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From wire evil to power line poetics: The ethics and aesthetics of renewable transmission



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ABSTRACT

Building upon a selective history of so-called “wire evil,” and more recent social science research regarding public perceptions of electric infrastructure, this article explores renewable transmission lines as sites of tension between landscape aesthetics and environmental ethics. It reports the results of an ethnographic study performed at a utility-owned arboretum in Omaha, Nebraska and suggests a “power line poetics” may help balance the aesthetic experience of electric infrastructures and the ethics of renewable energy development.

Prologue

I pass the thicket, enter the grove, and pause beside an Eastern cottonwood, Nebraska’s state tree. This entire strip of suburban forest, which is wedged next to the interstate, echoes with the sounds of passing traffic. Amidst this white noise, I run my fingers over the rough bark and consider the roots beneath my feet. The roots, and their spread, are like ancient precursors to the electrical infrastructure overhead. The other, metallic network is visible on the woodland’s edge—aluminum and steel-reinforced cables hang between 45-foot tall wooden utility poles (which were once Douglas firs, a species also harvested for Christmas trees). The network also shines on the clearing’s western rise—quarter-inch lines locked to accordion insulators and attached to an 180-foot lattice steel tower. Like this cottonwood’s roots—its longest fingers dug forty, fifty feet below the earth’s surface, its elbows ranging outwards, some of them exposed on the banks of a nearby ditch—the power lines that weave through the surrounding landscape are often dismissed. To see this tree for its root system is analogous to seeing the electricity we generate and consume for the overhead lines in our environment. To see the forest (as grid) for the trees (as power lines) is to appreciate the lines as a series of material artifacts, structures with a technological function and a social meaning.

The roots underground and lines overhead are necessary links in their respective systems, yet “tree” and “electricity” often attract warmer visions and more magnanimous associations. The thick branches stemming from this cottonwood’s trunk rise seven stories tall and reign over the bur oak, hackberry, and maple at their shoulders. As autumn progresses, visitors’ eyes will be drawn to the cottonwood’s thousands of waxy, silver and green leaves as they turn yellow and then

drop to the forest floor. Next spring, the cottonwood may grow even taller and broader. Growth will depend upon the gnarly root system that tunnels for sustenance in this soft, loamy soil.

Similarly, the local electric system, a node of which radiates from the substation attached to the lattice steel tower on the hill, almost instantaneously transfer electrons to millions of lights and machines. The lines I can see and hear emitting a constant hum, pulse power through the city, help to charge my smart phone, and make sure the laptop upon which I will transcribe my field notes does not go dark. As the season changes and the days get shorter, the electricity in these lines will help to heat my family’s home. Those grey, metallic threads are arbiters of convenience and also critical conduits: without electric power, many electricity-dependent citizens like me could not survive the winter. Of course, the analogy only follows so far. Both root systems and wire systems extend from tree trunks and wooden arms, yet unlike the organic shoots that burrow beneath this living specimen, the engineered, metallic threads overhead must hide in plain sight, and when such structures fail to hide, when the lines on the horizon do poke into attention, they are often loathed as blight.

1. Introduction

Across North America and Europe, increased renewable energy production has made wind turbines and solar panels more familiar parts of the visible landscape; increased sustainable consumption has brought humans into closer contact with electric vehicles and energy-efficient appliances. Compared to the tall, sleek white wind turbines or the nimble electric vehicles with names like Leaf, Tesla, Bolt, and Volt, the transmission lines that link various forms of production and

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consumption are often seen as static and banal. Social scientists and energy policy scholars have conducted significant research regarding public perceptions and various siting procedures, pylon designs, and community engagements [1–11]. This research shows both the function and perception of electric infrastructure is shaped by technical, financial, environmental, and cultural forces, such as aesthetics. In short, where and how individuals see power lines is both an outcome, and influence, of the work they do in distant places and immediately visible landscapes.

This article contributes to existing research by placing the perception of power lines within the constellation of “energy, ethics, and ethnography” formed by this special issue. Clearly, the lines transmit energy, and energy in the anthropocene has ethical consequences. At first blush, the ethical dilemma posed by power lines pits the need to build more transmission lines (to deliver more renewable energy, reduce CO2 emissions, and slow climate change) against the desire to protect the environment from the unsightly, dangerous blight caused by sweeping wires and looming pylons. However, a simple “pro” or “anti” power lines stance does not effectively translate to a clear ethical position. Many ethical strains are enmeshed in public engagements with electric infrastructure, including century-old critiques of “wire evil.”

