Science Communication as Emotion Work: Negotiating Curiosity and Wonder at a Science Festival

Abstract

STS scholarship has long emphasised that science is emotional as well as cognitive and social. A 2014 science festival, Science in the City, held in Copenhagen, provides a case for thick description of emotion within the production and reception of public science communication. For organisers of science communication the overarching aim was to call forth a suite of emotions focused around curiosity and wonder; in contrast, visitor experiences were constituted through the emotions of reading and negotiating science communication. Negative emotions, in particular, were tied to a sense that navigating science communication and producing the 'right' emotions can be effortful. Visitors therefore found strategies to resist the behaviours required of them. Consumption of science communication may therefore be framed as emotion work, for both producers and consumers: curiosity does not necessarily emerge naturally, while science communication products may themselves require work to negotiate.

Keywords
Science communication; Science festivals; Emotion; Public Engagement; Curiosity

Introduction

Some 90 science and science-related festivals are planned in the UK for 2019, ranging from the Yorkshire Fossil Festival to Abingdon's ATOM Festival of Science and Technology.[1] In the US, the Science Festivals Alliance gathers together dozens of festivals held in almost every state.[2] And in 2018 European Researchers Night – a cross-national public event featuring hundreds of lab tours, workshops, science shows, and debates – attracted over 1 million participants.[3] Such festivals are an increasingly important part of the landscape of science communication (Kaiser et al 2014). Whether held in a bar in chilly February or a marquee at a summer music festival, these events are framed as "community based celebrations of the fascinating world of science and technology",[4] and thereby an important site where science and scientists meet their publics (Davies 2018).

Even more explicitly than other forms of science communication, science festivals foreground the (potential) pleasures of public engagement with science (Bultitude & Sardo 2012). They are leisure activities, and are framed as spaces that feature a unique "combination of science with an element of fun or entertainment" (ibid, 2789). In this respect they are an important case for the focus of this paper, the emotions of science communication. Here I build on recent STS interest in public engagement with science, and in particular its affective characteristics, but extend this to consider science communication more broadly. Public engagement is generally understood as activities that are funded by or oriented towards the democratic accountability of science policy institutions (Bucchi &

[1] This is a conservative estimate, based on the calendar of science festivals at https://www.big.uk.com/festivals.
[2] https://sciencefestivals.org/festivals/
[3] http://ec.europa.eu/research/mariecurieactions/actions/european-researchers-night_en
[4] https://sciencefestivals.org/festivals/

Trench 2014; Stilgoe et al 2014). By focusing on science communication, I am interested in activities that make no claim to having an impact on policy other than in the widest sense (Davies & Horst 2016). I am concerned with what happens when we explore the affective regimes that circulate around science in a context not explicitly oriented to citizenship, and where it is leisure rather than democracy that is foregrounded.

The paper investigates experiences of emotion at a particular case study of science communication, a large public science festival ('Science in the City') held in Copenhagen in 2014. I explore the emotions that are articulated in the production and reception of science communication within this event, asking two specific questions. First, what emotions do producers of science communication attempt to elicit? And second, what emotions are experienced as science communication is received and negotiated?

Analytical perspectives

Affect and emotion

There has been extensive interest, in recent years, in affect and emotion across social research and theory (Leys 2011; Wetherall 2012). Though this work is multi-disciplinary and takes many different forms, there are, crudely, two key strands. The first views the study of affect as involving profound epistemological and methodological shifts. Drawing on the work of Brian Massumi (e.g. 1995), this tradition figures affect in terms of intensities, overflowings, becomings; its enhanced prominance is thus viewed as offering a profound challenge to discourse-oriented, representational modes of research (Gregg & Seigworth 2010). This strand of work often distinguishes between emotion, seen as the socially mediated interpretation of fundamental flows and intensities, and affect, understood as the more basic, 'autonomous' intensities themselves (Wetherell 2012). Emotions can be named – 'joy', 'fear', 'nostalgia' – while affect is simply experienced. Given that recent scholarship has troubled this distinction (Boler & Davis 2018), I do not see affect and emotion as describing entirely different phenomena, but I do, in the discussion that follows, tend to use 'emotion' to refer to the expression of particular, named emotions by individuals, and 'affect' to gesture towards less clearly articulated atmospheres or flows (Anderson 2009) produced by particular entanglements between bodies, materialities, and spaces (Gregg & Seigworth 2010).

The second strand of work more straightforwardly rediscovers emotion as a topic of study, slotting it back into social research as a phenomenon to be noticed and interrogated (Stearns & Stearns 1985; Svendsen & Koch 2011; White 2009; Wright & Nyberg 2012). A key study in this tradition is Arlie Russell Hochschild's *The Managed Heart* (2003), in which Hochschild develops the notion of emotional labour based on research with service workers such as flight attendants, bailiffs, and cashiers. Having introduced 'feeling rules' – the unwritten norms of cultures and sub-cultures as to what, and how much, one should feel in particular situations – Hochschild argues that "[w]hat was once a private act of emotion management is sold now as labor in public-contact jobs" (p.186). Increasingly, workers are required not just to do a particular job but to perform, consciously or unconsciously, a particular set of emotions.

