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EIGHT

Afterword

This book has explored what happens when people from minoritised, and specifically racialised, groups encounter science through a variety of everyday science learning practices from a sociological perspective, while foregrounding issues of social justice. It is traditional for a final chapter to discuss things like the implications of research for practice, the limitations of the research and ideas for future research. Those of you reading this book in order will have noticed however, that the previous chapter focused at length on the implications of the research carried out of this book for understanding inclusion and equity, both in theory and in practice, along with a call to action. As a result, it is worth noting that this is not a traditional conclusions chapter. Instead I have titled it "Afterword" and use it as a space to discuss some of the ideas that fall out of this research, in particular, questions about science content, racism and thinking beyond everyday science learning. This chapter finishes by taking a snapshot of equity in the contemporary everyday science learning landscape, where I discuss both my cynicism and greed about what change is possible.

To be clear, the key implication of the research I have discussed in this book is that everyday science learning is exclusive. This exclusion is embedded in the structure of the fields involved in everyday science learning and in their practices.

Thus, as discussed in Chapter Seven, we need to do more than tweak staff training or marketing materials if we want everyday science learning to be truly public. We need to radically overhaul the systems, practices and ways of thinking that shape everyday science learning. Furthermore, we need to go beyond that to think about how inclusive everyday science learning practices can contribute more widely to disrupting and transforming social inequalities. I appreciate this may seem overwhelming, but I do not believe that minimising the need for change serves anyone well, least of all people minoritised groups, like the participants who took part in the research I have discussed here.

On one hand, this is a book about everyday science learning practices. How they reproduce exclusive, oppressive practices of discrimination based on 'race'/ethnicity, class, gender and other facets of people's intersecting subjectivities. It is about how we can learn from experiences of exclusion to disrupt and transform everyday science learning such that the knowledges, practices and selves of people from racialised groups are recognised, represented and respected. On the other hand, this book can also be read as an example of how institutional racism and institutional class discrimination work together (not to mention how these are inflected in a kaleidoscopic manner with gender and the other facets of peoples' lives). In particular this book can be used as an example of how structural inequalities in the UK operate to protect and reify middle and upper class whiteness. In this second reading the context that frames the research (everyday science learning practices) provide a case study through which the reproduction of social disadvantages, not least the interplay of racism and class discrimination, can be unpacked. These two different perspectives provoke different ways to develop the work started here, as I discuss below.

Disrupting and transforming science

The research carried out for this book shows just how exclusive everyday science learning practices can be and the damage that exclusion does to people at the sharp end of them. As I have argued throughout this book, as people who feel included in everyday science learning, whether as researchers, practitioners and producers, policy makers or included users, we have a responsibility to centre social justice in our work. If we do not, we have to ask serious questions about whether we are happy to reproduce advantages for dominant groups at the expense of the minoritised. Two significant questions remain unanswered for me from the research reported in this book. First, how do we change what counts as science content in everyday science learning? And second, how can we think seriously about science practices above and beyond those involved in everyday science learning?

Content matters in everyday science learning. As discussed in Chapters Two, Four, Five and Six, science-related content was rarely welcoming for participants. Instead, science was represented in ways that reproduced tired tropes of being stale, pale and male (Lawler, 1996). As such I argued in this book that from a social justice perspective it is important to reconsider the science question, not least in terms of whose knowledges and practices count when it comes to thinking about science content in everyday science learning practices. I repeat this point here because one trend I see in attempts at equity work in everyday science learning is that people are more comfortable focusing on *how* science is communicated rather than the science content itself, as though science content is fixed and sacrosanct. As I discussed in Chapter Four, despite having a wealth of science-related knowledge and practices, even participants echoed extremely conservative views of what could and could not be called science.

