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Engaging Foucault to Better Understand Underrepresentation of Female STEM Faculty

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Introduction

Underrepresentation of female engineering faculty persists across the country[1]. Moreover, the numbers of female faculty remain disproportionate to the numbers of women receiving PhDs[2], and those numbers are even lower for the subset of women of color[3-4]. For instance, across STEM fields, despite accounting for approximately 13% of the PhD graduates in 1996 and 20% in 2006, women only accounted for 17% of the untenured faculty and 7% of the tenured faculty (not accounting for those who already had tenure before the recent graduate cohorts) in 2006.[5] A large body of literature has identified numerous challenges for female faculty members, including lack of professional development and mentoring, both unconscious and overt biases, gendered socialization, and work-family balance[6-15]. Despite the large body of literature and decades of attention and effort, significant change in the numbers of female faculty has not occurred, and change is predicted to remain slow well into the future[16]. Given that underrepresentation persists despite the large amount of time, energy, and money spent on increasing the numbers of female engineering faculty, we suggest, as other recent work has (e.g.,[17]), that new theoretical perspectives are needed to better understand the challenge. To that end, this paper suggests that Foucauldian notions of *power*, which are currently under-engaged in the engineering education literature, could advance research on underrepresentation and challenges faced by female faculty.

Our work adds to the body of recent engineering education scholarship advocating the benefits of greater theoretical engagement[17-19]. Theory can allow a body of literature to grow, unite, and advance, to move beyond the status quo. For instance, Beddoes & Borrego[17] assert that:

> The importance of theoretically sound and consistent studies is increasingly recognized within education research (Shavelson & Towne, 2002)[20]. Theoretically grounded work connects researchers, allows generalizations across studies, and advances the field of engineering education by avoiding re-inventing the wheel. Moreover, as theory is intended to be transferable it is a potentially important link between engineering educators and gender studies scholars, thus promoting interdisciplinary scholarship in the complex research topic of women in engineering. (p. 283)

Similarly, education scholars have asserted that, "Theoretically engaged empirical work allows a broader and more complex discussion between scholars – one that extends beyond the particularities of individual empirical projects"[21] (p. ix). Moreover, critical social theory connects educational institutions to broader social and political systems and creates a link between past, present, and future research[22] (p. 3). Therefore, we suggest that advancing research on women in engineering will likely entail deeper engagement with a broader range of theories, including around power.

This paper begins with an overview of our theoretical lens: Foucauldian notions of power. Following that is a two-part literature review on: 1) work-family balance and related policies, and 2) engagement with Foucault in engineering education literature. After a description of our

methods, we present our findings, identifying ways in which further engagement with Foucault's scholarship can help engineering educators and administrators better understand both the challenges faced by female engineering faculty and persistent underrepresentation of female faculty. Specifically, we identify the following topics that would benefit from further engagement with notions of power: 1) internalization of social norms and policy non-use, and 2) discourses surrounding work-family balance. We discuss how under-engaged Foucauldian perspectives can illuminate challenges that merit further attention and research.

Theoretical Lens

Michel Foucault was a French historian, philosopher, and social theorist. His work has been highly influential across a wide range of social science and humanities fields. Although his analyses focused on different contexts and sites, several key ideas related to power are pertinent to our data on female STEM faculty.

Foucault re-conceptualized traditional social theory notions of power[23, 24]. In his studies, power is conceptualized as operating through our thoughts, actions, and discourse. Traditionally, researchers have conceived of power as the influence of groups with disproportionate resources, as individuals with high ranking positions, or as individuals who are bequeathed authority over others with fewer resources or attributes[24]. For example, in the university context, organizations such as the National Science Foundation (more resources), department chairs (authority/position), and administrators (authority/position) who have direct influence over faculty members might be studied. In contrast, Foucault describes power as exercised, or performed by all people (although perhaps unequally), as we live our everyday lives[23, 25]. It operates through the internalization of social norms, beliefs, and power relations rather than through external coercion[26, 27]. In this conceptualization, power is better thought of as a "system of relations spread throughout the society"[23] (p. 35), or as a network[28], rather than as located in any particular institution. Yet, institutions are significant. Foucault understood power as relational, and most specifically was interested in power relations between individuals, social structures, and institutions[23, 29].

