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Embodied Genres, Typified Performances, and the Engineering Design Process

Scott Weedon[1]
and T. Kenny Fountain[2]

Abstract

Using rhetorical genre theory, the authors theorize the engineering design process as a type of embodied genre enacted through typified performances of bodies engaged with discourses, texts, and objects in genre-rich spaces of design activity. The authors illustrate this through an analysis of ethnographic data from an engineering design course to show how a genred repertoire of embodied routines is demonstrated for students and later taken up as part of their design work. A greater appreciation of the interconnection between genre and design as well as the role of typification in producing embodied genres can potentially transform how writing studies conceives of and teaches both design processes and genres in technical and professional communication settings.

Keywords

engineering design, genre, embodiment, metagenres, design process, embodied genres, engineering pedagogy, ethnography, classroom lectures, performance, typification

[1]Texas Tech University, Lubbock, TX, USA
[2]University of Virginia, Charlottesville, VA, USA

Corresponding Author:
Scott Weedon, Texas Tech University, 2500 Broadway, Lubbock, TX 79409, USA.
Email: scott.weedon@ttu.edu

Introduction

Scholars in writing studies have often explored the affinity between design and the practice of technical and professional communication (or TPC). This affinity has been clarified and extended by research into the rhetorical shaping of designed things (Buchanan, 1985), the similarities between the writing process and the design process (Kostelnick, 1989), and the relationship of rhetoric to the arts of design (Ackerman & Oates, 1996; Haller, 2000; Kaufer & Butler, 1996; Medway, 1996; Winsor, 1994). In writing studies, the work of Dorothy Winsor (1994, 1998, 1999) has cemented a rhetorical perspective on technical work and design. At the core of Winsor's and others' research rests recognitions that rhetoric and design respond to contingent and emergent situations and that both involve inventing, arranging, arguing, appealing, composing, and judging (Buchanan, 2001, 2009). Recently, scholars of rhetoric and composition (Leverenz, 2014; Marback, 2009; Newcomb, 2012; Purdy, 2014; Wible, 2020) and TPC have focused on Buchanan's (1992) concept of "wicked problems" (see Rittel & Weber, 1973) to rethink how pedagogy and practice might account for indeterminate situations conditioned by contrary and conflicting discourses (see Tham, 2020; Weedon, 2019).

In TPC, for example, Wickman (2014) has suggested strategies for taming wicked problems, such as respecifying topoi as "placements" to locate spaces for invention across design domains and genres of technical writing. Pope-Ruark (2014) advocates fostering in students a type of metis, a kind of intelligence to flexibly respond to emergent issues encountered in design situations. These strategies seek to provide writers with the means for adopting a design mentality while adapting to design situations. Demonstrating the value of this approach, Cushman (2014) identifies authentic design problems in TPC as rarely given, thus requiring reflective, dynamic articulation sensitive to the developing constraints of a situation—which involves "attuning ourselves to instability and indeterminate situations, acknowledging that processes and problems are mutually constituted" (p. 4; see also Dorst & Cross, 2001). Given the design-oriented nature of TPC practice, theoretical and methodological efforts to accentuate the link between TPC and design thinking need to consider what the two domains might share. One approach to meet this need is to view the teaching and execution of the design process in light of the rhetorical approach to genre as social and embodied action.

Calling attention to genre and embodiment seems particularly apt in the case of design processes. While often conceptualized as modes of reflection (Schön, 1983) or cognition (Cross, 2006), design work is thoroughly embodied (Kimbell, 2011, 2012; Luck, 2014; Murphy, 2005), social (Bucciarelli, 1994; Cross & Cross, 1995) and typified through the uptake of disciplinary

discourse (Atman et al., 2008). Designers engaged in design activity perform an embodied process, assembling texts, tools, people, and environments, whereby a situation is researched, defined, and analyzed and solutions for it are evaluated, synthesized, and tested. This is as true for basic design activities, such as selection design and redesign, as it is for more wicked design problems. This embodied process is a recurrent enactment employed to respond to recurrent situations, which, while typified, are not predetermined. In this way, design activity not only responds to but also structures the situation, just as genres structure and respond to social actions (Bawarshi, 2003). The design process, as a typified performance, configures people in material assemblages (i.e., body-object-environment interactions) to achieve the social action of design: to define and solve problems. Design activity, then, is a social practice in which a community of actors use discourses, texts, tools, and distributed labor to achieve goals. Furthermore, design activity is a rhetorical and embodied action of defining, framing, and structuring problems. Research into design activity should consider those practices of definition and framing, their delineating power, and the texts, technologies, and even embodied practices that make them possible.

TPC and writing studies more generally confront all types of design problems, from the wicked to the mundane. Design is disciplinary, social, cognitive, embodied, and rhetorical. Because of this complexity, teaching and research in design would benefit from a framework that accounts for these aspects. Scholarship from rhetorical genre studies (RGS; Freedman, 1999) provides this framework. Drawing from an analysis of data collected during an ethnographic study of an engineering design course, we make two interconnected claims in this article. The first is that the engineering design process functions as a type of genre, a typified performance of bodies engaged with discourses, texts, and objects in genre-rich spaces. Broadly speaking, the design process, taken as a shorthand for various instantiations of design activity, involves an iterative sequence of particular meaning-making foci that respond to and are shaped by communicative exigencies, which Freadman (2020) defines as "occasion[s]" for the "implementation of rhetorical decisions in order to intervene in social affairs" (p. 121).[1] These exigencies constrain a designer's actions, while also opening up a space to discover and invent other possible actions (Newcomb, 2012). Two common forms of engineering design activity are the redesign of an existing object and "selection design;" the major tasks of the latter type involve "selecting the components with the needed performance, quality, and cost" (Dieter & Schmidt, 2013, p. 6). In both cases of design activity, designers work within a field of constraining variables, selecting and prototyping through a refinement process. Similarly, in TPC, scholars have often approached genres as "typified

rhetorical actions based in recurrent situations" (Miller, 1984, p. 159). We suggest that the design process, specifically the engineering design process, is a type of genre.