Although I touched on this in Chapter Four, trying to understand how to usefully and meaningfully reconfigure what counts as science in everyday science learning seems to me to be a key area worthy of further work. Happily, there are practices and ideas that already exist that we might be able to use. Researchers working in science education on indigenous knowledge have long since debated these forms of knowledge can be reconciled with science in ways that are neither appropriative nor patronising (Bang et al., 2014; Kim, Asghar, & Jordan, 2017). What if the science content of an everyday science learning project did not focus on knowledges that had their roots in the European 'enlightenment'? In practical terms, what could we learn from combining practices about the co-construction of scientific knowledge from citizen science practices with arts practices that seek to revalue how public art is created and understood (Ballard, Dixon, & Harris, 2017; Gibson, 2001). How might we use these practices and ideas to reimagine the epistemic practices of science? Although I do not have a clear sense of the answers, questions about how we work to open up the space of what counts as science seem crucial for developing meaningfully inclusive, equitable everyday science learning practices.

The question of science content is one that travels beyond everyday science learning and has implications for what we consider as the goals of social justice in relation to science. My second concern is about the relationships between developing inclusive, equitable everyday science learning practices and the broader worlds of science education and scientific careers. It is all very well creating everyday science learning practices that support, for instance, youth from minoritised backgrounds to feel comfortable using and producing science in a citizen science project. But we have to recognise that should those youth decide to pursue their science related skills beyond such a project the environment they will meet will not necessarily be a

friendly one. What is achieved if, for instance, a young Black woman from such a project goes on to study a PhD in physics only to experience the exclusive and damaging practices that we know take place in science in higher education (Gonsalves, Danielson, & Pettersson, 2016; Johnson, Brown, Carlone, & Cuevas, 2011; Ong, 2005)?

It seems to me we must consider disrupting and transforming science and science related practices as well as everyday science learning. Indeed, as Londa Schiebinger (2007) has argued, a significant question remains about what kinds of science knowledges, skills and practices count and how they are counted. I remain convinced however that as others have argued, from an epistemological perspective, a social justice perspective and a practice perspective, the most interesting, valuable, adaptive and ultimately useful forms of science will come from an inclusive scientific community (Longino, 1990; Medin & Bang, 2014).

Racism, knowledge and research

This book has been about what happens when people from racialised groups encounter science in the public sphere, through activities that I have described here as everyday science learning practices. In this book I have tried to tell a story about how structural inequalities — racism, class discrimination and sexism in particular – shape and are exacerbated by everyday science learning practices. Although I took an intersectional approach, as the story has unfolded I focused more and more on how the various intersecting structural inequalities participants experienced are rooted in racism and their position as racialised groups in the UK.

Ultimately therefore, this book is about racism. It is about the experiences of Latin American families and Sierra Leonean elders. It is about the stories of Fatima,

Ibrahim and Mr Bhakta. It is about how institutional racism structures visits to science museums. It is about trying to change everyday science learning practices such that racism and associated practices of racialised class discrimination, racialised sexism and their intersections are recognised for what they are, so they might be addressed, disrupted and transformed.

As discussed in Chapter One, this book is based on qualitative, ethnographic research with five community groups in London, over a two-year period. It was exploratory research, designed to develop a better understanding of how people from racialised groups, living in relative poverty, experienced everyday science learning. Drawing on Mariana Ortega's (2006) work about whose experiences, practices and knowledges we attend to and how this affects knowledge making, this research was about providing a different point of view to that which dominates the literature. What this book offers therefore are the insights and experiences of people whose stories are not usually taken into account across the fields of everyday science learning. As Mitsuye Yamada(2015/1981, p. 69) wrote, quoting Cherríe Moraga "what each of us needs to do about what we don't know is to go look for it". This book is my attempt to listen and learn, as well as to share.

But in my experience not everyone finds it easy to think, listen or talk about exclusion, or racism in particular, in everyday science learning. Thus, specific but potentially undermining questions about generalizability[i] arise from time to time. Clearly, this research, rooted in qualitative and ethnographic methods, will not speak to everyone's experiences. That people across five different community groups, who never met one another, told stories that echoed each others so closely is still valuable information to me. Thus, by being transparent about the methods used, involving participants in the analysis and presenting this work as clearly as I can, I hope to

assure you the examples drawn on in this book are meaningful (please see the appendix for further details about research design and analysis).

