

“Taught to be automata”: Examining the departmental role in shaping initial career choices of computing students

Mara Kirdani-Ryan, Amy J. Ko & Emilia A. Borisova

To cite this article: Mara Kirdani-Ryan, Amy J. Ko & Emilia A. Borisova (2023): “Taught to be automata”: Examining the departmental role in shaping initial career choices of computing students, *Computer Science Education*, DOI: [10.1080/08993408.2023.2171689](https://doi.org/10.1080/08993408.2023.2171689)

To link to this article: <https://doi.org/10.1080/08993408.2023.2171689>



Published online: 05 Mar 2023.



Submit your article to this journal [↗](#)



Article views: 6




View related articles [↗](#)



View Crossmark data [↗](#)



“Taught to be automata”: Examining the departmental role inshaping initial career choices of computing students

Mara Kirdani-Ryan ^a, Amy J. Ko^{a,b} and Emilia A. Borisova^a

^aPaul G. Allen School of Computer Science & Engineering, University of Washington, Seattle, USA; ^bThe Information School, University of Washington, Seattle, USA

ABSTRACT

Background and Context: Post-secondary Computer Science (CS) students' career choices are complex sociocultural decisions, shaped by self-efficacy, belonging, and a multitude of known factors. Prior work has investigated the effect of these factors on career choice, but perspectives that examine norms of career practice are unexplored within computing.

Objective: This work applies Field Theory to surface the norms of career practice within a CS department, the mechanisms used to reinforce these norms, and students' experience of these norms.

Method: We conducted semi-structured interviews of 18 students, graduates, academic advisors and senior faculty program leaders within one CS department, analyzing data with a Bourdieusian lens.

Findings: In line with prior work, we found that normative career practice centered prestige, leading students to prioritize work at elite technology companies. This work contributes three mechanisms of norm enforcement: companies utilized their departmental position to recruit more effectively, curricula optimized preparing students for prestigious work, and career advising assumed alignment with departmental norms. Students aligned with departmental norms opted for prestige to alleviate career uncertainty and because more fulfilling work felt inaccessible; students unaligned with departmental norms felt conflicted about their participation within CS and substantial effort was required to resist norms.

Implications: Normative CS career practice likely discourages students who lack alignment with norms from participating in CS; additionally, the narrowness of established norms leaves little space for alternatives. Broadening participation efforts in CS are unlikely to be successful without structurally broadening what constitutes legitimate career practice to make space for students' diverse aspirations.

ARTICLE HISTORY

Received 29 October 2021

Accepted 19 January 2023

KEYWORDS

Careers; norms; advising; post-secondary

1. Introduction

For many post-secondary computing students, one's graduation is closely tied with a series of significant career choices. These choices might determine where a new graduate lives, potentially severing them from their community. They determine the kind of learning a new graduate does, whether learning to be productive in an organization

(Begel & Simon, 2008b), or learning to be productive on a team (Begel & Simon, 2008a). Perhaps more importantly, one's choice of job shapes what problems a graduate chooses to invest in, whether for-profit consumer products, enterprise solutions for businesses, or not-for-profits and government organizations with pro-social motives. While a student's choice of first job after graduation is likely not their last, their initial choice can also shape their future earnings and opportunities (Brunner & Kuhn, 2014).

Frequently, this transition from formal education to professional work happens in community. Faculty might advise students on computing careers, career and academic advisors might support students with mock interviews and résumé reviews, and students might attend job fairs and practice coding puzzles with peers. Beyond academic spaces, students might look to family and friends for expectations and guidance.

This transition, and the choices that shape it, are complex, sociocultural decisions. For example, graduates' self-efficacy about their skills and career choices is strongly related to their level of confidence in their choices (Margaret Alexander et al., 2011; Young Choi et al., 2012). The choices available to graduates are strongly determined by their life circumstances, such as income, race/ethnicity, and their social network (Diemer & Blustein, 2006). Educators, peers, and family all influence student interest in STEM majors and careers, which in turn affects STEM self-efficacy and career outcomes (Nugent et al., 2015). Career choices are also influenced by students' values (Trapnell & Paulhus, 2012). Race and ethnicity are also related to career aspirations, but only in that different racial groups face different opportunities and barriers (Fouad & Byars-Winston, 2005).

These factors are broadly explained by existing theory on career choices. *Social Cognitive Career Theory (SCCT)* (Lent et al., 1994) presents a model for these factors, including self-efficacy in career skills, outcome expectations, goals, social supports and social barriers. The theory posits a complex interplay; for example, structural barriers might influence self-efficacy and outcome expectations, which might reshape interests and goals. Prior work within computing education, for instance, shows that social supports are particularly important for students' decision to study computing (Alshahrani et al., 2018).

Prior work on students' career choices is consistent with SCCT, and emphasizes that perceptions of computing majors are entangled with perceptions of computing careers. For example, parents occupations and attitudes, early computer experiences, social expectations and encouragement, role models, and self-efficacy all influence both major and career choice (Ahuja et al., 2006), and there is clear evidence that structural barriers, stereotype threats, and environmental cues can shape the influence of these factors (Fincher & Robins, 2019). Prior work has found that students who value the social impact of their career have a lower sense of belonging in some Computer Science (CS) departments (Lewis et al., 2019a); similar work has shown that such communal goals are more common amongst students with marginalized identities (i.e. students who identify as cis-gender women, ethnic and racial minorities, first-generation, queer, transgender, non-binary, and gender non-conforming) (Allen et al., 2015; Diekman et al., 2010; Lewis et al., 2019a; Tellhed et al., 2018). The communities that students come from to study computing can also enforce cultural stigma to learning CS and pursuing CS careers, shaping their willingness to learn (DiSalvo et al., 2013). Students may also bring stereotyped perceptions about CS careers (Clarke & Joy Teague, 1996; Kahle & Schmidt, 2004), which are often reinforced by their community (Margolis & Fisher, 2002; Margolis, 2010)

and rarely corrected by CS curricula (Vesisenaho et al., 2009), but nevertheless can strongly shape students' choices of what to learn.

While prior work in computing has examined students' career choices through SCCT's factors, framings that center social learning have received less attention. Theories of social learning examine what norms of behavior exist within social groups, and how those norms affect group members. Within a sociological framing, one's career decision is affected by one's sense of belonging and self-efficacy, but these factors are a byproduct of both implicit norms within social groups that govern behavior, and one's habituation to norms experienced throughout one's lifetime (Bourdieu, 1977). From this perspective, norms shape language, action, and career choice, and typically create spaces of competition that push individuals to make choices along defined norms, often without knowledge that any norms exist. Specific to career choice, prior work has adopted *Field Theory* to demonstrate how prestigious universities are organized and structured to push students towards prestigious work (Binder et al., 2016; Bourdieu, 1998b; Daoust, 2020), leading to students at prestigious universities to opt for careers with prestige more often than students at less-prestigious universities (Davis & Binder, 2019).

Prior sociological work has examined computing career choice within a factor lens, and careers broadly, but examinations of computing career choice are unexplored. Theories of social learning argue that one's learning is inextricably tied with one's participation within a social group, and that this participation shapes what future choices are possible (Bourdieu, 1977, 1998b). For post-secondary computing students, learning is inextricably tied with participation within the department, and the departmental norms of career practice would shape students' choices of future enterprise. From prior work examining institutional effects on student career trajectories (Binder et al., 2016), it is likely that CS departments favor careers that fit the implicit departmental norms, perhaps rejecting or delegitimizing those that do not. This follows conjectures from Kallia and Cutts, who also note a literature gap around the affect of CS organization, structure, and norms on participation (Kallia & Cutts, 2021). As one's future career prospects are one of the primary motivators to study computer science (Carter, 2006), the affect of departmental norms on student career choice could illuminate larger affects on participation.

Thus, in this investigation, we look to surface the norms of career practice within computing, as well as the interactions between these norms and the numerous social and rational factors described in prior work. As examinations of computing career choice are largely unexplored, we sought to deeply understand a single CS department within higher education,¹ leaving multi-institution work for future studies that would hopefully benefit from the richer insights of our deeper case study. Given that our university houses a CS department that centers theory of computation and software development and whose graduates tend to pursue engineering positions, we centered our inquiry around this program out of convenience, familiarity, and access. We adopt a sociological perspective, treating this department as a *field*: a structured social space that ascribes norms of career practice, norms that subsequently shape students' career choice by virtue of their participation. Within this case, we ask the following research questions:

- What norms of career practice exist within this Computer Science department?
- How are these norms reinforced by members of the department?
- How are these norms experienced by students?

By examining this department through Bourdieu's *Field Theory*, we surface CS career norms and the affect of those norms on student experiences. This paper contributes one of the first investigations into CS career choices as intertwined with the norms of a CS department. Throughout, we report in detail on the perspectives of students, advisors, graduates, and program leaders on careers. We begin by discussing our theoretical framing and method in more detail, then present the results of our case study. We end with a discussion of the implications of this work, reframing prior work surrounding CS participation and offering avenues for future work.

2. Theoretical background

To investigate the norms of career practice within a CS department, we primarily ground within theories of social learning, but utilize perspectives from Social Cognitive Career Theory and prior work in career norms outside of computing to shape our analysis.

