(Dis)embodied masculinity and the meaning of (non)style in physics and computer engineering education

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ABSTRACT

Physics- and computer-related disciplines are strongly male dominated in Western higher education. Feminist research has demonstrated how this can be understood as reflecting a strong privileging of mind and rationality (over body/nature/emotions) in these disciplines, which harmonises with broader notions of masculinity as transcendental and disembodied. However, as we demonstrate in this paper, being recognised as legitimate in these fields is also tightly connected to embodiment. Drawing on post-structural gender theory, we explore how notions of corporeality, style and aesthetics are articulated within computer engineering and physics settings at two higher education institutions, one in Canada, one in Sweden. Using empirical data from two case studies, we demonstrate that these disciplines are usually understood as ‘gender neutral’ by students but that interest and competence in these fields are simultaneously understood as embodied through neglect for style and corporeal aesthetics, in ways that contribute to the masculinisation of these fields.

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Introduction

In a Western higher education landscape where women are in the majority in most fields, physics and computer engineering stand out as two fields where men remain over-represented (Corneliussen 2012; Gonsalves 2018; OECD 2015). The masculine orientation of these fields is particularly marked, even when compared to other fields within STEM (science, technology, engineering and mathematics) education (Rosser 2018). This is surprising given that both physics- and computer-related disciplines are traditionally conceived as highly abstract and ‘immaterial’, or as Traweek (1988) formulates it, marked by a ‘culture of no culture’ (162). A common understanding within those fields is, consequently, that they are unaffected by differences anchored in the body (cf. Corneliussen 2012; Keller 1992; Wajcman 2004). A large body of scholarship within feminist science
studies and feminist technology studies has, however, demonstrated how gender indeed matters in these disciplines (e.g. Bug 2003; Harding 1986; Rolin 2008; Traweek 1988; Wajcman 1991). That these fields continue to be strongly male dominated is often explained as reflecting a gendered mind/body split, well explored in feminist classics like Lloyd’s *The Man of Reason* (1984/1993). As Lloyd demonstrates, Descartes conceived of the ‘radical separateness of mind and body’ (1984/1993, 41) to enable ‘egalitarianism in knowledge’ (44) because it eliminated from Reason all forms of knowledge that involved the body or habitual skills. Positing that ‘the sciences consist entirely in the cognitive exercise of the mind’ (42) was for him a way of making knowledge accessible for all. Despite this inclusive intent, Lloyd argues that the lasting influence of Descartes’ method was to reinforce the alignment of the mind and reason with maleness in Western philosophy, while the body and emotionality/irrationality is aligned with femaleness.

We suggest that such lines of reasoning are particularly relevant to fields like physics and computer engineering, where the privileging of mind over body is strongly emphasised. However, it is not obvious how these philosophical investigations of the history of Western ideas can be translated into insights that would help us understand and research actual settings. We must take care not to assume before investigation that people in a particular setting equate mind, reason and cleverness to masculinity. Instead we need to deliberately investigate whether this is the case; otherwise we will simply ‘discover’ what we had already assumed before investigating. Lloyd is herself critical of such empirically insensitive appropriations of her work, and argues that:

> The maleness of reason belongs properly neither with sex nor with gender. Its proper subjects are not men and women but concepts and principles […] The symbolic content of maleness and femaleness cannot be equated with socially produced masculinity and femininity. *(1984/1993, ix)*

Lloyd suggests, therefore, that the symbolic links between maleness and reason manifested in Western philosophical discourse on the one hand, and socially produced masculinity and femininity on the other, is a relation that needs to be explored through interdisciplinary enquiry (see Rolin 2008 for a similar argument).

In the following article, we will engage with such an exploration empirically. Drawing on two previously conducted case studies of physics and computer engineering education respectively, we will engage in an analysis of patterns in patterns, i.e. try to pinpoint cross-cutting themes and commonalities between settings, in order to tease out what underlying cultural logics might begin to explain these. We are inspired by Paechter’s (2006) call for increased attention to ‘the body as a dressed and decorated object’ (131) in educational research, and her argument that it is critical to attend to the ways that legitimacy and membership in learning communities is connected to embodiment. As such, we will attend to corporeality and specifically to such aspects of the body that relate to aesthetics and style. As we detail more explicitly below, we address these themes from a post-structural perspective, which means that we are not primarily interested in investigating how pre-categorised male and female students relate to their respective discipline. Rather, we interrogate what it means to be involved in computer engineering and physics, and how this is connected to gender through discursive practices. Although computer engineering and physics are distinct fields with their own
disciplinary specificities, they also share interesting similarities in gender patterns worthy of further scrutiny (cf. Gonsalves 2014, 506). This article investigates these similar gender patterns and the way they relate to gendered ideas about mind as male and body as female. The research questions are:

(1) How are students’ perspectives of physics and computer engineering shaped by discourses of gender?