To demonstrate that the engineering design process functions as a type of genre, we take seriously the role of embodiment in the teaching and execution of the design process and in the creation and deployment of genres. Our first claim, then, necessarily rests on a second claim that, as we discuss below, is not original to our current study, but one that we contend is underappreciated in writing studies research. That is, *genres can be materially instantiated not just through texts and discourses but also through bodily practices.* Said another way, certain embodied routines and orientations can function as genres. These embodied enactments of genre are uptakes, or the "[embodied] performance of genres in moments of interaction and innovation" (Bawarshi, 2015, p. 186), witnessable through gesture, bodily orientation, movement, and text and tool use. We view embodiment as including distinct bodily actions, embodied orientations to and dispositions toward texts, objects, people, and environments, as well as knowledge of how to navigate such complexes.[2] Like Haas and Witte (2001), we understand embodied acts to be those actions that are "accomplished by means of the human body," that "take place in real time and in specific physical spaces," and that involve the "skillful and often internalized manipulation of an individual's body and of tools that have become second nature" (p. 417; see also Clayson, 2018).

Writing studies research has explored embodied acts using gestures to write technical specifications (Haas & Witte, 2001), communicating tacit technical knowledge through gesture (Sauer, 2003), performing "chalk talk" lectures for students of mathematics (Artemeva & Fox, 2011; Fox & Artemeva, 2012), and composing an engineering report through a "product calculator" (Bivens & Cargile Cook, 2018). Of course, not all embodied acts are genres. Embodied genres, we contend, are bodily performances that involve recurrent, goal-directed activities that respond to recurring situations through typified responses. That is, embodied practices, by which we mean (to borrow from Lynch, 1997) "embodied (or contextually located) instances of discourse and action," can be understood as genred when they become typified performances that respond to a recurrent situation or construe a recurrent situation into a type (p. 335). And embodied practices become genred when those typified bodily routines, orientations, and performances coalesce into a witnessable construal of situations, such as a classroom demonstration where a professor shows students how to order their work trajectory through a Gantt chart.

The present article seeks to not only reiterate what previous research has demonstrated, namely, that RGS (Freedman, 1999) has the theoretical

foundation to develop a concept of embodied genres (see Artemeva & Fox, 2011; Bawarshi 2015; Fogarty-Bourget et al., 2019), but also demonstrate the necessity of attending to embodied genres to understand how the design process is executed and taught. To do this, we answer previous calls to embrace, in the words of Devitt (1993), "new notions of genre as dynamic patterning of human experience" (p. 573). Knapp (2002), for example, recognizes that genres can be "performative as well as textual" (p. 290). As "material entities" (Devitt et al., 2003, p. 542), or material instantiations of social action that take a number of forms, genres are shaped by the material conditions of their enactment and uptake (Reiff, 2011). Genres are also multimodal (Gonzales, 2015); that is, they convey meaning by way of multiple communicative channels, semiotic resources, and forms of media (Kress & Van Leeuwen, 2001). Prior's (2009) work has been influential in guiding genre theory toward a "mediated multimodal genre systems" approach that seeks to account for the ways in which various modalities interact with each other, such as how "oral and embodied genres" interact with "written and visually inscribed genres" (p. 28). Recently, Miller et al. (2018) have emphasized the need for a "material conception of genre" that attends to "embodied rhetorical practice" (p. 271). The term we use, *embodied genre*, implies that not only do genres shape bodies and bodies shape genres, but also the genre itself is accomplished by and through the body. The body intertwined with the objects and texts of its environment is the material and multimodal means through which the genred action is performed.

In addition to rethinking the design process as a type of embodied genre typified through bodily performance, our study addresses a need for conceiving of design work that encompasses the often-mundane tasks common to engineering and TPC classrooms and workplaces, tasks that do not always resemble the radical problems implied by proponents of design thinking. The highly contested concept of design thinking (Brown, 2009; Buchanan, 1992; Dorst, 2011) has many definitions, but its most controversial conceit is that the popular term "design thinking" designates a particular and replicable way of doing design work or thinking like a designer. The debate between influential designers Norman (2010) and Moggridge (2010) over whether or not design thinking (as a kind of creative thinking specific to designers) even exists is echoed in recent interviews by Pope-Ruark (2019). For example, Dyke Ford (in Pope-Ruark, 2019) distinguishes between design thinking, or the attitude any engineer or designer has toward design work, and "design thinking" in quotation marks, which is a more specific, step-by-step approach for radical innovation stemming from an industrial design perspective. Also, Melonçon (in Pope-Ruark, 2019) asserts that although "design thinking" has become ubiquitous, she has rarely seen it work in practice. While models for

radical design solutions are necessary to tackle wicked problems, we argue that there should be more attention to developing approaches that reflect a wide range of design situations and problems.

When we talk of design thinking and design activity in TPC, we often have in mind what Dieter and Schmit (2013) term *original design* or *innovative design*, which uses an "original, innovative concept to achieve a need" (p. 5); this is perhaps the most advanced type of design project. But engineering design also involves more mundane forms of design activity, such as (1) *adaptive design*, which creates "a novel application" of an already "known solution"; (2) *redesign*, which seeks "to improve on an existing design" (p. 5), also called "variant design" (p. 6); and (3) *selection design*, when a project uses "standard components" and the task is to select from these components to address a design problem (p. 6). Sriram et al. (1989) use a similar hierarchy to describe types of engineering design activity, though they term them *creative design; innovative design; redesign*; and *routine design* (pp. 80-81). In both TPC and engineering classrooms, students often begin with design activity at the lower ends of this hierarchy. In these settings, students are introduced to the professional genres involved in that design activity, whether it be Gantt charts, patents, or technical documentation. In thinking through design activity and genre, we will focus primarily on the lower end of that hierarchy, though our argument speaks to more open-ended forms of design at the top.

In what follows, we turn to research in rhetorical genre theory and design studies to theorize how the design process functions like an embodied genre, specifically an embodied metagenre (in Carter's [2007] sense of the term), one that is, like all genres, enacted through typification. To articulate this concept, we then provide an analysis of ethnographic data, specifically two moments from an engineering course. In the first, the professor demonstrates for engineering design students how to read a patent for generating design concepts. The professor engages in a specific and ubiquitous embodied genre (the lecture), one that is composed of bodily interactions with texts and technologies. In the second episode from the field site, a team of students perform an uptake of the lectures in their own design work through both bodily and textual means. We focus on these two moments to theorize the genre of designing, because genres are recognizable by the genres that precede them and the uptake that holds between them (Freadman, 2012, p. 558). We emphasize both the teaching of the design process as well as the performance of the design process because what a genre is is conditioned by the genre that precedes it. We see this as a key theoretical finding of Freadman's (1994, 2020) tennis analogy, and we demonstrate its explanatory power in the analysis below. A greater appreciation of this interconnection between genre and

design can potentially enrich how we conceive of and teach design processes, while also expanding what counts as a genre.