Detangling the wires’ apparent wickedness from positive electric rhetoric contributes to the anthropological interest in electricity, which “as commonly understood, is always already social” ([12] p. 532). It is also part of the recent, interdisciplinary turn to infrastructure, which anthropologists have been encouraged to analyze “as concrete semiotic and aesthetic vehicles oriented to addressees” ([13][13] p. 329). Here, I challenge the assumption that these “aesthetic vehicles” are inactive eyesores. I argue that power lines are actors and that they convey a certain agency. The lines, and the values attached to them, create place as well as intersect landscape. The purpose of such an argument is to reorient energy discourse and to expand the influence of aesthetic experience in discussions of environmental ethics. What meanings *could* electric infrastructure transmit to viewers? How might direct, physical engagement with improve its perceived fit in an environment? Answering such questions through ethnographic research reinforces the significance of experiencing electricity and/in landscape.

High-voltage overhead transmission lines (HVOTLs) are filled with tension and demand compromise. Transmission lines—which are also called power lines, and sometimes “power-lines” include all of the wires, cables, guys, cross arms, poles, pylons, towers, insulators, conductors, switches, transformers, and other materials required for transmissions 69kv or greater. Public concerns about the lines tend to coalesce around their real or potential impact on property value, safety, land use, human health, wildlife, ecosystem, and aesthetics [14–16]. While these and other factors, such as the siting process and forms of public engagement, have been subjected to numerous empirical studies, aesthetic impact remains difficult to value and parse.

On the one hand, it is hard to design visually pleasing poles and pylons. The lede of a 1982 *New York Times* editorial, “There’s no way to beautify a power-line pylon,” predicts the ambiguous conclusion of a recent review of industry efforts to change materials, shapes, and insulator configurations: “improving public perception through design has ultimately led to unrealistic expectations” ([17] p. 38). On the other hand, it is difficult, if not impossible to predict how, why, and for how long an individual or a group may oppose the aesthetic impact of a particular power line. In 1996, the International Electric Transmission Perception Project concluded that “aesthetics emerged as a major issue of concern,” but the results of existing research made it, “difficult to draw specific findings or conclusions” [15]. It seems that both industry and the public agrees—the lines are, at best, not pleasing, and, at worse, egregious monstrosities.

In a recent news article on possible health impacts of power lines, a Columbia University Professor of Environmental Health Sciences claimed: “I probably would not be terribly worried [about lines’ health effects] other than the fact that they’re terribly ugly” [18]. Such

assurances may dispel persistent fears about the carcinogenic effects of electromagnetic fields; however, assuming the lines are safe but “terribly ugly,” “eyesores,” or “blight” can signal a troubling ethical intervention. If the lines are universally ugly or inherently blight, then complaining about their aesthetic impact seems frivolous and even unethical, especially in relation to other environmental quandaries (e.g. sweeping deforestation, exploitative labor practices used to extract precious metals and fossil fuels, superpowers’ lukewarm efforts to reduce global warming). In addition, if we assume *all* lines are ugly and they must blight *some* areas then opponents may be labeled as NIMBY (Not in my back yard) and morally blameworthy.

Philosophers have challenged the idea that Nimbyism is inherently immoral or egotistical [19], [20]. Social science researchers studying perceptions of transmission lines have also worked to debunk NIMBY stereotypes, showing that even those who do not live nearby lines often oppose them based on aesthetic, political, or environmental beliefs [4,21,22]. Utilities and transmission planners may improve stakeholder engagement by accepting that, rather than hackneyed NIMBY responses, resistance to a power line in a particular place is “neither irrational nor necessarily unethical” ([23] p. 118). Of course, the negative perceptions can appear irrational, especially as the perceived burdens of lines in the landscape are psychologically disconnected from the benefits derived, both by the individual who enjoys electricity in her or his home, and by the community making a transition to more renewables.

The problems posed by overhead electric transmission lines are not new, but putting the lines underground costs 6–20 times more than overhead [24]. Gaining public acceptance for renewable, overhead transmission lines is increasingly important. In 2015, the U.S. electric power industry produced 1.925 million metric tons of carbon dioxide, or 38% of all energy-related emissions. Of these, 1.364 million metric tons, or 71%, were linked to coal [25]. Without interconnected regional, national, and international grids, the renewable revolution may have to wait for advancements in local energy storage. For instance, efficient, house-sized batteries might store wind and solar energy generated in times of surplus and, when the wind stops or night falls, the stored energy could meet local demands. Alternatives to futuristic storage technology may already exist.