In a similar vein, I am also frequently asked about how generalizable the research carried out for this book might be to white, working class groups. This is a question all too often asked at conferences, to the extent that I now include my answer in the body of my presentations. That there are, yes, doubtless people from white working class backgrounds share aspects of participants experiences of exclusion from everyday science learning. As to exactly how, who, why, where or when, I cannot say on the basis of this research. What's more, I am not only reluctant to speculate given the potential for damage, but because I have experienced this question too many times as a way to derail talk about racism. While I think it is of course important to think about exclusion as multiple and intersectional, there is no getting away from the fact that this study is about people from racialised groups. I have therefore found it more and more necessary to insist on 'race'/ethnicity and racism as key parts of this story, not least to prevent them being whitewashed away. Thus I have pushed to retain some specificity of language around racism and 'race'/ethnicity amidst words like exclusion and social justice. Perhaps I have still not pushed hard enough.

Beyond science: disrupting and transforming culture, education and politics

Read as a case study of how institutional practices across the different fields involved in everyday science learning — from the mass media, to museums, to schools, to political processes — are shaped by and in turn reproduce structural inequalities, this book has implications that travel beyond spaces where science is represented. For a start, aspects of the racial and classed discrimination participants experienced during

the accompanied visits to the science museums and a science centre had nothing to do with content. Instead, racial profiling by security guards such that they were followed and repeatedly asked not to touch exhibits, or being asked to leave cafes before other visitors, are behaviours that are unrelated to learning science. As such, paying attention to practices of institutional racism, class discrimination, sexism and other forms of oppression across spaces that have nothing to do with science seems important.

Content, of various forms, does matter though and the research discussed in this book provides an example of how practices related to content – in this case to science – are marked by structural inequalities. Might this have implications further afield? If we take the field of art museums for instance, we can see from research by Cecelia Garibay (2017) and Catherine Hahn (2016) that issues of 'race/ethnicity and racism play out in terms of the knowledges, practices and content on display, as well as in visitor patterns. If we turn to the museum field more broadly research from Carol Dixon (2012, 2016), Viv Golding (2009) and the American Alliance of Museums (2018) show that questions of power, 'race'/ethnicity and structural inequalities continue to shape the museum landscape. And if we think too about research from Richard Sandell (2007) and Amy Levin (2010) we can see that similar struggles with representation, respect and recognition play out in museums in terms of (dis)ability, sexuality, gender, class and the intersecting subjectivities of people's lives. Thus, as the slogan I see increasingly frequently on t-shirts and twitter puts it, "museums are not neutral". The research discussed in this book suggest the same is true for science in the mass media as well as public engagement with science practices in higher education and politics. Building on the parallels between international museum studies and the research carried out for this book suggests that the participants

experiences discussed here may have wider relevance beyond science-related settings.

As such, thinking beyond the science context of this book, we might think about how partial patterns of participation play out in television watching, enjoying sports or voting and what those patterns mean in terms of structural inequalities in our societies. What can we learn from how the ideas discussed in this book spread (or not) into research about who gets to produce content in the cultural, educational and political industries and the various influences on their agency (Dent, 2016; Puwar, 2001; Saha, 2018; Taylor & O'Brien, 2017)? What might thinking about publics in terms of structural inequalities mean for debates about public engagement and participatory democracy? How can concepts such as Fraser's (1990) micro-publics be developed in meaningful ways across these different contexts?

For scholars of social justice, being unable to participate in, benefit from or otherwise shape valued public practices, whatever they may be, constitutes a significant form of marginalisation and oppression (Fraser, 2003; Young, 1990). Ideas developed in this book about how inclusive, participatory and democratic models of various publics might be understood therefore apply beyond everyday science learning. If we understand publics as heterogeneous and active in global, multi-cultural societies, we can reimagine practices such that differences are valued rather than erased (Benhabib, 2002; Young, 1990, 2000). I make this point because as Puwar (2004) has argued, not everyone gets to be included in the public, yet ideas about what is public and who the public are lie at the heart of our societies. Thus it is helpful to keep in mind, as discussed in Chapter Two, that publics are brought into being in the light or shadow of specific practices, and that ideas from social justice can help to provide a framework for understanding what these practices of inclusion and exclusion mean.