Central to this conceptualization of power is the idea that power is not (only) repressive, but productive or generative[23, 30]. It produces, among other things, discourses, which are both products of and conduits for power[25]. Discourses are sets of ideas that govern

> …the way a topic can be meaningfully talked about and reasoned about. It also influences how ideas are put into practice and used to regulate the conduct of others. Just as a discourse 'rules in' certain ways of talking about a topic…so also, by definition, it 'rules out', limits or restricts other ways of talking, of conducting ourselves in relation to the topic or constructing knowledge about it[31]. (p. 72)

In other words, discourses shape not only what is said, but also what is thought, and what can be known and accomplished. In that way, they are intrinsically bound up in the operation of power. As Howarth explains, "discourses constitute symbolic systems and social orders, and the task of discourse analysis is to examine their historical and political construction and functioning"[32] (p. 5). As other engineering education scholars[33] have explained, the aim of discourse analysis in the Foucauldian tradition is to examine and deconstruct the problematic assumptions that exist

within a discourse[32]; and to illuminate how the framing of a problem shapes what is said and thought about the problem[34].

Foucault's conceptualization of power means that scholars should take a bottom-up approach rather than a top-down approach to understanding and studying power because it is at the local, micro level that we can see the operation and effects of power[23, 28]. Research should explore how power operates in the everyday relations between people and institutions, how local forms of power are negotiated by individuals, what results from those micropractices, and how people construct/understand themselves, their actions, and their relations with others[23, 25, 28, 30].

This overview is necessarily simplified and focuses only on those aspects of Foucault's scholarship that are most germane to the analysis at hand. Additionally, we recognize that Foucault's scholarship has been subject to critique and is not without limitations, a recounting of which are beyond the scope of this paper. Nonetheless, our analysis suggests that his ideas have much to offer research and initiatives aimed at understanding and addressing persistent underrepresentation of female engineering faculty.

Literature Review

Work-family Balance and Parental Leave Policy

Balancing work and home life is something that many faculty members, men and women alike, must face. However, women often face additional struggles or barriers and ultimately relinquish more in their careers than their male counterparts[8, 35-40]. Many of these barriers revolve around the "second shift" for women or the continuing expectation and tendency for women to shoulder more of the household and childrearing responsibilties regardless of partners' occupations[36, 41-43.] Additionally, on the flipside of unbalanced responsibilities for women, men are often relieved of household activities, and their careers are bolstered by being married and having children[36, 44-46]. Further compounding matters, male faculty typically do not experience the same kind of stigma female faculty members experience for having children[7]. Although, notably, men do experience heightened stigma for taking parental leave, in part because taking leave violates the normative expectation of who takes care of children[47-49].

Not only do work-family balance challenges exist for women in STEM faculty positions, research has demonstrated that graduate students are cognizant of such challenges while pursuing their degree. Female graduate students, aware of the challenges above, sometimes opt for non-academic career paths[50, 51] or "second-tier" academic paths, such as lecturers, instructors, and adjunct faculty[52]. They perceive overlap and competition between tenure and childbearing "clocks"[50, 51], and systemic barriers to parenthood (in contrast to male graduate students who less often perceive conflict between parenthood and a faculty career)[50]. Therefore, work-family balance challenges not only create unjust environments for current faculty, but also prevent potential female faculty from pursuing academic careers.

In light of the research findings above, other researchers and agencies, such as the AAUW and the National Academies, have made numerous recommendations to address the imbalances in work-life commitments for STEM faculty. Likewise, numerous institutions have instituted policies and programs to address these imbalances[40]. Some of the more ambitious policies are

those that fall under the title of *parental leave*. On the broadest level, all employees of a university (and any business with over 50 employees in the U.S.) are eligible for unpaid parental leave to take time to bond with a new child. Unpaid leave, however, is less promising for many employees who cannot afford to stop receiving pay at a time of increased expense. Many other types of policies fall under the heading of parental leave, including: paid parental leave; paid maternal leave (in recognition of the additional physical burdens women face); tenure clock extension (which typically extends the tenure clock for one year); release from teaching, committee, or other work responsibilities; and other related policies[53, 54]. In their survey of higher education institutions in the United States, Hollenshead and colleagues found that on average research intensive universities had more parental leave policies than other types of universities, including doctoral granting, masters granting, four year schools, and associate colleges[53]. In general their results suggest that larger research institutions and programs with more advanced graduate studies tend to have more parental leave policies, which is likely commensurate to some degree with the level of resources these different types of institutions have. However, at the time of their study, only 20% of their respondents had some form of paid parental leave. The most common type of leave policy was the tenure-clock stop, which 49% of the responding universities and colleges had. Notably, the National Science Fouundation instituted new family-friendly policies last year, suggesting increased national recognition of parental leave policies to address issues of underrepresentation[55].

