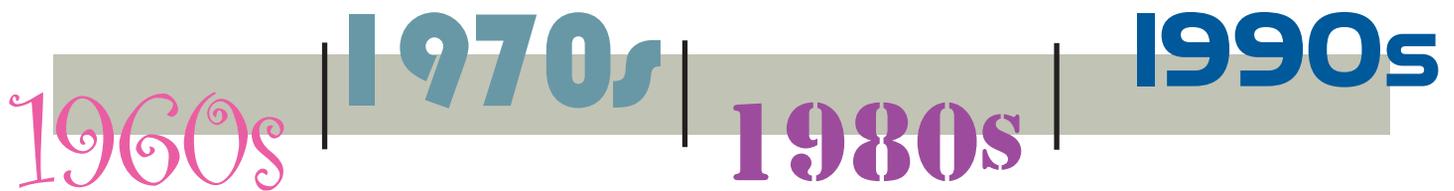


# Aesthetics and Public Perception of Transmission Structures

## A Brief History of the Research



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Aesthetics and public perception of transmission structures are of longstanding concern to the utility industry. Recent studies suggest that the visual impact of transmission lines is one of the industry's most pressing concerns and that "more visually acceptable pole designs" is the number one technical improvement that could ease the siting of new lines.<sup>1</sup>

For decades, utilities have sought to answer the following questions: Would more visually appealing transmission structures improve public acceptance of new lines? What measure of acceptance would justify the cost and effort? Despite over 40 years of research, the answers remain speculative. Over the years, as specific concerns gained importance, researchers responded by shifting focus. Despite continued interest, the research has left behind an uncertain state of knowledge, and it appears that no sense of resolution has been reached.

As we review the design and the public perception of design of electrical transmission structures from the 1960s through the 1990s, we see that that the largely piecemeal approach to the issues and the methods undertaken in these studies reflect the social, as much as the scientific, concerns of the time.

### 1960s

#### The 1960s: The Emerging Field of Aesthetic Design

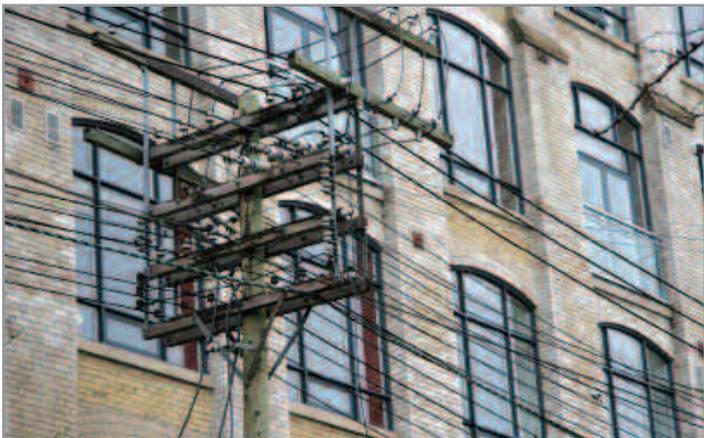
The 1960s were a decade of public confidence in science and engineering. Society's adjustment to rapid advances in science and technology was giving rise to a new concern for environmental quality. In general, the issues associated with public opposition to the visual impact of transmission structures that we experience today were already identified and framed by the mid-1960s.

During this decade, research on the design of transmission structures was an emerging field, brought about by the increasing attention being paid to electric-utility facilities and their place in the landscape. In large part due to nationwide beautification efforts, the public no longer equated transmission lines solely with the benefits derived, but began to view them as detrimental to the aesthetics of the landscape. What path to take in this increasingly adversarial environment was by no means clear, but dealing with aesthetic factors seemed to some in the industry to offer the promise of reducing hostility.

It was in this context that the power industry initiated early attempts to design transmission poles that were more aesthetically pleasing. Henry Dreyfuss<sup>2</sup> and Associates, a group of well-respected industrial designers, were commissioned to undertake the challenge.<sup>4</sup> Dreyfuss's goal was never intended to make structures obvious and fanciful. His hope was to convince environmentally aware Americans that transmission poles could be an acceptable visual addition to the landscape. Perhaps, he noted in an interview, they can be brought to the same level of public acceptance as well-designed bridges.<sup>3</sup> The design of transmission structures presented a unique challenge for Dreyfuss, who had built his reputation on analyzing the interaction of people and technology to determine what form new products should take.

