When I first introduced my research on gender and the ‘making’ of computer scientists in Singapore to one of the computer science classes where I would be conducting participant observations, the professor interjected and asked if I was looking to talk only to women. I explained that I was looking to talk to everyone, towards a broad understanding of gender in computer science. This example, however, was not the only time that my research about gender was initially taken to be exclusively about women. In another course, when the professor sent an introductory email to students on my behalf, he prefaced it by explaining: ‘We in Singapore are slightly more “blessed” in that our gender gap in computing is not as skewed as that in other countries, but that also makes us an interesting case study too.’ Here, the lack of women compared to men in the form of the ‘gender gap’ was how this professor interpreted my research.

I had assumed when starting my research that the so-called ‘woman problem’ in computer science – that is, the common question of ‘why are there fewer women than men in computing and other science, technology, engineering, and mathematics (STEM) fields?’ – would indeed spark shared interests between myself and computer science students and professors. The relative dearth of women in computer science compared to men has been a focus of much academic and popular research and debate. It has also been a common issue of concern for different groups and organisations, such as computer science departments seeking to increase the number of women in their programmes, tech companies that want to present themselves as gender inclusive, and individuals whose genders are marginalised within the discipline. What I did not anticipate was how my research was continually reframed by others in terms of this question and how that shaped my own under-
standings of my research during my fieldwork. This article examines the complexities and challenges relating to doing fieldwork on gender while ‘studying up’. In doing so, I highlight the ways that epistemological hegemony can affect and shape ethnographic fieldwork. I argue that reflexive practices and fieldwork support should include explicit attention to the epistemological dynamics and implications – both personal and academic – of ‘studying up’.

I first discuss some of the key ways issues of epistemology and studying up have been considered in anthropological methods and practice. I then turn to my own experiences during fieldwork. I show below how pursuing ethnographic research from a feminist and queer perspective entailed grappling with hegemonic norms regarding gender in computer science, which presented a challenge in maintaining my methodological and theoretical perspectives throughout my research. I discuss the construction of these hegemonic norms and what contending with them meant in practice when conducting my research. In particular, I explore, in the context of my research on computer science education, how gendered epistemological contexts shape the questions that can be asked – and are even thinkable to ask – for research on gender and computer science. I conclude by returning to a consideration of the epistemological implications of studying up for conducting ethnographic research on gender and computing and for anthropology more generally.

**Studying Up, Epistemology and Anthropology**

Laura Nader (1972) introduced the concept of ‘studying up’ in anthropology to argue that researching powerful institutions and actors provides valuable and necessary insights not available through the classic anthropological approach of studying those who are or have been ‘othered’ and disempowered.

Nader argues that by studying up anthropologists can discern the meanings and practices of those operating within and through often opaque institutional and cultural systems, providing a means to critique operations of power. By studying up anthropologists have interrogated the values of AI researchers (Forsythe 2001), the cultural practices of Wall Street bankers (Ho 2009), and the organisational practices of think tanks and policy professionals (Garsten and Sörbom 2018), among many other possible examples (e.g. Cohn 1987; Irani 2019; Myers 2015), which have contributed to understanding and interrogating local and global(ising) scientific, technological, financial and political systems.

Epistemological dilemmas have previously been highlighted as a key matter of concern in the context of studying up and, specifically, of the anthropology of experts (Boyer 2008; see also Holmes and Marcus 2005). Feminist and queer studies researchers have also explored tensions in conducting research with participants, who are often in privileged or powerful positions and whose perspectives diverge from their own (Cohn 1987; Forsythe 1999; Lewin 2016). These tensions tie into longstanding debates in anthropology around cultural relativism and the role and relations of ethnographers to research participants (e.g. Abu-Lughod 1990). Yet, in discussing his experiences studying investment bankers, Dan Souleles (2021) highlights how studying up requires a re-thinking of both anthropological theory and ethics.