Genres and Design Activity: Typification and Embodiment

Across disciplines and fields, design is often seen as an approach to solving problems (Buchanan, 1992; Carter, 2007; Dorst, 2011; Norman, 2013; for alternative conceptions, see Bucciarelli, 1994). Those who view design activity as a form of problem solving often conceive of design problems in terms of situations that involve technical rationality (Simon, 1996), argumentative reasoning (Rittel, 1988), or reflective dialogue (Schön, 1983). In each of these perspectives, the design process is not simply a method for making things but a "material-discursive" practice (Barad, 2007) that constitutes a situation as possibly tractable (p. 142; see also Jack, 2019). That is, the design process is an approach to unspecified situations that functions to identify a situation as problematic, contradictory, or wicked—and thus amendable to or requiring design. When situations become design problems, their tractability becomes possible. A preliminary step in design, then, is framing, or the creation of a standpoint from which to approach the problem (Dorst, 2011). In a sequence that recalls Bitzer's (1968) description of how rhetors confront rhetorical situations, Dorst understands framing as the action of perceiving a situation, interpreting it through preconceived concepts, and adopting actions to address it that entails certain expectations. Ylirisku et al. (2009) elaborate on Dorst's idea and stress the power of framing to construe and formulate situations as types; it is essentially a meaning-making action that is enacted through representations and artifacts (see also Deuten & Rip, 2000).

Ylirisku et al.'s (2009) concept of design is consonant with an approach to genre as a social action that frames a situation. Framing and construing a situation as a type is key to both design and genre. In Bawarshi's (2003) words, "[a] genre conceptually frames what its users generally imagine as possible within a given situation, predisposing them to act in certain ways by rhetorically framing how they come to know and respond" (p. 22). Bawarshi adds that genre not only helps users frame situations but also provides them with appropriate dispositions to act. From this perspective, genres are material-discursive enactments that involve recurrent, goal-directed actions that respond to situations by way of typification. As such, embodied practices can be understood as genres when those bodily actions and performances become typified responses to a situation or construe a situation as a type. We argue that framing and typification are crucial to understanding the design process

as an embodied genre, a typified bodily performance that responds to and constructs recurrent situations.

Typified Performances and Embodied Actions

We use the term *typified performance* to designate a repertoire of witnessable bodily actions and orientations deployed on and with texts and objects to construe a situation as a certain type and thus open to particular responses and structuring.[3] A body's typified performances on and with texts and objects render specific situations as types that call for certain forms of cognitive and material responses. To appreciate the design process as an embodied genre, one made possible through the body's typified performances on and with discourses, texts, and objects, we return to the phenomenological concept of typification as a formative mechanism of genre. Associated with Schutz's phenomenological approach to sociology, typification serves as one of the conceptual pivots for Miller's (1984) description of genre as social action. Typification, or the conceptual and social construction of phenomena into types, continues to provide explanatory power for rhetorical genre theory (Bazerman, 2013; Read, 2016; Russell, 2010). To understand genre recurrence, Miller notes that situations must be construed as types, which consist of elements perceived to be similar or analogous to past situations. After all, as Miller points out, "[w]hat recurs is not a material situation" but instead "our construal of a type" (p. 157). In Miller's view (1984), for situations to be types and thus call for typified responses, they must be interpreted as such: "[b]efore we can act, we must interpret the indeterminate material environment" (p. 156). Genres frame situations and create possibilities for a situation's tractability; genres are both constraining of actors' intentions and channeling of actors' or an institution's actions.

Embodied genres, enacted through typified bodily performances on and through texts and objects, are particularly common in school settings where participants learn to perform the genred tasks necessary to succeed. Berkenkotter and Thein (2005) demonstrate the ways in which literate practices become physically embodied in the bodily performances of young children as part of "their enculturation" into the practices of schooling (187). This is not only a feature of young children's learning. As Artemeva and Fox (2011) demonstrate in their studies on mathematics lectures, college-level students rely on instructor's embodied demonstrations to help them perform mathematical concepts and proofs (see also Fox & Artemeva, 2012). Embodied genres are prevalent in a range of advanced educational settings, from the PhD dissertation defense (Swales, 2004) to the typical conference presentation (Tardy, 2009). As students progress, the genres they learn

(however, they are materially instantiated) become more complex and nearly taken for granted as key activities in their respective genre ecosystems. Spafford et al. (2006) analyze the medical case presentation as an "apprenticeship genre" that merges school and workplace genres (p. 122), while Fountain (2014) illustrates how the gross anatomy lab is made possible through routinized bodily interactions with texts and objects that form the core educational practices of that space. In each case, these embodied performances are a response to and construal of a particular type of situation that is reinforced and elaborated by recurrence. We will show that typified bodily performances comprise the design process as well, and that the engineering design process, in particular, is an embodied genre insofar as it is responsive to and constitutive of rhetorical situations, weaving together and woven by assemblages of bodies, discourses, texts, objects, environments, and constraints.

Design as an Embodied Metagenre

When undergraduate students are taught to engage in design activity, they are being instructed (often explicitly) to perform bodily actions—bodily routines, orientations, and interactions—they will imitate in situations that call for design-based problem solving. They are taught to perform a typified process of meaning making and not just to produce a product. These kinds of typified performances take place in what Pickering (2013) called the "thick of things," in a "dance of agency" between discourses, texts, objects, people, and environments where no one element is fully invested with the power to direct or arrange action, or at least not all the time (p. 26). Furthermore, learning to engage in design activity for disciplinary purposes attunes one to an ecology where the client needs, material conditions, financial restraints, and other forces condition and affect the methods and motivation for designing. Additionally, if the design process functions like a genre, as we contend, then its enactment is a ritualized performance of the core values of the discipline (Dannels, 2005); it is an ideological battleground where the motivation and identity of a discipline can be defined (Applegarth, 2012); and it is a space where the intentions of individual actors must accommodate the genre's form and practice (Bazerman, 1994). Thus, embodied performances of genre are subject to the same power dynamics and effects as textual genres.