Along with the prevalence of work-family balance policies, researchers have also studied policy *use* specifically, both in academia[48, 49, 53, 56-59] and other contexts[47, 60-62]. Such research has revealed that faculty members are often unaware of parental leave policies at their university or that they are not fully aware of the actual affordances of said policies[49, 57, 58]. For example, in one study of STEM faculty members, the policies' language was not clear to all respondents[57]. Furthermore, the policies themselves were structured with the assumption of a regular (i.e., 9:00-5:00) work schedule, similar to that of staff members, which did not coincide with the looser, more continuous work structure of faculty. STEM faculty members could not simply stop research, particularly grant-funded research, publications, mentoring graduate students, maintaining labs, and other responsibilities.

In addition to not aligning with the work context of faculty careers, researchers have found that other members of an organization, in academia and beyond, influence if and how an employee takes leave[49, 58, 61, 62]. For instance, Blair-Loy & Wharton found that supervisors' views of parental leave had a substantial impact on employees' decisions to take leave[62]. Furthermore, Kirby & Krone found that employees' discourse about parental leave discouraged eligible employees from taking advantage of leave[61]. People who took advantage of leave were seen as having an unfair advantage over those who did not take leave, and the employees not taking leave felt they had to shoulder the burden of the work that leave-taking employees were released from. In our own research, we have also found that supervisors, department chairs, colleagues, and policy officials at the university have influence over if and to what extent faculty took advantage of parental leave[56]. In a related vein, Tremblay & Genin discovered that employees who had *not* tried to enact the policy had positive perceptions of the policy, but those who *had* tried to use the policy had negative perceptions of it[60]. Professors in medical and dental schools likewise face disconnects between work-life policies and actual policy use[63]. Taken together, these results demonstrate that, even with parental leave policies in place, perceptions and actions

of supervisors and colleagues negatively impact employees' views of and likelihood of using the policy, thereby undermining its core intent.

In summary, work-family balance represents a clear barrier to better representation of women in STEM faculty positions. Despite the progress toward addressing some of these difficulties through policies, such as parental leave, many challenges still remain in the execution of those policies. Discourse around gendered expectations in regard to family, the norms of STEM faculty life, and the use and perception of work-family balance policies continue to complicate participation in STEM fields.

Engagement with Foucault in Engineering Education Scholarship

Likely the most in depth and explicit use of Foucauldian scholarship in engineering education is Donna Riley's textbook companion for a thermodynamics class, which incorporates some of Foucault's notions of power, knowledge, and truth to help illuminate the development of thermodynamic laws and encourage students to think critically about their impact as future engineers[64]. Beyond this instance, we performed a search for other uses of Foucault's work in engineering education scholarship. We searched proceedings of the American Society for Engineering Education (ASEE) (1996-2012) and Frontiers in Education (FIE) (2001-2011) conferences, as well as *Journal of Engineering Education (JEE) (*1993-2012*)*, *International Journal of Engineering Education (IJEE)* (1994-2012), and *European Journal of Engineering Education (EJEE)* (1975-2012) for the following terms: *Foucault*, *Foucauldian*, *Foucault power*, and *Foucault notion of power*.

We found very little engagement with Foucault's ideas. Many of the outlets returned no results, and the majority (13/17) of results we did find were ASEE papers. Most of the ASEE papers and the four others only mentioned Foucault as a citation or in a passing reference in the body of the paper. However, two articles in *IJEE* were Foucauldian-inspired discourse analyses[33, 65]. Two conference papers from Donna Riley also dealt with Foucault in more depth. One reviewed her class on thermodynamics that uses Foucauldian notions of power and knowledge[66], and another discussed Foucauldian notions of identity creation through power and knowledge as it related to the ethical views of engineering students[67]. Riley's work differs from ours as her work has focused on bringing Foucauldian notions into the classroom, whereas we are interested in using his concepts to understand ongoing issues of underrepresentation with STEM faculty. We recognize that these searches are limited in that they can only tell us who is explicitly engaging Foucault and that other scholars draw on the large body of work inspired by Foucauldian ideas even if they cite Foucault minimally or not at all. Nonetheless, our search revealed that there is very limited engagement with Foucault in engineering education. On the other hand, in higher education literature more broadly, there are more in-depth recent efforts to examine power and explicitly engage Foucault[68].