Souleles (2018) also highlights the need for and provides examples of strategies for researching people who are ‘hard-to-access’. He points out how common ethical approaches in anthropology presume ‘a sort of power dynamic between the researcher and those they study such that the people studied need to be protected from the researcher’ (2021: 209). Similarly, long-term participant observation is meant to give access to participants’ social and cultural life while anthropologists are meant to guard against prioritising their own voice over that of their interlocutors. Without reproducing any strict divisions between anthropologists versus research subjects, this classic anthropological approach does not consider the ways that anthropologists may also need to examine the implications of and work against prioritising and reproducing hegemonic worldviews or epistemologies from the field. I now turn to discussing my own experiences during fieldwork to highlight these challenges.

**Heteronormativity in Computer Science and in Singapore**

My research was an ethnographic study of undergraduate computer science education at a large public university in Singapore, which I am calling Temasek University, conducted for my PhD dissertation (Breslin 2018). This article is based on my experiences conducting fieldwork for this research over 11 months, primarily during the 2013–2014 academic year. This consisted of participant observation in an undergraduate computer science programme and particularly attending eight computer science classes...
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(four each semester) covering all undergraduate course levels and including lectures, labs, and tutorials, along with a variety of events in the department, university, co-curricular groups such as the student hacker group, as well as events by Singaporean tech communities. I conducted in-depth semi-structured interviews with 30 students and 13 professors, and an additional seven interviews with administrators, professionals, and industry recruiters. I also collected and analysed relevant Singaporean and tech news media, government policies, and computer science curricula at Temasek University and guidelines produced by organisations such as the Association for Computer Machinery (ACM). This article and my fieldwork are also informed by my own experiences as an undergraduate computer science student in Canada several years earlier.

Beginning my research, I wanted to understand how gender is made and remade through computer science knowledge and practice in undergraduate education and in students’ everyday performances (Barad 2007; Butler [1990] 1999), while recognising that identities are situated, multiple and partial (Haraway 1988). I thus sought to understand the construction of gender without taking masculinity and femininity as predetermined, but rather that gender categories and gender norms are produced through ‘intra-actions’ (Barad 2007).

Once I started my fieldwork, it quickly became apparent to me that there was a pervasive assumption of binary genders and heteronormative relations in computer science knowledge and practice, as well as in Singaporean governance and social norms. These assumptions are precisely what I was interested in exploring for my research. Performances of heteronormative gender binaries were common in computer science in terms of language usage, teaching practices and examples, and the construction of computer science knowledge, and in Singapore in terms of government law and policy and everyday practice. For example, commonly used phrases by professors in class such as ‘good morning boys and girls’ asserted an immediate distinction between ‘boys’ and ‘girls’ and erased other gendered possibilities. Gender/sex (treated interchangeably) was also used as an aspect of social reality to be drawn on as a resource for teaching examples, such as drawing ‘male’ and ‘female’ stick figures as part of an early programming exercise. In some cases, gender distinctions were taken as directly illustrative of mathematical or programming concepts, such as the example employed by one professor of ‘girls’ and ‘boys’ as a ‘partition’ that separates a set into subsets where every element fits in exactly one of the two subsets or categories.

Similar gendered examples and illustrations were used by different professors for multiple and different concepts. That is, heteronormative gender binaries were taken as a given and, more generally, would casually and implicitly be used by students and professors in ways intertwined with their understandings and conceptualisations of computer science knowledge. This occurred in different ways across the majority of courses I observed and beyond; it was also seen, for example, in showcases of student projects, departmental social media posts, along with broader disciplinary knowledge seen in textbooks, tech developments and tech news (see Breslin 2018). In the few instances where gender was addressed explicitly, this was often in relation to events or groups focused on women in computer science, such as advertising the annual Grace Hopper conference or a recruitment event for women being held by a multinational tech company. I was told by students of one or two core courses that had policies on forming groups so that each included women and one exceptional upper-year course that offered a ‘5% advantage’ in the form of a grade bonus ‘for female student … if none of the male students has objections’ as only three female students had been enrolled in the course over ten years. Temasek University also publishes ‘male’ and ‘female’ enrolment statistics for programmes at the university, including computer science, where at the time of my fieldwork students categorised as female accounted for 30% of those enrolled.