(2) How do notions of embodiment and corporeality, particularly as articulated through style and appearance, relate to the gendering of student subject positions within these fields?

Research context

Previous research on gender in both computer engineering and physics education has highlighted the importance these fields place on intelligence, and ‘being smart’, i.e. strongly privilege mind over body (e.g. Gonsalves and Seiler 2012; Wong 2016). This is often taken as an explanation for the masculine orientation of these fields, because we know from previous research that the mind/body split carries gendered connotations. As Rolin (2008) argues, there is, however, a need for more research into real-world educational contexts that empirically explores how the mind/body split becomes gendered, and is made relevant.

Recent research that has addressed how embodiment and corporeal aesthetics relate to the gendering of STEM education has focussed on ‘hyper-femininity’ in STEM contexts (Dawson et al. 2020; Francis et al. 2017) – associating it with compulsory heterosexualised femininity (Rich 1980) or pretty, popular forms of femininity (Read, Francis, and Skelton 2011). The ‘girly girl’ is an identity position emerging in recent research in STEM education, which is constructed in opposition to identities for physicists or computer scientists. Research exploring the ‘girly girl’ in physics cultures has demonstrated the denigration of stereotypical femininity in relation to physics cultures from K-12 all the way through to the doctoral level of education (Francis et al. 2017; Godec 2018; Gonsalves 2014). Similar patterns have been identified in relation to engineering. For instance, Kvande (1999) has discussed informants’ impressions that ‘a female graduate engineer cannot dress in lace and frills because she won’t be taken seriously’ (305) and how such sentiments reflect the ‘very limited ways of constructing femininities’ (325) in engineering organisations. This resonates well with studies that have demonstrated how the perceived masculinity of computer technology is tightly connected to neglect for the body (e.g. Ensmenger 2015; Turkle 1984/2005; Wajcman 2004).

Gonsalves (2014, 2018) provides examples of doctoral students distancing themselves from ‘girly-girls’ in order to position themselves as insiders to physics. In distancing themselves from girly-girls, they assert their difference to ‘other’ (non-physicist) women (see also Danielsson 2012; Tsai 2004). Informants also characterised stereotypical femininity as incompatible with physics and asserted that performances of femininity might be interpreted as a lack of seriousness about physics, or an unwise investment of time and energy. Ong (2005) similarly describes students’ characterisations of femininity. Echoing the mind/body dualism, one university student suggested that ‘one cannot be attractive and think’ thereby constructing ‘scientific culture as intolerant of beauty and intelligence within a single body’ (605). Francis et al. (2017) and Godec (2018) have demonstrated...
how similar patterns shape secondary school physics contexts, where ‘superficial’ concern with appearance and ‘girly-girl’ femininity is constructed as in opposition with ‘hard’ and ‘serious’ physics.

As can be seen, several studies have highlighted how interest and competence in physics and computer technology are understood as something that can be read off the body. In this article we contribute to this discussion in two dimensions. First, through drawing on empirical material from both physics and computer engineering education simultaneously, we enable a discussion of what it is regarding these (and similar) disciplines that make them particularly ‘articulable’ to a certain form of masculinity. Second, drawing on the theoretical framework described below, we connect this to a discussion of the logics that underpin this particular form of masculinity. In this way, we also nuance the often taken for granted focus on femininity in discussions of style and appearance and connect this theme to a discussion of masculine bodies.

Theory and method

Post-structural feminist theory

We draw on post-structural feminist theory to situate this research (Butler 1990; Paechter 2006). Paechter (2006) has argued that as femininity operates asymmetrically and in opposition to masculinity, it is constructed as a position of powerlessness. Distancing oneself from femininity therefore becomes a way to claim power. She suggests that ‘to oppose stereotypical or normalised feminine positioning is to reject the disempowerment that comes with it’ (2006, 257). Feminist research in science also has a long history of drawing on the binary construction of gender to demonstrate how femininity is constructed in opposition to sciences, particularly physics (e.g. Ong 2005).