2.1. Social cognitive career theory

The most modern attempt to explain career choices is Lent's and Brown's *Social Cognitive Career Theory* (SCCT) (Lent & Brown, 2019; Lent et al., 1994). Building on Bandura's Social Cognitive Theory, SCCT attempts to surface a unifying theory to describe career interest development, career choice, and persistence and performance in career aspirations (Lent et al., 1994). SCCT derives several predictive models based on individual self-efficacy and outcome expectations (social cognitive mechanisms (Bandura, 1986) relevant for careers), as well as social supports and barriers (contextual factors) (Lent & Brown, 2019). Prior work has demonstrated adequate fit of SCCT's performance model among computing students (Lent et al., 2008) and has utilized SCCT as a grounding theory for examining students' choice to study CS (Alshahrani et al., 2018) and students' career development among marginalized students in STEM (Garriott et al., 2017; Turner et al., 2019). In contrast with prior work utilizing SCCT to analyze barriers to participation in specific career enterprises, this work instead chooses to focus on the established norms of a CS department. While a theoretical grounding centering SCCT might surface students' experiences of norms as social supports (when norms fit one's experience) or social barriers (when fulfillment of enforced norms felt inaccessible), we would need more explanatory power to specifically describe the norms themselves, due to the tendency for norms to be implicit and unstated. Thus, this work primarily utilizes theories of social learning to describe institutional norms, but we note SCCT's career-centricity, the affect of social barriers and supports on one's agency and capacity to act within various career domains, and the large body of existing literature that centers factors described within SCCT.

2.2. Social learning

Theories of social learning examine learning that occurs as a component of group membership, largely drawing from Bandura's Social Cognitive Theory (Bandura, 1986). However, in addition to describing how skills and practices are learned without formal instruction, social learning theories can be used to describe implicit learning. Of particular relevance to this work is how social groups maintain norms of practice, how those norms

are enforced and reproduced, and how newcomers and established group members respond to existing norms.

Bourdieu's seminal *Field Theory* (Bourdieu, 1977) describes the negotiation of agents for *capital*: financial resources, beneficial social relationships, and institutional qualifications, but also behaviors and practices that signal competence and expertise (Bourdieu, 1986). Bourdieu's agents, from a lifetime of learned social forms and negotiations for *capital*, bring a set of predispositions and embodied cultural forms that persist within their own behavior, *habitus*, to spaces of social-cultural relations in which agents look to gain power and position, *fields* (Bourdieu, 1977). Bourdieu's *fields* are frequently described as a space in which a "game" is played (Kallia & Cutts, 2021); agents bring their existing *habitus* and their social and cultural *capital* to bear as they struggle, strategize, and compete for *capital* within a *field* (Bourdieu, 1998a). Agents act based on their sense of what will establish or maintain their *capital*, but more specifically, what will give capital legitimized by a given *field*.

Agents are also bound by the rules of the game within a *field*. These rules dictate acceptable practice when competing for capital, as well as what forms of capital are legitimate (Bourdieu, 1977). While not strictly implicit, many rules are often constituted outside the realm of what can be discussed, questioned, and debated, and are seen as the objective fabric of social reality, they are what "goes without saying because it comes without saying" (p167) (Bourdieu, 1977) Thus, agents frequently act without cognizance that a set of rules exists, and further, without the language to describe such impositions. Rules of the game, or norms of practice, tend to favor those whose *habitus* matches the expectations imposed by a *field*, and those whose *habitus* is imbued with *capital* legitimized by the *field*. For instance, educational settings tend to favor certain ways of speaking that demonstrate established cultural capital (e.g. "you're so articulate" (Khan, 2020)) and police those that do not (e.g. African-American Vernacular English), legitimizing a *habitus* formed within upper-class families and imposing rules that define "acceptable" speech.

As *Field Theory* is well-utilized within prior work that examines social learning of students within elite career contexts (Binder et al., 2016; Daoust, 2020), and the university career context has been explicitly addressed by Bourdieu (Bourdieu, 1998b), we ground this work within *Field Theory*. In surfacing norms of career practice within a CS department, we view a CS department as a *field* that legitimizes certain forms of career *capital*. As students seek these forms of *capital*, a set of career norms are formed within the *field* (RQ1). This process of seeking capital can be treated as competitive game, one with a set of enforcement mechanisms to ensure that competition remains acceptable (RQ2). However, no *field* is wholly encompassing; individuals (especially students) bring their intersection of membership between various *field* to bear upon their career practice. This multi-membership, along with students' existing *habitus*, might be consistent with practice within the departmental *field*, but also might bring expectations of behavior that conflict with notions of legitimized *capital* and contradict norms within the department (RQ3).

For Bourdieu, norms of practice are not a permanent fixture within oneself. Rather, these help form the basis of one's belief in the legitimacy of a *field* (both norms and game), and that the questioning of these beliefs necessarily constitutes a crisis (Bourdieu, 1977). Those whose social position requires adherence to contradictory structures, for

instance those recently shunted between social classes (Aarseth et al., 2016) or those whose *habitus* conflicts with norms of a *field*, tend to be especially aware of norms and thus particularly prone to crises (Bourdieu, 2000). However these crises are insufficient for one to question and break adherence to norms; one also needs to engage in critical discourse that demarcates between opinion and *field* norms (Bourdieu, 1977)

Prior work has emphasized that as students bring their existing *habitus* to computing practice and computing culture, many experience dissonance when computing *capital* conflicts with their *habitus*. Stereotypes that paint computing careers as individualistic, isolated, and with low-social impact (Alshahrani et al., 2018) likely dissuades students whose *habitus* lacks *field* alignment from studying computing (Kallia & Cutts, 2021), while students that persist will likely feel a lack of belonging (Lewis et al., 2019a). Additionally, some prior work finds that the computing profession is largely perceived as interesting, competitive, and prestigious (Papastergiou, 2008). Broadly, those whose *habitus* aligns with notions of *capital* within computing likely feel an identity alignment, a sense of belonging, and are more likely to persist within the *field*. However, a gap in literature exists with regard to the specific organization and structure of CS *fields* with respect to the forms of *capital* legitimized within the *field* (Kallia & Cutts, 2021).

2.3. Career funneling

Prior work has also examined students' learning of institutional career norms. In 2013, Cech detailed a "culture of disengagement" within engineering education through three pillars: (1) the belief that engineering work should be disconnected from social and political spheres that might bias engineering practice, (2) the ideological dualism separating technical and social work, devaluing the latter, and (3) an ideological endorsement of meritocratic beliefs, emphasizing the fairness within existing systems of social advancement (Lucena, 2013). In 2014, Cech extended this line of inquiry with evidence, finding that engineering students' interest in the interplay between public welfare and their engineering work declined over the course of their undergraduate program and did not rebound upon leaving college (Erin, 2014). Drawing from Bourdieu, students' sense of *capital* legitimized within an engineering program directly affected their own beliefs, persisting within students' *habitus*.

Prior work has also utilized field theory to examine learning of institutional career norms. Looking specifically at highly selective, elite universities, (Binder et al., 2016). found that many students arrived on campus experiencing uncertainty around their career prospects, but quickly learned to distinguish between elite work within elite employment sectors and ordinary jobs through *Career Funneling* where elite institutions acted as pipelines to elite jobs. More recently, Davis and Binder examines the multi-layered career advantages conferred by elite institutions, finding that students at elite private institutions enter more prestigious firms within elite industries than their public university counterparts (Davis & Binder, 2019).

Within an individual employment sector, Daoust examined Canadian undergraduates' experience of the recruitment process in accounting where students learned to measure jobs at a set of prestigious "Big Four" companies against all others (Daoust, 2020). Daoust, also utilizing *Field Theory*, found that accounting students belief in the legitimacy of the recruitment game was constructed around three mechanisms of securing capital (1) the

long-term career opportunities offered by firms, (2) the social recognition conferred by peers upon landing a Big Four position, and (3) and the appeal of a “fun” and “exciting” career. Students’ beliefs in the recruitment game were maintained unless students experienced some split, for instance a rejection from elite accounting firms. These “points of disjuncture” allowed the possibility for students to distance themselves from the recruitment “game”, allowing space for reflection and new, more independent understandings.

3. Method

As students’ *habitus* was likely formed well before they arrived to the department, and our goal is to surface the career norms of the department, we primarily employ the notions of *capital* within the departmental *field* and career norms that curtail deviations or devaluings of legitimized *capital* within the department. To this end, we sought to surface experiences of career norms from individuals with varying amounts of *capital*, thus we interviewed four populations: students, graduates, advice givers and program leaders. Prior work has primarily focused on students (Daoust, 2020), and recent graduates (Binder et al., 2016); we also sought to assess how members with greater *capital* within a CS department experienced, identified with, and replicated forms of career *capital*. With the goal of surfacing counter-narratives (Daniel & Tara, 2002) from the perspective of students, we chose students (11 total) as our primary population² We recruited students through email lists, word of mouth, and posts to student groups. Students were not compensated, so we phrased our recruiting statement around our perception of student interests, emphasizing this work’s goal to create “organizational, structural change” to incentivize participation. We recruited recent graduates (graduated within 5 years) in the same way as students (3 total). For participants with greater *capital*, we recruited faculty and staff that students looked to for career advice (referred to as advice-givers, 3 total, recruited via snowball), and senior-faculty program leaders (1, recruited directly). While the number of participants with greater *capital* is small relative to the number of students, we note that prior work examining post-secondary career socialization exclusively interviews students and recent graduates (Binder et al., 2016; Daoust, 2020). Additionally, we intended to situate our departmental framing around the students interviewed, and that we interviewed a significant proportion of the relatively few department members who have notable *capital* with regard to student careers. In total, we interviewed 18 participants and obtained 4 hours of interview data.