If we consider any educational, cultural or political practices to be socially or personally valuable therefore, we must consider how exclusion operates and what equitable systems could look like. From this perspective for example, an inclusive, empowering experience would be one that involved multiple voices, spaces and publics in equitable ways.

Taking the temperature of the water: A snapshot

I do not believe that inclusive, equitable everyday science learning practices are beyond our grasp. I appreciate how overwhelming the influence of structural inequalities can seem however, even when a person, team or organisation *is* committed to change. You can't just wish your way out of structural inequalities and institutional racism. Change takes work, making mistakes, admitting what we do not know, picking ourselves up and starting again. But it is possible. For instance, research in the US with Latinx communities found science museums were expected to be unfriendly places, with hard to understand exhibits (Garibay, 2009). When their languages *were* represented however, people from Spanish speaking backgrounds in the US felt more valued by science museums, more comfortable during their visits and felt the museums were more culturally relevant (Yalowitz, Garibay, Renner, & Plaza, 2013). This is no small change.

The empirical and theoretical accounts of exclusion and inclusion in everyday science learning that I could not find at the start of this project are becoming more and more available (Feinstein, 2017; Garibay & Huerta Migus, 2014; Philip & Azevedo, 2017). Staying with museums as an example, issues of access, equity and inclusion seem to be garnering attention in ways that I desperately hope are meaningful. The work documented by Gretchen Jennings and Joanne Jones-Rizzi (2017) testifies to the

deep commitment of particular practitioners and institutions to equity in science museums. Building on the "Race: are we so different" exhibition they developed with the American Anthropological Association, the Science Museum of Minnesota's anti-racist approach to everyday science learning places racial equity at the heart of all their activities, from exhibition content to staff recruitment (American Anthropological Association, 2018; Science Museum of Minnesota, 2018). Furthermore, inclusion and equity no longer seem to be single-issue concerns. It gladdens my heart to be able to reference projects that have addressed inclusion in museums from multiple and overlapping perspectives (see for instance, Achiam & Holmegaard, in press; Dancstep & Sindorf, 2018; Garibay, Lannes, & González, 2018; Sandell, Dodd, & Garland-Thomson, 2010). And the stories I hear through social media, when I attend conferences or organise workshops, suggest to me change is happening in different countries and different practices.

For someone who cares about equity and everyday science learning these seem to be exciting times. Makerspaces such as the Mothership HackerMoms project set up by parents to reconfigure practices of participation centred on gender equity and childcare disrupt established patterns of interaction and access to technology (Dawson, 2017; O'Sullivan, 2018). Citizen science groups that meaningfully co-develop projects with refugee youth no longer seem like a distant dream (I can think of a couple in London run by community groups and the work of the French group L'Atelier des Jours à Venirs group takes this approach too) (L'Atelier de Jour à Venir, 2018). At the national scale, a collaboration between the Wellcome Trust and the UK government called "Inspiring Science" made a significant investment in UK science centres focused on diversifying their audiences. Activist networks of practitioners such as the Museum Detox group in the UK or the Museums as Sites for Social

Action (MASS Action) project in the US are raising the profile of equity issues across the practices they touch. These are all profoundly hopeful practices.

My work has left me in the peculiar position of being both cynical and greedy. Cynical because I worry equity and inclusion have become a fashion in everyday science learning. And the problem with fashions is they rarely endure. As Feinstein (2017) argues, organisations such as museums face pressures that compete with and can undermine equity efforts, not least financial pressures. Thus, as we saw in the UK in the late 2000s, staff roles related to inclusion and community development were the first to be hit by the redundancies that resulted from austerity politics following the financial crash of 2007-2008. Unless equity and inclusion are at the heart of everyday science learning, they will remain at risk of seeming like luxury add-ons, all too swiftly dropped when money is tight or when a shiny new fashion comes along. When Gloria from the Afro-Caribbean group asked me how much difference taking part in this research project would make to inclusivity and equity in everyday science learning, I had to tell her I was not sure it would.