The notion of emotional labour has been widely taken up across social and organisational research. While much of this scholarship considers emotion work within employment relations, and thus mobilises a view of labour as activities performed for recompense (e.g. Bolton & Boyd 2003; Brotheridge & Lee 2003), the concept has also been extended to

describe other kinds of unpaid but still laborious emotion work. It has been particularly pertinent to studies of domestic environments and the gendered division of labour within these. “Emotional labour”, writes James, “is most easily recognised as part of the caring role of women in the home” (1989, 22). In this context emotional labour is the emotion work that is expected of particular roles: women, for instance, may be required to care for the feelings of others, express tenderness, or suppress ‘negative’ emotions such as anger or bitterness (Duncombe & Marsden 1993). In these cases the concept of emotional labour is applied beyond the emotion work done within paid labour, to encompass effortful articulations or management of emotion within leisure or the home.

The performance or elicitation of particular emotions can thus be understood as laborious even outside of the context of labour relations. In examining such emotion work in the context of science communication, this research can be situated more in the latter strand of research than the former, and focuses on how emotions are desired, called forth, or expressed. I take Kimura’s view that emotions “are not spontaneous and autonomous states of being but are embedded in social contexts” (2017, 7) and am thus interested in what has been termed affective practices (Wetherell 2012), feeling rules (Hochschild 2003), or affective economies (Ahmed 2004). Such social practices and norms are not stable, but are always produced anew within specific contexts; they do, however, have wider resonances, affinities and attachments (Ahmed 2004). The research is therefore concerned with how individuals and groups are affected by and through science communication, the ways in which particular emotions are enacted in it, and the resonances that these emotions have with wider dynamics.

Emotion in science and science communication

STS has long recognised that science is an emotional as well as a cognitive and social endeavour. Historians have described, variously, the role of emotions such as curiosity, wonder, or empathy in the production of what came to be understood as modern science (Daston & Park 2001; Harrison 2001; Lanzoni 2012), while emphasising that emotions are not tied to individual psychology but can be “studied as objects and as agents integral to scientific *practice*” (White 2009, 793; emphasis in original). Two emotions have received particular attention. Wonder and curiosity have both been framed as simultaneously integral to the creation of modern science and as having been purged from its contemporary form (Campbell 2004; Cochoy 2016; Daston & Park 2001). Wonder (and its cousin, the sublime) lay behind early collecting practices but was eventually “constituted … as a drag” upon knowledge production (Campbell 2004, 5). Curiosity travelled from vice to essential component of the scientific mind (Harrison 2001) before, according to Frank Cochoy (2016), itself being replaced by a “‘cooler’ form of knowledge, determined … by the possible usefulness of the knowledge produced” (p.29).

In both cases the emotions are overlaid with moral judgements: wonder “is a form of perception now mostly associated with innocence” (Campbell 2004, 5; those susceptible to it, Campbell notes, include children and lunatics), while curiosity is associated with “innocence and, in its more mature manifestations, with the pursuit of truth for its own sake” (Harrison 2001, 266). Similarly, in both cases it is clear that the experience of the emotion and its meaning with relation to science are historically contingent. As White (2009) has argued, the emotional economies of science are different at different moments and in different places. Emotions such as wonder and curiosity, however consistent their referencing by scientists, will therefore have differing valences depending on the context of their articulation.

Despite a long history of the promotion of curiosity within scientific popularisation (Cochoy 2016; Onion 2016), emotion has only risen to prominence in relatively recent studies of science in public (Davies 2014; Michael et al 2018). The focal point here has been public participation and engagement, often in the shape of deliberative mini-public formats (Chilvers & Kearnes 2015; Goven 2006; Marres 2012). Such research has argued that public engagement with science is fundamentally productive: it is not only that certain democratic practices are normalised while others are elided, or that some groups are silenced or rendered invisible, but that public engagement co-produces its participants, its democratic hinterland, and science itself (Chilvers & Kearnes 2015; Felt & Fochler 2010; Horst & Michael 2011). Affect – in its broadest sense – plays a role within this productivity, and the emotional and aesthetic dimensions of public engagement have therefore become an increasing focus of attention.

Thorpe and Gregory point out that "the affective condition of *confidence* is the desired outcome of participatory activity" (2010, 286; emphasis in original), writing that the UK's programmes of anticipatory public engagement have sought to entangle citizens with the "feelings, values and expectations" (p.293) of innovation regimes. More broadly, Swyngedouw (2010), following political theorists such as Chantal Mouffe, has argued that the rise of participation and consultation is one aspect of a post-political condition in which disagreement and conflict are anaesthetised through the promise of consensus through deliberation. In an era of environmental disaster, the affective characteristics of climate change discourse – fear, apocalyptic visions, a sense of continually deferred catastrophe – are mobilised to shore up this post-political state by acting as a kind of lightning rod for anger and eliding the recognition of genuine social division. In the context of one instance of dialogic risk communication, Kimura (2017) has similarly highlighted tropes such as hope, solidarity, and personal agency, arguing that these are typical of the articulation of neoliberalism as an affective regime. There is little space in these forms of engagement, she writes, for the expression of "negative, conflictual, or disturbing emotions" (p.17).

Public engagement may thus be understood as producing affective citizens, aligning its participants with particular emotional regimes. My intent in this paper is to explore this form of co-production in the context of science communication, by which I mean formats that (generally) do not have the policy focus of public engagement (Bucchi & Trench 2014; Horst et al 2016). Public science communication (such as museums, popular science writing, or public events) is ostensibly framed as being about leisure or education rather than citizenship; it has, however, a long history of being used to train the 'right' kind of citizens and of being implicated in nation building (Bennett 1995; 1997; Bensaude-Vincent 2009). Though it may not be framed as a civic activity, it nevertheless performs its participants in particular, civically-informed, ways. While we know something about the pleasures of science communication – for instance the oft-cited but rarely unpacked notion of 'fun' (Bultitude & Sardo 2012; Jensen & Buckley 2016) – what is largely missing is analysis of how emotions are experienced and performed. Here, then, I will explore a case study of science communication, examining its 'feeling rules' (Hochschild 2003) and thus investigating what kinds of citizens are being produced within it.

