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Abstract

This article investigates place-making—a process involving appeals to embodiment, materiality, and spatial arrangement—as a means for building communicative relationships between technical scientific communities and lay publics. Drawing from discourses related to the National Historic Chemical Landmark Program's 89 landmarks, we illustrate how the National Historic Chemical Landmark Program builds different types of relationships with nonexperts via the utilization of place as (a) narrative framing device, (b) proprietor, and (c) gatekeeper. These findings reveal the ways in which specific strategic place-making gestures can support more or less public engagement in the processes of scientific work and outreach.

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On September 20, 2014, members of the American Chemical Society (ACS) dedicated the 76th landmark of the National Historical Chemical Landmarks Program (NHCLP) in the name of Thomas Edison. A commemorative plaque was unveiled during the ceremony and emplaced for prosperity at the Thomas Edison Center in Menlo Park, New Jersey. Hewed in raised golden letters and set against a black backdrop, the plaque's text justified the selection of Edison and this specific location as a notable place in chemical history by appealing to where Edison conducted his chemical work and the physical materials he used. It noted that although Edison initially "developed an interest in chemistry as a young boy while growing up in Michigan," he had opened the "nation's largest private laboratory in Menlo Park, N.J., for invention, research, and product development," where he employed a range of variously skilled workers in "well-equipped machine shops and electrical and chemical laboratories" ("Thomas Edison," 2014). The plaque went on to explain, "At Menlo Park, Edison led a comprehensive survey of filament materials, selecting carbonized bamboo for his first commercial electric light bulb" ("Thomas Edison," 2014). This tribute identified notable, landmark-worthy chemistry in terms of specific places where the science itself was said to have ensued, places that ostensibly could be visited in person and that contained the physical and discursive remnants of technical innovation.

The stated goal of the NHCLP, which was initiated by the ACS in 1992 and now encompasses 89 landmarks across 31 U.S. states and seven international locations, is to "examine, note, record, and commemorate outstanding chemical and chemical engineering achievements and landmarks in this country and abroad" ("Guide to," 1991, p. 3). Landmarks are nominated by local ACS chapters and reviewed and approved by ACS leaders, with selections made in the interest of establishing "persistent reminders of where we have been and where we are going along the divergent paths of discovery" (p. 5). Over the course of the program's now 28-year implementation, NHCLP architects have worked to circulate a publicly engaging narrative that positions chemistry as fundamental to the nation's vitality by arranging markers of that narrative throughout the national and international topography. As NHCLP manager Judah Ginsberg explained in a 2009 issue of the Journal of *Chemical Education*, by connecting the story of chemistry's "achievement" with the "place where it happened," the NHCLP aims to generate "public awareness," facilitate chemical education, and build support for scientific endeavors past, present, and future (Jacobsen & Ginsberg, 2009, p. 161).

Research in science and professional communication has initiated important explorations into how science is made rhetorically available to nonexpert publics. Findings demonstrate, for instance, that narratives are an especially powerful way for publics to establish points of scientific identification and understanding and that persuasive public science campaigns tend to be tailored closely to the situated nature of the time and place at hand (Dahlstrom, 2014). Moreover, research by scholars such as Newman et al. (2017) and Ploeger (2009) suggests that place-making-a strategic process that involves appeals to embodiment, materiality, and spatial arrangement-has the potential to facilitate engaged, informed public participation in and with technical communities of science, an outcome associated with sound regulatory and policy initiatives (Endres, 2009). The present research aims to build from these insights, as well as the notion that science history has long been theorized in terms of landmarks and physical, emplaced discoveries (Livingstone, 2007), to explore the specific means through which the making and arranging of place can configure science and its history as a more or less public enterprise.

Our analysis of the NHCLP demonstrates that the program arranges chemistry as differentially available to nonexpert audiences by enlisting three "place-making gestures"-what Stewart and Dickinson (2008) defined as a "series of (often nonverbal) forms and signs" through which "places make a claim to placeness" (p. 283). These include enlisting place as (a) narrative framing device, in which members of nonexpert publics are oriented to the "story" of science, (b) proprietor, wherein ownership is used to demonstrate the availability of science to nonexpert publics, and (c) gatekeeper, in which physical inclusion enables or thwarts lay participation in the broader community of scientific interests via appeals to admittance and mobility. In what follows, we delineate these place-making strategies in terms of how they function communicatively and how they constitute lay publics in relationship to technical science and histories of technical science. We proceed, first, by reviewing findings about how place-making transpires generally and in scientific and technical contexts specifically. Next, we provide an overview of our methodology, before then explicating the specific gestures through which appeals to place and place-making facilitate specific types of connection between technical chemistry and members of the lay public via the NHCLP.