In addition to this normalisation in computer science and the University, government law, policy and discourse in Singapore similarly rely on assumptions of heteronormativity. Homosexual acts between males remain illegal under Section 377A of the Penal Code 1871 ‘outrages on decency’ and marriage between persons of the same sex is not recognised (Singapore Statutes Online 2021, 2022). While in practice the law is no longer enforced, recent attempts to have it repealed have also failed. Transgender and nonbinary people in Singapore face many barriers from legal and medical systems, which limit access to gender-confirmation surgeries and other forms of treatment and create mismatches between identities, bureaucratic systems and legal documents, and contribute to marginalisation and discrimination (Ho et al. 2016). Policies requiring or assuming heteronormative gender and sexuality are also found across a variety of other facets of government regulation, including housing and taxation (e.g.)
Talking About Gender

As I sought to explore the construction and production of gendered norms and boundaries, in introducing my topic and interviewing students and professors I worked to keep my language open. I would ask whether they thought gender was relevant to computer science and in what ways. My questions, however, were widely interpreted as asking about the role of and difference between men and women in computer science. A Singaporean student in her third year, for example, suggested that men were more ‘passionate’ but women were more ‘hard working’, offering a contrast, but one that seemed to support the idea of equal but differing capabilities. Another first-year Singaporean student similarly relayed a discussion she had with a friend:

My friend and I talked about it like last week … so we discussed about how’s life and stuff like that and how’s the programming going … and then she was saying that guys are actually better at programming. And then somehow they are just quicker at solving problems and stuff like that, but I kind of disagreed with her, because I feel that girls can do programming as well, not just guys because it’s just all about the way you look at things. Because, I mean guys and girls are different definitively. Like they think – they look at things differently. Maybe the guys might be quicker to solve programming because how their mind works, maybe we look at things more complicated so that’s why take a longer time to finish programming.

The specific differences varied among responses, but with the repeated premise that men and women (or male and female, often used interchangeably) are different, treating gender and these traits as an essentialised binary.

I began asking about gender differences in my interviews and about the comparatively few number of women in computing because it seemed one of the few ways many people were willing to speak about gender norms without an obvious sense of confusion or discomfort. Doing so elicited responses on different qualities for men and women that were seen as ideal for computer science. ‘Actually it’s kind of weird, because I like to think that girls are generally more meticulous, so they can do well at this, just off the top of my head’, Ping, a fourth-year Singaporean student, expressed when I asked him why he thought there might be fewer women in computer science. These responses are similar to those where my questions were kept more broad and general in relation to gender. While not always easy to categorise, among students approximately 50–60 percent of interviewees expressed clear and explicit gender or sex comparisons in terms of inherent qualities, skill or interest in computing. Another 30 percent discussed differences in behaviour (e.g. enrolling in different types of courses) or relayed general perceptions of gender differences.¹ The remaining interviewees simply asserted there were no differences between men and women in terms of computing. The majority of responses closely resemble those in academic literature that examine, measure and compare men’s and women’s qualities, abilities and interests (e.g. Beckwith and Burnett 2004; Dambrot et al. 1985; Turkle 1988). These answers provide insights in and of themselves about how participants see and understand gender and, specifically, about the construction of femininities and masculinities. Yet, they also reveal a gap in perspectives and politics between myself and my research participants.

While students and professors were generally willing and open in speaking with me, few showed much interest in the details of my research. The ongoing issues of disparate numbers of women in the discipline, however, were known to many participants, even if the disparity was not as marked in Singapore as in

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the USA or Canada. The issue therefore did provide a means of interpreting my research for participants, as I thought it might. It also presented a partial connection that my participants and I shared. A few participants also discussed biases against women in computing, similarly offering a partial shared matter of concern, but the discussion did not extend beyond reporting on things students had heard about, experienced or said. To the extent that discussions of numbers, differences or biases stood in for gender analysis, it also stopped discussion in a variety of ways. Given an opportunity, I would clarify that I was looking at both men and women (sometimes saying other genders as well) and was taking a broad approach to gender and its role in computer science, yet that was generally the end of the conversation. This was partially a matter of time; both students and professors seemed constantly busy and overloaded with work and activities. Yet, to extend the discussion would have also meant elaborating on gender theory. There were few circumstances where this seemed appropriate since it would have prioritised my perspective over that of my participants. It also would have meant contesting the discourse of the Singaporean government and implicitly critiquing a variety of practices of professors in teaching and doing computer science, professors who had been generous enough to let me observe their classes and their teaching.