Following emotion at 'Science in the City'

Methodological approaches to studying affect and emotion have included encouraging informants to speak or write about their emotions (Guerrier & Adib 2002; Wright & Nyberg 2012); using textual analysis, observations or ethnography to notice and interpret affective

flows (Kimura 2017; Svendsen & Koch 2011); relying on auto-ethnographic accounts or embodied methodologies (Militz & Schurr 2016; Trivelli 2015); and using new literary forms (Ashmore et al 1994) or other experimental representational techniques (Dewsbury 2010). This research combined several of these approaches with the aim of creating a thick description (Geertz 1973) of emotion within the production and reception of a science festival.

The Science in the City festival was held over six days in Copenhagen in June 2014. It was associated with the biannual science policy conference Euroscience Open Forum (ESOF), which was held in Copenhagen that year, but ran separately from ESOF and as a public, freely accessible festival. Its tagline was 'Science building bridges', and it was framed as "a free science festival for families, students and everyone who is curious and can't help wondering".[5] Held in the Carlsburg City area of Copenhagen – the sprawling former industrial campus of the Carlsberg brewery (Figure 1) – it involved over 80 separate science communication projects, from public lectures to installations, table displays, science cafes, and workshops. The research took the Science in the City festival as a central case (and included, for instance, participant observation of the site as a whole), but also focused on six of these science communication projects (briefly described in the appendix) for more detailed investigation. It involved a number of different empirical engagements.

Figure 1: Part of Carlsberg City during the Science in the City festival

<Insert Figure 1 here>

First, interviews were carried out with the event manager for the festival as a whole and with organisers of the six science communication projects. Given that some projects had multiple organisers, this resulted in conversations (of between 30 and 90 minutes) with 12 people. The interviews were semi-structured and focused on the background to and aims for the different projects and the festival. Second, I carried out a programme of (auto)ethnographic engagement with the festival. Prior to the festival itself one of the six projects was being developed from my home department, and I was a participant observer in the planning process for this; during the six days of the festival I was present, spent time at each of the project sites, and took extensive fieldnotes that detailed my experience of the dynamics and emergent meanings of the festival environment. In keeping with a desire to follow affect, I paid particular attention to bodies, emotions, and atmospheres within these observations (Gregg & Seigworth 2010).

Third, students (n = 12) or other ESOF participants (n = 11) were recruited to use the self completion of a free text questionnaire to help them document their experiences at Science in the City. Students were recruited from my home department, while other informants were found using personal contacts and snowball sampling (Cresswell 2002). Focusing on the six projects under particular investigation, the questionnaire invited respondents to reflect on their experiences, and in particular what they noticed and felt during their time with each project through questions such as 'What did you spend most time doing?' and 'How did the activity make you feel?'.

[5] This was the English explanation; the parallel Danish text was "Science in the City er en gratis videnskabsfestival for familier, studerende og for alle, der ikke kan lade være med at undre sig". Given the presence of ESOF delegates and expected visits from tourists, much of the festival material appeared in both English and Danish. The website is archived at https://web.archive.org/web/20160314081631/http://www.scienceinthecity.dk:80/da.

The data collected – interview transcripts, field notes, and questionnaires – were subject to repeated reading and coding, during which particular attention was paid to bodies, emotions, and materiality. Key themes were identified through this process. Based on these themes, and in what follows, I discuss findings from the analysis in three sections. In the first I outline the emotional characteristics of the aims and motivations that organisers ascribed to science communication at Science in the City (largely drawing on the interviews with these organisers), while in the second I discuss the emotions that those encountering this science communication recorded themselves as experiencing (largely drawing on the questionnaire data). The third section reflects on the affective dynamics of encounters between audiences, science communication organisers, and the material environments they were situated within (primarily using material from participant observation). In all three sections I discuss these themes through illustrative quotes; the material presented, then, represents a wider corpus of similar content.

Imagining science communication: Curiosity, wonder, empowerment

In this section I outline the ways in which organisers of science communication framed their activities through references to particular emotions. My key argument is that organisers emphasised a desire to trigger a suite of emotions around curiosity, wonder, and surprise. Successful science communication which called forth these emotions was understood as transforming its audience such that individuals would continue curious, active, and critically engaged even as they left the festival.

The six projects used as a focal point for the research were very different, and were being assembled by different kinds of groups with different kinds of aims (see appendix). Almost the only commonality across all the projects and the framing of Science in the City as a whole was a repeated reference, by organisers, to curiosity as the key way in which visitors to the festival should be affected. Indeed, as we have already seen from the tagline of the festival, this was inscribed into the design of the event as a whole. Nina[6] was the event manager who had been employed by the Danish Ministry of Science and Education to coordinate Science in the City. She had a host of aims for it, from effectively communicating its theme of 'science building bridges' to having 30,000 people attend. But when it came to "was it good or was it bad", she said that:

> for me, I would say that it's very important that people will go out there and actually be curious about it, and go home from the festival and think okay, I learned something that- it gave me something new into my life. And it's not like it has to be something big, but okay, I learned something that I haven't expected, today. Or my curiosity was stimulated a little bit more than this morning.