To account for the embodied performances of genre that constitute design activity, we turn to Carter's (2007) theorizing of metagenres. Carter's approach conceives of patterns of cross-disciplinary ways of knowing and doing as metagenres, social formations that respond to recurrent social situations. In a categorization of the academic ways of knowing and doing at his

university, he finds, for example, that disciplines in the sciences, business, and engineering have comparable patterns of "problem-solving" that are instantiated in their curricula and accomplished through various textual genres, such as lab reports and marketing plans (pp. 395-396). Disciplines of architecture, art and design, and rhetoric and writing are, by contrast, "performance" disciplines, where patterns of doing are exhibited through finished artifacts (pp. 401–402).[4] These and other disciplinary patterns of meaning making through doing may be grouped into specific metagenres. For example, engineering's pattern of ways of doing is instantiated in design as a problem-solving process (Carter, 2007), where it helps accomplish curricular outcomes. What we take from Carter is the way design functions as a metagenre that can be exhibited in and sustained by textual genres but is not reducible to them. In fact, the engineering design process, understood as an embodied metagenre, is enacted not through texts alone but through recurrent and typified bodily performances on, with, and through texts and objects (in environments that call for engineering design). Orientations and routines executed by the body give those texts and objects their disciplinary meaning and make possible the genred work of engineering design.

While we hesitate to posit various levels of genres (meta- or otherwise) that overarch and govern material instantiations of genre (see Freadman, 2012, pp. 556-560), we do find Carter's description of metagenres as ways of being helpful in relating varieties of genres to larger goal-directed activities in a dynamic, reinforcing process.[5] Deuten and Rip (2000) describe this dynamic, reinforcing process of genre as creating an infrastructure that shapes the roles of actors and objects, and which is itself defined, sustained, and propelled by those same actors and objects. To see the engineering design process as a kind of embodied genre or, following Carter, an embodied metagenre, one must go back to where many engineering students first encounter the design process—the classroom. There, the design process is presented, as most genres are, as a form of conventional action used to socially construe situations and address both professional and educational needs (Eubanks, 1998). In the data we examine below, students are taught to read a key text (in this case, a patent) that establishes ways of attending to and embodying a discipline's values and warrants for knowledge. Through this analysis, we will show how the genre of the design process is performed and taken up by means of the body.

Field Site and Methods

This article is a revaluation of work from an ethnographic study of a university engineering design course conducted by Weedon, portions of which have

been published elsewhere (Weedon, 2017, 2019, 2020). Weedon's original aim in his ethnography was to understand, from the perspective of writing in the disciplines and technical communication (Russell, 2007), how student engineers learn to attend, through genres, to engineering problems in the way professional engineers might attend to them. In that initial study, Weedon argued that the process of professionalizing student engineers into professional engineers is a practice of directing and training the students' attention through learning design and learning to write. At base, the class has students engage in design work not to produce a product or a process but to cultivate and display attention to the ways in which professional engineering work is carried out. Students come to attend to engineering problems not as textbook problems but as problems that are thoroughly intertwined with real-world constraints. Students take up and contest the professional attention they are taught and bring it to bear on how they frame design problems; how they make judgments in the design process; and how they compose the genres of professional engineering.

Practically speaking, this article originates from ongoing, years-long conversations between Weedon and Fountain about the original ethnography (and the publications drawn from it), as well as the nature of the engineering design process, the role of the body is executing and teaching design, and the ways in which RGS might shed light on both. By reevaluating the de-identified data of that study, Weedon and Fountain sought to answer those questions and theorize a new formation of engineering design by turning to the underappreciated embodied potential of genre. In this current article, then, we use data from that ethnography to demonstrate a larger framework—how the engineering design process functions as a genre—a theory that only emerged through our collaborative reanalysis of that original data. The reanalysis of data and the demonstration of that theory we present here allows us to bring what we hope will be more specificity to the analysis of embodied action, by adapting (as we discuss below) a vocabulary for articulating what bodies do in the situated practices of engineering design, classroom lectures, and cooperative text- and object-focused work.

In the institutional review board (IRB)–approved ethnography, Weedon observed a 15-week engineering course requiring students to design a product in groups of seven to 10.[6] The course, which enrolled 70 to 80 students, was the second in a sequence of three that began with an introduction to both manufacturing methods and CAD software and ended with a course that had students work in groups on a design project with minimal instructor oversight. The course that Weedon observed had students perform an instructor-guided hybrid version of a redesign and selection design process to create a design for a chainless bicycle, a portable water desalinization device, or a

solar tracker. The course, required for all mechanical and aerospace engineering students, attracted students from many engineering majors, such as biomedical and biomechanical engineering. The class's aims, expectations, and outcomes were consistent with those of other engineering design courses across the United States (Atman et al., 2014). The larger ethnography explored the ways in which genres attuned students to the professional standards and ends of engineering and business (see Weedon, 2017, 2019, 2020).

Weedon's ethnography combined four sources of data: (1) observational field notes of the entire course (Emerson et al., 2011), (2) video recordings of the meetings of one project team (Ball & Smith, 2011), (3) phenomenologically inspired one-on-one interviews (Seidman, 2013), and (4) the collection of all course materials, including the syllabus, handouts, homework, PowerPoint slides, and the course textbook. The data for this specific article come from field notes of two consecutive classes focusing on how to use patents as part of the conceptual design phase. The field notes below are from full field notes composed from in situ "jottings" (Emerson et al., 2011, p. 49) within a week of when they occurred. Weedon attended 15 weeks of the engineering design course, sitting near the entrance of the lecture hall to observe both the professor and the students. The earlier study extended from a pilot study the prior semester, allowing Weedon to anticipate the sequence and substance of the lectures. He noted not only the content of the lectures, the asides, and the students' questions but also the embodied interaction that facilitated and enacted the work of lecturing. Jottings specifically indexed the gestures that accompanied and directed the lectures: *deictic*, or pointing gestures; *iconic*, or gestures representing objects, spatial relationships, or actions; and *metaphoric*, or gestures that represent abstractions (see McNeill, 1992). Stemming from the subjectivity and orientations of the researchers, field notes are inevitably perspectival, offering an imperfect mediator of the embodiment of classroom practices, but they do allow attention to the phenomenological details of class conduct.

Our analytic approach is, like Miller's (1984), inspired by ethnomethodology: "it seeks to explicate the knowledge practice creates" (p. 155). The field notes for the following illustrations were selected using the ethnomethodological principle of perspicuity to identify "primitive examples" of order and action that provide insight into the "haecceity" or 'this-ness' of a practice (Garfinkel, 2002; Lynch, 1993, p. 300). Haecceity, from an ethnomethodological perspective, directs investigations to the "situated rhetorics" and "embodied and interactional work" that order the local contingencies of an activity (Lynch, 1991, p. 98). Our discussion below will first focus on a typified occurrence of many scientific and technical educational settings: the demonstrative tuning of bodily routines and bodily orientations exhibited in

genres like mathematical demonstrations (Artemeva & Fox, 2011; Gerofsky 2011), science lectures (Myers, 2009), anatomy lab presentations (Fountain, 2014), and architecture workshop critiques (Lymer, 2009).

