Transfer Student Receptivity in Patriarchal STEM Contexts:

Evidence of Gendered Transfer Student Stigma in Computer Science from a Mixed

Methods Study

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Abstract

Research Questions: While community college transfer (i.e., upward transfer) represents an important mechanism for advancing equity across STEM fields, existing studies of gender and women's participation within computer science have largely excluded the perspectives of upward transfer students. We address this gap in the literature by exploring transfer receptivity and gender discrimination within computer science, guided by the following questions: 1) How do upward transfer computer science students report their receptivity experiences, and how might this differ by gender? 2) How do upward transfer computer science students make meaning of receptivity experiences, and how might that meaning making be shaped by gender?

Methods: We use a sequential mixed methods design, relying on longitudinal survey and interview data from upward transfer computer science majors, collected throughout students' first year at the receiving university.

Results: Findings reveal that, relative to men, upward transfer women report greater experiences of transfer stigma and challenges accessing resources at the receiving university. Qualitative findings document additional nuances in how upward transfer students—especially women—describe resilience as they navigate the university campus, encounter navigation challenges at the university, and make meaning of various manifestations of transfer stigma on campus.

Contributions: In addition to implications for research and theory, we discuss what universities can do to foster a more receptive environment for upward transfer women. Specific recommendations focus on ensuring that spaces for women in computing are inclusive of transfer students and, likewise, creating supportive transfer cohort communities that are inclusive of women.

Keywords: upward transfer; mixed methods; STEM; computer science; gender

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Transfer from community colleges to universities—often referred to as upward transfer—represents a critical mechanism for advancing equity in science, technology, engineering, and mathematics (STEM) fields (Bahr et al., 2017). Community colleges are a primary entry point into higher education for many students, particularly women, Students of Color, students who are first-generation to college, and those representing any combination of these and other historically minoritized[1] groups in higher education (Bahr et al., 2017; LaSota & Zumeta, 2016; Shapiro et al., 2017). While transfer is a common goal among students who enter STEM programs at community colleges, transfer rates remain low (Taylor & Jain, 2017). Even for those who successfully navigate transfer processes, receiving four-year universities are not always welcoming. Upward transfer students in STEM tend to report lower levels of support than students who began their degree at the four-year university (Blaney, 2020) and often experience stigma from students and faculty alike (Laanan et al., 2010). For upward transfer women who are concurrently experiencing gender discrimination in STEM environments, transfer stigma may be especially challenging (Wang & Wickersham, 2019).

We focus our inquiry specifically on upward transfer students in computer science (CS). Even when compared to other STEM fields, women remain remarkably underrepresented in CS majors. In 2019, women represented only 20% of bachelor's degree recipients in CS and just 17% of CS associate's degrees (NCWIT, 2020). Given the important role that transfer plays in facilitating access to higher education, some emerging research has specifically considered upward transfer women's participation in CS, documenting unique predictors of upward transfer women's retention in CS majors and careers (Blaney, 2021). More broadly, upward transfer women's experiences may be uniquely shaped by their status as both transfer students and women within the patriarchal context of CS (Frieze & Quesenberry, 2019). Without intentionally considering educational mechanisms to better support students who

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[1] In this work, we use *minoritized* and *minoritization* to acknowledge the action and social construction of minoritization and oppression.

experience minoritization due to their transfer status and gender, collegiate CS programs will not realize their full potential to develop the talent of the future computer science workforce.

Drawing upon research on STEM transfer pathways and gender equity in CS, this sequential-explanatory mixed methods study considers how gender and upward transfer intersect. In particular, we focused on how upward transfer students are supported at their receiving university within the gendered context of CS. This work was driven by two research questions. The first question required quantitative methods to provide an initial look at receptivity experiences, while the second question required a more in-depth analysis of student meaning making. More specifically, we addressed the following:

1. How do upward transfer computer science students report their receptivity experiences, and how might this differ by gender?

2. How do upward transfer computer science students make meaning of receptivity experiences, and how might that meaning making be shaped by gender?

Conceptual Framework

Our study is guided by Wang's (2017) STEM upward transfer model. While applications of this model have primarily focused on success among transfer aspirants enrolled at community colleges, Wang also emphasized "the need to support STEM transfers *beyond access* [emphasis added] to 4-year STEM majors" (p. 53). Thus, we focus our inquiry on students' experiences of support after they arrive at receiving four-year institutions. Further, applications of Wang's STEM transfer model emphasize the importance of considering how transfer receptivity experiences intersect with gender, race and ethnicity, and other aspects of students' identities and background (Wang & Wickersham, 2019). In this way, the model informed our decision to focus specifically on how receptivity intersects with gender, centering women's experiences in the unique context of undergraduate CS. As such, we integrated studies of student support and success in undergraduate CS programs to provide a deeper look into upward transfer CS student experiences. As we describe in the literature review that follows, much of the scholarship on gender and women's participation in computing has focused on the patriarchal culture of computing majors, which can ultimately contribute to women's attrition from computing. This literature provided

context for how we applied Wang's (2017) model, guiding how we considered the role of gender, discrimination, and identity salience within our analyses. In sum, Wang's STEM upward transfer model informed the research questions we constructed (i.e., our focus on receptivity and gender), the methodologies employed to examine those questions, and our interpretation of results. In the research design section below, we provide a more detailed discussion of how Wang's model guided variable selection, statistical procedures, and the interview protocol.

Literature Review

This study brings together literature on upward transfer student receptivity and women's experiences and participation in the unique context of computing-related majors. Importantly, while our study focuses specifically on CS, much of the existing literature has explored student experiences in aggregate computing majors to be inclusive of computer engineering, information technology, informatics, and other interdisciplinary CS-related majors; thus, our literature review will often refer to computing majors more broadly. To provide a shared lens for our study, we begin with a review of research examining upward transfer receptivity and post-transfer experiences, much of which is situated within STEM contexts. Next, we review recent studies that have considered equity in transfer pathways specifically within CS and other computing-related majors. We close with key literature on gender and women's participation in CS.

Transfer Receptivity Experiences

Within scholarship on community college pathways, researchers have long acknowledged the importance of receptivity within four-year institutions for upward transfer students (e.g., Berger & Malaney, 2003; Townsend, 1995). Jain and colleagues (2011) outlined three interrelated elements of post-transfer receptivity: four-year institutions have a responsibility to 1) acknowledge the unique and intersectional structures that guide transfer students' experiences, 2) provide students with academic and financial support to succeed at high levels, and 3) engage in regular review of transfer programs for ongoing improvement. Scholars have stressed that these elements are not intended as stand-alone

initiatives, but rather are interconnected as part of "a transfer receptive culture [that] must be institutionalized throughout the campus" (Jain et al., 2011, p. 258).

Scholars have also examined specific post-transfer experiences and their impacts, collectively documenting social connections to the receiving campus (e.g., Berger & Malaney, 2003; Townsend & Wilson, 2006, 2009) and access to high quality advising/institutional supports (Townsend & Wilson, 2006) as important elements of receptive transfer experiences. For instance, Jackson and Laanan's (2015) study illustrated that security provided by financial aid packages was associated with STEM upward transfer students' positive social adjustments to their receiving campus. In addition, Berger and Malaney (2003) found that socializing with peers, living and working on campus, having fewer family commitments, and spending less time working off campus were each associated with post-transfer achievement and satisfaction. Importantly, other scholars have pointed out disagreement among researchers about the relevance of social involvement for upward transfer students who may prioritize academic engagement amidst adjustments to large, complex university settings (refer to Bahr et al., 2012; Owens, 2010; Townsend & Wilson, 2006, 2009). Along these lines, Zilvinskis and Dumford (2018) found that support from faculty was critical in shaping upward transfer student experiences and engagement on campus. Taken together, research consistently documents that being engaged on campus tends to be associated with more positive outcomes, while off-campus commitments are sometimes associated with negative experiences and outcomes.