In taking a queer approach to gender, I was actively trying to leave open these binary constructions as they are reproduced in social science literature as much as in computer science knowledge and practice. Yet, by asking directly about gender differences, I was accepting and reproducing the naturalness of such distinctions, and certainly led interviewees towards that direction of discussion. The translation of research between informants and participants is, of course, a common occurrence in fieldwork. In doing research, anthropologists and their work are often interpreted in different ways based on the social and cultural contexts, as well as on personal relationships and individual and community goals (Kondo 1990; Reddy 2009). In many ways, this type of translation is a necessary part of doing fieldwork. Yet, in addition to this translation, the context of studying up also shaped the ways I was able to think about and approach gender in my research during fieldwork.

**Believing in Heteronormative Problems**

The translation of my research to be primarily about women in computer science, or about differences between men and women, occurred partially as a process of rendering it into a framework that fit within institutional and disciplinary norms. In particular, it often entailed a translation into a problem-based framework. Doing this translation work, however, also started to shape my own thinking which began to shift to operate within this framework and became remarkably hard to think around.

As I joined various computer science classes for my fieldwork observations, I remember feeling that what was being taught seemed so normal and natural. I recognised and understood the material from my undergraduate studies, although it had been at least five years since I had done any substantial programming. Thus, while I took fieldnotes that included the content of computer science knowledge, at the time I did not – or possibly could not – think to question it. During observations, I was more interested in how computer science was being taught and learned. I simultaneously felt as though I had forgotten all of my anthropological theory. It did not seem to make sense in the context of computer science.

In the introduction to her book *Crafting Selves: Power, Gender, and Discourses of Identity in a Japanese Workplace*, anthropologist Dorinne Kondo evocatively recounts her experience of shock and mis-recognition on spotting her own reflection in a shop display case near the end of her fieldwork (1990: 16–17). Kondo explains how she experienced a collapse and fragmentation of her identity as her sense of self was being rewritten in order to ‘make’ her Japanese (1990: 17). Kondo’s experiences point to the shifts in identity and senses of self that can often occur through long-term ethnographic fieldwork as ethnographers immerse themselves and actively seek to become enculturated as part of the practices, daily lives and routines, and social interactions of those they are studying and working with. The flip side of this immersion is how it shapes the multiple facets of our identities. As Kondo recounts, ‘I became “the Other” in my own mind, where the identity I had known in another context simply collapsed’ (1990: 16). Although I never experienced this self-othering, increasingly throughout my fieldwork I had this nagging feeling that I could no longer really think like an anthropologist and I had forgotten (or had lost) the purpose and meaning of my research.

At the same time, I was continuously asked what I was trying to find out, to answer. What was my hypothesis? My response that I was interested in how gender is involved in computer science felt unsatisfactory, insubstantial. There was no problem to solve, except when my research was frequently...
reinterpreted as being about the lack of women in computer science. As my research continued, I also began to think about how I could go about proving or predicting various suppositions, for example that women more than men pursued careers in fields other than computer science following their degrees. That is, I was beginning to think about research more in numerical and statistical terms to solve a problem, rather than in terms of students’ experiences, values and behaviours. I was thus coming to reinterpret my research and myself to ‘fit’ in computer science. This shift in perspective often implicitly entailed accepting norms about gender, and about how to do research on gender in computer science.

