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ORIGINAL ARTICLE

# Faculty subcultures in engineering and their implications for organizational change

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## Abstract

**Background:** Prior efforts to understand faculty culture have largely described monoliths where individuals are differentiated by their productivity. Little prior work provides rich faculty subcultural descriptions and their connections to specific activities, including disposition to change.

**Purpose/Hypothesis:** This article describes the goals, assumptions, methods, and inferences made about faculty culture within an engineering department at a large university with very high research activity, with the potential to enrich future discussions about change among the target audience of engineering faculty, administrators, and researchers.

**Design/Method:** We employ cultural consensus theory (CCT) to characterize faculty culture, based upon a detailed survey, analysis, and member checking. We use the academic ratchet - as a theoretical framework to interpret CCT results, and extend our understanding using previously published change theories.

**Results:** We discovered two faculty subcultures of roughly equal membership: (a) change-oriented and (b) continuity-embracing. Members of each subculture agree on the primacy of research but differ in their views of change, leadership, and trust. Members of the change-oriented subculture seek large-scale changes but feel disempowered to pursue them, while members of the continuity-embracing subculture seek modest changes and feel empowered to enact them.

**Conclusions:** We introduce a scalable, person-centered culture characterization approach (CCT) to the engineering education research community. This approach deepens our understanding of faculty culture, and our results reinforce the central role of the academic ratchet in shaping faculty activities. This analysis illustrates the potential roles of each subculture in enacting change of various types and magnitudes.

KEYWORDS

cultural consensus theory, doctoral institutions, faculty attitudes, institutional culture

  

# 1 | INTRODUCTION

Academic organizations have their own cultures, norms, and expectations that vary widely by institution. To some extent, culture tracks institution type; teaching-focused institutions often have a strong tradition of faculty-student interaction, mentorship, and a deep student-centric decision making process. Research-intensive institutions may be more faculty-centric, especially those with large undergraduate and graduate enrollment. Culture within an academic unit is shaped by history, personality, leadership, and locally shared values as well as the values of the broader institution.

Within this broad and complicated milieu of academic organizations lies the underlying definition of the tenure-track faculty role, which again is strongly institution dependent. Broadly speaking, faculty assume responsibility for "teaching, research, and service," with highly elastic definitions for each that reflect not only institutional characteristics but also individual and institutional aspirations. Moreover, an individual tenure-track faculty member's distribution of effort within the three broad categories is dependent on a huge variety of factors, including their own priorities and interests; the needs of the department, college, or institution; and the rewards structure articulated through promotion and tenure criteria. All of these dynamics are situated within a departmental (or college, or institutional) culture that signals "appropriate" and "inappropriate" choices about how faculty spend their time, the activities they engage in, and the set of priorities they demonstrate based upon their actions.

Our team is engaged in an organizational change research project centered on an Engineering School (ES). Within the College of Engineering at this institution, academic programs are organized into schools (rather than departments), and the ES studied here represents a single engineering discipline. Our prior work suggested that the organizational culture within the ES shapes all manner of faculty and student activities. We have reported on some of this work elsewhere (Briody, Berger, Wirtz, Ramos, & Guruprasad, 2018; Briody, Rodríguez-Mejía, Rothstein, Wu, & Berger, 2019; Briody, Wirtz, Goldenstein, & Berger, 2019; Wirtz et al., 2018), and our past work on cultural characterization within the ES has focused largely on interview and observation protocols of a relatively small number of individual faculty. Faculty generally reported on an intense sense of busyness, constant time pressures, and significant struggles with the scale of the organization (primarily defined as undergraduate enrollment). On balance, however, our previous data left us with an incomplete picture of the faculty culture in the ES. More specifically, we became curious about the variation in beliefs among the faculty, whether these differences could be characterized as distinct subcultures, and the extent to which an individual's beliefs aligns with any specific subculture. As a result, we have formulated the following research question to guide this study:

> *To what extent do faculty in the ES align with definable subcultures, what are the key features of those subcultures, and what does membership in a subculture suggest about how faculty respond to their teaching, research, and service mandate?*

To collect broad-scale data from department faculty, we have chosen an approach (cultural consensus theory; CCT) suitable for large-scale data collection via a faculty survey. This paper describes our formulation of the survey instrument, its delivery, the data analysis, and our interpretation of the results as related to departmental mission and its disposition to change.

# 2 | BACKGROUND AND LITERATURE

## 2.1 | Origins of the work

The genesis of this work was an on-going research program focused on change in the ES, an academic unit home to more than 1,300 undergraduate students. This project has attempted change in the domains of how faculty teach using creative assessments, how faculty teach and evaluate teaming skills, how students engage with co-op opportunities, how students connect with potential mentors, how students gain leadership experiences, and how faculty can support student conceptual understanding of key engineering topics (Berger, Wirtz, Goldenstein, Morrison, & Briody, 2018; Goldenstein, Wirtz, & Berger, 2018).

Our observations throughout all these efforts were a culture-based interpretation of what many others have cast as a "diffusion" problem (Rogers, 2010). There was a differential commitment among faculty members to support these change initiatives, even though many of them are ostensibly within the bounds of faculty responsibility. Our hypothesis, derived from our own experience as well as the work of others (Baba & Pawlowski, 2001; Merton, Froyd,

Clark, & Richardson, 2009), was that "culturally correct" behavior among faculty in the ES did not include substantial and ambitious change events requiring collective action, and instead focused on individual autonomy and smaller-scale change. This view is reminiscent of Henderson-type models for faculty change in pedagogical practice (Borrego & Henderson, 2014; Henderson et al., 2011; Henderson, Finkelstein, & Beach, 2010), a point to which we return later in the paper. We adopted a cultural point of view and decided to probe not only issues of innovation and change, but more generally about multiple dimensions of faculty and departmental life. Our goal was to characterize the culture within the ES, from which we would extract some understanding of faculty disposition to changes of the types mentioned above as well as their general view of their role and experience in the ES.

## 2.2 | Definition of culture and researcher positionality

In this study, we take an anthropological view of culture, and define it as "everything that people have, think, and do as members of their society." (Ferraro & Briody, 2017, p. 10) Anthropology considers culture as integrated, holistic, and comprehensive—a system that is "coherent and logical" (Ferraro & Briody, 2017, p. 21). This orientation contrasts with other disciplines (e.g., business, psychology, education) that view culture as "something that the organization has ... rather than [something it] is or [something it] may become" (Ferraro & Briody, 2017, p. 192). Our view is that culture entails processes of thinking, talking, behaving, prioritizing, and producing. Parts of a cultural system (e.g., governance, education, and technology) are interrelated, forming a whole; these elements with one another make sense in their own cultural context, but may make much less sense elsewhere. And, of course, cultures can contain subcultures, groups of individuals who exhibit somewhat distinctive views and behaviors related to the broader culture. We use the term "culture" throughout this work to indicate the "system" in the ES, and the term "subculture" to indicate differences in experience or perspective within the ES system.

Our positionality in this study aligns closely with the anthropological perspective of culture, in that culture represents *something that an organization is*. We are a collection of engineering education and anthropology researchers who understand that culture is shaped by people (here, largely the faculty), but also by processes, policies, the physical space, and many other organizational features. We also believe that every organization is "perfectly designed to get the results it gets" (a quote attributed to Deming, but whose actual origin is disputed). By this we mean that all of the positive and negative features of the ES can be attributed to the holistically defined culture of the organization. We also believe that because faculty are long-term, high-status residents of both an academic unit and the university as a whole, they have a disproportionate role in shaping culture. Faculty define the curriculum and set academic and other policies and requirements at the university and local unit levels, and their overall role as campus leaders in many settings affords them tremendous (although typically implicit) power to define the culture. As such, we believe strongly that to understand how the culture shapes ES outcomes—for faculty, students, and staff—we must understand the culture through the eyes of the faculty.

## 2.3 | Cultural studies in higher education

### 2.3.1 | Characterizations of culture and cultural differences

Academic disciplines are widely characterized as having different cultures, traditions, and styles of inquiry (Becher, 1994; Biglan, 1973; Kolb, 1981). Institutions also have their own cultures and subcultures defined by domain, role, or many other factors (Arcelus, 2008; Magolda, 2005). Faculty are considered to be members of one of an institution's many subcultures because (from the university's point of view) they generally ascribe to a common set of beliefs and rules along with common work practices and pedagogical processes. However, the faculty subculture itself is not monolithic but instead is organized hierarchically based on rank (Clark, 1989; Kuh & Whitt, 1988) and potentially many other factors (although, at least in the United States, there is a strong emphasis on collegiality (Bergquist & Pawlak, 2008)). Faculty collaborate on some activities (e.g., committees) and work to reach agreement on key issues (e.g., departmental policies, admissions, and faculty hiring). A faculty subculture generally possesses within-group variations that can affect departmental operations, including issues like decision making processes and outcomes (Briody, Cavusgil, & Miller, 2004).