If, as Merleau-Ponty (2005) contends, "we are our body" in that "we are in the world through our body" (p. 239), then all human actions can be understood as embodied actions. Reading, writing, even thinking are all, in Haas and Witte's (2001) words, "accomplished by means of the human body" and "take place in real time and in specific physical spaces" (p. 471). We have sought to address the capaciousness of the term *embodied action* by developing a vocabulary adapted from gesture studies (Kendon, 2004; McNeill, 1992, 2000) and studies of situated action (Fox & Artemeva, 2012; Goodwin, 1994, 2007). In Table 1, we define the types of embodied actions—routines, orientations, and interactions—that we identify in the data we present.

Bodily orientation is an important performance in class lectures and other pedagogical settings. As Fox and Artemeva (2012) demonstrate in their study of mathematics chalk talks, the professors' bodily orientation in relation to the board suggests where students should focus their attention. If a professor faces the board (with her back to the class), this directs students' attention to the displays on the board. By turning to face the class (back to the board), she directs students to focus on her and her talk. Gaze, where the professor is looking, is part of bodily orientation in that it suggests where students should be looking (e.g., at the board or screen or object in front of them) (Goodwin, 2007).[7] Often, in educational settings, a speaker will verbally direct participants' immediate or future attention to a specific object by instructing them to "look" or "consider" as well as by highlighting the importance or value of an object or process to their ongoing work.

The embodied actions we analyze—bodily routines, orientations, and interactions—are not always discrete and easily isolatable phenomena. When a professor faces a class, pointing up at an image projected above them, while instructing students to identify features of the image, they are engaged in routines of gesture (pointing) and bodily orientation (both at the class and at the image above her) simultaneously. Rather than view this vocabulary as a rigid classification, we instead seek to use it to explain with some granularity what we mean by embodied action, in a way that accounts for the role specific actions, such as bodily orientation, play in the classroom lecture and the engineering design process. Like Goodwin (2013), we find that "human action is less a universal typology of sharply differentiated action types, than a series of entanglements (Ingold, 2007) that invoke, and accumulate through time, locally relevant webs of semiotic and social relationships" (Goodwin, 2013, p. 16). As such, qualitative researchers studying embodiment need to navigate the extremes of an overly prescriptive and limiting taxonomy of

Table 1. Description of the Terms Used to Describe the Embodied Actions Identified in the Data.

Types of embodied actions	Examples	Code used
1. *Bodily routines*: (a) *Environmentally coupled gestures*: Gesticulations that accompany and depend on talk-in-action (Kendon, 2004), which are environmentally dependent (i.e., their meaning relies on objects or structures in the immediate environment; Goodwin, 2007);	(a) Using a deictic or pointing gesture while speaking about an object in the environment, such as a section of a patent projected on a document camera.	BR: CG
(b) *Environmentally independent gestures*: Gesticulations that accompany and depend on talk-in-action (Kendon, 2004), which are environmentally independent (i.e., their meaning is not reliant on the immediate environment; McNeill, 1992, 2000);	(b) Using an iconic gesture to represent grabbing an object and bending it back (a gesture whose meaning may depend on talk but not objects in the environment)	BR: IG
2. *Bodily orientations*: (a) *Physical bodily orientations*: The positioning of one's body and gaze in relation to people, texts, tools, and/or objects of the environment, which invites others to focus on and attend to what the body is oriented toward (Fox & Artemeva, 2012; Goodwin, 2007);	(a) Turning one's body and gaze toward a whiteboard or turning one's head and gaze to an image projected on a screen.	PBO
(b) *Verbally directed bodily orientations*: Directions for another to position their body, gaze, and attention on the people, texts, tools, and/or objects of the environment;	(b) Instructing another to "look" for something within a document or directing another to the importance of an object for their work.	VBO
3. *Bodily interactions*: The body's use and manipulation of or physical interaction with an object or person in the immediate environment;	(a) Writing on a whiteboard or picking up an object (book or device) to display to others.	BI

bodily actions, on the one hand, and an unhelpfully vague terminology that conceals the specificity of action, on the other.

In our analysis, then, we focus on a professor's embodied actions, namely, her bodily routines of gesture, bodily orientations that seek to secure attention, and bodily interactions with texts and objects. These embodied routines, orientations, and interactions demonstrate for engineering students a particular way of seeing and doing. We then turn our attention to the ways in which students take up the professor's lecture in their own design work. The professor's lecture is itself an uptake of the genre of design activity that is then positioned for uptake in the students' genre of design activity. As we stress in the article, it is through uptake that these genres are identifiable as such. We follow Freadman's (2020) principle that "there is never one genre without another, with which it stands in a relation of reciprocal difference" (p. 105). With regard to how we frame these two moments, we follow Alač and Hutchin's (2004) recommendation to take a wide scope in examining embodied actions of meaning-making (p. 638). We, therefore, focus on the professor's and students' talk and bodily interactions with and through technologies as a witnessable bricolage of putting things together in certain positions: namely, the work of indexing, arranging, and contextualizing engineering knowledge and design-relevant performance performed through talk, routines of gesture, body orientations, and text- and object-interactions.

In the perspective we adopt here, technical work is an achievement of order through performances with and orientations to texts and technologies. We will show that these embodied achievements of order become genred through the manner in which they are demonstrated, what kind of knowledge they index, and the kind of uptake they secure. Again, genres classify patterns and constellations of performances by construing recurrent situations—and the practical human actions of those situations—as types. Thus, our study looks at the constitution of genre through practical actions, and our analytic approach allows us to keep in mind that genre is "genre-ing"—the deploying of a repertoire of routines and orientations to construe situations (Bawarshi, 2015; Berkenkotter & Huckin, 1995; Orlikowski & Yates, 1994).

By looking closely at a performance and accounting for those features that would make it generic, we can employ a bottom-up approach to genre constitution rather than taking the genre as a secured and self-evident fact (Freadman, 2012). This perspective is not an alternative to RGS but crucial to it because it continues on a path that leaves behind a template view of genre and fully embraces a performance view (Freadman, 2012; Melonçon, 2018; Prior, 2009). By focusing on the work of embodied performances on, with, and through texts and objects, we position ourselves to analyze a type

of uptake, namely, the bodily and disciplinary "disposition(s) assumed through the use of genres" (Emmons, 2009, p. 142).