In relation to conversion among fundamental Baptists, Susan Harding explores ‘the consequences of listening’ (1987: 168). She shows how conversion works as a process of acquiring a specific religious language and that if a person is willing to listen, then they have begun to convert; they have begun to move across the space between non-belief and belief (1987: 178). I have previously discussed the idea of ‘the consequences for listening’ in relation to engineering educators working to implement change towards incorporating more sociotechnical content and context in an engineering curriculum as part of a grant. We show how the grant structure produced the circumstances for some engineers to be required to listen and thus become open to and begin to adopt the goals of the grant, to which they had not been previously committed (Breslin and Camacho 2021).

In relation to my fieldwork in computer science, while sitting in classes and listening to the discussions about computer science knowledge, and trying to fit in with computer scientists, I was accepting, believing and performing the reality constructed through computer science knowledge, which was all the more familiar and believable to me because of my own studies in computer science as an undergraduate student.

In the computer science system of belief, ‘reality’ can be and is rendered and framed in terms of problems with technical solutions. Such problems only need to be made explicit, broken down into smaller parts, each with particular, logical and detailed steps to solve according to the various algorithms, data structures and programming languages that students have learned, along with each student’s own ingenuity and passion – a process that I refer to as ‘rendering technical’ (Breslin 2018). These technical solutions are presented as a ‘natural’ part of human practice and thought, distinct from social/cultural practice, as has similarly been discussed in relation to a variety of technical and scientific practices and even of all of ‘modernity’ (e.g. Haraway 1997; Latour 1993; Mayhew and Patitsas 2021). That is, the hegemonic epistemology in computer science entails practices of rendering technical, which shape the possibilities for thinking about what are valid or real problems in computer science and in the world. This epistemological approach demands a problem to solve; in other words, a solution must be possible in order to provide an area for intervention.

While I was not fully participating in the same education process as those enrolled as undergraduate computer science students, with ongoing assignments and tests marking my progress, although I had already done this in the past and did write a few exams as part of my fieldwork, I was nevertheless coming to believe in computer science ways of knowing. Through this process, heteronormative assumptions about gender and practices for rendering technical problems and solutions were reconfiguring how I thought about and approached gender in computer science and my research about it. In particular, I was often implicitly reconfiguring my approach to gender to focus on ‘women in’ computer science (Faulkner 2000), where a problem and solution can be formalised and quantified.

Ethnography in/of the Hegemonic

In planning my research, while I thought the topic of women in computer science could provide a connection and shared concern with participants, I was determined not to be ‘drawn back into the heteronormative black-hole’ of focusing on statistics and the numbers of women, as I wrote in my initial research proposal. Yet, the hegemony of gender binaries and problem-based approaches in computer science and in Singapore made this a difficult endeavour, one that often felt impossible while actually doing my fieldwork and speaking with people every day who would translate and reconfigure my research, my perspective on gender and my perspective on knowledge production. In particular, the binary comparison between men and women that is a central part of this ‘problem’ shapes the types of questions that can be asked and the types of solutions or interventions that are possible. As such, while many (myself included) may start research with the intention of avoiding questions of women in computing, the possibilities for thinking, communicating and doing research on gender in computer science are continually redirected to questions of comparing ‘opposite’
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The intersections of heteronormativity and practices of rendering technical – that is, the hegemonic epistemology in computer science – structured ‘the possible field of action’ during my research for understanding and approaching gender and computing (Foucault 1982: 790).

The challenges that I faced in following a methodological and theoretical approach that grates against categories of practice and hegemonic gender norms, as a person who otherwise mostly fits within those norms, are negligible in comparison to (but provide insight into) the experiences of those who inhabit identities marginalised in computer science and by the Singaporean state. Yet, as I discuss above, these norms in conjunction with (and as part of) the hegemonic epistemology of computer science do have consequences for conducting research in the context of studying up. That is, they impacted the ways I was able to think about and conduct my research during extended participant observation. Concerns in anthropology over ‘going native’ have been rightfully critiqued and anthropologists and feminist scholars have highlighted the partial, multiple and situated ways anthropologists relate to their interlocutors in the field (Hanson 2018; Haraway 1988; Narayan 1993). As such, I seek not to reproduce strict divisions and distinctions between anthropology and anthropological subjects, and partial connections with participants sharing an interest and concern about women’s role in computing did indeed provide a means of connection. But I also seek to highlight how the power dynamics entailed in studying up reshape the challenges and risks of doing fieldwork. As Souleles (2018, 2021) suggests, more practical discussions around fieldwork and ethical practice are needed in these contexts, including in relation to navigating hegemonic norms and values of the field at hand and the implications for our epistemologies in research.