Place-Making to Build Connections

Scholarship representing a diversity of fields has contributed to the study of place and the processes involved in its strategic making. Setting the stage for this research, Massey (1994) characterized place itself as uniquely bounded

by both material location and discursive construction. She contended that the act of place-making—which Ewalt (2018) defined in terms of "material arrangements" that allow for encounters across diverse phenomena "as part of a persuasive strategy" (pp. 380-381)—is an ongoing negotiation of discourse, social expectation, and physical embodiment that coalesces around individuals' attachments and relationships. On a structural level, Massey argued that making place involves harnessing the dynamics of existing systems of power, but, despite this grounding in often long-ingrained norms and ideals, scholars such as Endres and Senda-Cook (2011) have demonstrated that place-making's inventive force can go beyond iterations of the status quo to foster resistance and evolution.

Questions about how strategic place-making transpires and to what ends have been considered in terms of, first, the central role that language and naming plays across place-oriented case studies. Cresswell (2015) explained that "when humans invest meaning in a portion of space and then become attached to it in some way (naming is one such way) it becomes a place" (p. 16). This can function at the level of a general descriptor of an area as, for example, "rural" or "middle-class" (Benson & Jackson, 2012, p. 793), or more specifically in terms of naming a particular site "ground-zero" (Donofrio, 2010, p. 150), or "Starbucks" (Dickinson, 2002, p. 5), and thereby hailing the assumptions and ideals associated with those titles.

Second, research into the processes of place-making demonstrates how narrative, in combination with naming, functions to create opportunities for identification. In his study of Northern Apache place-naming practices, for instance, Basso (1996) illustrated how place-naming serves as a form of access that—in the context of overarching cultural narratives—preserves the words of the ancestors in relation to specific landmarks and ensures that, long after the physical landmarks themselves change, the places associated with those locales continue to reflect a long-ago geographical and cultural history. In this case and others, narratives constitute a store of common knowledge and public memory that function to arrange physical space in accordance with cultural, social, and discursive happenings and thereby create engrained meaning.

Third, scholars find that place-making is enacted via its invitation to specific others to share in the ideas and ideologies it furthers, both as it represents the past and as it projects into the future. Appeals, for example, to visit a specific museum, memorial, or landmark create opportunities for thinking, feeling, remembering, and encountering phenomena together. In this process of what Edbauer (2005) conceptualized as doing place, participants confront common resources and embodied ways of knowing as they decipher themselves and others. For these reasons, constituting place has proven to be an effective means for generating support from those who might not otherwise identify with the

ideas, histories, or goals at hand (see, e.g., Ewalt, 2018). At the same time, those without an invitation to place are more likely to find themselves excluded from participation via associated conversations, engagements, and identities (Nakayama & Krizek, 1995). Place, in this way, can function as the point around which community boundaries are made and maintained.

In the context of science specifically, strategic place-making has been considered in several cases as a potentially effective, though sometimes misguided, mechanism for specialists to circulate their findings and ideologies to nonspecialist audiences. Johnson (2008) highlighted the role of place-making in the dissemination of public scientific vocabularies as they were enacted via a traveling science museum exhibit. She argued that the creation of the exhibit as a place for public engagement with science was a means by which the pharmaceutical industry transformed lay viewers into patients and consumers, although not necessarily into participants in the broader scientific community. Conversely, Pohlman (2004) found that a museum exhibit covering an international archeological dig functioned to support nonexpert audiences in conceptualizing science as process-rather than product-through the lens of place-making. Similarly, Newman et al. (2017) found that the construction of place in citizen-science conservation efforts genuinely improved lay understanding, participation, and engagement concerning the technical issues at hand. These considerations of place as a strategy for scientific public outreach reveal that place-making as a communicative process is not tied inherently to a specific ideology or outcome. In this regard, this existing research invites additional explication of the specific ways that place-making gestures operate to configure science as available (or not) to lay audiences. Thus, the present research poses the following research questions:

Research Question 1: How does the ACS enlist place strategically in the NHCLP via specific rhetorical gestures?