Unfortunately, studies also illuminate how receiving universities often fall short of creating a receptive culture where students feel supported and can form meaningful connections with peers and faculty. For example, university efforts to socially integrate students who enter as first-years may have the unintended consequence of contributing to a hostile transfer culture, as students who begin their degrees at four-year institutions may form early social circles that are then largely closed off to transfer students (Lee & Schneider, 2018; Nuñez & Yoshimi, 2017; Starobin et al., 2016; Townsend & Wilson, 2006, 2009). At the nexus of gender and transfer, researchers have found that upward transfer women in STEM have more difficulty with academic adjustment than upward transfer men (Jackson & Laanan, 2015).

Further, "transfer stigma" (i.e., implicit and/or explicit minoritization or skepticism directed at transfer students) can be pervasive on university campuses, leading transfer students to doubt their ability to succeed at the four-year university, despite successfully transferring with strong academic records (Shaw et al., 2019). Within STEM more specifically, recent studies highlight how faculty often perpetrate microaggressions in the form of exclusionary comments that assume all students began their degree at the receiving institution (Elliott & Lakin, 2020). These exclusionary experiences may lead transfer students to leave STEM majors in favor of other disciplines where they find greater support (Corwin et al., 2020).

Post-Transfer Success in Computing

The studies cited above focus on transfer students across disciplines or transfer students in aggregated STEM contexts. However, as argued by Wang (2017) and others, STEM disciplines hold distinct cultures that motivate our need for greater disciplinary specificity. Emerging literature on transfer success in computing primarily relies on existing survey data to examine the factors that predict retention (Blaney, 2021b), sense of belonging (Blaney & Barrett, 2021), degree aspirations (Blaney & Wofford, 2021), and related outcomes. Other scholarship points to the crucial role universities play in creating a receptive culture by providing campus and departmental resources (e.g., transfer seminars, tailored advising, career and cultural centers), all of which have been shown to help upward transfer CS students feel a sense of belonging (Kwik et al., 2018). In addition, studies show that feeling supported by one's peers may increase upward transfer students' persistence in CS (Blaney, 2021b) and lead to higher GPAs (Massi et al., 2012). These studies echo the broader literature on transfer receptivity and success, documenting the importance of campus engagement, while revealing similar negative relationships between non-college obligations and key outcomes. At the same time, transfer receptivity in computing may differ from other disciplines, given unique curricular considerations (e.g., programming languages used in introductory coursework may vary across institutions), as well as the vast gender imbalance and patriarchal context of computing (Blaney, 2020).

Women's Participation in Patriarchal Computer Science

Our study is also guided by the broader literature on gender and women's experiences within the patriarchal context of CS, a topic that has received considerable research attention. While studies about women's participation and gender equity in computing have considered myriad factors that may contribute to women's underrepresentation in the field (e.g., Alvarado et al., 2019), overwhelmingly, studies point to the harmful effects of the hostile and stereotypically masculine culture that characterizes undergraduate CS spaces and women's experiences in them (Margolis & Fisher, 2002; Pantic & Clarke-Midura, 2019). For instance, women were found to associate stereotypical CS paraphernalia with men, which contributes to feelings of not belonging in that computing environment (Cheryan et al., 2009). As one way to reduce this, scholars have stressed the importance of faculty support for fostering women's confidence in undergraduate CS (Fisher & Margolis, 2002; Blaney, 2020; 2021a; Starobin et al., 2016).

More recently, researchers have emphasized the complexities of intersectionality, structures of domination, and multiple identities for women navigating CS and related STEM fields (see Wisniewski et al., 2018). Turning to recent student-level research on sense of belonging, Sax and colleagues (2018) found that white and Asian women in introductory CS courses reported lower sense of belonging than white and Asian men. Similarly, racially minoritized women in computing reported a lower sense of belonging than racially minoritized men (Sax et al., 2018). Guided by these findings, scholars have argued for more intersectional research and theory on identity development among women in CS (Rodriguez & Lehman, 2018). We extend this argument by calling for research that considers upward transfer and gender equity, in light of students' other intersecting identities.

Research Design

Driven by our research questions and goal to provide a more complete picture of upward transfer receptivity experiences in CS, we relied on a sequential-explanatory mixed methods design (Ivankova et al., 2006), in which qualitative analyses were guided by quantitative results (see Figure 1) and the streams of research were further integrated in the discussion of this manuscript. After analyzing survey data, we analyzed interview data to elicit deeper understandings of transfer experiences. Interview data were analyzed using a general qualitative design (Percy et al., 2015; Saldaña, 2016), guided by critical

constructivism (Kincheloe, 2005). In keeping with our sequential-explanatory approach, we present the quantitative methods followed by a discussion of the qualitative methods.

Survey Data and Methods

This study draws on longitudinal data from students who completed two surveys, both of which were informed by Wang's (2017) STEM upward transfer model (see Wang & Lee, 2019). More specifically, we administered a survey in fall 2021 to just over 400 incoming upward transfer students majoring in CS, upon their arrival across five receiving universities, all research-intensive institutions across Southern California. The survey had a response rate of 44%. After deleting responses from students who did not meet the study eligibility criteria, our baseline sample included 156 first-year upward transfer students in CS majors, 53% of whom went on to take a follow-up survey approximately three months later. This yielded a longitudinal survey sample of N=82 participants. Among those in the analytic survey sample, 28% were women, 72% were men, and no students indicated another gender identity. Separately, 32% of participants were from East Asian groups; 22% were Southeast Asian; 12% were South Asian; 1% were Black; 13% were Latina/o/x; 2% were Middle Eastern or Persian; 1% were Native Hawaiian/Pacific Islander; and 27% were white. Forty-three percent of participants were first-generation to college. Ninety-two percent of participants were CS majors, and the remaining 8% were majoring in a closely related field housed within the CS department. To incentivize response to the first survey, all respondents were entered in a raffle to win a $50 gift card (three $50 gift cards were raffled off at each of the five participating campuses). To incentivize response to the second survey, students received a guaranteed $20 gift card, sent immediately upon completion of the survey.

Measures

To examine post-transfer experiences, we selected variables to capture both general support in CS and transfer-specific supports and receptivity experiences, informed by our conceptual framework (Wang, 2017) and relevant literature (e.g., Sax et al., 2018; Shaw et al., 2019). To measure general support, we relied on two different composite variables capturing departmental support and peer support in CS, each adapted from Sax and colleagues (2018). Next, we included three composite variables capturing transfer-

specific experiences: navigational ease at the receiving campus (Hurtado & Guillermo-Wann, 2013); institutional support for transfer (Hurtado & Guillermo-Wann, 2013); and transfer stigma (Laanan et al., 2010). Refer to Table A1 for a detailed description of each composite variable, including reliability information.

Students self-reported their gender on the survey by selecting one of the following: woman, man, or another gender. To better understand and deconstruct the significance of gender identity and gendered CS experiences in our analyses, we included two single-item measures adapted from Momentum (n.d.): gender salience and observed gender discrimination in CS. First, to measure gender salience, students self-reported the frequency with which they experienced the following on a five-point scale (1=Never; 5=All of the Time): *During the current academic year, when interacting with individuals in your major/department, how often have you felt self-conscious about your gender?* To assess observed gender discrimination within the department, students indicated how frequently they observe the following on a five-point scale: *While interacting in your academic department during the current academic year, how often have you heard individuals make insensitive or insulting remarks about women?* While this measure of observed gender discrimination is limited in its focus on remarks that are explicitly discriminatory, we used this to provide an initial look into discriminatory experiences/observations, which we further explore through the qualitative stream of this work.