It is thus important to our analysis that we attend to power asymmetries in binary understandings of masculinity and femininity. However, we approach this perspective with caution, as we acknowledge that recent work in gender research has paid greater attention to gender fluidity. Francis and Paechter (2015) argue that gender performances can rarely be uniquely characterised as entirely ‘masculine’ or ‘feminine’, although, and especially in physics education, we see repeated examples of discrimination operating along these binary constructions (e.g. Francis et al. 2017; Traxler et al. 2016). We also recognise that individuals may not identify with local constructions of feminine or masculine in ‘expected’ ways. That is, some female informants might identify with perceived ‘masculine’ positions and also some male informants might dis-identify with particular masculine positions, even when these are highly valued in the local context.

Performativity, intelligibility and recognition

We also draw on Butler’s (1993) notion of gender as performatative. This means that we are interested in investigating the logics that produce gendered intelligibility, and the ways in which references to gendered norms produce gender as an effect. Butler (1990) argues that notions of intelligible gender are co-produced with sexuality in the heterosexual matrix. This perspective allows us to address a shortcoming in many studies on gender and STEM, namely a reluctance to problematise how heteronormativity shapes the
gendering of such fields (Landström 2007). In our analysis, we attend to the ways that sexualised logics are intertwined with and shape the production of gendered subjectivities in physics and computer engineering.

More broadly, we use post-structural gender theory to investigate the structuring cultural logics and norms that make some individuals identification with certain subject positions (e.g. men as ‘tinkerers’ or women as ‘rule-followers’) seem natural. This is in line with what discourse theorists Glynos and Howarth (2019) refer to as a retroductive analysis. This analysis tries to explain a problematised phenomenon by searching backwards for the logics that underpin the phenomenon or make it appear more intelligible. Further, our post-structural understanding of the subject aligns with science education researchers (e.g. Archer et al. 2010; Avraamidou 2019; Carlone and Johnson 2007; Gonsalves and Danielsson 2020), who have emphasised the importance of intelligibility and recognition for the successful performance of identity within disciplines (e.g. Lemke 2001). Identity work may take the form of bids for recognition as a certain kind of person (Carlone and Johnson 2007; Gee 2001), wherein recognisable identities in a disciplinary field are constructed in relation to gendered norms.

We combine this understanding of gender and subjectivity with a framework often adopted in feminist technology studies, namely that gender and technology (and in our case physics) can be thought of as co-producing categories (see Ottemo 2020). This enables us to investigate potential homologies between gender and discipline, that is, their ‘resonance’ and the cultural meaningfulness of their relation (cf. Middleton 1990, 9). We believe that by explicitly conceptualising the relationship between gender and discipline, we can avoid the risk of producing an analysis where the discipline is positioned merely as a background to students’ subjectivities. Thus, our analysis investigates links between discipline and the gendered formation of subjectivity. We acknowledge that these links are also shaped by other categories of difference, such as race, class, ability, etc. (e.g. Avraamidou 2019), but have chosen in this paper to focus mainly on the intersection of gender and discipline.

**Methods**

Methodologically, we draw on two already conducted case studies (Stake 1995) in two different national settings: a computer science and engineering programme at a Swedish technical university (CSE) and a physics department in a research-intensive Canadian university (PhysC). The CSE programme is a 5-year engineering programme awarding the equivalent of a Master’s degree. It is structured around a combination of engineering and computer science and covers both hardware and software-oriented aspects of computer technology. It has around 100 students in each year and usually recruits between 5% and 10% women and has done so for a long time. The programme was followed through a combination of participant observation in both formal and informal settings and ethnographic interviewing, with 10 male and 3 female students, all from year three being formally interviewed. Informants all resided within or close to the university town. They were chosen on the basis of being part of different loosely formed subgroups identified during field work, and hence to capture diversity in the group. Gender balance among informants was also sought, but was ultimately not achieved because of the low number of women in the programme. Semi-structured interviews were conducted after
the fieldwork and covered informants views on: their (educational) background; the education and the teaching they now received; technology and their discipline; student culture and gender as well as what signifies ‘typical’ students on the programme both when it comes to style/appearance and what it meant to be a CSE student more broadly. The themes related to student’s view of their discipline and of typical students are particularly central to this article (see Ottemo 2014, 2015 for further details).

