Low Stakes, High Fun? Genre, Gender, and Identity at Adult Science Entertainment Events

By

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Abstract

Adult science entertainment events (ASEEs) constitute a new mode of engagement with science defined by their focus on adult audiences and the use of social venues to create low-stakes environments for learning. ASEEs vary widely in format, ranging from science-at-the-bar events, where patrons can enjoy a drink while listening to presentations, to museum after-hours events, where adults can explore exhibits outside regular visiting hours. The sheer number of these events represents a significant field-wide effort being put into these programs. I conducted a comparative case study of three ASEEs, using observations, interviews, and document analysis. In the first paper, I defined ASEEs as a unique subfield of informal science education and created a research agenda for these programs. In the second paper, I created an empirically derived framework for understanding how design and implementation decisions shape engagement. In this framework, I defined how the structure and framing of an event establish an interactional genre and explain the relationship between these elements and how people perform facets of their identities. This framework demonstrates that event genres can be evoked, and therefore can be altered. As part of this paper, I explore how elements of the structure and framing of these events evoke the carnivalesque (Bahktin, 1984) or subvert the traditional norms of science. In the third paper, I applied this framework to address gender equity at these events and found that female-presenting people's expertise was more frequently contested than male-presenting people's, even when drawing on equivalent resources. Additionally, I found that even in genres where expertise was less salient, the gendered landscape still skewed to favor male-presenting people's experience. Looking across the three papers, it appeared that the carnivalesque elements of these events might be what makes them low-stakes and fun; however,

it also seems that these elements may introduce risk for some groups; therefore, what makes these programs fun needs to be examined. ASEEs are worthy of further research to ensure these programs are equitable spaces for science learning. The structure, framing, genre, and performativity framework appears to be a promising approach for examining equitable engagement in these programs.

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Chapter 1: Introduction

Goals and origin of the project

This dissertation project was inspired by my own experience at what I have since come to call “adult science entertainment events," or ASEEs. In 2014, I learned that science museums, spaces I long loved and felt at home in, were hosting events for adults. I was thrilled. These programs not only provided me with a chance to explore these spaces without children underfoot, but I could also do so with a drink in hand. I was quick to buy tickets and partook in many in the coming years. However, despite enjoying myself, I noticed a repeated pattern in the interactions of those around me: within heterosexual couples, men were overexplaining science concepts and exhibits to women. This phenomenon, often referred to as "mansplaining," refers to when men explain things to women in condescending ways, often without reason, and often things that women need no explanation for (Bridges, 2017; Solnit, 2014). It appeared to me, as an outsider, that these mini-lectures aimed to impress women but that they often failed to accomplish this goal. My observations at this stage were far from systematic, and I had no plans to do anything with them other than joke about it with friends; however, they stuck in my memory. In graduate school, reading about informal science education (ISE) and public engagement with science (PES) caused my curiosity about these events to spike once again as it occurred to me that these events might not be the most equitable spaces for science learning and others might not share my positive experience.

As a white millennial woman, in a heterosexual relationship, with an undergraduate degree in science and extensive experience visiting these spaces, I felt welcomed at these events.

I left feeling that these events had affirmed my identity as a person that liked and supported science; however, I wondered if women who had been mansplained to for two hours also felt affirmed and if people with other marginalized identities felt welcomed in these spaces at all.

My personal experience at these events provided the impetus for this research, and literature on other informal science learning environments (ISLEs) provided the momentum needed to get this project off the ground. The extensive body of research on the ways that ISE has the potential to address the inequities of school science yet continues to perpetuate them inspired me to wonder about equity at these events (DeWitt & Archer, 2017; Feinstein, 2017). The notion of science capital made me recognize how ASEEs have the potential to modify one's capital and helped me internally justify the importance of examining science education events for adults (Archer, Dawson, DeWitt, Seakins, & Wong, 2015). Lastly, reading literature on individual science entertainment events helped me to realize that there was, in fact, a gap in the literature around these programs. However, the gap had been disguised with rhetoric about hypothetical outcomes for participants, the relationship between science and society, and democratic engagement (Dallas, 1999, 2006; Desai, 2005; West, 2005; Wiehe, 2014).

Although the literature on these events was limited, what does exist suggests that events provide a unique opportunity to research science identity. There is a great deal of research on science identity and identity development in youth (see: Dawson et al., 2019; Kim, Sinatra, & Seyranian, 2018; Rahm, Gonsalves, & Lachaîne, 2021; Wade-Jaimes, King, & Schwartz, 2021). However, there is limited research on adults' science identities, and ASEEs provide a unique setting for researching how people form and perform their science identities in a free-choice learning environment (Falk, 2005).

Additionally, research on ASEEs is beneficial for practitioners. Many museums and other organizations have invested a great deal of resources into these events, and some have even come to count on them as a source of revenue (Cuseum, 2016; Dallas, 1999; Melamed, 2016; Navid & Einsiedel, 2012). As such, it is important to better understand these programs and what they accomplish.

Lastly, the literature on ASEEs suggests that although these programs have the potential to expand access to science by being low-stakes and highly social, they are attended by a limited audience that is well-educated, white, already has a great deal of familiarity with science, and often skews male (Cohen & Macfarlane, 2007; Desai, 2005; Norton & Nohara, 2009; Robinson et al., 2017). This makes understanding the equity implications of these programs important. I was inspired to understand what was happening at these events, particularly regarding gender equity. However, because of the limited research in this area, there were sub-questions I needed to address first.

Structure of the dissertation

The first question I asked was how to define these events: which programs fit into the ASEE category? What held them together as a coherent group, and how were ASEEs similar or different from other programs in the ISE space? These questions are addressed in chapter two. In chapter two, I contrasted ASEEs with other programs to carve out a description of the field through comparison. This characterization provided a definition of ASEEs that was practically and theoretically useful but could be benefited by empirical data on these programs. Much of what I relied on in building my understanding of these programs was practitioner and grey

literature. My second goal for chapter two was to construct a research agenda for ASEEs by examining which questions had been asked of other science learning environments and applying them to ASEEs. Chapters three and four touch on some of the areas for research I identified.

Once I had a working hypothesis for the features that defined ASEEs and important directions for research, I next realized that I needed an approach for understanding what was happening at these events. In chapter three, I created an empirically derived framework for understanding how actions, behaviors, and interactions at ASEEs are shaped by design and implementation decisions. I entered with the assumption that aspects of the environment would shape engagement at the events, and through the literature discovered the notion of genre. Genre refers to the interactional category of the event, such as "talk show interview" or "formal schooling," and evokes certain ideas about how people should behave and interact (Davies, 2009). I connected genre theory to Butler's (1990b) theory of performativity, which states that identities are performed, and those performances vary based on the context. I used these ideas to construct a framework for understanding standing engagement at ASEEs. Although much of chapter three was devoted to constructing a framework for analyzing ASEEs, I also went into detail about how the design and implementation decisions shaped engagement at the events I observed and began to explore how these events compared to one another and thus cohered (or not) as a category. This led to the refinement of the ASEE category and a set of new, more theoretically informed questions about what distinguishes ASEEs from other ISLEs.

With my approach to viewing these events solidified, in chapter four, I applied my framework to return to the original question of equity by addressing the question: how do the types of social interactions evoked by ASEEs influence the gendered ways people experience these events? This chapter was influenced by research on the gendered history of science and

how science remains gendered today (Schiebinger, 1989, 2013). In chapter four, I focused explicitly on expertise and who and how people gained the attribution of expert in the subset of events I examined. Expertise was a common performance in my observations; however, there are many more aspects to the gendered landscape at these events. This final question began to touch on the equity implications of these events, but there is still much work to be done in this area.

Finally, in chapter five, I summarized the conclusions of the three articles and suggested directions for future research, given my findings.

Research plan and changes

I initially aimed to include a diverse set of ASEEs with ranging formats and focal topics, including museum and bar/café events as well a range of focal topics. I hoped this variation would allow for a comparison of the influence of format and science focus on engagement at these events. In the end, I was only able to include three sites in my dissertation project. I could not find a science museum within driving distance hosting an event or secure funding to travel to one further away. This change in plan was disappointing because engagement in science museum after-hours events had been the original inspiration for the project. The final subset of sites included a museum after-hours event, which occasionally included science as the focal topic and two presentation-based events at bars. One of the presentation events had an exclusive science focus, while the other often included science as a focal topic but covered a wide range of subjects.

My data collection included observations, interviews, and the collection of marketing materials for document analysis. I had initially hoped that through observation, I could capture interactions between participants, but in the end, I was not able to collect this fine-grain data due to having a reduced number of observations. I had hoped to complete a year's worth of observations at each site to provide a complete picture of each program's offerings; however, a few months into data collection, the COVID-19 pandemic caused all events to be canceled for the following two years. If I had been able to observe all the events I had originally planned to be present for, I believe that it would have been possible over time to both capture the broader experience of an event and fine-grained data; however, because my data collection was cut short most of my observations focus on the broader experience of the event. Additionally, I had begun data collection at each site at different times, which meant that I had different numbers of observations at each site ranging from a single observation at one site to four at another.

Concerning interviews, I was also impacted by pandemic shutdowns. Over time, I realized that the most successful approach for recruitment ended up being for organizers to share information about my study with their email lists; however, this realization came at the same time as pandemic shutdowns. At the museum site, this resulted in no interviews as they were unable to assist with this aspect of the project given the burden of the pandemic, but it limited interviews across the board. With more time to recruit, I would have conducted more interviews at each site.

Theoretical evolution

In addition to data collection changing, my theoretical lens also evolved throughout this project. In my original conception of this project, I had hoped to capture how these events modified participants' science capital (Archer et al., 2015), data best gathered through interviews; however, due to the pandemic, I struggled to conduct interviews and ended up not applying this lens to my analysis. Additionally, I entered with the assumption that the dating context of these events would be highly relevant and that most gendered interactions would occur in the context of interpersonal relationships. I am sure that many gendered interactions did occur within these conversations, but it was data I was unable to capture; however, I observed that gendered interactions still occurred on a scale I was able to observe. Therefore, although my ideas about dating contexts largely went by the wayside, other aspects of the gendered environment, such as the genderedness of expertise, came forward.

Lastly, the most significant change in my theoretical approach came from the addition of genre (Davies, 2009). I entered data collection with the belief that capturing the tone of these events was important, which I thought could be captured by documenting the atmosphere of the event. Expanding my reading led me to the notion of genre. Genre helped me to capture the experience of the event far better than the atmosphere alone and came to play a significant role in my analysis.

Summary

In summary, the findings of this research have limitations, both as a product of the COVID-19 pandemic and the stage of this research; however, I believe that the following chapters make a compelling case for continuing research on ASEEs. These events are unique

from other ISLEs and deserving of their own research agenda. I have provided a methodological framework for analyzing these events and applied this framework to make a case for examining equity in these programs.

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Chapter 2: A new venue for science learning: Defining a research agenda for adult science entertainment events

Introduction

Over the past two decades, there has been a proliferation of science-themed entertainment events targeting adults (Kaiser, Durant, Linett, Levenson, & Wiehe, 2013). Although they have many historical analogs (Gregory & Miller, 1998), today's adult science entertainment events (ASEEs) constitute a new mode of engagement with science defined by their focus on adult audiences and use of social venues to create low-stakes environments learning without an emphasis on content-based learning goals (Kaiser, Durant, Linett, Levenson, & Wiehe, 2013). ASEEs vary widely in format, ranging from science-at-the-bar events—science cafés, Nerd Nites, and other events where patrons can enjoy a drink at a local bar while listening to presentations—to museum after-hours events where adults can explore exhibits, drink in hand, without children underfoot. The sheer number of these events represents a significant field-wide effort being put into adult science entertainment. For example, pre-pandemic, in 2019, there were 600 registered science cafés, over 100 registered Nerd Nites, and Pint of Science events were recorded in 400 cities worldwide. These numbers almost certainly underestimate the prevalence of science-at-the-bar events, which many different groups sponsor with no central organization or formal affiliation.

ASEEs serve a wide range of purposes and have been cited as beneficial for hosting venues and patrons. For non-museum venues, such as bars and cafés, ASEEs provide increased revenue on what would otherwise be slow nights (Dallas, 1999; Navid & Einsiedel, 2012). For

museums, ASEEs create a gateway for millennial membership. Young adults without children have historically been a challenging audience for museums to capture; however, these after-hours programs can serve as a pre-membership program and help expand support for museums (Cuseum, 2016; Melamed, 2016). Additionally, many authors have argued that science-at-the-bar events may positively shift the relationship between science and society through democratic engagement (see: Dallas, 1999, 2006; Desai, 2005; West, 2005; Wiehe, 2014) by both "bringing scientists and the general public together…to discuss the big scientific issues that concern us all," (Dallas, 2006, p. 229) and to show the public that their tax dollars are working (Desai, 2005). It has also been argued that these events help increase trust in science and humanize scientists (Tan & Perucho, 2018).

In the current so-called post-truth era, these programs may prove to be increasingly relevant as they provide an opportunity for those who have aged out of formal education to engage with science. In the past several years, belief in science has become increasingly polarized, debates have sprung up around what counts as fact, and the notion of expertise has been increasingly challenged (Lee, 2021; McIntyre, 2018). One of the proposed solutions to addressing this issue in education is to provide more avenues for people to collectively make sense of the scientific information they encounter (Feinstein & Waddington, 2020). With their social focus, ASEEs may be one venue where adults can collectively sensemake.

Despite these potential benefits of ASEEs, research also suggests that these events may be plagued by the same issues as other informal science learning environments (ISLEs) in that they disproportionately serve those who are already well served by science education and/or feel a strong connection to science (DeWitt & Archer, 2017; Feinstein, 2017). Several authors have noted that these events are largely attended by white men, already immersed in science, a trend

that may perpetuate science's exclusive culture (Cohen & Macfarlane, 2007; Desai, 2005; Robinson et al., 2017). Because most research on these programs has taken the form of individual program evaluations, it is difficult to determine the impact of these programs on venues and attendees. A systemic approach to researching ASEEs would provide a clearer understanding of best practices that benefit hosting organizations and attendees and allow lessons to be shared across programs.

In this paper, I aim to establish ASEEs as a subfield of ISLEs worthy of scholarly attention and to construct a preliminary research agenda. Defining ASEEs as a distinct category of ISLEs is important because the goals and contexts of these programs differ systematically from other ISLEs. Although lessons learned in other contexts can still be applied to ASEEs, these programs serve an unusual audience for informal science education (ISE) and are taking place in a historically significant time for engagement with science. As such, there is much to be learned about these programs that cannot be gleaned from research in other settings. Research on ASEEs should aim to describe the emerging field, document goals and impacts, and understand the impact of design decisions. Equitable access to and participation in these programs should also be incorporated as a cross-cutting theme in research.

Defining ASEEs

This article aims to define ASEEs as a functional organizational category for research. In order to define ASEEs, it is crucial to understand what distinguishes these events and why they cannot neatly be understood through the lens of other events. One way to clarify the niche ASEEs occupy is to compare them to other programs. Drawing inspiration from Pappa and

Koliopoulous (2021), who compared science programs using two axes, I have also mapped out the ISE landscape graphically (Figure 1). Pappa and Koliopoulous (2021) used age as one axis and level of formality as the second. In assessing the difference between ASEEs and other programs, I believe it is more useful to make the second axis goal-oriented, as apart from the audience's age, this is one of the features that sets ASEEs apart from other programs. The boundaries around each type of program are purposefully fuzzy, as events within the same category are far from homogenous. The goal of this figure is not to describe all possible ISLE variations but to provide one perspective for distinguishing real-world phenomena and demonstrating how these programs tend to group.

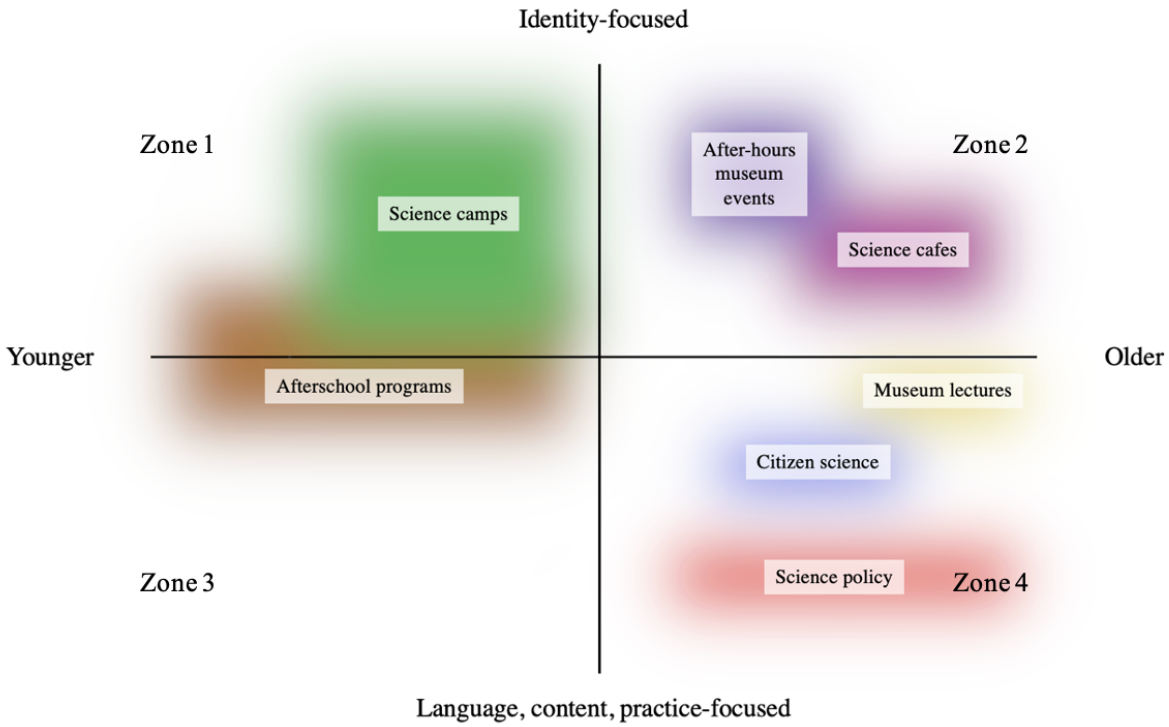

Figure 1. Map of the informal science landscape.

Organization of the map

The x-axis is organized by age, with young children on the far left and the elderly on the far right. For ease of organization, I have placed aging out of formal schooling near the center of the x-axis, despite this being far from the middle point of life. As many programs serve a range of ages, the shapes stretch across the x-axis. It is important to note that the organization of the x-axis is particularly significant in American and western contexts. In American contexts, mainly those defined by the norms of white middle-class Americans, children are often excluded from adult socialization. This is not the case for other cultures where children are included in a broader swath of activities (Rogoff, Paradise, Arauz, Correa-Chávez, & Angelillo, 2003).

The y-axis is goal-oriented. The structure of this axis was inspired by Bell, Lewenstein, Shouse, & Feder's (2009) framework for understanding the capabilities of informal science learning environments (ISLEs), what they refer to as "strands of science learning ."There are six strands of science learning, two of which are unique to ISE. These are strands one, "Experience excitement, interest, and motivation to learn about phenomena in the natural and physical world," and six, "Think about themselves as science learners and develop an identity as someone who knows about, uses, and sometimes contributes to science," (Bell et al., 2009, p. 4). These strands are heavily interconnected and relate to feeling a personal connection to science. Therefore, I have placed goals related to these strands at the top of the y-axis and labeled them identity-focused. Strands two through five are shared between informal and formal learning environments and are more typically associated with the goals of formal schooling. These strands focus on learning and applying scientific language, concepts, and practices, and the bottom of the y-axis is labeled as such. This field mapping is imperfect as it can be challenging to infer the

goals of these relevantly new programs; however, it will require further research to better define the span of this axis.

Description of zones

In zone one, fall programs typically associated with ISE, including, but not limited to, afterschool programs and science-themed camps. These programs target school-aged children and operate across a large range in the y-axis, as the missions of these programs can vary drastically. Many of these programs aim to accomplish concrete learning goals while providing an enjoyable learning environment and helping students form a personal connection to science. Family-oriented programs span all zones but exist primarily in zone one. These programs view adults in their role as parents with the goal of supporting adults in encouraging their children's learning.

In zone two fall ASEEs, which target adults in their mid-20s and onwards, generally focusing on people post-college up to their late 30s (Cuseum, 2016; Desai, 2005; West, 2005). The labels used in zone two have been inherited from previous writing on these events; however, these containers represent heterogeneous programs. For example, events labeled science cafés may do several different things. Some events with that label may be better aligned with public lectures. Part of the research on ASEEs will need to redraw and/or relabel the boundaries of these events. I will return to zone two later when comparing to adjacent zones.

Zone three contains programs that are more strictly limited by language, content, and practice-based learning goals. These include some afterschool programs and other science enrichment activities. This is also the zone in which formal schooling operates. Because of the

emphasis on meeting educational standards, this is arguably the most researched of all the zones on this map.

Lastly, zone four contains other programs which target adults but have language, content, and practice-based learning goals. Many programs exist within this space, but I have chosen to call out museum lectures, citizen science, and science policy forums as these are some of the most well-researched programs in this zone.