Prior detailed studies of academic units are sparse although Godfrey's work (Godfrey, 2001, 2003; Godfrey & Parker, 2010) converged on a six-factor cultural description of engineering units based on interviews and observations of

faculty and staff: (1) an engineering way of thinking, (2) an engineering way of doing, (3) being an engineer, (4) acceptance of difference, (5) relationships, and (6) relationship to the environment. In Godfrey's and other studies (see also Baba & Pawlowski, 2001; Merton et al., 2009; Tener, 1999), however, across-group experiences of culture among different unit constituents (faculty, staff, students, parents, etc.) have been largely neglected as have within-group experiences. Given the different roles played by these constituents in unit governance and decision making, it seems imperative to further elucidate group-level experiences in addition to the unit-level descriptions of culture. Our research group has previously published a characterization of the undergraduate student culture in the institution studied here (Briody et al., 2018). However, the centrality of faculty in the life, organization, structure, policies, governance, and day-to-day operation of academic units is undeniable, and cultural descriptions of the faculty are currently lacking in the literature. As a result, while some dimensions of Godfrey's framework for culture of an academic unit appear later in our analysis, we also focus on much more local, ES-specific components of culture inspired by a variety of data sources.

#### 2.3.2 | Culture and organizational performance

Our anthropological perspective also views performance as part of culture along with other outcomes, work products of the organization and its members, and the dynamics of its day-to-day operation. Miller (2007) identified seven elements in an assessment of the organizational performance within higher education: effectiveness, productivity, quality, customer and stakeholder satisfaction, efficiency, innovation, and financial durability. Several of these dimensions are clearly related to faculty work, so within Miller's framework understanding faculty motivations and behaviors is important. Miller's framework can be applied to both the academic and administrative aspects of colleges and universities and includes organizational, program, and process-based units of analysis—all of which again overlap with the faculty domain. Alternate frameworks for exploring organizational performance involve a comparison of perceptions of the current state with an ideal or imagined state (Briody, Wirtz, et al., 2019), a logic model of all parts of the system against which progress can be assessed (Butler, 2016), and principles and steps to guide evaluation activity (Fetterman & Wandersman, 2018). Within all of these frameworks, understanding the culture (and subcultures) of an organization leads to deeper insights into the outcomes the organization achieves.

### 2.4 | Theoretical framework: Cultural consensus theory

#### 2.4.1 | Brief background

CCT is a person-centered methodology for discovering and estimating group/subgroup consensus by analyzing questionnaire data from group members, somewhat akin to cluster analysis (Batchelder, Anders, & Oravecz, 2018). CCT entered the anthropological literature in the 1980s (Romney, Weller, & Batchelder, 1986) via a collaboration among anthropologists and medical clinicians. There are many practical use cases in which a group of individuals may be queried about their shared connection to some specific knowledge, beliefs, or opinions. CCT has been used to understand individuals' beliefs about backpackers and tourism (Paris, Musa, & Thirumoorthi, 2015), wildlife management (Miller, Kaneko, Bartram, Marks, & Brewer, 2004; Paolisso, 2007), and obesity (Ulijaszek, 2007). Nonetheless, the bulk of the CCT literature focuses on the more theoretical or mathematical aspects of CCT, led by Anders and Batchelder (Anders & Batchelder, 2012; Batchelder & Anders, 2012; Batchelder et al., 2018), with essentially no applied studies of academic organizations using CCT. CCT provides a pathway to answering our research question because it accommodates large-scale data collection via a survey instrument whose results are interpretable within the context of our previously collected data.

#### 2.4.2 | Underlying assumptions

Romney et al. (1986) defined three underlying assumptions of CCT: (a) the respondents come from a common culture, which means there is a common answer for each response item; (b) the respondents' answers are independent from one another but they are correlated with the common answer; and (c) item difficulty (a term of art from the CCT literature, described below) conforms to certain criteria about heterogeneity (Batchelder & Romney, 1988). We add to this a fourth criterion: that the results can be triangulated with other data sources, including member checking. This work

complies with these conditions as follows. The pool of respondents has experienced the same environment, which in our context includes the physical infrastructure, leadership, decision-making processes, and the like within the ES. Hence, they hold informed opinions based upon their experiences in this environment (Assumption (a)). Assumption (b) states that all respondents' opinions are affected by these shared experiences but not affected by one another's opinions, which we ensured using individual, private email invitations to complete the CCT survey. Assumption (c) ensures that all questions are drawn from a coherent domain, and compliance with this assumption was tested using a posterior check as described later. Finally, we cross-checked CCT results and interpretation against our other data collection and member checking interviews conducted after the CCT results were disseminated to the faculty. As such, CCT using a survey-based approach was the ideal candidate for this research, and some of the mathematical details of its use are presented later. CCT is also a new, person-centered tool for engineering education research, and its use here extends the method to a new domain and exposes it to a new community of researchers.

### 2.5 | Theoretical framework: The "academic ratchet"

This study explores faculty culture, and one key element of culture is time and the ways that individuals spend their time. Prior work on time allocation by faculty has focused on trade-offs among job roles (teaching, research, service, etc.; Fairweather, 2002; Link, Swann, & Bozeman, 2008), as well as changes in time allocation over time (Milem, Berger, & Dey, 2000), across different institutions (Singell & Lillydahl, 1996) and cultural contexts (Bentley & Kyvik, 2013), and by demographics such as gender or race (Toutkoushian & Bellas, 1999). Taken together, these works make the sensible case that many faculty simply respond to the incentive structures of their institution when making time allocation decisions. They also highlight that not all faculty experience those incentives or expectations the same way. For instance, Fairweather (2002) proposed that only a small fraction of faculty can be above-average performers in both teaching and research (what he calls the "complete faculty member") because of the significant time commitments required to achieve productivity in each domain.

The framework used to interpret the results of this paper is the academic ratchet (Massy & Zemsky, 1994), first proposed in the early 1990s but as relevant today as it was then. The central argument of the academic ratchet is that faculty seek to maximize their discretionary time, by which Massy and Zemsky mean "time for pursuing professional and personal goals" (p. 2). Their argument continues by positing that faculty achieve greater discretionary time by "loosening their institutional ties and responsibilities" (p. 2) to the extent possible. They further argue that faculty use their agency with discretionary time in specific ways related to the pursuit of deep, specialized knowledge: teaching graduate courses in their area of expertise, seeking funded research projects, creating scholarship based upon their research, and so forth. Engineering education's shift toward an engineering science framework (Froyd, Wankat, & Smith, 2012) is one reflection of this thirst for more specialized knowledge. Massy and Zemsky assert that academic organizations are complicit in this ratcheting because rewards structures align with the research-oriented outcomes of this discretionary time (external grants, scholarly publications) rather than with the undergraduate teaching mission (as also noted by Fairweather, 1993; Fairweather & Rhoads, 1995, and many others)—especially at institutions like the one studied here.

The consequences of academic ratcheting are significant, because faculty exercise agency with their discretionary time. Setting aside the question of rewards structures, some choices for use of discretionary time may support *institutional* goals (say, mentoring undergraduate students) while others help achieve *individual* goals (say, achieving fellow status in a professional society). The option to engage in organization-oriented activities has been termed extra-role behavior and reflects a kind of organizational citizenship that exists outside the formal rewards structure (Organ, 1988, 1997). The extra-role construct has been applied to undergraduate mentoring (DeAngelo, Mason, & Winters, 2016) as well as in school settings (DiPaola & Hoy, 2005). We return to these ideas later to help interpret the results of our data collection and analysis.

## 3 | METHODS

### 3.1 | Participants

This study is part of a larger funded research project on organizational change within a single academic unit (the ES). This article focuses on ES culture (and potentially subcultures) from the perspective of the faculty. We chose a sampling frame consistent with this goal and our research question: the set of instructional faculty in the ES, a total of 87 people.