The second case study takes place in the physics department of an Eastern Canadian research-intensive university. The doctoral programme followed is a typical research programme which takes students about 4–5 years to complete. 11 doctoral students (6 women and 5 men) from across the department’s three main research areas (astrophysics, condensed matter and high energy physics) participated in the study. Although the programme draws an international pool of students, all the students involved in this study were at the time residing in the same Eastern Canadian city where the university is located. Over the course of a year, participants were followed through observation in formal settings (e.g. laboratories, lab meetings, seminars) and informal settings (e.g. reading groups, coffee/tea gatherings, social events). Observations involved the collection of field notes which informed the construction of interview guides, designed to investigate the individual physics experiences of each participant. Participants were interviewed twice using semi-structured interviews (Kvale 1996) that focussed on episodes of recognition (e.g. Carlone and Johnson 2007), and moments when participants felt more or less like physicists. To capture how feeling like a physicist intersected with style/appearance, interviewees were prompted to describe episodes when they recognized themselves as physicists, or when they recognized others as physicists (see Gonsalves 2010 for details).

The empirical underpinning of the present article hence consists of ethnographic field notes and in total 24 transcribed semi-structured interviews. Each data set has been thematically analysed (e.g. Braun and Clarke 2006) and reported on individually based on these analyses (see Gonsalves 2010, 2014, 2018; Gonsalves, Danielsson, and Pettersson 2016; Ottemo 2015). It was on the basis of these publications that some surprising and detailed similarities between the first and second author’s empirical material were identified. Against the background of this initial inductive analysis and a shared theoretical orientation, we identified cross-context similarities between the datasets that were judged worthy of further scrutiny. Thus, the analytical method can be described as abductive in the sense that empirical similarities inductively sparked our interest in a joint cross-case analysis. This theoretically-driven stage of analysis was guided by a focus on (a) how students conceive of their respective discipline in relation to gender, and (b) how notions of embodiment, style and appearance relate to the gendering of student subject positions at the respective programme.

Writing across both disciplinary and geographical contexts in this way is not meant to suggest that we think of physics or CSE as universal cultures unaffected by local context. On the contrary, we agree with Mellström (2009) that relations between gender and discipline (technology in his case) can be understood as culturally embedded. For instance, Gupta (2015) has demonstrated how the mind/body split appears to have more pluralising than masculinising effects on IT technology in an Indian context. Gupta thus ‘questions the application of universal assumptions based on Western examples to countries in the east’ and argues that ‘the economic and socio-cultural context has a substantial role in defining the relationship between technology and masculinity’ (661).
While Canada and Sweden are arguably more culturally similar to each other than to, for instance, India, we still believe that cultural differences shape both gender, disciplinary cultures and their relations. However, we also find that the similarities between contexts make this analysis all the more interesting. In particular, we suggest that our cross-context investigation will enable us to highlight how similarities in understandings of disciplines connect to similarities in how typical students engaging in these disciplines are represented.

**Results**

Results demonstrate how most of our informants understand their respective discipline as manifestly or potentially *gender neutral*. At the same time, they acknowledge that being a student in their respective discipline is highly gendered and our analysis suggests that notions of corporeality and style are central to such gendering. While other themes also emerged in relation to the individual cases, three themes stand out as particularly salient from our cross-case analysis: The gender neutrality of the disciplines; Passion not fashion; and Gendering fashion.

**The gender neutrality of the disciplines**

Informants across the two cases conceive of physics and CSE as gender neutral disciplines. For instance, Carol (PhysC) explains that ‘usually when I am talking to anybody, it is like talking to somebody who doesn’t have a sex [laughter], everybody is just unisex it seems’. Alice (PhysC) further explains regarding her discipline that ‘I think of physics from a more gender-neutral perspective so that I don’t think of it as a masculine endeavor …’ Laura (PhysC) connects this gender neutrality to the rationality and objectivity inherent to the discipline, and suggests that:

Science has to be objective and rational, practically by definition. Just because men laid claim to science by pretending only people with penises could think rationally does not make this untrue. Any association of rationality with masculinity exclusively is imagined, along with the assumption that only men could understand politics, or money, or poetry, or anything else. […] A good scientist must be rational and objective, and this is not me accepting that science is masculine.

Such sentiments also resonate well with the importance of being ‘smart’ to be recognised as a competent physics student. Alice, for example, described being motivated to pursue physics because:

this is what I felt was the most difficult, most challenging thing I could do, and I liked a challenge. And I wanted to feel like I was smart and I wanted to feel like I was, you know, I wanted everyone else around to feel like I am smart too.