Research Question 2: How do these gestures create opportunities for public identification with and participation in technical communities of science?

Method

Research Orientation and Data Collection

This study is guided, first, by a critical rhetoric orientation to data collection, which involves the identification, selection, and analysis of relevant rhetorical texts (this framework operationalizes texts for analysis as "fragments," not because the texts themselves are inherently deficient or underdeveloped but because it holds that there is no such thing as a complete text that exists outside of the overarching communicative landscape; McGee, 1990, p. 279; McKerrow, 1989). In this framework, texts are selected with the criteria that they are representative of the central discourses and questions at issue, especially as those discourses and questions play out in terms of communicative strategies and power dynamics. For the case at hand, central questions clustered around the ways in which the NHCLP employed place-making in its public outreach initiatives. The authors therefore set out to identify and analyze all the textual materials produced by the NHCLP about the program, thereby not so much deriving a sample of discourse for analysis but, rather, a complete and comprehensive set of NHCLP-produced discourses. These data included all archival correspondence and records concerning the NHCLP held in the Othmer Library of Chemical History's collection, "Records of the American Chemical Society National Historic Chemical Landmarks Program," at the Science History Institute in Philadelphia, Pennsylvania (three boxes or 3.2 linear feet of textual material); and all publicly available NHCLP documents from the ACS website, which includes an extensive directory and overview of each landmark and organizes landmarks by year, product category, and general location (ACS, n.d.).

Second, the study was also guided by a field-based orientation to rhetorical criticism (McKinnon et al., 2016). Tenets driving this approach-which is dedicated to augmenting textual data collection with discourse garnered via qualitative inquiry-include recognition of the "value of researcher presence for studying place" and an ongoing commitment to conceptualizing rhetorical action as embodied, emplaced, and interactive (Endres & Senda-Cook, 2011, p. 259; Middleton et al., 2015). With these tenets in mind, four of the authors traveled to six distinct and conceptually diverse NHCLP landmarksthree authors traveled to one site each and one author traveled to three sites to see the commemorative plaques, interact with their locations directly, and triangulate analytical conclusions via the lens of direct, embodied experience (Lindlof & Taylor, 2019). Primary documents including photographs, fieldnotes, and observational memos garnered from these trips were included in the data and correspond with landmarks at Columbia University; New York University; the University of British Columbia; the Smithsonian Institute; a former factory building in Cambridge, Massachusetts; and a former industrial building in Brooklyn, New York.

Data Analysis

Artifact analysis began at the start of data collection and continued throughout and beyond the collection process. Research team members engaged in a constant comparative analytic approach that involved, first, carefully reading and examining all the data as it were compiled for central themes, appeals, and overarching narratives, and second, comparing discursive fragments to each other to identify distinctions, continuities, and points of overlap (Charmaz, 2014). Team members went through this process repeatedly both individually and as a group until all the data had been compiled, compared, and conceptualized. Following consultation concerning existing literature and the key concepts therein associated with strategic place-making, team members created a codebook of overarching themes and associated rhetorical patterns (Tracy, 2013). This allowed them to map emergent place-making strategies or gestures and their components to individual rhetorical texts, and to track the larger arguments about place and place-making they engendered. Team members then identified central elements of distinct place-making gestures, classified specific examples from the data for each gesture, and conceptualized how nonexperts were constituted by the discourses under consideration. The findings reported below are the result of this iterative, team-oriented engagement with the NHCLP data.

Results

Our inquiry into the NHCLP's strategic place-making revealed three central place-making gestures related to narrative framing, proprietary appeals, and representations of gatekeeping, each of which constituted lay publics in complex and not always inclusive relationships with the chemical sciences and its professed history.