We must also take note of the right-wing politics growing in countries across the world. Our societies face serious challenges, not least that in some places racism, class discrimination, sexism and other forms of oppression are far from subtle. In 2017 staff at the Smithsonian National Museum of African American History and Culture in the US found a noose left in a gallery (Lopez, 2017). A noose. Take a moment to think about that. Another museum colleague, this time in the UK, recently told me racist and sexist abuse seemed to be growing in their visitor feedback and comments, on evaluation forms as well as on their website. At the very least then, organisations involved in everyday science learning must find a way to speak back to the structural inequalities that continue to shape and influence them, since no response

looks alarmingly like institutional support for racism, class discrimination, sexism, other forms of oppression and their intersections.

My feelings of cynicism are closely related to my feelings of greed. Greed, because I want to write about the 'most' we could do rather than the 'least'. Greed, because I want so much more than to be able to list the few people, places, projects and organisations that centre their work on equity and inclusion organisations that, in doing so, appear somewhat radical against the backdrop of standard everyday science learning practices. I want people involved in everyday science learning to learn from some of the practices of organisations such as the Black Cultural Archives in London and Glasgow Women's Library (Black Cultural Archives, 2018; Glasgow Women's Library, 2018). I want an equivalent of the Guerrilla Girls for everyday science learning as well as science, technology, engineering and maths (Guerilla Girls, 2018). I want equity oriented change across the different fields involved in everyday science learning that does more than reflect a passing trend for politics and social justice, but that drives equitable change within and beyond these practices. I want these changes to be embedded, resilient, meaningful, widespread and sustainable.

Although I have explored issues of exclusion and equity in everyday science at length in this book, a series of uncomfortable questions remain in my mind, drawing on the work of people like Ortega (2006), Jennings and Jones-Rizzi (2017) and Puwar (2004). How can we build long-term, trusting relationships with the people and communities who hold the expertise to support community-centric practice? Can we relinquish enough control over content and practice that changes intended to support inclusion and equity are real, deep and sustainable? Can we acknowledge that we do not own scientific ideas, practices or the objects that embody these ideas? Can we, instead, own our ignorance and look for help?

And let's nor forget our histories and the legacy of oppression we operate within - are we trustworthy? As Elizabeth Rasekoala (2018) put it, "do not trust the naked man who promises you clothes". Can we make the changes needed to make everyday science learning equitable without appropriating the knowledges, practices, time and effort of partners whose help is sorely needed? How can we alter practices radically enough that a them/us, insider/outsider dynamic is transformed?

These are difficult, thorny questions. Addressing them means being active, being brave, taking a stance, building relationships, being patient and being humble. Everyday science learning holds vast potential for disrupting rather than reproducing social disadvantages. But the kinds of changes I am writing about, within and across everyday science learning fields and, if we are to be ambitious, within science and tech writ large as well as our societies, are no mean feat. I recognise the idealism inherent in writing about change in this way but I find comfort in the oft-quoted words of Lorde who wrote "revolution is not a one time event. It is being always vigilant for the smallest opportunity to make a genuine change in established, outgrown responses" (1984, pp. 140-141). From this perspective, each attempt to develop meaningfully inclusive, equitable practice, however small, helps us to learn more and embrace this challenge. What's more, from this perspective we can also see a way to think carefully about how everyday science learning practices could be used to support, leverage and campaign to work against the structural inequalities that shape our societies and the opportunities of those within them. I am still learning. And there is so much still to learn.

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[i] Questions of generalizability, transparency and reliability in qualitative research are much discussed in terms of methods. Indeed, as discussed in Chapter One, these can be useful questions to ask, not least to understand clearly the terms under which research is carried out. My point here is somewhat different. It is that these kinds of questions can, in my experience, be used to draw attention away from the experiences of racialised groups, especially those experiencing multiple and intersecting structural inequalities, who are written off as extreme outliers.