I have expanded the comparison for the adjacent zones, one and four, as that is where the boundaries with ASEEs may seem haziest. ASEEs are set apart from zone one by their focus on adults beyond their role as parents. In most ISLEs, parents are considered with regard to their role as a child's teacher and supporter, but their experience is rarely discussed as having its own merit. This frames science engagement as "an activity for kids, not for them" (Falk et al., 2012, p. 21). Many science and STEM programs are designed for children and families with the learning goals for adults being around better supporting their children (National Science Foundation, 2003). Even some programs for exclusively adult audiences are framed as opportunities for parents to learn science so they can share a passion for the subject with their children (ASTC, 2005). ASEEs go beyond this and see adults as a worthwhile audience in their own right. This is relevant for several reasons. Unlike programs for youth, which parents may encourage them to attend, ASEEs are entirely voluntary for adults, thus aligning them with free-choice learning (Falk, 2005). Additionally, given their stage in life, adults' interests may differ from those of children. Adults may want to learn about different topics than younger audiences or ask different questions about the science they encounter. Lastly, the way adults socialize will be different from children. Giles (2004) noted that the science café he organized was often used as a singles meet-up event. The potential for romantic encounters in these spaces may lead to a

different set of interactions around science. Therefore, although lessons from research in zone one may be applied to ASEEs, ASEEs target a unique audience whose experience in ISLEs is understudied.

ASEEs are distinguished from zone 4 by their differing goals. In a workshop on the evolving nature of science engagement opportunities, hosts and organizers of events I would categorize as ASEEs described their focus in terms of the richness and quality of the social experience rather than clearly defined individual learning outcomes:

> …these practitioners said they were trying to express or share something with them, to create compelling, often emotional and sometimes highly social experiences—without preconceived impacts or even a thought for utility (Kaiser et al., 2013, p. 17).

These goals are more aligned with strands one and six than formal schooling. By comparison, the programs in zone four place a greater emphasis on scientific language, content, and practices.

Historically, museum lectures have targeted older adults whose primary motivation for attendance is learning and who hope to gain knowledge applicable to their everyday lives (Sachatello-Sawyer & Fellenz, 2000). Citizen science and science policy forums again have an emphasis on utility. The goals of these programs are broad-ranging, but for many, participants must immerse themselves in the language and practices of science to participate (National Academies of Sciences, Engineering, 2018). In doing so, participants in citizen science and science policy forums lose their layperson status and can be taken more seriously in science practices (Epstein, 1995). As such, although these are not events in which participants are taught, as one would be by a teacher in formal schooling, the goal of these programs is to learn

language, content, and practices that will bring them closer to the goal of expertise on a given topic. Although participants may learn scientific information at an ASEE, this is not the primary goal of these programs, nor would participation in ASEEs exclusively lead to the formation of expertise on any one topic.

ASEEs are often deliberately directed at younger adults and defined in opposition to more staid public events: “not your grandparents' science scene" (Kaiser et al., 2013, p. 1). This shift in format, goals, and tone deserves a distinctive research approach to understand these programs on their own terms. In the following literature review, I draw on research from science education and science communication. My focus is on science education, and I believe it is useful to think about ASEEs as a subset of science learning environments, but events such as science cafés are also a popular research topic in science communication. Although science education and communication ask different questions (Feinstein, 2015), there is enough overlap in the research to draw on both in creating a framework for understanding ASEEs. Research from science communication has informed my understanding of what these events are like and why they deserve their own practical and analytical category.

Methods and Analysis

This paper was written as part of an exploratory research project in which I used interviews, document analysis, and participant observation to explore the design and implementation implications of ASEE events in a mid-sized city in the midwestern United States. The first section, which does not draw on data from the research project, is a narrative review of the research and practitioner literature on ASEEs. Because ASEEs go by many names,

and because much of what has been written about them appears in the "grey literature" of poorly indexed practitioner magazines and journals, it would be difficult to apply the tools of systematic literature reviews. Instead, I conducted a narrative literature review. As previously discussed, ASEEs are not an established field; therefore, in conducting this review, I have pushed up against the bounds of what might be considered an ASEE and included events that do not quite fit to make inferences. In conducting this literature review, I cast a large net, searching for research on science cafés and adjacent events and after-hours and adult-only events at museums. The goal of this narrative literature review was to capture the current state of research on this relatively new field, thus, a wide net was cast. I purposefully excluded galas and other one-off philanthropic events as those were purely fundraising-oriented. Additionally, I originally included science festivals as part of the search but ended up determining that science festivals are containers for smaller events; therefore, ASEEs might take place as part of a science festival, but not all science festivals are ASEEs or even contain them. This literature draws on research from different fields as well as practitioner literature—where much of this writing and insight into subjective rationales has been done.

The second section of this paper builds on the literature review to provide a preliminary agenda for research on ASEEs. In this section, I draw on a subset of the data from my exploratory research project (interviews with ASEE organizers) to illustrate the different strands of research that I suggest. The methods, analysis, and results of the exploratory study are the subject of two forthcoming papers. For the purposes of this paper, however, it is useful to know that I spoke to six organizers from three different ASEEs in a single mid-sized Midwestern city. The ASEEs comprised a convenience sample of the city's three most prominent and widely known events, and the organizers interviewed represent all the official organizers for these

programs. Interviews addressed their programs' history and goals, visitor demographics and engagement observations, benefits and drawbacks to attendance, future goals for the program, and personal perspectives on science (Appendix 1). I looked for instances in the interviews where organizers shared information describing the emerging field, documenting goals and impacts, and understanding the impact of design decisions to inform the research questions within each category.

To be clear, the strands were developed theoretically, *not* in response to this data. Instead, I use the data to ground the proposed research strands in the concrete experiences and problems of practice articulated by ASEE organizers. These experiences and problems may not be generalizable, but they do suggest that the theoretically developed research strands have some ecological validity.

Literature review

This review aims to address some of the sub-genres and tensions within ASEEs. There are still many questions to be asked regarding the boundaries of ASEEs and the classification of sub-genres. Despite the limitations of this review, patterns still emerge, suggesting that ASEEs occupy a unique space in the ISLE landscape.

Firstly, ASEEs are perceived as having excellent outcomes for hosting venues. Science-at-the-bar events are often hosted midweek on what would otherwise be slow nights for the hosting bar/café. These events help bring in patrons and generate extra revenue for these venues (Dallas, 2006; Desai, 2005; Navid & Einsiedel, 2012; West, 2005). In museums, after-hours events allow them to target hard-to-reach millennial audiences, whose museum attendance has been dwindling

(Cuseum, 2016; Melamed, 2016; West, 2005). Although not science-based, an after-hours art-themed event targeting millennials at the Isabella Stewart Gardner Museum credits its after-hours program with bringing in over 200 new memberships over three years (Harlow, Alfieri, Dalton, & Field, 2011).

Much has been written about the potential benefits for attendees and the relationship between science and society in general. According to Dallas, science cafés create important opportunities for adults to learn about the process of science and for science to resituate itself within the social context:

> Science has lost control of the discussion of science, and over the next decade, there are going to be many more interactions between scientists and the public. Café Scientifique is a step toward bringing scientists and the general public together in a friendly environment to discuss the big scientific issues that concern us all (Dallas, 2006, p. 229).

Other scholars of science Cafés see them as generating unique opportunities for democratic engagement (Balling & Schuler, 2004; Desai, 2005). According to Desai (2005), most adults who choose not to pursue science careers end up being ignored by the scientific community, and this is an issue because, despite their career choices, science influences their lives:

> Because the concepts and inventions that often emerge from current research (and the potential ethical dilemmas surrounding them) are likely to become central in their lives and the lives of their children, it is important for [the adult] demographic to be informed

> about these topics. Since they pay taxes that support much of this research, it is critical—for them and society at large—that they be aware, engaged, and invested in the work their tax dollars support (Desai, 2005, p. 12).

As such, supporters of this format of ASEE argue that these events provide rare opportunities for adults to engage with science and to influence the trajectory of research so that it better meets the needs of people (Dallas, 2006; Jensen & Buckley, 2014; Tan & Perucho, 2018). This rationale for ASEEs does not fit neatly within the strand-based goal-oriented established in figure 1. This is not to say that these events do not still have an identity component, but rather that democratic engagement could be considered a third axis for mapping the ISLE space. Further research could help determine whether or not democratic engagement is occurring at these events and whether or not it is a helpful concept for distinguishing ASEEs from other ISLEs and each other.

Despite these claims, there is limited evidence of impact on attendees. Several authors have documented that attendance at these events is largely white, most people in attendance already have a great deal of familiarity with science, and the audience often skews male (Cohen & Macfarlane, 2007; Desai, 2005; Norton & Nohara, 2009; Robinson et al., 2017). This data suggests that people attending these events are likely already privileged when it comes to access to science. Although this data does not speak directly to participant outcomes, it does suggest that black, indigenous, people of color, people who do not identify as men, and those without a previously established connection to science may feel excluded from these events, unable to access them, or that ASEEs are not designed to appeal to those outside of their normative audience. This echoes findings from other settings which have demonstrated that informal

science learning environments can be invisible or inaccessible to minoritized groups (Dawson, 2014b).

Non-white, non-male participants may still stand to benefit from ASEEs, and may even benefit more than the normative audience when they do attend. Gutwill (2018) found that adult women who visited the Exploratorium, including their after-hours event, reported increased science self-efficacy and that their science self-efficacy remained elevated over a three-month period. His findings suggest that the benefits of visiting the museum were low for adults already familiar with science, but for those with limited experience, even these brief events were enough to change how they thought about their ability to engage with the discipline. Together, these findings suggest that these types of programs may benefit people without a previously established connection to science; however, they may be less accessible to that same group.

These events' design, marketing, and implementation likely shape who comes. For instance, Norton and Nohara (2009) found that the marketing of science cafés in Japan seemed to shape attendance. Examining a series of six science cafés over three years, the authors noted that the gender balance was 50:50 at two events, but the rest skewed male and tended to draw in those whose work related to science and technology. Of the two events that attracted more women, one event they attributed the shift to the topic—how humans perceive the tastes of sweet and sour, as compared to topics such as the future of energy and solar cells—and the other event they attributed to referring to it as a "science parfait," as opposed to a science café. The authors also noted that the two events that attracted more women also attracted greater diversity in age and profession. These findings suggest that even slight shifts in framing, like moving from science café to parfait, can shift who is attracted to these events.

The location also appears to matter. Tan and Perucho (2018) found that hosting their Nerd Nite event at a bar in the financial district of Hong Kong led to those from the finance industry making up a large portion of attendees. They suggested that "a better strategy for science communication is to bring science to the target audience, rather than expecting the target audience to go to the places of science" (Tan & Perucho, 2018, p. 823). These results suggest that the marketing of ASEEs and structural features such as location may greatly impact access to these events.

It may not always be so easy, however. Others have documented more difficulties in shifting the demographics of their audience. When organizing Pint of Science in Thailand (a science-at-the-bar event), Robinson et al. ((2017)) noticed that these sorts of events usually drew a mainly ex-pat audience. Hoping to counter this trend, they shifted their approach, hosting half the talks each night in Thai and holding the event in a neighborhood outside the ex-pat community. However, the events continued to draw a primarily ex-pat audience, and by the second evening of talks, the organizers were forced to switch the presentations exclusively to English to appease those who showed up.

Additionally, Davies (2009) suggests that aspects of framing lead to different genres of engagement. The framing of ASEEs may be particularly powerful because many ASEEs are relatively new, and participants may not know what to expect. Davies (2009, p. 401) sees genre as "enable[ing] us to structure our discourse and interactions in particular ways; they enable or disable certain behaviors and carry with them particular norms." Genre is culturally embedded in events and shapes participants' discourse and interactions. Examining a series of panel-style science cafés, Davies (2009) found that at each event, a great deal of work was done defining the event and internally framing the genre. She suggests that part of the reason for this is that these

events are an unfamiliar form of engagement with science for many people. Unlike sitting down to a meal with your family, the norms of engagement at these events are not well defined, and therefore organizers set aside time to frame the event and define the genre. Throughout the events studied, Davies (2009) saw many overlapping genres, from traditional school to news interview. Davies notes that "the newness of the 'science dialogue event' and the flexibility of genre might suggest that events can be continually reinvented by all those present, [but] in practice some [people] are more able to do this than others," (Davies, 2009, p. 412). Most of the event functioned as a traditional lecture, with audience members only able to influence genre in the Q&A portion.

Lastly, researchers have examined the motivations and barriers to scientists' participation. Across the board, authors have documented that it is easier to recruit scientists for science festival events than to participate in one-off science-at-the-bar activities (Dallas, 2006; Manning, Lin, & Goodman, 2013; Mizumachi, Matsuda, Kano, Kawakami, & Kato, 2011). Wiehe (2014) has suggested that the reason for the high number of scientists who partake in science festivals is because of the variety of ways to be involved and the social pressure among scientists to participate. Fewer scientists participate in science-at-the-bar events, so the same social pressure might not exist.

Scientists may also find the informality and open-ended format of ASEEs challenging or distasteful. In a Japanese study of science Cafés, Mizumachi et al. (2011) found that scientists thought of science Cafés as too time-consuming and troublesome. Because the science Café format discourages traditional presentation modes such as PowerPoint, scientists were often asked to prepare something different for science Cafés, and many saw this as beyond the scope of their work. Several scientists in their sample even claimed that it would be a better use of their

time to inspire youth to pursue science careers rather than taking time to speak to an exclusively adult group. Additionally, several of the scientists felt pressure to be representatives of science. This echoes Dallas' (2006) claim that he found it difficult to pull in scientists around topics currently in the news as no one wanted to be the face of those issues. Finally, Mizumachi et al. (2011) found that scientists were most apprehensive about the dialog aspect of science Cafés. They tended to have a deficit perspective of the audience and assumed that the audience would be incapable of understanding their research.

This contrasts with Mayhew and Hall's (2012) experience recruiting scientists for a junior science Café. The authors had some issues recruiting due to the sheer number of scientists it took to run a recurring science Café, but everyone they approached was eager to participate in this program with high schoolers. Again, this points to a conception of spending time with youth being worthwhile, whereas science dialogs with adults may be seen as a waste of time.

This literature review not only suggests that ASEEs are unique spaces for science learning but also highlights extensive gaps in our understanding of this field. Most of what has been written about these programs has taken the form of individual program evaluations, grey papers, and organizers' subjective commentary on their own programs. There is still much work to be done to inform our baseline understanding of these events, their impacts, and the influence of event design. A systematic research agenda is needed to fill in the gaps around ASEEs and understand these programs that are becoming omnipresent in the science education landscape.

Research agenda

The research agenda is divided into three sections: describing the emerging field, documenting goals and impacts, and understanding the impact of design decisions. Each of these areas of research has been explored in other ISLEs, and this research has led to more equitable and inclusive spaces. As such, in each section, I return to the theme of equity. In recent years ISLE research has taken equity as a major focus, recognizing how ISLEs have the potential to address the inequities of school science yet have fallen short of accomplishing that goal (Bell, Lewenstein, Shouse, & Feder, 2009; Dawson, 2014, 2017; Feinstein, 2017; Feinstein & Meshoulam, 2014). Several scholars have documented how ISLEs continue to perpetuate a Matthew effect, making those already privileged in science scientifically richer (Dawson, 2014a; Feinstein, 2017). The question that therefore looms over ASEEs is whether these events perpetuate, exaggerate, or ameliorate inequities in science. The limited research on ASEEs has already highlighted some potential benefits and drawbacks of attendance, such as their potential to improve the self-efficacy of people without previously established science identity (Gutwill, 2018) and the exclusive nature of these events (Cohen & Macfarlane, 2007; Desai, 2005; Norton & Nohara, 2009; Robinson et al., 2017). As such, no matter the direction of ASEE research, equity will need to be an essential consideration of these events.

Describing the emerging field

As previously mentioned, baseline information on ASEEs is limited. In comparison with formal education, mapping the ISE landscape is challenging; however, over the past several decades, we have come to a clearer understanding of the major institutional players. With regards to ASEEs, however, this is new terrain, and our understanding is inadequate. The existing

literature suggests that ASEEs are emerging as unique spaces for engagement with science, which may provide rare opportunities for adults to engage with science in social, low-stakes settings; however, these programs are still evolving. One of the main areas of research into ASEEs should be to explore their ecology—distribution, networks, and stakeholders— and evolution—history and trajectory.

Falk and Dierking (2018) have proposed viewing science learning as an ecosystem in which resources and stakeholders far beyond formal schooling contribute to science education. Concerning the ecology of ASEEs, it is important to ask how these programs interact with other ISE stakeholders. Who hosts ASEEs, and what is their connection to other ISLEs? Have ASEE hosts been involved with other ISLEs in the past, or are new stakeholders emerging? Additionally, it is relevant to ask about the sorts of communities that can support ASEEs. According to one organizer, graduate students were a core part of their presenter and audience demographic, "…young, college educated, graduate student professionals, I think are most of the folks we see." According to an organizer of another program, most of their audience were scientists, "I also think we are getting a lot of scientists or scientists in training, so students and postdocs, maybe some early career scientists, or scientists who work for state government." Together, this data suggests that at least for these two programs, proximity to a university—or at least a critical mass of people with advanced degrees—helps ensure that their events have an audience. Therefore, it is relevant to ask about the sorts of community-level resources that are necessary to support these events? For example, do ASEEs do better in university towns, and if so, how does this shape attendance? ASEE ecology says something about their communities and where resources are placed. It may be that ASEEs are signifiers of gentrification or that these programs do not just draw the normative audiences discussed above but instead signify that these

groups are already present in a community. Understanding the distribution of ASEEs is part of understanding equity in the science education ecosystem more broadly.

As a starting point, the field lacks basic information about the number and distribution of these programs: how many ASEEs exist nationwide, where do they occur, when did they begin, and what format do they take? Some numbers are known for programs tied to national organizations; however, the ASEE landscape is diverse, and far more exist than are being recorded by organizations such as Nerd Nite or Pint of Science. In 1975, Hyman found that only 20% of museum programs targeted adults, and the dominant format of those programs was lectures with limited opportunities for interaction. A similar survey conducted in 2000 found that 94% of museums offered adult programming (Sachatello-Sawyer & Fellenz, 2000). Although these metrics measure different things, the comparison suggests that the number of adult-oriented programs expanded even before 2000. The organizers interviewed in this research were aware of many programs, several of which were one-time occurrences, which had been hosted by various groups in the community. In order to understand the scope of the field-wide investment in ASEEs, it is also important to understand who is putting resources into these events and which stakeholders are involved.

In terms of evolution, the history and trajectory of these events are a large unknown. Are they stabilizing into a coherent field? How are they changing in response to shifting societal pressures? Although it is difficult to predict the future of ASEEs, researching the past and present of these programs can help reveal where ASEEs are headed. Knowing when programs began and what motivated their creation has particular relevance regarding the evolution of ASEEs. This data will help place ASEEs in the context of historical events and allow researchers to track the spread of these programs over time. By examining start dates, researchers can track

temporal and geographical patterns, providing an additional perspective on the goals and impacts of ASEEs.

A survey of the ASEE landscape could help answer some of these questions regarding field-wide distribution, history, and demographics. The survey methodology would require more careful consideration, as it might be challenging to reach ASEEs not connected to a national network or association; however, anecdotal evidence suggests that organizers are very familiar with the ASEE landscape in their respective cities, therefore moving from larger associations and organizations to snowball sampling might provide a helpful way to reach more programs. Combining surveys with archival research may also prove beneficial. Using archival research on previous science entertainment events, such as Lyceums and Chautauquas (Bell et al., 2009; Ray, 2005), as well as exploring the political climate around science at the time these programs popped up might shed light on these programs' origins and futures.

Documenting goals and impacts

As described by Kaiser et al. (2013), the goals of ASEEs are not always clearly articulated; as such, it is important to understand the purpose of ASEEs. In researching this question, I start from the assumption that ASEEs serve multiple goals and stakeholders, and each should be considered. As such, research on the goals and impacts of ASEEs can be divided into three categories: hosting organizations, scientists/presenters, and audiences. Examining the goals and impacts of ASEEs for each group can help reveal areas of tension, for instance, between the goals of organizers and participants. It may also reveal rifts in the implementation of ASEEs –

ideas articulated in the rhetoric of ASEEs but not addressed in practice. These different subjects of study may be of interest to different research groups.

The goals of ISE are often implicit as these programs are not governed by the same standards as formal schooling. Informal science education as a field is more open to the idea that stakeholders have different goals; for instance, summer camps are often aware that meeting some educational standards will benefit their campers, but campers are likely there to have fun and that parents are also looking for childcare during those hours. Most camps are ready and willing to juggle these multiple goals, and to understand the experience of camp, each of these stakeholders and goals must be understood. The same is true for ASEEs. Understanding the goals and impacts for each stakeholder will help address the bigger question regarding the purpose of ASEEs.