Key to her account is the notion of curiosity and a sense of surprise – that people get something they "haven't expected". These emotions also shaped the design of the festival site. As noted above, Science in the City was held in Carlsberg City, which Nina described as a "huge area" that needed work to make "people walk from one area to another". The organising team needed a way to map and structure the site and to help them decide where to situate particular projects. One possibility had been to group the projects thematically ("health … body and brains … future technologies"). This was seen as too parochial, however, in that it tempted people to visit only one area, so the group brainstormed "the most important words we're talking about all the time" and eventually came up with a list that was used to define particular areas and thus to navigate the festival: Wonder; Explore;

[6] All research participant names have been anonymised.

Inspire; Engage; Rethink; Discover (and, more prosaically, Media and The Garden; see Figure 2). The naming thus summarises what festival organisers thought that visitors should be doing: experiencing emotions of active and engaged curiosity.

Figure 2: Map of the festival site, taken from the programme

<Insert Figure 2 here>

In this – and despite the high degree of independence project organisers had from the festival organisation as a whole – they were mirrored by individual project organisers. In so far as organisers were aiming for impacts on public audiences (Davies 2018), those impacts were viewed as relating to surprise, wonder, curiosity, questioning and (further) engagement. The brief extracts below are typical of the ways in which organisers talked about what they wanted their projects to do:

> I think I would like the installation to create questions in the heads of the visitors, so they actually think about these things (Leonard, 'Breaking and Entering')
>
> [The aim is] enabling people to actually engage with science … to ask questions and actually get behind this information layer that we sometimes have in science and actually be able to be curious (Kaspar, 'Science Moves')
>
> …it will be an installation that you can see with your eyes, and use your soul and your intelligence or whatever, you know, and your curiosity (Lise, 'Isbræ')

As Kaspar's quote suggests, triggering curiosity was sometimes viewed as a process of empowerment and 'enabling'. Inducing these emotions would allow visitors to engage with science for themselves, to "get behind this information layer that we sometimes have in science" and to interact with scientific knowledge in their own way and on their own terms. The sense is of long term impacts. The picture that was built up in the interviews was of science communication as enabling a process of transformation: a visitor engages with some communication activity or installation, is snagged by awe, surprise, or wonder, which in its turn leads them to be curious, and to continue thinking, engaging or questioning. As an individual, they become more active in interrogating the world around them.

In both the emotions described, and their precise articulation as being inspirational of continued engagement, there are clear parallels with historical accounts of the role of these emotions in science (Daston & Park 2001; Harrison 2001). It is striking, however, just how far these emotions are divorced from any kind of content-based learning or sense that curiosity about science is necessarily about *knowledge*. Rather few of those interviewed wanted to communicate specific facts. Indeed, wonder and curiosity are specifically enacted, in the final instantiations of Science and the City projects, as emotions that are triggered by experiences that go beyond words. In the case of the installation 'Seeing the Unseeable' (which one entered through a darkened tunnel, around which strobe lighting played) this is particularly explicit: the installation, its organiser Mads said, should be an "immersive" and "magical experience" where "the audience move into this unseeable world". Charlotte, one of the organisers of 'Breaking and Entering' similarly prioritised the tactile and emotional aspects of the project. It had to be, she said, "an experience where you *sense* a lot of things about science … you'll *feel* like being part of the game and not just watching it" (emphasis mine).

Wonder and awe – and through them a personal transformation to become more active and engaged with the world – are therefore called forth by experiences more than by facts. In this respect interviewees framed their activities as empowering participants through imbuing them with some of the characteristics of science itself (Campbell 2004): as Niklas ('Ig Nobel Show') said, "the most beautiful thing science can do to you is it can make you think". In promoting (this form of) curiosity, as continual, active and empowered engagement with the world, interviewees implied both that this was a valuable and important way to experience the world and that science, as the starting point for this disposition, was itself a civic good.

It is worth highlighting again the characteristics of the citizens thus produced. To repeat some of the language of organisers, science communication should "create questions in the heads of the visitors, so they actually think about these things", enable people "to ask questions and actually get behind this information layer that we sometimes have in science", "be curious", and "use your soul and your intelligence … and your curiosity". Passive or quietly ambivalent engagement is not an option: the emotion work demanded or anticipated by these producers of science communication is of the performance of excitement and engagement. The feeling rules (Hochschild 2003) of science communication, as represented here, normalise childlike enthusiasm and wonder (Campbell 2004; Onion 2016). We might thus understand this regime of curiosity as seeking to produce citizens who are above all active and engaged, rather than passive, bored, or distanced from science. Finally, promoting curiosity might be framed as a means of empowerment, but it is also empowerment along particular lines, ones that exactly draw on ideas about the 'beauty' of science and scientific thinking (to quote Niklas).

Negotiating science communication: The emotions of engagement

The organisers of science communication projects and Science in the City as a whole therefore framed their aims in terms of promoting curiosity, and, through this, enabling active engagement with the world. In this section I look at how these projects were experienced in practice. What emotions were engendered in visitors as they encountered these instances of science communication?

Compared to organisers' accounts there was much greater diversity in what respondents reporting on their experiences had to say, with a range of both positive and negative emotions described. In what follows I outline the dominant themes within these. My key argument from these data is that most of respondents' emotional and intellectual energy went into negotiating engagement with science communication, rather than responding to its content. The bulk of what was reported relates to the emotions of 'trying to understand', whether that is about navigating the festival site (and other people within it), or figuring out what one is 'supposed' to be doing, learning, or feeling. Negotiating science communication was thus more a practical or pragmatic exercise – asking the question: what is going on in this space and how should I behave in it? – than one that was necessarily about encountering science *per se*.