Place as Narrative Framing Device

The place-making gesture that emerges most explicitly throughout the analyzed NHCLP discourses is the employment of place as a narrative framing device that orients lay audiences to the technical scientific story being put forth. Place functions in the text of almost every commemorative plaque as an entrée for readers to make sense of and begin engaging with the narrative, as well as a mechanism for justifying the selection of any one particular landmark for inclusion in the project. For instance, during one author's visit to the landmark denoting the former Polaroid Corporation Laboratory in Cambridge, Massachusetts, where Edwin Land developed "instant photography," they were met with a plaque affixed to an exterior, red brick wall that read, "From his workplace in this building, Edwin H. Land (1909-1991) led the Polaroid Corporation in its development of the first instant photography system" ("Edwin Land," 2015; M. Krall, observation, May 13, 2019). Prior to learning about what Land's technology is, visitors to the landmark are oriented narratively to the "workplace" of this science and encouraged via their own physical positioning to orient themselves with respect to the same rough bricks that contained countless chemical reactions in years past. Place, in this sense, provides visitors with both physical and narrative standpoints as they attempt to understand—and ultimately arrange themselves within—chemistry's history and community via the project's discourses.

Other landmark plaques commence similar to the Cambridge landmark with clauses such as "at this site" ("Sohio Acrylonitrile," 1996), "in this building" ("Neil Bartlett," 2006), "at this institute" ("C.V. Raman," 1998), and "in his laboratory in the basement of this building" ("Edward W. Morley," 1995). These appeals assure visitors that they have entered what Johnson (2008) termed a "contact zone" of technical science where the referenced overlap of the physical location with the science's emplaced history blurs the boundaries of chronological time and technological expertise to create apertures for narrative understanding and identification. Indeed, these references create the impression that visitors' specific "spatio-temporal alignment" within designated landmarks sets them apart from other nonexperts in that they have achieved an unparalleled vantage point for considering one or more of science's historical achievements (Harris, 2018, p. 25).

Beyond providing an entrée for landmark narratives, appeals to place also function in some instances as overarching metaphors that offer cues about how audiences should engage personally with the tale unfolding. For instance, the plaque affixed to the Joseph Priestley House in Northumberland, Pennsylvania, which was dedicated in 1994 and recognizes Priestley as the "Discoverer of Oxygen," is upheld as a "Mecca for all who would look back to the beginnings of chemical research" ("Joseph Priestley," 1994). The inference in this case is multifold. First, the plaque identifies Priestley's research on oxygen as a scientific foundation that contemporary audiences can conceptualize via their interaction with this house, a house that is said to have provided the literal infrastructure for chemical reactions and experiments that function, in this narrative, as the metaphorical grounds of chemistry as a modern discipline. Second, the plaque upholds chemistry as its own brand of (or alternative to) religion and the selection of this spot, which housed Priestley's "library of some 1,600 volumes and his chemical laboratory, where he first isolated carbon monoxide" ("Joseph Priestley," 1994), as deserving of a pilgrimage through which interested parties can perform and inscribe their devotion to science via the "rhetoricity of the moving body" (Harris, 2018, p. 24). Moreover, the plaque notes that not only did Priestley do research in this house but he also "supervised the construction of this house and laboratory from 1794 to 1798, then lived and worked here until his

death in 1804" ("Joseph Priestley," 1994). In this telling, Priestley, the house that he constructed and toiled in for the remainder of his adult life, and the science that he performed are metaphorically conflated into one narrative configuration that solidifies the historical account on offer and clears a spot for visitors to engage with science via the lens of religious encounter.

Overarching place-oriented metaphors along these lines are often coupled in the NHCLP discourses with detailed descriptions of the physical location and materials of science. This practice recenters attention onto place as an orientation and, in some cases, results in plaque inscriptions rife with details that-through their unwieldiness-highlight the insufficiency of language in the face of material embodiment. For instance, several plaques provide cumbersome address-oriented information (e.g., the "Savannah Pulp and Paper Laboratory" Landmark plaque explains that the laboratory at hand was "originally housed in a warehouse at 512 W. River Street"; "Charles Herty," 2001) and name-change chronologies (e.g., the "Production and Distribution of Radioisotopes at ORNL" Landmark plaque explains that the "Clinton Laboratories" were "later renamed Oak Ridge National Laboratory"; "Production," 2008), as well as extensive lists of the particular services and activities a given locale facilitated (e.g., the "Mellon Institute of Industrial Research was established," the plaque explains, to house research, offer training facilities, provide scientific resources, and more; "Mellon," 2013). A plaque for the landmark celebrating "Acetyl Chemicals" (1995) infuses this practice of detailed descriptions concerning buildings, architecture, and the materials of science with a construction-oriented metaphor, explaining,

This plant was the first in the United States to use coal rather than petroleum as a raw material in the commercial production of acetyl chemicals—important *building blocks* [emphasis added] in the synthesis of a wide range of consumer products. ("Acetyl Chemicals," 1995)

Here and elsewhere, the NHCLP communicates that science demands the establishment of a worthy place where the complex construction of raw materials can unfold. With this particular narrative gesture of strategic place-making, anyone who recognizes the inherent value of these places by naming them, encountering their story, and/or making pilgrimage to them is constituted as a more or less engaged member of the broader community of chemical sciences.