This group included all tenure-track faculty (including those with appointments split across multiple departments), limited-term lecturers, and others with various instructional roles. Faculty with titles like Research Professor who did not have instructional responsibility were not invited to participate. There were several people in the sampling frame who had joint appointments in the ES and those with a courtesy appointment but who nonetheless taught one or more classes in the ES within the last few semesters. Members of the sampling frame were invited by email (each with their own unique link) to participate in a CCT survey, with subsequent reminders sent to those who had not yet responded 3, 8, and 11 days later. The survey was described at a faculty meeting before the first invitation email was sent, and faculty were explicitly asked to participate. The final sample in this study included $n = 54$ individuals from the sampling frame (response rate over 60%) who completed the survey in its entirety.

The demographics of the $n = 54$ respondents were generally consistent with the overall demographics of the sampling frame, to the extent that we know them for these faculty. We do not have access to faculty personnel files or other self-report data that would allow us to confidently characterize certain demographics of nonrespondents. The respondents were largely heterosexual men (almost 80%) as indicated in their gender identity responses on the survey, with almost 10% of respondents declining to define their gender identity on the survey. Almost 26% of respondents did not indicate a race or ethnicity on the survey. Less than 10% of respondents indicated their race to be Native American or Alaska Native, Black or African American, or Native Hawaiian or other Pacific Islander, or their ethnicity to be Hispanic/Latinx. Distribution of respondents by rank was similar to the sampling frame across the non–tenure-track roles of continuing lecturer or affiliated faculty (respondents: 5.6%, sampling frame: 10.2%) and assistant/associate/full professors on the tenure track (respondents: 25.8/18.5/50.0%, sampling frame: 20.4/15.9/53.4%). Respondents spanned all disciplinary subareas of the department and included people with a diversity of experiences outside of this institution (at other academic institutions as well as national labs and industry positions). We acknowledge that our sample reflects a male, heteronormative perspective in the data, though this perspective is likely the dominant narrative within the ES faculty. We address this situation in more detail in the Limitations section.

## 3.2 | The CCT survey

### 3.2.1 | The cultural consensus items

The CCT survey was composed of several sections, focusing on cultural consensus, faculty priorities, time devoted to specific tasks, department workload distribution, and demographics that could not be collected from other sources. The cultural consensus section was composed of 40 dichotomous (yes/no) cultural statements, and each respondent was invited to express their agreement with each statement in a binary way: "yes" indicated agreement with the statement, and "no" indicated disagreement. The 40 statements presented to respondents were created by our research team as a result of multiple rounds of ideation and revision. In all cases, we considered the data collected throughout the project to establish key categories that ES stakeholders (faculty, staff, and students) had previously indicated were important. These categories included leadership, collaboration, scale, and several others, as summarized in Table 1. Within each category, our prior research (including interviews, observations, surveys, and review of institutional documents) inspired creation of potential survey items, and each item was checked against the strength of evidence available from our dataset for its importance to the faculty. Items with the strongest prior research evidence were down-selected for potential inclusion in the final version of the survey. We started with more than 80 potential items across 10 categories, and subsequently chose 40 for inclusion on the survey. Because many of the item categories were closely related, some of the items could legitimately have been placed in multiple categories. For instance, the Scale category was inclusive of concerns about the large number of undergraduates, which also relates to the Students category. For clarity of presentation, we have placed each survey item into a single category.

Each of the 40 cultural statements went through multiple rounds of revision within our research team for both specificity of language and expectations about what a culturally acceptable answer might be. Some of the items were intentionally phrased to be explicit about a specific category (i.e., using the word "change"), while other phrasings were more implicit. For instance, many of the cultural statements actually ask respondents about how they evaluate trade-offs related to time, even though "time" is not explicitly used in the statement. We framed the 40 items with the expectation that about half of them would have a culturally appropriate answer of yes, and the other half would have an answer of no. This framing was accomplished through review of prior research evidence as well our insider knowledge gained by executing this large research project. Of course, the expected existence of multiple subcultures within the ES

**TABLE 1** Sources for cultural statements on the cultural consensus theory (CCT) survey

| Category | # questions | Data source(s) |
|---|---|---|
| Change | 3 | Faculty/student/staff interviews, change team discussions, department head discussions, program data |
| Collaboration | 2 | Faculty interviews, P&T documents |
| Faculty identity | 5 | Faculty/staff interviews, P&T documents, change team discussions |
| Faculty role | 6 | Faculty/staff interviews, P&T documents, dept. head discussions, change team discussions |
| Leadership | 4 | Faculty interviews, COACHE survey results, change team discussions |
| Mentorship | 2 | Faculty interviews, COACHE survey results |
| Scale | 4 | Faculty interviews, program data, change team discussions |
| Social life | 4 | Strategic planning documents, COACHE survey results, faculty interviews |
| Students | 5 | Faculty/student/staff interviews, data from associated projects |
| Trust | 5 | Faculty interviews, change team discussions |
| Total | 40 | |

*Note: Except as noted below, data sources are associated with this project.*

- Change teams are grassroots teams of Engineering School (ES) constituents assembled to design and execute specific change projects (Berger et al., 2018).
- COACHE survey results were available to us in aggregated form for faculty across the ES (Anonymous, 2018).
- P&T documents and program documents are publicly available from the institution and ES department.
- Associated projects are on-going, separately-funded research efforts whose data in some way informs this work, e.g. student resource usage research (Stites, Berger, Rhoads, & DeBoer, 2019).

means that it was quite difficult to anticipate what the mainstream opinion about some statements might be. In a similar way, we could not a priori know that all items were of similar difficulty (the third assumption from Romney et al., 1986), and posterior calculations given later confirmed that the heterogeneous item difficulty assumption was appropriate for the responses received. Our research team iterated on each statement several times before settling on the final language for inclusion. Table 1 also shows the number of statements from each category included on the final version of the CCT survey as well as the source(s) from our prior data that inspired the items.

Many of the items were framed using generic terms such as "the department" (to indicate the academic unit) and "leadership," which we intentionally chose to be an elastic term interpretable by each respondent. We intended "leadership" to be inclusive of department heads, deans, the provost, and others with formal leadership titles as well as individuals with departmental titles such as Associate Head or Assistant Head, committee chairpeople, and influential faculty within the department regardless of title or rank. Several statements were framed around "collaboration" in general rather than a more specific instance of "research collaboration," "collaborative/team teaching," or any other prescribed type of collaboration. Similarly, questions about "change" did not specify a dimension of change (e.g., adopting pedagogical innovations, transforming curriculum, initiating new research areas, or changing decision-making practices or policies), so these items were intended to probe the general disposition to change in the department rather than change in any particular domain.

The trust questions were adapted from the Behavioral Trust Inventory, and the language from the original source (Gillespie, 2003) was modified from its original industry orientation to be appropriate for an academic organization. Trust is highly contextual, and an individual's willingness to extend trust is a function of both the person in whom trust may potentially be placed as well as the activity that person will engage in. In this survey, the trust items were framed (a) within Gillespie's reliance domain related to skills, abilities, or judgments of others and (b) specifically to probe the extent to which individuals "can rely on" or "can depend on" "leadership" to do something on their behalf. We focus on "leadership" rather than someone else (for instance, a senior colleague or a mentor) because the broad category of leadership was an important theme that emerged out of much of the data we collected from faculty prior to administering the survey.

### 3.2.2 | Other survey items

We also included several questions related to number of years of service as a faculty member (at any institution, at any rank), number of years of service on the ES faculty, number of years of industry experience, and administrative and

leadership responsibilities (including being an editor of a journal or having a significant leadership role in a professional society) as well as race/ethnicity and gender questions. We asked about years of service in various settings (industry, national lab, and higher education) and years of service in the ES rather than asking about age. Our expectation was that both years of service in the ES and personal demographics (gender or racial identities) might play important roles in defining the ES culture, so we asked a set of questions about those factors on the survey.

### 3.3 | Integration of other data sources

For faculty who consented to participate in the CCT survey and who fully completed the survey, we connected their survey responses to other public data sources relevant to their academic careers. We drew citation and h-index data from Google Scholar and Scopus, sponsored awards data from our institution's sponsored programs office, historical teaching data (course number, credit hours, enrollment) from our institution's databases, and salary data from a public database (ES is part of a public institution). Salary data represented total employee compensation from institutional sources including academic-year salary plus summer salary, but excluding income from consulting, an employee's privately held company, or other noninstitutional sources.