What positive emotions were reported? Experiences of curiosity and wonder were certainly mentioned in questionnaire responses (for instance: "I [felt] curious of how people see science"), but these were not dominant. Rather respondents tended to describe whether they had found something 'interesting' or not; experiences of 'fun' or entertainment; and specific pleasures relating to aspects such as the aesthetics of a project (Bultitude & Sardo 2012; Jensen & Buckley 2016). The binary interesting/not interesting was the dominant

language with which participants responded to being asked about experiences of science communication, with the term heavily used in the responses as a generic positive marker (for example: "everything was incredibly interesting"; "I was interested in the photographs"; "I found this activity/project interesting"). Though 'interesting' is clearly seen as a good thing, and something that science communication should be, its use gives rather little away as to the details of the experience and what it means for something to be interesting: in this respect, the term operates as an empty signifier. In contrast terms such as 'fun' and 'entertaining' were explicitly related to pleasure, laughter, humour and enjoyment (reinforcing the emphasis on fun in science communication noted above; Bultitude & Sardo 2012). This, for instance, is one respondent writing about their experience of the Ig Nobel Prize Show, a public lecture based on the Ig Nobel Prize Awards:[7]

> This was a public lecture, so I spent most time listening to the speakers, but I also spent quite a long time laughing … I felt thoroughly entertained, and even though the lecture went on for about an hour and a half I did not lose interest or feel a lapse of attention at any point. It was clear that these scientists took their research very seriously, but were at the same time aware of how humorous it was in the eyes of the public. (Respondent 11, on 'Ig Nobel Show')

Laughter, humour, and easy attentiveness were all frequently associated with science communication projects that were seen as entertaining or fun and thereby as pleasurable. But it is worth noting the way in which the respondent describes their experiences. That "the lecture went on for about an hour and a half" is given as evidence of just how entertaining the content was; similarly, the scientist-presenters' attitude of taking "their research very seriously" while also being aware of its humour is mentioned approvingly. The pleasure largely comes from the way in which the communication is framed, managed and conveyed. Later, the same respondent noted that they will particularly remember how two of the presenters were "very good at 'putting on a show' and making their research interesting". The positive emotions engendered by this instance of science communication are thus tied up with the format and style of its presentation, rather than, or as well as, the scientific content.

There is similar attention to the framing of communication when respondents talk about negative emotions. As a corollary to the set of positive emotions described above, there are references to experiences of the different projects as being boring, frustrating, or disappointing, or to the projects as making the visitor feel stupid. Again, though, these negative emotions largely relate to the challenges of correctly reading the experience rather than to the content in and of itself. The extracts below are typical:

> [I spent most time] reading the text of the posters, trying to find a common thread (apart from being related to the ocean). I was trying to figure out 'the point', beyond showing some pretty pictures (Respondent 17, on 'Ocean of Resources')

> …it made me feel confused, the exhibition, because it was so unclear what I was supposed to know and walk away with (Respondent 4, on 'Seeing the Unseeable')

> [I spent most time] trying to figure out the point of the sculpture … I am still not sure what I was supposed to learn … [I felt] confused and indifferent (Respondent 7, on 'Isbræ')

[7] As well as annual awards for science that 'makes you laugh and then think' there are associated books, online resources, and international events such as the one organised at Science in the City. See http://www.improbable.com/ig/.

Negative emotions such as confusion, frustration, or a sense of exclusion or effortfulness therefore relate to an experience of the projects as a social and intellectual challenge to be overcome. Respondents wanted and expected a "common thread", a "point", and a sense of what they were "supposed to learn". Their expectation was that each project should tell them how to behave and what they should take from engagement with it; negative emotions emerged when these requirements seemed not to be met. Similarly, participants often described the emotional challenges of navigation – how to find particular projects, and to find one's way around them once they had been identified – or of relating to others in the space. One respondent wrote that a project made them feel "a little bit out of place" because it was "maybe not for older, educated people", and that they had felt pressurised to let children take priority in experiencing it. Others mentioned awkwardness or self-consciousness because an activity was too empty or too full. For this participant, for instance, their key memory of one project was of loneliness: "[My experience was] a bit lonely. When I was exploring the installation I was the only visitor" (Respondent 15).

Overall, then, though these respondents reported a range of emotions as being called forth by their engagement with Science in the City projects, the bulk of what they described emerged from their management of the situation of encountering science communication, rather than from the content of that science communication. This, of course, contrasts with the expectations of producers, as well as with broader ideas about the emotions of science communication (Bultitude & Sardo 2012; Onion 2016). This is a specific kind of emotion work: as a visitor, there is effort involved in figuring out how to engage and then in responding in the correct way to that engagement. Participants at times explicitly referenced this sense that engaging with science communication could be hard work:

> The project was a bit hidden, and looked a bit boring and like something you needed to have a lot of energy to engage with (Respondent 12, on 'Breaking and Entering')
>
> …I also skipped the last two [parts of the installation], because I already had 'taken in' too much (Respondent 15, on 'Seeing the Unseeable')
>
> At first it was difficult to get in the right mind-set for the experience, so you had to invest and concentrate (Respondent 8, on 'Breaking and Entering')

Here science communication is explicitly described as something that can take a "lot of energy", quickly become exhausting, or requires you to "invest and concentrate". The positive emotions – curiosity, wonder, awe – organisers seek to elicit therefore do not emerge naturally or spontaneously. These respondents found themselves being active not so much in being wondering, questioning citizens but in interpreting their situation, understanding what a piece of science communication required of them, and reading what their response should be. All this, as the quotes above make clear, can be effortful.