Moreover, place as an orientation and point of recognition is deemed so significant to the chemical community in this account that the NHCLP situates specific places as essential actors in their own right. For example, in a landmark documenting Alice Hamilton's development of occupational medicine, Hamilton's engagement with Hull House, where the landmark was dedicated in 2002, is described as necessary for her progress as a scientist. The plaque explains that "through living and working in the Hull-House neighborhood, she identified occupational diseases plaguing those who worked in the dangerous trades" ("Alice Hamilton," 2002). Audiences viewing the landmark near Hull House are encouraged through this appeal to imagine how this specific place situated her to engage scientifically with the scenarios she encountered. The underlying premise here is that, had Hamilton not found herself at Hull House, her contributions to chemical history would not have unfolded. Without the place at hand, this account implies that there would have been no science, a rhetorical gesture that justifies the NHCLP proper just as it also arranges audiences to conceptualize scientific history— and their role within it—from the ground-up.

Place as Proprietor

In addition to orienting visitors to engage narratively with chemistry through place, NHCLP also gestures in directions that indicate place is inherently proprietary and that audiences are connected to the chemical discipline and its history via their own potential for emplaced scientific ownership. Appeals along these lines make science available to lay publics by engaging an "entrepreneurial spirit" that conceptualizes science as something that can be consumed by those who purchase and/or use scientific processes and products (Halloran, 1984, p. 79). The mechanics of this gesture tend to fall under the umbrella of discourses that uphold seemingly participatory models of science communication wherein "groups of individuals who are affected by the products of science are invited to become part of a community of evaluators and decision-makers" (Bubela et al., 2009, p. 515). The decision making on offer, however, is generally more about buying specific goods or, perhaps, voting in favor of scientific research agendas and funding than it is about engaging directly with scientists and scientific practices. Yet we find that even this circuitous connection, mediated through the construction of place, functions in the case of the NHCLP as an invocation for public identification with technical chemistry, just as displaying photographs of nature's sublimity has been shown to symbolize and induce feelings of domestic ownership over the environment (DeLuca & Demo, 2000).

Consumption and manufacturing goods are consistent NHCLP themes that serve as defining features of the places marked. Several landmarks are named for well-known products firmly grounded in American consumer culture (see, e.g., the "Columbia Dry Cell Battery" Landmark, 2005, and the "Scotch Transparent Tape" Landmark, 2007). Their accompanying plaques and associated online materials describe them as inherently linked to the places where those products were developed and/or manufactured. For instance, Cincinnati, Ohio's Procter and Gamble Headquarters houses the "Tide Synthetic Detergent" Landmark (2006) with a plaque noting how "P&G chemists, working at the Ivorydale Technical Center," altered their existing chemical formulas to produce and debut "Tide, the first heavy-duty synthetic detergent" that was and is "strong enough to clean heavily soiled clothes" ("Tide," 2006). The appeal in this instance functions in terms of an impactful shift in "geographic scales" (Harris, 2018, p. 34), which involves associating the dedicated (macro-level) efforts of scientists in the location at hand with the demanding (micro-level) work that Tide does to clean the garments of those who use the product, and perhaps even with the devoted (meso-level) labor of individuals doing laundry in homes nationwide. Scientific research is domesticated through this symbolic transference of place into something connected to lay audiences in ways tactile and personal.