### 3.4 | Quantitative analysis

The mathematical details of CCT have been thoroughly presented elsewhere (Batchelder et al., 2018). In brief, CCT uses a person-centered, cluster-like analysis to indicate membership in the subcultures identified by the survey items. CCT is person-centered because it focuses on the respondents (as in a cluster analysis) rather than on the survey items (as in a factor analysis). Mathematically, a subculture can be interpreted as a characteristic response pattern to the 40 dichotomous cultural statements. We interpret the subcultures in practical terms in the Discussion section. The quantitative method produces estimates of the difficulty of each item and cultural competency of each respondent. The analysis was conducted in R using the CCTPack package (Anders, 2017). Mathematical and procedural details are presented in the online supplementay material (Gelman, Carlin, Stern, Dunson, Vehtari, & Rubin, 2015).

### 3.5 | Member checking

After survey analysis, we took several member checking steps. First, we constructed a custom, two-page summary report for each survey respondent. The report consisted of text descriptions of our processes for collecting, analyzing, and interpreting the survey data along with a table of survey responses for each of the 40 cultural statements. The table indicated the percentage of respondents agreeing with each item (broken down by subculture, as well as for all respondents) and the actual response (yes/no) provided by the individual whose report it was. The text elements of the report included descriptions of the subcultures as well as each individual's subcultural membership. Individual reports were emailed to each respondent, with an invitation to meet with a member of our research team for a 30-minute member checking interview. A general summary of the data was also emailed to all ES faculty who were invited to complete the survey, and they too were invited to participate in an interview. The interview protocol involved reviewing the report to answer specific questions from the individual as well as an open-ended discussion about their agreement with our interpretation and description of the subcultures and (for survey respondents) their subcultural membership. We interviewed a total of $n_{mc} = 5$ ES faculty members as part of the member checking process.

## 4 | RESULTS FOR CULTURAL CHARACTERIZATION NUMBER OF SUBCULTURES

We collected $n = 54$ complete responses to the survey, and the analysis confirmed the existence of two faculty subcultures in the ES. To determine the number of subcultures, we used factor analysis of the $54 \times 54$ respondent matrix, which indicated that 33.2 and 23.4% of the variability in respondents were accounted by the first two factors. This indicated two potential subcultures among the respondents. A posterior check (Figure 1) of subculture number showed that the scree

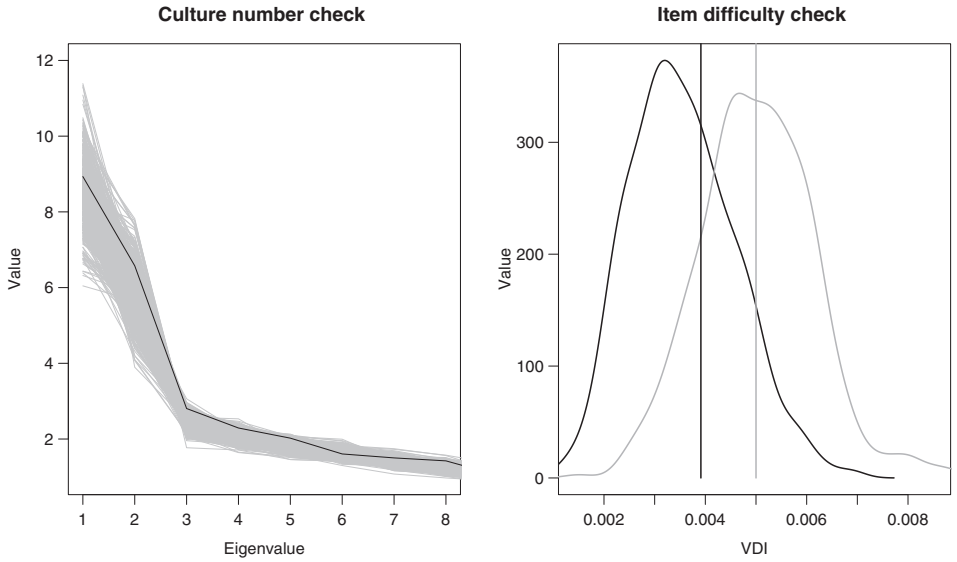


**FIGURE 1** Posterior check of model specification: Number of subcultures based on eigenvalue ratios (left) and heterogeneity check based on Variance Dispersion Index (VDI, right)

**TABLE 2** Sensitivity of subculture membership to changes in number of subcultures explored in cultural consensus theory (CCT) analysis

| | 2 subcultures | 3 subcultures | 4 subcultures |
|---|---|---|---|
| Number of people in SC1 | 29 | 29 | 27 |
| Number of people in SC2 | 25 | 23 | 23 |
| Number of people in SC3 | — | 2 | 1 |
| Number of people in SC4 | — | — | 3 |

plot of the actual data (the black line) fell within the distribution of simulated data (the gray lines), and, hence, two subcultures was an appropriate choice. The item difficulty check used the Variance Dispersion Index (VDI; see the online supplementary material) to validate the hypothesis of heterogeneous item difficulty. In this analysis, the VDI lay within the appropriate range and confirmed the heterogeneous difficulty assumption. Membership distributions for models with different numbers of subcultures are presented in Table 2, and these data further confirmed that two subcultures was the most reasonable conclusion of the analysis.

## 4.1 | Membership in the subcultures

The statistical inference estimated that 29 respondents belonged to Subculture 1 (SC1) and 25 respondents belonged to Subculture 2 (SC2). The average respondent competency $\bar{\theta} = 0.42$ for both cultures; average guessing bias for SC1 is $\bar{g}_1 = 0.48$ and for SC2 $\bar{g}_2 = 0.50$. A $t$ test indicated that there was no significant difference for competency ($p = .77$) or bias ($p = .37$) between the two subcultures.

Seniority (defined as total years of professional experience, which strongly correlates to years of experience in the ES) emerged as the only demographic variable that *suggests* subculture membership (although it was not statistically significant), with more seniority correlated to membership in SC2. Seventy-nine percent of SC1 respondents have been faculty members in the ES for 15 years or less (compared to 60% for SC2). SC2 had a higher proportion of faculty of rank Professor (60%) and people with 25+ years of faculty experience (32%) compared with 41 and 10% in SC1. No other personal demographic variables (including gender and race/ethnicity) were correlated to membership in one subculture or the other as determined by a chi-squared independence test. Although SC1 had a larger proportion of women respondents, the total number of women in the dataset ($n_w = 4$) was too small to draw concrete conclusions.

We explored other potential predictors of membership in the subcultures, including research metrics (h-index, total citations, research grant awards), teaching metrics (total credit hours taught, total number of undergraduate or graduate advisees), and annual compensation from all university sources. We observed no systematic influence of any of these variables in predicting membership in either subculture. Figure 2 shows the distribution of subculture membership for respondents to the survey as a function of teaching responsibility (as measured by number of student credit

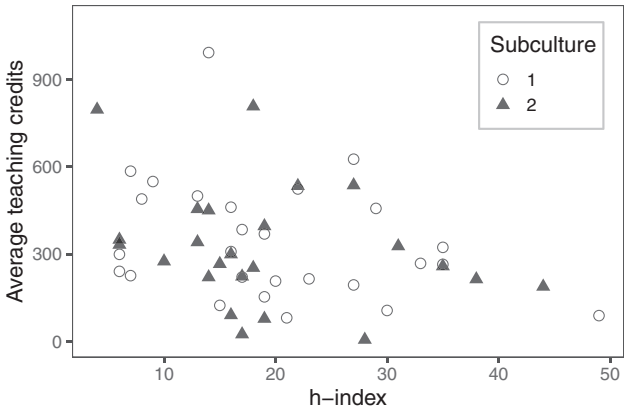


**FIGURE 2** Example of subculture membership exploration: Average student credits instructed versus instructors' h-index by subculture

hours taught) and a measure of research impact (h-index). This example is emblematic of all the combinations of factors we explored; there were no systematic trends of subcultural membership as a function of any pair of predictors.

## 4.2 | Cultural descriptions

### 4.2.1 | Cultural responses to individual items

Responses to each cultural statement are summarized in Table 3 by subculture (SC1, SC2) and for the entire sample ("All"), grouped by item category from Table 1, with a significance metric for differences between SC1 and SC2. We bolded rows corresponding to cultural statements for which the responses of the two subcultures were statistically different using a threshold $\alpha = 0.05$ and a chi-squared test. This threshold corresponds to a roughly 30% difference in response frequency between the two groups, which in turn represents (for $n_1 = 29$ and $n_2 = 25$) about eight individuals, or roughly one-third of the population of the subculture. The table clearly suggests that across the 40 cultural statements, the two subcultures have multiple points of agreement and disagreement within and across statement categories. The 13 points of significant disagreement represent the distinguishing features of the subcultures, while the points of agreement indicate the overall perspectives and values of the department faculty. In the next few sections, we explore both the shared cultural features and their differences, and form a narrative description of the two subcultures evident in our data.