Hosting organizations

As discussed in the introduction, organizers cite various reasons for hosting these events. Programs that exist under the umbrella of a larger organization, such as after-hours events at museums, may have to articulate their goals in the context of the museum's mission; however, some ASEEs may not have such clearly articulated goals. To understand ASEEs, it helps to understand why organizations put resources towards them. The question of why invest in ASEEs can be further divided into what organizations hope to accomplish by hosting them and what they see as beneficial for those who attend. Concerning impact, findings from previous research and grey literature need to be replicated on a larger scale. Although museums have mentioned that ASEEs have been used as a pre-membership program to increase support from millennial audiences (Cuseum, 2016; Melamed, 2016) and science cafés have mentioned benefits for the host bar/pub (Dallas, 1999; Navid & Einsiedel, 2012; West, 2005), these findings are isolated.

Although not directly related to learning, these results provide important context. It is normal in conversations about school reform, for example, to include budgets and questions of long-term fiscal sustainability. The fiscal viability of organizations like museums influences what programs they choose to offer. According to one organizer, their ASEE program was an important strategy for securing the long-term sustainability of their museum:

> Well, early on we called it a pre membership program….we have couples who have come [to the event] and had their wedding at the museum and who are now members… but also, I think having the community value of our museum and beyond….We want the whole community to be excited about our space and what we're doing and find a way to connect with it and so these events have really helped with that.

These results have potentially serious impacts on the fiscal sustainability of these organizations and programs. Exploring the question of impact on a broader scale will help determine whether ASEEs are beneficial for hosting organizations and can help inform those who hope to host ASEEs in the future.

It is also relevant to ask whether hosting organizations consider equity as a goal for these events. Many museums have taken equity as a goal, including it as part of their missions, adding free or reduced-cost admission, and advocating for greater public transportation options to their venues (Martin, 2003); however, these same organizations may not see ASEEs as part of their equity-oriented work. Although my search has not been exhaustive, I have yet to find a museum offering free admission to their after-hours event (in contrast to the range of museums offering free admission to other sorts of programs). In my discussions with organizers, even museums

who view equity as central to their mission see ASEEs as outside of that goal. Programs hosted outside museums are often advertised by word of mouth and social media and therefore reach limited social groups. If equitable access to ASEEs is not a goal of these programs, but participation in science is, this rift should be explored.

Organizations may not have clearly articulated answers to these questions, and therefore this research is best suited for a qualitative interview approach in which organizers are encouraged to talk through their goals for the event and not prematurely confined to check boxes. Once saturation has been reached in the interviews, surveys could be used to address this question on a broader scale.

Scientists/presenters

Scientists and other presenters hold a unique role at ASEEs. Scientists are not involved in organizing these events but are often the focal feature. Many ASEEs organize their events around themes and ask experts in the field to speak on those topics as part of their programming. Previous research has found that scientists are not motivated to participate in ASEEs the same way they are motivated to partake in other public engagement with science opportunities (Dallas, 2006; Manning, Lin, & Goodman, 2013; Mayhew & Hall, 2012; Mizumachi, Matsuda, Kano, Kawakami, & Kato, 2011). Additionally, Mizumachi et al. (2011) found that scientists were less willing to work with adult audiences than youth because they did not think adults were worthy of the extra effort. ASEEs often require a less formal presentation style than scientists would use in traditional lectures, and they, therefore, cannot simply reuse old presentations for ASEEs. This extra effort, combined with a deficient perspective of audiences, meant that scientists did not find participation in ASEEs worthwhile. However, this research is several years old and context-

specific. Scientists' perspectives on participation may depend on the format of the ASEE, the audience's makeup, and/or what is being asked of them by organizers. Additionally, scientists' perspectives may have shifted with the recent COVID-19 pandemic and the political climate. As such, it should be asked: what are scientists' motivations for participating, and what are the barriers to participation? How does their perception of ASEEs compare to participation in other public engagement opportunities, and why do these differences exist?

Proponents of ASEEs have also said that these programs provide an opportunity to narrow the gap between science and society (Dallas, 2006). For example, Cohen and Macfarlane (2007) recounted the story of a scientist reconsidering funding priorities after partaking in a science café:

> ...because the very idea that an $8-billion machine, the Large Hadron Collider was being built to see whether this particle even exists was fascinating to the group, and led to challenges that, one can fairly assume, the teacher had never faced from his peers in physics—for example, "How many schools could we build for the price of that?" Presenters often mention their delight in the unpredictability of the discussion. (Cohen & Macfarlane, 2007, p. 236)

Regarding impact, it should be asked what scientists get from participation in these events. Is it an opportunity for scientists to share their research, increase trust in science, or reconsider their previously held beliefs? Understanding the impact of ASEEs on the scientists/presenters will help evaluate previous claims about these types of programs.

Audiences

Although some work explores why organizations host these events, the same cannot be said for why audiences attend them. In their 2000 survey, Sachetello-Sawyer et al. asked participants in museum programs why they attended, and the number one response was "for the joy of learning" at 80%. Participants also mentioned "to pursue a long-standing interest or hobby" (58%), "to meet people, socialize" (54%), and "to engage in creative activity" (47%). This research has not been updated since ASEEs have risen to prominence. Therefore, it should be asked: what are attendees' motivations for coming to ASEEs? Understanding why people are motivated to attend ASEEs may help organizers to design better events and for researchers interested in public engagement (PES) with science to capture a new perspective on PES.

In other ISLEs, some work has been done examining identity-related motivations. STEM or science identities can be considered part of one's social identity (Kim et al., 2018). These identities are products of the social groups in which one participates, and engagement in other ISLEs has shown that they are important spaces for identity formation (Kim et al., 2018; Wiehe, 2014). The social element of ASEEs may provide an important space for science identity development, and this motivation for attendance should be explored. In a related strain, the motivations and identities of people who do not attend should also be considered. For people who know of these events yet choose not to attend, why not? Do they also identify with science? How does their identity differ, if at all, from those who attend?

As previously mentioned, much has been said about potential outcomes, but so far, only Gutwill's (2018) work directly addresses the question of impact. The question of impact needs to be examined from multiple angles, including learning outcomes, identity formation, social connections, and beliefs. In particular, attitudes toward science need to be explored. In writing on

science cafés, lofty claims have been made about how these programs may shift audience members' perspective on science and make them more positively inclined towards the discipline (Dallas, 1999, 2006; Desai, 2005; Navid & Einsiedel, 2012). These claims are particularly relevant in today's polarized political climate and therefore deserve empirical exploration. Whether or not these programs shift audience members' attitudes about science should be tested.

A second cluster of questions related to ASEE audiences is who is coming. In addition, to understand why people attend, it is important to understand who comes, particularly demographic shifts. Sachetello-Sawyer et al.'s (2000) found that the audience for these programs skewed older, toward women, and were more highly educated than the general public. Existing practitioner literature suggests that current demographic patterns differ. Many ASEEs today target audience members in their mid-20s through 30s and do not have knowledge-based goals (Kaiser et al., 2013). Previous research did not track race or ethnicity, but it is crucial to track these demographics to determine if these events continue serving a privileged and homogenous audience.

One organizer interviewed for this study reported that the audience for their ASEE was:

> …majority White people…we're very kind of monochromatic in that way. And I have been trying to think through ways to help build more inclusion into it, but I haven't. And I guess ultimately, I haven't like got the energy on it just yet, but probably should.

Another organizer mentioned that most presenters and audience members were men and that it was occasionally difficult to ensure they had a women present in the evening's line up:

> So we definitely have more male identifying people ask to present….[the original program organizers said] to make sure we have at least one woman every time. And there are months when it's been hard to do that. Like just based on the number of people that are asking to present. And I'll like regularly will kind of put that mention out there, like, "Hey, we need women up here." Because we're not going to just have a whole mile line up full of men. So men definitely seem to -- they will reach out more often for presenting. In terms of like attending…I think, from a numbers perspective, I think it's like a 60/40 split of men to women would be my guess. Maybe that's generous. Maybe it's more like 70/30.

Although these findings may not be representative, they resonate with existing research and suggest that exclusive demographic trends in both hosting and attendance should be explored.

Capturing broadscale demographic data may be difficult—at this point, we do not even know what audience data ASEE sponsors and organizers are collecting. Many programs may not track this sort of data, and in early research, organizers may only be able to provide their best guess at audience demographics. Nevertheless, even this sort of subjective glimpse of the emerging field would help to inform our understanding of the evolution of ASEEs, including their growth and reach. As such, one starting point for capturing demographic data could be asking sponsors and hosts what audience metrics they collect.

Design and implementation considerations

Lastly, research should consider design and implementation decisions. Specifically, we should aim to understand the relationship between design and implementation decisions and their impact. What decisions are most relevant to particular goals? What choices lead to unexpected consequences? Understanding the relationship between design decisions and impact will allow programs to accomplish their goals better and allow theory-building around engagement in these learning environments. Research in this strand has proved beneficial in other ISLEs. For example, the EDGE framework for exhibit design examined which design attributes girls responded best to and why and used these attributes to develop exhibits that better engaged girls (Garcia-Luis & Dancstep, 2019). Similarly, Universal Design for Learning research has explored the relationship between exhibit design and learning outcomes for those with disabilities and developed guidelines for improving engagement (Rappolt-Schlichtmann & Daley, 2013). This strand of research has proved beneficial in other ISLEs and could likely benefit ASEEs.

There are two strands of design and implementation decisions—structure and framing—which relate to the genre of the event (Davies, 2009). Structural elements relate to who can attend and what activities they will engage in once present, whereas framing elements relate to expectation setting about the event. The influence of location and format should be heavily considered regarding the structure of events. As previously mentioned, some researchers have found an event's location to significantly influence attendance, whereas others found contrasting results (Robinson et al., 2017; Tan & Perucho, 2018). The influence of location should be examined across multiple programs not only to examine this pattern but also to explore the influence of community on these events. How does the location of an ASEE influence attendance and demographics? Does the makeup of the broader town or city shape who comes?

In terms of format, I have mentioned hands-on play at museums and presentation events, but there are variations of these programs and other formats, such as hands-on classes, which may also fall within the ASEE umbrella. The format strongly influences how people can engage with science, and the influence of format should be examined. Additionally, online formats should be considered. Many online events emerged during the pandemic, and although they may be more easily accessible than in-person events, online engagement has more negative and sexist commentary than is usually seen in person and, therefore, may shift the way people engage (Amarasekara & Grant, 2019).

There are two components to framing events: framing done in advance of the event in the form of marketing materials and framing done in person by organizers (Davies, 2009). Both these framing components set expectations and norms for engagement at the event. Norton and Nohara (2009) documented that even slight shifts, such as name tweaks, in the marketing of these programs can shift the demographics of attendees. The marketing of these programs and the framing done in advance of these events should be examined to determine how shifts shape attendance. In-person framing by organizers should also be examined to determine how norm setting by hosts shapes engagement. The organizer of one ASEE program described how the organizers actively worked to establish norms for engagement in their event:

> Yeah. I mean we encourage people to, you know, swearing is great like that, being crashed is totally cool. [We would try] to drop a couple of bombs like in the intro just to sort of loosen things up. And I think, and I definitely do that too to try to keep it, and the intent at least is to remind people that this isn't meant to be like a formal lecture presentation, like to try to distance it from that. That's the hope on it and to let people feel

> free to speak as you would, you know. I don't think we try to, like, I don't know if we necessarily encourage it, we kind of encourage it, but to at least like, let it be, you know, "Hey, whatever you want to say, if you want to say it that way, say it that way. And feel free to do that."

Dawson (2014b) documented that these sorts of events can appear invisible to underrepresented groups because they are either unaware of their existence or assume, based on their understanding of the event, that these spaces are not for them. It is not enough to try to shift audience perceptions, however. To make these spaces equitable places for engagement with science, it is necessary to understand the impact of design decisions and make changes to improve access to and participation in these programs.

Although there are many potential avenues for research in this strand, comparative case study and design-based research are two promising approaches. Comparative case study would assess patterns across cases to determine how and why particular programs and actions work or fail. This approach has proved beneficial in understanding the process and building theory about how actions influence outcomes (Bartlett & Vavrus, 2017). Design-based research on a single or narrow set of programs would allow researchers to see the impact of modifying individual variables, providing insight into the relationship between design and outcome. Additionally, design-based research would respond to calls in the field for research that prospectively tests theories of change as opposed to the common trend of retrospective evaluations (Froschl, Sprung, Archer, & Fancsali, 2003).

Conclusion

This research agenda aims to develop a framework to understand the purposes and outcomes of ASEEs so that we may eventually improve their implementation. Addressing these questions will require collaboration between practitioners and researchers, but I believe such collaboration will benefit both parties. By investing in ASEE research, practitioners will learn which designs better serve audiences and about the fiscal impact of these programs. Researchers will not only learn about the design of these programs, but these findings will also shine a light on the current climate for engagement with science more broadly. This research is particularly relevant in the post-truth era and during the COVID-19 pandemic, in which trust in science has often appeared contentious. Understanding why adults attend identity-forming and/or affirming science events may help shed light on the current relationship between science and society.

There is still much work to be done defining these events. The definition of ASEEs I have put forth so far is only a hypothesis for how these events fit together. Empirical research will be needed to test this hypothesis and determine how these events are similar and different to one another and other ISLEs and public engagement opportunities.

Although the research topics were separated for the sake of organization, each topic is heavily interconnected, and the most efficient approach would be to tackle them in tandem. For example, questions regarding goals and impacts could be addressed in conjunction with the evolution and ecology of ASEEs. Similarly, goals and impacts are heavily related to design decisions, and research in one area is likely to impact the other. The broad range of research questions will require not only collaboration between different parties but also a wide variety and combination of methodologies, as well as an acceptance that the boundaries of this field may be fuzzy at first. It is possible that events that market themselves as low-stakes social environments

are, in fact, more serious, and what one might assume is an ASEE from the outside is better aligned with a traditional lecture.

This research agenda is meant to provide an entry point for understanding ASEEs and provide an updated perspective on field-wide priorities, particularly in the current political climate. Understanding how adults view these programs and how hosting organizations view programs for adults is important not only for designing better, more equitable programs but also for understanding public engagement with science in an increasingly polarized world.

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Chapter 3: "Not the same vibe": Developing a framework for analyzing adult science entertainment events

Introduction

In recent years there has been a shift in public engagement with science; opportunities that emphasize fun, irreverence, and entertainment are springing up online and in bars and museums worldwide. According to Kaiser, Durant, Linett, et al. (2013, p. i), this shift is "dissolving the once-bright line between science and popular culture." One trend within this broader shift is the increase in in-person events for adults – what I call Adult Science Entertainment Events or ASEEs. These events target exclusively adult audiences instead of youth or families and strive to create low-stakes, social environments for science learning. Traditionally, opportunities for adults to engage with science have been limited to activities such as citizen science, science policy forums, or more formal lectures. These kinds of more traditional events hold science in reverence and focus on building science literacy. Adult science entertainment events challenge this idea by focusing on entertainment. The idea of science as entertainment is not new. In the early 1800s, people partook in Lyceums, in which the public gathered with experts for lectures, debates, and experiments (Ray, 2005), and in the late 1800s, Chautauquas brought together families to learn from lecturers and entertainers (Scott, 1999). In the 1990s and early 2000s, science cafes or café scientifiques rose in popularity worldwide, providing people with an opportunity to "meet to discuss the latest ideas of science that are impacting society" at local pubs and cafés (Dallas, 2006, p. 227). What makes ASEEs noteworthy today is their dramatic rise in popularity and a simultaneous diversification of styles

and formats. Although there are no firm statistics on the number of ASEEs worldwide, several sources have noted the trend (Cuseum, 2016; Dowell, 2014; Kaiser et al., 2013; Melamed, 2016; Sayer et al., 2014). ASEEs take various forms, but common formats include presentations at bars, hands-on play, and museum exploration. These programs can now be found in nearly every mid-sized or larger American city and are expanding worldwide (Robinson et al., 2017; Tan & Perucho, 2018). Despite the increase in the number of these events and the differences between ASEEs and other formats that previously dominated the adult science engagement landscape, research on ASEEs is still in its infancy.

The research that does exist on ASEEs shows that these events serve somewhat homogenous audiences but that the framing of these events can heavily influence the makeup of these audiences. Several articles have noted that these events are primarily attended by well-educated, white men already familiar with the fields of science and technology (Cohen & Macfarlane, 2007; Desai, 2005; Norton & Nohara, 2009; Robinson et al., 2017). Robinson et al. (2017) reported some struggles in attracting racially and ethnically diverse audiences to a Pint of Science event in Thailand. Pint of Science is an event where people come to a pub to drink and learn about a current science topic. The event organizers recognized that these events usually drew in a sole ex-pat audience in Thailand and hoped to counter this trend. They planned to host half of the talks each evening in Thai and hold the event in a non-expat community. Despite these attempts, the crowd consisted primarily of ex-pats, and by the second evening of talks, the organizers were forced to switch the presentations to exclusively English to appease their audience. Cohen and Macfarlane (2007) found similar results when surveying the audience of a Science Café in Denver, Colorado. Half of the participants worked in science or technology fields, and racial and ethnic minorities were underrepresented. Interestingly, although men

outnumbered women at these events, the difference was slight at six to five. Desai (2005), on the other hand, found that at most Science Cafés in her sample, women made up the majority of participants, but again, most of the audience already had a background in science and technology. In a study of Japanese Science Cafés, Norton and Nohara (2009) found that Science Cafes tended to be dominated by men in their 30s-60s who worked in science and technology but that the topic and format of the Science Café seemed to influence the demographics of attendance. Certain topics and titles, such as "Science Parfait," attracted more women, younger people, and those working in a greater variety of fields. Additionally, formats in which non-scientists were included in expert panels attracted more non-scientist audience members than events with titles such as *Global Warming: The Facts* with solely scientist speakers.

There is also research to suggest that ASEEs may be particularly beneficial for people without a previously established science identity. Gutwill (2018) found that for adults between 18 and 29, even a single visit to a science museum was enough to increase their science self-efficacy. For women, their self-efficacy remained increased over three months. Gutwill's (2018) findings suggest that for those with limited science education and without a previously established science identity, even these brief encounters were enough to change how they thought about their ability to participate in the discipline. Additionally, several researchers have theorized about the positive potential of ASEEs to shift the relationship between science and society by infusing science with the public interest, connecting scientists with the public, and creating forums for meaningful discussion (Balling & Schuler, 2004; Cohen & Macfarlane, 2007; Dallas, 2006; McCallie et al., 2009). Considering these findings together suggests that ASEEs are complicated spaces with the potential to both perpetuate exclusive stereotypes related to science and expand access to the discipline. As such, engagement at ASEEs is an important

topic of research. Understanding the forces that shape engagement at these events will help to design more equitable programs in the future.

This article explores the mechanisms shaping actions, behaviors, and interactions at these events. I use observational and interview data to develop a framework for understanding how the *structure* and *framing* of ASEE events influence actions, behaviors, and interactions at these events. Structural elements are intentional decisions related to an event's implementation, including the event's format and the physical environment. Framing refers to elements related to setting expectations and establishing norms at the event. Together, structure and framing create a blueprint for how actions, behaviors, and interactions will take shape. The following question guided my research: How does the structure and framing of these events shape actions, behaviors, and interactions at ASEEs? This article begins to touch on the equity implication of structure and framing, but this topic is more substantively addressed in the following article.

Theoretical framework

This research is grounded in Butler's (1990a) theory of performativity. This theory, developed around performances of gender, assumes that identities are not internal products but are instead inscribed upon a person by external forces. Butler sees identities as constructed through shared language and communication, and therefore the language that people use to talk about themselves and others defines what it means to be a man or woman in our society.

Although the notion of performativity is situated within a discussion of gender, performativity can and has been used to understand other identity markers and characteristics. According to Kotthoff and Baron (2001, p. ix), "In many contexts, gender is not the only identity

category a person acts out: people act as friends, neighbors, computer experts, scientists, etc., and they play certain roles in these social environments." Identity facets constantly intersect, coming to the forefront and being pushed into the shadows depending on the context.

Performativity is tightly linked to the structure and framing of events. According to Butler (1990), performances are heavily context-based, and structure and framing play major roles in defining context. These elements do not cover every aspect of the environment, as there are components that organizers cannot design for and that participants bring with them. However, structure and framing play an important role in establishing the external forces shaping performances at these events. Structure sets boundaries around who can partake and how they will do so. The category of an event, such as a presentation or hands-on play, determines how a person is likely to participate. These modes of participation each draw on schemas from prior engagement that shape the performance of the moment. According to Chong and Druckman (2007, p. 104), "Framing refers to the process by which people develop a particular conceptualization of an issue or reorient their thinking…". Advance framing in marketing materials creates a picture of what participation in the event will look like for future participants. In-person framing by organizers sets the tone for what kinds of interactions will be considered appropriate. Together, these elements represent the intentional and modifiable features that shape performances.

The lens of performativity allows for a look into the mechanisms behind why actions, behaviors, and interactions at ASEEs take the form they do rather than an evaluative "what happened" assessment. Using performativity as a theoretical framework calls for closely examining these events' physical and social environment, the forces shaping engagement, and the power and privilege each person holds in a given context.