Statistical Procedures

Because participants were nested across five universities, we examined intraclass correlations [ICCs] across all measures of support and receptivity. ICCs were low ($.007 \leq ICC \leq .104$), allowing us to analyze the data using a single-level structure without increasing the risk of Type I error.[2] We began our analysis of the research questions by reviewing means and standard deviations across all key variables capturing support and receptivity, followed by independent samples t-tests to assess gender differences across these measures (RQ1). To further explore significant results, we ran additional analyses examining

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[2] ICCs were not calculated for three variables, because the between campus variance was too low to accurately calculate the ICC value, further supporting our decision to dismiss the clustered data structure within our statistical analyses.

how gender differences might be explained by experiences of gender discrimination and gender salience within the CS context. These analyses were guided by our conceptual framework, as Wang (2017) emphasized the importance of understanding transfer experiences in relation to larger contexts and intersectional experiences. To that end, we first used independent samples t-tests to assess gender differences on identity salience and discrimination. Next, we used OLS regression to examine the relationship between gender identity, gender salience, and observed gender discrimination, treating transfer stigma and navigational ease as dependent variables. Other measures of receptivity and support—beyond transfer stigma and navigational ease—were not explored in regressions, because no significant gender differences emerged from descriptive analyses. Importantly, the goal of these analyses was not to predict stigma and navigational ease; rather, we wanted to further examine variation in students' reported transfer receptivity experiences (RQ1), controlling for gender salience and observed gender discrimination within the analysis.

Interview Data and Qualitative Methods

A subset of 18 participants (refer to Table 1) completed interviews approximately two months after the second survey was administered. Participants were selected purposefully to maximize diversity in gender, race, ethnicity, and parental education. Prospective interview participants were invited via email, and all participants received a guaranteed $25 gift card incentive upon completion of the interview. While all women survey respondents were invited to participate, only four completed the interview. Interviews were approximately one hour in length and relied on a semi-structured protocol, which included questions about transfer experiences, institutional supports, and identity salience (e.g., What aspects of your background or identity are salient to your college experiences? What, if any, barriers have you faced or overcome in relation to transferring to your university?). Interview questions and probes were developed to capture aspects of Wang's (2017) STEM upward transfer model.[3] All interviews were recorded and transcribed verbatim.

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[3] While the qualitative analysis was guided by quantitative results, the interview protocol was developed prior to completion of the quantitative stream of this work.

Insert Table 1 About Here

Qualitative Analysis

To examine how upward transfer students in CS made meaning of receptivity experiences, and how gender related to that meaning making (RQ2), we analyzed interview data in phases, using a general qualitative approach (Caelli et al., 2003). We conducted an initial round of *deductive coding* framed by the quantitative findings, in keeping with our sequential-explanatory design. Because deductive analyses were contingent on quantitative findings, we elaborate on the integration of the quantitative and qualitative research streams in the summary of quantitative results below. However, we also sought to understand participants' meaning making *inductively*, constructing themes based on participants' descriptions of their post-transfer experiences and how they made sense of their institutional and social positionality, related to their upward transfer status and gender.

Through our critical constructivist approach, analysis distinguished between participants' interpretations of gender and transfer experiences and the research team's interpretation of discrimination within CS and higher education more broadly. More specifically, during the first phase of the analysis, members of the research team carefully reviewed all verbatim interview transcripts to identify inductive codes and instances of deductive codes, which were organized into preliminary themes. Preliminary themes were compiled and organized to create a working codebook of themes, descriptions, example quotes, and counterexamples. Two members of the research team coded a sample of two interview transcripts in NVivo to ensure consistency and reliability in the coding process. To that end, we discussed minor discrepancies in the identification and application of individual codes to achieve consensus and revise the final codebook accordingly. Next, the codebook was used to code the remaining interview transcripts, and coded data were compiled and analyzed in relation to the second research question. Finally, as we drafted the qualitative findings presented below, we organized themes around key quantitative results to further facilitate the explanatory value of our qualitative analyses and findings. To further ensure trustworthiness throughout all stages of analysis, we coded counterexamples that emerged

in relation to each theme. We also met regularly to discuss our collective understanding of themes and counterexamples, as well as how our interpretations might be informed by our positionalities.

Integration of Research Streams

As discussed above and throughout the findings that follow, we employed a sequential-explanatory mixed methods design in alignment with our research questions. The two streams of the research were conducted in distinct stages to address the first descriptive research question (using quantitative methods) and then the second explanatory research question (using qualitative methods). These two forms of inquiry were integrated in two primary ways, as illustrated by Figure 1. First, quantitative results informed qualitative analyses through deductive coding and the presentation of results (i.e., themes were organized in relation to key quantitative findings). Second, we brought the streams together more comprehensively to create a richer interpretation of results within the discussion and implications section of this manuscript.

Positionality

In light of our critical constructivist approach, we considered how our positionalities inform this work in ways that we may or may not be aware. We reflected on our positionalities individually and as a research team throughout the development of this manuscript, particularly during the qualitative analysis and reporting, as we describe above. The first author is a white woman and assistant professor of higher education. Her research is focused on gender equity and upward transfer pathways in CS, and she is a disciplinary outsider in CS. Her positionality shaped the questions that are asked in this paper and likely the nature of the interview protocol, information that participants chose to disclose in the interviews that she conducted, and the analytical approach in this paper. The second author, a postdoctoral researcher, played a large role in analyzing interview data alongside the first author. Their research, examining institutional interventions to advance equity and support first-generation Students of Color, along with their identification as a Latine scholar, informed their analysis. The third author is a white man who serves as both a professor of learning sciences and associate dean for graduate studies. His research focuses primarily on issues of learning and motivation using mixed methodologies in higher education,

which shaped the interpretation of results. The fourth author, an assistant professor of higher education whose research examines (in)equity in STEM graduate school pathways and mentorship, also conducted interviews for this paper. In the data collection and writing process, she reflected on her social identities and experiences—particularly her identities as a white cisgender woman who navigated a direct pathway to a baccalaureate degree—and documented this reflexivity in personal journaling and analytic memos.

Limitations

Before presenting findings, it is important to highlight key limitations of this work. First, because women are severely underrepresented among upward transfer CS students, our sample is made up primarily of men. While interview data allowed us to explore gendered experiences in greater depth, we were only able to recruit four women and one non-binary participant to the interview sample. While the lack of gender diversity in our sample is reflective of the larger discipline (see Blaney, 2020), the sample composition still limited our ability to examine variation. Second, the sample includes students across five research universities; receptivity experiences may look different for students transferring into other types of universities, such as public comprehensive universities and liberal arts colleges. Similarly, this study was conducted in a single state context—which allowed for greater depth in our analysis—and it will be important for future research to consider other state contexts. Finally, our survey and interview data were collected throughout students' first year at their receiving universities; while our decision to focus on this critical time in students' degree programs was intentional, future research should explore receptivity experiences over a longer period of time.

<div align="center">

Findings

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Quantitative Findings: Gender Differences in Navigational Ease and Transfer Receptivity

This study started with an exploration of gender differences in transfer student experiences. As shown in Table 2, we found that women reported lower navigational ease on their receiving campus (M=3.70, SD=0.73) relative to men (M=4.07, SD=0.56; t=2.43, p=.017). Put differently, compared to men, women reported greater challenge accessing post-transfer resources (e.g., advising services). Additionally, women reported higher levels of transfer stigma (M=2.99, SD=0.75), when compared to

men in the sample (*M*=2.34, SD=0.94; *t*=-2.94, *p*=.004), suggesting that upward transfer women may

have uniquely stigmatizing experiences. These significant findings represent medium and large size

effects, respectively (Cohen's *d*=.57 and .76). There were no significant gender differences on students'

reports of institutional support for transfer, peer support, or departmental support.

Insert Table 2 About Here

While cell sizes limited our ability to examine intersecting differences by gender and

race/ethnicity, we ran supplemental one-way ANOVAs to check for mean differences across key

variables between Women of Color, Men of Color, white women, and white men (i.e., an aggregated

four-group variable). Results showed that the significant gender differences on navigational ease and

transfer stigma scores primarily reflected the gap between white women and Men of Color (see Table 3).

These analyses were limited by cell sizes, which may explain the lack of other significant findings. Still, it

is notable that no significant differences emerged between Women of Color (*n*=15) and Men of Color

(*n*=45) or any other group in our analyses.

