

1 Night Matters – Why the Interdisciplinary Field of 2 “Night Studies” is Needed

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32 **Abstract:** The night has historically been neglected in both disciplinary and interdisciplinary
33 research. To some extent, this is not surprising, given the diurnal bias of human researchers, and
34 the difficulty of performing work at night. The night is, however, a critical element of biological,
35 chemical, physical, and social systems on Earth. Moreover, research into social issues such as
36 inequality, demographic changes, and the transition to a sustainable economy will be
37 compromised if night is not considered. Recent years, however, have seen a surge in research into
38 the night. We argue that “night studies” is on the cusp of coming into its own as an
39 interdisciplinary field, and when it does, the field will consider questions that disciplinary
40 researchers haven’t yet thought to ask.

41 **Keywords:** night; night science; interdisciplinary science

42

43 1. Introduction

44 At any given moment, half of the Earth’s surface experiences night. The night is not only a time,
45 but in many respects a place: nocturnal environments are critical habitats for both humans and other
46 forms of life. Over the past 150 years, the night has undergone a series of major transformations.
47 Electrification, industrialization, and capitalism have altered humanity’s experiences with night as
48 both time and place. Ecological studies demonstrate that these changes have also affected nonhuman

49 species [e.g. 1]. However, despite its importance to natural and social processes, in many ways we
 50 remain in the dark when it comes to our understanding of night. The challenges facing our planet
 51 and humanity during this century often have direct and indirect connections to the night that must
 52 not be overlooked. There is, therefore, a pressing need for interdisciplinary research into the night to
 53 come of age, expanding into a recognized field, because the night matters.

54 2. The night as an interdisciplinary research challenge

55 We are a set of researchers and practitioners from diverse backgrounds in the natural and social
 56 sciences, humanities, and NGOs (Table 1), united by our common interest in the night. There has
 57 historically been a lack of balance between investigations into processes that occur during day
 58 versus night, from disciplinary and especially interdisciplinary perspectives. Humans are diurnal,
 59 and it is difficult to conduct research at night, regardless of disciplinary specialization [2]. Moreover,
 60 because most people (including scholars) sleep at night, nocturnal processes and issues are easily
 61 overlooked. There are also intellectual and institutional reasons for our lack of knowledge about
 62 night. Research on the night is generally fragmented and siloed. Disparate topics too often appear as
 63 “someone else’s problem” or are considered only as a facet of another field, thereby making
 64 interdisciplinary inquiry fundamentally difficult. This fragmentation, lack of professionalization and
 65 institutionalization hampers raising the appropriate questions, let alone finding solutions. In Donald
 66 Rumsfeld’s famous framing [3], there remain many “unknown unknowns” with respect to the night.

67 **Table 1.** Areas of main activity of the authors.

Area	Field	Name
Humanities	History	A. Roger Ekirch
	Literature & gender studies	Susanne Bach
Natural sciences	Chronobiology	Dieter Kunz
	Ecology	Franz Hölker
	Ecology/arctic night	Jørgen Berge
	Geography	Luc Gwiazdzinski
	Physics	Christopher Kyba
	Physics/engineering	Andreas Jechow
	Visual Neuroscience	Manuel Spitschan
NGOs	International Dark-Sky Association	John Barentine
	Night mayor of Amsterdam 2012-2018	Mirik Milan
Science communication		Sibylle Schroer
Social sciences	Cultural studies	Will Straw
	Planning	Dietrich Henckel
	Planning	Josiane Meier
	Science and technology studies	Sara Pritchard
	Sociology	Christine Preiser
	Sociology/night economy	Adam Eldridge

68
 69 A pressing “nighttime” problem, for example, is growing concern over mismatches between
 70 social and biological time in humans. The 2017 Nobel Prize in Physiology and Medicine was
 71 awarded for the discovery of the molecular mechanisms in nearly all living organisms that govern
 72 circadian rhythms, ranging from activity patterns to blood pressure. The timing of many common
 73 human behaviors is often no longer aligned with these biological clocks, and there is ample concern

74 that widespread insufficient or ineffective sleep [4] is detrimental to health. Sleep, however, is not
75 simply a medical issue that can be isolated from broader social, cultural, and economic change.
76 There are complex causes of changes in human sleep patterns over the past 150 years [5]. The
77 development and expansion of artificial light at night [6,7] has played a central role, with most cities
78 now brightly illuminated. Beyond lighting, factors such as incessant processes in industrial plants,
79 connectivity across time zones, provision of 24/7 services including energy, security, and health care,
80 and the possibility of constant technological connectivity in both professional and personal domains
81 have expanded many human activities beyond previous temporal limits [e.g. 8].

82 Extending the hours of labor for non-essential services, to take but one example, both reflects
83 and reinforces industrial capitalism [9]. Nighttime shifts that enable factories to raise profits for
84 shareholders often pay more than equivalent day shifts. This financial incentive, in turn, often
85 attracts workers who are economically marginal, including many women, people of color, and
86 immigrants. Despite increased compensation, the nighttime economy may end up worsening social
87 and economic inequality and magnifying environmental injustice, for instance, if these groups end
88 up suffering from higher rates of disease and poorer health. There are also social costs due to
89 incongruities between the schedule of workers and those of their families. One may question
90 whether night economies really raise local revenue, once sleep deficits and healthcare costs of night
91 shift workers are also considered. This example demonstrates how night is an “interdisciplinary
92 object”; physical and social processes at night—circadian rhythms, capitalism, education, race,
93 gender, security, mobility, public lighting, and inequality—are entangled in complex and sometimes
94 unexpected ways.