The Engineering Design Process

In this section, we describe how the design process might be viewed as an embodied metagenre, one that is reflexively enacted through typified performances of bodies and objects.[8] To do this, we turn to an engineering professor's demonstration of reading a patent to invent design ideas. We choose this ordinary classroom demonstration, itself an example of the embodied genre of the classroom lecture, for several reasons. First, as Stains et al.'s (2018) empirical research has shown, lectures are "prominent" forms of instruction throughout college-level STEM (science, technology, engineering, and math) disciplines (p. 1468). Engineering students, in fact, are commonly introduced to the design process through textbooks and lectures, though they will engage later in hands-on exploration in makerspaces and field sites. Second, classroom lectures are occasions whereby disciplinary or field-specific embodied and kinesthetic ways of knowing are made available to students. For example, Gerofsky (2011) finds that students often "engage in an embodied, visceral way with mathematical objects like graphs," by taking up the "large gesture and kinesthetic whole-body movements" of their instructors (p. 254). Third, through the professor's embodied performance with a patent, she demonstrates firsthand practice with what Roth (2014) terms "representational engineering knowledge" (p. 98), or the use of material often multimodal representations to create, visualize, and pass down engineering knowledge. Engineering design, according to Cardella et al. (2006), depends on actions performed through the use and creation of "external representations of information," such as verbal texts, sketches, diagrams, pictures, and calculations (p. 6). In fact, they found that students who learned to read and, more important, produce their own verbal and graphical texts more often "progressed to the later stages of the design process" (p. 18). We are not suggesting that the patent is the key textual or graphical representation for all types of engineering design work; however, for this design course, the patent was crucial. Finally, and relatedly, this common scenario of the classroom lecture makes visible the kinds of embodied actions students are expected to take up into their design work. Implicitly, the teacher's orientation to texts, digital interfaces, and expert knowledge is taken up through imitation and adaptation by her students as they perform these actions as part of their design process. In other words, the professor introduces and demonstrates embodied reading strategies that will structure the metagenre of design. The students will, in turn, take up these embodied routines to enact their own design work.

The classroom consists of four tiers of seats in a semicircle facing a whiteboard with a projector and lectern where the professor presents the class material. Time in the classroom is spent lecturing and giving presentations three times a week for 50 minutes. Students are put into groups of around seven to 10 early in the semester and told to meet throughout the next 14 to 15 weeks to work on their design projects. They meet weekly in the library, computer labs, or eating areas, or virtually through Google Docs. The course's major project required student teams to engage in a hybrid redesign-selection design of a chainless bicycle, a portable water desalinization device, or a dual axis solar tracker for a resident of southern Ontario, Canada. The major products of the design process are a team charter, a Gantt chart to segment the phases of the design, decision matrices, two oral progress reports, a final presentation, and submission of all design documentation. At each presentation, students use PowerPoint to show their completion of a stage of the design process. They then project their future course of action and explain what remains to be done. These slides consist of problem statements, decision-making procedures, materials and manufacturing methods for the product, iterations and components of the design, risk assessments, Gantt chart updates, and summaries of team member roles. At the end of each presentation, fellow students and the teacher ask questions or critique the plans or designs, as the presenting students justify their choices.

The engineering design process used in the course is taken from Dieter and Schmidt's (2013) popular *Engineering Design* textbook, which focuses primarily on product design. The authors conceive of design as a problem-solving method that "establishes and defines solutions to and pertinent structures for problems not solved before, or new solutions to problems which have previously been solved in a different way" (Blumritch, quoted in Dieter & Schmidt, 2013, p. 1). The definition is open enough to include various possible design ends such as innovation, adaption, respecification, and optimization (p. 5). Dieter and Schmidt's (2013) design process is adapted from Asimow (1962) (see Figure 1), where the design activity proceeds from defining a problem to detailing a design, and passes through three major phases of conceptual design, embodiment design, and detail design (Dieter & Schmidt, 2013, pp. 14–17). The phases are broken down further throughout the text into iterative sequences of information gathering, arranging, synthesizing, and evaluating.

The topics and sequence of the engineering design course adhered closely to the sequence of the textbook; however, the professor supplemented the text with her own materials and experience working for a midsized manufacturing firm. The Dieter and Schmidt text and the professor's lectures provided students with formulas, methods, heuristics, and algorithms to match

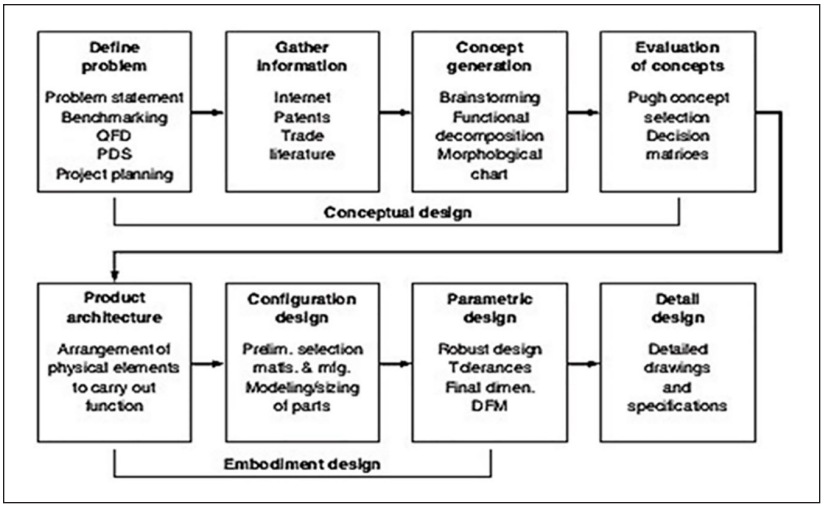

Figure 1. Design process from Dieter and Schmidt (2013).

customer requirements to technical specifications, make criteria-based decisions, and generate ideas. These configurations of data, criteria, and action are genres that organize and index the work and knowledge of design, and make visible (through bracketing) the pertinent networks of actors and their functions (Read, 2016). Such configurations also orient the attention of their users to possible actions circumscribed by situations (Bazerman, 2013, p. 54). The orientation to and use of these genres are shaped by the embodied, typified performance of the design metagenre itself. To illustrate this claim, we reproduce and analyze field observations of this engineering design course, specifically the professor's demonstrations of embodied acts that students will later take up as part of the process of design.