Insert Table 3 About Here

Gender Salience and Discrimination May Explain Gender Differences

We were especially interested in examining *why* we observed significant gender differences in

transfer stigma and navigational ease. Thus, we conducted additional analyses on survey items capturing

gender salience and observed gender discrimination within receiving CS departments to determine if

these variables might explain observed differences on transfer stigma and navigational ease. Independent

samples t-tests showed that women reported greater gender salience (*M*=2.68; *SD*=1.32) than men

(*M*=1.54; *SD*=1.13) within the CS department, *t*=-3.84, *p*<.001. This is unsurprising given the broader

literature on gender stereotypes and student outcomes in STEM spaces (e.g., Cheryan et al., 2009).

Women also reported greater observed gender discrimination in the department (*M*=1.91; *SD*=1.23) than

men (*M*=1.34; *SD*=.88), but this difference was just beyond the bounds of significance, *t*=-1.99, *p*=.056.

Further analyses using chi-square tests (see Table 4) indicated that, relative to women, men more

frequently reported that they "never" feel self-conscious about their gender (76% of men, relative to 27%

of women) or observe discriminatory remarks against women (85% of men, relative to 55% of women). These findings suggest that it is possible that the gender differences we observed in transfer stigma and navigational ease scores are due to observed gender discrimination within the CS department, which, in turn, makes gender salient to upward transfer women.

To further explore this possibility, we used OLS regression to examine how gender identity, gender salience, and observed gender discrimination in the department collectively relate to navigational ease and transfer student stigma outcomes. Regression was used to aid in the interpretation of other analyses (i.e., our goal was not to make causal inferences about the relationships between gender, identity salience, and transfer experiences). These analyses further documented a negative relationship between gender identity and navigational ease (B=-0.39; SE=0.15; p=0.013), R^2=0.08, F=6.4, p=0.013. Gender salience and observed gender discrimination did not significantly relate to navigational ease scores in the regression analysis. In contrast, an OLS regression model with transfer stigma as the dependent variable, R^2=0.14, F=6.57, p=0.002, reveals that gender identity (B=0.49; SE=0.23; p=0.038) and gender discrimination (B=0.52; SE=0.24; p=0.037) each statistically predict transfer stigma scores. In other words, women's greater transfer stigma scores may be partially explained by observations of gender discrimination in CS. Thus, addressing overt gender discrimination within CS departments may reduce perceived transfer stigma among upward transfer women.

Summary of Quantitative Results and Connections to Explanatory Qualitative Analysis

Quantitative results addressing the first research question suggest that upward transfer students' general feelings of support in CS did not differ by gender. However, relative to men, women reported greater transfer stigma and lower navigational ease at their receiving universities. We posit that emergent gender differences in transfer student stigma might be due to gender discrimination in CS. As a next step in understanding these results, qualitative analyses examined *how* supportive and stigmatizing experiences manifested, students' *meaning making* related to these experiences, and the *role of gender* in shaping experiences and meaning making via deductive coding described above. Other qualitative

findings discussed below emerged through inductive analyses and further complicate quantitative results by identifying other salient identities that shaped receptivity experiences.

Insert Table 4 About Here

Qualitative Findings: How Students Make Meaning of Their Receptivity Experiences

To address the second research question, we drew on interview data to examine students' meaning making around post-transfer support and stigmatizing experiences with regard to gender, in particular. Findings are presented below, and themes are organized into three parts to address this research question and further explain quantitative findings. In Part One, we discuss themes related to navigational resilience. Part Two includes a discussion of themes related to the myriad challenges students faced in their transition to the receiving university. In Part Three, we discuss themes capturing stigmatizing experiences at receiving campuses, which intersect with gender, age, and other salient identities. Throughout the findings, we reference the proportion or number of participants coded for each theme to further enhance trustworthiness and transparency of our data. Proportions should not be used to draw inferences about the importance of themes, especially given women's underrepresentation in our sample (e.g., some themes emerged for a smaller number of participants, but were especially important within interviews with women participants).

Part One: Navigational Resilience

Through our analysis, we constructed three themes related to how students developed navigational resilience, which shaped their receptivity and adjustment experiences. These themes captured 1) foundational experiences at the community college; 2) the development of independence during and after the transfer process; and 3) how transfer experiences played a particularly important role in developing women's resilience within patriarchal environments in CS majors at receiving universities.

Foundational Community College Experiences. Nearly all students discussed foundational and developmental experiences they had at community colleges, primarily involving student organizations, robust advising support, and one-on-one faculty interactions, which prepared them for success at four-

year institutions. For example, Zach explained how faculty at his community college were supportive and "non-judgmental," which fostered his sense of belonging to the community college campus, saying:

> The professors seem very open, non-judgmental. I never felt like I was incapable of taking the classes. At least for me…there was always that fear…that maybe I'm just not cut out for academic life. But I…always felt welcome at the community college that I went to.

Zach and others frequently discussed supportive interactions with faculty that developed their sense of belonging within academic spaces and resilience through the transfer process.

In addition, participants spoke about the benefits they received from serving in leadership roles within their community college. For instance, Gray, who became vice president of her community college's women in CS club, explained how she "took on a lot of responsibility with the club" at her community college which "taught [her] a lot about leadership and a lot about people and the field in general." Gray and others in our sample, particularly women, discussed community college leadership experiences as critical for their development. Although students credited these experiences with developing foundational skills that served them during and after the transfer process, they also described challenges during their adjustment to their four-year university when comparable leadership opportunities were no longer accessible, which we discuss further in the sections on navigation challenges and stigma.

Transfer Taught Students to be Self-Directed. Most students discussed being self-directed through the transfer process, which prepared them to identify and access resources at their receiving campus. For example, YK explained how he was able to independently identify the courses he needed to take and did not need support from university advising staff:

> I kind of already knew my schedule ahead of time, and even when I met with counselors once a semester, they said [that] I already knew my own schedule, so they didn't really need to help me with that at all.

YK and others spoke of how they developed independence and an intrinsic motivation to be successful, despite obstacles, which served them during their adjustment to the four-year university. Kate, who had encountered numerous family and health-related challenges that extended her time at community college,

explained how the resilience she developed at her community college was essential to her success adjusting to the fast-paced quarter system. These references to the quarter system reflect the unique characteristics of the institutions represented in our study, which had implications for adjustment and receptivity among participants in our sample. Kate went on to explain how, "in a quarter system, you're not going to get all the information from lectures that you need," crediting her resilience and intrinsic motivation for her success and describing "resilience" as "something that [she has] come to really value about [herself] and think of as a strength." Kate's description of her independence, motivation, and resilience through her adjustment to her university was largely representative of other participants. Notably, Kate and other women in the sample also emphasized resilience in relation to persisting through the patriarchal culture of computing, discussed below.

Transfer as a Buffer to Gender Discrimination Among Women Participants. Resilience manifested in unique ways for women, as they navigated frequently discriminatory spaces on their receiving campuses. All women participants described experiences of gender discrimination and/or an awareness of hostility toward women in CS. In particular, two women directly explained that being a transfer student served as a buffer to the discrimination they encountered. For example, Kate described how she was more resilient to discriminatory and disparaging comments from peers because she was an older transfer student, explaining that she does not "care what a 19-year-old dude thinks…if my classmates are a little misogynistic, I don't really care." Kate's comment is representative of how women and other participants discussed age as a salient identity and one that separated them from other students who followed more direct degree pathways. For women in our sample, being older than "traditional" college students—and bringing a range of personal and professional experiences to their receiving campus—enabled them to build resilience against harassment from other CS students. To be clear, this finding does not indicate that upward transfer women are never impacted by gender discrimination or that larger underlying inequities do not need to be addressed; rather, this finding simply provides insight into the nuanced experiences of upward transfer women as they navigate gendered STEM spaces.