After all interviews were complete, a demographics survey was sent to populations recruited at-large (graduates and students). Out of 14 at-large participants, 13 completed our survey; among those, 3 identified as women, 10 as men, and respondents were between 20 and 5 years old. In terms of ethnicity, 6 identified as White, 3 as Asian or Asian American, and 2 as both White and Asian. Two participants opted to self-describe their ethnicity; one identified as North African, another identified as “Teochew and Hakka from Vietnam – two Chinese ethnic minorities that have diaspora populations in Vietnam”.

With regard to our positionality, at the time of the study, one author was a program director of a computing-related undergraduate program at the same institution, but in a different department. Another author was a graduate student in the CS department studied. These positions within the institution gave us context, perspective, and access,

while also requiring examinations along *reflexivity*, the careful, self-aware analysis of the dynamics between researchers and those being studied (Finlay & Gough, 2008). Prior work emphasizes the importance of engaging in reflexivity, but little agreement on how best to approach reflexivity (Call-Cummings & Ross, 2019); our approach involved recurring reflections around the claims in our results, our relationship to those claims relative to our positions, and a reconsideration of claims when we believed our positionality had warped our interpretations. Our approach does not aim for objectivity, but rather a transparent account of subjectivity amenable to future interrogation in scholarly discourse.

With the intent of following a semi-structured, fluid, conversational, and flexible interview protocol (Aydarova, 2019), we crafted a open-interview protocol around three themes: (1) how the participant understood the process of finding a job after graduation, (2) what was required of them and how they struggled in fulfilling those requirements, both explicit and implicit, and (3) their reflections and feelings on the entire process. Additionally, students were asked to reflect on their choice to major in CS to build rapport and frame career decisions in the context of the department, and graduates were asked to contrast their recollections of their initial job search with their current career perceptions. For advice-givers and program chairs, we centered their interactions in students' career processes, and how they viewed their role in serving students.

After transcribing interview data, our analysis followed the spirit of Hammer and Berland's perspectives on qualitative data analysis, who encourage those in the social sciences to distinguish between qualitative coding done to test claims, requiring inter-rater reliability, and qualitative coding done to generate claims for future investigation (Hammer & Berland, 2014). Our goal was to generate claims. We began by analyzing the transcripts for career norms and how they were enforced and experienced by participants. We first corrected interview transcripts, and anonymized statements that discussed specific members of the department, which also provided us an opportunity to read each transcript. We then performed an additional reading where we pulled out statements that described participants' career choices, or the career choices of others within the department, as well as statements that described the overall department in terms of perceptions, norms, and practices. These statements were then thematically analyzed through an inductive coding by the first author, who presented the results of this coding to the second author. The second author offered reflections, insights, and raised reflexivity concerns when the results felt too removed from the data, after which the first author revised codes and claims accordingly. The analysis that we present resulted from several iterations of revising codes, recoding data, and forming new analyses from the recoded data. Our final themes represent a grounded consensus interpretation between the first and second author.

4. Results

4.1. *The norms of career practice*

Throughout this work, we identify participants by a letter and number – the letter refers to the type of participant (S for students, G for graduates, A for advice-givers, and L for

program leaders), the number distinguishes between participants of the same type. Researcher interjections within quotations are enclosed with square brackets.

First, we situate our case within prior work. Prior work utilizing Field Theory to describe undergraduate career practice studied students within highly selective institutions with established paths towards increasing one's *capital*: elite institutions. The work we draw on here found that students within elite institutions learned to opt for highly selective firms, viewing those firms as garnering the greatest career *capital* and admiration; prestigious, by another word (Binder et al., 2016; Daoust, 2020).

Unlike institutions under study in prior work (Binder et al., 2016; Daoust, 2020), ours is a public university. However, the CS department within which we situate has a highly selective and competitive admissions process, analogous to those at elite institutions. We began many of our interviews with students and graduates by asking why participants chose to major in CS as a way to build rapport, and in their justification, several emphasized the stress of the department's admissions process. To compare, we asked a graduate if departmental admission was more stressful than finding a job, they replied:

Oh, 100%. . . you can always look for a job later, what happens if you don't get in? (G1)

At the time of this work, the department's admissions requirements emphasized introductory CS course grades, leading these courses to become sites of competition, one marker for an elite institution. From one student:

It's very, very competitive, you know. And so, like, tests are super high stress and, like, you feel like you're never, like. . . Any of the work you do is never going to be enough. (G3)

Choosing to participate in the department's competitive admissions process also came with a broader reputation on campus, described by one student as:

Like cut-throat and like, 'cause it's very competitive to transfer into the major here. Um. . . I think a lot of external people (would be) like oh I get it you're a CS major. Like, oh you're a sellout you're just gonna like do that to make a lot of money. (S3)

Many students, however, were less concerned what values might be signaled by pursuing work in CS and more concerned with gaining entrance to the highly competitive space:

Yeah, and uh, yeah it was just a my first couple years of college were incredibly stressful. Um, just feeling really like a ton of pressure to perform at a very high level constantly. . . ultimately for me. . . I [stammers] . . . if it wasn't for me being a teaching assistant, and probably be being a veteran. I don't think I'd be here. (S7)

With our institution competitiveness, the only form of career capital that we found to be legitimized was jobs at highly selective, prestigious firms. Notions of prestigious work incidentally included highly selective graduate programs, but prestigious industry jobs were the primary norm of career practice. This replicates prior work (Binder et al., 2016; Daoust, 2020): elite institutional *fields* legitimize roles at highly selective, prestigious firms and students learn to value and prioritize these legitimized roles.

The department's career counselor was the most frequent source of career advice for participants; they noted students' familiarity with departmental career norms and how that reflected in their advising:

When you look at the articles that are written about this program, so many of them focus on the jobs and high paying salaries that our kids are getting. This department is marketed as a program that will enable you to go for those high paying software jobs. The comp expectations are between 150 - 200k total comp per year. So many of the students are aware of this coming in and the majority of the students I talk to are going for the same thing. As a career counselor, it's convenient that so many of my students are trying to solve the same problem. (A3)

Prestigious employers, matching those studied by Binder et al (Binder et al., 2016), have highly competitive recruiting processes, with salaries among the highest offered to new college graduates. Within our case, we found specific companies were prioritized over others; again the career counselor:

I think for most students, they're like, "I wanna go to, like, one of the big companies", so that's why they're like: Facebook, Microsoft, Google, Amazon (A3)

These companies formed a colloquialism, the "Big Four" within our case, referring to the four largest department recruiters.

A simple definition of normative career practice might examine jobs frequently selected by recent graduates, and, indeed, out of 470 students that responded to the department's 2019 graduation survey (when this work was performed), 312 planned to be employed (66.4%) and of those 312, 152 planned to be employed by Big Four companies (48.7%).³ Granted, Big Four employment was not exclusive; survey results show a long tail of other employers (over 80), but no company outside of the Big Four hired more than 8 graduates.

However, we emphasized student career preferences in our analysis, following prior work (Binder et al., 2016), and found that students who internalized systems of career prestige came to delineate between forms of future work, based on the work's affinity to prestige. In our case, we found that among many students this belief was absolute, outside the realm of opinion, and forming an "arbitrary distinction" (Bourdieu, 1977) between firms. In this work, one student described occupational preferences through a tier list.

I guess the top bar would be like... Amazon, the big tech companies that pretty much everyone knows. (Then) a respectable start up, right? That's like growing explosively... Um, and then below that I think it kind of breaks down into more like, industry specific things, right? (S10)

Interpreting "the big tech companies that pretty much everyone knows" as Big Four companies, in this list, Big Four companies received the most legitimacy within departmental norms. We asked where their perceptions of this tier list came from:

Things like what people say in, um, Blind... CS Career Reddit⁴... Um, (A3), the career seminar... Um, and then friends and coworkers at the various places that I worked at. I would say (the rankings have) been pretty consistent. (S10)

The consistency of rankings from sources outside the departmental *field* aligns with Bourdieu's Theory: a *field* is not isolated, rather it exists within larger *fields* and often aligns with established routes to capital within these larger *fields*. From this student's experience, departmentally legitimized career *capital* was consistent within and beyond the departmental *field*. Other participants were less explicit about tier lists, but we consistently found Big Four companies prioritized or named as normative career practice. S4, for instance, saw Big Four companies as a departmental norm, and felt insecure measuring up to others pursuing careers in line with that norm:

When I started kinda looking for jobs I- I just had like no interest in applying for like, Microsoft or Google or anything. . . I can't really explain why. Uh, maybe it was just 'cause like I felt like, uh, just because like everyone applies there, you know? Just, yeah, feeling like I just couldn't really stand out, uh, that much from like anyone kinda here. (S4)

For prior work (Binder et al., 2016), and Bourdieu's theory broadly, one's success is inextricably tied up with how *field* members perceive routes towards *capital*, and success and *capital* are frequently equated. Some students' beliefs in career *capital* were outside the realm of questioning, however, others were able to surface their perception of departmentally legitimized *capital*. S2, a CS junior, offered:

If you get into the Big Four, you've made it? You know, I think it's a form of getting validation for me. . . I think that a lot of people say 'they specifically have the resources available for me to do this project'. . . But maybe like, subconsciously, everyone (thinks) "I must be a successful person. Um and if I (get a Big Four job), that's like the next step in being successful person. So that's what I must aim for". I think that's maybe under a lot of people's heads. Um just cause that's definitely under mine. (S2)

4.2 Enforcing and reinforcing

Given the situated nature of this work, we chose to specifically examine the modes of reproduction. Within a *field*, Bourdieu emphasizes that notions of *capital* are not given, rather members enforce their own adherence to norms and the adherence of others (Bourdieu, 1977). This enforcement is especially powerful when performed by those with capital (*dominators*, in Bourdieu's language), but can also be performed and enacted by those without (*dominated*, in Bourdieu's language) (Bourdieu, 1977).