Methodology

In this research, I conducted an exploratory comparative case study across three sites. The variation in structure and framing across sites allowed for greater theory building around the relationship between structure and framing and actions, behaviors, and interactions. With capturing performances and the forces shaping them in mind, data collection took the form of field observations, interviews, and document analysis. Particular attention was paid to the social and physical environment, specifically how context influenced performances of science and/or gender. Of course, I was unable to capture all the contextual features influencing performances. However, by engaging in participant observation, immersing myself in the spaces I studied, and hearing firsthand from participants and organizers about their motivations and experiences, I aimed to capture as detailed an account of attendees' experiences as possible.

Site descriptions

I selected three sites in a mid-sized Midwest town. The three sites represent two categories of events while still converging around the creation of low-stakes social learning environments (Table 1). The sites also embody a range in degree of science focus, cost, and audience. These characteristics represent different structural elements, creating opportunities for comparison. The names of the sites have been changed to protect the identity of the organizers and interviewees.

Table 1. Summary of site descriptions.

Program name	*Location*	*Format*	*Focal topic*	*Frequency*	*Cost*
Craft Brews	Museum	Museum after-hours event	Mixed (science, history, arts + crafts, making)	Monthly	$12 in advance, $15 at the door
Presentation Pint	Bar	Presentation series	Mixed (mainly science, some popular culture, and history)	Monthly	Free
Sip of Science	Bar	Presentation series	Science	Monthly (during the academic year)	Free

Data collection

Data collection occurred between January 2019 and July 2020, with myself as the sole data collector. In order to increase the validity of my findings, I triangulated my findings across three sources of data: field observations, interviews, and document analysis. Cross-checking my findings across these multiple sources allowed me to confirm that multiple forms of data aligned my findings and interpretations. The number of observations and interviews differed across sites (Table 2). The reasons for these differences will be discussed below.

Table 2. Summary of data collection.

Program name	*#Observations*	*#Organizer interviews*	*#Attendee interviews*
Craft Brews	2	1	0
Presentation Pint	4	2	6
Sip of Science	1	3	8

Field observations

I completed seven observations across the three sites. The number of observations at each site differed due to pandemic-related shutdowns. Although the goal was to have a similar number of observations at each site, due to differences in schedules and lead-up times to start observations, data collection at SS started later than at CB and PP. Soon after the first observation at SS, the event was suspended indefinitely, so only one official observation was completed. Although observations at CB and PP started around the same time, CB hosted fewer events in the period before the pandemic shutdowns began.

At each event, I engaged in participant observation, fully immersing myself in the spaces and engaging in the behavioral norms of the events to gain a tacit understanding of the experience (DeWalt, 2010). The form of my participation varied at each event. However, it involved listening to presentations, purchasing food and drinks when available, engaging with hands-on exhibitions, making crafts, having informal discussions with attendees, and sitting back for more formal observations of other people's interactions. Participant observation allowed me to experience firsthand the norms of the space and how my actions, behaviors, and interactions were shaped by the structure and framing of the event.

While in the field, I recorded jottings on my phone. These jottings included brief observations, thoughts, and quotes to document the event without entirely removing myself from the situation (Emerson, Shaw, & Fretz, 1995). The jottings were structured around a protocol to ensure that I paid attention to certain aspects of engagement during each observation. In addition to general notes on the flow of the event, I made sure to attend to audience demographics, engagement—specifically where people appeared supportive or critical of presentations or activities—gendered interactions, and at presentation events, what sort of questions were being

asked (Appendix 2). After the event, I immediately expanded the jottings into full field notes while my memory was still fresh.

Interviews

I conducted semi-structured interviews with both attendees and organizers. In total, 14 attendee interviews were recorded, in addition to six organizer interviews. As visible in table 1, no attendee interviews were conducted with participants of CB. The initial recruitment strategy for interviews was to recruit in person near the exit of events. I had limited success with this technique at PP and no success at SS and CB. In order to conduct more interviews, I asked organizers to share information about my study with their email lists. This email recruitment took place during the early stages of the pandemic. Unfortunately, at this time, the museum staff were struggling under the burden of closing to the public and could not assist with work that was not essential to their operations, resulting in no attendee interviews at this site. For both PP and SS, email recruitment proved to be more successful.

Attendee interviews focused on the attendee's motivation and circumstances for attending, their experience at the event, and their personal perspectives on science (Appendix 3). The interviews lasted between 30 and 90 minutes.

Organizer interviews focused on the programs' history and goals, visitor demographics and engagement observations, benefits and drawbacks to attendance, future goals for the program, and personal perspectives on science (Appendix 1). Each organizer was interviewed individually, and the interviews lasted between 40 and 60 minutes.

Document analysis

The final mode of data collection was document analysis. For each event I attended, I collected marketing materials in the form of social media posts, email blasts, and web postings marketing the event. The goal of document analysis was to better understand how these events were framed for potential attendees. Materials marketing these events created an image of what participation in these events would look like for future attendees; therefore, analyzing these materials was essential to understanding how expectations were set.

Participants

Interviewees self-selected for participation in this study and therefore do not represent a random audience sample at any given event. Among the 14 attendee interviewees, there were nine men and five women. Eleven of those identified with the term "science person," and 12 had careers or some college education in science which they identified as having a background in science. Interviewees were not asked about their racial/ethnic background or sexual orientation; however, seven volunteered to share that they were white, and four volunteered to share that they were straight.

Analysis

A professional transcription service transcribed the interviews, and all documents, field notes, and transcripts were imported into MaxQDA for analysis. Initially, the data was coded for emergent themes. Then, the data was coded iteratively, and during each pass, codes were refined, condensed, and/or divided. Eventually, the emergent themes were divided into the categories

which became the core of my framework: structure, framing, genre, and performativity. Each of these broader categories contains several subcodes referring to specific features of each category. The definitions of each category and code are discussed in the findings.

In addition to emergent themes, I also attempted to apply codes from other research on similar events, specifically Archer et al.'s (2016) and Dawson et al.'s (2019) codes for gendered performances of science and Davies' (2009) genres for science cafes. Archer et al. (2016) identified three performances related to masculinity: laddishness, muscular intellect, and translocational masculinity. In their research, Dawson et al. (2019) identified four performances related to femininity: good girl student, performances that drew on masculinity and race/ethnicity, silence, and cool girl student. Of these performances, laddishness, muscular intellect, and silence were identifiable in my data. These codes had to be refined and recategorized to account for adults as opposed to adolescents. In applying Davies' (2009) genres for science cafes, only formal schooling was identifiable in my data and was applied without modification.

Positionality

My identity influenced both what I could observe and how I interpreted the data I collected. As a white millennial woman with a background in science, I generally felt that I fit in in these spaces and was welcomed; however, being a woman in these spaces subjected me to some interactions which made me feel unsafe and distracted from my data collection. My experience having been an attendee in these spaces, as opposed to exclusively an outside

observer, shaped my understanding of genre; however, someone else may have experienced different genres or interpreted the genres I identified differently.

Findings

In answering the question, "How does the structure and framing of these events shape actions, behaviors, and interactions at ASEEs?" I found that I needed to refine my analytic categories to provide a clearer account of the differences between events. Additionally, I identified a further component of actions, behaviors, and interactions: genre. Genre refers to the interactional category of the event and captures the experience of the event better than structure and framing alone, as well as provides a bridge, linking structure and framing to performativity. I will first demonstrate how expanding structure and framing can provide a more robust lens for analysis and then demonstrate how adding genre to this framework better captures the process through which structure and framing influence actions, behaviors, and interactions.

Structure and framing

Due to the curious comparison between PP and SS, I will focus on these two events while expanding the definitions of structure and framing. On paper, PP and SS look quite similar. Both events happen on weekday evenings at venues in the community. Both events have similar structural templates with presentations followed by Q&A. Even the marketing materials for each event look similar, highlighting the presentations with humanized and personal biographies of presenters. However, despite these similarities, the experience of attending these events is quite

different. Expanding the definitions of structure and framing helps to better capture these differences. These terms and their definitions are summarized in table 3.

Table 3. Revised definitions of structure and framing.

Design/implementation element	*Defining features*
Structure: Intentional decisions related to organization and planning of an event.	Format - Structural template: Focal event activities - Flow of event: Time structure including activities' pacing, sequence, and duration - Conditions of access: Scheduling of the event, entry restrictions, and cost
	Physical environment: Includes location, layout of space, seating arrangement, availability of food/drinks, lighting, sound, and music
Framing: Lens through which attendees interpret an event	Advance framing: Done through marketing materials; creates an imagined future participant
	In-person framing: Done in-person by organizers/hosts; sets expectations for appropriate engagement

Structure

Structure refers to intentional decisions related to the organization and planning of an event. Structural elements influence who can attend an event and what activities they can engage in once there. As initially conceived, the *structural template*, referring to the highlighted event features on paper, was the most important element of structure. Based on this narrow definition of structure, PP and SS looked quite similar as they have nearly the same structural template, with the exception of PP consisting of three back-to-back presentations and SS only having a single talk per event. Dividing structure into two categories, *format* and *physical environment*, provided a more robust structural description of these events, which better captured the differences between them.

Format. The *structural template* of an event is just one component of format. In addition, format includes the *flow of the event* and *conditions of access*. The event flow refers to the event's time structure and consists of the activities' pacing, sequencing, and duration. In my data analysis, I identified flow as a defining difference in the structure of SS and PP. PP hosted three speakers, each talk divided by a 20-minute drink break. The drink break created an extra 40 minutes at PP, which was explicitly allotted for socializing, compared to SS, which had no scheduled time to socialize. During the drink break at PP, I observed people catching up on life, discussing work, and working on group school assignments. People drank heavily during the drink break, even taking shots of liquor. The noise level in the room also rose during this time due to the number of people talking. Several interviewees from PP also cited the drink break as an important feature of the event because it allowed them time to catch up with friends. According to one attendee, one of the main reasons they attended PP was for the opportunity to socialize, "part of the reason I do those types of events is to socialize."

The intended purpose of the drink break was apparent even to those who disliked it, such as one interviewee who said that he disliked the drink break because he often came alone and felt uncomfortable during that time without anyone to socialize with. According to one organizer, the purpose of the event was primarily social, as opposed to purely educational:

> So, I would say it serves more, it serves more a primarily a social function. I don't expect that a lot of people have like long lists of memorized facts that they've taken away. I think it definitely might spark interests in certain areas that people didn't know they were curious about. So, I think there's definitely like an intellectually stimulation piece to it.

> But I think it's more about people wanting to be in a space with other people who are just curious about weird intellectual stuff.

This quote highlights the importance of socializing and community building for the organizers, hence why they built opportunities for socializing into the flow of the event.

Another difference in PP's flow compared to SS is that the Q&A session at SS was far longer. Most of the event time at SS was designated for audience questions and comments. In contrast, at PP, each talk was followed by a brief (3-5 question) Q&A session in which the audience asked questions via Twitter which the organizers moderated. The length of the Q&A at SS allowed for not only more questions but more in-depth questions and even back-and-forth discussions about the technical details of the research and societal implications. Despite similar structural templates, the flow of the events made space for different activities to take place.

Conditions of access include scheduling of the event, entry restrictions, and cost. These planning decisions are grouped under conditions of access as they dictate who can attend. Scheduling includes the day of the week, time of day, and total duration of the event. All the events in this sample were hosted on weekday evenings outside the 9-5 workday. These scheduling decisions limited attendance to a specific subset of adults who worked in positions that followed those hours. For example, someone working second or third shift would have had difficulty fitting one of these events into their schedule.

Entry restrictions refer to whether events were ticketed and/or limited entry to those over 21. Explicit entry restrictions at CB and PP prevented anyone under 21 from entering the space, whereas at SS, anyone could enter. This is related to cost, which refers to the price of ticketed attendance and the expected, but not mandatory costs, such as purchasing food/drink and tipping.

PP and SS were both free, but PP attendees were explicitly encouraged to purchase drinks and tip bartenders. At CB, tickets were either $12 or $15, depending on whether or not they were purchased in advance, and there was always an option to purchase one or more upcharge activities. This research can only conjecture about the influence conditions of access had on attendance, as I did not speak to anyone who was aware of these events yet chose not to attend; however, these conditions likely played a role in shaping the audience.

Physical environment. The second element of structure is the physical environment. The physical environment includes the location, space, seating arrangement, availability of food/drinks, lighting, sound, and music. These components played a role in generating the atmosphere at each event. Some aspects of the physical environment, such as seating arrangement or lighting, were only intentional in that they accompanied the selected venue. However, both PP and SS bounced between several venues before finding a space that best suited their needs; therefore, although organizers did not control each aspect of the physical environment independently, this category still represents intentional elements. According to one organizer from SS, the search for an appropriate venue was a somewhat difficult process:

> We have had some trouble identifying an appropriate venue from time to time…. So the venue that we use as our pilot venue was great, but they didn't have a PA system. And also there was a limited capacity to expand the audience just based on size limitations of the venue itself. So, without a budget…we needed to find a venue that had a PA system, ideally, and then also the space, and either easy access to public transit and/or parking, wanting to be as accessible to the public as possible. …we were limited in our capacity to

> expand audience wise, because we were in a small room there. I think we fit maybe 70 before it got really uncomfortable in that room. We then moved to a different venue further away from downtown….And so, we moved there because they had more of an event space. Similarly, on or near several bus lines, easy to reach by bike, walking, car. And then, we've had some changes there as well.

In my observations, lighting and the availability of alcohol appeared to play the largest role in defining the atmosphere of an event. Lighting played a role in creating ambiance, with lower lighting associated with more socialization than brighter-lit spaces. At PP, the space was dimly lit except for the bar, which was the only illuminated space during the drink break. This drew attention to the bar, possibly reminding patrons of the option to purchase alcohol. A PP organizer described the difference between PP and other lectures as, "….And like the lights are on, it's just a much different experience." As he mentioned, although other lectures may have had similar speakers covering similar topics, the atmosphere of the space was different from that of PP. One of the elements he attributed to that difference is lighting. Although SS dimmed the floor lights when talks began, the seating area remained well-lit. The difference between the stage and floor lighting was far less stark than at PP. At CB, lighting changes were a common topic of negotiation among staff and vendors, with vendors commonly asking for lights to be dimmed or brightened to meet the needs of their activity.

In addition to lighting, the option to purchase alcohol emerged as a defining feature of these events. Several interviewees cited the mere presence of alcohol, unrelated to consumption, as increasing the informality of the event. These interviewees compared SS to an event hosted on

a university campus without alcohol outside my sample. When comparing events with and without alcohol, one interviewee said:

> …. I mean, [I've] gone to plenty of lectures, you know, I attended plenty of lectures where there was no alcohol. But it just feels so much more casual, and feels so much more, kind of come inviting to just, like, come in, grab a pint, and sit down.

It is important to note that the option to purchase alcohol is separate from the consumption of alcohol, which I will discuss in genre. Although all the events in this study had the option to purchase alcohol, consumption patterns varied.

To summarize, the format and physical environment were intentional elements that made space for different activities and shaped the event's atmosphere. In this subset of events, I identified the flow of the event, lighting, and the option to purchase alcohol as particularly salient elements. These elements defined these events in comparison to one another and adult science engagement opportunities more broadly.

Framing

In the field of communications, framing is speech, text, or other communication that creates the perspective or lens through which a reader will interpret a story (Chong & Druckman, 2007). Framing includes *advance framing* done through event marketing materials and *in-person framing* done by organizers at the event (Davies, 2009). Viewing framing as a component of expectation setting allows us to see how framing shapes the establishment of norms at these events.

Advance framing. The marketing materials created around these events defined what type of people would enjoy these events and thus created an imagined future participant. Davies (2009) refers to this as external framing, but because I aim to highlight the intentional aspects of design and implementation, I instead to this as advance framing. I take advance framing to refer to any marketing materials circulated to advertise or alert the public to these events, including website posts, email marketing, and social media posts.

Overall, PP and SS distributed somewhat similar marketing materials for their events. Both sets of materials focused on the presentations at these events and provided brief summaries of the talks and presenters' backgrounds. Despite these similarities, there were some notable differences. At PP, all the website materials included the words "be there and be square." This embrace of the term "square," commonly used as an insult, suggests a participant who has been otherwise ostracized. The language used in PP's marketing also celebrated the term "nerd." Together, these marketing materials referenced the cultural stereotype of a nerd as someone who may have been labeled uncool or excluded from other groups. At SS, the marketing materials emphasized the human side of science, advertising the event as an opportunity to learn about the presenters' research and personal lives. The topics of SS presentations almost always had a topical or community link, suggesting that these events are for invested community members and/or those already interested in scientific research. I had initially placed more emphasis on advance framing; however, throughout my analysis, I identified in-person framing as better capturing some of the differences between PP and SS.

In-person framing. In Davies's (2009) research on science cafes at the Dana Center, she found in-person framing by organizers crucial in setting audience expectations for engagement for the remainder of the event. Davies refers to this as internal framing; for simplicity, I will refer to it as in-person framing.

The length of organizer introductions appeared particularly salient to expectation setting, as activities that are most familiar require the least framing, and those that are unfamiliar require more time to set expectations (Davies, 2009). In discussing norm establishment, Cialdini and Trost (1998, p. 155) write, "We are most likely to use the evidence of others' behavior to decide the most effective course of action when the situation is novel, ambiguous, or uncertain." As such, the length of an introduction at a given event says how novel or unique the organizer assumes that event to be for the audience. For example, eating dinner with one's family requires no introduction to set norms. A parent may occasionally remind their children of proper manners before sitting down to a meal. However, these subsequent reminders are more likely to come after children have blundered dinner table manners. PP had the longest introductions, sometimes even as long as 11 minutes, whereas at SS, the introductions were less than two minutes. This suggests that the organizers of PP saw their event as different from what the audience may have experienced in the past and therefore required additional expectation setting. On the other hand, SS organizers appeared to expect that audience members already understand how the event would proceed, perhaps because it is similar to other events audience members may have attended in the past. Put another way, the short introduction at SS suggests that no norming needed to be done to set expectations for behavior. Instead, the introduction was devoted to increasing the trustworthiness of the presenters.

The content of the introductions also differed between the two events. The content of the opening remarks sets the tone for the discourse of the event and models engagement for the audience (Davies, 2009). At PP, organizers deliberately used curse words in their talks to set the expectation for irreverent humor:

> Yeah. I mean, we encourage people to, you know, swearing is great like that, being crass is totally cool. Even, you know, [the prior organizer] and I talked when I first kind of was taking over, he would say like, he tried to drop a couple of F-bombs like in the intro just to sort of loosen things up. And I think, and I definitely do that too to try to keep it, and the intent at least is to remind people that this isn't meant to be like a formal lecture presentation like to try to distance it from that. That's the hope on it and to let people feel free to speak as you would, you know. I don't think we try to, like, I don't know if we necessarily encourage it, we kind of encourage it, but to at least like, let it be, you know, "Hey, whatever you want to say, if you want to say it that way, say it that way. And feel free to do that."

Although this quote specifically references "F-bombs," I saw the organizers use irreverent humor more generally in my observations. Every opening talk included a section on the event's history and a mini-presentation aimed at modeling the type of content they were looking for in future presentations. Although these talks usually looked relatively chaste on paper, profane humor was always sprinkled in.

Introductions such as this set the expectation for the type of language that will be heard and the appropriate forms of engagement from the audience. Organizers often responded directly to audience feedback and encouraged call and response and banter with the audience.

There was no event history or mini-presentation during the SS introduction. However, instead, a brief hand raise survey of who had attended the event before and who was familiar with the topic, followed by a short formal introduction of the speakers and their credentials. This credential-focused introduction was contrasted by the speaker introductions at PP, where at one event, a Ph.D. holding researcher was introduced as "liking it saucy" with no mention of her education or research background. Examining in-person framing allows for a more thorough understanding of the norms at these events. Together, in-person and advance framing set an expectation for who would enjoy the event and how to behave and interact once there.

Genre and performativity

Although expanding structure and framing helped to better capture the differences between attending PP and SS, this expansion only provided better descriptive categories and failed to explain why actions, behaviors, and interactions at these events differed. When comparing PP to more traditional lectures, an organizer said, "Like it was still the same presenters, but not the same vibe. Like vibe is the only word that I can really kind of come up with for it." This quote suggests that even organizers struggled to capture what differentiated these events from other opportunities for adults to engage with science. I believe that this difference can be captured by genre.

Genre is the interactional category of an event, meaning it refers to the general interactional template the event evokes. Genres such as “talk show interview” or “formal schooling” evoke certain ideas about how participants should behave and interact in these settings (Davies, 2009). It is an outcome of choices around structure and framing and a product of shared and consistent past experiences within groups. Elements of structure and framing can work to evoke a genre, which can shape people's actions, behaviors, and interactions at an event. However, genre is not exclusively a product of structure and framing. Genre is co-constructed by organizers and attendees. Partaking in consistent, shared experiences over time makes it possible for a person to enter a new space with new people and already know the actions, behaviors, and interactions expected, provided the structure and framing of the activity provide some clues. The genre of an event creates spaces for particular sorts of social performances to take place. For example, when attending a sporting event for the first time, a person uses a combination of structure, framing, and prior experiences to determine what sorts of behavior is expected of them. Entering a space and seeing vendor stands with alcohol suggests a more rambunctious form of engagement than stands of exclusively popcorn and cotton candy. Advertisements highlighting "rivalries" suggest the event may be populated with more passionate fans than events labeled as "debuts" or "expositions." Announcers telling the crowd to "make some noise" at a basketball game sets a different expectation for behavior than golf announcers reminding the crowd to stay quiet and still during players' shots. These structural and framing clues, combined with prior knowledge of sporting events, help attendees to place this event in an interactional category and behave appropriately for the genre.