Dreyfuss emphasized functionality and appearance, noting, "We wanted to evolve a form which not only met its function, but was a graceful and elegant structure." Still, he had trouble reconciling his own negative feelings for transmission lines with the positive light in which he hoped to portray them and later commented that if they could make the transmission structures as unobtrusive as possible, perhaps they wouldn't be noticed. Despite this perspective, Dreyfuss, through his focus on structural analysis and use of different materials, produced designs of monumental, visible objects, though many were sleek and elegant in form.

Although a few companies implemented Dreyfuss's designs, the expected far-reaching impact of his work fell short of expectations. One explanation may have been the decline of modernism as a favored approach to aesthetics. The designs had less to do with their intended surroundings and more to do with manipulation of newer materials.<sup>5</sup> He devoted little consideration to the right of way or to the effect of landscape on design selection.<sup>6</sup> And on a practical level, many of the aesthetically designed structures Dreyfuss created were problematic from an engineering standpoint.<sup>7</sup> His work was to



be the first and the last cooperative attempt by industry to create new aesthetic structure designs.

Despite potential shortcomings, work on structural design brought aesthetic concerns to the attention of the entire electrical utility industry. Based on the promotion of aesthetic designs, the industry believed transmission structures could be aesthetic contributions to the landscape, but the question of whether the visibility of the structures was meant to be obvious or not would be revisited often in the next decade.

## 1970s

### The 1970s: Formalizing Design Principles and Public Involvement

By the beginning of the 1970s, many of the principles of aesthetic transmission design that would be used for the next 30 years were established: clean lines, simple structures, visually rational and streamlined designs and unobtrusive structures that would blend into, and be in harmony with, their surroundings. Utilities began to accept that both the tower and its context should be considered when assessing visual impact. One utility executive noted, "The aesthetic tower will not, of itself, guarantee an aesthetically acceptable installation."<sup>4</sup> It was unavoidable that the industry would continue its struggle with the design issue of aesthetic visibility versus inconspicuous structures.

Meanwhile, public opposition was increasing apace with utility investment in new lines. In some cases, this opposition took a criminal form. In Minnesota, a vehemently opposed 400-kV line was built and subsequently vandalized when legal efforts to stop the line failed. Because this was the state's first line sited under new public participation requirements, the interested parties were relatively inexperienced in how to productively involve the public. Although the reaction in Minnesota seemed unusual and not representative of the tone of national opposition, it did demonstrate the powerful emotions generated by the visibility of these lines.

The first formal effort to measure public perception of transmission lines was a 1972 survey that assessed public preference for two types of structure designs. The researchers reported that two-thirds of those surveyed preferred steel poles to lattice structures. Half of the participants said they would take action—sign a petition, write or call their electric company, or discuss possible actions with their neighbors—if lattice structures were put up instead of steel poles.<sup>11</sup> Although simplistic, this first attempt at a formal public survey gave legitimacy to public opinion, which had previously been overlooked. It also paved the way for more studies on public perception of transmission structure design.

# “...only 12% of their sample groups found the appearance of transmission lines particularly unattractive or bothersome.”

By the end of the 1970s, the focus turned from a collaborative effort in developing new innovative designs to individual efforts, designed to improve existing structures through the use of alternate materials, aesthetic coatings and various paint colors. It was felt that these measures would help integrate transmission structures into the landscape. The new axiom was that people wanted to see transmission lines as little as possible. Both the 1972 survey and a 1976 Canadian study<sup>12</sup> revealed the same results: only 12% of their sample groups found the appearance of transmission lines particularly unattractive or bothersome. A few years later in 1979, an influential paper analyzed why the public disliked transmission structures, and went on to present ways to minimize their visual impact.<sup>13</sup> This appeared to resolve the debate of whether transmission structures could be an aesthetically pleasing and acceptable contribution to the landscape.