Where these appeals become even more persuasively vivid is when the goods referenced are both connected to their development through place and linked to a broader public good. The "Tide" Landmark (2006) hints at the feel of this appeal by tying Tide to the domestic work of family life, but it stops short of associating that emplaced labor with an explicit higher purpose. By contrast, the "Selman Waksman and Antibiotics" Landmark (2005) is commemorated both for the place of its underlying scientific work and the widereaching health implications of the scientific research referenced. Its plaque, which hangs on the walls of the State University of New Jersey, reads, "Here, in Martin Hall, Selman A. Waksman and his students isolated antibiotics produced by actinomycetes, most notably streptomycin, the first effective pharmaceutical treatment for tuberculosis, cholera, and typhoid fever" ("Selman Waksman," 2005). This characterization implies that this specific institution and hall provided the specialized infrastructure necessary for researchers to isolate a chemical material powerful enough to halt the spread of multiple deadly diseases. The use of technical terms in this inscription highlights the expert nature of Waksman's science while the reference to "antibiotics" in general and the listed names of widely known but all-but eradicated maladies emphasizes the gains that chemistry done in this place has procured for all. Moreover, audiences' own unique experiences with antibiotic treatments to ward off bacterial infection offer a warrant in this account for the overarching claim that this science is a public good and that they-as members of the public—have a proprietary stake in that good and its perpetuation.

Corresponding appeals interconnecting place, lay proprietorship, and an overarching good are made in other landmark inscriptions hailing the benefit to "mankind" and the "relief" brought to "millions of people and animals" by well-known, emplaced products and the chemical industry writ large. In one case, scientists are hailed for their "advocacy" on behalf of the broader public in restricting chlorofluorocarbons, which—in the process of doing chemical research at the University of California, Irvine-they found "could deplete Earth's atmospheric ozone layer, which blocks the sun's damaging ultraviolet rays" ("Chlorofluorocarbons," 2017). This landmark, much like several others dedicated to the "Legacy of Rachel Carson's Silent Spring" (2012) and "The Keeling Curve" (2015), functions as a counter to the capitalist critique that could be brought against the NHCLP as a whole in that it hails chemical regulation and upholds chemical insight as vital to thwarting harmful production practices that work against public health and environmental well-being. In these cases, the safety regulations that result from chemical research are characterized as having been inspired by and created on behalf of lay people and the places in which they live and, therefore, as something that lay people have a significant degree of ownership in. Without them and a concern for their physical safety, the NHCLP suggests that the chemical research behind this work may have found no place to progress. Lay people are thus situated through this gesture as inspiration for-and therefore an important part ofscientific research and the broader scientific community.

Place as Gatekeeper

A third place-making gesture featured throughout the NHCLP and its discourses overlaps with the other two and posits physical engagement with place as a gatekeeper to scientific inclusion. Reoccurring textual allusions offer an infrastructure for this appeal. For instance, both the commemorative pamphlet and the website associated with the "Smith Memorial Collection at the University of Pennsylvania" Landmark begin by proclaiming, "Any serious student of the history of chemistry in America will eventually seek out the Edgar Fahs Smith Memorial Collection, one of the foremost international historical collections of chemistry books and manuscripts" ("Smith Memorial," 2000). Potential visitors are thereby led to believe that the act of physically making the trip to access this landmark distinguishes one as a member of the in-group, while those who have already completed the journey are assured that their entry has been gained rightfully.

In its reference to the "serious student," however, the "Smith Memorial" Landmark (2000) pairs the claim that anyone willing and able to travel to the landmark could become a member of the scientific community with the premise that such inclusion must be earned through hard work and acts of dedication. The aura of impenetrability that has long been associated with scientific knowledge is performed in this case in the overarching invitation for individuals to visit places that, it turns out, the NHCLP does not ensure are easy to find (Ceccarelli, 2001). The first clue one might have that a pilgrimage to individual landmarks may be more difficult than the public relations materials for the NHCLP imply-materials inviting busses of school children, history buffs, and other nonexpert audiences to make the trip-is the dearth of a map or directions in the project's online profile. ACS's original instructions for landmarks' "illustrative material," as laid out in the project's 1991 guidebook, encourage the use of "photographs, drawings, schematic diagrams, and other graphic materials to illustrate and enhance the text," but include no mention of visuals-or text-to help direct visitors to the plaques on display ("Guide To," 1991). As a result, each landmark's website and commemorative pamphlet provides only a vague statement about where the plaque was originally dedicated, along with an accompanying photograph of the dedication ceremony. In this context, those attempting to visit a landmark embark with an unclear sense of where they might be headed and what might be necessary to get there. This experience of being technically invited to participate in the NHCLP but not provided with the resources necessary to do so, encapsulates some of the major hardships of connecting with technical science from a nonexpert subject position (Gagnon & Komor, 2017). Visitors to the NHCLP have no map to locate the landmarks, just as lay people, by definition, lack the different resources and capacities to associate with chemistry in terms of professional identity or culture. They might embark forth (cognitively or physically) toward a chemical association when the technical community gestures toward their inclusion via outreach initiatives, but they are likely from this position to lose their way through the particularities and rigorous requirements of the path.