A recent computer model built by Alex MacDonald and colleagues at the National Oceanic Atmospheric Administration shows that a nationwide network of high-voltage direct current (HVDC) lines could meet U.S. energy demands by point-to-point transmission from giant wind farms and solar fields in the rural areas to the more populated (and energy hungry) areas of continent. The researchers conclude that such a sustainable, large-scale electric network could reduce carbon emissions by 80% from 1990 levels [26]. Such massive systems would have significant international and even global benefits but, as one energy expert explained, “The problem is not rooted in technology, but rather in the way that the U.S. power system is organized legally, politically, economically, and culturally” [27].

A culture of public resistance to overhead transmission lines has manifest in different forms and with varying intensities. Whether or not a community decides to accept a power line may not be their most pressing ethical or environmental dilemma, but, just as a fallen tree branch or a pesky squirrel can short a transmission line and lead to widespread blackouts, particularly negative perceptions of power lines can have sweeping effects.

2. Wire evil and electric rhetoric

As electric power systems proliferated through North America and Europe, the overwhelming advantages wrought by broad and nearly instantaneous communication and power networks drove far deeper into our social landscape than some of electrification’s more contentious, albeit well-documented, effects on politics, communication, commerce, and culture [28–32]. In popular discourse, electrification

was affirmed with the advent of positive electric language. David Nye argues that early-twentieth-century electrical metaphors (“plugged in,” “got his wires crossed,” “recharging” etc.) gave emphasis to “integration and connection because electrical lines created a permanent link between a producer and a consumer” ([29][29] p. 19). While the process of electrification and its metaphors may have focused on an exciting, widespread process, electric lines in the landscape (i.e. the “permanent link” between production and consumption) were neither always welcome nor always permanent.

By the turn of the twentieth century, Nye also notes, many urban areas in the United States were “cluttered by five-tiered electric poles, with a maze of telephone, telegraph, and electric wires overhead” ([18] [18] p. 8). Tracing the roots of Americans aesthetic concerns as they coiled below the proliferating web of wires overhead shows that, as early as the 1880s, when Thomas Edison and Charles Brush’s competing direct current systems began to illuminate storefronts, wealthy homes, streets, and then cities, some individuals and groups were outraged by the addition of more overhead lines to streets cluttered by telegraph and telephone lines. Safety was a primary concern, and lineman’s electrocutions and the temptation to climb the structures led to some shocking and gruesome public displays. Nevertheless, public outrage often hinged on aesthetic impacts and extended an ethical agency to the sight of the lines.

In New York City, the Underground Wire Bill of 1884 sought “to remedy an evil known to exist in defiance of the will of the people” [33]. Telegraph, telephone, and the emerging light and power providers ignored the law. They suggested that communities and businesses that desired electric service should tolerate the poles and wires as a necessary evil. Eventually, subway tunnels, which doubled as conduits for electric infrastructure, provided “the natural remedy for the evils which have been put upon [New York] city” [34]. In 1890, Mayor Hugh Grant hired loggers to cut down the poles in Manhattan and Brooklyn. Crowds followed the crews crying “Tim-ber!” as the so-called “telegraph forest” was cleared.

Political action, legal precedents, and underground conduits eradicated overhead wires’ vile impact in select metropolises, but urban planner Charles Mulford Robinson observed in 1911 that “as long as the pole and wire evil continued in so aggravated a form,” smaller American cities like Raleigh, North Carolina and Binghamton, New York could “not seem more than a country town” [35,36]. During the early twentieth century, lines for lights and power ranged between cities, rural power plants, and country towns. Diverse sceneries were studded with similar-looking wooden poles that linked to taller, stronger steel pylons carrying increasingly higher-voltages across greater distances. Like their earlier inner-city counterparts, suburban and rural Americans initially welcomed electrification. Agricultural towns of early-twentieth-century California, “would spring to life dramatically as the transmission lines reached them” ([27][27] p. 267). Other rural communities across Europe and North America “viewed the arrival of transmission lines as a distinct benefit,” yet, after electrification was widespread and then taken for granted, “the positive symbolism of transmission lines seems to have declined” ([14][14] p. 22).

The rise of public resistance to overhead lines was especially strong in agricultural communities bypassed to deliver electricity from sites of production (e.g. next to a hydroelectric dam or a coal mine) to the urban core. In the 1970s, a Minnesota farmer objecting to a 400-kilovolt direct current line that would run through his property towards Minneapolis claimed the utilities involved were “an evil cartel assaulting individual farmers.” Another opponent of the same line believed destroying good farmland with power lines was “morally wrong” and “evil.” “And all it takes for evil to prevail,” he continued, “is when good men and women sit back and do nothing.” Here, overhead lines threatening to cross one’s farm seem to symbolize another attack on local, agrarian beliefs and values. In such a battle, a third member explained, “we could have just as well saved our money [spent on legal

fees] and got violent as hell” (). For these residents, the corporate interest served by the lines was viewed as evil; therefore, the lines themselves seemed evil.