When it comes to CSE, the situation is similar. For instance, Douglas (CSE), echoes Laura’s view on science quoted above, declaring that ‘science is quite independent from who came up with it. There could exist an alien race without genders that came up with science’. Douglas here posits the bodily compartment of scientists as so irrelevant that even aliens could have come up with it. Such ‘mind-privileging’ is particularly pronounced in relation to CSE because it is conceived as a domain especially distant from its embodied
knowers. For instance, in the CSE department, employers that want to recruit students from the CSE programme publish posters on the student billboards, explaining ‘we want your brains, we want your hacking’, articulating computing as a purely mental endeavour. This works well because computer technology itself is largely understood as immaterial. As Derek (CSE) explains it ‘there is nothing physical about computers and therefore it is quite a gender neutral domain, you can be equally good at it regardless of whether you are a boy or a girl’. Daniela (CSE) goes so far as to suggest that CSE could potentially ‘be a very feminine area within technology’ because designing things for computers is a ‘very intellectual process’ that does not entail any particular strength. She therefore suggests that it is actually quite paradoxical that the CSE programme is among the most male dominated at her technical university.

As can be seen, the rational and mind-privileging aspects of the disciplines are, from our informants’ perspectives, largely taken to guarantee the gender neutrality of the fields. This resonates well with previous research demonstrating how computer technology is often conceived as immaterial and as such ‘beyond’ the body (e.g. Corneliussen 2012; Reagle 2018), while physics is understood as a ‘pure’ science affected only by a ‘culture of no culture’ (Traweek 1988, 62).

**Passion not fashion**

Given that students conceive of their disciplines as gender neutral, it is not surprising that when asked about the gender patterns that nevertheless shape these fields, they emphasise other factors. Among these, ‘image’ and ‘interest’ are particularly salient. Such characteristics are tightly tied to the notion that both CSE and physics are for ‘geeks’, and that a lifelong passion for and engagement in these fields is both assumed and highly valued. For instance, David (CSE) explains: ‘People who study here have grown up with computers and have their entire background … When we encounter a new subject, we just continue with our hobby’. Derek agrees and makes clear that ‘I was interested in computers long before I started studying here, for sure!’

Darin suggests that such passion is one of the characteristics that separate CSE students form other students at his university:

> Those who are most passionate about what they’re doing, that’s probably CSE students. […] Most people that study here, if they choose to study mechanical engineering, they have no experience with that, they come here, they learn, and they might change a bit. But a CSE student, a classical CSE student, has lived in this ‘world of computers’ all life, before applying here.

This lifelong passion for computers has been noted by Margolis and Fisher (2002) who consider this a central component in ‘geek mythology’, where typical students are represented as ‘in love with computers’ (65).

In our data, such engagement is central to being a CSE or physics student, and we also see it manifested in a form of neglect for style and aesthetics. Our data suggests that being a CSE or physics person is considered so all-consuming that style and corporeal aesthetics become peripheral, and, in a circular movement, not caring about style and aesthetics then becomes a signifier for being passionate about your discipline. For instance, Laura (PhysC) suggests that:
Hard-working theoretical physicists who get wrapped up in their work often look absentminded because they don’t pay much attention to their appearance—they are often seen with stains on their clothes or unseen-to tears.

Peter, another of our PhysC informants, suggests that the particular ‘style’ that such inattention to appearance results in, means that one can actually recognise fellow physicists in public even in the foreign context of a new city:

Yeah, it’s like, it’s very cliché, [outside of the convention centre] you see so many people who look like, kind of like these physics geeks. With everyone it’s always the same thing … they have this over-precise haircut, or the t-shirt put in the pants and then something, like at least one awkward thing, doing one awkward thing.

Similarly in CSE, David explains how one can recognise a fellow CSE student among other students at the school:

Well, you know … It’s this CSE guy, with a bit of a slacker posture and often sweatpants. And if you see someone at school, you recognise … Maybe I’m being caught up with appearance, but, I don’t know, generally CSE students seem a bit less concerned with appearance …

Dennis describes the dominating style likewise: ‘Sweatpants and a washed out t-shirt, preferably from a programming contest, that is the ideal here’, while Derek, more succinctly, suggests that: ‘Characteristic for the CSE student is a very poor taste in clothes’.