Methods

Participants and Recruitment

Interviewees were 29 faculty members in science, technology, engineering, and agricultural fields at a large, public research university in the Mid-western region of the United States. Faculty at this university were non-unionized. Interviewees included 7 men and 22 women. Seventeen held tenure-track assistant professor positions, 10 were tenured, and 2 had been denied tenure. Several different racial and ethnic groups were represented; however, because not all participants chose to provide demographic information, we cannot report those numbers.

Recruitment focused on faculty progressing through particular career path points, such as initial hiring, third-year review, tenure, and subsequent promotion. Tenured or tenure-track faculty in the colleges of science, technology, engineering, and agriculture were identified through: 1) publicly available data, such as departmental websites and newsletters; 2) college-level Deans' offices; 3) faculty hire date; and 4) modified snowball sampling. An email was sent to eligible faculty inviting them to participate in an interview focused on their career pathways or experiences with parental leave policy. If interested in participating, faculty contacted us. Additionally, at the end of each interview, participants were asked for names of other faculty members who might be eligible and willing to participate in the study.

Data Collection and Analysis

Semi-structured[69], in-person interviews were conducted between 2009 and 2011. Interviews averaged approximately 60 minutes in length. Interviews were recorded and transcribed by a professional transcriptionist. Transcripts were pseudonymized to remove actual names and any other identifying information. Participants were invited to review the transcripts and identify any parts they wanted deleted or modified to protect their identities.

The analysis presented here emerged from two larger, ongoing studies of the career pathways of STEM faculty and their use of parental leave policies. The original and overarching aim of the research project was to better understand the careers of female and minority STEM faculty members in order to inform policy changes that can benefit them. Interview questions focused on: participants' views on pipeline and chilly climate metaphors and the way they explain women's underrepresentation in STEM; aspects of women's career pathways not covered by the pipeline and chilly climate models that should be given further attention; how those metaphors fit their own career pathways; their experiences with parental leave policies and processes; how they located and accessed information on those polices and processes; and what changes they would like to see.

While analyzing faculty members' discourses of work-family balance and their use of a parental leave policy[70, 71], Foucauldian notions of power emerged as an important lens through which to examine the data. Foucauldian theories were not explicitly part of the research as it was originally conceptualized, and they did not feature in the interview questions. Rather, the current analysis emerged after the interviews were concluded. The authors were already familiar with the work of Foucault, and, in the course of reading interview transcripts, saw that it could advance previous analyses of the data. The lens was then used to guide data analysis for this paper. Interview transcripts were coded for instances in which Foucauldian power could illuminate the data, and the data was then analyzed using axial coding practices[72].

Findings and Discussion

Our interviews revealed several important ways in which drawing on Foucault provides insights about the challenges faced by female faculty members. First, many participants discussed how colleagues' perceptions exercised power over their thoughts, actions, and decisions. For instance, one participant worried that having children would negatively affect perceptions of her in the tenure and promotion process:

> The other thing to…think about is how having kids…affects others' opinions of you. Which I think is more the serious thing…I'm afraid that…if I have kids before tenure, people will think that maybe I'm not so serious or maybe, like, the job isn't my highest priority or if they would use it as an excuse to look down on me, which I'm not saying people in this department would necessarily. But I don't know. I don't know everybody really well…When you go up for tenure, they're the ones that are gonna be deciding whether or not you get to stay. And so, if people think that you're good and you take your work seriously and you're productive, then you're good to go. And if people think that you're just off having a bunch of kids all the time and you're not doing your work…that reflects negatively on you. But at the same time…there's…all these guys in the department…who have kids, right? And I don't think it's ever reflected negatively on them that they've had kids.