In 1980, the collective fear of lines in the landscape was dramatized in a made-for TV film, *Ohms. Ohms* (which is the SI derived unit for electrical resistance) is the story of a Midwest farm community’s fight against a power line and, what one protagonist calls, “big million volt monsters!” The TV-promotion includes clips of earth-movers tipping pickup trucks, a violent brawl between farmers and utility workers, and the image of a lattice steel tower glowing against the sunset while the voiceover exclaims: “Somebody has power! Somebody has none! Somebody is lying! Somebody is going to get hurt! Ohms, Wednesday at 9, 8 Central!” [38]. The plot borrows from the real-life conflict in Minnesota analyzed by Paul Wellstone and Barry Casper in *Powerline: The First Battle in America’s Energy War* and historian Bill Luckin said viewing *Ohms* inspired his own book-length study of public resistance to electric infrastructure, *Questions of Power: Electricity and Environment in Interwar Britain* [39].

These histories of electrification in the United States and the United Kingdom reveal a general pattern of public responses. After the initial, exciting process of electrification, a community develops an appreciation for the risks of electrocution and a dependency on electric technologies. After a period of adjustment, they tend to ignore the lines or remove them as far as possible from public view. Slowly, and sometimes subtly, the lines in the landscape return to the field of attention. The lines that once delivered benevolent electricity begin to appear as symbols of unethical blight.

Familiar with this pattern, engineers and utility representatives have challenged the characterization of overhead lines as “evil” and their siting and construction in natural landscapes as unethical practice. Instead, they focus on the uncertain and costly attempts to appease aesthetic complaints. The most frequently suggested alternative to building visible overhead lines—completely undergrounding existing and future infrastructure—is not financially feasible, and most communities are not willing to incur such costs in their electric bills [40]. Therefore, those who oppose transmission lines seem to place too much value on aesthetics of landscape and tend to ignore the extreme, possibly unethical financial burden of rerouting or burying the lines. In the 1960s, a Vice President of Southern California Edison (SCE) scoffed that calls for undergrounding transmission lines had “sort of taken the place of mother love— everybody’s for it and hardly anybody dare be against it” [41].

More recently, during a heated conflict about undergrounding a 500-kilovolt line meant to bring renewable wind energy on a transmission line through Chino Hills, a suburb of Los Angeles, an SCE spokesperson explained that burying the line in this particular neighborhood would be unfair for the rest of the Californians who desired renewable, affordable electricity. She said, “I think the protest is interesting...250 households along 3.5-miles want these towers undergrounded, but there are 12 million people in California from Mount Shasta to San Diego who are going to have to split the bill” [42]. Two years later, when Chino Hills successfully lobbied the California Public Utilities Commission to reverse their decision and force SCE to underground the line and to remove the 198-foot towers (some of which were set within 125-feet of family homes), the same spokesperson explained, “We don’t think 12 million people should have to pay more than \$700 million because a few hundred households want a better view” [43]. (The final cost was closer to \$250 million [44]).

Similar couplings of ethics and aesthetics have been made during recent debates about renewable transmission lines. As one journalist explained regarding a contentious line that passed through the Highlands of Scotland, “weighing economic demands against beauty remains a thorny and potentially time-consuming job,” as calls to underground often disregard the fact that “consumers pay for [undergrounding] through their electricity bills, everyone would have to fork out to protect the views and house prices of a few people” [45].



Fig. 1. Looking north over the Omaha Public Power District Blondo Street Station and adjoining Arboretum. Photo by the author.

Implying opponents simply want “a better view,” can devalue other intentions, for example the desire to stop the lines so as to help stop a coal or nuclear power plant or to help protect a vulnerable ecosystem or specific species.

Alternatives such as more aesthetically pleasing pylon designs have had limited success. In the 1970s, industrial designer Henry Dreyfuss designed some of the only “aesthetic power lines” erected in the United States [46]. In 2011, the National Grid held an international competition to solicit new pylon designs. Entries included a “flower tower,” a “wind sail,” and various futuristic-looking structures that appear like modernist sculptures [47]. The first place prize was awarded to a practical, sleek, T-shaped pylon with diamond-shaped insulators hanging from either arm. In 2015, these T-shaped pylons began appearing in the U.K. and have received generally warm responses [48], but their effectiveness at improving aesthetic impacts and defusing public resistance has not been fully determined.