Field-notes from research team members' trips to individual landmarks provide some insight into both the hardships of gaining access to landmarks and the resultant sense of triumph and merited admittance garnered from a successful landmark find. As Jordan (2004) demonstrated, the rhetorical act of gatekeeping tends to derive its persuasive force from strategic ambiguity wherein two conflicting ideals are upheld simultaneously, and the NHCLP's public outreach orientation, in combination with its vague descriptions of individual landmark locations, arranges visitors to experience the potency of those dynamics at work. During several of the team's trips, a first attempt at locating landmarks had to be abandoned in the face of exhausted resources. In one instance, a trip ended in no landmark find at all because—in that case—the Smithsonian did not have the marked item, the Bakelizer, on public display (B. Mann, observation, May, 26, 2019; "Bakelite," 1993). There was (and is) no specification on either the NHCLP or the Smithsonian websites that that particular landmark is not permanent, and the disappointment of a failed trip was exacerbated by the rigors of a cross-country journey home. Later, however, a successful landmark find elicited in this research team member the sense that they had become more firmly configured within the community of chemical sciences than they might have been if they had not faced an antecedent of hardship and failure. The place-oriented struggle itself—one that the ambiguous NHCLP discourses arranged them to perform and that, it could be argued, echoes the trails of scientific training and research—invited entry into a mode of witnessing made possible by what Cram (2016) identified as a "feeling cartography" wherein one's "emotional landscape" merges with and thereby emphasizes the production of place and its ideological investments (p. 141).

Even in one instance where the specific landmark building was not overtly difficult to locate, field-notes from the trip reveal that the role of place as gatekeeper functioned in other ways that ultimately solicited various registers of emotional investment. During a visit to the "Neil Bartlett and the Reactive Noble Gases" Landmark (2006), one researcher made their way to the chemistry building at the University of British Columbia in Vancouver without incident. Their field-notes from that trip speak to the symbolically rich architectural gestures of the building (Hasian, 2004), gestures that seemed to do as much to keep lay people from entering as they did to elicit removed admiration from those same people. The field-notes explained, "The chemistry building is a castle. The gray stone and many old glazed windows are intimidating already. It's also Sunday, so it feels like I'm about to invade a stronghold even as I sit on the ground outside to take in the view" (M. Parks, observation, June 16, 2019, p. 3). At every stage of their subsequent "invasion" of what looked to be hallowed halls, the research team member felt out-of-place and therefore regularly had to be goaded out of the immobility that the scenario orchestrated. Eventually, they were rewarded for what felt like subversive efforts to push forward. The field-notes from this encounter capture, again, the tensions inherent in seeking—and finding—a place that does not seem to want to be found:

The doors to the stairs in block B are unlocked so I silently scuttle upstairs. The bridge is open and it is BEAUTIFUL! Bright stained glass is striping it in rainbows. Yet, it is also eerie—empty, forbidden. I feel that I am trespassing as I quietly follow the bridge into block C. . . . And THERE is the landmark designation in the upper right corner! While the sunlight makes it difficult to read, there is a description of the landmark. (M. Parks, observation, June 16, 2019, p. 6)

In this case, the building's design, the empty halls, the lack of arrows or directions for accessing the landmark once inside cohere to inspire something

that echoes the affective moment of the landmark's discovery. That lay people are clearly meant not to be there—not to invade the ivory towers of science and make discoveries—warrants that those nonexperts who do make it inside have successfully navigated the NHCLP's unique "dynamics of spatiality" (Chávez, 2019, p. 9) and infiltrated the broader community of chemical insiders symbolically and corporeally. However, their relationship as insiders to that community is only made meaningful because it exists in contrast to most other lay people.