A summary view of differences between SC1 and SC2 is provided in Figure 3, which shows the difference Δ between the percentage of respondents in SC1 and SC2 who responded "yes" to each item. Items from Faculty Role, Leadership, and Trust showed the largest divergence, while the categories of Change, Leadership, and Trust showed the largest number of items with a significant difference. Interpretation of these items, categories, and their differences is explored in the next few sections.

### 4.2.2 | Shared cultural features

In the following discussion, we present the statements themselves (using numbering and language from Table 3), followed in parentheses by the item category (from Table 1) and the percentage responding "yes" from the relevant group (All, SC1, or SC2). We discovered six prominent themes in the data (Table 4), three that seem to be shared by both subcultures and three that are distinguishing features of the subcultures.

### 4.2.3 | A research focus plus workload pressures

Across the department, faculty generally viewed their role as very research-oriented, with clear tensions between scale and scope of responsibility and the shared understanding that rewards systems are oriented around research productivity. For instance, strong majorities of both subcultural groups (≥80% of all respondents) agreed with the statements

**TABLE 3** Percentage of respondents agreeing with each cultural consensus theory (CCT) survey statement by subculture (SC1, SC2) and across all respondents. Differences between SC1 and SC2 larger than 30% are bolded. *p*-values from chi-square tests are given

| Item (category from Table 1) | All (%) | SC1 (%) | SC2 (%) | *p* |
|---|---|---|---|---|
| **1. This department really seizes the available opportunities for change. (Change)** | **33** | **14** | **56** | **.003** |
| 2. The biggest barriers to change around here are related to personnel. (Change) | 48 | 52 | 44 | .769 |
| **3. The biggest barriers to change around here are structural, including policies, procedures, and hierarchies. (Change)** | **63** | **79** | **44** | **.017** |
| 4. Collaboration is encouraged and rewarded at this institution. (Collaboration) | 81 | 72 | 92 | .135 |
| 5. Faculty need to be careful when collaborating across Schools or Colleges. (Collaboration) | 24 | 31 | 16 | .332 |
| 6. Research productivity is what earns the faculty status around here. (Faculty Identity) | 85 | 86 | 84 | .999 |
| **7. When faculty engage in curriculum development, course reform, or teach lab or design classes, they are respected and valued by their peers. (Faculty Identity)** | **65** | **45** | **88** | **.002** |
| 8. The best faculty in this department are the most well-funded. (Faculty Identity) | 37 | 28 | 48 | .205 |
| 9. The way faculty earn high status around here is to focus on the productivity of their individual research group. (Faculty Identity) | 80 | 83 | 76 | .782 |
| 10. Faculty should talk about rejected papers and declined proposals so others can learn from their experience. (Faculty Identity) | 72 | 76 | 68 | .735 |
| 11. Faculty spend too much time doing things that could be done by others (i.e., doing things that you don't need to be a faculty member to do). (Faculty Role) | 61 | 72 | 48 | .120 |
| 12. Faculty are most effective when they are focused on their own research program. (Faculty Role) | 67 | 76 | 56 | .210 |
| **13. Faculty are empowered to change things they don't like about this department. (Faculty Role)** | **41** | **3** | **84** | **.001** |
| 14. Around here, faculty life really improves when you get tenure. (Faculty Role) | 43 | 41 | 44 | .999 |
| 15. The faculty spend too much time doing things that could be done by qualified and well-trained staff. (Faculty Role) | 69 | 76 | 60 | .338 |
| 16. The faculty in this department should really only teach technical subjects, and leave communication, teamwork, and entrepreneurship to others. (Faculty Role) | 19 | 21 | 16 | .927 |
| 17. Faculty members really should take a stronger leadership role in departmental issues. (Leadership) | 81 | 79 | 84 | .927 |
| **18. Leadership does a good job of fixing all the things that are wrong around here. (Leadership)** | **41** | **10** | **76** | **<.001** |
| **19. The workload assignments (membership on committees, teaching load) around here are distributed equitably. (Leadership)** | **67** | **52** | **84** | **.026** |
| **20. In this department, committee meetings are usually very inefficient uses of faculty time. (Leadership)** | **44** | **59** | **28** | **.047** |
| 21. Faculty should spend more time mentoring undergraduate students. (Mentorship) | 61 | 55 | 68 | .494 |

(Continues)

**TABLE 3** (Continued)

| Item (category from Table 1) | All (%) | SC1 (%) | SC2 (%) | *p* |
|---|---|---|---|---|
| **22. This department has a good track record in mentoring young faculty. (Mentorship)** | **54** | **38** | **72** | **.026** |
| 23. This department has so many undergraduate students that there's no way we can do educational innovation. (Scale) | 20 | 28 | 12 | .281 |
| 24. The faculty spend too much time dealing with large undergraduate classes, and there's little time to do anything else. (Scale) | 39 | 52 | 24 | .071 |
| 25. In this department, the faculty want to connect with the students, but there are so many undergraduates that it's hard to really connect with them. (Scale) | 70 | 76 | 64 | .514 |
| 26. The faculty are supportive of staff taking on more strategic & leadership roles within the department. (Scale) | 78 | 72 | 84 | .488 |
| 27. Building community among the faculty is important in this department. (Social Life) | 87 | 83 | 92 | .547 |
| 28. For junior faculty in this department, it's important to develop a good relationship with several key senior faculty. (Social Life) | 81 | 90 | 72 | .189 |
| 29. In this department, it is difficult for faculty to have a healthy work-life balance. (Social Life) | 52 | 62 | 40 | .179 |
| 30. This department is an easy place for faculty to fit in and feel at home. (Social Life) | 74 | 69 | 80 | .541 |
| 31. The faculty believe ethical issues such as cheating are prevalent among students. (Students) | 54 | 59 | 48 | .612 |
| 32. Students generally respect the faculty's time. (Students) | 81 | 72 | 92 | .135 |
| 33. The faculty in this department would rather have the 1-to-1 interactions with students in their classes handled by the TA. (Students) | 39 | 31 | 48 | .320 |
| 34. The faculty really should engage more with undergraduate students outside of the classroom, for instance on competition teams like Baja or formula. (Students) | 56 | 55 | 56 | .999 |
| 35. The faculty in this department do not spend too much time worrying about academic integrity issues. (Students) | 46 | 45 | 48 | .999 |
| **36. The faculty can rely upon leadership to represent their work accurately to others. (Trust)** | **30** | **3** | **60** | **<.001** |
| **37. The faculty can rely upon leadership's work-related judgments. (Trust)** | **46** | **21** | **76** | **<.001** |
| **38. The faculty can rely upon leadership's task-related skills and abilities. (Trust)** | **56** | **34** | **80** | **.002** |
| **39. The faculty can rely upon leadership to handle an important issue on their behalf. (Trust)** | **48** | **14** | **88** | **<.001** |
| **40. The faculty can depend on leadership to back them up in a difficult situation (Trust)** | **63** | **34** | **96** | **<.001** |

"6. Research productivity is what earns the faculty status around here." (Faculty Identity; All = 85%), and "9. The way faculty earn high status around here is to focus on the productivity of their individual research group." (Faculty Identity; All = 80%). The strong positive responses to related statements supported this view, including "12. Faculty are most effective when they are focused on their own research group." (Faculty Role; All = 67%). Members of both subcultures viewed workload pressure as a crucial element of their experience: "25. In this department, the faculty want to connect with the students, but there are so many undergraduates that it's hard to really connect with them."