Social scientists and humanities scholars can contribute to public discourse about electric infrastructure by acknowledging and clarifying electricity’s material and metaphorical uses. For example, in the edited collection, *Cultures of Energy*, the editors introduce their project as a series of figurative “powerlines” (one word) that link together studies of energy practices as they flow across cultures. They then place what they call “conversational pylons” between sections to “provide structural support for the conceptual themes that run throughout the volume” ([49] p. 23). As metaphor, the pylons are sites at which various ideas can intersect, hang together, and generate dialogue. As material artifact, the ensuing chapter by Scott Vandehey suggests overhead transmission lines can tear communities apart.

Vandehey’s piece outlines public responses to a power line project in another Southern California suburb outside San Diego. It opens with a suburban homeowner admitting she does not want to “seem NIMBY,” but “we don’t want those powerlines ruining our community!” ([50] p. 246). To save the community, a grassroots campaign forces the utility to agree to bury the proposed line, then to agree to reroute the line far from homes and under a highway, and finally to reroute the line outside of their community altogether. Vandehey anticipates the community bonds formed by successfully fighting overhead power lines might be redirected into demands for more energy-efficient and sustainable

suburbs. This could happen. Some suburbanites may be roused into further political action by the shared experience of fighting against ruinous, dirty, and ugly power lines. However, such an antagonistic and reactionary approach to transmission infrastructure seems to contradict the inclusive and dialogue-generating “powerlines” of the introduction.

The separation between metaphorical and material electricity has not been overlooked. In “Anthropology Electric,” Dominic Boyer recognizes thinkers such as Sigmund Freud, Michael Foucault, and Gilles Deleuze used electricity and electric metaphors to think about, with, and through. He also admits that such “insulated analogies to electrical science and engineering” ([1][1] p. 534) often underplay how deeply electricity has been engrained into modern life. Consider “grid.” During the twentieth century, public and private utilities extended political and economic influence by adopting techniques of based load and creating natural monopolies [29]. For Boyer, “grid,” is not benign, rather, it is “inclined to encourage demand, to expand itself, to solicit further dependency on its powers, which then grow in response” ([1][1] p. 533). Recent decentralization and the introduction of sometimes-unstable renewable energies threaten to disrupt the energypower of “grid.” As our grids change, so too will relationships to the visible lines drawn through the landscape. Ethnography may not offer a permanent solution to the ruptures of electric language and electric lines, but it can help to realign the relationship between the lines’ forms, functions, and environmental impacts.

3. Ethnographic roots and survey results

The Eastern Cottonwood with which I began this piece is part of a small forest on the eastern side of a unique, 26-acre site in Omaha, Nebraska (Fig 1). The Omaha Public Power District (OPPD) purchased the land from a family farmer in the 1970s to build an electric substation. The substation occupies approximately 8 flat acres and is surrounded by a chain-linked fence topped with barbed wire. Inside are three yellowish metal sheds and two sets of massive transformers. The transformers include circuit breakers, switches, bushings stacked like metal discs, and hundreds of grey boxes. Electric fields cause the machinery to vibrate, and it emits a hum that can be heard up to 600 feet from the fence. The machinery is surrounded by dozens of obelisk-

shaped pylons. Extending from the substation, one set of six cables rises to the 140-foot-tall lattice steel pylon near 108th Street and then sweeps west. Another set rises to a similar pylon nearer Blondo Street and then continues towards the Dodge Street corridor (one of west Omaha's most populated business districts). Two more sets of high-voltage lines rise to meet the towers to the north.

In 1992, OPPD set in motion a plan to convert the rest of the unused acreage around the substation into a public green space that would teach visitors about planting “the right tree in the right place.” The OPPD Arboretum was completed in 2004 and seems to gain in popularity each year. It currently holds a Trip Advisor “Certificate of Excellence” as well as the #8 ranking on the website's list of “Top Ten Parks and Nature Attractions in Omaha” [55]. OPPD's Twitter feed recently posted “Answer: 23,400. What is it? Average number of visitors to the OPPD Arboretum. See why here” [56]. The space is popular, but not universally known among Omahans. Some visitors referred to it as a “hidden gem” and, based on my observations over the past year, the estimate of 23,400 annual visitors seems generous.

Three paved sidewalks guide visitors from the parking lot and curve through the Arboretum. Markers along the paths show 201 types of shrubs and 208 different species of trees. The posted labels beneath the trees offer both common English and Latin names as well one of three symbols, which indicate whether that species should be planted near overhead lines (heart), should be planted with caution (diamond) or *not* planted near lines (circle with a strike through). The approved “heart” species—crab apples, elms, and my personal favorite, the Amur chokecherry (*prunus maackii*)—are positioned along 1.7 miles of relatively flat sidewalks. Towards the northern end, the sidewalk zigzags at a steeper elevation in a series of switchbacks. The sidewalk stops at the “substation overlook” and then loops back to connect with the 1-mile woodchip path that winds through the forest, which features some of the non-recommended specimens like the Eastern Cottonwood.