Similar concerns over stigma for women were echoed by numerous others. In fact, one participant reported that she did not even tell colleagues about her pregnancy until her eighth month of pregnancy because she believed they would judge her negatively, and she was already at a disadvantage because she had less "respect and stature" than older, male colleagues. Other female participants believed that older, male colleagues perceived their pregnancies as "inappropriate," and the women's presence made "things very uncomfortable."

The negative perceptions of pregnancy and having children caused female faculty members to not use family-related policies. Despite the existence of policies such as parental leave and tenure clock extension, colleagues' perceptions shaped if and how female participants took advantage of the policies, often resulting in non-use of the policies. One woman told us that no one in her department had ever applied for tenure clock extension before, and she therefore did not take it either due to fears of stigma. She said, "I would be worried it would raise red flags," and colleagues would think, "she must be special needs." However, she also went on to recognize the problematic cycle that policy non-use creates: "Maybe I should be the one that's like 'I'm gonna use this [policy]' so that future women can say 'Oh, she did this'" and then be able to take advantage of the policy. Another participant likewise believed that women are stigmatized for taking advantage of parental leave policies and that if parental leave and tenure clock extension are not automatic for all faculty then "women won't take it because then they'll look bad."

Such issues of policy non-use highlight the fact that the existence of family-related policies is insufficient for full implementation. Administrators and researchers need understandings of policy use, and perhaps more importantly, non-use, in order to understand the experiences of female faculty members. Here, Foucauldian power is a significant concept because of its attention to "micro-practices" as conduits of power. Foucault believed that studies of an institution should explore "the way in which it is created, sustained, and modified through the meanings and ideas of a host of micro-practices"[27] (p. 352). When women do not take advantage

of parental leave and tenure clock extension because they fear negative repercussions for their careers, the power of gendered social and institutional norms is exercised. McHoul & Grace explain that a central question of concern to Foucault was, "How can time and labor be extracted from bodies when they are 'free' and in control"?[29] (p. 63). Explorations of the answer to that question are needed in order to fully understand, and subsequently address, the gendered challenges of a faculty career under unequal family responsibilities.

In addition to internalizing gendered expectations of academic culture specifically, we also observed internalization of gendered social norms and roles more broadly. For example, one participant explained how broader social pressures in the form of gender role expectations shape women's decisions and actions:

> Most [women] either their societal expectation or self-expectation is that they are the primary caregiver for not only their family, but their extended family…If grandma gets sick…no one goes to the hospital and says well where's all those male relatives? They say well how come your daughter's not here or how come your sister's not here helping take care of you. I mean you look at society and you can say well it's self-imposed -- OK but it's also…even if you don't feel like you…need to do that, you'll get the societal pressure to feel like you need to do that.

She also discussed career sacrifices she had made to have children, saying that there are realities of having children that entail missed career development opportunities, but those choices are "not imposed by other people, it's imposed by me." Her comments clearly reveal her "choices" operating as a site of gendered power.

Secondly, our interviews highlighted the importance of examining how power operates through faculty discourses. Specifically, we observed discourses of *choice* and *fairness* that warrant deconstruction. As discussed in the literature review, societal norms still hold women to greater household and child-raising responsibilities than men in ways that make faculty careers more difficult for women. Despite widespread recognition of those societal gender inequalities however, both male and female participants engaged a discourse of *choice* in their explanations for underrepresentation. For instance, one faculty member explained that being a professor is a highly demanding job, "so a lot of people may just voluntarily decide this is not the job for me." Echoing a similar belief, another interviewee said: "There's different choices. And the choices can all be equally positive…if I decided not to stay in academia [that] is not necessarily a bad thing…It's just a choice." A third participant likewise did not see underrepresentation as a significant problem, but rather as something that "just happened." He recognized that underrepresentation exists, but believed it was just a matter of individual priorities, not necessarily a problem that warrants action:

> I think the more fundamental question is, "[Is underrepresentation] necessarily a bad thing or is there something wrong with that?"...it just happened that women [have] more maybe responsibilities at home…I mean sometimes, you know, different people have different priorities and [it's] just a fact…I don't know whether it's sad or it's just the way it is.