Given a norm of career practice that led students to prioritize prestige broadly, and Big Four companies specifically, we found three mechanisms by which *field* members reinforced and strengthened student adherence to that norm. First, organizations with established capital were given space to create recruiting footholds within the department. Second, departmental career advising assumed alignment between students' *habitus* and departmentally legitimized career *capital* leaving little space for students to explore alternative modes of career success. And third, courses and curricular objectives emphasized preparation for careers in line with departmental career norms, at a pace that left students little space to consider much else. We discuss each in turn. We note that not every participant could name career norms, in this section we primarily draw from those who could.

4.2.1. Using established capital to gain capital

Bourdieu emphasizes reproduction of existing social hierarchies as members with capital utilize their power and position to obtain more capital. Within the department, we found that organizations with established capital utilized their position to gain more capital, in the form of student job applications, employment positions, and renown within the CS department. Organizations, especially larger, established entities like the Big Four, used their existing capital to recruit more effectively than smaller companies, recognized by a senior-faculty program leader when describing student career decisions:

I'm so proud of our students, they do so well, but I think a lot of times they follow their friends from the year before and they stay within the guard rails and they do what they've seen, seen to be the normal. . . a lot of them prefer the larger companies, some of it is risk aversion. Some of it is the (larger) companies can just beat the mid-sized companies and the start ups because they're using their resources effectively to win at recruiting. . . And a lot of this is inertia. . . go where your friends go. And recruiters go where they've recruited great employees in the past. So it's just literally straight up inertia. (L1)

In their simplest forms, established pipelines (or, funnels, from prior work (Binder et al., 2016)) between university and industry lead students to prefer organizations emphasized within those pipelines. To restate in Bourdieusian terms, notions of *capital* within a *field* are self-reinforcing and self-replicating as members choose actions legitimized as ways to gain and maintain capital.

Beyond pipelines between organizations and academia, several participants noted career norm signaling from explicit markers in their academic space. Specifically, one CS building prominently featured names of organizations that supported the construction of the building, primarily Big Four companies and others with established *capital* with which to finance support. An advice-giver described the results of a student survey on this naming;

The students were like, "It feels like (the CS department) is only pushing us to work at these big companies", right? Because they're named. And that is a true perception. And we were like, we didn't think about that, but also, building is expensive. Like someone's got to pay for it. (A2)

A student also emphasized that company names on rooms and buildings in which courses were held gave a clear signal of legitimacy:

It really normalizes going into big tech just after undergrad. Which I think implicitly normalizes not going down other paths, and not asking questions of these big tech companies. I mean, this is what makes (the CS department) money, right? (S1)

Here, the "inertia" between firms and the CS department affected student career outcomes, but also students' academic space whereby only companies with sufficient *capital* could be named within this space.

4.2.2. Advising assumes aspirational alignment

From our interviews, we found several routes for students to receive career advice: the department's career counselor, the department's career seminar, advice from advice-givers beyond the career counselor, and a variety of routes outside the departmental *field* (e.g. friends, family, and faculty outside the department). As our focus is the

departmental *field*, we examined the advice that students received within it. We found that advice from within the *field* tended to assume alignment between students' *habitus* (in the form of career aspirations) and departmentally legitimized career *capital*; that students would follow career norms, and that little space needed to be left for students to examine and assess their career aspirations.

This work was performed as part of a larger project that examined career norms across two departments, and within that larger sample we found two types of career-advising: mechanics-based advising and situated advising. Mechanics-based advising looks to teach the mechanics of job seeking to prepare students for applying to a variety of jobs – this might include résumé reviews and mock interview sessions. In contrast, situated advising work with students to assess their values, motivations, and various competing factors that leads them to choose certain jobs over others. The two are not strictly distinct, a single advising session might begin with situated advising to assess student motivations to better inform feedback for a résumé review; modern career counseling recommends approaches that incorporate both (Busacca & Rehfuss, 2016). However, without situated advising to understand student motivations for their work, we found that exclusively mechanics-based advising within a *field* tended to assume normative alignment, as no space is made to understand student's personal disposition.

Within CS, we found that advice-givers tended towards mechanics-exclusive advising, and situated advising was seen as unnecessary or beyond students' capabilities. We center the department's dedicated career counselor in this work as they were the most frequently cited source of career advice for students, and because their position explicitly centered advising, whereas advising was a more ancillary job component for other advice-givers. They offered their perspective:

Do (students) understand, what motivates them? Like, and how do they bring that into (their) job? Like, even if a student thinks that they know what they want, I'm always like, 'You just have to go and get more information, because there's nothing here in school that can teach you'... I think it's, like, literally they don't have the apparatus to even think about, like, how you should even think about that, you know? It's like that Maslow's pyramid thing, right? Like, our kids just don't exist in that, that upper triangle. (A3)

They also taught the department's career seminar, another source of career advice, and noted that the advising was primarily mechanics-based as well, prioritizing preparing students for technical interviews. Occasionally, students experiencing dissonance between departmental career norms and their own *habitus* would come for advice, but this was rare:

It's maybe once a month that I have a kid in my office being like, "I actually don't want to be a software engineer, and I don't know what to do now". But, for the most part, most kids do want to pursue software engineering and that makes my job as a career counselor easier because I have a lot of experience helping students pursue that. (A3)

We found that adherence to departmental career norms was largely left unquestioned and that situated advising was only available if students specifically asked for it. Situated advising could constitute critical discourse, space to critique departmental career norms, but the career counselor was unconvinced that this type of advising would be helpful for most students:

We can talk about job content, but also, at the end of the day, and this is probably just me being really jaded, like, it's all the same shit. Corporate America is all the same shit... like, you are building things to make the company money... Most kids are gonna just go to make money somewhere, and that's totally fine. You know? (A3)

Beyond the department's career counselor, we asked other advice-givers if they would help students examine their own career motivations, and give space for students to deconstruct departmental career norms. One offered:

I think it's important (to make) sure that they're thinking about things, like I don't really just want all of the students to go be cogs at Google and Facebook. Not saying that you can't work at Google and Facebook. Um, but if the only thing you care about is money... Not that you shouldn't care about money. Um, but like, if, you aren't thinking about impact on people, that's not great. Like, would you be happy there? That's something maybe they don't think about. Would you be doing something that you think is making the world a better place? Not saying that you have to be a, like a poor person that's only doing charity work your whole life. (A2)

We offered a hypothetical space through which this advice-giver navigated with tentative statements and conversational hedging, which signals that this space may have been unfamiliar – they were unsure of exactly what they felt comfortable expressing to students and where an intervention felt possible. While uncertainty to intervene against established norms is understandable, our investigation did not find any official context within which students could examine departmental career norms and career beliefs. Primarily, we found that departmental career advice was focused on preparing students to succeed in applying to prestigious organizations that fulfilled the departmental norm.

4.2.3. Courses and curricula optimized for prestigious jobs

Academic courses are the primary mode of interaction between students and departments, and, while CS courses were not explicitly focused on career funneling, departmental career norms found hold in students' coursework. First, as students came to prefer firms aligned with departmental norms, course material came to reflect the narrow reality of student career experiences. One advice-giver that previously taught data structures worked to meet student motivations:

You want to motivate your work. And the majority of your students are going to go work at internships at big companies. And so you make your example kind of about these. (A2)

They also recommended the department's teaching assistant program to students looking for ways to prepare for technical interviews, framing one's decision to teach within departmental career norms.

Beyond a specific course, several participants noted that the pace and rigor of coursework left little room for career reflection. A program graduate emphasized how course content, independent of motivation, could lead students towards big tech companies:

Preparing graduates does not mean allowing them to think in a reflective manner about, software about... staples in (CS). It means they need to learn how to do Paxos so that they can understand a distributed system... so that they can go work at whatever it is (G2)

From their perspective, course curricula optimized for preparing students to gain career *capital*, as legitimized by the department, at the expense of other forms of career preparation.