To reinforce the normalization process by which visitors learn to design private landscapes and gardens according to their future proximity to public infrastructure, a small section of (non-energized) lines towards the back displays trees in relation to transmission and distribution lines. These models are unique. The landscape architect for the project, John Royster, told me this might be the only public green space in the world into which power lines have been purposely sited. The dummy lines highlight OPPD's overall mission, which is to present the public with a visual demonstration of how to select trees that are less likely to interfere with energized power lines.

In September of 2015, I began visiting this site an average of once per week to record the movements and activities of visitors. The parking lot was rarely empty, although in the winter months I sometimes spent an hour or more walking the trails without seeing another person. During the weekdays, most visitors came alone or with one other person for recreation or exercise. They made loops around the concrete paths and through the forest. Seldom did visitors walk up the hill to the substation overlook and around the tallest transmission tower. Most went through the forested area, sat in the gazebo, or stood near to the small waterfall and corresponding koi pond. They infrequently stopped and read the educational displays related to tree trimming and energy conservation.

During evenings and weekends, the Arboretum was considerably busier. The clean, well-maintained site provides picturesque backdrops and is a popular place for outdoor photo shoots. On fair weather weekend days, semi-professional photographers arrived with large cameras, props to get a baby's attention, collapsible reflectors, and supplemental lighting and batteries. They positioned their subjects within various sceneries: The rocky waterfall, the wooden fence near the substation fence, and the wooden bridge leading into the forest. These groups rarely ventured more than 100 feet from the parking lot and, their portraits were also positioned so as to exclude the substation and other electrical infrastructure (Fig 2).

This participant observation and a review of the tools and

frameworks created by Priestly et al. [15] helped me to draft a 28-question survey. I recruited survey participants with signs at the Arboretum and at a local coffee shop, and, in the final days of the online study, with a Tweet posted by OPPD from the handle, @oppdcares. The survey had three goals:

1. Gauge beliefs about the overall environmental quality of Omaha (including its overhead infrastructure) and the visual salience of transmission and distribution lines (i.e. How often and accurately do individuals notice them)
2. Measure participants' feelings about what actions should be taken with regard to transmission and distribution lines (“We should tolerate...” “We should embrace...” “We should ignore” or “We should remove or bury”) and their acceptance of a hypothetical grid expansion program.
3. Gather general observations about the utility and identify individuals willing to give formal follow up interviews.

Between May 1 and June 30 of 2016, 81 participants fully completed the online survey through Qualtrics. 34 were prompted by a flyer at the Arboretum, 29 from the flyer at the coffee shop, and 18 from the @oppdcares post to Twitter. Clearly, the accuracy of such a small, self-selective survey is questionable compared to the area-specific surveys conducted by Priestly and Evans ($n = 216$) [21] and the regional, online studies of public perceptions such as those by Devine-Wright et. al ($n = 1041$) [51] and Devine-Wright and Batel ($n = 1519$) [48]. However, the modest results do seem to confirm previous findings about public perceptions and environmental quality, visual salience, and willingness to pay.

Respondents ranked the aesthetic impact of 8 different man-made objects in regard to their aesthetic appeal. Power lines ranked last. Similarly, Soini et al. [52] tested attitudes towards various man-made and natural parts of the landscape and found that, of the 20 elements provided to respondents, only three were considered to negatively affect the landscape and that “power lines” were reported to have the most negative effect. In addition, both sets of respondents had generally favorable views of other features and the general environmental quality of their area. My respondents gave high ranking for qualities such as “Access to trails, parks, or green spaces” and lowest rankings for “maintenance of roads.”

In response to the question “How do you feel about the location of power lines with regard to your daily activities? Select all that apply,” 51% ($n = 41$) of the total respondents reported “[the lines] don't bother me.” That response was followed by a question of visual salience: 59% of respondents said they could see an overhead transmission line from where they live, and 46% reported that they noticed transmission or distribution lines daily. This suggests low impact and high visual salience. The lines have not faded into the background, but they do not appear particularly bothersome.

A subsequent question asked what action, in general, should be taken with regard to overhead lines in one's neighborhood. 20 of the 41 respondents who previously selected “they don't bother me,” indicated that the most appropriate response was to “tolerate them as necessary.” However, 9 of the 41 respondents who said the lines “don't bother me” also indicated that, as a community, “We should come together to remove or bury the existing and any new overhead lines.” Overall, 46% of respondents indicated the community should “remove or bury” all overhead lines rather than “tolerate” (37%), “ignore” (10%), or “embrace” (5%) them.