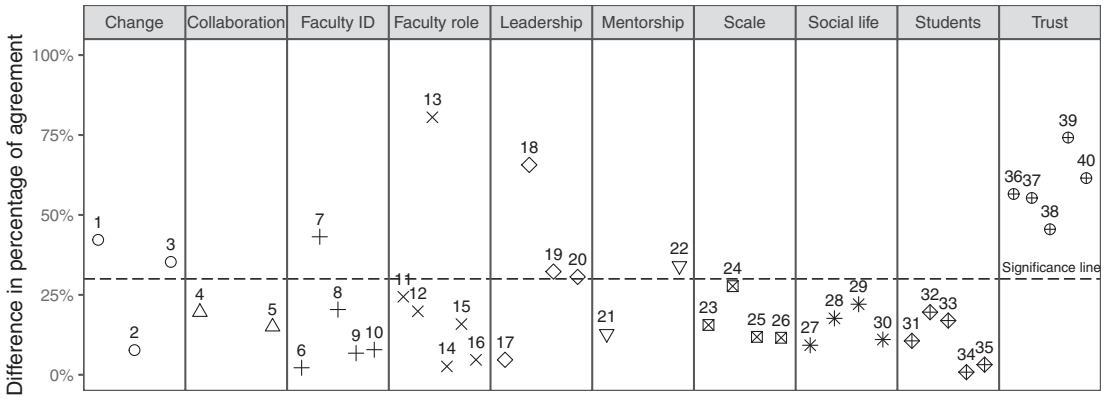


**FIGURE 3** Divergence between SC1 and SC2 across 40 cultural statements. Difference is calculated as $\Delta = |(\text{percent yes})_{SC1} - (\text{percent yes})_{SC2}|$. The dashed horizontal line is $\Delta = 30\%$, which roughly corresponds to $p = .05$ for chi-squared significance test (i.e., $\Delta > 30\% \Rightarrow p \leq .05$)

**TABLE 4** Overview of interpreted themes from cultural consensus theory (CCT) analysis

| Theme | SC1 | SC2 |
|---|---|---|
| Research focus | Both subcultures agree on the research focus of faculty life, but acknowledged the tensions around workload, scale, and expectations about productivity. Members of SC1 and SC2 hold subtle differences in research perspectives. | |
| Faculty aspirations | Faculty embrace a holistic view of their responsibilities but recognize that workload prevents them from living up to those aspirations. | |
| Scale | Both subcultures agree that scale is a challenge, particularly in the workload implications of the large undergraduate program. | |
| Leadership | SC1 perceives ineffective leadership. | SC2 seems satisfied with leadership. |
| Change | SC1 seeks change but felt disempowered to enact it. | SC2 feels empowered to enact change. |
| Trust | SC1 conveys weak trust in leadership in several contexts. | SC2 experiences the ES as a high-trust environment. |

(Scale; All = 70%). Pervasive workload pressures were present in our other data collection as well (Briody, Wirtz, et al., 2019). Faculty consistently responded that some of their responsibilities could be handled by other people, as indicated by agreement with the statements from various categories: "15. The faculty spend too much time doing things that could be done by qualified and well-trained staff." (Faculty Role; All = 69%), and "26. The faculty are supportive of staff taking on more strategic & leadership roles within the department." (Scale; All = 78%). They also agree that "32. Students generally respect the faculty's time." (Students; All = 81%), from which we infer that faculty believe both undergraduate and graduate students understand the serious workload pressures faculty experience. Taken together, this evidence suggests that faculty recognize the primacy of research, would like to devote their efforts to it, but constantly make workload trade-offs across other areas of responsibility.

Members of SC1 more aggressively operationalized "workload" as "time," as evidenced by their responses to explicitly time-related questions (Items 11, 15, 20, 24, 32). It is possible that members of SC1, who skew younger than SC2, seek to preserve their time for research-related activities because many of them have not yet been promoted through the faculty rank to Full Professor.

### 4.2.4 | Faculty aspirations, in tension with workload and scale

Despite these pressures, faculty claimed a broad view of their responsibilities by agreeing that "17. Faculty members really should take a stronger leadership role in departmental issues." (Leadership; All = 81%) and "21. Faculty should

spend more time mentoring undergraduate students." (Mentorship; All = 61%). Moreover, they agreed that "27. Building community among the faculty is important in this department." (Social Life; All = 87%). These views conveyed that faculty perceive their faculty role to be broader and fully inclusive of all the components of the university's mission. However, the two subcultures agreed that scale (operationalized largely as undergraduate enrollment) is a challenge. For example, a majority of respondents in both subcultures agreed that "25. In this department, the faculty want to connect with the students, but there are so many undergraduates that it's hard to really connect with them." (Scale; All = 70%). A slim majority of both subcultures agreed that "34. The faculty really should engage more with undergraduate students outside the classroom, for instance on competition teams like Baja or formula." (Students; All = 56%).

We characterize these shared cultural features as a combination of aspirational (faculty want to spend more time with students, want to build community, and want to empower staff) and practical (rewards systems are geared toward research productivity, and faculty workload is generally quite high). There seems to be a reasonable shared cultural understanding of these features across the two subcultures.

#### 4.2.5 | Divergence between SC1 and SC2. Subtle differences in perspectives on research, rewards, and time

Despite the shared research-oriented view, members of SC1 rejected the statement "8. The best faculty in this department are the most well-funded." while SC2 accepted it with a 20-percentage-point higher margin (Faculty Identity; SC1 = 28%, SC2 = 48%). Members of SC2 also valued activities other than research, with a significant majority accepting "7. When faculty engage in curriculum development, course reform, or teach lab or design classes, they are respected and valued by their peers." (Faculty Identity; SC1 = 45%, SC2 = 88%). In terms of the time pressure, the majority of respondents in SC1 agreed with statements like "20. In this department, committee meetings are usually very inefficient uses of faculty time." (Leadership; SC1 = 59%, SC2 = 28%), and "24. The faculty spend too much time dealing with large undergraduate classes, and there's little time to do anything else." (Scale; SC1 = 52%, SC2 = 24%), both of which were rejected by members of SC2. We infer that faculty in SC1 perceive more time management related stress than those in SC2, and this pattern is consistent with our previous assertion that members of SC1 operationalize their workload in terms of time and its management. Members of SC1, who are in general earlier in their career than those of SC2, also expressed this challenge through their agreement with "29. In this department, it is difficult for faculty to have a healthy work-life balance." (Social Life; SC1 = 62%, SC2 = 40%).

#### 4.2.6 | More dramatic differences in views of leadership

Three of the four leadership questions showed significant differences across subcultures ($\Delta > 30\%$). Members of SC1 and SC2 held a starkly different perception of leadership's role in departmental change: "18. Leadership does a good job of fixing all the things that are wrong around here." (Leadership; SC1 = 10%, SC2 = 76%). The cultural statement does not define leadership, nor does it define specific "things that are wrong around here," but clearly members of SC1 believe that whatever those things are, they are not being addressed by leadership. Moreover, members of SC1 believe it is not their job to fix them, it is "leadership's" job.

Members of SC1 held an overall dim view of leadership's ability to run the organization, including workload assignments and committee meetings: "19. The workload assignments (membership on committees, teaching load) around here are distributed equitably." (Leadership; SC1 = 52%, SC2 = 84%); "20. In this department, committee meetings are usually very inefficient uses of time." (Leadership; SC1 = 59%, SC2 = 28%). From this evidence, we infer that members of SC1 believe departmental operations are subpar, while members of SC2 see fewer leadership deficiencies.

#### 4.2.7 | Strongly differentiated views of change

Members of SC1 perceived that the department is not prone to change, that barriers to change are significant, and that those barriers fall into a few specific categories: personnel, structures, policies, and hierarchies within the department. The differences between subcultures are particularly dramatic in the perception of the department's orientation to change: "1. This department really seizes the available opportunities for change." (Change; SC1 = 14%, SC2 = 56%). A

related statement about Faculty Role supports this view: "13. Faculty are empowered to change things they don't like about this department." (Faculty Role; SC1 = 3%, SC2 = 84%). Moreover, members of SC1 perceive the largest barriers to change as being structural: "3. The biggest barriers to change around here are structural, including policies, procedures, and hierarchies." (Change; SC1 = 79%, SC2 = 44%). From this evidence, we infer that members of SC1 have identified and perhaps personally experienced barriers to change, and do not feel empowered to enact change. In particular, members of SC1 believe that there are structures in place—notably including hierarchies—that prevent change from happening.

#### 4.2.8 | Diametric views on trust

Perceptions of trust were even more starkly different across the subcultures. Of the five trust statements on the survey, members of SC1 and SC2 responded statistically differently to every one. Broadly speaking, in the context of leadership, members of SC1 perceived the department to be a low-trust environment, while members of SC2 believed the department to be a high-trust environment. The gap between perceptions of trust across the subcultures was at least 46% points for each trust item. For instance: "40. The faculty can depend on leadership to back them up in a difficult situation." (Trust; SC1 = 34%, SC2 = 96%). A gap of 74% points was observed on the statement: "39. The faculty can rely upon leadership to handle an important issue on their behalf." (Trust; SC1 = 14%, SC2 = 88%). SC1's lower degree of trust in "leadership" was also observed in other categories from their profound lack of agreement with: "18. Leadership does a good job fixing all the things that are wrong around here." (Leadership; SC1 = 10%, SC2 = 76%) and "22. This department has a good track record in mentoring young faculty." (Mentorship; SC1 = 38%, SC2 = 72%). From this evidence we infer that members of SC1 neither feel empowered within the ES nor believe they can count on "leadership" to support them.