In my case, the time for detailed coding of my fieldnotes and interviews, and re-reading anthropological and Science and Technology Studies research and theory, was essential in rebuilding my sense of self and theoretical direction. It was the process of carefully sifting through and coding my fieldnotes and interviews that helped me recognise the ways that I was ‘summoned’ to think and behave in particular ways (Kondo 1990; Mahmood 2005). This also emphasises the necessity of thorough fieldnote-taking and coding practices. The process of analysis, however, was also essential for untangling the nuances of gender performance and hegemonic practice more broadly, thus enabling me to explore and interpret the many subtle ways that students and professors interpreted their gender identities while learning and doing computer science, and the struggles they face in becoming computer scientists.

While many of my participants presented and asserted themselves in categorically normative ways, some students also interpreted and performed gender in ways that subtly worked around hegemonic norms. One student, for example, told me of how she felt feminine in certain circumstances but not others. Or, while explicitly denying that there was any issue relating to gender in computer science, as we discussed gender in the abstract, another student expressed her struggles with the time and dedication that computer science demands when she has a vast array of other interests and aspirations. In maintaining or rebuilding a feminist and queer epistemology and approach to gender as I did my reading and detailed coding, I was able to acknowledge and explore these complex assertions and enactments of gender. That said, this process is ongoing, and I am continually negotiating how my perspectives on computer science, gender and knowledge production have been shaped and reshaped by my embeddedness in both anthropology and computer science.

Conclusions

‘Studying up’ in anthropology is valuable for examining and understanding the operation of power, which also entails recognising and interrogating the norms and inequities in which research participants and researchers are interpolated. I have discussed my own experiences during fieldwork to highlight the personal and academic challenges involved with studying up and contending with hegemonic norms and epistemologies and how this brings particular risks. Within the epistemologies of computer science, ‘reality’ can be rendered technical and framed in terms of problems and solutions. This works to shape research – even when starting with a queer and feminist approach – and redirect it towards framings based on questions around ‘women in’ computer science. Such framing relies on and reproduces assumptions of heteronormative and essentialist gender binaries, tied to and supported by the hegemony of heteronormative gender in computer science and in Singapore. Yet, in the context of ‘studying up’, this hegemonic epistemological context contributes to governing ways of approaching research and to approaching gender in computer science.
More generally, ‘studying up’ brings the risk of anthropologists reproducing hegemonic epistemologies in losing grasp of one’s own analytical approaches and theoretical perspectives. Such reproduction could shape our fieldwork, but also ourselves, our research conceptualisations, research insights, and writings. I highlight how I have worked to rebuild my original approaches and address them in the analysis of my fieldnotes and interviews. My experiences, however, highlight the need for more detailed examinations and discussions of power dynamics, how these shape the epistemological risks of fieldwork while studying up, and how we grapple with and respond to these in fieldwork and in writing. Without attending to the ways hegemonic epistemologies become integrated in our fieldwork experiences and in ourselves, anthropologists also run the risk of leaving the construction of hegemonic ways of knowing – and their forms of governance – unquestioned.

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Notes


2. In a variety of computing contexts, researchers have similarly shown how heteronormative assumptions are written into and enacted by different technologies, such as image and facial recognition (Keyes 2018), the design of forms and databases (Bivens 2017; Spiel 2021) and dating programs (Hicks 2016). Gender is thus taken and instantiated in computer science as a hetero-cis-normative construct, with implications for both technologies and people involved in computing.

3. Some students’ responses were complex, where students who discussed seeing clear and essentialised binary gender differences also held multiple and complex approaches to their own gender identities.