The belief that the community should not be required to tolerate the lines was also reflected in the voluntary comments. Of the 44 comments, the adjective “eyesore” appeared 12 times. One individual wrote, “Our lines are buried, but the power lines around my house are an eyesore.” Another offered, “Our house has buried lines and there are no eyesores, but when I drive past Candlewood Lake [a nearby neighborhood] there is this home there with a pylon in their yard. I feel



Fig. 2. The map of the Omaha Public Power District Arboretum. The flattening of the space obscures visual impact of the substation and the transmission lines which pass through the landscape.

terrible for them.” A third explained that growing up in a neighborhood with buried lines and then moving to one where they were above ground made him cautious with his home purchase because “I did not want a huge eyesore, but thankfully [the distribution lines] are discrete enough.” These comments about “eyesores” seem to offer a more current manifestation of “wire evil.” The connotation of a “sore” suggests the line is not just unappealing to look at, but that it has somehow blighted or disfigured the landscape.

During follow up interviews conducted on site, interviewees shared overwhelmingly positive views of the space. One woman excitedly told me “This place is awesome! It’s like being in the middle of nature.” When I asked whether she thought the substation and lines nearby were part of nature, she explained that having the lines present improved the space: “How can you teach people if you can’t see this stuff? They come here and see it and then say ‘Oh, it’s okay.’ It shows the two things [infrastructure and nature] living in harmony.” I asked whether she would prefer not to have the pylons on the hill. She replied, “No, I think this place would lose its impact if they were buried. This place is great. Anyone who worries about power lines needs to get over it.”

The interviewees who had not previously visited the Arboretum seemed surprised at its beauty. One man told me the overhead lines like those stemming from the substation were visual pollution that always bothered him and yet, a few minutes later, he looked the other way and told me the area reminded him of Boston Common, which was, in his opinion, the most beautiful park he had ever seen.

These survey comments and interviews suggest the range of perceptions attached to the lines in the immediate environment. The casual desire to avoid “eyesores,” seems contrasted by responses to a hypothetical grid expansion. The grid expansion question in my survey

borrowed directly from the baseline scenario in a broader study by Cohen et al. [9]:

Environmental sustainability and long term reliability of the electricity system can only be ensured by a bundle of measures, such as—but not exclusively—the construction of new, above ground power lines and pylons (i.e. poles or towers). Please imagine that your local government announced a large program of local infrastructure investments, contributing to the enhancement of the power grid in the whole of the United States. As part of this program, during the next year, a high-voltage power line with standard pylons would be built in your neighborhood. These power lines (including poles and/or towers) would be up to 198-foot high, and be built at a distance of at least 800 feet from your home.

How do you think YOU would react to the announcement of this power infrastructure program?

Responses to the baseline suggest strong opposition. For Cohen et al., 34% of the 7659 respondents from 27 European countries indicated, “definitely not accept the new project without opposition.” Similarly, although on a severely smaller scale, 32% of respondents to my survey selected “definitely not accept without opposition.” An additional 43% of respondents to my survey indicated they would “probably not accept without opposition.” Although more than half of the participants in my study indicated that the lines around Omaha “do not bother me,” 75% indicated they would definitely or probably not accept a grid expansion project if it were sited near their home.

When tested against the alternative scenarios, Cohen et al. concluded that ancillary information about specific environmental or economic benefits may improve public acceptance. Multimodal

information campaigns and public meetings meetings are certainly critical to gaining public acceptance for energy reform. Still, the effectiveness of such information campaigns varies, as exemplified by a recent article in the *Journal of Environmental Planning and Management* titled: “They give you lots of information, but ignore what its really about: residents’ experience with the planned introduction of a new high-voltage power line” [53]. These researchers conducted 15 interviews with individuals living within 500 m of an accepted route for a new HVOTL. Some people they interviewed reported that the way in which the utilities presented the information about the negligent impacts on human health had made them nervous and “participants felt that they were given a false sense of influence [in the siting process] to avoid any civil unrest without getting any actual influence” [53].