Many of our informants describe this neglect of style and aesthetics as more or less a by-product of a passionate preoccupation with their respective discipline. However, there are also descriptions in our data of how it actually takes effort to achieve this ‘non-style’ and supposed inattention to appearance and corporeal aesthetics. For instance, Laura (PhysC) tells that:

I know a girl who dresses in skirts and heels when at summer schools, but told me she never dresses up around her supervisor, so that he will think she is always working.

We interpret that it thus entails a certain reflexive effort on the part of some students to actually achieve an appearance which demonstrates that one does not attend to style or aesthetics, because all one cares about is physics. Dave (PhysC) echoes this deliberate effort. He suggests that ‘physicists like to be different from other people’ and refers to the ‘uniform’ for astrophysicists commonly seen at Astro meetings:

You go to a physicist meeting and what really characterises a physicist is wearing sandals with white or gray socks with the t-shirt of the last observatory they’ve been observing at and that’s like, so typical.

Ruby also refers to the astrophysicist ‘style’ and suggests that physicists ‘don’t mind when their personality quirks show’. For Ruby, adopting the astrophysicist style of socks and sandals is a way of signalling her insider-ness. She describes going to astrophysics meetings where attendees joked ‘they will recognise us by our sandals’ and she states ‘yes, sometimes wearing sandals makes me think, feel like a physicist’.

Our interpretation that non-style can in fact be considered a cultural value and something that is cherished, rather than an incidental by-product of being passionate about CSE or physics, is supported by previous research. In her studies of computer culture at MIT, Turkle (1984/2005) identified notions circulating among students that the body is
not to be valued because it is merely a ‘flesh’ thing. She further describes an annual contest meant to select ‘the ugliest man on campus’:

For several weeks, the students who think of themselves as most ugly parade around the main corridors of the Institute, wearing placards that announce their candidacy. They flaunt their pimples, their pasty complexions, their knobby knees, their thin, undeveloped bodies. (Turkle 1984/2005, 183)

As can be seen, disavowing style and corporeal aesthetics is not so much an unconscious by-product of being consumed by computer technology, but rather something that one reflexively plays with and to some degree cherishes. Turkle also interviews the founder of this contest, who explicitly connects the meaning of such degradation of the body to sexuality:

Everyone knows that engineers are ugly. To be at Harvard is to be a gentleman, to be sexy, to be desired. To be at MIT is to be a tool, a nerd, a person without a body. The contest just makes irony of the obvious. (1984/2005, 183)

We will return to this theme in the analysis section below. Here, we wish to emphasise that the form of disembodied masculinity associated with not caring about style and appearance is not a comfortable position for all male students. This becomes apparent when interviewing Dexter, a CSE student who is always neatly dressed and obviously cares about style and appearance. When asked if he considers himself representative of the CSE students he answers:

I hope that I am. I think that CSE students should project an appearance of being well-kept, and that he knows his computers but is not married to them.

Interviewer: Is this the case?

No, no! I do not want the perception to be that if you are a CSE student you are also fat, have a beard and a pony tail and like to play computer games. I really wish that that image, which is unfortunately still prevailing, I wish it would go away so that we can form a new image.

One interpretation is that Dexter does not share the dominant ideas of how one should enact masculinity at the CSE programme. Possibly akin towards more ‘metrosexual’ notions of masculinity himself (cf. Haywood et al. 2017), he recognises that he cannot be considered to represent the students at the programme.

An interview with Darin similarly identifies how masculine ideals that diverge from the prevalent disembodied ‘geek’, circulate among some students in the CSE programme. When asked about the male dominance in the CSE programme, he responds paradoxically: ‘It is a male dominated programme – without men’. We interpret here that Darin acknowledges the numerical dominance of men at the programme but simultaneously wants to distance himself from the form of masculinity they enact. His idea of masculinity is different, and hence he can understand the programme as male dominated but does not see other male students as enacting ideals he associates with men. In this way, both Darin and Dexter challenge a simplified binary understanding of gender.

**Gendering fashion**

As can be seen, caring about appearance and style is not something one expects from students at the CSE programme nor in the physics environments we have investigated.
Through a combination of disavowing and at the same time gendering such interests, aesthetics and style were portrayed instead as feminine interests and positioned in direct opposition to being interested in technology and physics. For instance, Diana from the CSE programme suggests:

A girl who is really into fashion would probably find the program really boring […] You’ve got to have an interest in computers, and if you do, you are kind of ‘boyish’. Of course, as a girl at the program you could probably like computers and still have an interest in fashion, but you cannot be the stereotype who only likes to shop. People like that would find the program really boring because they’re oriented in the completely opposite way.