Other times, women in our study articulated extensive knowledge of the structural inequities and patriarchy present in computing, which helped them make sense of their experiences. For example, Gray described knowledge of the history of women's participation in CS, explaining how:

Women are not very well represented in computer science or software engineering fields, and it wasn't always that way. You know, we used to outnumber men in computing fields. And then I think what changed was what a software engineer represented…

Gray went on to recount how women had been "pushed out" of computing because of gender stereotypes that developed in the field as CS careers became more prestigious, and "society has kind of spun the software engineer as just this nerdy white guy who's on his computer." Throughout Gray's interview, it became clear that having this broader knowledge provided a layer of protection, shielding her from what she knew were *false* stereotypes about who could succeed in computing. She further expressed an acknowledgement of how these stereotypical environments must be much more difficult for women who are "right out of high school." Gray's comments were representative of other women who framed their transfer status and age as a privilege in the context of CS.

Part Two: Navigation Challenges

Despite the resilience students developed at community colleges, post-transfer experiences were not without challenges. Three distinct themes characterize these navigational challenges: 1) isolation due to the larger campus size; 2) challenges balancing competing priorities and demands; and 3) adjusting to a different academic calendar.

Feeling Isolated and Overwhelmed on Larger Receiving Campuses. Thirteen students in our sample emphasized the challenges that came with adjusting to a university that was much larger than their community college. Within these discussions, students often focused on interrelated experiences of large lecture courses, challenges locating and accessing advising and related resources, and more general feelings of isolation on their large university campus. For example, Michael discussed how university courses were much larger than courses at his community college:

>The thing is that, community college only had classes up to like 30 or 25 people. They had zero
>
>lecture halls. Here, it's been mostly lecture hall classes…I think the larger classes are definitely
>
>worse. Just from experience, because it's no one-on-one with the teacher ever…you just sit there
>
>and he lectures for an hour.

Michael's description of adjusting to larger lecture courses was representative of how several participants discussed courses at their receiving campus. Because these courses contrasted with the format of courses at students' community colleges, students had to adjust their study habits while concurrently navigating other challenges.

Just as students discussed feeling "anonymous" within large lecture courses, seven students discussed impersonal and inaccessible advising interactions at their larger receiving campus. For example, Nick described readily available resources at his community college but struggled to find comparable ones at his university:

>Academic advisors are so overloaded…and have a lot of weight on them, which kind of reduces
>
>your priority. So, they forget about what they have to do once the meeting is over. They might
>
>have it on their back burner… They might do it, they might not.

Gray further explained that her receiving university does not "have enough people to sit down with you one-on-one." Because limited advising resources led many students to manage their advising and course needs without help from faculty or staff, participants who already described a tendency to work independently may have felt a compounding sense of isolation.

Finally, several students focused on how they struggled to navigate and engage across campus due to the larger university size—in terms of both enrollment and physical space—further contributing to feelings of isolation. Specifically, Ariel described feeling overwhelmed by her receiving campus, which made her feel like she did not belong:

>I'm still adjusting. I still don't even feel like a [university] student yet. I feel like maybe I just need
>
>a little bit more time to get into the mix of things. Because one of the reasons why I really liked
>
>[my university] was how diverse it is and how many different spaces there are for people. I just

feel like I haven't found them yet… At my community college, those things kind of presented

themselves to me, because it was a lot smaller.

As Ariel and others explained, students often appreciated the greater opportunities and diversity of their

larger receiving campus, even as they were unsure of how to access those opportunities. This finding may

partially explain why women reported lower navigational ease on the survey, as they may have

experienced greater feelings of isolation and/or disappointment when they were unable to access student

groups that they were especially interested in pursuing (e.g., identity-based groups in computing). While

this theme provides insight into the social isolation that students experienced in relation to navigating the

larger university campus, findings below highlight other forms of isolation, including the isolation that

students felt due to gender discrimination and/or transfer stigma on campus. Collectively, these findings

reveal complexity and nuance in terms of the specific forms of isolation that students experience and

overcome when navigating different campus spaces.

Balancing Competing Demands on Students' Time. Eight students in our study described

additional demands on their time after transferring, which made it difficult for them to adjust and form

connections at their university. As we allude to above, Ariel expressed an interest in getting more

involved with student groups related to Chicano Studies. Still, she struggled to make time to engage in

these communities, explaining that "when I didn't have work, I was more involved in programs…and I

felt like it was easier to find programs at my community college." For Ariel, the financial cost of

attending her university created pressure to work more hours than she had previously worked while

attending community college, constraining her time and opportunities for on-campus engagement. Nick

echoed Ariel's point, discussing his work responsibilities coupled with a heavy course load:

I was trying to actively participate in [a student group], but it is kind of hindering me, because I

have a job right now. I work part time, which also takes up a lot of time in the whole week. And

the assignments… [create] a huge load as well, which keeps increasing drastically as the days go.

Similar to Ariel and Nick, Kate described competing demands on her time, which led her to leave her

internship, despite wanting to continue:

> Honestly, it really is definitely over 40 hours a week of studying and working and doing the
>
> homework…I was doing an internship…that was 10 hours a week, but this quarter I just have not
>
> had time to do anything with it, which is really unfortunate because I really loved it.

As Kate and others discussed, increased demands on students' time over the course of their first year at

the university often led to disengagement with beneficial activities that they wanted to pursue. These

demands were largely a result of heavy course loads, time spent working, and other responsibilities.

      Adjusting to the Fast Pace of the Quarter System. Another frequent theme related to

navigational challenges was unique to the context of the participating universities. Many participants in

our interview sample attended community colleges that used the standard semester system, while

receiving universities all had academic calendars that were organized into 10-week quarters. In the

context of transitioning to a new campus, the quarter system posed yet another challenge for many

students, with 11 students discussing the quarter system transition at length. As YK explained:

> So the semester system tends to be a little bit more flexible in terms of the schedule…. the
>
> semester system is like a marathon. Like, you don't want to go too hard at the beginning…you
>
> kind of want to pace yourself throughout, so you don't burn yourself out too quickly. And then for
>
> the quarter system, you're sprinting. You kind of have to go all out from start to finish. So, it kind
>
> of becomes more draining once you get toward the end of it.

Although this theme may be unique to students at the participating institutions, this finding provides

insight into the types of challenges that emerge due to specific institutional contexts. While any one of the

challenges that students experienced may have been manageable—indeed, the themes above also

demonstrate transfer students' high levels of resilience—the combination of challenges resulted in

significant burdens and intense feelings of isolation.

Part Three: Stigmatizing Experiences at Receiving Campuses

      Nearly all students discussed transfer stigma to varying degrees. These discussions sometimes

focused on students' own perceptions that they were stigmatized, while other times focusing on peer

comparisons and general feelings of isolation on campus. We discuss associated themes, including: 1)

gendered descriptions of transfer stigma; 2) how transfer stigma intersected with age; and 3) how credit

loss represented a manifestation of transfer stigma within the CS department.

      Gendered Descriptions of Stigma and Social Isolation. Some students, particularly men,

expressed stigma as a sense that others underestimated their ability. For example, Zach explained how his

classmates were hesitant to work with him due to his transfer status, presuming that his peers must

assume "that 'there's a 60 to 80 percent chance that this guy's probably not that good at coding.' Like…

people will be a bit more cautious of you…in a group project." Jeff likewise stated that "it's pretty

generally thought that community college is for people that didn't get into normal college." Zach and Jeff

were representative of other men in our sample, who described very overt perceptions of transfer stigma.

Because of these perceptions and beliefs, several of the men we spoke with described how they

intentionally chose to not identify themselves as transfer students, perhaps as a strategy for maintaining

their privileged status as men in CS. Interestingly, women's descriptions of transfer stigma—as well as

August's, a non-binary participant—tended to be more covert, despite higher transfer stigma scores on the

survey; they generally acknowledged that "transfer students have it a little harder," but did not explicitly

express a sense that other CS students discriminated against them for being transfer students.