For others, the intensity of coursework meant that finding a job became another task on an already long list. From a student:

This quarter was just really like, really hectic especially for the first half. I just wanted to get... the job kinda thing... out of the way, right? Like, I was like, "I just need to get that figured out and then I can like, relax and just focus on school or whatever". (S4)

Another graduate (G1) was looking for work "anywhere where the name doesn't make you shudder", and beyond that, felt that the job search was another chore to complete:

To be able to get (the job search) done as soon as possible was just great. Looking at it in the simplest terms um... like a chore, you know. I need to clean my bathroom, like I can put it off or I can just get it over with. (G1)

While the intensity of students' coursework left little space for much else, career reflection was largely absent from CS curricula. A program graduate, in addition to noting the "ridiculous" amount of work, observed that career reflection (and metacognition broadly) was entirely absent:

I mean everyone knows that none of (students' experiences), uh, (laughs) are related to metacognition. (laughing) You don't find that in getting all your tests to pass, You don't find it in, you know, the grades that you need to get in to be in the major (G2)

They explicitly named departmental career norms and existing modes of replication in our interview, and identified career beliefs among other students that seemed wholly unquestioned:

So, why is it that I didn't feel I was valued, by that kind of cohort? Because I think that they, unfortunately, have been taught to be automata. And, (laughs) that's like, that's so sad. (G2)

We asked a senior-faculty program leader if there was curricular space for career reflection, they also felt that curricular demands might interfere:

Um. We're trying to do more of that... I could point to bullets on slides or discussions in classes, but if you asked the students they'd probably say no and therefore they're probably right. (laughs) I'll think we're trying. And I think it is there. But it'd be easy to blow by when you're trying to understand Djekstra's shortest path algorithm. (L1)

4.3. Students' experiences: aspirational affinity

At the time of our interview, most students had aligned their career aspirations with departmental career norms, prioritizing prestige. Not all students chose Big Four opportunities, many chose work that was less prestigious, but still fulfilled existing norms, following the "rules of the game" within the departmental *field*. We categorized the majority of students and graduates (7 students, 1 graduate) that we interviewed as aligning with these norms, opting for software engineering work that centered prestige without experiencing crises (in contrast with those we discuss later in [Section 4.4](#)). Among the participants that we interviewed, this was a narrow majority, but we believe that most

students within the department would fit this category, as our recruitment messaging likely attracted students feeling some degree of emotional conflict or crisis.

4.3.1. Alleviating uncertainty

Among the students that opted for prestigious work, few justified their choices by emphasizing prestige. Following prior work (Binder et al., 2016), several students chose prestigious majors and employment as a way to alleviate uncertainty around one's future career interests. As rationale, Daoust notes the effectiveness of prestigious organizations in convincing students that working elsewhere entails risks (Daoust, 2020).

We found this to hold for student career prospects, but also for their choice of major. For one, their choice to pursue a prestigious CS major allowed security around career interests that could change over time. They described their decision to pursue CS over other degree options:

It's hard to get into CS but it's easy to leave. So, I thought, "I'll go for the most competitive thing that I'm... interested in". And then hope that I can leave it. So I guess to me it was less like, "Oh I have to make a decision now". It was more like here's time to play the system. (S9)

For this student, the competitiveness of the department, intertwined with notions of an elite institution, drew them to pursue CS:

I think we would all love to say that's not part of it. But I think that it was, you know, the competitiveness is a draw because it allows me to hedge my bets. You think, "Yeah, there's a reason it's competitive. Like, this must be something good". (S9)

Prior work notes competitiveness as a potential draw of elite institutions (Binder et al., 2016), here opting for a competitive major allowed for "hedging", a sense of security against the uncertainty of changing career aspirations.

This student's beliefs were not unquestioned, they understood their choice to pursue prestige as a conscious choice. However, prestige was not the stated object – for them and many others, prestige was a means to some other end. This student mentioned a desire to teach, but predicted that it would be more likely for them to end up at a Big Four company than a not-for-profit, as the Big Four company would allow them to explore many potential interests. Another student voiced the same rationale, hedging future interest development:

Um, it was kinda split between big companies where I knew they would have like all sorts of roles that I could like find something that I would be super interested in... I was like finding big companies, like Amazon or Google... I know they have these opportunities um, so that is where I'm currently planning on going. (S8)

Others emphasized a desire for resources and support to grow, which, from their perspective, was most available at prestigious companies. One student specifically named the Big Four earlier in our interview:

Um, I think right now, what I'm considering is sort of, um I wanted to work for like a bigger corporation on my first new grad because I feel like they have the resources to train you and to grow you. Right now, I don't think that I'm actually going to be able to have too much impact on any product. Because you know, that these things are designed so then you're sort of a small cog. (S2)

4.3.2. Deferring impact

Binder et al., (2016) note that when asked about career trajectories within the 5–0 year time frame, many students centered impact, opting for careers in healthcare, research, or entrepreneurship, career aspirations that students felt were contingent on a prestigious first job. While some students in our case emphasized goals other than prestige in their career search, most that expressed desires for impact-oriented careers opted to defer those desires in favor of prestige for their first job. S9, who framed their choice to major in CS as a “hedge” against future interest development, described their career choice in a similar way:

Yeah, so when I see my career through that five year lens of you know, big company and then uh lecturing or smaller company that does something that’s education based. But I guess I just think of that because um, I realize that I’m hedging my bets in some ways by going to a large company with the assumption that it may uncover a new interest for me. (S9)

S8 also mentioned strong interests in education and they were considering graduate work, but chose an internship at Amazon over work with greater personal alignment:

Um, it was a few things. I definitely like feel emotional conflict about working for Amazon... but like on the other hand, it’s a very good offer and like money is a thing that I need to live. So in that respect, I’m just like this is the best offer that I’ve gotten. [good offer?] Oh, just in terms of salary, relocation, benefit’s, stuff like that. (S8)

Prior work found that students’ insecurities, born from stringent comparison to other elite students led them to opt for high-status careers (finance, consulting, tech) over low-status careers (teaching, social work) (Binder et al., 2016). In our case, we found that students’ insecurities limited the scope of job options that felt accessible. Some saw prestige as a temporary necessity to gain industry experience; S2 felt that they weren’t established enough to find work beyond “a small cog” (see Section 4.3.1), likewise, S5 felt they needed to break into the industry first:

Well, my current plan is to try to get hired at a big- bigger company or maybe just to break into the industry, get some experience. Uh, not necessarily stay there, because like, well, I have an idealistic hope to help the world more than harm it. And so, you know, working at, like, Amazon and just having... Like, getting money and, I don’t know, donating some of it wouldn’t necessarily be the best use of... That’s how I feel about it. [Which bigger companies?] Not Amazon. So, like, being at Microsoft would be a great resume thing. (S5)

Another felt that work-value alignment was unreasonable:

I guess like when... I like... realized like it was probably like unreasonable for me to go to grad school and... to like get a job where I felt like the mission aligned with my value right away it’s like that’s the next thing... [why?] Um, maybe I didn’t have the skill sets to get the jobs at those companies, I don’t know (S3)

For others, centering prestige was an inevitable result of a competitive recruitment process. S7 wanted to “help solve the problems of the world”, offering the climate crisis as an example, but felt like they would probably end up “somewhere like (Amazon Web Services)”, somewhere that centered prestige over social impact. We asked why this felt inevitable, they replied that the number of “really cool jobs” that centered social impact felt limited when compared with the number of jobs centering prestige:

I guess the way that I see it is, there's only a limited number of really cool jobs out there. And those are the ones that everybody wants. So they're the most highly competitive, especially at the, especially at the entry level. . . there's a lot of like, amazing, amazing undergraduate students that are coming out here. And so, uh you know, not necessarily comparing myself to them, but also at the same time kind of comparing myself to them, right? It's when when an employer is looking for who they're going to hire they're going to hire the most qualified candidate, right? (S7)

While impact-oriented jobs did not fit notions of career *capital* legitimized by the department, the competitiveness of the departmental *field* nevertheless precluded this student from pursuing more impactful work.

4.4. Students' experiences: crises

The majority of students and graduates within CS described career aspirations aligned with forms of career *capital* legitimized by the department, prioritizing prestigious work without crisis or dissonance. However, Bourdieu notes that those without positions of *field* power (i.e. students in the department) have a special interest in deconstructing existing notions of *capital* (Bourdieu, 1977). This deconstruction requires work (as described in 2.2), but departing from established norms may enable students to choose roles that offer greater fulfillment, at a time when students are just beginning to establish their career aspirations (Binder et al., 2016).

Within the CS department, many students and graduates described some degree of dissonance or emotional conflict, but few (2 graduates and 4 students) articulated that conflict into a crisis during our interview. Among the students experiencing crises, we found that: (1) crises predominately originated from a conflict between participants *habits* and the limited forms of career *capital* legitimized by the department, (2) the critical discourse necessary to question one's belief in departmental career norms only occurred outside the department, and (3) engaging with work that conflicted with departmental career norms required substantial effort from participants. Rather than present data around these themes, we opt to share stories along the trajectory from crisis to critical discourse and resolution, emphasizing the barriers that participants' experienced.

4.4.1. Selling out and inadequacy

We begin with one student whose crisis, at the time of our interview, came from conflicts between perceptions of the department and the career choices available to them. Early in our interview, S3 noted that the reputation of CS majors on campus was "cut-throat", and that being a CS major meant they were a "sellout", creating a dichotomy between other students who could connect their values with their work and CS students who prioritized career prestige (i.e. Big Four jobs) and financial gain. As application season came around, they felt it was unreasonable to find work where the mission aligned with their values, and, as such, they were unsure why they wanted a job in the first place. They had signed an offer at the time of our interview, and reflected:

I definitely feel like a sellout. I'm not even like working for a big company or anything but I still just feel that way . . . my work won't be helping (to create equality in the world) at all. (S3)

While students taught within a prestige-centering *field* are certainly not required to adhere to departmental norms, S3 perceived few legitimate alternatives to enacting that stereotype.

During our interview, the reality of their career prospects left them unfulfilled and scrambling. They asked themselves:

Like why do I want a job? Maybe I should've thought about a lot more before I even started searching for a job. [Do you want a job?] Well, I mean, I don't know. That's like something that I still don't know. Like I don't know that it's gonna be the most fulfilling thing. Not that that was like the main purpose, but like, you know. (S3)

We asked why they felt that fulfillment was important to them, they replied "I don't know". In our interview, they mentioned that their role as a teaching assistant felt fulfilling, they felt that other avenues towards fulfillment existed, but they weren't sure what those avenues were.