Such sentiments are also reflected in Diana’s reasoning around gender more broadly:

When I think of a typical girl, I think of someone with an interest in clothes and such things, and also that one recognises if your friends have gotten a haircut and similar things, eh, you kind of pay attention to such details. Whereas boys, that feels a bit more like, I don’t know, typical for boys … it is cars, it is computers.

Douglas (CSE) reasons similarly, and explains that: ‘To be feminine is to go shopping for clothes. To be masculine is to go shopping for unnecessary gadgets [laughs]’. These socially conventional ways of articulating femininity through attention to appearance and style are understood among informants, but at the same time marginalised within the programmes we investigate. For example, when discussing the reception of new students to his programme, David, a CSE student explains:

Among the new students this year, a completely new kind of girl showed up, you know, blond and cares about her appearance. That is not so common among students at the program. Girls here are typically less obsessed with appearance …

As can be seen, David here acknowledges the presence of women at his programme but suggests that they usually adhere to the same norms regarding corporeality and style as described in the previous section. When girls that ‘care about’ appearance show up at the programme, this represents for him ‘a completely new kind of girl’. Instead, according to David, many female students at the CSE programme avoid positions that single them out as ‘deviant’ or other in relation to dominant masculine ideals.

This resonates well with Carol (PhysC), who feminises an interest in clothes, appearance and style, and simultaneously distances herself from such interests:

I find it hard to talk to a lot of other women because their interests are so far from my own, that we don’t really have a lot in common. I am not interested, I barely ever watch TV and I always wear the same clothes. Like, all the new clothes I get are gifts that people give me, you know. Um, my roommate has been cutting my hair for the last year and before that I got it cut a year before and I might get it cut this year. Like, to me there is just not time for these things. But I find that a lot of women make time for these kinds of things and I am more interested in computer games and, like, if I had to choose between getting my hair cut or playing a computer game I going to pick the computer game or any other game, but not getting my hair cut. I don’t even like people touching me so much, so and thing, pedicures, nails, I hate all that stuff!

What is worth noting here is that not only does Carol feminise an interest in caring about appearance and style, she also positions this interest in contrast to playing computer games. This resonates both with Laura’s comments above, i.e. that hard-working
physicists do not make time for such ‘trivial’ things as caring about style, and also with Diana’s line of reasoning, that suggests that interest in style is in direct opposition to interest in computers. Following Paechter (2006, 131) this indicates an awareness that to be recognised as a ‘proper’ physics person, one should not decorate the body.

**Analysis**

In this section, we take a step back from student’s self-understandings and instead, in a retroductive mode, search for the cultural logics that structure the above findings and can render them more intelligible. Looking at the three themes described above, we suggest that two logics underpin and connect these. First, the notion that the disciplines in focus are gender neutral gains strength from the form of distancing of the body and style that we have described. Extrapolating the discursive logics we have identified, we argue that neglecting everything corporeal is a way of privileging the mind and simultaneously insisting that in CSE and physics the only things that matters are reason, rationality and/or being smart. However, manifesting this neglect is hard without simultaneously centralising the body and aesthetics, even when it is with the purpose of rejecting it. Rather than the body appearing merely irrelevant, we suggest, then, that the very rejection of the body (through the rejection of style and appearance) is central to making physics and CSE appear as disciplines where only the mind matters.

Second, as we have also demonstrated, students not only distance themselves from and downplay the value of corporeality and style, but in so doing also position these interests as feminine. We suggest that this empirically manifested association between femininity and style is not culturally arbitrary, but instead follows heteronormative logics that are in line with Butler’s notion of the heterosexual matrix (see also Dahl 2011). Following Butler’s (1990) analysis of the intimate links between gender and sexuality, such a rejection of aestheticising the body is in line with performances of masculinity that rely on the denial of the presence of eroticised difference. That is, it adheres to a heteronormative logic which suggests that there is no point in ‘dressing up’ or attending to corporeal aesthetics for men in purely male homosocial settings. Such logics draw from broader societal homophobic anxiety around decorating the body, as discussed for instance by queer theorist Richard Dyer. He has described how ‘concern with appearance is so associated with gay men in this society that not to be so concerned with it has often been taken as a badge of real/heterosexual masculinity’ (2002, 64). With Dyer, it becomes possible, then, to understand the distancing from corporeality and style not only as a privileging of mind but also as an insistence on male heterosexuality in that context.