      Notably, transfer stigma was often discussed alongside broader peer comparisons that led

students to feel that they did not belong or "fit in" on their receiving campus. For example, Ian explained

that he did not "pronounce [himself] as a student," because he did not feel like he belonged to the larger

campus, going on to say:

      I just feel a little left out, I guess… I haven't met anyone from different departments, just because

      I'm not taking classes in those fields. I don't need to take GEs, so you don't meet other students in

      other majors at all, unless it's through clubs.

Drawing comparisons to peers who seemed more engaged across campus led Ian to feel isolated. For Ian

and others, having already met general education requirements meant that it was harder to connect with

students from other majors.

In addition to general peer comparisons, many students described comparisons to other CS students within their courses, which seemed particularly harmful. For example, Ann explained how comparing herself to classmates was a primary source of stress, explaining:

> In some of the upper division courses that I'm taking right now, some of the students are in their sophomore year. I do feel some difficulties already in there as a junior, and those students are still in their sophomore year.

Ann drew harsh comparisons between herself and her classmates, who had been attending the university longer, adding how she often questions herself, wondering "why are they smarter?" Ann's comparisons to peers extended beyond the classroom, causing her concern about her competitiveness for academic and professional opportunities like internships, because her "more experienced" peers would have applications that "will stand out more than [hers]." Notably, Ann's social comparisons also shaped her participation in her university's student group for women in computing, as was the case for other women in our sample. Despite being active in a comparable student organization at her community college, Ann described feeling like she was not well-suited for leadership in her university's student organization:

> When [the group has] a couple of different positions for like outreach or president or something, if I want to try to run—I am allowed to, of course—but I will see that some of those other members, they are very early in their education, like they're like a sophomore, or even a freshman, they are already a proud member. So…if I want to run, would I be competitive?

For Ann and the other women participants in our study, these experiences were often jarring, as students sought community at their university. Like Ann, all of the women interviewed described being highly active in their community colleges' women in computing groups, within formal or informal leadership positions. When they sought out comparable experiences at their receiving campus, they faced disappointment from feeling like they did not entirely belong.

Nearly all participants also described turning to their transfer cohort (i.e., other CS majors who transferred at the same time) and investing in that student community. While women are even more underrepresented among upward transfer CS students, relative to CS majors who begin their degree at the

university (Blaney, 2020), the women participants in our study described investing significant labor in creating Discord groups and other social communities to bring their transfer cohort-mates together. For example, Kate explained how her work to identify all transfer CS majors and include everyone in her cohort was "like Pokémon, like gotta collect them all." Further, while August and others described their transfer cohort as an "intimate" community and diverse group with "significant breadth in life experience," future research should further explore inclusivity and equity within and beyond transfer cohort spaces at receiving universities.[4]

Indeed, despite the disproportionate labor some students provided through organizing these communities, transfer cohorts were only sometimes inclusive spaces. Notably, four of our 18 interview participants came from a campus with a particularly tight knit transfer cohort. However, this same cohort included only a few students who were not men, and one man interviewed at this university expressed a hostile attitude toward Asian students in CS. Specifically, Jeff described his perceived challenges "as a white male" and made xenophobic remarks about international students. While more inquiry is needed to understand the impact discriminatory attitudes and remarks may have on transfer cohort dynamics, this example serves as a reminder of the potential limitations of transfer cohort communities as an inclusive space for transfer students who are not from dominant groups in CS.

Age Saliency Intersects with Transfer Stigma. While not all students directly named transfer stigma, half of students discussed feeling stigmatized due to their age, relative to students who entered their university directly from high school. Age was highly salient to these participants, who often disclosed this information at the outset of the interview. For example, when asked to introduce himself at the start of the interview, Zach responded by naming his major and then immediately discussing his age, saying, "I'm 30 years old, so I'm pretty late for somebody going back to college." Similarly, when asked if being a transfer student was salient to him within his CS classes, Michael, who was 27 at the time of the interview, explained how "the bigger difference is just that so many of these other students are just, you

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[4] To protect the confidentiality of our participants, we are limited in our ability to share additional details about the size, structure, and composition of transfer cohorts described within participant interviews.

know, four years younger than me." In addition, some participants who focused on age also related this to

feeling behind or a pressure to catch up to students who went straight through at the four-year university.

For instance, August, one of a number of students who stopped out prior to successfully transferring to

the university, noted, "I wasted a lot of time…and I recognize I'm older than a lot of my college peers."

While many men in our study (including Michael and Zach, quoted above) discussed their age as

a reason for socially isolating themselves from other students with whom they did not connect, women in

our sample discussed how they strategically built connections with peers despite being older. For

example, Kate, who was 29 at the time of the interview, discussed how she "leaned into" being older,

using humor to build rapport and connect with younger CS students and positioning herself "like the

grandma," going on to explain:

> I might make jokes about being old, like if that comes up. You know, people are like, "oh, yeah,
>
> I'm gonna go all night." And I'm like, "oh, no, I can't do that. I'm old, my bones hurt." Although I
>
> might not say what exact age I am… Maybe there is, but I don't think there's actually really a
>
> sense of shame in it. Not anymore…I'm just like, "okay, you guys got to make sure you eat and
>
> make sure you get sleep…" I leaned into it.

Age and gender intersected in important ways for women in our sample, who often discussed their age

and transfer experiences as a buffer to the gender discrimination and patriarchy they observed around

them (discussed above). By framing themselves as a "grandma" or "mom" among their classmates,

upward transfer women were able to build connections with other CS students that were relatively free

from harassment. While this finding demonstrates a high level of social skill and resilience among women

in our sample, it also underscores the highly patriarchal culture within CS, in which women feel

compelled to draw on their relatively older age and maternal figuration to protect themselves from

discrimination and harassment.

Credit Loss as a Manifestation of Transfer Stigma. Several participants described credit loss in

the transfer process, and these descriptions sometimes included implicitly stigmatizing language about the

rigor of community college courses. Most often, students described credit loss related to CS-specific

courses, which did not transfer for credit toward major requirements. Gray explained how "just about every computer science class [she] took did not transfer," which she understood to be a result of her university changing required programming languages while she was attending community college. Other times, students were not sure why courses did not transfer for credit, especially in instances where they had to retake courses that were identical to those they had taken at community college. NC explained how he had to retake a course at his university that "literally used exactly the same books, and it didn't transfer over, or it transferred over like a general credit, instead of specifically for the class I took." As another example, Ethan explained how, while all his non-CS credits transferred successfully, he was unexpectedly required to "test out" of CS courses, despite having taken comparable courses at his community college:

> The actual CS stuff, I had to test out of… For each course, you had to take [a test] related to that course. And it was basically like taking a final for that course. And then whatever grade you get on that, you get in the course…and that's the middle of summer, you're already worried about going to a new school, you have to worry about that. Like it's just like a whole bunch of little, tiny things. They add up and you won't realize it until you're in the moment or like when you're talking about it right now…all these little, tiny things are always stacking up against you.

When discussing the impact of having to retake CS courses or meet additional testing requirements, despite previously taking the equivalent courses at community college, students primarily focused on the financial implications and impact these setbacks would have on their graduation timeline. However, the failure of university faculty and staff to accept students' prior CS credits was yet another manifestation of stigma against community colleges and transfer students, demonstrating how policies and practices at the receiving campus devalue work completed at the community college.

Discussion and Implications

This mixed methods study examined upward transfer CS students' receptivity experiences, focusing on the intersection of transfer receptivity and gender. Initial quantitative results document gender differences, such that women report lower navigational ease and greater transfer stigma, relative to upward transfer men. In keeping with our sequential-explanatory design, interview data can be used to

further explain emergent gender differences in quantitative findings, and we organize our qualitative

findings around the most notable quantitative findings—focusing on themes related to navigational

resilience, navigational challenges, and stigmatizing experiences—to enhance the explanatory value of

our interview data. Building on the connections to quantitative results within the qualitative findings

presented above, we further integrate the two streams of this work in what follows.

