Institutional Change and Economic Performance*. Cambridge: Cambridge University Press, 1990.
- Rich, Catherine and Travis Longcore. *Ecological consequences of Artificial Night Lighting*. Washington, DC: Island Press, 2006.
- Rolston, Holmes. *Environmental Ethics: Duties to and Values in the Natural World*. Philadelphia: Temple University Press, 1988.
- Rowe, Robert and Lauraine G. Chestnut (eds.). *Managing Air Quality and Scenic Resources at National Parks and Wilderness Areas*. Boulder, CO: Westview Press, 1983.
- Salmon, Michael, Melissa G. Tolbert, Danielle P. Painter, Matthew Goff and Raymond Reiners. “Behavior of Loggerhead Sea Turtles on an Urban Beach, II. Hatching Orientation.” *Journal of Herpetology* 29, 4 (1995): 568-576.
- Salmon, Michael and Blair E. Witherington. “Artificial lighting and seafinding by loggerhead hatchlings: Evidence for lunar modulation.” *Copeia* 4 (1995): 931-938.
- Scitovsky, Tibor. *The Joyless Economy*. New York: Oxford University Press, 1976.
- Shulze, William D., David S. Brookshire, Eric G. Walther, Karen Kelly MacFarland, Mark A. Thayer, Regan L. Whitworth, Shaul Ben-David, William Malm and John Molenaar. “The Economic Benefits

- of Preserving Visibility in the National Parklands of the Southwest." *Natural Resources Journal* 23 (1983): 149-65.
- Smith, Adam. *Essays on Philosophical Subjects*. Edited by William P.D. Wightman and J.C. Bryce. Indianapolis: Liberty Classics, [1758] 1980.
- Swaney, James A. "Elements of a Neoinstitutional Environmental Economics." *Journal of Economic Issues* 21, 4 (1987): 1739-1779.
- Tool, Marc. "A Social Value Theory in Neoinstitutional Economics." *Journal of Economic Issues* 11, 4 (1977): 823-846.
- . *The Discretionary Economy*. Santa Monica, CA: Goodyear Publishing Company, 1979.
- Verheijen, F.J. "Photopollution: Artificial Light Optic Spatial Control Systems Fail to Cope With. Incidents, Causations, Remedies." *Experimental Biology* 44 (1985): 1-18
- Walker, Merle F. "The Effects of Urban Lighting on the Brightness of the Night Sky." *Publications of the Astronomical Society of the Pacific* 89 (1977): 405-409.
- Witherington, Blair E. and Karen A. Bjorndal. "Influences of Artificial Lighting on the Seaward Orientation of Hatchling Loggerhead Turtles." *Biological Conservation* 55 (1991): 139-149.