One of the most important aspects of genre regarding its influence on actions, behaviors, and interactions is its co-constituted relationship with performativity. The genre of an event

creates space for performances to take place, and in turn, these performances define the genre. Genre and performativity are related to actions, behaviors, and interactions as the genre creates a schema for the modes of engagement, and performances fill the roles made possible by the genre. An analysis of genre allows one to see how small, deliberate choices in structure and framing have a holistic impact on the experience of the event.

To justify the benefit of adding genre to this framework and its relationship to performativity, I will provide thick descriptions of each site and highlight the genres and performances present. In identifying genres, I have highlighted the genres which were most obvious to me, given my prior experiences. I took inspiration from Davies (2009) and named each of these categories after other settings. Not all these genres have been defined by previous research, but instead are based on observation and family resemblance to other common activities. It is important to note that another person with different prior experiences may feel these events evoked slightly different genres than I identified, and those genres would also be valid. Additionally, just because an event evokes a genre does not mean that every aspect of that event fits neatly within that category. There may be elements of events that evoke one genre and other elements that directly contradict. For each genre identified, I will also highlight the performances taking place in that genre. These performances overlap and shift based on the context. It is not possible to exhaustively catalog the roles or performances present at an event because there is an endless number of intersecting performances happening everywhere simultaneously; therefore, I will only highlight one to two performances in each genre made possible, as I only aim to capture the relationship between these two elements and their influence on actions, behaviors, and interactions at these events. Each genre and its relationship to structure, framing, and performativity are summarized in table 4.

Table 4. Summary of identified genres.

Genre	*Event*	*Structure*	*Framing*	*Performances*
Comedy show: Irreverent humor, drinking on stage, heckling/banter with the audience	Present & Pint	Central stage with bar	Organizers relied heavily on humor, fostered back-and-forth banter during their opening remarks	Supportive audience member: cheered and laughed at appropriate times
				Heckler: attempted to derail presentations by shouting
Happy hour: Socializing in small groups, binge drinking, the celebration of drinking, unsolicited romantic approaches	Present & Pint	Drink break, dim lighting, music, layout of space	Organizers encouraged the audience to grab drinks, tip bartenders, chat with the people around them	Life of the party: Audience members made themselves the center of attention
				Wannabe Casanova: Unsolicited approaches, touching without consent, assuming the automatic interest of the other party
Public lecture: Presenters using technical speech, note cards, or PowerPoints, technical questions from audience, the expectation for the audience to remain quiet and respectful, topical questions during the Q&A	Present & Pint Sip of Science	PowerPoints, projector screens	Marketing materials which highlight the presentation aspects	Expertise: Sharing education, professional experience, institutional affiliations, or personal experiences related to focal topic
Community forum: More event time focused on discussion than lecture, questions that highlight community impact	Sip of Science	Majority of time devoted to discussion/Q&A	Organizers encouraging audience questions	

Recess: Loud shouting, the use of play structures and children's toys	Craft Brews	The space having large and prominent play structures	Marketing materials which highlighted the chance to "play"	Childish performances: Playing with children's exhibits and play structures, embracing the space as if it was their own

Present & Pint

The event occurred on Wednesday evenings at a bar a few miles away from a local university campus. Upon entering the venue, a bouncer checked IDs and stamped the hands of those over 21. The space was essentially one large room. At the front was an elevated stage with low round tables on either side and rows of folding chairs taking up half the room. A scattering of high-top tables occupied the rear of the space. There were two bars on either side of the room, but only one was open for the event. Beer, wine, and liquor were available for purchase, but there was no food. The bar was the only well-lit section of the room. When people arrived, they congregated in small groups, chatted at the bar, or grabbed seats together. Nearly everyone purchased drinks. Most people purchased beer, but it was not uncommon for people to also purchase shots of liquor. When the organizers arrived, they put up a slide that read "be there and be square" and played indie pop music through the speakers. The event always started with an introduction from the organizers, which included a review of PP's history and a comical mini-presentation on topics ranging from the history of the holiday Mari Lwyd to self-lubricating snow shovels. Following this mini-presentation, the first real talk began. Although PowerPoints were not mandatory, every speaker I observed used one. The event did not have an exclusive science focus, but science and STEM were common themes of many presentations. Additionally,

although speakers were often associated with the local university, no credentials were required to speak on a topic, only passion for the subject. Audience members were usually quite engaged with the talks, laughing, shouting responses, or heckling. Each talk was followed by a Q&A period during which audience members could submit questions via Twitter which the organizers moderated. The best question (as chosen by the organizers) won a free drink. Between each talk was a 20-minute drink break, during which time the organizers encouraged people to refresh their drinks and chat with those around them. During this time, the music returned, and the lights over the bar went back on. There were three presentations and two drink breaks throughout the night, and the event usually ended around 10 pm. In my analysis, three genres appeared most obvious at PP: comedy show, happy hour, and public lecture.

Comedy show. The comedy show genre was defined by irreverent humor, drinking on stage, and heckling/banter with the audience. For example, when discussing video game mechanics, one presenter said:

> [Presenter] explains a Pokémon yellow hack, explaining how throwing away 68 of an item gets you to the end of the game, and says, "If only there was one more, it could have been a 69 joke". Then, the male audience member in front of me starts clapping. [Excerpt from field notes]

In this instance, the presenter strays away from the topic of his presentation to insert sexual humor into his talk. This was not the only instance in which this happened. It was fairly common

for presenters across the board to use humor, particularly for men presenters to use sexual humor.

Drinking on stage was often responded to with chants of "drink" or "chug" from the audience. This engagement differs from what one might expect from a more traditional lecture. Audience commentary was not exclusively reserved for drinking, and there were several instances of heckling in which audience members made fun of the presenters' statements or clothes.

Several aspects of the structure and framing worked to evoke the comedy show genre.. The most influential aspect evoking the comedy show genre was the in-person framing done by organizers. The organizers fostered back-and-forth banter during their opening remarks. In one instance, an organizer teased an audience member for having a missing finger. Although the audience member's comments were difficult to hear, they appeared to engage in approximately a minute of banter, which concluded with the organizer announcing, “We like people who participate.” Organizers' opening remarks also established humor as the norm. No matter the subject of the opening remarks, the organizers always included comedy, often mature comedy, in their talks. For example, when discussing prior presentation topics as part of a bid to encourage more people to present, an organizer showed a picture of vocal cords related to a presentation on puberty and said, “these are vocal cords get your mind of the gutter.” This type of in-person framing evoked the comedy show genre by highlighting both the comedic aspect of the event and explicitly encouraging interaction by the audience in the form of banter.

The comedy show genre made certain performances visible. PP had a great deal of audience engagement, which appeared to split into two categories: supportive audience member and heckler. Supportive audience members cheered and laughed at appropriate times, engaging

with the presentations without derailing them. Heckling audience members teased presenters or made commentary that distracted from their talks, similar to what one might see in a comedy show when a heckler attempts to derail a comedian's set. These heckling performances included chants of "drink" or "chug" any time a presenter stopped to take a sip of their drink on stage, as well as "I've seen this one" or sarcastic shouts of "wow." In another instance, a man was heckled for his outfit. He was the second man presenter in a row to wear a suit vest, and when he got on stage, men in the audience shouted, "two vests!" and "go vest!".

Happy hour. As for happy hour, this genre was defined by socializing in small groups, mainly socialization focused on topics unrelated to the event, binge drinking, the celebration of drinking, and unsolicited romantic approaches. This genre was reminiscent of what one might expect when grabbing a drink after work with friends. For example, upon entering PP and finding that her friend had already purchased drinks, one attendee said, "Oh my god! You bought shots? I love you." It was common in the period before the event and between talks for people to cluster in groups around the bar or lean across chairs in the seating area to chat with one another. In my observations, the subject of these conversations was never about the event but instead focused on other topics, such as whether or not to pet a dog who was also in attendance.

The bar-like atmosphere was a product of the physical environment with dim lighting, music, and a layout that led people to cluster around the bar. The advance framing of the event did little to highlight the happy hour genre other than mentioning the event's location, but in-person framing by organizers highlighted this genre by encouraging people to grab drinks, tip bartenders, and chat with the people around them.

One of the notable performances was people acting like the life of the party. Life of the party performances were loud and easily visible. Audience members made themselves the center of attention, something that would not typically be seen in a lecture or comedy show, where the center of attention would almost always be on the stage. This performance included people shouting and drawing attention to themselves, such as at the start of an event when a woman shouted, "Rush botany!" or when attendees loudly proclaimed their love for alcohol.

Another performance made possible by the happy hour genre was that of wannabe Casanova. Casanova's exploits of women and reframing stories of abuse to paint victims as interested and willing are well-known and widespread. Men's media occasionally perpetuates the notion that women should and will be willing participants in romantic advances (Ward, Vandenbosch, & Eggermont, 2015). The wannabe Casanova performance included men approaching women unsolicited, touching them without consent, and assuming the automatic interest of the other party. In one instance, a man approached one woman to strike up a conservation about the frequency of the event and, within ten minutes, had touched her chest under the guise of looking at a pin. Additionally, the woman organizer of PP shared that she was hit on "pretty emphatically" via social media after giving a presentation.

Public lecture. The final genre I identified at PP was that of the public lecture. Although the structural template is reminiscent of more traditional lectures, this genre was far from being the most dominant at PP. The public lecture genre was defined by presenters using technical speech, note cards, and/or PowerPoints during their presentations, technical questions by the audience, the expectation for the audience to remain quiet and respectful during the talks, and for the audience to ask topical questions during the Q&A.

At PP, every presenter used PowerPoint slides. However, many presenters used irreverent humor or shocking images on their slides which would not be seen in a traditional public lecture. Other elements of the public lecture genre were brought in by presenters who possibly misinterpreted the dominant genre of the event. Notably, in one instance, a younger white man gave a talk using notecards. This made his talk seem rigid and formal, and the audience did not respond well. During his talk, I could hear fellow audience members whispering, and there was very little of the usual audience interaction. On the other hand, there were two instances in which older, more credentialed white men gave more formal talks but received outstanding feedback. In both instances, the men were associated with universities and had years of firsthand experience with the topics of their presentations. Both these men used quite formal PowerPoints, made little to no jokes, and gave talks that were well-rehearsed, one even used notecards. However, whether it be because the quality of the talks was better or because these men were more established in their respective fields, their public lecture-style talks were accepted and celebrated at an event where most talks more closely resembled comedy show sets.

This genre appeared to be evoked by the advance framing of the event, which highlighted only the presentations, giving the impression on paper that these were presentation-centered events rather than entertainment oriented. The main performances that this genre enabled were related to expertise.

Performing expertise took the form of presenters highlighting their education, professional expertise, or personal experiences—such as geek or nerd knowledge—to gain credibility. When highlighting expertise, presenters listed their relevant educational and research credentials, and those without topical credentials referenced their experience in other well-respected fields to leverage that capital into the adjacent field of their presentation topic. For

example, in a talk on video games, one presenter included in his online bio that, "He graduated from [a university] as a chemical engineer and took up a job with a small chemical plant in the area." Chemical engineering expertise has no direct relevance to video games; however, engineering is held in esteem in our society, and being an engineer marked him as intelligent, increasing his credibility (Archer et al., 2015). Leveraging capital from adjacent fields commonly took place at PP as presenters were not required to hold any credentials in a subject to present.

Geek and nerd expertise was referenced at PP by presenters who lacked professional or educational credentials on the topic and did not have relevant expertise to leverage. For instance, when an HR professional presented on Disney's fairytale adaptions, the presenter self-identified as "the token weird Disney girl" in her friend group. Through her statement, she told the audience that although Disney expertise is not seen as cool, she is recognized as an expert by others and accepts this label.

Sip of Science

The event was held at 7 pm on Wednesday evenings. Upon entering the event, no one checked IDs, but occasionally vendors sold food near the entrance. The stage was elevated in the front of the room, surrounded by rows of chairs and a scattering of tables along the back and sides of the space. At the rear of the room was the bar serving beer, wine, and liquor. The entire room was lit, and music played from the speakers but so quietly that it was hard to make out what was played. As people arrived, they grabbed drinks and filled table seating first. No one lingered to sip and chat at the bar. Most people appeared to purchase beer, and I saw no one purchase shots of liquor. A handful of people took advantage of food sales at the door and the

option to bring in take-out, but most people just consumed drinks. When the organizers arrived, they set up the projector and took the stage to introduce the speakers. When the talk started, the lights on the main floor were dimmed. Each night there was a single presentation with two speakers. SS had an exclusive science focus, and many events focused on topical scientific research. Although the program was not run through the university, all the organizers were university employees and saw SS as part of the university's science outreach mission. According to the organizers, the goal of SS was to bring science to the community, share university research, and create a positive association with science. The presenters usually only used a single slide with their names and the title of the talk. The presenters introduced themselves and their credentials and spoke for 5-10 minutes before the Q&A began. Audience questions ranged from the social impacts of science to more technical questions about the validity of specific scientific techniques. There were no breaks for people to refresh their drinks or use the restroom. One or two people headed to the bar to refresh their drinks during the Q&A, but most stayed seated, only consuming one drink. When the event ended at 8:30 pm, most people left immediately. The most easily identifiable genres at SS were public lecture and community forum.

Public lecture. As previously mentioned, the public lecture genre was defined by presenters using technical speech, note cards, and/or PowerPoints during their presentations, technical questions by the audience, the expectation for the audience to remain quiet and respectful during the talks, and for the audience to ask topical questions during the Q&A. Unlike PP, which heavily utilized PowerPoint slides, the public lecture genre at SS was identifiable through technical questions by the audience, topical questions, and the generally respectful

discourse between the audience and presenters. Additionally, both presenters and audience members used technical language.

This genre was evoked through the framing of the event. The advance framing highlighted this event as an opportunity to learn about current scientific research topics, and in-person framing in the form of opening remarks was brief and credential-focused, suggesting that attendees draw on pre-existing models for engagement. Given that most speakers were doctors, high-level professionals, or university researchers, the default mode of engagement appeared to be respectful.

Similar to public lecture-performances at PP, the performance of expertise was clearly visible in this genre at SS. Presenters were required to be highly credentialed in their fields, meaning they did not need to leverage expertise from other fields. Despite already entering with credentials granted through their selection as presenters, at the SS event I observed, I still witnessed the two co-presenters compete to establish superior expertise between one another. A man presenter repeatedly stated that he had eight more years of experience than the woman co-presenter. During the presentation, he reinforced his superior expertise by saying things such as, "there is a huge inconsistency in what she said that needs clarification," and reminding the audience that she worked for him. Through these actions, he labeled himself as having more expertise than his co-presenter. This performance was highly gendered and will be discussed in more detail in the following article. Not only did presenters display expertise, but it was the opinion of at least one interviewee it required a degree of expertise in science to understand the information as well, “[The presentations] seem targeted at, the level of information is high. And the people are clearly experts. But not intimidating you know, focused only to fellow graduates and postdocs.”

Community forum. The second genre this event drew upon was the community forum. Community forums are events where community members come together to discuss focal topics. Community members can share ideas, make comments and ask questions of experts. The community forum genre is defined by more time focused on discussion and Q&A than a lecture and by questions/comments that highlight community impact instead of existing exclusively in the technical realm. The flow of SS favored time for audience feedback and discussion over lecture with approximately 5-10 minutes of lecture and the majority of the hour and a half devoted to questions and comments. Although many of the questions asked of presenters were technical in nature, audience members at SS also often utilized the event to ask questions about community impact. Following the community forum genre, not all audience participation took the form of question-asking. Occasionally audience members proposed ideas or responded to each other's questions. According to one attendee, the conversations happening among audience members during the Q&A portion was their favorite part of the event:

> I really found the whole night stimulating….There was a lot of interaction, and so that was real encouraging as well here….it made it feel more community-wide. There were a lot of people that were engaged…some where people were correcting other people and saying, "No." You know, like, the public health people were saying, "No, this really is how the public health piece should be working. And if people aren't doing that, this is what they should be doing." And so this was bringing in another side of science, you know, the maybe more practical side. So I thought that was really good…

Performances of expertise also occurred among the audience when attempting to convince others of the validity of their idea or have their answer to a question be taken seriously. In these bids for their expertise to be recognized, audience members referenced recent scientific articles they had read and/or their professional credentials.

Craft brews

The event started at 6 pm on Friday evenings. By start time, people were usually lined up outside. Most events sold out in advance, but occasionally a few tickets were available for purchase at the door. A security guard checked IDs at the door to ensure everyone entering was of legal drinking age, and once inside, people could purchase alcohol freely. The museum saw the event as fulfilling adults' need to play. The event benefitted the museum as a "pre-membership" program—making adults aware of the museum's mission and leading to their eventual membership when attendees had children. All the events were organized around a theme. This event did not have an exclusive science focus but had hosted several science-focused events over the years; however, there were no science-focused events in my sample. Both staff and many attendees dressed following the theme, wearing costumes, themed t-shirts, or accessories. Most nights, the museum hosted a scavenger hunt related to the event's theme. The information table for the hunt was always busy at the start of the evening, with people eager to hunt for clues. In addition to the scavenger hunt, each event offered several activity stations related to the night's theme. Most activities had a crafts/making component, and there was often some sort of performance available. The museum spanned multiple floors, and in addition to the special activities, adults were welcome to use the regular exhibits, including a large indoor play structure. It was common to hear shrieks of joy and fear as people slipped down the slide. There

were two locations to purchase alcohol and usually a specialty cocktail aligned with the night's theme. These sugary concoctions were popular among attendees. Most events also included an area for dancing with a DJ; however, these areas tended to be one of the less popular spots, with arts and crafts stations taking the spotlight. The event officially ended at 10 pm, but most of the crowd had cleared out by then, with the bulk starting to leave around 9 pm. The most visible genre at CB was recess.

Recess. The recess genre was defined by loud shouting—what could be likened to using outdoor voices inside—and the use of play structures. Just as in school, when teachers opened the doors to recess and children moved from their quiet spots in line to running through the playground, adults underwent a similar transformation when entering CB. CB was the only event that drew on the recess genre, and it was not uncommon for adults to scream and shout, despite being in a museum. In one instance, a woman at the top of the slide shouted, "Hey bitches on the slide, I'm going!" Although her language was notably adult, her behavior of shouting down the slide to warn others of her approach was reminiscent of how a child might behave on a playground. Screaming in excitement/fear while on the slides and other play structures was common, as were adults simply sitting and drinking inside the indoor jungle gym for prolonged periods. This genre was both a product of the structure, with the physical environment having many spaces for play, and the framing of the event, which was advertised as an opportunity to "play like a grown-up," setting the expectation that play would be an essential aspect of the event.

This genre made childish performances visible, as adults were encouraged to embrace the children's museum as a space for themselves. Similar to what defined the genre, childish

performances were defined by adults playing with children's exhibits and play structures, partaking in children's craft projects, and more generally, embracing the space as if it was their own.

Discussion

In this article, I created an empirically derived framework for understanding how design decisions shape engagement. This framework retains the original concepts of structure, framing, and performativity but adds another key concept—genre—that helps explain how structure and framing impinge upon the social world. Structural elements dictate who can attend an event and what activities they will likely engage in once there. Framing works both before and during the event to influence the constraints of structure. Advance framing establishes imagined participants, painting a picture of the type of people who attend and the activities they partake in, whereas in-person framing more firmly establishes norms at the event. Together, structure and framing establish an interactional genre for the event, enabling people to create a schema for appropriate engagement by drawing on past experiences that share similar physical environments, activities, and norms. Genre and performativity are connected through their co-constituted relationship: Every genre creates opportunities for certain performances and roles to be enacted. Those performances work, in turn, to establish the genre.

This framework draws on ideas from earlier research exploring engagement in ISLEs, specifically Davies's (2009) work on genre at Science Cafes and Archer et al.'s (2016) and Dawson et al.'s (2019) research on performativity at adolescent visits to a science museum. Genre and performativity offer complementary insights. A genre-oriented analysis reveals the

broader social context and norms while focusing on performativity draws attention to the individual and interpersonal interactions which occur as a product of the broader social environment. With these new lenses, the updated framework offers new theoretical tools for understanding and explaining why actions and interactions at ASEEs look the way they do. It also sheds light on the potential affordances and drawbacks of ASEEs as a mode of engagement with science. Applying this analytical lens to ASEEs will allow researchers to address why certain genres and performances arise at these events, how structural and framing decisions may exclude minoritized groups, and how restructuring and/or reframing these events may lead to events that better serve more diverse audiences. To illustrate the power of this framework, I will show how the framework helps to further define ASEEs as a category by illuminating the carnivalesque elements of these events.