## 1980s The 1980s: Considering Public Perception of Transmission Lines

Research during the 1980s produced little in the way of cooperative industry research or progressive knowledge. Advancements were led primarily by individual efforts and, as a result, progress was unsystematic and suffered from various methodological shortcomings. Contributions during this decade came from the insights of the researchers, who advanced the notion of consistent methods and, with its attendant benefits and perils, encouraged a shift toward public involvement.

A literature review, published in 1984, concluded that there was a great deal of public concern regarding the visual impact of transmission lines, but as of the early 1980s, there was “surprisingly little” empirical research to determine how the public perceives the lines.<sup>10</sup> This was supported by a subsequent study of public attitudes and perceptions in which the authors noted, “In carrying out this work, it became increasingly clear that, while both the power company and the planners had made implicit assumptions about how residents would perceive and regard the transmission lines built in their neighborhoods, little was really known about this area.”<sup>14</sup>

A 1988 article noted, “There is no single or best aesthetic solution, yet the public wants to be involved in the aesthetic decisions for any given siting.” It also noted that elements such as aesthetic preference should not be generalized and are best examined on a case-by-case basis.<sup>15</sup> Structure design was beginning to be seen as just one factor among many affecting public perception of transmission lines.

The 1984 study pointed out one of the difficulties of conducting research on aesthetics when it observed that, “vague public fears about health, safety, and other environmental aspects of the transmission system often get attached to the appearance issues.”<sup>10</sup> This was especially true in a decade that marked the first indication of public concern over the potential health effects of exposure to electromagnetic fields (EMF). By the late 1980s, the EMF issue had started to erupt, and it became difficult, if not impossible, to separate aesthetics-related opposition from health-related opposition. The public may not have liked the look of a line, but expressing fear regarding the potential health effects of EMF became a stronger and more compelling argument for public opposition.

The literature review from the early 1980s summarized public perception by noting, “The early studies exhibited significant variation in focus, study design, definition of key variables, data collection, sampling, and analysis.” It went on to state that, “the research studies were few and far between, and frequently were conducted in a conceptual vacuum, without much reference to potentially helpful ideas from the social sciences or to the lessons provided by other work done in the field.”<sup>10</sup> This trend, which was characterized by a marked shift from large collaborative research to the isolated efforts of individual companies focused on site-specific problems, continued throughout the decade.

# 1990s

## The 1990s: Establishing a Basis for Future Research

The research of the 1990s took a new turn – characterized not so much as producing new information as producing new thinking. Serious consideration was given to establishing consistent research methods, and recognition of a research imperative—to validate findings—emerged. Researchers sought a new objective: to reveal the relationship between cause (design) and effect (perception). These efforts were unfortunately short lived, as the suggested principles would not be put into practice.

Once again, the research agenda reflected circumstances of the times, but in this instance, pressure was being exerted from within the industry. Rather than projecting far into the future, utilities were focusing on the next 5-10 years.

As the system worked to cope with existing demand, the industry was facing regulatory uncertainty. Fear of stranded investments brought about a sharp decrease in the number of lines constructed during this decade.<sup>19</sup> Because companies were not building new facilities, the various groups of utilities, regulators, and citizens were not presented with their associated challenges. As a result, industry funding for research dropped off dramatically during the 1990s, as evidenced by the declining budgets of leading collaborative electric-industry associations. Experimental research all but came to a halt due to declining investment in infrastructure.

A 1990 case study found perception to be influenced by personal, contextual, and symbolic factors, similar to findings from previous decades. The report summarized that “the paucity and inconclusiveness of the research can be interpreted as an indication that transmission line aesthetic evaluation is an area of professional practice that is in too early a stage of development to have generated either pressures for validation or a framework for

evaluation.”<sup>21</sup> Each major analysis produced throughout the decade would repeat this theme.