Just as with Hochschild's (2003) notion of emotional labour, then, experiencing and correctly responding to science communication can be viewed as a form of emotion work. Organisers seek to configure their audiences as active, engaged, and curious. They demand emotional (and intellectual) performances which demonstrate one's engagement with science (as, often, in public engagement more widely; Chilvers & Kearnes 2015). In contrast to this imagination of science communication – in which it produces curious and active citizens – when we look at the experience of participants we find emotion articulated rather differently. Rather than emotions of wonder and curiosity being straightforwardly triggered by the presentation of science, effort is required both to read and navigate an instance of science communication and then to perform the active engagement that is encouraged. In

this case, at least, visitors' emotional experiences are focused on understanding and managing behavioural norms and exerting themselves to perform in the correct ways – to figure out what the communication is 'about' and what one's response should be. All this, as we see above, can require "a lot of energy" – just as for the performance of emotions expected of particular (gendered) roles or professions (Bolton & Boyd 2003; Duncombe & Marsden 1993; James 1989).

The point here is not to suggest that science communication is always experienced as laborious or effortful. Indeed, the very fact that visitors to Science in the City are there voluntarily suggests that any emotion work that must be performed is balanced against the positive emotions that are also called forth. But these organisers, at least, framed the production of curious and engaged citizens as happening rather naturally; data from participants highlight that navigating science communication and producing the right emotions can be laborious. Not surprisingly, then, we see some resistance from users to taking up the behaviours and emotions asked of them (for instance in the 'skipping' of parts of an installation mentioned in the quote above). It is this resistance, ambivalence, and negotation that I explore in the final empirical section.

Performing science communication: The 'dance' of interaction

If visitors reported that engaging with science commucation involves particular emotions, what did this look like in practice, and what role do material structures and practitioners of science communication play in these performances of engagement? Here I (primarily) draw on the ethnographic portion of the research, and, in that I pay greater attention to bodies, spaces, and objects, am concerned with affect as well as emotion. My key argument relates to what I started calling, in my fieldnotes and in later analysis, a 'dance' of interaction between visitors and science communication/ors. What is at stake is how these different actors are being asked to behave, with the dance representing the negotiation of those behaviours. I start by quoting my fieldnotes at a point where they describe one embodied instantiation of this dance of interactions, in the shape of a particular way of moving around the festival. As I write I am sitting and observing one of the projects I studied, an interactive installation (Figure 3), which was situated in a larger marquee also containing other projects (the 'KU [Københavns Universitet] space' in the fieldnotes; see Figure 4):

> There is a particular kind of 'wandering' walk, which is very distinctive, and which I have just witnessed, as a woman (an ESOF delegate with a tag) came through the door behind me and walked slowly round towards the hopes and fears sticks [part of the installation]. You walk slowly, almost staggering, with a side to side movement; you take your surroundings in but are not committing to anything. The walk is quite heavy, because your weight is slowly placed and has this sway to it – I initially noticed her because her footfall was loud on the wooden boards of the tent. She was chewing gum, and also had a particular expression on her face: slightly cynical, distanced. To me the whole effect connotes the question: is there anything interesting for me here? Probably not – but I'm going to take a quick look just in case. Here, I suppose, the answer was no: she moved round the back of the installation, taking in some of the text, and giving a half-interested, half-scornful smile-nod, drifted through the rest of the KU space – and then left. In all she was probably here for a couple of minutes. (Fieldnotes, Thursday)

Here this visitor is able to balance engagement with non-engagement. She 'drifts' such that she can get a sense of this installation, and the KU space as a whole, without having to stay more than a couple of minutes or become seriously entangled in the content that is being offered.

Figure 3: The 'Breaking and Entering' interactive installation

<Insert Figure 3 here>

Figure 4: One corner of the 'KU tent', with a science show being carried out

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Many of the projects at Science in the City sought to snag and ensnare visitors in longer lasting engagements. The installation being observed here, for instance, contained multiple interactive elements and, according to its organisers, deliberately sought to configure its visitors as active participants in negotiating the knowledge and ideas it presented. This woman, at least, is wary of being caught in these lures. She moves her body in a way that allows her to skirt the edges of the installation, and to move away if she wishes; at the same time, her swaying walk is slow enough that she can look at what is on offer. She can get a sense of whether she wishes to participate further – to invest the time and emotion work required by such participation – without committing to doing so.

This balance between being ensnared and escaping is heightened when science communicators enter the scene. Several of the projects studied involved live demonstrations or the presence of communicators to guide or instruct. On the one hand, this enhances the ability of a piece of science communication to 'catch' a visitor, given that communicators can move around, (attempt to) start conversations, and perform the enthusiasm and curiosity that they want to instill. (As one respondent wrote about their experiences, "I was a bit worried that some of the guides would catch me"; Respondent 20.) On the other hand, the presence of people – as opposed to content presented in other ways – introduces rather complex social dynamics, including around norms of politeness and face. It is one thing to back away from an informational display; quite another to reject someone's advances to guide you through that display. The involvement of communicators therefore heightens the danger that one becomes stuck doing emotion work with a piece of science communication that you might otherwise simply stop engaging with.