ASEEs and the carnivalesque

Throughout this article, I have focused on comparing PP and SS because, on paper, these events appear quite similar. These two events are marketed as presentations by one or more speakers, followed by a Q&A session. Both take place at community bars in the same neighborhood on weeknight evenings. The layout of each event is similar, with elevated stages in the front of the space surrounded by rows of chairs and a scattering of tables. However, despite the similarities, the experience of attending these two events is quite different. One explanation for why these events, which fall within similar format categories, have dissimilar genres is that certain structural and framing elements deployed at PP allow for the creation of the carnivalesque. The notion of the carnivalesque, referring to the subversion of the traditional or

expected genres, was developed by Bakhtin (1984) and is rooted in an understanding of literary categories. According to Bakhtin (1984), the carnivalesque has four defining characteristics. The first is free and familiar interaction among people, meaning that hierarchies are broken down, and the boundaries that constrain interaction are removed. The second is eccentric behavior, referring to behavior that in other settings is not usually accepted. The third is carnivalistic mesalliances—the coming together of things usually separated, such as the young and old or heaven and hell. The final characteristic is profanation, through which piety is stripped of its power and blasphemy is celebrated. These characteristics are held together by dualistic paired images, as one cannot celebrate blasphemy without recognizing what is pious nor revel in eccentric behaviors without recognizing what makes them otherwise unacceptable (Bakhtin, 1984). As such, for a genre to be carnivalesque, it must draw on tradition while also separating itself from it.

At PP and SS, these characteristics are visible to different degrees. At PP, the flow of the event, specifically the drink break, creates an explicit opportunity for intermingling between groups. The organizers even told the audience to use the drink break to "chat with the people around you," thus encouraging intermingling. At SS, there was no allotted time for such interaction and thus fewer opportunities for people to socialize, let alone socialize between groups. The structure of these two events made space for different amounts of interaction. Additionally, at PP, traditional academic hierarchies, which hold educational credentials in esteem over lived experience (Collins, 1979), are challenged to a degree. At PP, presenters merely need to demonstrate a passion for their topic to present. According to one organizer, the only credential for speaking was, "as long as you care about it, that's really the big thing." This is vastly different from how expertise is usually conceptualized in science as a product of advanced

degrees and research experience (Barnes & Edge, 1982; Collins, 1979). At SS, the traditional academic hierarchy was maintained as presenters needed to be firmly established and credentialed in their fields. Although it was not mandatory that speakers held an advanced degree, organizers always tried to have at least one university-affiliated speaker. In this way, these events made space for different groups to perform expertise.

In Bahktin's (1984, p. 123) discussion of familiar and free interaction, he explicitly refers to the removal of "socio-hierarchical inequality… People who in life are separated by impenetrable hierarchical barriers". Although room for intermingling was made at PP, one could argue that these interactions were not occurring between otherwise impenetrably separated groups. At both events, most audience members appeared to be well-educated, white, and many affiliated with the nearby university. Even when interactions did occur at these events, it is unlikely that they broke down the hierarchies that Bahktin referenced. The lack of hierarchical subversion is also a product of the structure and framing of these events, as the timing and location of these programs make them accessible to only a select group of people. Although PP encompasses more familiar and free elements than SS, neither event completely fits this characteristic.

As for eccentric behavior, the heckling of presenters at PP could be considered typically unaccepted, as this behavior would not be acceptable at SS or many other presentations. At SS, there were instances in which audience members did not demonstrate what would be considered traditionally respectful modes of discourse, such as when a man aggressively asked questions, but this behavior was shunned by his fellow audience members rather than accepted. Eccentric behavior appears to be a product of genre, with more subversive genres, such as comedy shows

or happy hour, leading to more eccentric behavior than those more closely aligned with academia, such as lecture or schooling.

With regard to mesalliances, at PP, academic talk was melded with curse words and sex jokes, fusing the serious and academic with the irreverent. For this mesalliance to occur, presenters had to draw on the traditional while separating themselves from it. Thus, PowerPoint slides with photos of animal genitalia and elevated stages with drinking presenters. Presentations were given on subjects that one organizer referred to as “weird” or what otherwise might be considered not worthy of a presentation. For instance, most people likely have not attended a presentation on self-lubricating snow shovels or watched a presenter talk through photos of insects that use their feces as modes of self-defense; however, at PP, abnormal topics are standard. The event is framed as for “nerds” and people who otherwise might not fit in, and the topics are also unusual. Internal framing at the event's start sets the norm for "weird" subjects as the organizers model a mini-presentation. Although some presenters discuss their research or professional passions, most try to add a non-academic angle when addressing the topic. At SS, the mesalliances were less sharply contrasted. Alcohol was also available but not as prevalent, and although presenters included personal anecdotes and encouraged questions about their personal lives, there were no sex jokes or "F-bombs.”

Similarly, profanation was far more visible at PP than at SS. As previously discussed, science has particular standards for credibility. For someone to have authority on a topic, they must be able to speak in the language of science and hold advanced degrees or institutional affiliations. PP profanes science in two ways. First, by celebrating irreverent humor, especially when used to discuss serious/unfunny topics. Irreverent humor makes light of the solemnity and authority of science. Second, by allowing people to present based on their passions as opposed to

technical credentials. As previously discussed, presenters at PP merely needed to convey their passion for a topic when pitching talks to the organizers. This could be considered a sacrilege of traditional notions of expertise that relies on external bodies (universities and other institutions) to confer credibility upon a person (Collins, 1979). By not having these credentials, they subvert the authority of science to convey expertise. At SS, no obvious profanation was visible. Traditional notions of expertise were upheld, as were norms around respectful engagement. In fact, one organizer even mentioned that one of their goals for the event was to create a "positive affiliation toward expertise at the university," thus reinforcing the traditional view of scientific institutions as conveyors of expertise.

This comparison suggests that although SS had some carnivalesque elements through structure, framing, genre, and performativity, PP leaned much further into the realm of the carnivalesque. PP had structural elements which not only made space for more carnivalesque interactions but also leaned into the carnivalesque through the physical environment with loud music and darkened rooms. Additionally, the framing of PP established subversion as the norm and allowed new audiences to perform expertise. The comparison between the carnivalesque elements of these two events begs the question, what to call the features which are not carnivalesque?

One way of thinking about the opposite carnivalesque is sober. I use sobriety not to refer to a lack of alcohol consumption but rather to reference the solemnity and dignity of engagement, particularly engagement with science. Sobriety upholds the social authority of and deference towards science by maintaining hierarchies between scientists and the public (Akin et al., 2021; Brossard & Nisbet, 2007). This hierarchy maintains the authority of science within a small group of people and institutions. Structural sobriety looks like limiting opportunities to

socialize through the flow of the event, which keeps the focus on the event on the presentations. As for framing, sobriety looks like setting the expectation and norm that audience members should show deference to presenters through topical questions and hand raising. Lastly, sobriety only allows those with predetermined credentials to perform expertise and requires audience members who wish to establish expertise to reference their professional credentials to claim authority on a subject. SS fits the sober mold far more than the characteristics of the carnivalesque, but neither PP nor SS fits neatly within either category. This suggests that these labels are not black-and-white categories but rather the ends of a spectrum.

These findings have implications for defining ASEEs as a category. My previous assumption that ASEEs are defined by their target audience and the degree to which their mission diverges from the traditional goals of science education is incomplete. Although it holds that these events target adults as their primary audience, the sober/carnivalesque spectrum complicates my previous assumption that identity-focused goals define ASEEs. A better way of defining ASEEs as a category of events may be to define them by their relationship to the carnivalesque. Although hosted in the evening and serving alcohol, SS had few carnivalesque features and could be considered more similar to traditional, sober lectures. ASEEs can then be defined as events that target adults as their primary audience and use carnivalesque elements to subvert traditional modes of engaging with science.

In addition to informing the defining features of ASEEs, these findings also point to the evolving nature of these events, particularly through mismatches in genre. As previously discussed, there were several instances at PP in which either presenters or attendees appeared to misunderstand the genre of the event. Specifically, speakers presenting more formal talks than expected, and attendees not appreciating the drink break. For the two older, white professor

presenters, the mismatch between performance and genre turned out okay, with attendees enjoying their talks despite the presentations looking more like traditional lectures. However, for the less established presenter, a young white man without a degree in his presentation subject, his more formal presentations did not capture the audience's attention. Instead, it led to a presentation in which the audience appeared distracted, and several interviewees did not remember when asked to recount their experience of the event. That these presenters did not give talks that drew on the comedy show genre suggests that the norms around presenting were still evolving and open to interpretation. Additionally, this suggests that mismatches between structure, framing, genre, and performativity can occur. Although the structure and framing of PP aligned to establish comedy show and happy hour as the dominant genres of the event, the roles available for presenters within these genres were limited. In one instance, an elderly white man used his privilege to create a role that previously did not exist, that of a formal presenter. This ability to contest the genre of the event with his performance appeared to be a product of his privilege stemming from his age, whiteness, and credentials.

At CB, a mismatch occurred in the structure and advance framing of the event. In the marketing for one event, the event was portrayed as more similar to a rave, with attendings having the option to "Go psychedelic in our black light room" and dance to the DJ's "gleaming beats." Several attendees showed up in attire more expected at a rave than a mostly well-lit children's museum hosting arts and crafts activities. These people looked disappointed in their tight neon clothing and out-of-this-world headpieces as they wandered the museum among the other patrons in jeans and t-shirts. The advance framing of this event was not aligned with the activity structure, which appeared to lead to some disappointment.

Additionally, the interviewee who felt there was too much socialization time at PP experienced a mismatch in genre, possibly due to unclear advance framing. He had expected the presentation portion of the event to be the central component, but according to the organizers, socializing and creating community was one of their main goals. The fact that this interviewee, who was unhappy with the length of the drink break, did not recognize the importance of socialization at PP suggests expectations are not being accurately set. The marketing materials only highlighted the talks and did not mention the drink breaks between presentations, which fails to frame these events as social opportunities. It is also possible that mismatches in the expected genre may be more common in events farther down the spectrum towards carnivalesque. The farther that presentation format events fall from traditional lectures, the more difficult it may be for patrons to identify the genre because of the consistency and pervasiveness of the public lecture genre in our society.

Conclusion

In summary, the structure and framing of events evoke an interactional genre that shapes and is shaped by performances. The methodological and theoretical language of structure, framing, performativity, and genre provides a robust approach for examining similarities and differences across different events. Using this framework to view ASEEs will help to explain differences in engagement and provide an approach for intentional program design.

ASEEs draw on carnivalesque elements, and it may be that carnivalesque is the defining feature that sets ASEEs apart from other opportunities for adults to engage with science. As we continue to explore the conceptual boundaries of this emerging category, it appears that the

notion of the carnivalesque is one of the most important ideas which unites and distinguishes these events. Defining ASEEs in this way has consequences for the category, as it would push many events, including SS and many science cafes, out. It also has consequences in terms of equity. The carnivalesque elements entail risk for certain groups. Authors discussing a wide variety of topics have explored how carnivalesque environments may encourage behavior that is otherwise deemed risky or unsafe (e.g., Cronin, Mccarthy, & Collins, 2014; Pielichaty, 2015; Price, 2010). The prevalence of risk may even suggest that it is a defining feature of the carnivalesque. However, this risk was not uniformly distributed in the subset of events I examined. For example, comments on race, non-cis bodies, women, and the othering of certain groups made it so that those who did not perform white masculinity took on more risk in these spaces than others.

Despite the uneven distribution of risk, the carnivalesque also has some desirable features. Many of the subversive elements make these events fun and could draw in people who would not usually spend their weeknight evenings engaging in an educational event. By attempting to increase the informality and fun of these events, these programs may draw in crowds that other activities for adults to engage with science, such as citizen science and science policy forums, do not capture. The carnivalization of science outreach may create beneficial affordances for science education, but if all carnivalesque entails risk, we need to think more critically about how this risk can be equitability distributed.

Moving forward, this framework needs to be refined with a greater variety of sites. Examining more ASEEs will allow for better theory-building around why actions, behaviors, and interactions at these events take the form they do. What is or is not carnivalesque/subversive will vary based on geographic norms. For instance, Pedretti and Iannini's (2020) research on

controversial exhibits in science museums found what was considered controversial to vary from country to country, with the US having the tamest perception of what counts as controversy. Cultural differences like these may complicate the spectrum of carnivalesque and sober, but more data points will be needed to further explore. In addition to expanding research sites, the questions asked of ASEEs need to be expanded as well. Given the history of ISLEs appearing invisible, inaccessible, and exclusive to minoritized groups, it is important to address how these events serve and/or exclude BIPOC communities. I hope this framework will be a valuable tool in examining engagement at these events and catalyzing collaboration between practitioners and researchers.

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Chapter 4: Gender and expertise at adult science entertainment events

Introduction

Informal science education (ISE) presents solutions to issues that plague formal schooling, but it is also known to have its own set of problems when it comes to equitable access to and engagement with these environments. Many scholars have mapped these problems, and they include a vast set of issues from these environments being invisible to underrepresented groups to these spaces favoring the experience and learning of men and boys (Archer, Dawson, Seakins, & Wong, 2016; Dawson, 2014b). Issues related to gender equity are particularly well documented. Among children, boys have been seen to dominate certain exhibits, forcing girls to play elsewhere (Greenfield, 1995). Researchers have also demonstrated that exhibits can reinforce gender roles, leading to the exclusion of those who feel pressure to conform to gendered stereotypes (Dancstep née Dancu & Sindorf, 2018; Dawson et al., 2019; Diamond, 2010; Kremer & Mullins, 1992). Additionally, research on family visits has documented differential participation among mothers and fathers, with fathers engaging their sons more frequently in discussions of science, while mothers focus on teaching non-science lessons (Cone & Kendall, 1978). The frequency and type of interactions between parents and their children also varied along gendered lines (Diamond, 1981). Although this extensive body of research examines gendered interactions among children and families, research on adults in ISLEs, other than in parenting roles, is limited.

The recent emphasis on adult-oriented programming makes it particularly important to consider how similar issues play out among adults. Over the past decade, adult science

entertainment events (ASEEs) have risen in popularity worldwide. These events host exclusively adult audiences for low-stakes, high-fun opportunities to engage with science. These events are hosted at bars, museums, and other community spaces, and common activities include presentations and hands-on play with exhibits. These social environments often emphasize community building over learning outcomes (Kaiser et al., 2013). Research on these events is still in its infancy, but what does exist suggests that these programs may serve somewhat homogenous audiences which skew male, white, and already have a high level of comfort with science (Cohen & Macfarlane, 2007; Desai, 2005; Norton & Nohara, 2009; Robinson et al., 2017).

The field of professional science has a long gendered and racial history. Although women and people from diverse racial and ethnic backgrounds have contributed much to science, many of their contributions have been erased. According to Schiebinger (2013, p. 190), "As the prestige of science began to grow, history was rallied to lend legitimacy to European males' claims as sole heirs to its fortunes." These actions not only shaped who received credit for discoveries but also the language of science. Men were primarily responsible for research on biological sex and used these findings to further exclude women from the field (Schiebinger, 1989). Additionally, the language men applied to their findings took on tropes that favored masculinity. For example, sperm were discussed as being active and forceful, whereas eggs were viewed as passive until penetrated by the sperm (Keller, 1985). There is ample evidence that the pattern of undervaluing women’s expertise and contribution to science continues today (Boring, 2017; Hoorens, Dekkers, & Deschrijver, 2021; Khazan, Borden, Johnson, & Greenhaw, 2019; MacNell, Driscoll, & Hunt, 2015; Mitchell & Martin, 2018; Ni, Smith, Yuan, Larivière, & Sugimoto, 2021).

Given the long-term trend of women's expertise and contribution being underappreciated and what is known about gender dynamics in ISE from research on families, it is important to understand what gender equity looks like at ASEEs. These increasingly popular events are commonly framed as beneficial for science engagement, as they provide rare opportunities for adults who have aged out of formal schooling to engage with science in low-stakes, social environments (Dallas, 1999, 2006). However, those ideas stand in contrast to gender equity-related findings from other settings. In this article, I examine gender equity at two ASEEs by addressing the question: How do the types of social interactions evoked by ASEEs influence the gendered ways people experience these events? On a theoretical level, I aim to better understand how the different social interactions evoked by ASEEs shape the gendered experience, with particular attention to the negotiation of expertise. On a practical level, I hope to shed light on the implications of design and implementation choices for those who organize and sponsor ASEEs, as well as those who study them, so that they can better address gender equity at these events.

Theoretical framework

My conceptual framework applies genre theory and the idea of gendered performance to explore how the design of ASEEs shapes how people enact and experience gender at these events. I pay particular attention to expertise, as this attribute holds a great deal of capital in both science and non-science contexts.

Genre

Although ASEEs are still a relatively new and evolving form of events, elements of these programs can evoke other common types of social interaction – what some researchers refer to as genres. According to Davies (2009, p. 401):

> A genre is socially and culturally embedded: it relies on those participating in a communicative process (from watching a film to being interviewed) being familiar with its norms…. Genres thus enable us to structure our discourse and interactions in particular ways; they enable or disable certain behaviors, and carry with them particular norms.

In the previous paper, I used genre analysis to help explain how participants experience these events. My analysis revealed that ASEEs draw on a wide range of familiar genres, from happy hour to recess and public lecture. These genres are evoked by familiar aspects of the structure and framing of these events (Davies, 2009). As discussed in the previous paper, structure refers to elements related to the event's design and implementation, which influences who can attend and what types of activities they will engage in once present. Framing refers to the lens through which participants have their expectations for the event set, including advance framing in the form of marketing materials and in-person framing done by organizers (Davies, 2009). Together these elements evoke genres that allow people to structure their interactions in familiar ways and set norms for engagement. For example, when one decides to visit a restaurant they have never eaten at, elements of the structure and framing help cue them to behave in ways appropriate to that environment. Advance framing in the form of website content and aesthetics might help

them determine whether the restaurant is fine dining or fast casual. In-person framing by the host or other staff would also help cue them to the formality level of the space. The structure of the dining experience, including the physical environment and timing of the meal, could also help them to gauge whether raucous laughter was appropriate or if a more subdued voice should be used. Identifying genre allows for a more in-depth understanding of the social forces at play at these events and how ASEEs relate to other social environments.

Performativity

One way of understanding how people behave and interact is through the lens of performativity. Butler's (1990b) theory of performativity is formulated around the notion of gender. It postulates that gender identities cannot be distinguished from how people *act out* their identities, as such identity should therefore be understood as constructed externally—through interactions with others and the broader social environment—rather than internally. According to Butler (1990b, p. 190):

> … there is neither an 'essence' that gender expresses or externalizes nor an objective ideal to which gender aspires, and because gender is not a fact, the various acts of gender create the idea of gender, and without those acts, there would be no gender at all.

Although many see gender as a product of people's bodies and biological differences as the defining features of "men" and "women," performativity challenges this assumption. In Butler's theory, the notion of gender has been developed through performances that are products of (and

which help constitute) the social environment. As Dawson et al. (2019, p. 3) frame it, "…this perspective sees identities as embodied practices, [and] bound up in social norms about what it means to be a certain type of person." In this perspective, the appearance of one's body is not irrelevant; however, it is not what defines how a person acts and behaves.

The theory of performativity does not treat gender as an objective reality but acknowledges the power that beliefs around gender hold. Norms around gendered behavior and appearances in our society play a powerful role in shaping people's behaviors and interactions. People's ability to conform to or oppose social expectations around gender performance is tightly linked to their power and privilege in a given situation. Subjugated people are less likely to exhibit agency, even when it comes to something as personal as identity performances (Kotthoff & Baron, 2001).

Although Butler (1990) developed their theory of performativity as part of an analysis of gender, performativity can and has been applied to other identity markers (Kotthoff & Baron, 2001). People perform their identities as mothers, athletes, and “science people," among countless other identity facets. These identities intersect, and depending on the context, some facets may be more prominent at certain times than others.

In the previous paper, I explored how performativity and genre are tightly related; the way that people perform their identities is shaped by the genre at hand, and the genre is, in turn, defined by the performances taking place. Genres can elicit different norms around performance due to the consistency and stability of certain interactions over time. Although the same identity facet can be performed in different genres, the performance of that identity will vary. For example, there are ways that one might express being a sports team fan that varies with the social context. It would be socially acceptable for a fan at a live game to express their support with loud

cheering and energetic gestures; however, when discussing their favorite team with their peers at work, it would be considered more appropriate to express their fandom by sharing their knowledge of player stats or telling others how many games they have attended. Although this person's fan identity is being performed in both contexts, how they perform their fandom varies with the social environment and genre.

Expertise

In this study, I am interested in exploring how the genres evoked at ASEEs elicited different norms around the performance of expertise and how others received those performances. Performing expertise refers to how people assert they have authoritative knowledge or judgment that others should recognize and accept. Expertise is a desirable performance because with expert status comes power. People trust domain experts to make domain-related decisions. Expertise is part of what separates scientists from the public and grants scientists credibility (Gieryn, 2006). Non-scientists who wish to participate in civic and policy decisions where scientific expertise is seen as relevant must often work to overcome what Parthasarathy (2010) calls an expertise barrier. Although non-scientists may know much about the matter being decided, their knowledge is often disparaged and dismissed (Epstein, 1995; Wynne, 1992).