Throughout this work, we heard many students express feelings of insecurity and inadequacy, we pressed gently for explanations, and their responses indicated that pressing further could shift the interview tenor into an interrogation, potentially harming students. For one, however, we felt that we had established enough rapport to more concretely question existing norms and imagine alternatives without causing harm. Our conversation with S10 was similar to others in [Section 4.3](#); they felt they needed to develop their skills before they could pursue more impactful work, and that prestigious companies would be the best place engage in that learning. Given this perception, they deferred career wants of "helping other people" in favor of positions more situated around professional development:

Um, I feel right now I definitely am in the "learning what it's like to be a software engineer". Um, so that would probably lead me away from risky companies. I want somewhere that's a little bit more stable and has the resources, um, to support software engineers, for the short-term. . . I feel like right now, given my limited experience, I would only feel comfortable sticking with what I know, which I know can't solve a lot of problems. And I feel like I want to gain more experience. . . before I'm ready to tackle like bigger, bigger problems that have the impact that I want. (S10)

Similar to others in [Section 4.3](#), S10 emphasized stability, deferring work that was in-line with their values and centered social impact for work legitimized by departmental norms.

Compared with S3, S10 felt little crisis around their work, but we wondered what could result from critical discourse within our interview. As S10 was one of our later participants, we asked for specificity around insecurities, asking what needed to change before they were able to have the impact that they wanted, what would be different after 5 years at a prestigious company that would allow them to pursue impact.

Right. And I kind of, now that got me thinking too, is like I did- I had a smaller scale project (during my internship) that I actually did design, create and implement. I guess I do have experience kind of on a smaller scale of that. And now it's like, "Well okay, I've done that on a small scale, what's stopping me from doing that on a bigger scale?" And I guess there is no answer, like there is no- yeah, I could do it on a larger scale, I do have that experience. Yeah there's nothing. (S10)

Finally, we asked them to define where their notions of inadequacy came from, they responded: "Myself. That's uh. . . That's the problem". For S10, enacting a critical dialogue

and scaffolding self-examination allowed for a recognition and some resolution of the inadequacy that we heard from many students.

While we scaffolded critical discourse for S10, a graduate, G3, leveraged the crisis of an academic failure to engaged in critical discourse on their own.

Me as, like, a person, I'm very introspective. . . This, like, one experience. . . I did horrible in this class, like, so bad. And, like, I-I just sat there, you was, like, okay, so, like, who do I want to be? Like, what kind of life do I want to live, versus, you know, like, versus what my parents want me to do, you know? (G3)

For G3, the work of demarcating between legitimized forms of *capital*, both within the departmental *field* and outside, allowed for broader reconsiderations of their work. We note, however, that for both S10 and G3, critical discourse occurred independent of the department; in our interview for S10 and independently for G3.

4.4.2. Considerable work for resolution

While most participants had yet to articulate a crisis or engage in critical discourse, two students described prior crises, mechanisms of critical discourse, and future plans to engage with work conflicting with department career norms. One, S1, experienced a crisis after being accepted into the department, when a department faculty member published an article critical of efforts to broaden participation in CS:

I read the article and he was just talking about why women don't code, and I was like, I'm not surprised, based on my experience in his class. But wow he really published this. I remember just questioning, like, "Wow, is this, like, really what I want to go into?" But, I was, like, intent on pursuing EdTech. So, I went, whatever, that's really frustrating. (S1)

This article surfaced dissonance between their values and legitimized forms of career *capital* within the department. They attended the department's New Major Orientation, but a lack of any discussion of the article alongside existing diversity efforts within the department led them to distrust department career advisors (A3 and others). Fortunately, they found mentorship from a professor outside the department, and engaged in critical discourse:

He would just, like, ask me questions and I would start bawling. (laughs) Especially during that first quarter in CS. That just, I feel like. . . Everything that I'm doing is at odds with who I am and what I value. (S1)

This mentorship, and the critical discourse scaffolded within, allowed them to engage in work outside the department's career norms, but not without consequence:

And, (through my own research) I found out about like, this movement towards tech with social impact. I know that I can explore (EdTech and social impact) in, like, these different ways. Um. But I had to do it in such, like, a tiring way. . . I, like, was fortunate enough to be able to (go to Impact Labs in NYC). But, I had to go cross country to learn about these interests that I have. (S1)

S1 engaged in critical discourse outside the department to demarcate between the impositions of legitimized career *capital* and their own *habitus*, finding work outside existing career norms. However, it is critical to note the work and persistence required,

both to separate from departmental career norms while maintaining major status, and to pursue more personally aligned work, rather than accepting existing norms.

For the participants that described a crises, spaces for critical discourse were critical to their ability to question established norms. However, we only found these spaces outside the department. We established this space for S10, S1 found space in another department, G3 established space independently and another student, S11, found space to question within industry. Like S1, S11 felt a mismatch between their sense of themselves and their departmental experience that manifested into a crisis:

I was in CS, and all the CS courses were all technical, and everyone around me was trying to get a software engineering internship. So I was like, “This is the path forward”. And I like coding. It’s not like I don’t like it. But then doing it for 0 hours a week, it’s just like, is this the right track moving forward? (S11)

Without space within the department to engage in critical discourse and surface alternatives, they followed established routes of career practice and accepted a Big Four internship. However, they found mentorship within this position:

So I was at Microsoft, and (a project manager) told me, “Here’s what you should build”. And I was like, “Why don’t I get to decide that?” Like “because that’s my job”. And I think we had a conversation from there. (S11)

This conversation spurred an interest in product management; well-established within prestigious organizations, but outside of departmental norms that centered software engineering. After redirecting their career trajectory, they felt concerned about their ability to secure positions within product management, so they looked to better understand the landscape:

Yep, so I was like, “Okay, let me go ahead and do, um, you know, customer interviews. Go talk to PMs in industry” And eventually um, I . . . networked with around 10–15 PMs. Um, I just want and had coffees with them. So for one whole quarter every week probably get two- two coffees with someone and just talk with them about product . . . [So you- you did a user study?] Basically, yeah. (S11)

S11 followed a similar trajectory to S1: conflicts between established departmental norms led to a crisis that was unresolved until they found a context for critical discourse. This discourse, over time, led to a change in their career direction. However, discourse alone was insufficient to change career direction; a considerable amount of work and persistence was required to secure work outside departmental career norms.

5. Discussion

Our findings hold consistent with Bourdieu’s theory, and provide nuance into the landscape of CS students’ career experiences. Participants described a highly selective and competitive CS department, similar to “elite” institutions described in prior work. Through investigating our research questions, we found that the primary career norm within our CS department was to choose highly selective, prestigious firms, which led students to primarily pursue work at the “Big Four”: Microsoft, Facebook, Amazon, and Google (RQ1). Unquestioned norms have a tendency to become self-reinforcing; within our case we found three mechanisms of reinforcement (RQ2). First organizations with established

capital utilized that capital to create recruiting footholds within the department to “win at recruiting”. Second, departmental career advising assumed alignment between students’ *habitus* and departmentally legitimized career *capital*, leaving little space for students to explore alternative modes of career success. And third, courses and curricular objectives emphasized preparation for departmental career norms at a pace that left students little space to consider alternatives.

For those with capital within a field (i.e. students), Bourdieu argues that a crisis is necessary to adopt a reflexive stance with which to examine established norms, along with a critical discourse to demarcate between norms and opinion (Bourdieu, 1977). For students whose career aspirations were aligned with departmentally legitimized career *capital*, crises were largely absent: students chose prestige to alleviate uncertainty around changing future interests, for the perceived potential for growth that prestigious firms offered, and because work with greater personal alignment felt inaccessible without gaining *capital* from prestigious work first (RQ3). Those that experienced crises were able articulate career goals independent of departmental norms, but only if they engaged in critical discourse and found space for the considerable work required to resolve a crisis (RQ3). We found no official space for critical discourse within our CS department; the combination of norms and reinforcement left many students to endorse prestigious work, despite more pro-social career aspirations.

Our results also expand interpretations of prior equity and inclusion efforts in computing education. This body of work has focused on students’ choice to study computing and their persistence within computing majors to surface causes of underrepresentation across gender and race (Margolis & Fisher, 2002; Margolis, 2010; Teague, 2002), but the focus has been primarily on entry, rather than exit. The prestige-centric career norm that we surfaced in this work aligns with agentic goal orientations (those that emphasize performance or achievement), leaving little space for communal goal orientations (those that emphasize collaboration and helping others) (Diekman et al., 2010). Prior work has explored links between goal orientations and career choice; (Lewis et al., 2019b). found that cisgender women and racially minoritized students in computing tended to have higher communal goal orientations, and (Wang et al., 2015). found that students seeking social-impact oriented careers were less likely to study CS. Meanwhile (Ross et al., 2020). found that women introduced to CS in school were less likely to chose CS careers, suggesting that outreach methods that utilize exposure may not be effective in engaging participants with computing. Given our results, it seems broadening participation within CS would be unsuccessful without addressing legitimized career norms, following conjectures from (Kallia & Cutts, 2021).