Although the stated goals of the NHCLP include facilitating chemical education and generating public awareness (Jacobsen & Ginsberg, 2009), the gatekeeping gesture at work in so many of the landmarks suggests that, in fact, the program's major purpose may be more ceremonial and internal than it is outward-facing. Further evidence for this reading exists in the NHCLP's documents and website wherein the central event highlighted for each landmark is the unveiling of plaques with local sponsors (rather than, e.g., visits to witness the plaques and associated landmarks after the unveiling ceremony). The unveiling ceremony is upheld on the ACS website as the cumulation of extensive internal work related to the "Landmark Nomination Process," which involves the completion of complex nomination documentation, repeated review by subcommittee, and approval by the ACS Board Standing Committee on Public Affairs and Public Relations ("Landmark Nomination Process," 2020). This is not to say that the program does not also aim to serve and incorporate nonexpert audiences but that the act of working with local ACS chapters to get those chapters ushered into and recognized within the national chemical community seems to stand supreme, in some cases working against the interests of outreach-oriented aims.

Conclusion

This study identifies how the NHCLP enlists strategic place-making to create connections with lay publics. It delineates three major gestures through which this process transpires and considers how each individual gesture constitutes nonexperts in relationship with technical chemistry and its professed history. First, our findings reveal that, when place-making occurs through the lens of a narrative framing device—something that transpires in the NHCLP largely through textual references to having experienced and appreciated landmarks in a material and therefore scientifically oriented sense, lay audiences are generally guided in very clear ways to see themselves as physically and relationally connected to the world of technical science. Place, in these cases, serves as an opening through which nonexperts can connect to professional,

disciplinary chemical study. Similarly, when place is evoked in a proprietary sense—wherein ownership over products associated with landmarks is upheld as a legitimate connection to technical science, lay audiences are also guided to partake in a reading of self as scientific through the consideration of both consumer goods and their own membership within a public that—according to this account—chemistry has historically aimed to protect. In both of these gestures, strategic place-making creates opportunities for lay identification and even engagement, though the extent to which they facilitate critical engagement—something that many consider essential for scientific engagement—is limited.

Conversely, when the NHCLP engages in place-making through the gesture of gatekeeping, which involves appeals that require the performance of hardship as proof of scientific connection, the outcome is that most are unable to meet the requirements. That they are ostensibly given the opportunity to form a connection with technical science through this gesture, only to find themselves wanting, almost ensures that the vast majority of lay people will not come to see themselves as scientifically invested and connected as a result of this process. This may differentiate the NHCLP and other scienceoriented outreach projects to some extent from many other public "memory places" (Blair et al., 2010, p. 2), which are often designed intentionally to foster genuine public engagement (Stevens & Franck, 2015), though-it should be noted-they also have a tendency to devolve in some cases into sites for exclusionary, insider-focused interaction (Schiavo, 2016). In this regard, then, this study suggests that the gatekeeping gesture in particular may be one that scientific outreach initiatives consider omitting from their strategic place-making agenda. Future research is needed to continue illuminating how strategic place-making in the context of science specifically can be a more inclusive and authentically public process. Future research is also needed to demarcate additional ways in which scientific strategic place-making, memorializing, and commemorating align with or differ from other types of historical place-making.

This study is limited in that, for one, the NHCLP case study does not offer a comprehensive portrayal of strategic place-making gestures in the context of public scientific outreach initiatives. Future research is needed to further dimensionalize and explore the gestures identified in this case and to identify and analyze additional gestures that have been employed toward the end of achieving scientific outreach. For another, while there is certainly evidence that the NHCLP has successfully generated interest and involvement, especially from those already situated within the chemical discipline, there is a lack of empirical evidence about the extent to which that success has created—or will create—a longitudinal public association with chemistry and the professional chemical history that the ACS endorses. Quantitative research on the NHCLP and its impact at a societal and public or lay level will generate a clearer sense of whether these specific place-making gestures are functioning communicatively in the ways that are articulated in the present analysis.

In its most basic sense, what the present study makes clear is that the strategic process of place-making can take a variety of different forms in the context of public science outreach and that the continued study of those forms, their characteristics, and their implications will do much to improve efforts to bridge technical science, its interests, and its outcomes with that of broader, lay society. Such work will also invite continued investigation into what it means to be associated, or otherwise engaged, with science from a nonexpert perspective, and how that meaning can and should shift across context, situation, and the places that bring science to life for experts and nonexperts alike.

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