While women reported greater transfer stigma than men on the survey, their narratives illustrate

how transfer stigma and gender discrimination converge in nuanced ways. Relative to men, women and

non-binary participants' descriptions of transfer stigma were more covert; however, that does not mean

that their transfer experiences are without challenge. Indeed, upward transfer women described unique

feelings of isolation, particularly when seeking opportunities to build community with other women in

computing that were comparable to their experiences in community college. These challenges may also

explain emergent gender differences in navigational ease scores. That is, women may have reported lower

navigational ease on the survey due to the disappointment they faced when they were not able to build

community and access opportunities for women in computing at their receiving campus. These findings

are reminiscent of prior studies that document how peer cultures at universities can unintentionally

exclude transfer students (Berger & Malaney, 2003; Townsend & Wilson, 2009) Yet, more research is

needed to understand how similar dynamics may play out for transfer students from non-binary groups

who may face additional isolation and exclusion from university initiatives to develop support structures

for women in computing.

At the same time, women participants described unexpected assets associated with being a

transfer student. Being older and having more experience helped them develop a layer of protection from

the patriarchal environment in computing. In some cases, women intentionally othered themselves,

positioning themselves as the "mom" or "grandma" among their CS classmates. Taken together, we

identify distinct ways in which transfer stigma manifests for upward transfer women in CS, which are

more complex than what can be explained through survey data alone. In the remainder of this paper, we

explore these nuances by discussing 1) institutional structures shaping transfer receptivity and 2) the more specific contexts shaping women's receptivity experiences.

Institutional Factors and Structures Shaping Transfer Receptivity

Our findings on the impact of larger institutional environments at receiving universities are largely consistent with prior research and theory on the importance of transfer receptivity (e.g., Wang, 2017; Xu et al., 2018), extending this research to the patriarchal context of CS. While participants in our study frequently described high levels of navigational resilience, they also described distinct challenges faced during their first year at receiving campuses. Specifically, qualitative findings further explain survey results related to navigational ease, documenting challenges associated with the larger size of receiving universities, adjusting to a new academic calendar, competing demands on their time, and limited access to support services. Drawing on quantitative and qualitative findings, we discuss specific strategies for reimagining structures that facilitate transfer student receptivity in CS.

Providing Material Supports to Transfer Students in CS

As recommended by scholars in prior research (e.g., Jain et al., 2011), universities can provide financial support for transfer students and tailored, accessible advising as two suggestions for mitigating navigation challenges documented in our study. Taking tangible steps to reduce the myriad challenges encountered by transfer students may go a long way in improving receptivity experiences in the short term. In the longer term, computing departments should grow in size and capacity, so that they can accommodate transfer students, reduce dependence on large-enrollment lecture courses, and improve pedagogical practices within remaining lecture courses. Unfortunately, transfer students in CS are likely affected by the current shortage of CS faculty (Shein, 2019), as universities may increase course caps to accommodate growing enrollments. Nguyen and Lewis (2020) also document how departments impacted by the faculty shortage in CS may adopt exclusionary practices (which may be especially harmful for upward transfer students), such as inflexible prerequisites and restricting admission to the CS major. These and other policies also increase the demands facing academic advisors in CS, who may then have less time to provide tailored support to transfer students. Given the importance of access to high-quality

academic advising for transfer students (Townsend & Wilson, 2006), these structural pressures in CS

departments present a particularly troubling reality—one that must be met with a financial investment in

staff infrastructure for CS programs.

Developing a Transfer Receptive Culture and Debunking Stigma

Our findings confirm and extend prior research on transfer stigma (Laanan et al., 2010), speaking

to the importance of receptivity and support at receiving universities. While quantitative findings provide

initial insight into disparities in transfer stigma among CS students, interviews revealed how stigma

around transfer emerged in myriad covert and overt ways. Upward transfer students in our sample

frequently discussed their age as closely linked to transfer stigma, for example. Other times, students

discussed more general social comparisons, leading them to feel stigmatized. While some research

documents the positive role that peer socialization can play in transfer students' success (Berger &

Malaney, 2003), evidence from our study suggests that peers contribute to both support and

stigmatization.

Receiving universities can do more to recognize the strengths that transfer students bring with

them from community colleges. As one step to debunking transfer stigma and developing a more

receptive transfer culture at receiving institutions, CS departments may consider holding panels with

alumni from a wide array of educational backgrounds (including community college transfers) to support

a shift in departmental culture that recognizes the successes of transfer students. Additionally, CS

departments at receiving institutions could implement "transfer visit days," where soon-to-be upward

transfer students could socialize with students at receiving institutions prior to transfer, which could

enable upward transfer students to build earlier connections to the receiving university, easing the

adjustment process. Such efforts could mitigate isolation that transfer students experience as they navigate

the university campus and increase access to beneficial peer communities that were elusive to some

students in our study.

Recognizing Credit Loss as a Manifestation of Transfer Stigma

While credit loss has received significant attention within studies of transfer receptivity and post-transfer success (e.g., Giani, 2019; Hodara et al., 2017), we conceptualize credit loss in our findings as a manifestation of transfer stigma. Our critical constructivist approach to this work positioned us to deconstruct students' descriptions of credit loss, identifying covert values embedded within policies. For example, requirements to "test out" of courses that one has already taken at community college may send a message to students that their community college courses are not valued. While more research is needed to explore the attitudes of faculty and other individuals responsible for creating policies around CS credit transfer, the present findings point to clear implications for practice. Simply put, receiving universities should honor articulation agreements and accept credits from community colleges. Testing transfer students as a method of *proving* prior knowledge acquired from community college coursework represents a practice rooted in transfer stigma. Future research should also consider how disparities in students' experiences of transfer stigma (like those we identified through our quantitative analyses) may be driven by larger institutional policies and practices (like those identified through our interviews).

Putting Upward Transfer Women's Experiences in Context

We also identified how upward transfer women may experience minoritization within university student groups *and* within CS transfer cohorts. While our conceptual framework emphasizes the importance of considering gender and other social identities that impact transfer student pathways and outcomes (see Wang, 2017), our findings provide further complexity and disciplinary specificity to our understanding of women's experiences in patriarchal computing contexts. On one hand, women in our study struggled to fully connect within organizations for women in computing, given their limited history at the university relative to some student members, age stigma, and other factors. On the other hand, when women gravitated toward their transfer cohort for an alternative community, those transfer cohort spaces were not universally welcoming. Together, these and other findings related to upward transfer women's experiences point to a need for more intersectional research to deconstruct how upward transfer women experience gender discrimination and transfer stigma, alongside multiple forms of discrimination and minoritization in CS at their university campuses.

Isolation Within Groups for Women in Computing

Given that women in our sample described being actively involved in student organizations at community colleges, it makes sense that women would seek out comparable opportunities at receiving campuses. Yet, women described stigmatizing experiences and feelings of isolation within university student groups, which may partially explain why women report greater levels of transfer stigma on campus. Importantly, these experiences of isolation were covert in nature. It was not that non-transfer women were actively hostile to transfer students within groups for women in computing; rather, transfer women felt like they did not belong as new members of university groups, despite having extensive leadership experience in comparable groups from their time at community college. Adding specificity to the implications offered in related research about women's experiences in STEM organizations (Wofford et al., 2023), we recommend that faculty advisors and student affairs staff offer specific guidance to leaders of student organizations about how to create recruitment strategies and community-building mechanisms that result in an explicitly welcome environment for transfer students. Creating such environments for upward transfer women is especially important within identity-based groups (e.g., women in computing groups) which strive to be inclusive spaces for students.

Gendered Experiences Within Transfer Cohorts

While a limited number of universities are represented in this research, we leveraged the qualitative stream of inquiry to discuss patterns of transfer support within specific institutional contexts, including participant discussions around the importance of the "transfer cohort." While transfer student cohorts sometimes provided an opportunity to build community, the nature of that community looked different for upward transfer women who were one of only a few women in their transfer cohort, which is consistent with recent research showing that women are especially underrepresented among transfer students in computing (Blaney, 2020). Further, the women we interviewed described how they invested significant time in developing a community within their transfer cohort (e.g., identifying all transfer students and creating inclusive social media groups), while men in our sample sometimes disengaged from the transfer cohort. These findings are reminiscent of other scholarship documenting gender

inequities in how labor is distributed within undergraduate computing spaces, which, in turn, reinforces gender stereotypes about computing (see Blaney, 2021a). More research is needed to understand experiences within transfer cohorts, particularly for women, non-binary students, and those racially minoritized within CS, who may experience isolation in their cohorts and/or the department more broadly.