Another review noted that the research to date had not gone far enough in exploring how concerns about aesthetics compared to other concerns, what factors influenced perceived aesthetic effects, and to what degree the measures to mitigate aesthetic impact had been effective. Public perception of transmission structure aesthetics had been a case study driven field, and it became clear that case studies were not the best approach to this type of research.<sup>20</sup> In response, researchers undertook an analysis of the major research conducted to date in hopes of producing a

foundation for developing a standardized approach. At last, it appeared that work in the area of perception of transmission lines was finally progressing.<sup>22</sup>

In 1993, an international collaborative effort was launched. Its authors observed that that industry’s best practices had been defined more than 20 years prior by industrial designers and landscape architects who formulated rules of good design based on the traditional principles of their professions. Emphasizing the continued opposition to transmission lines, the authors implied that these principles were not entirely adequate for current needs and identified specific flaws in the assumptions used in prior research. Apparently, the basis for some design measures that were

developed to mitigate visual impact suffered from a lack of scientific rigor. The authors found that public evaluations of measures to reduce a structure’s visual impact—for example, tower type, color, and treatment of the right of way—were not always consistent with the philosophies driving the design professionals who recommended them.<sup>23</sup>

This work led to the need to generate an empirically based understanding of how people who live near recently built or upgraded transmission lines perceived the lines’ effects. The



long-term goal was to use this understanding to develop guidelines for the planning, siting, design, and evaluation of new and upgraded transmission lines. It also suggested developing specific guidelines for the planning of public involvement programs to produce more publicly acceptable siting, a more efficient siting process, and a minimum of legal and political challenges. The report concluded that, without additional research on regional preferences, knowledge on the subject could not advance. It described a need for updated research that was well coordinated and used consistent research designs, survey instruments, and methods of analysis.<sup>23</sup> The results of these efforts are now regarded as a foundation for a field that, despite 30 years of research, was still considered in its infancy.

## Summary and Conclusions

The effect of aesthetic design on public perception of electrical transmission structures remains an elusive topic. The melding of technical practices with societal demands can lead to complex

interactions. Despite more than 40 years of research, findings relating these two subjects are far from being established as definitive.

The collaborative efforts of decades past have proven more successful than individual ones, yet even the largest collaborative efforts have not produced far-reaching conclusions. The research suffered from a shifting focus and an overall lack of scientific rigor. While these decades demonstrated consistent efforts in addressing an erratic slate of design and perception issues, scientific progress toward improving public perception through design has ultimately led to unrealistic expectations.

Despite their intimate relationship, design and perception research have proven difficult to correlate in a meaningful way. Introducing a more standardized approach to measuring this relationship can help to improve the aesthetics of transmission lines, and ultimately, to ease public opposition to the numerous new lines that will be required to meet the energy demands of the 21st century.<sup>25</sup> ●

## Footnotes

<sup>1</sup>This work was sponsored by the Electric Power Research Institute, Palo Alto, CA, Rights-of-Way: Siting, Vegetation Management and Avian Issues Research Area. John W. Goodrich-Mahoney, Project Manager.

<sup>2</sup>Dreyfuss was already at this point a well-known figure in industrial design. He was not a stylist, instead he applied common sense and a scientific approach to design problems. Significant Dreyfuss designs included a "flat-top" deluxe refrigerator for General Electric (1933), the "Princess" telephone (1959), and the spherical "Model 82 Constellation" vacuum cleaner for Hoover (1954). In 1960 he published *The Measure of Man*, an ergonomic reference. He retired in 1969.

<sup>3</sup>Bruce Howlett's paper noted that the public disliked transmission poles for their large size, linearity, and the fact that, because they carry bulk power, they are of no direct value to the areas that they cross. With regard to visual impact, Howlett noted that different paint colors can help to conceal a structure.

<sup>4</sup>Regarding visual impacts, this report found that 40% of respondents felt that the transmission line under study negatively affected the visual character of their neighborhood. Those who had positive feelings about the line pointed out the woodlands or bike path along the right-of-way. Although five different types of poles were included in the study, the findings could not be applied to any particular type of structure.

<sup>5</sup>The report noted that structures should be compatible with the surrounding landscape in line, form, color, and texture. Solidity, complexity, legibility ("the property of the structure to express its mechanical function in a simple and immediate way"), and aesthetic quality of the pole should also be considered, the report suggested. Cost was also a factor. It continued, "Because of the extra costs involved, special aesthetic design should be considered only after it has been determined that other alternatives

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