### 4.3 | Member checking with ES faculty

We distributed individual survey reports to all $n = 54$ faculty respondents and invited all ES faculty members to participate in member checking interviews, eventually conducting $n_{mc} = 5$ such interviews (4 with respondents, 1 with a nonrespondent). The interviews were structured around two primary questions, after which wider discussion generally ensued: (a) "To what extent do you agree with our characterization of the common features of the two subcultures?" and (b) "To what extent do you agree with our interpretation of the distinguishing features of the two subcultures?" We interviewed members of both subcultures and faculty across three ranks. The mainstream view of these participants was that our interpretations of the data were appropriate and consistent with their lived experiences in the department. In particular, each agreed that the three cultural vectors we identified (change, leadership, and trust) were defining features of faculty life in the ES. Interviewees were generally surprised that seniority was not a statistically significant predictor of membership in the subcultures, although they agreed with our conclusion that it is a trend worth acknowledging. Several interviewees indicated their perception that seniority-driven differences in perspective exist and that status and hierarchies in the ES faculty were strong. Several also noted their hypothesis that the key metric is *years of service in the ES*, rather than years at the institution or years as a faculty member at any institution. The nonrespondent interview shed anecdotal light on our interpretation of the respondent data. The nonrespondent indicated their reluctance to complete the survey because of concern about the confidentiality of their responses. We interpret this as a lack of trust in the overall environment that certainly echoes the leadership-oriented trust issues that emerged from the survey. In general, the member checking interviews confirmed our interpretation of the CCT analysis.

## 5 | DISCUSSION A PROPOSED MODEL OF ES FACULTY CULTURE

Our results revealed no demographic, performance-based, or other measured variables that predicted membership in either subculture, with the exception that more seniority *suggests* (but does not predict) membership in SC2. We propose that the two faculty subcultures include people who are change-oriented (SC1) and those who are continuity-embracing (SC2). These two subcultures had nearly the same membership in our dataset ($n_{SC1} = 29$; $n_{SC2} = 25$).

## 5.1 | SC1 is change-oriented: What kind of change, and whose responsibility?

Members of this subculture clearly expressed a preference for change, inclusive of policies, procedures, and hierarchies (Item 3), and the expectation that leadership would fix problems (Item 18). They also felt dis-empowered to enact change themselves (Item 13), and broadly believed the ES was not positioned to embrace change (Item 1). They held an unfavorable view of service-related workload (Items 19 and 20) and perceived inadequate mentoring of young faculty (Item 22). We infer from these observations that members of the change-oriented subculture support large-scale changes that likely require the cooperation of many people—they perceive themselves, as a single individual, powerless to enact such large-scale changes, and rely upon those in power ("leadership") to enact change instead. Moreover, they perceive structural barriers to change, and we propose (based upon our insider knowledge of the ES and our other data collection) that those barriers relate to decision-making processes, review and approval processes, and the like. As a concrete example, the ES (like the institution in which is exists and many higher education organizations) has strict, thorough, and very time-consuming processes for review and approval of curriculum changes that can easily be perceived as stifling innovation. We propose that members of this subculture expressed frustration in the structural processes of workload assignments and mentoring: those components of departmental function need to be changed, but are the domain of senior members of the ES and its leadership.

## 5.2 | SC2 is continuity-embracing: Stability, for what purpose?

By contrast, SC2 expressed a more balanced focus toward their primary job functions—research and teaching—though they acknowledge that research does matter more with respect to status and rewards. They do not express concerns about the department leadership and believe that if something is "wrong" it will be addressed. Members of SC2 also believe that work-life balance is easier to achieve than do members of SC1, that collaboration with others (including those outside ES) is acceptable and encouraged, and that faculty can be effective as researchers, as teachers, and perhaps in other kinds of roles. For many members of SC2, which skews older than SC1, their careers began at a time when teaching held more prominence in the life of a university professor and before the aggressive shift to engineering science and associated expectations about scientific research (Froyd et al., 2012).

Members of SC2 do not consider either the current leadership, or change generally, to be problematic, and we posit two possible explanations: (a) their vision for change is small enough that it can be successfully implemented by a single person or small group or (b) because neither leadership nor change more generally can have a strong negative impact on them at this stage in their careers. They are essentially engaged in doing what they have been doing—their research and their teaching—and do not require much help from department leadership to be successful. Members of this subculture prefer the status quo, stability, and continuity, believing that there really is no need for substantial change in ES practices or operation, and that "leadership" is functioning well.

### 5.2.1 | ES subcultures: Driving factors

These results broadly fit into Massy and Zemsky's academic ratchet framework (Massy & Zemsky, 1994), in which protecting discretionary time for research and scholarship forms the fabric of the faculty role. Table 3 and the earlier discussion reinforce the primacy of research in the faculty experience. They also connect to the extra-role behaviors required to achieve all elements of the ES and university mission. The ES faculty share a cultural understanding of the role of research, and institutional forces including promotion and tenure guidelines surely play a role in sharpening this element of the culture. Preservation of research time perhaps contributes to the intense sense of busyness we have observed among the ES faculty, because prior scholarship indicates that time spent on teaching and service accrues in addition to rather than instead of time devoted to research (Milem et al., 2000). Unbundling of faculty work, that is, deconstructing the faculty role to distribute certain functions to others (advising or even teaching) (Gehrke & Kezar, 2015), further reinforces the ratchet by empowering faculty to focus on research. The social distance between faculty and students uncovered in our prior work (Briody, Wirtz, et al., 2019) likely has its origins in these ratchet and unbundling arguments. The differentiating factors between the two subcultures appear to be their views about the scope of specific extra roles (especially "change" roles), and the sense of empowerment they feel to enact change (Item 13). This observation is consistent with the argument of Besterfield-Sacre, Cox, Borrego, Beddoes, and Zhu (2014), who succinctly summarize the literature on educational

innovation: "awareness and interest [among the faculty] do not translate into widespread action" (p. 199). Our prior work on staff-led change initiatives supports this view of faculty action (Rodríguez-Mejía, Briody, Rothstein, & Berger, 2020).

Institutional actions, policies, and practices reinforce the academic ratchet within the ES, and the specific language we use to describe the faculty role is replete with implicit messages. From a linguistic anthropology perspective (Fairclough, 1992), the institutional language we use elevates the role of research. Research is filled with "opportunities," "achievements," and can be measured to determine "productivity." Researchers maintain their authority over research directions and curate their reputation within their disciplinary community, and these activities take place largely outside the academic organization in which they work. Faculty in the ES mostly do technical research in their engineering science domain of expertise, not engineering education research, so the overlap in research/teaching mission is weak. On the other hand, we describe teaching as a "load," a drain on a system, one which challenges the efficient functioning of the system. The term conjures images of heavy burdens born by the system and the individuals in it. The teaching load is something to be actively managed by the faculty and department head, with the goal of allowing sufficient time to engage in other activities (presumably research). The service role is "assigned" (in some cases, volunteered for), challenging the autonomy of faculty and claiming what would otherwise be faculty discretionary time and directing it toward institutional goals. This institutionalized language (throughout academia, not only in the ES) conveys a message to faculty members that teaching and service are of secondary importance in the life of the ES and at many other institutions. These results confirm that whatever aspirations individual faculty members might hold about their nonresearch roles, signals from the institution are heard and internalized by faculty, who clearly recognize the primacy of research.

## 5.3 | Situating these results in prior literature

Our results broadly align with past research by Godfrey and Parker (2010), Miller (2007), and Tener (1999) in the sense that we have uncovered evidence of faculty attitudes related to the categories defined in those prior works. Our work, however, identified subcultures within the faculty (the SC1 and SC2 columns of Table 3), while prior work has focused on a more general cultural description (the All column of the table). CCT, therefore, adds value over prior work by allowing us to quantify the relative membership of faculty in the subcultures. Our results are broadly consistent with many of the assertions in Tener (1999), including "Faculty is characteristically resistant to change," "Academics respect and relish individualism," and "Most academic rewards and motivation are antithetical to outcomes assessment" (p. 67). However, the results presented here break down the faculty monolith presented by Tener; we have established that *some* faculty are resistant to change, relish individualism (i.e., embrace the academic ratchet), and have motivations that are antithetical to outcomes assessment.