Performing a Patent Reading: Demonstrating the Embodied Genre of the Design Process

In this particular lecture, which took place in the third week of the engineering design course, the professor discusses strategies for design concept generation. The course has progressed to the conceptual stage of design (see Figure 1), and the professor is discussing the common ways in which engineers frame the design and generate ideas for pursuing solutions. An important step in this phase is reviewing the existing patent literature on a design or topic, which allows designers to understand the state of the art and to provide

a stimulus to creative thinking about concepts (Dieter & Schmidt, 2013). But patents are complex genres that contain not only information for what is protected by the patent but also information that would allow someone to reproduce the design once the patent has expired (Bazerman, 1994; Burk & Reyman, 2014; Foscarini, 2019). Patents include identifying information of the patent holder, references to prior art, abstract, introduction, background, summary of the invention, description of the drawings, the preferred embodiment, and the claims. Thus, sifting through the patents requires a set of well-honed reading skills.

The professor's discussion of patents ranged over two class sessions in the fall semester of 2014. In the first class, she prepared students to complete a homework assignment designed to teach them how to find and read patents. They would later be required to employ patents to generate design ideas. She delivers her lecture at a computer lectern where her internet browser is projected onto a large screen behind her. Below is an excerpt from the field notes of that day. The bolded text and the bracketed codes highlight the embodied actions she demonstrates for students: (1) bodily routines with environmentally coupled gestures [BR:CG]; (2) bodily orientations physically enacted [PBO]; (3) bodily orientations verbally instructed by the professor [BOV], and (5) bodily interactions with objects and texts [BI].

> [10:15 am] The course instructor projects the homework assignment due Friday. The homework requires students to look at chapter 5.9 in the textbook on patent literature and then retrieve an actual patent that concerns their project. They are to make a PDF of the actual patent and not a copy of the patent record or file. To illustrate what the teacher wants, **she navigates the projected web browser to the United State Patent and Trademark Office website [BI]**. She says the patent website is great for "information on who is working on different projects. . . . What you want to look for are the full texts of patents. . . . use keywords to search for what you need." **She types in desalinization** [one of the design project topics] **and chooses a patent [BI]. Opening up the file, she clicks on the patent itself [BI]** rather than the patent record, which she does not want the students to produce in the homework. **The patent, then, is visible on the screen behind her [students' PBO].** She says **you can tell the difference by the format [VBO, PBO].** She says, **look for the classifications ("which are like the Dewey Decimal System") [VBO]** as she **brings the page into full view [BI, PBO]: "What we're really looking for is the whole patent" [VBO].** She then **scrolls down the length of the patent [BI]**, saying **"The real important part is the claims, what this patent says it does," [PBO, VBO] and shows where it starts by pointing the cursor [BR:CG]. She scrolls back over the background portion of the patent [BI, PBO]**, saying that **it will be "helpful" in showing where people are getting their ideas [VBO].** She remarks that this a process patent and not an artifact patent.

She then **shows the class how to search for patents using the module the library provides for the class [BI, PBO]**.

In the above excerpt, the professor orients the attention of the class to the patent literature. She does this by interacting with the computer [BI], which projects the desktop onto the screen behind her. Throughout this moment in the lecture, she positions her body to face the computer in front of her [PBO]. However, the projected image of the patent, which she describes and instructs students how to use, invites them to focus their attention on the screen [PBO] and the specific sections of the patent she explicates with her directive language (i.e., "look for," "the important part") [VBO]. She teaches students to narrow their searches through keywords and to differentiate between patent records and patents themselves. The professor builds on their previous experience with classification systems (a perhaps-dated reference to the Dewey Decimal System) and demonstrates that pertinent information for their projects is readily available by searching the topic of portable desalinization devices, which is one of the design project topics. Furthermore, the discussion demonstrates a way of attending to and reading patents. She emphasizes the importance of the claims, saying that the claims are what the patent does. Students need to focus in order to understand whether exactly the patent claims are proprietary. Then as a second move in attending to the patent, the professor scrolls up to the Background portion and offers it as a portal to the generation of ideas that presumably led to the patent's state of the art. Through an orientation to the website's interface and perceptual glossing provided by the professor, the patent becomes readable and a mediator of concept generation.

In the following class, the professor continues her discussion of patents, displaying a patent on the projection screen, to "go over the structure" and to learn to read the patent as "information for brainstorming." She uses a pen and the document projector [BI] to highlight where she wants students to focus. In other words, she uses the pen to make an environmentally coupled deictic gesture [BR:CG] on the patent that rests on the projector, to point out to students key sections [PBO] and provide instructions for how to use the patent in the design process [VBO]. She looks down at the patent during her instruction [PBO] and narrates her own scanning of the document [VBO], but looks up at the students frequently [PBO] to supplement her demonstration with information about patents generally and how they function for inventors and organizations.

[10:10 am**]** She **first directs the students' attention to the classifications section and tells them that the classifications numbers [VBO]** allow one to

> find the other categories into which the patent has been filed. **By looking at the classification numbers [VBO]**, the professor says you can see what other patents on your topic are out there. She **runs the pen over the heading [BR:CG] and shows that the patent number code reveals [PBO]** that this is the second iteration of the patent. She **then scans down to where the holders of the patent are named [PBO]** and says that often the holders of a patent are the company owners and not individual inventors or engineers. This is so because anything designed with company time or resources is the company's property. She says that she knows inventors who have waited to create and design products or processes until after they retired, so as not to invent on company time.

Here, the professor connects an embodied attention to patents with tactics for gathering information and understanding the textual history of the patent. The classification numbers are part of a system for expanding the gathering of research and possibly encountering new concepts on a topic. Next, the scanning of the IND codes reveals the structure of the patent and links the patent to its partially occluded history of iterations (see Swales, 1996). Finally, she ties the identification of the patent owner to insider knowledge of how patents mediate ownership in corporations, while providing students with a way to evade corporate claims to intellectual property. The demonstration of embodied scanning, made possible in part by the instructor's deictic gestures with cursor and pen, is introduced to students as part of the design process and is intertwined with an uncovering of the networks in which the patent is embedded and the social actions it performs. Throughout, she is inviting them to direct their gaze [PBO], and thus their attention, to the patent as well as the information and instruction she provides.

This intertwining of the professor and the students' embodied performances with an array of actions the patent itself performs continues as the professor creates a focus for the students to understand the patent through its generic content:

> Continuing with the projected patent **[BI, PBO]**, the professor then **moves on to the abstract which summarizes the contents of the patent [PBO]**, and then **scrolls down to the first drawing [PBO].** She describes the drawing as without dimensions, but states **"that you should be able to follow the drawings [VBO]** and get the same results as the inventors." **She scrolls down farther to the background and summary sections of the patent [PBO]** where there are resources for an understanding of the field. She mentions to the class that **patent jargon is difficult;** therefore, they should **look at the drawings and look at the claims to understand what is really being presented [VBO]**. She steps back from the demonstration for a moment and

> faces the class **[PBO]** to mention that a patent means that an inventor or company has a right to manufacture that product for profit. The room, subdued up until then, comes alive; students start asking questions about patent law. . . . She then briefly touches on the difference between a trade secret and a patent and the different types of patents. [. . .]