As discussed in greater detail elsewhere[70], the discourse of choice served to de-problematize underrepresentation and remove the responsibility for change from within the academy. The over-simplified focus on choice obscures the ways in which power operates to influence our lives in ways that often go unseen[41, 73-76]. Understanding the continued influence of social structures on individual "choice" therefore requires engaging notions of *power* in the Foucauldian sense of that term[77] where power is understood not as something held and imposed by others on us, but rather, as exercised through our actions and thoughts so that women's subordination occurs not through "the exclusion of women or overt directives as to how they 'should' behave," but instead by "participation through individual choice (in a fundamentally unchanged social structure)"[41] (p. 62). Summarizing Rose[78], Baker[41] explains that:

> Promotion of the hyper-responsible self and denial of imposed constraints and limitations is a covert technique through which to govern where individuals are persuaded to make meaning of their life *as if it were* the outcome of individual choices made in furtherance of self-interest and self-actualisation. Thus, people are governed through their freedoms and aspirations rather than in spite of them. [emphasis added] (p. 58)

Additionally, a discourse of *fairness* also emerged in the interviews, specifically, when discussing course-release related to parental leave. Responses revealed that course release for parental leave is seen as unfair, and colleagues often expect women to make-up their teaching load in following semesters. Such expectations are based on a belief that the "playing field" is equal for men and women, and, therefore, course release represents an unfair advantage for women. However, as discussed in the literature review, there is a large amount of literature demonstrating numerous ways in which the playing field is not equal to begin with. Therefore, the discourses of choice and fairness are problematic because they both work to obscure gendered facets of family life and of the professoriate. As Baker explains:

> Under conditions of unequal power and subordination (such as emotional pressure and entrenched social demands regarding domestic work, for example), it may be more accurate to describe acquiescence rather than choice or consent to prevailing norms…consent is never freely or neutrally given in situations of inequality…in situations of socially structured constraint, choice is a highly relative and often unsuitable term which does not account for the conditions in which people are making decisions and which bestow more 'choice' on some and limit it for others.[41] (p. 58)

In other words, because male and female faculty members are not playing on a level playing field, decisions and discourses faculty engage to discuss those decisions need to be examined as sites of the operation of power, rather than written off as merely individual choices. We also note that significant differences between participants from different disciplines were not observed, nor were differences between men and women or faculty at different career levels.

Conclusion

Our interviews revealed the operation of gendered forms of power in the Foucauldian sense wherein power is manifested through subtle societal expectations and our own thoughts and actions. We saw this in how gender role expectations placed on women as caregivers were internalized and shaped women's actions and choices. We also saw it in the fears and stigmas

associated with having children as a female faculty member, including around the significant issue of tenure decisions. The fears of being judged negatively or stigmatized for having children need to be understood as forms of power influencing women's decisions and lived experiences. The existence of work-family policies is insufficient if they are not used. Our analysis also highlights the significant, yet understudied, role of faculty discourses around the careers of women. Specifically, the interviews revealed several discourses that deserve further exploration: choice and fairness. Identifying these discourses and understanding how they work against equality illuminates how they contribute to the persistence of underrepresentation despite decades of efforts. Using power as a theoretical lens demonstrates the need to understand why and how policies are and are not used, and the discourses faculty members employ to make sense of work-family issues for women. It highlights the need to focus on how power operates to sustain institutions through individuals' thoughts and actions.

Our claims here are modest. We wish simply to show that Foucauldian power is an under-engaged yet valuable theoretical construct that could offer useful insights and potentially advance research on women in engineering. At the same time, we recognize that this theoretical lens may be more difficult to incorporate into research, as well as to get published, than more "packaged" theories. The same argument has recently been made about the use of feminist theories in engineering education[79]. More specifically, developing studies around power may be difficult in an engineering education context where theory is often not engaged in complex ways but is rather simply matched to data in what Ball[80] has labeled "concept matching." Concept matching means that researchers ''merely apply theory gesturally, simply to boost their findings" rather than deeply exploring theory in complex or challenging ways[81] (p. 78). This trend has been critiqued by education scholars who contend that theory can be better used when it is wrestled with, problematized, and reflected upon, "it cannot be simply applied to a given problem and let go again"[81] (p. 78). Power is a theoretical lens that should be considered in that light. For further reading on the uses of theory in educational research, and the challenges of deeply engaging with theory, including Foucault, we direct readers to *Theory and Educational Research*[22].

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