It is crucial to share information about specific transmission projects through letters, pamphlets, websites, environmental impact reports, in-home visits, and town hall meetings. It is also important to obtain community feedback early in the process and to show participants how their comments can directly influence routing and design choices. Utilities hoping to improve stakeholder engagement in the siting process may also find it beneficial to supplement text-based campaigns with on-site discussions regarding the function of the siting and engineering processes behind the construction of an HVOTL. These public demonstrations could outline what the infrastructure does, why it may be advantageous to select one route over another, and how the public can remain safe while it is in operation. Such sessions could also provide opportunities for two-way dialogue, as utility designers, engineers, and project managers can listen to customers concerns and follow up with further details about how a project can or will change a particular landscape. Meanwhile, before and beyond that process, utilities, landscape architects, planners, designers, and others working to build a better grid can benefit from ethnographic studies that show how groups engage with visible infrastructure and the systems of beliefs and experiences that shape energy ethics.

4. Conclusion: aesthetics of infrastructure and power line poetics

Further site-specific, ethnographic research might be conducted with groups who use recreation areas (such as bike paths or nature trails) near or within transmission line right-of-ways. Groups that frequently visit “aesthetic” areas around substations (like the Arboretum) should also be observed. A potential site like this is being built in Seattle, Washington. Slated to open in 2019, the Denny Substation will include pedestrian paths, a dog park, and interior rooms for community events and art displays. The elevated walkways that move around the substation will offer visitors “intimate understanding of the facility through integrated graphics, educational components, landscape and seating areas” [57]. This substation allows one to imagine a permanent learning landscape designed to evoke the pastoral (where technology and nature seemingly coexist), to share information about renewable technologies, to solicit feedback about energy practices, and to introduce plans for future infrastructure. In addition to surveys about specific perceptions and statistics like “number of visitors,” conducting ethnographic research in such places could help social scientists better understand how energy ethics emerge from both external, distance-spanning networks as well as internal, aesthetic experiences of place.

The qualitative and quantitative research of public perceptions may also be used to support a new poetics of power lines. Electric infrastructures, like cultural poetics, mediate exchanges of social practice. Some anthropologists have assumed that, “unlike consumer objects, infrastructures are not intended to be displayed and aestheticized” [54]. Such a position seems to be supported by Devine-Wright’s findings that “social research on low carbon energy generation tends to render the grid invisible” ([48][48] p. 4128). However, like poems or billboards, power lines send messages that can demand our attention. Brian Larkin, in his intriguing article, “The Politics and Poetics of Infrastructure,” challenges the fundamentally inaccurate belief that infrastructures are

by definition invisible [13]. Infrastructures occupy margins, but as they move materials and circulate people, goods, and information they also attract and circulate dreams and desires. In cultural discourse, Larkin suggests, the poetics of infrastructure “can take on fetish-like aspects that sometimes can be wholly autonomous from their technical function” ([2][2] p. 329). Like the artificial light that now shapes our conception of night or the pitch of passing traffic which echoes through the Arboretum forest, the tools and materials embedded in our human-built landscapes—glass, steel, aluminum, plastic, or organic light emitting diodes—attract and shape what it means to be human in a particular age.

Another such humanistic approach to the wires in our environment appears in Mike Anusas and Tim Ingold’s “The Charge Against Electricity.” The case made by the mock “prosecution” is that the quick, invisible, remote conduction of electric forces sets the consumer “into a bubble, protected from any direct interchange with the environment” ([47][47] p. 541). The wires sustaining the consumer’s bubble, “remain largely out of sight, for were they to be seen, the bubble would immediately burst.” Even power lines “run high overhead across unpopulated areas so as to be as far as possible from the sphere of everyday attention” ([47][47] p. 543). The defense counters that visible wires allow one to “follow the paths of conductivity” and potentially burst the bubble ([47][47] p. 549). Furthermore, a radical new “topology of lines” might foster transparency and accountability. These new networks could weave between perceptual and material boundaries “so as to create compositions of electronic beauty and utility” ([47][47] p. 551).

This novel suggestion, that electricity might be rehabilitated through new configurations of its lines and wires, is akin to previous attempts to improve design, but it also seems to reinvigorate the form and function of lines’ aesthetic impact.

In select instances, the function *and* form of power lines have been sources of inspiration. In the 1930s, the British “pylon poets,” used overhead lines to evoke changes to social structures and physical environments. Their lines of poetry struggled to reconcile the power of the new lines in landscape erected by the National Grid [56]. Currently, the web-based “Pylon Appreciation Society” shares photographs and information inspired by the lines’ function and aesthetics. Poeticizing pylons and power lines will not completely dissolve claims of wire blight, but it may better show the power of their aesthetic impact and strengthen their association with smart appliances, electric cars, solar panels, wind turbines, and other tools of our sustainable future. As social scientists and humanities scholars shed light on how, where, and why the lines make meaning, we can find ways to better leverage ethics and aesthetics and balance visible electric infrastructures with less-visible environmental impacts.

Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at <http://dx.doi.org/10.1016/j.erss.2017.05.040>.

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