This work was an exploration of normativity within CS careers; many avenues of future research exist. As this work only looked at learners within CS, it suffers a survivorship bias, ignoring those whose conflict exceeded their capacity to manage it. As prior work has looked at students’ decision to not pursue CS (Margolis, 2010), future work could uplift narratives from those that opted against CS due to a lack of fit, or a lack of belonging. Additionally, this work examined a single elite department; future work could examine career norms in other computing spaces, especially ones without our department’s highly competitive backdrop. However, as norms within elite institutions are supported by prior work (Binder et al., 2016; Daoust, 2020), future work also could look to intervene, aiming to improve belonging for students experiencing dissonance and improving cognizance

for others. Those with dissonance are likely to be the best guides through existing norms and while some work has examined tensions among students considering CS (Vakil, 2020), future work could expand these efforts into domains of computing practice (industry professionals and faculty, as two potential options).

Given the career norm and mechanisms of reinforcement surfaced in this work, and that these likely hinder inclusion efforts, some clear steps exist for CS departments. As students will likely come to computing spaces with an existing *habitus*, and a corresponding set of assumptions, departments and educators should create space for students to question and interrogate their own assumptions. Freirian problem-posing (Freire et al., 2018), person-centered therapy (Rogers et al., 2015), counter-stories (Daniel & Tara, 2002) and counternarratives (Kirdani-Ryan & Ko, 2022; Miller et al., 2020) all offer mechanisms for surfacing assumptions of learners and presenting one's *habitus* as an object of critique. For those with power within CS, broadening the legitimized forms of career *capital*, or, better yet, enacting a career support practice that "takes nothing for granted" (Nash, 1990) in line with Freirian (Freire et al., 2018) and Bourdieusian pedagogies (Nash, 1990) could have a dual effect of allowing individuals and groups (Wang et al., 2015) to find holistic belonging within CS, rather than be seen as "sellouts". A practice of empathetic "not knowing" would aim to assume as little as possible and encourage questioning; this practice of surfacing underlying career assumptions and re-authoring career narratives is well-supported (Busacca & Reh fuss, 2016). However, this space for questioning must be made explicit as many students may be either unaware of existing assumptions or negotiating "situations replete with contradictions" (Holland et al., 1998) resulting from other mechanisms of marginalization (Erete et al., 2021; Rankin et al., 2021).

Finally, our findings raise a critical question: who do we want our students to become? Some have described computing as a "discipline in service of society, its people, and their needs" (Computer Science Framework Steering Committee et al., 2016; Fincher & Robins, 2019), and broadly, theories of social learning describe how participation within a *field* is a process of identification, a process of "becoming a certain person" (Ison, 2010). Who do our students become, by virtue of their participation in CS? Our findings, substantiated by prior work, argue that students replicated the prestige-centricity of their institutions, and while this benefits established organizations, it limits students' capacity for self-expression within their careers. We hope that, somewhere over their lifetime, students take space to deconstruct their own *habitus*, but we are uncertain where this would occur. Universities are likely one of the most intellectually diverse spaces that students encounter throughout their lives, and, in our case, departmental career norms limited the diversity that students could express, and the diversity that they could experience in career aspirations of others. What would happen if we taught students to form their own career response, rather than to replicate the career response that was assumed of them? We wonder how the diversity of careers, and expectations of careers in computing would change if computing education researchers and practitioners made space for students to consider themselves in their careers, rather than pursue prestige at the behest of their institutions.

Notes

1. For this work, we use "department" to refer to departments, schools, colleges, and other academic units.

2. We obtained approval from our university's Institutional Review Board before beginning this work.
3. Unfortunately, existing data only asks about student plans, rather than where students actually end up.
4. <https://www.reddit.com/r/cscareerquestions/>.

Disclosure statement

No potential conflict of interest was reported by the authors.

Funding

This material is based upon work supported by the National Science Foundation under Grant No. 1539179, 1703304, 1836813, 2031265, 2100296, 2122950, 2137834, 2137312, and unrestricted gifts from Microsoft, Adobe, and Google.

Notes on contributors

Mara Kirdani-Ryan is a PhD student at the Paul G. Allen School of Computer Science & Engineering at the University of Washington (Seattle, USA). Their research critically examines cultural norms in computer science and explores teaching those norms to others.

Amy J. Ko is a Professor at the University of Washington Information School (Seattle, USA). She studies our individual and collective struggle to understand computing and harness it for equity and justice.

Emilia A. Borisova is an undergraduate student at the Paul G. Allen School of Computer Science and Engineering at the University of Washington (Seattle, USA).

ORCID

Mara Kirdani-Ryan  <http://orcid.org/0000-0003-1079-9023>

References

- Aarseth, H., Layton, L., & Bjerrum Nielsen, H. (2016, February). Conflicts in the habitus: The emotional work of becoming modern. *The Sociological Review*, 64(1), 148–165. <https://doi.org/10.1111/1467-954X.12347>
- Ahuja, M. K., Ogan, C., Herring, S. C., & Robinson, J. C. (2006). Gender and career choice determinants in information systems professionals. In Griffeth Roger (Ed.), *IT Workers: Human Capital Issues in a Knowledge-Based Environment* (pp. 277).
- Allen, J. M., Muragishi, G. A., Smith, J. L., Thoman, D. B., & Brown, E. R. (2015, December). To grab and to hold: Cultivating communal goals to overcome cultural and structural barriers in first-generation college students' science interest. *Translational Issues in Psychological Science*, 1(4), 331–341. <https://doi.org/10.1037/tps0000046>
- Alshahrani, A., Ross, I., and Wood, M. I. (2018, August). Using social cognitive career theory to understand why students choose to study computer science. *Proceedings of the 2018 ACM Conference on International Computing Education Research*, 205–214, Espoo Finland. ACM.
- Aydarova, E. (2019). Flipping the paradigm: Studying up and research for social justice. In K. K. Strunk, L. A. Locke (Eds.), *Research methods for social justice and equity in education* (pp. 33–43). Springer.

- Bandura, A. (1986). Social foundations of thought and action: A social cognitive theory. In D. Marks (Ed.), *Prentice-Hall Series in Social Learning Theory*. Prentice-Hall.
- Begel, A. and Simon, B. (2008a). Novice software developers, all over again. *Proceeding of the Fourth International Workshop on Computing Education Research*, 3–14, Sydney, Australia, ACM Press.
- Begel, A. and Simon, B. (2008b). Struggles of new college graduates in their first software development job. *Proceedings of the 39th ACM Technical Symposium on Computer Science Education*, Portland, Oregon, USA.
- Binder, A. J., Davis, D. B., & Bloom, N. (2016). Career funneling: How elite students learn to define and desire “prestigious” jobs. *Sociology of Education*, 89(1), 20–39. <https://doi.org/10.1177/0038040715610883>
- Bourdieu, P. (1977). *Outline of a theory of practice*. Cambridge Univ. Press.
- Bourdieu, P. (1986). The Forms of Capital. In *Cultural Theory: An Anthology* (pp. 81–93).
- Bourdieu, P. (1998a). *Practical reason: On the theory of action*. Stanford University Press.
- Bourdieu, P. (1998b). *The state nobility: Elite schools in the field of power*. Stanford University Press.
- Bourdieu, P. (2000). *Pascalian Meditations*. Stanford University Press.
- Brunner, B., & Kuhn, A. (2014). The impact of labor market entry conditions on initial job assignment and wages. *Journal of Population Economics*, 27(3), 705–738. <https://doi.org/10.1007/s00148-013-0494-4>
- Busacca, L. A., & Rehfuss, M. C. (Eds.). (2016). *Postmodern career counseling: A handbook of culture, context, and cases*. John Wiley & Sons.
- Call-Cummings, M., & Ross, K (2019). Re-positioning power and re-imagining reflexivity: Examining positionality and building validity through reconstructive horizon analysis. In K. Strunk Kamden, Locke Leslie Ann (Eds.), *Research methods for social justice and equity in education* (pp. 3–13). Springer.
- Carter, L. (2006). Why Students with an Apparent Aptitude for Computer Science Don't Choose to Major in Computer Science. *Proceedings of the 37th ACM Technical Symposium on Computer Science Education*, Houston, Texas, USA. <https://doi.org/10.1145/1124706.1121352>
- Clarke, V. A., & Joy Teague, G. (1996). Characterizations of computing careers: Students and professionals disagree. *Computers & Education*, 26(4), 241–246. [https://doi.org/10.1016/0360-1315\(96\)00004-8](https://doi.org/10.1016/0360-1315(96)00004-8)
- Daniel, G. S., & Tara, J. Y. (2002, February). Critical race methodology: Counter-storytelling as an analytical framework for education research. *Qualitative inquiry*, 8(1), 23–44. <https://doi.org/10.1177/107780040200800103>
- Daoust, L. (2020, January). Playing the Big Four recruitment game: The tension between illusion and reflexivity. *Critical Perspectives on Accounting*, 66, 102081. <https://doi.org/10.1016/j.cpa.2019.04.002>
- Davis, D., & Binder, A. (2019, January). Industry, firm, job title: The layered nature of early-career advantage for graduates of elite private universities. *Socius: Sociological Research for a Dynamic World*, 5, 237802311985971. <https://doi.org/10.1177/2378023119859711>
- Diekman, A. B., Brown, E. R., Johnston, A. M., & Clark, E. K. (2010). Seeking congruity between goals and roles: A new look at why women opt out of science, technology, engineering, and mathematics careers. *Psychological Science*, 21(8), 1051–1057. <https://doi.org/10.1177/0956797610377342>
- Diemer, M. A., & Blustein, D. L. (2006, April). Critical consciousness and career development among urban youth. *Journal of Vocational Behavior*, 68(2), 220–232. <https://doi.org/10.1016/j.jvb.2005.07.001>
- DiSalvo, B., Guzdial, M., Meadows, C., Perry, K., McKlin, T., and Bruckman, A. (2013). Workifying games: Successfully engaging african american gamers with computer science. *Proceeding of the 44th ACM Technical Symposium on Computer Science Education*, 317, Denver, Colorado, USA: ACM Press.
- Erete, S., Rankin, Y. A., and Thomas, J. O. (2021). I can't breathe: Reflections from black women in cscw and hci. *Proceedings of the ACM on Human-Computer Interaction*, 4(CSCW3), 1–23. <https://doi.org/10.1145/3432933>
- Erin, A. C. (2014, January). Culture of disengagement in engineering education? *Science, Technology, & Human Values*, 39(1), 42–72. <https://doi.org/10.1177/0162243913504305>
- Fincher, S. A., & Robins, A. V. (2019). *The Cambridge handbook of computing education research*. Cambridge University Press.
- Finlay, L., & Gough, B. (2008). *Reflexivity: A practical guide for researchers in health and social sciences*. John Wiley & Sons.