Even among those who might be seen as “credentialed” experts, claiming expertise is not a simple matter than can be easily reduced to titles, degrees, and affiliations. Although two people may perform expertise in similar ways, such as by presenting similar credentials, the way others respond to these performances may vary. For example, several studies have documented

that women and racial minorities are disadvantaged in student teaching evaluations, particularly when it comes to science, technology, engineering, and math (Boring, 2017; Hoorens et al., 2021; Khazan et al., 2019; MacNell et al., 2015; Mitchell & Martin, 2018). Multiple studies have found that when students are divided into groups who believe their instructor is either a man or woman, this perception will shape their evaluations despite the actual gender of the instructor (Khazan et al., 2019; MacNell et al., 2015).

Participants' bids for expertise were attempts to assert their authority over a domain of knowledge and to have their statements accepted as accurate and credible by others. When making a bid for expertise, people presented resources in the form of credentials, self-descriptions, and accounts of past experience intended to convince others that they have authority on a subject. When a bid for expertise was accepted, one often saw nothing. On the other hand, contestation was more easily visible, as, in these contexts, the contestation of expertise was often publicly presented. Other, more internal sorts of contestation, such as the doubts people feel about a speaker's authority, were less visible. In this paper, I refer to contestation that all attendees saw as public and that which I learned about only through interviews as private. I refer to this progress of bidding, accepting, and contesting as the negotiation of expertise. This process determines how and whom it was decided was able to be seen as an expert. Additionally, as previously discussed, the association of science with masculinity may lead people to accept expert science performances more easily by male presenting people (Archer et al., 2013; Keller, 1985; Miller, Eagly, & Linn, 2015; Miller, Nolla, Eagly, & Uttal, 2018; Smyth & Nosek, 2015; Steinke, Applegate, Lapinski, Ryan, & Long, 2012; Steinke et al., 2007).

Methodology

I collected data from two sites: Presentation Pint (PP) and Sip of Science (SS). These sites shared some macro-level similarities but differed in the details of their implementation. Data collection took the form of field observations, interviews, and document analysis, allowing me to triangulate my findings.

Site descriptions

Both sites were located in a mid-sized Midwestern city in the United States. The sites converged around their stated intention to create low-stakes, social learning environments; however, they varied in their format and focal topics. These variations between sites allowed for a comparison of the influence of structure and framing on genre.

Presentation Pint took place monthly and was connected to nationwide series of events. Organizers of PP saw the event as serving primarily a community building and social function:

> …there's kind of like a norming around it's cool to want to know nerdy shit. And like celebrating that kind, that community….So, I would say it serves more, it serves more a primarily a social function. I don't expect that a lot of people have like long lists of memorized facts that they've taken away. I think it definitely might spark interests in certain areas that people didn't know they were curious about. So, I think there's definitely like an intellectual stimulation piece to it. But I think it's more about people

> wanting to be in a space with other people who are just curious about weird intellectual stuff. But like it can be a casual thing rather than feeling stuffy.

The organizers were volunteers and did not see this program as related to their professional responsibilities. The focal topics of PP varied greatly, but science was a frequent focal area. Anyone was allowed to present on any topic, regardless of their credentials. Presentation Pint was free to attend, but attendees were encouraged to purchase drinks. Additionally, attendees were required to be over 21 to enter and had to show ID at the door.

Sip of Science also took place monthly. Organizers at SS, similarly, saw the event as an opportunity for community building but had a greater emphasis on learning and sharing university research. One organizer described the goals as:

> I would say the purpose is to bring a little more science out in the world, engender a sense of community, and, you know, positive affiliation toward expertise at the university. And to have fun.

The organizers of SS were technically volunteers but saw their work on the program as related to their work at the nearby university. Talks at SS were always science-focused and done by presenters either associated with the university or working locally in the field of their talk. Sip of Science was also free to attend and had the option to purchase drinks; however, it was neither encouraged nor discouraged. Although SS was attended almost exclusively by adults, there was no age restriction to enter.

Data collection

I collected data between January 2019 and July 2020. The number of observations differed between sites (Table 1). Additional data collection was planned but ultimately curtailed by the constraints of the COVID-19 pandemic. I triangulated my findings across three data sources: field observations, interviews, and document analysis. Comparing my interpretation of the data across multiple sources lent validity to my findings.

Table 1. Summary of data collection.

Site	*# Observations*	*# Organizer interviews*	*# Attendee interviews*
Presentation Pint	4	2	6
Sip of Science	1	3	8

Field observations

I engaged in participant observation at both events to gain a tacit understanding of the experience by immersing myself in the behavioral norms of the event (DeWalt, 2010). This form of observation allowed me to experience firsthand how genre influenced actions, behaviors, and interactions. While observing, I made jottings on my phone, allowing me to stay present in the event while still capturing observations and quotes (Emerson et al., 1995). The jottings were structured around a protocol in order to ensure that I paid attention to certain aspects of engagement during each observation. Specifically, I made sure to capture audience demographics, patterns of engagement related to where people appeared critical or supportive, gendered interactions, and the questions that audience members asked of presenters (Appendix 2). Immediately after the event, I expanded the jottings into full field notes that were used for analysis.

In my field notes, I recorded my perception of the gender of those interacting around me. Seeing gender was not only essential to addressing my research question but is also “central to the way we perceive and structure the world and events in which we participate" (Järviluoma-Makela, Moisala, & Vilkko, 2012, p. 1). However, it is important to note that my assessment may not represent how the people I observed identify themselves. As such, I use the language of male and female presenting.

Interviews

I conducted private, semi-structured interviews with organizers and attendees. I interviewed organizers near the study's outset, which provided useful guidance for refining my observations. The organizer interviews lasted between 40 and 60 minutes and focused on the program's history and mission, visitor demographics and engagement, benefits and drawbacks to attendance, their future goals for the program, and their personal perspectives on science (Appendix 1).

Attendee interviews focused on motivation for attending, circumstances around attending, experience at the event, and personal perspectives on science (Appendix 3). Attendee interviews lasted between 30 and 90 minutes. My recruitment strategy for attendees shifted throughout the study. Initially, I attempted to recruit interviewees at events by standing near the exit and approaching people with information about the study. I had limited success with this technique and shifted to email recruitment shared through the events' email lists. The email recruitment strategy was more successful.

Document analysis

For each event attended, I collected marketing materials in the form of social media posts, email blasts, and website postings marketing the event. These marketing materials contained descriptions of the talks and self-written biographies of presenters. The goal of collecting these materials was to analyze how speakers presented their credentials.

Participants

Interviewees self-selected to partake in interviews and therefore do not represent a random sample of event participants. The 14 interviewees included nine men and five women, 12 had careers or college education in science which they identified as having a background in science. Interviewees were not asked about their racial or ethnic identities or sexual orientation; however, seven volunteered to share that they identified as white, and four shared that they identified as straight. Although my sample was somewhat homogenous, based on my observations, this sample appeared to be representative of these events, which appeared to skew slightly male and have majority white attendees.

Analysis

A professional transcription service transcribed the interviews. All documents, field notes, and transcripts were imported into MaxQDA for analysis. I aimed to identify patterns in the data related to how the social interactions evoked at these events influenced gendered interactions. I first developed a framework to identify genres and then looked within genres for performances related to gender, or which appeared to have a gendered aspect.

In order to identify genres, I focused my analysis on the field notes, looking for ways in which these events were similar to other common modes of interaction (Davies, 2009). I began by attempting the apply genres identified at science cafes by Davies (2009), and expanded the analysis to include genres which emerged in my own data. The defining characteristics of these genres and the event features which evoked them are listed in table 2. After identifying genres, I next looked at performances taking place within each genre. I began by looking for performances which other research had identified in informal learning environments, specifically performances identified by Archer et al. (2016) and Dawson et al. (2019). I modified these codes to better suit the adult audience of these events and added other performances that described engagement in these settings. Although it would be possible to identify an endless list of performances taking place at these events, I focused on performances related to gender, and more specifically performances of expertise, as there is a great deal of cultural capital associated with expert status. With regard to determining if performances had a gendered aspect, I looked for whether or not these performances were more often done by male or female-presenting people and whether or not these performances appeared to have a differential impact on one gender or another. These performances and their defining features are also listed in table 2. I focused on the comparison of performances between genres, as opposed to between events, as I had already done a detailed comparison of the two events in the previous paper. Comparing between genres allow for an analysis of the influence of genre, as opposed to a focus on design features.

Table 2. Description of genres and performances identified in analysis.

Genre	*Event*	*Structure*	*Framing*	*Performances*	Gendered aspect
Comedy show: Irreverent	Present & Pint	Central stage with bar	Organizers relied	Supportive audience	Not visible

humor, drinking on stage, heckling/banter with the audience			heavily on humor, fostered back-and-forth banter during their opening remarks	member: cheered and laughed at appropriate times	
				Heckler: attempted to derail presentations by shouting	Often done by male-presenting audience members
Happy hour: Socializing in small groups, binge drinking, the celebration of drinking, unsolicited romantic approaches	Present & Pint	Drink break, dim lighting, music, layout of space	Organizers encouraged the audience to grab drinks, tip bartenders, chat with the people around them	Life of the party: Audience members made themselves the center of attention	Not visible
				Wannabe Casanova: Unsolicited approaches, touching without consent, assuming the automatic interest of the other party	Often done by male-presenting audience member to female presenting audience members
Public lecture: Presenters using technical speech, note cards, or PowerPoints, technical questions from audience, the expectation for the audience to remain quiet and respectful, topical questions during the Q&A	Present & Pint Sip of Science	PowerPoints, projector screens	Marketing materials which highlight the presentation aspects	Expertise: Sharing education, professional experience, institutional affiliations, or personal experiences related to focal topic	The response from audience members to speakers' performances of experience varied depending on their perceived gender

Community forum: More event time focused on discussion than lecture, questions that highlight community impact	Sip of Science	Majority of time devoted to discussion/Q&A	Organizers encouraging audience questions		

Positionality

My identity as a white millennial woman in these spaces shaped both what I was able to observe and how I interpreted what I saw. Gendered performances, specifically in the context of romantic encounters, proved to be an important facet of engagement at these events. Given that I was involved in some of these encounters, I have included some auto-ethnographical observations of my experience. I believe these brief snippets of my experience are essential for two reasons. First, according to Lumsden (2009, p. 3), "By reflecting on our experience of gendered interactions and emotions, we can shed light on the internal dynamics of the social world in question." As such, my experience is important data in this research, especially when it comes to capturing performativity. Second, including my experience responds to calls for researchers to include their harassment in research rather than ignoring these experiences or treating them as a rite of passage (Hanson & Richards, 2017; Kloß, 2017). My worldview inevitably skews my interpretation of actions, behaviors, and interactions at these events; however, through triangulating my findings, I hope to increase the validity of this research.

Findings

In answering the question, how do the types of social interactions evoked by ASEEs influence the gendered ways in which people experience these events, I found that expertise held varying degrees of salience across different genres and who and how people acquired the attribution of "expert" followed gendered patterns. Additionally, in exploring genre at these events, I found that even in genres where expertise held less salience, that gendered interactions still occurred, which may make those who present as women feel less welcome. Gendered interactions related to expertise and otherwise are discussed in the context of the genres they took place within.

Public lecture

As discussed in the previous paper, the public lecture genre was characterized by presenters using technical speech, note cards, and/or PowerPoints during their talk, the expectation for the audience to remain quiet and respectful during the talks, and a structured opportunity for the audience to ask topical questions during the Q&A. This genre was evoked by messaging before and during the event, which framed the event as a learning opportunity and highlighted speakers' credentials. It was also evoked through the structure of these events with the format aligning with that of more traditional lectures—presentation followed by Q&A. This genre was always present at SS and episodically visible at PP, where only older, more credentialed speakers drew on it.

The public lecture genre made a limited set of roles available, mainly that of the qualified presenter and respectful audience member. At a public lecture, it is generally not considered

appropriate for presenters to use vulgar language, and it is expected that talks will have a clear and educational goal. For audience members, the expectation is that they will allow the focus on the event to remain on the people on stage by avoiding interruption or speaking out of turn.

When performing expertise in the public lecture genre, people used a narrow set of resources to make their bids. Both speakers and audience members listed their degrees, years of experience in a specific field, and institutional affiliations. Although speakers also included personal anecdotes when introducing themselves, my interpretation of the role of those details was to make them more relatable rather than credible. Bids for expertise took place at the event or online in the self-written biographies published by presenters. For example, one online biography said, "[The presenter] is a professor of history at [a nearby university]," and another said, "Working out of [a research lab], the [presenters] are on the leading edge of efforts to understand what makes us sick." In this second example, not only are the speakers' credentials emphasized but they are also described as being "on the leading edge" of research, further emphasizing their expertise on the topic.

The public lecture genre at PP was most clearly visible in talks given by three university professors. The talks were clearly rehearsed, heavily utilized the PowerPoints behind them, and made limited use of humor. All three began their talks by reviewing their credentials, focusing on their university positions and years of professional experience. For the two male-presenting presenters, there was no contestation of their expertise on these topics either publicly or privately; in fact, both were reviewed overwhelmingly positively in the interviews. People viewed the talks as high quality and enjoyable, despite having a different genre to many of the other talks at the event, which drew more heavily on the comedy show genre. One interviewee described one of the speakers as:

> …this guy was a pretty good speaker as well, very engaging. His language was just very, I don't know about poetic, but very presentable, like a very stage presence. So, that one was really, really cool.

Contestation was visible in the talk given by the female-presenting professor, however. At the start of her talk, she presented her credentials, including that she was an experienced physics professor and had given this same presentation many times. Despite the resources she used from physics and physics education in her bid for her expertise to be recognized, two men interviewees criticized her talk during one-on-one interviews with me. One man described her talk as a "show and tell" and felt "there was a bit of showoffiness about it that didn't engage the audience." He also said he "could help this woman" improve her presentation abilities. Another interviewee said the woman did not present physics in the way that he thought was best:

> …I felt like it wasn't presenting physics in like, a way that I would want to present physics. Like not in a way that would seem as interesting or engaging. It was cool to learn about-- like, the most interesting thing I found about it was like, what roller derby is. And so, I would have like, found a talk just about roller derby just a lot more interesting. But I felt like the physics in there was kind of forced, I guess.

These men did not accept her bid for expertise in physics education and even went as far as to say she was being showoff-y and they could do better. When making these criticisms, they presented their own resources, one having a physics degree and the other teaching experience, as the justification for their viewpoint. Interestingly, this presenter was not criticized or heckled during her talk, despite the skepticism with which some audience members viewed her bid for

expertise. This suggests that there are degrees of success when using one's resources to make a bid for expertise, in which the most successful bids suppress dissent publicly and privately. This professor appeared to have only partial success. Her resources were enough that she was able to suppress public dissent—it appeared that none of these men felt comfortable heckling during her talk or the question period— instead, they chose to comment on it privately.

At SS, two co-presenters competed to establish superior expertise with one another. Although both presenters began the talk by reviewing their credentials, including graduate degrees, research positions, and years of experience in the field, one presenter repeatedly attempted to make a bid for superior expertise over his counterpart. The male-presenting presenter stated several times that he had eight more years of experience than the female-presenting presenter. During the presentation, he reinforced his superior expertise by saying things such as, "there is a huge inconsistency in what she said that needs clarification," and reminding the audience that she worked for him. In each of these instances, the female-presenting presenter laughed off his statements and moved on.

Bids for expertise were not limited to presenters. Audience members at SS made similar bids for their authority on the topic to be recognized. In one instance, a male-presenting person began his question by stating, "A Science paper came out this week saying…" suggesting that he was a reader of the high-impact journal. Although drawing on this resource is more subtle than stating one's degrees or job title, it signaled, at the minimum, a baseline level of comfort and familiarity with scientific research. In another instance, this same person insisted there was a conspiracy occurring in the medical field. The speakers did not have much expertise in the area of his comment, but a female-presenting person in the audience spoke up to say that she was an expert on the topic and that there was a scientific justification for the phenomenon he was calling

a conspiracy. Despite her bid for authority by stating that she worked as a university researcher, the man continued to speak over her, using a condescending voice and repeating his point. At this point, the female-presenting person shouted that what he was saying did not make sense and hit her hand on the table in front of her as she made her point. After this disagreement, the speakers stepped back in and moved the Q&A along. The female-presenting person's bid for authority was not recognized in any visible way, even though she employed a resource that others had successfully used to have their expertise accepted.

When the public lecture genre was evoked at both PP and SS, expertise was performed in consistent and predictable ways. Perhaps related to the emphasis on presenters conveying information in this genre, the overt performance of expertise by both presenters and audience members was clearly visible. Regardless of the content area of the talk, the public lecture genre appeared to shape presenters' and audience members' expectations of how expertise should be performed. One's education, work experience, and institutional affiliations were used to attempt to lay claim to expertise. Despite the consistency of these norms, however, female-presenting people's bids were more likely to be met with skepticism or rejection.

Comedy show

The comedy show was defined by irreverent humor, drinking on stage, and heckling/banter with the audience. The comedy show genre was evoked by framing the event as an entertainment opportunity and using humor in the marketing materials and in-person framing by organizers who emphasized humor in their introductory remarks. Additionally, it was evoked by the structure of the event, specifically the physical environment mimicking that of a comedy

club. This genre was only present at PP, and although presenters used PowerPoints, those drawing on the comedy show genre relied heavily on humor in their talks and held alcoholic drinks in their hands as they spoke. As compared to public lecture talks, not all the talks drawing on the comedy show genre had a clear educational goal; instead, many of the talks were composed of related anecdotes and funny facts, which did not combine into a clear narrative.

The two roles made most obvious by the comedy show genre were that of comedian and audience member. The comedian role emphasized playfulness, humor, and a willingness to roll with the punches. Unlike audience members at the public lecture genre, it was more acceptable for audience members to engage with talks in this genre. Interactions between presenters and the audience occurred often, sometimes initiated by the presenters and other times by the audience. Audience participation included loud laughing, encouraging callouts, and heckling, such as shouts of "chug" or "drink."

In this genre, expertise did not have as clear of a role; however, as the format of the event was still presentation-oriented, presenters still included credentials as part of these talks. These bids for expertise were still negotiated and contested, though people employed different resources in their bids. During presentations that evoked the comedy show genre, people without education or work credentials explicitly related to their topic leveraged degrees and work experience in what are often considered high-status fields. Others used attributions by friends to claim competency in a subject. For example, in a talk on video games, one presenter included in his online bio, "He graduated from [a university] as a chemical engineer and took up a job with a small chemical plant in the area." Chemical engineering expertise has no obvious relevance to video games; however, engineering is held in esteem in our society, and being an engineer marks him as intelligent, increasing his credibility (Archer et al., 2015).

Attributions by friends were also used to claim competency on a topic by presenters who lacked professional or educational credentials and did not have high-status expertise to leverage. For instance, when presenting on Disney's fairytale adaptions, the presenter self-identified as "the token weird Disney girl" in her friend group. Through her statement, she told the audience that she is recognized as an expert by others and accepts this label. However, this presenter was heckled several times during her talk, and although it was difficult to make out the heckler's words, it was clear from her response that he was critical of what she was saying, as at one point she responded by saying:

> What was that? I worked customer service, and I got none of [the previous presenter's] training, so I will tell you to go fuck yourself.

From my observations, it was difficult to determine whether or not the heckling was related to her expertise, however, in this analysis, it was notable as this was the only disruptive instance of heckling I observed, and it happened to a female-presenting person. Unlike the public lecture genre, I did not observe any private contestation of expertise related to talks drawing on the comedy show genre.

Although expertise appeared to hold less salience in this genre, gender still emerged as highly salient. In addition to the female-presenting person being heavily heckled, the comedy show genre invited sexual humor, all of which I observed as done by male-presenting people, occasionally at the expense of women. For example, in one instance, a male-presenting organizer introduced a Ph.D.-holding female-presenting person by saying that she "liked it saucy" before apologizing for not asking her permission to say that. In a talk on video games, a male-presenting

presenter mentioned the number 68 and then said, “If only there was one more, it could have been a 69 joke". During the Q and A session of a talk on trees, an exchange occurred in which the speaker joked about "tits":

> [Question asker]: You said mangroves are two breasts away from being mammals. What else makes them like a mammal?
>
> [Presenter]: To be a mammal you have to have some tits, sweat glands, hairs, live birth. I think they should be mammals.

This type of humor influenced the gendered landscape of these events beyond just the negotiation of expertise.

Discussion

Across these two genres, the performance of expertise held varying salience and people used different resources in their bids for expertise; however, gender played a role in both. In the public lecture genre, female-presenting people's expertise was publicly and privately contested. The difference between public and private contestation suggests that there are degrees of acceptable expertise beyond which others felt that they could not make a public contestation. Although it was not clear if the heckling of the Disney presenter at PP was a product of her performance of expertise or not, it is notable that she was the only presenter that I observed be heckled repeatedly and aggressively. Although it was common for presenters to receive a single

heckle or chants of "chug" or "drink," this was the only instance I witnessed in which a presenter had to pause a talk to confront a heckler. Additionally, male-presenting people's use of sexual humor in the comedy show genre created an overlapping gendered context in which women and their bodies were viewed as the object of jokes. Overall, these findings suggest that although expertise was performed differently in the public lecture versus comedy show genres, that gender played a role in shaping who gets to be seen as an expert and whose security and comfort were favored. In this section, I first focus on the gendered nature of expertise and then on the broader gendered environment of these events.