95 Now-established interdisciplinary fields, such as gender studies and environmental studies,
96 provide precedents for the kind of institutionalization and professionalization of research that we
97 envision. Like the environment, night is an especially broad topic that invites diverse perspectives.
98 Furthermore, night studies scholars have already drawn from a wide range of humanities, social
99 sciences, and science disciplines. Because of the complexity of the night, it is essential to establish
100 deep collaboration among social scientists, natural scientists, and humanists that unites
101 empirically-based understandings of physical or biological processes with similarly
102 empirically-grounded understandings of cultural, social, and historical processes [c.f. 10]. Complex
103 social problems are unlikely to be easily fixed by technoscientific “solutions”. For example, therapy
104 based on applied understanding of the “night hormone” melatonin could not solve the sleep crisis
105 on its own.

106 Failing to consider the full interdisciplinary context of night has already affected real-world
107 situations. Consider the recent replacement of outdoor lighting in Rome in 2017 [11]. The city’s
108 lighting transition was undertaken within the frame of energy consumption and cost, and resulted
109 in the replacement of existing warm color lamps with “colder” white LED lighting. Missing from
110 consideration in the policy decision were public expectations and the cultural meaning of urban
111 light, as well as the negative environmental side effects of broad spectrum (white) light [12]. As a
112 result, residents and tourists had strong negative reactions to the light, arguing that the ancient city
113 should not be lit with cold, harsh white lighting [12]. In addition, in trying to address one
114 environmental problem (climate change), Rome may have worsened another (light pollution) in the
115 process.

116 We suggest that an interdisciplinary approach to night governance that incorporates cultural,
117 economic, environmental, and other concerns would yield solutions to nighttime problems that
118 avoid public backlash, negative impact on tourism, and wasted budget due to reversal of policy [e.g.
119 13]. Given the broad changes that the night has experienced in recent decades, the quickly spreading
120 recognition of the value of “night mayors” in cities including Amsterdam, London, and New York
121 City [14], and the growing concern over “loss of the night” caused by artificial illumination and
122 shifting schedules, a multi-faceted approach to night as an integrated field of study will redound to
123 the public welfare, as well as deepen our knowledge of this critical realm of everyday existence.

124 Organizations such as institutes, university departments, and research clusters have been
125 established to bring interdisciplinary focus on places (e.g., oceans, polar areas, and area studies),

126 topics (e.g., migration and transportation), and even times (e.g., history). It is, therefore, in some
127 sense surprising that a similar organization has not yet been founded to address the night.
128 Momentum seems to be building in this direction, however. For example, the Consortium for Dark
129 Sky Studies recently established a new undergraduate minor in “dark sky studies” at the University
130 of Utah. Gaston recently made a compelling case in *The American Naturalist* for why “nighttime
131 ecology” must be established as a synthetic program of research in this scientific field [15], and Shaw
132 has argued for “nightology,” proposing an integrated approach to nocturnal urban research [9].
133 While these are exciting developments, we suggest that the emerging field of night studies must
134 necessarily be much broader.

135 Beyond advancing interdisciplinary knowledge of the night, we expect that night studies
136 researchers will, in many cases, work closely with organizations on evolving challenges, such as
137 those related to night governance, sustainability, or a carbon-free economy. Ideally, knowledge
138 transfer from night studies scholars to practitioners will help them address emerging challenges,
139 rather than responding to them after the fact.

140 An example of an interdisciplinary challenge for cities where night studies scholars could
141 provide expertise is in the provision of public transit during the night. Night transit serves diverse
142 publics, who surely have different expectations for service and perceptions of safety (e.g., a group of
143 young men heading to a nightclub, versus a female first-generation immigrant nurse returning home
144 alone after working an evening shift). Lobbies for late night transit often include the entertainment
145 industry, while taxi companies, residents, and transit worker organizations are often against
146 expanded night services [e.g. 16]. From an economic perspective, night transit may provide benefits
147 due to increased activity, but impose future costs due to the health impacts of sleep loss by those
148 using the service. Furthermore, long commutes and lost sleep may increase overall social inequality
149 within a region [17]. Without a full picture, governance of the night may therefore serve the interests
150 of a select powerful group, rather than the community generally.

151 3. Conclusion

152 The night has experienced major changes in recent decades, and the pace of change is unlikely
153 to slow down. While research into the night has expanded greatly in recent years, we believe that
154 further networking and institutionalization is urgently needed. In order to develop into a recognized
155 interdisciplinary field, night studies will need to see the establishment of journals, conference series,
156 dedicated funding lines, research institutes, and university departments offering programs of study.
157 If the field develops as we hope it will, perhaps it may eventually become recognized by the Greek
158 term “nyctology”: the study of night matters.

159 4. Addendum

160 Note that another opinion on “science of the night” with a different focus was recently
161 published by Michele Acuto [18]. We agree strongly with Michele Acuto, and encourage readers to
162 also read his piece. This manuscript was drafted independently over a period of in-person and
163 online meetings spanning from 2017-2019, without any correspondence with Michele Acuto.
164

165 **Author Contributions:** AJ, CK, DH, FH, JM, and SS initiated the project, and selected and invited the rest of the
166 co-authors to contribute. All authors collaborated on developing the outline and choosing specific examples or
167 case studies via electronic and in-person meetings. Multiple drafts of the opening paragraph were written by
168 co-authors, and ranked by all authors to select an initial opening. SP wrote the first complete draft of the paper,
169 and all authors critiqued this draft. AJ, AE, CK, CP, DH, FH, JM, and SS edited subsequent drafts. CK
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