- Fouad, N. A., & Byars-Winston, A. M. (2005, March). Cultural context of career choice: Meta-analysis of race/ethnicity differences. *The Career Development Quarterly*, 53(3), 223–233. <https://doi.org/10.1002/j.2161-0045.2005.tb00992.x>
- Freire, P., Macedo, D. P., & Shor, I. (2018). *Pedagogy of the Oppressed* (50th anniversary ed.). Bloomsbury Academic.
- Garriott, P. O., Raque-Bogdan, T. L., Zoma, L., Mackie-Hernandez, D., & Lavin, K. (2017, February). Social cognitive predictors of Mexican American high school students' math/science career goals. *Journal of Career Development*, 44(1), 77–90. <https://doi.org/10.1177/0894845316633860>
- Hammer, D., & Berland, L. K. (2014). Confusing claims for data: A critique of common practices for presenting qualitative research on learning. *Journal of the Learning Sciences*, 23(1), 37–46. <https://doi.org/10.1080/10508406.2013.802652>
- Holland, D., William Lachicotte, D. S., Jr., & Cain, C. (1998). *Identity and agency in cultural worlds*. Harvard University Press.
- Ison, R. (2010). Social learning systems and communities of practice. In C. Blackmore (Ed.), *Social learning systems and communities of practice* (pp. 73–87). Springer London.
- K-12 Computer Science Framework Steering Committee et al. (2016). *K-12 computer science framework*. ACM.
- Kahle, J., & Schmidt, G. (2004). Reasons women pursue a computer science career: Perspectives of women from a mid-sized institution. *Journal of Computing Sciences in Colleges*, 19(4), 78–89.
- Kallia, M. and Cutts, Q. (2021, August). Re-examining inequalities in computer science participation from a bourdieusian sociological perspective. *Proceedings of the 17th ACM Conference on International Computing Education Research*, Virtual Event.
- Khan, K. (2020). What Does a Terrorist Sound Like? Language and Racialized Representations of Muslims. In H. S. Alim, A. Reyes, P. Kroskity (Eds.), *The Oxford Handbook of Language and Race* (pp. 398–422).
- Kirdani-Ryan, M. and Ko, A. J. (2022). The house of computing: Integrating counternarratives into computer systems education. *Proceedings of the 53rd ACM Technical Symposium on Computer Science Education*, Providence, RI, USA. 1, 279–285.
- Lent, R. W., & Brown, S. D. (2019, December). Social cognitive career theory at 25: Empirical status of the interest, choice, and performance models. *Journal of Vocational Behavior*, 115, 103316. <https://doi.org/10.1016/j.jvb.2019.06.004>
- Lent, R. W., Brown, S. D., & Hackett, G. (1994, August). Toward a unifying social cognitive theory of career and academic interest, choice, and performance. *Journal of Vocational Behavior*, 45(1), 79–122. <https://doi.org/10.1006/jvbe.1994.1027>
- Lent, R. W., Lopez, A. M., Lopez, F. G., & Sheu, H.B. (2008, August). Social cognitive career theory and the prediction of interests and choice goals in the computing disciplines. *Journal of Vocational Behavior*, 73(1), 52–62. <https://doi.org/10.1016/j.jvb.2008.01.002>
- Lewis, C., Bruno, P., Raygoza, J., and Wang, J. (2019a, July). Alignment of goals and perceptions of computing predicts students' sense of belonging in computing. *Proceedings of the 2019 ACM Conference on International Computing Education Research*, 11–19, Toronto ON Canada. ACM.
- Lewis, C., Bruno, P., Raygoza, J., and Wang, J. (2019b). Alignment of goals and perceptions of computing predicts students' sense of belonging in computing. *Proceedings of the 2019 ACM Conference on International Computing Education Research*, Toronto, ON, Canada.
- Lucena, J. (Ed.). (2013). *Engineering education for social justice* (Vol. 10). Springer Netherlands.
- Margaret Alexander, P., Holmner, M., Hendrik Lotriet, H., Matthee, M. C., Pieterse, H. V., Naidoo, S., Twinomurinz, H., & Jordaan, D. (2011). Factors affecting career choice: Comparison between students from computer and other disciplines. *Journal of Science Education and Technology*, 20(3), 300–315. <https://doi.org/10.1007/s10956-010-9254-3>
- Margolis, J. (2010). *Stuck in the shallow end: Education, race, and computing*. MIT press.
- Margolis, J., & Fisher, A. (2002). *Unlocking the clubhouse: Women in computing*. MIT press.
- Miller, R., Liu, K., & Ball, A. F. (2020, March). Critical counter-narrative as transformative methodology for educational equity. *Review of Research in Education*, 44(1), 269–300. <https://doi.org/10.3102/0091732X20908501>

- Nash, R. (1990, December). Bourdieu on education and social and cultural reproduction. *British Journal of Sociology of Education*, 11(4), 431–447. <https://doi.org/10.1080/0142569900110405>
- Nugent, G., Barker, B., Welch, G., Grandgenett, N., ChaoRong, W., & Nelson, C. (2015, May). A model of factors contributing to STEM learning and career orientation. *International Journal of Science Education*, 37(7), 1067–1088. <https://doi.org/10.1080/09500693.2015.1017863>
- Papastergiou, M. (2008). Are computer science and information technology still masculine fields? high school students' perceptions and career choices. *Computers & Education*, 51(2), 594–608. <https://doi.org/10.1016/j.compedu.2007.06.009>
- Rankin, Y. A., Thomas, J. O., & Erete, S. (2021). Real talk: Saturated sites of violence in cs education. *ACM Inroads*, 12(2), 30–37. <https://doi.org/10.1145/3463406>
- Rogers, C. R., Dorfman, E., Gordon, T., & Hobbs, N. (2015). *Client centered therapy: Its current practice, implications and theory* (reprinted ed.). Robinson.
- Ross, M., Hazari, Z., Sonnert, G., & Sadler, P. (2020). The intersection of being black and being a woman: Examining the effect of social computing relationships on computer science career choice. *ACM Transactions on Computing Education (TOCE)*, 20(2), 1–15. <https://doi.org/10.1145/3377426>
- Teague, J. (2002). Women in computing: What brings them to it, what keeps them in it? *ACM SIGCSE Bulletin*, 34(2), 147–158. <https://doi.org/10.1145/543812.543849>
- Tellhed, U., Bäckström, M., & Björklund, F. (2018, February). The role of ability beliefs and agentic vs. communal career goals in adolescents' first educational choice. What explains the degree of gender-balance? *Journal of Vocational Behavior*, 104, 1–13. <https://doi.org/10.1016/j.jvb.2017.09.008>
- Trapnell, P. D., & Paulhus, D. L. (2012, January). Agentic and communal values: their scope and measurement. *Journal of Personality Assessment*, 94(1), 39–52. <https://doi.org/10.1080/00223891.2011.627968>
- Turner, S. L., Ri Joeng, J., Sims, M. D., Dade, S. N., & Ses, M. F. R. (2019, February). Gender, and STEM career interests, goals, and actions: A test of SCCT. *Journal of Career Assessment*, 27(1), 134–150. <https://doi.org/10.1177/1069072717748665>
- Vakil, S. (2020, April). "I've always been scared that someday I'm going to sell out": Exploring the relationship between political identity and learning in computer science education. *Cognition and Instruction*, 38(2), 87–115. <https://doi.org/10.1080/07370008.2020.1730374>
- Vesisenaho, M., Puhakka, H., Silvonon, J., Sutinen, E., Vanhalakka-Ruoho, M., Voutilainen, P., and Penttinen, L. (2009). Need for study and career counselling in computer science. *39th IEEE Frontiers in Education Conference*, San Antonio, TX, USA. IEEE.
- Wang, J., Hong, H., Ravitz, J., and Ivory, M. (2015). Gender differences in factors influencing pursuit of computer science and related fields. *Proceedings of the 2015 ACM Conference on Innovation and Technology in Computer Science Education*, Vilnius, Lithuania (pp. 117–122).
- Young Choi, B., Park, H., Yang, E., Ki Lee, S., Lee, Y., & Min Lee, S. (2012, October). Understanding career decision self-efficacy: A meta-analytic approach. *Journal of Career Development*, 39(5), 443–460. <https://doi.org/10.1177/0894845311398042>