Concluding Thoughts and Future Directions

By adapting Wang's (2017) conceptual framework to explore the nexus between patriarchal CS contexts and transfer receptivity, this study contributes needed disciplinary specificity to theorization about upward transfer in STEM, as well as a more nuanced perspective about the intersecting structures of discrimination that upward transfer students may face at their receiving institutions. The findings of this study point to important considerations for future adaptations of Wang's framework. Specifically, our findings reveal how the interconnected nature of post-transfer learning and transfer receptivity may come to fruition in CS (e.g., through student groups and transfer cohorts), as well as deeper insight about how transfer receptivity (or the lack thereof) is shaped by policies and practices at receiving institutions.

We envision several important areas for future research based on the conclusions of this study. Our study points to a need for future research that considers the intersection of gender discrimination and transfer stigma, among other forms of minoritization in CS. We identify significant room for growth in the exploration of transfer cohorts and peer comparisons among transfer students in CS. There is also a great deal to be learned about how credit transfer functions in CS and the implications of these credit transfer policies on perpetuating transfer stigma. As understanding of these dynamics develops through further research, we may become better positioned to scaffold social and institutional support structures to facilitate student feelings of belonging and success at their receiving universities.

Table 1. Overview of Interview Participants

Pseudonym	Gender	Race/Ethnicity	First-generation to college
Ariel	Woman	Latina	Yes
Jasper	Man	Asian/Asian American	No
Nick	Man	Asian/Asian American	No
NC	Man	Asian/Asian American	Yes
Zach	Man	Asian/Asian American	No
Mel	Man	Asian/Asian American	No
Ethan	Man	Latino	No
Gray	Woman	White	No
Michael	Man	White	No
Bob	Man	Asian/Asian American	Yes
YK	Man	Asian/Asian American	No
Ann	Woman	Asian/Asian American	No
Rip	Man	White	No
Ryan	Man	Middle Eastern or Persian	Yes
Kate	Woman	White	No
Ian	Man	Asian/Asian American	No
August	Non-binary	White	No
Jeff	Man	White	Unknown

Note. Students selected their own pseudonym at the start of the interview; all names shown in this table are pseudonyms, even those that appear to be initials. To incentivize response, all participants received a $25 gift card upon completion of the interview. Note that no students reported a non-binary gender identity on the baseline survey; however, one interview participant reported a non-binary identity at the time of the interview.

Table 2. Gender Differences in Support Measures

	Mean (SD)			t	Sig.
	All (*n*=82)	Women (*n*=23)	Men (*n*=59)		
General Support in CS					
CS Departmental Support	3.38 (.89)	3.25 (.93)	3.44 (.87)	0.86	.395
Peer Support CS	3.04 (.97)	2.87 (.83)	3.11 (1.02)	1.01	.314
Transfer-specific Support/Stigma					
Navigational Ease	3.97 (.63)	3.70 (.73)	4.07 (.56)	2.43	.017*
Institutional Support for Transfer	3.62 (.79)	3.48 (.98)	3.68 (.71)	1.02	.309
Transfer Stigma	2.52 (.94)	2.99 (.75)	2.34 (.94)	-2.94	.004**

Note. Information about how each composite variable was assessed is shown in Table A1.

Table 3. Transfer Stigma and Navigational Ease by Gender and Race/Ethnicity

	Mean (SD)			
	Women of Color [a] (*n*=15)	White Women [b] (*n*=6)	Men of Color [c] (*n*=45)	White Men [d] (*n*=8)
Navigational Ease	3.92 (.59)	3.28 [c] (.89)	4.08 [b] (.55)	4.10 (.67)
Transfer Stigma	2.93 (.83)	3.33 [c] (.42)	2.25 [b] (.85)	2.63 (1.16)

Note. Superscripts indicate significant differences from corresponding group ($.019 \leq p \leq .030$). This table aggregates racial and ethnic groups to mitigate cell size limitations. Notably, 21 women in the sample reported their race and ethnicity on the survey: 13 were Asian women, six were white women, one was a Latina woman, and one was a Black woman.

Table 4. Gender Differences in Identity Salience and Gender Discrimination

	Percent Among			
	Women	Men	Chi-square	Sig.
During the current academic year, when interacting with individuals in your major/department, how often have you felt self-conscious about your gender?				
Never	27.3	76.3	16.50	0.000***
A little, sometimes, often, or all of the time	72.7	23.7		
While interacting in your academic department during the current academic year, how often have you heard individuals make insensitive or insulting remarks about women?				
Never	54.5	84.7	8.14	0.004**
A little, sometimes, often, or all of the time	45.5	15.3		

Note. *$p<.05$; **$p<.01$; ***$p<.001$. Before running chi-square tests, we created dichotomous measures of gender salience and observed gender discrimination.

Figure 1. Summary of Sequential-Explanatory Design

Quantitative Stream (RQ1)		**Qualitative Stream (RQ2)**		**Further Integration of Methods**
Research Question: How do upward transfer CS students report their receptivity experiences, and how might this differ by gender? **Key Steps:** - Conduct quantitative analyses to address the research question - Interpret and summarize quantitative findings that will inform qualitative analyses	⇒	**Research Question:** How do upward transfer CS students make meaning of receptivity experiences, and how might that meaning making be shaped by gender? **Key Steps:** - Analyze interview transcripts in stages, using both *inductive* and *deductive* approaches - Present qual findings to facilitate *explanatory interpretations*, drawing connections to quant results	⇒	Provide a more complete picture of gender and receptivity experiences in CS by comparing and contrasting research streams within the discussion and implications

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TRANSFER RECEPTIVITY IN STEM

Appendix

Table A1. Overview of Composite Variables

Variable	Items	Cronbach's Alpha
Departmental Support (Sax et al., 2018)	*Within your department and/or classes for your academic major at your current institution, how much do you agree with the following statements?* I feel a sense of community in my department; My department inspires me to do the best job that I can; My department cares about its students; My department hosts or sponsors programs and activities designed to promote diversity and inclusion.	0.85
Peer Support in CS (Sax et al., 2018)	*To what extent is each of the following kinds of support available from students in your academic major at your current university if you need it?* People to hang out with; People to confide in or talk to about your problems; People to get class assignments for you if you are sick; People to help you understand difficult homework problems.	0.85
Navigational Ease (Hurtado and Guillermo-Wann, 2013)	*At my current college, I have been able to…* Learn what resources are available on campus; Find help when I need it; Figure out which requirements I need to graduate; Find information helpful to me as a transfer student; Enroll in the courses I need; Understand what my professors expect of me academically.	0.84
Institutional Support for Transfer (Hurtado & Guillermo-Wann, 2013)	*Please indicate the extent to which you agree or disagree with the following about your transfer experience. At my current college…* Campus administrators care about what happens to transfer students; I have received helpful advice about how to succeed here as a transfer student; Faculty take an interest in the success of transfer students.	0.88
Transfer Stigma (Laanan et al., 2010)	*Please indicate the extent to which you agree or disagree with the following statements about your experience at your current institution.* Because I was a community college transfer, most students tend to underestimate my abilities; Because I was a community college transfer, most faculty tend to underestimate my abilities; There is a stigma at my university among students for having started at a community college.	0.83

Note. For the measures of departmental support, navigational ease, institutional support, and transfer stigma, students responded to each individual item on an agreement scale ranging from 1=Strongly disagree to 5=Strongly agree. For the measure of peer support in CS, students responded to individual items using a five-point scale ranging from 1=Never to 5=Very often. Items within each measure were averaged to create each composite variable.