Expertise

These findings agree with previous work on women's authority in science which has found that women's expertise is more harshly contested than men's, particularly in the context of academia (Boring, 2017; Hoorens et al., 2021; Khazan et al., 2019; MacNell et al., 2015; Mitchell & Martin, 2018; Ni et al., 2021). The genres that make up the academic space are closely related to the public lecture genre. Across academia, expertise and the authority it grants are held in high regard, as was visible in the public lecture genre. These studies help make sense of the findings of this research and explain why female-presenting peoples' expertise was contested more than male-presenting people's in this genre.

Boring et al. (2016) suggest that the trend of undervaluing and contesting the contribution of women could lead women to feel unwelcome in science. This same trend could be true in this set of ASEEs; however, research on ASEEs points to more positive outcomes. When researching adult visits to the Exploratorium during both regular visiting hours and after-hours events,

Gutwill (2018) found that a single visit was enough to increase the science self-efficacy of visitors and that women's self-efficacy remained elevated over three months. These types of events which include more hands-on play and exploration, draw on different genres than the ASEEs examined in this study. Other genres may expand access to science identities by not placing such great emphasis on expertise granted through pre-established credentials.

The public lecture genre is not the only option for ASEEs to draw on, and other genres may have less problematic norms around who is allowed to be an expert. In this research, the comedy show genre appeared to have less stringent boundaries on acceptable expertise, which may expand who can be seen as an expert and a knower in these spaces. Shifting the genre of an event away from public lecture by modifying elements of the structure and framing may create more opportunities for a broader swath of people to be accepted as experts.

The gendered landscape

Although the comedy show genre accepted a broader range of resources in bids for expertise, women still received more heckling and sexual jokes objectified women's bodies. Additionally, the genres mentioned were not the only gendered genres at these events. Different genres were evoked at different times. Although SS mainly drew on the public lecture genre, at PP, the genre shifted between public lecture, comedy show, and happy hour. The happy hour genre was discussed in the previous paper and was defined by socializing in small groups, particularly socialization focused on topics unrelated to the event, binge drinking, the celebration of drinking, and unsolicited romantic approaches. This genre made space for a performance I referred to in the previous paper as Wannabe Casanova. In this performance, men approached

women in ways that appeared to make them feel uncomfortable and unsafe, including touching them without consent and aggressive come-ons. The happy hour genre was present during the drink breaks at PP and, therefore, essentially was alternatingly present between each talk. In addition to the example addressed in the previous paper, a male-presenting person grabbed my shoulder and whispered, "hi there," and the shoulder of another female-presenting person as he whispered in her ear. In another instance, a male presenting person sitting in front of me continued to turn around and stare at me during the presentations, even attempting to look at my phone where I was writing down jottings. When I left my seat during the drink break, he followed me and asked why I had only consumed water that night. The performances within the comedy show and happy hour genres added to the gendered landscape.

Additionally, overt sexualization carries different weight for different participants. Objectifying women can lead to viewing themselves as less competent and less human (Heflick & Goldenberg, 2009). Placing women and their bodies at the center of jokes, therefore, has the potential to make female-presenting people feel unwelcome or less capable at these types of events. At the same time, female-presenting people may have felt physically unsafe due to interactions made possible by the happy hour genre. As discussed in the previous paper, there is a degree of social acceptance around men approaching women at bars, and drawing so heavily on the happy hour genre during the drink break likely made space for this sort of behavior.

Together, these genres and the behaviors occurring within them created a gendered landscape that attendees were forced to navigate. This landscape is summarized in figure 1. Genres are listed at the top of each circle, and the potentially fraught consequences of the gendered interactions happening within these genres are listed below. This diagram demonstrates that even when genres shift, attendees may move into another dangerous context and that these

contexts overlap. At PP, the genre of the event shifted between those depicted in figure 1, yet going from one genre to another did not provide a reprieve for female-presenting people, as each made space for interactions that may have led them to feel unappreciated, unwelcome, or unsafe. In the public lecture genre, female-presenting people's expertise was more contested than male-presenting people's, even when they included similar resources in their bids for authority. In the comedy show genre, women and their bodies were objectified. Finally, in the happy hour genre, male-presenting people made aggressive come-ons and touched others without consent. In this environment, female-presenting people not only had to deal with the interactions happening within one of these genres, but these interactions likely compounded, potentially leading to an experience where they did not feel intellectually valued or physically safe.

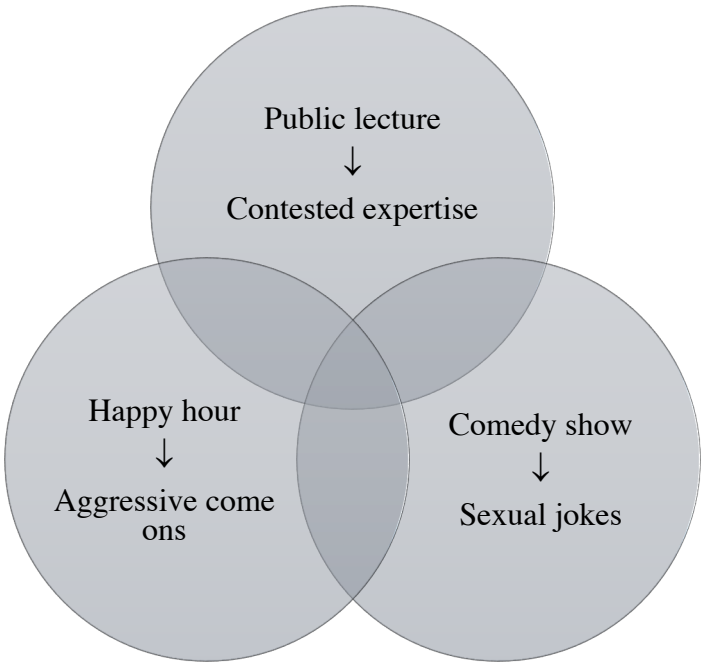

Figure 1. Diagram of the gendered landscape at Present & Pint.

There were dangers in all contexts that emerged as products of the genres at hand. However, these genres and these instantiations of these genres are not the only ones available for organizers of these events. There are settings where female-presenting people's expertise is less likely to be questioned and comedy shows in which they are not objectified. It is possible to evoke genres that neither evoke gendered evaluations of expertise nor the objectification of women. Understanding genre helps us understand those dangers and suggests an approach for addressing them. We should look for spaces where women's contributions are more accustomed and expected and where gendered expectations are more commonly subverted to find inspiration for restructuring and reframing these events.

Conclusion

In conclusion, this study sought to examine gender equity at ASEEs by applying a genre analysis to the negotiation of expertise at these events. I found that the resources people used in their bids for expertise varied depending on the genre and that female-presenting people's expertise appeared more frequently contested than male-presenting people's, even when drawing on equivalent resources. Additionally, I found that even in genres where expertise was less salient, the gendered landscape still skewed to favor male-presenting people's experience.

This research draws on limited data, and it would be unfair to make broad-reaching claims about ASEEs based on these findings; however, this data suggests that simply creating low-stakes social environments for learning will not necessarily expand access to science. Although these events may seem novel, they evoke other genres, and the implications of those genres need to be considered. Additionally, due to constraints in the data collection process, I

used existing research to tie my observations to the experience of female-presenting people at these events, but future research should directly examine how many people experience these events negatively, including feeling undervalued and experiencing harassing dynamics.

For researchers interested in exploring these events, this study points to the value of genre analysis in shining light on the connection between performances and the physical and social environment. Through a genre analysis, individual performances can be traced back to elements of an event's structure and framing. Additionally, for those interested in design-based research, it allows for a lens through which to explore variables to modify. Similarly, this approach has benefits for ASEE organizers. This research may help them consider the equity implications of their events and highlight pathways for change.

Exclusion in science is a longstanding and pervasive issue. White men are often implicitly and explicitly portrayed as the doers and knowers of science (Schiebinger, 2013). These events have been framed as a venue to help connect adults with science (Dallas, 1999, 2006; Desai, 2005; Navid & Einsiedel, 2012), but if that is the goal, it must be done justly. This research is just a small step towards exploring equity at these events. Future studies should explore a broader swath of these events and look more critically at issues related to gender equity, racial equity, and heteronormativity at ASEEs to make these rapidly expanding events more inclusive and equitable for those historically excluded from science.

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Chapter 5: Conclusion

Summary

In summary, this dissertation has laid the groundwork for viewing ASEEs as a subfield of informal science learning environments (ISLEs) worthy of further research. I have demonstrated that not only are ASEEs unique spaces for science learning but also that engagement in these spaces is potentially inequitable but fixable. In chapter two, I defined ASEEs in comparison to other programs and used research from other learning environments to construct a research agenda for ASEEs. I found that ASEEs were unique in terms of their target audience and goals in that they targeted adults in their mid-20s to mid-30s and, instead of having learning goals related to science language, practices, or concepts, had less clearly articulated goals related to identity, perspectives on science, and community. I was able to define the niche for ASEEs based on pre-existing literature; however, that literature was limited, and I realized that the conceptual work of defining the boundaries of this subfield could benefit from additional empirical data. I identified three areas for research: describing the emerging field, documenting goals and impacts, and understanding the impact of design decisions. These three paths were informed by the limited set of research on ASEEs and research which has proved impactful in other learning environments. This research agenda is meant to provide an entry point for understanding ASEEs and provide directions for research which will help to better understand these increasingly popular programs, make them more equitable spaces, and utilize these events for identity-oriented research.

In chapter three, I created an empirically derived framework for understanding how design decisions shape engagement. This framework combines the notion of genre with the

theory of performativity. In this way, this framework helps explain how the structure and framing of an event impinges upon the social world of the event. Structural elements dictate who can attend an event and what activities they will likely engage in once there. Framing works both before and during the event to influence the constraints of structure. Advance framing establishes imagined participants, painting a picture of the type of people who attend and the activities they partake in, whereas in-person framing more firmly establishes norms at the event. Together, structure and framing establish an interactional genre for the event, enabling people to create a schema for appropriate engagement by drawing on past experiences that share similar physical environments, activities, and norms. Genre and performativity are connected through their co-constituted relationship: Every genre creates opportunities for certain performances and roles to be enacted. Those performances work, in turn, to establish the genre. The methodological and theoretical language of structure, framing, genre, and performativity provides a robust approach for understanding equity at these events and examining similarities and differences across different events. I used this framework to compare two ASEEs. This comparison helped me to recognize that one feature which may set ASEEs apart from more traditional programs is the degree to which they subvert the traditional expectations and norms of science by embracing what Bakhtin (1984) calls the carnivalesque. They do this by creating opportunities for intermingling between scientists and non-scientists, embracing eccentric behavior, melding traditionally serious academic talks with irreverent humor, and profaning science by undercutting traditional notions of credibility and expertise. It is my hope that this framework will be a valuable tool in examining engagement at these events and catalyzing collaboration between practitioners and researchers.

Lastly, in the fourth chapter, I applied the framework of structure, framing, genre, and performativity to assess gender equity at ASEEs. I specifically focused on the performance of expertise and who and how people attempted to claim the attribution of expert at two of the events I observed. I found that within different genres, the performance of expertise held varying salience and people used different resources in their bids to be seen as an expert; however, female-presenting people's expertise appeared more frequently contested than male-presenting people's, even when drawing on equivalent resources. Additionally, I found that even in genres where expertise was less salient, the gendered landscape still skewed to favor male-presenting people's experience. In the comedy show genre, male-presenting people made jokes which placed women and their bodies at the punchline, and in the happy hour genre, male-presenting people appeared to feel comfortable making aggressive come-ons towards female-presenting people. These genres and the performances which took place within them add to the gendered landscape and may have made women feel underappreciated, unwelcome, and/or unsafe.

Implications

Looking across the chapters suggests several implications for ASEEs and research on these programs. The first is that the best way to define these programs may be by the degree to which they embrace the carnivalesque. Although I began by characterizing the difference between ASEEs and other programs as mission-oriented, the comparison of the two presentation-oriented events in chapter three complicates that characterization as both programs had similar goals according to the organizations, but the experience of attending each was quite different. The carnivalesque appeared to explain this difference and, therefore, maybe a better

characterization of these programs than the age/mission orientation I initially put forth. Related to this, the carnivalesque appears to have implications for engagement. Subverting the norms of science may be what makes these events more exciting and attractive to a broader audience; however, it appears that the same features that may make these events fun also create risk. In chapter four, I detail the risk for female-presenting people, specifically that women may be made to feel that their contribution is underappreciated or that they are unwelcome or unsafe. An analysis that looks beyond gender would likely demonstrate that more than just women bear the brunt of the risk. The implications of this research suggest that not only is it worth seriously considering the implications of "fun" events, but that what makes them fun should be examined. The carnivalesque appears to have the potential to both expand and restrict access to science identities in these spaces. This research suggests that although aspects of ASEEs can expand access to science identities, those same aspects may, in reality, serve an exclusive function.

Limitations

The implications of this research are constrained by several factors. Firstly, the small sample size. I only collected data from three sites, which limited the comparisons I could make. A greater number and variety of sites would have allowed for more robust theory building. Additionally, my implications are constrained by limited data collection. More observations would have allowed me to capture both the broader experience of the event and interpersonal interactions. Additionally, conducting observations over a longer time frame, as originally planned, would have allowed me to refine my observational strategy as new ideas emerged.

Similarly, more interviews would have provided a broader perspective on these events and allowed me to refine my interview protocol to address the questions which emerged over time.

This research was also limited by my original conceptualization of equity. I entered this project with a narrow focus on gender equity and failed to recognize how these spaces may exclude other minoritized identities. A broader consideration of equity would have allowed me to paint a more complete picture of the equity implications of these events. As it stands, because I entered this research with a narrow focus and my data collection was cut short by the pandemic, I could not expand my methodological approach to capture a broader perspective on equity and am limited in what I can say about the topic.

Lastly, to make the claims I would like about how structure, framing, genre, and performativity relate to equitable engagement in these spaces, I would have needed to capture people's responses in the moment. Unfortunately, I could not capture this fine-grain data in the limited number of observations I could make. Future researchers interested in this work should consider ways to capture responses in the moment, such as micropolling or video recording.

Next steps

As discussed in chapter two, there is still much work to be done on ASEEs and many possible directions to take this research; however, the previous chapters emphasize the potential of the structure, framing, genre, and performativity framework and the need to expand our understanding of this approach. Firstly, I believe it is important to explore the potential of the structure, framing, genre, and performativity framework as an avenue for change by combining it with design-based research (DBR). The framework could help identify modifiable variables for

DBR to iterate upon, which would, in turn, help refine theory around how design and implementation decisions influence actions, behaviors, and interactions at these programs. Given the importance of theory building in DBR (Barab, Dodge, Thomas, Jackson, & Tuzun, 2007; Brown, 1992), I believe that this would be a useful next step for ASEE research as it would help flush out our understanding of the relationship between design decisions and engagement, and also create opportunities to modify these environments for more equitable engagement.

This research has demonstrated that inequitable engagement is likely a feature of these events, which has stemmed in part from the design and implementation of these programs. As such, researchers need to continue to explore the equity implications of these events, particularly with regard to forming and performing science identities. My research has hinted at how these events may center whiteness, heteronormative relationships, and cis-gender bodies, so I would begin by exploring these topics.

In conclusion, although much work is still to be done, I believe this project has justified the need for future research and provided the groundwork for understanding ASEEs. Chapter two defines these events and argues why it is beneficial to research ASEEs and view them as a unique category. Chapter three provides a methodological approach for examining engagement at ASEEs, and chapter four applies that framework to demonstrate that inequities may be present at these events. This research adds to our understanding of these events and lays the groundwork for broader-ranging systematic research.

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Appendix 1: Organizer interview instrument

1. What is your role at [the organization]?
2. How long have you worked there?
3. What are your roles and responsibilities?
    a. [If not addressed] How does your position relate to [the program]?
4. When did [the program] begin?
5. What was the motivation for starting it?
6. [If applicable] How does [the program] fit the mission of your organization?
7. How has [the program] evolved over time?
8. How do you select topics/themes?
9. Do you align yourself with any other organization's design frameworks or implementation standards? If so, who?
10. What organizations would you say put on similar programs to yours? How are they similar? How are the different?
11. Do you have a target demographic for [the program]?
12. What is the main demographic that you see?
13. [For presentation events] Do you have any specific criteria regarding the credentials of presenters?
14. Have you noticed that events are used as date venues or opportunities for singles to meet up?
    a. [If yes] Is that something that you design around or use in your marketing?
15. Have you noticed any patterns around gendered engagement?
16. [For presentation events] Have you noticed if the gender of the presenter influences the feedback they receive?
17. [For presentation events] Have you noticed any gendered patterns of question asking or engaging with presenters?
18. [For museum events] Have you noticed if men or women take the lead in certain activities? Which activities are those? How is that behavior responded to by other members of the group?
19. [For museum events] Have you noticed if single gender groups or mixed gender groups behave differently in the space?
20. What do you think are the benefits to attendance for attendees?
21. Can you think of any drawbacks to attending?
22. Can you think of any drawbacks to attending related to the gendered dynamics of this event?
23. Do you have plans to change these events moving forward? If so, how?
24. What is the motivation for changing the events?
25. If you could change anything about these events, what would you change? Why?
26. How often do you read or talk about science?
27. Some people think about themselves as science people. When you hear that, what does it make you think of? What are some characteristics you might associate with a science person?
28. Do you think of yourself as a science person?

    a. If asked: someone that feels comfortable discussing science, reading news about science, being critical of scientific studies and more generally taking an interest in topics related to science

29. How do you think someone comes to think of themselves as a science person?
30. There is a commonly held perception that boys and men like science more than women and girls. Have you encountered that perception? What do you think about that?
31. You are, of course, welcome to not answer this, but how do you define your gender identity?
32. Do you believe one's gender identity can influence the way they think about science their ability to do science?
33. Has your gender identity ever influenced your thoughts on whether or not you could do science?

Appendix 2: Structured jottings protocol

Event information

Date:
Time:
Weather:
Topics:
Available actives:

Demographic information

Types of groups (nature of intra group relations + evidence):
Age rage:
Racial/ethnic demographics:
Gender demographics:

General engagement

How do people engage with each presentation/activity?
What do people enjoy/where are they supportive?
What do people not enjoy/where are they critical?
When/where is socializing happening? What kind of socializing?

Gender interactions/dynamics

Who leads and who follows and in what contexts?
How/where do people display authority?
What about these events is date like?
How do people impress each other?
Are public displays of affection visible?

Questions (presentation events only)

What questions are asked? Who asks questions?
[For PP] Who makes it known the question was theirs?
[For PP] Who wins best question? What kind of question was it?

General notes/flow of event

Final reflections

Appendix 3: Attendee interview instrument

1. Had you been to [the event] or an event like it before?
    a. If so, what was the event?
        i. What makes those events similar or different from [the event you attended]?
2. Why did you come to this most recent event? Why do you come to these types of events more generally?
3. Where did you learn about the most recent event?
4. Did you come with anyone to the most recent event?
    a. If so, who did you come with? What was your relationship with that person?
    b. [If romantic] Why did you select [this event] as a date venue?
    c. [If they came alone] Do you regularly go to events like this alone?
        i. Did you hope to meet someone at the event?
5. Is there anything about your background that you think is relevant to [this event]?
6. Is there anything about your [companion's] background you thought was relevant?
7. What was your favorite part of the event? Why?
8. What was your least favorite part? Why?
9. Was there a section of the event which you felt you had a particular connection to or that you already knew a lot about? What was that?
10. Was there a section in which you felt your [companions] already knew a lot about the topic? What was that?
11. [For presentations] Did you and your companion talk about any of the presentations during the event or afterward? Was it easy to talk to the people you came with about the talks?
12. [For presentations] How comfortable did you feel talking about these topics?
13. [For presentation events] Did you feel comfortable asking questions? Did you ask a question?
14. [For presentation events] Would you have felt comfortable approaching a presenter? Did you speak to any of them about their talks?
15. Did you feel like you fit in at the event?
    a. Alternative: intended for people like you
    b. Were there any times you felt uncomfortable or awkward?
16. How often do you read or talk about science?
17. Some people think about themselves as science people. When you hear that, what does it make you think of? What are some characteristics you might associate with a science person?
18. Do you think of yourself as a science person?
    a. If asked: someone that feels comfortable discussing science, reading news about science, being critical of scientific studies and more generally taking an interest in topics related to science
19. How do you think someone comes to think of themselves as a science person?
20. There is a commonly held perception that boys and men like science more than women and girls. Have you encountered that perception? What do you think about that?
21. You are, of course, welcome to not answer this, but how do you define your gender identity?
22. Do you believe one's gender identity can influence the way they think about science their ability to do science?
23. Has your gender identity ever influenced your thoughts on whether or not you could do science?

24. At [the event], did you notice if there were any instances in which gender affected people's participation in the event?