This logic has been discussed more closely in the field of masculinity studies, where research has demonstrated how a disavowing of potential homoerotic desires serves to strengthen notions of heterosexual masculinity (see Haywood et al. 2017). However, we wish to highlight an important distinction that emerges in our study. When informants in other studies reject aestheticising the body or having it appear erotically desirable, this is usually done to strengthen masculinity in the exclusively male settings. However, the contexts we have investigated are not exclusively male. While in minority, women are in fact present. We thus suggest that the presence of logics that traditionally serve to underpin heteronormative masculinity in the absence of women, can be read as a
misrecognition of the women who are actually present in the CSE and physics settings we study.

**Discussion and conclusions**

How is it that the mind becomes associated with masculinity and body with femininity in educational settings? In her probing of what physics education research can learn from feminist philosophy, Rolin (2008) cautions against explanations that rely on ‘question-begging a priori assumptions about what is gendered’ (1114). Instead of assuming, for instance, that associations between mind and masculinity established elsewhere are necessarily relevant in concrete contemporary educational settings, she suggests that ‘more empirical studies would have to be made’ (1117). We consider this article such a contribution to the empirical search for the mechanisms through which connections between masculinity, mind, rationality and smartness become (re)produced in contemporary educational settings. Our analysis contributes to this discussion by empirically demonstrating one way through which the mind/body split is made relevant within the disciplinary fields discussed and how it contributes to masculinise these. This is important because it allows us to form an understanding of how gender is locally performed in disciplinary settings without relying on received notions of the mind/body split as universally gendered.

We argue that fashion and corporeal aesthetics provide an arena for the simultaneous manifestation of passion and competence related to physics and CSE, and the gendering of the corresponding subject position being articulated. As is evident from our discussion of the perceived ‘gender neutrality’ of the disciplines, students hold the view that anyone can be smart and rational and hence engage successfully with physics and CSE respectively. Caring about style and appearance, however, simultaneously signifies femininity and not caring about or being passionate enough about physics and CSE. Thus, we see that paying too much attention to style and corporeal aesthetics is an action that undermines the potential to be recognised as passionate about one’s discipline.

This also explains the resonance, or the particular ease with which certain forms of masculinity can be articulated with physics and CSE. In the analysis above, we have demonstrated how this resonance between masculinity and physics/CSE emerges in the disavowal of style and corporeal aesthetics. We argue that this happens because such disavowal signals belongingness to both physics/CSE and heterosexual masculinity at the same time. It signals belongingness to physics/CSE because it aligns with these disciplines’ orientation towards rationality and being smart; and it signals belongingness to masculinity because it adheres to the heteronormative logics that posits inattention to style ‘a badge of real/heterosexual masculinity’ (Dyer 2002, 64). As such, we suggest that the disavowal of style and corporeal aesthetics underpins the ease with which fields such as physics and CSE can be articulated with disembodied masculinity and, hence, become fields that are particularly resistant to gender change. Again, we emphasise that this does not mean that all male students in our settings are comfortable in adopting this position, or that all female students are reluctant to do so. Rather, we have demonstrated that the gendered character of this position is culturally established through discursive work that positions corporeal aesthetics and style as feminine. Such patterns draw intelligibility from the heterosexual matrix and are well in line also with
findings from feminist philosophy on the gendered character of the mind/body dualism (e.g. Keller 1992; Lloyd 1984/1993; Wajcman 2004). Thus, our analysis demonstrates how the mind/body dualism is drawn into and (re)produced within the settings we explore, and what consequences this has for both male and female students.

To conclude, the initial wonder that arose when striking similarities between our two datasets were identified has, in a way, been resolved. We suggest that both CSE and physics share a distinguishing (although not exclusive) focus on mind and rationality. This does not in itself gender these disciplines, but instead mediates a particular relation to style and aesthetics, namely a relation of neglect. Through simultaneously positioning fashion as feminine (explicitly) and the lack of attention to style and aesthetics as masculine (implicitly/by consequence), this conjures a certain ‘resonance’ between masculinity and CSE/physics. This is somewhat ironic, because it suggests that the potential gender neutrality of the disciplines we have researched is largely undermined by the immaterial characteristics of CSE and the strong privileging of rationality and reason in physics – characteristics that are often, within the disciplines themselves, taken to guarantee the gender neutrality of the fields.

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