My fieldnotes, for instance, describe my getting 'sucked in' to a conversation at one project, despite my initial hesitancy. I had, I wrote, "the visitor's desire to look round by myself before deciding to ask questions or show enthusiasm", but eventually spent 30 minutes talking about table top demonstrations of physics experiments. Live interactions certainly increased the chance of visitors becoming more entangled in science communication projects – if they could be caught – but also brought other kinds of emotions. "It was a little awkward to talk to the curator [the live science communication guide]", wrote one respondent, "because I didn't really understand what he was saying – and did not want to disappoint him" (Respondent 12, on 'Seeing the Unseeable').

At Science in the City, then, there was a kind of dance performed between visitors and science communicators and their projects – an affective dance that might be, but was not necessarily, also experienced through the presence of specific emotions such as boredom or irritation. As the interviews with organisers would suggest, the projects were materially configured to draw people in, and to encourage their active involvement through conversation, engagement with interactive components, or simple dwell time. As with public engagement more generally, they sought to produce active and ultimately curious users (Chilvers & Kearnes 2015). But given the energy required for this kind of active engagement,

and the emotional performances potentially demanded, visitors were more hesitant. Often, they held back until they were sure of what they were getting into.

These dynamics are more complex than a straightforward push/pull. I wrote in my fieldnotes that "they (we) [visitors] expend energy trying to avoid interaction, initially at least – while we [communicators] expend energy trying to get them to talk, interact, do". But I also recorded instances of ambivalence in the communicators present at the festival. They, too, found that engagement could be laborious, and there were times when they felt that they 'couldn't be bothered' to engage in the dance (similarly, Hochschild writes of the exhaustion and disillusionment attendent on performing emotion labour in professional roles; 2003). It was also apparent that there was much more going on within Science in the City than science communication – or, at least, that successful science communication could be defined in different ways (Davies 2018). At some moments the dance of interaction took on a competitive element, with communicators seeking to ensure that their projects attracted at least as many people as others (for Nina, we can recall, the target of 30,000 visitors was one prerequisite for success). For communicators the emotions of science communication therefore also included fears of failure. A final extract from my fieldnotes gestures towards some of these dynamics; I am, again, sitting in a marquee containing a number of different projects:

> There is a real dance of interactions within this space: people trying to attract other people to talks or stalls, people trying to avoid contact, people trying to control others (their pupils), people simply trying to hang out with their friends (the group of kids next to me, playing music and dancing and talking). There is a sense that communication – this formal science communication we are engaged in here – is a competitive sport; it is somehow urgent to attract people and bring them in. We are all of us afraid that no-one will come to our events or stalls or exhibits. (Fieldnotes, Wednesday)

The emotion work of science communication is not straightforward. Despite strong commonalities in what is desired – the production of active, curious, wondering citizens – participants were entirely capable of resisting the scripts laid out for their emotional responses and behaviours (Felt & Fochler 2010; Horst & Michael 2011), and indeed in becoming enmeshed in emotions of a very different kind (frustration with the communication, loneliness, boredom). As with public participation more generally (Chilvers & Kearnes 2015), the production of affective citizens is not smooth or pre-determined but under constant negotiation. Indeed, it seems that, if the emotion work of science communication is most centrally about performing and producing curiosity, wonder and engagement, then this is, at times, as arduous for those modelling and stimulating these emotions as those they seek to induce them in.

Conclusion

The preceding empirical sections have outlined some of the dynamics of emotions and affect in one particular science communication event, the Science in the City festival. I have argued that for organisers of this science communication, triggering a suite of emotions focused around curiosity, wonder and engagement is an overarching aim (thus answering my first question: what emotions do producers of science communication attempt to elicit?). However, rather than automatically being caught up in the desired emotions of surprise, wonder, and curiosity about science, the visitors who reported on their experiences for this research tended to focus on the emotions of 'reading' science communication. Negative emotions, in particular, related to the challenges of correctly understanding what was being asked of them by science communication installations and activities. I also used

ethnographic data to describe a dance of interactions between science communication/ors and visitors, suggesting that what is at stake in this dance is how visitors are configured and expected to behave. Science communication, and communicators, seek to produce active engagement and the performance of curiosity; visitors, however, may resist this and attempt to manage the extent to which they engage with these communication projects (answering my second question: what emotions are experienced as science communication is received and negotiated?).

One aim of this discussion has been to explore how citizens are constituted within science communication activities (Bennett 1995; 1997), and how this relates to research that has explored the production of affective citizens within public engagement (Chilvers & Kearnes 2015). What is largely new here is the emphasis on curiosity, interest, and active engagement. Though curiosity has a long and complex history in how science is imagined and constituted (Cochoy 2016; Harrison 2001), research on public engagement has tended to find what we might call anaesthetised versions of citizenship (Swyngedouw 2010), in which lay participants are expected to become confident in and compliant with technoscientific regimes (Goven 2006; Thorpe & Gregory 2010). In these data the repeated message from organisers – and from the material instantiations of many of the science communication projects at Science in the City – is that content, even attitude, doesn't matter so much as the stimulation of curiosity. Users are configured as active. Their experience of science communication should turn them into active and empowered thinkers.

In this respect there are parallels with Kimura's (2017) finding that risk communication demonstrates a neoliberal sensibility in which personal agency and 'being in charge' is key. Here we might similarly understand the constant emphasis on curiousity as a means of imbuing citizens with personal agency and responsibility. This version of curiosity, we should also note, is one modelled on science, and it is not clear whether the framing of science communication as producing curious and engaged citizens would survive citizens who became critical of science. There is thus a need for further investigation of the versions of wonder and curiosity that are promoted and mobilised within science communication.