We see similarities to the four-quadrant Henderson model for faculty adoption of evidence-based pedagogical practices (Henderson et al., 2010, 2011) in these results; the four-quadrant model is summarized in Figure 4. Briefly, Henderson's

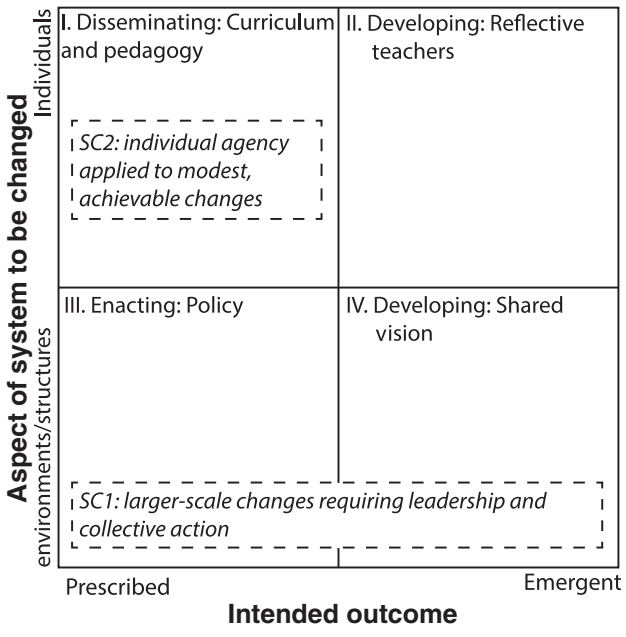


**FIGURE 4** Henderson four-quadrant pedagogical change model, adapted from Borrego and Henderson (2014). Italic text within dashed boxes overlays these cultural findings onto the four quadrants

four quadrants reflect a 2 × 2 grid with axes related to scope of change (individual vs. collective, inclusive of "environments and structures") and the intended outcome of change (prescribed or emergent). Although Henderson's model was developed to describe education-oriented change, we believe its general structure can be applied here as well. In particular, the change-based differentiators in our analysis suggest members of SC1 may resonate with Henderson's Environment and Structures scope for change but are frustrated by their perceived lack of empowerment to actually enact change. Members of SC2 lean toward the Individuals/Disseminating quadrant on the quad-chart and feel empowered to make appropriate changes. We restrict SC2's focus to the Disseminating quadrant because our data contain no evidence that members of SC2 seeks to become more "reflective" change-makers of any kind—pedagogical or otherwise. It is conspicuous that the Individuals quadrants focus on changes to teaching and learning practices, which are entirely within the control of individual faculty members, while the Environments and Structures quadrants encompass broader areas of change (policies and shared vision) and consequently require a larger number of participants plus advocacy from Leadership in the change effort. Taken together, we interpret the distinguishing factors between SC1 and SC2 in the context of the quadrants of the Henderson model on which they focus—either in their actual activities or in their aspirations.

## 5.4 | Implications for research

This research enables further examination of faculty culture in several respects. First, the methodology used here provides a person-centered template for scalable cultural studies in academic units. We have laid out our process for development of the cultural statements, based upon a wide range of prior data collection and analysis, and outlined the data analysis using CCT. The individualized faculty survey reports provided useful context in which to have the member checking conversations and also to widely disseminate the results of the data analysis. Taken together, this work enables a wide range of future culture-focused efforts by outlining a rigorous yet practical approach to using CCT for cultural characterization.

Second, this work provides an individual-level view of faculty subculture (i.e., which individuals are members of which subculture) as well as group-level comparisons across subcultures, and together these individual and group-level perspectives add nuance to prior studies of faculty culture monoliths (Godfrey & Parker, 2010; Miller, 2007; Tener, 1999). Our approach enables specific conversations with specific faculty about why they will or will not voluntarily engage in specific activities. It gives the ES faculty and administration a common vocabulary to use when discussing departmental issues, especially contentious issues that require lengthy deliberations and are influenced by the perceptions and opinions of individual participants. This work also connects to change projects; future change initiatives now have a scalable tool to help assess the culture(s) within which changes are to be made. Past change efforts detailed earlier in the paper either explicitly or implicitly attributed change outcomes to the prevailing culture of the organization while the approach we have employed gives change researchers a convenient path to understand the cultural landscape.

## 5.5 | Implications for practice

Throughout this article, we have been careful to not render a value judgment about the subcultures or express a desire for a faculty monoculture composed entirely of SC1 or SC2 characteristics. Each reader of this article may have a preference for how an academic department should function, but our goal here was to embrace an understanding of "what is," rather than express a desire for "what could be," culturally speaking. This pragmatic worldview leads us to apply these results to work practices, operations, and change processes within the ES. By making the existence of these subcultures explicit, we are exposing the two perspectives and using them to frame conversations within the ES that hopefully stimulate and facilitate change. The general response to this "cultural" line of research from the faculty has been very positive as evidenced by the high response rate to the CCT survey and its preliminary results (as shared at faculty meetings) and participation in prior data collection associated with this project. This research, therefore, provides an information platform on which change initiatives can be built, with a fuller understanding of departmental dynamics as captured by the subculture characterizations reported here. Indeed, in parallel with this study, we have convened grassroots teams of ES faculty, staff, and students to attack challenges in the ES and attempt to enact positive changes. In each case, the specific change and relevant goals and metrics were developed by the grassroots teams themselves, and this cultural view of the faculty provides useful context for our interpretations of the outcomes produced (or not

produced) by these grassroots teams. The origins, dynamics, and outcomes of several of these grassroots teams have been reported elsewhere (Rodríguez-Mejía et al., 2020).

### 5.6 | Limitations

This is the first work of its kind to use an anthropological approach for cultural characterization of a single engineering academic unit. Nonetheless, we acknowledge several limitations of this work:

- Diversity and sample size. The sampling frame for this work was a single academic unit, the ES, with a college of engineering, and this choice aligns with the objectives of the overall NSF-funded project of which this study is a part. Both the sampling frame and the sample enrolled in this study are insufficiently diverse to capture all important voices or to build a more generalizable set of conclusions. These findings are very contextual to the ES, and academic units that are more diverse or of a different size may produce different findings. However, we suspect that some of the observations here, such as the primacy of research or differential views of trust, may feel familiar to readers regardless of their setting.
- Member checking. Although we were unable to conduct a large number of member checking interviews, those we did conduct generally supported our conclusions, including the one interview with a faculty nonrespondent. In addition, these results are consistent with our prior data collection and add significant nuance to our previous understanding of ES culture from the faculty perspective. This study would benefit from a wider set of interviews with faculty participants.
- Transferability to other settings. These results are highly contextual to the ES and its faculty and may not be applicable in other academic units or settings. However, the overall approach of using a survey based upon prior data collection along with CCT analysis can be applied in other settings. We suspect these results may also have some degree of transferability to similar research-intensive academic units within institutions like the one studied here.
- More robust data collection. There are opportunities to collect other data to further refine our understanding of membership in each subculture. For instance, we characterized teaching activity via quantitative data (student credit hours taught) because it was easy to obtain for all faculty in our sample. This metric distinguishes between faculty who teach large undergraduate core courses from those who teach mainly upper-level (low-enrollment) electives and/or graduate courses. Future data collection could incorporate indicators of teaching quality or effort, perhaps using classroom observations or other approaches to further refine this teaching metric.

## 6 | CONCLUSIONS

This research illustrates how quantitative tools from anthropology can be used to characterize faculty subcultures within an ES. Our evidence confirms the existence of two faculty subcultures in the organization studied here, with nearly equal membership within the sample, and we expect that these two subcultures (and perhaps others) exist in large academic departments within universities like the setting for this research (i.e., those with very high research activity). Our work suggests that the academic ratchet (Massy & Zemsky, 1994) drives the ES operation in many respects and that the goal of preserving discretionary time for research places significant constraints on the type and scope of other activities (i.e., change-related activities) in which faculty may be willing to engage. Moreover, our results suggest that the two subcultures possess divergent views on the scale of change, with SC1 seeking larger-scale changes that quickly encounter structural barriers, resulting in their feelings of not being empowered. Members of SC2 support smaller changes, those that can be reasonably accomplished by an individual or small group of faculty, and are not suppressed by the structural barriers confronted by members of SC1. This study provides valuable insights about faculty subcultures, while also providing a methodological template for others interested in studying academic cultures.

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## SUPPORTING INFORMATION

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