Similarly, one key lacuna in this material is around why users were at the Science in the City festival at all. Those who participated in this research reported the emotions they experienced as they engaged with instances of science communication, and I have described the back-and-forth dance that seems to occur as visitors try to avoid excessive or unwanted emotion work. But these data have little to tell us about the broader context of why these visitors attended, what exactly they got out of the experience, and how they consume science communication generally (Davies & Horst 2016). Future scholarship should therefore seek to understand how, and on what terms, those who make use of science communication perform the emotion work inherent to it.

In focusing on emotion in science communication I have come to emphasise the effortfulness of particular performances: curiosity does not necessarily emerge naturally, just as science communication products themselves may require energy to negotiate. Engagement with science, of any kind, may demand such emotion work. A final point of reflection for communicators and others involved in designing and promote diverse forms of public engagement with science is thus to ask the question: what are we asking of people? And to what extent will this be experienced as laborious?

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Appendix: The six science communication projects

Project name	Project type	Description (from Science in the City programme)
Breaking and Entering? Explore how science and society relate	Interactive installation	How do new fields such as synthetic biology impact society – and how can we have our say on science? Breaking and Entering? asks you to engage with these questions as you explore the many connections between science and society. This interactive installation presents quirky films, intricate laboratories and inspiring assignments through hands-on exhibits, iPad-enabled augmented reality and online engagement. It asks (and you answer): what are the challenges when science and society meet – and how should they be met? Who is scientific research for? And what are its purposes?
Science Moves	Movement-based workshop	Join these activities and help create a double helix of people, simulate a brain using handshakes, or model complex flock behaviour using simple rules of movement. Science Moves consists of several events, happenings and flashmobs in which science is crossed with bodily understanding. As a participant, you will pretend that you are an object in a scientific model. For example, an atom, a neuron, a star – it all depends on the model. We have collaborated with scientists in specific areas to make games, where the rules determine how you are allowed to move. Together, you, the rules, and all the other participants become a scientific model – a human simulation. The activities are called kinesthetic exercises, and support "learning by doing" with a healthy combination of movement and thought. Playful and unforgettable, they permit you to ask relevant questions to the models – and some times these questions lead to new knowledge.
Glacier (Isbræ)	Art installation	Discover the art installation 'Glacier' and get a blast from the past which created conditions for our present. Glacier symbolizes the cold, white, silent ice covering Denmark and the Scandinavian countries during the ice age. The artist uses large blocks of chalk to create the illusion of the natural forms and forces of the glacier that created Denmark that we live in and off. Over thousands of years, Denmark has been trapped in the strong arms of the ice, and ice and meltwater has created the Danish hills, valleys and plains, and the strata we live on and off.

		Our vital groundwater flows in the Ice Age layers beneath our feet, like blood in the internal organs of the landscapes, and gives life to us all, and it is the same layers, which feeds the natural plants and the crops, which animals and people eat. The audience can read the story how the ice created Denmark, through a flyer, at the installation.
Ocean of Resources	Photography exhibit	This underwater photography exhibition by a professor in Marine Ecology illustrates some of the issues related to the exploitation of marine resources. Today, marine biodiversity play a crucial role for humanity. The photos taken in arctic waters illustrate what the ocean can offer of species and shows some of the abundant fauna and flora found under water in one of the most productive area for marine ressources. For each photo you can read about what you see and undergoing relevant research.
Seeing the Unseeable	Exhibition with videos, displays, and live demonstrations	It's not magic – it's science! Dive into a sea of unseeable particles, atoms and molecules and learn about a future revolution of science. In a few years – two giant research facilities - the MAX IV synchrotron and the European Spallation Source (ESS) - will open in Lund, Sweden – only 30 min drive from the city of Copenhagen. This event will take the audience to the other side of the Øresund into the heart of MAX IV and ESS, where photons and neutrons run. A journey guided by the scientists involved, that will make you understand how knowledge about atoms' positions can improve a wide range of the products that we ask for. MAX IV and ESS will be far more powerful than existing facilities around the world and will attract scientist worldwide working with diverse areas as intelligent medicine, super computers and tender meat. And though the physics are complex and dimensions are unimaginably, simple hands-on activities will make the audience understand the principles of imaging at MAX IV and ESS. And maybe the scientists can teach you a few tricks as well to show you that science might not be magic - but certainly magical.
The Ig Nobel Prize Show	Public lecture	Every year the Ig Nobel prizes are awarded to science that 'first makes you laugh then makes you think'. The prize ceremony is held at Harvard University and involves the premiere of a science opera and shorter scene performances involving Nobel prize winners and other prominent scientists. Since the first show in the early 1990s the ceremony has developed to one of the most popular, well-covered and funniest popular science events world-

		wide. The founder of the Ig Nobel Prize, Marc Abrahams, is guesting ESOF with several Ig Nobel laureates, telling their stories about why and how they came about winning the prize: Dr. Kees Moelliker, who was the first man ever to scientifically report on homosexual necrophiliac in ducks, Dr. Elena Bodnar, who won the prize for inventing a brasserie that rapidly can be transformed into a couple of face masks, and Dr. Magnus Wahlberg, who showed the Swedish Navy that they had hunted farting herring rather than Russian subs during the final part of the cold war.