The professor physically points at particular features and functions of the genre [BR:CG], always contextualizing them for the kinds of actions they can accomplish in the design process. The drawings that cover the claims of the concept become potential instructions for students to build from; the claims that expound the drawing become the means to understand what the patent is doing. The professor expands this attunement to form and function to emphasize how the genre of the patent is used to create products and profit. Students take an interest in the ramifications of this function, and the professor clarifies the difference between a trade secret and a patent. An embodied understanding of how to attend to and use a patent continues to open up opportunities for students to build industry knowledge and craft.

After enumerating types of patents, she resumes her discussion on the claims section and refocuses the class on the patent projected in front of them and the ways patents are attended to for design:

> She says of the claims, **"engineers I worked with wouldn't even look at the drawings but would go right to the claims," [VBO]** because, she continues, **the claims told you everything important you needed to know about the patent [VBO]**, thus reinforcing a point she made in the prior class. According to the professor, the claims sections **starts out with a very general claim and then moves down to very specific claims. Each claim is subordinate to the last [PBO, VBO].** You need **to learn to read the claims [VBO]** to find out exactly what the patent is trying to cover, she says. **Looking up at the class [PBO]**, she tells them "you have to be aware of what patents are out there." The patents provide the engineer the state of the art.

Here the professor repeatedly directs students to orient their bodies to the claims section of the patent by instructing them to notice, attend to, and use patent claims in their own design process. The claims, which are projected on the screen, become the focus of the demonstration and the key to understanding the patent itself and the way to fit any particular patent into the design process. This leads the professor to remind students to practice this reading not only as part of the design process but also as part of the professional awareness they must maintain in their engineering careers. The professor describes the patent as a kind of bridging document that connects not only their current student project and their later professional careers but also the

various stages of the design process. After all, students frequently either get stuck in problem solving and information gathering (Christiaans & Dorst, 1992) or skip these stages altogether in favor of jumping prematurely into concept generation (Wible, 2020). The professor's focus on and explication of the patent through her physical interactions with its features, conventions, and information typify this particular text as rich with opportunities for problem scoping, information collection, and concept design. Thus, the embodied actions demonstrated for imitation as part of design also serve as occasions for professionalizing the students' understanding of patents and orienting their current design work with the patent as a means of bridging key stages of design. Learning to enact the design process through typified performances, such as the one for finding and reading patents, introduces students to ways of acting in situations that prompt design thinking, while assisting students in building the genre knowledge they can use in engineering situations.

Adapting Performances: Imitating the Embodied Genre of the Design Process

The embodied actions of the professor—her routines of gesture, bodily orientations, verbal instructions for the students' bodily orientations, and interactions with objects—are visible to students, thanks in part to the overhead projector, which projects her hands, her pen, and the patent on which she focuses her attention. By scrolling through the patent's sections, deictically gesturing to parts of the text she expounds upon, she selects for students the sections they must attend to for the upcoming homework assignment and for their design work. In the first class, the professor showed students how to orient themselves to the U.S. Patent and Trademark Office website. In the second, the patent was perceptually segmented through embodied reading strategies and tied to the situation of design and other potential engineering situations. In both instances, the professor's embodied actions on, through, and with texts and objects were similar to Goodwin's (1994) accounts of highlighting, or "making specific phenomena in a complex perceptually salient by marking them" (p. 606). The professor's embodied actions not only mark salient phenomena to be seen in a particular way but also demonstrate a particular way of seeing. In other words, the professor demonstrates a particular and typified performance of attending to patents. Her talk coupled with her routines, orientations, and interactions that make the patent visible and intelligible are pedagogical and, as such, direct the students' attention to (1) an important text for engineers, (2) a way to scan and read that text, and (3) advice on how to use the text for future ends. All of these together demonstrate for students, in Carter's (2007) words, "the ways of knowing" and

"doing" of the engineering design process. The demonstration is a choreography of intentional displays, talk, and embodied actions on and with texts and objects that position students to take up those actions in their own engineering design work.

The professor's demonstration illustrates how one embodied genre (the classroom lecture) can appropriate a text-heavy, multimodal genre (the patent) to produce the rhetorical action crucial to the metagenre of the engineering design process. The patent genre responds to the need to protect intellectual property, grants a producer exclusive claims to profit from a demonstrably unique concept. In the design process, the marked patent becomes a place for invention, used to gather information on the state of the art for new ideas for selection design. These patents are glossed with the embodied acts the professor instructed and regenred in the sense of being oriented to and rearranged with an attention to the exigencies of the design situation.

In the above lecture and the ensuing design work, we can discern what genre scholars call uptake (Bawarshi, 2015; Emmons, 2009; Freadman, 1994, 2002, 2012) or, what Freadman (2002) terms "the bidirectional relation that holds" between genre actions (p. 40). Bawarshi (2015) argues that the key word in Freadman's definition is "holds," suggesting that it refers to "a relational force that informs, legitimizes, and results in certain actions" (p. 191). These genres—the classroom lecture, the patent, and the ensuing design work—are, in the words of Bawarshi and Reiff (2010), "dialogically related to and acquire meaning" through "interaction" with each other (p. 84). That is, the classroom lecture forms a relation with the patent genre through the professor's embodied performance, which in turn positions that genre for uptake as part of the design genre. We stress that this is not necessarily a causal relation; rather, uptake is a matter of a selection (Bawarshi, 2016, p. 190; see also Freadman, 2002) and improvisation (Artemeva, 2005), by reason of the possibilities and vagaries intrinsic to genre performance. This fact is perspicuously exhibited in the description above where the patent's contents had to be minutely conditioned by the professor's lecture in order for it to be suitable for the subsequent design work.

During team meetings where they sought to solve the design problem, the students take up the typified, embodied performances of glossing enacted by the professor on and with the patent. The way students orient themselves to and use patents in the design process instantiates and even re-performs (using bodies, texts, and objects) the professor's embodied performance that recontextualized the patent for new genre ends. We can see the traces of this uptake (in this case, re-performance) in the interactions with and arrangement of documents of one group of students working on a solar tracker. We see in Figure 2 four teammates engaged in a brainstorming session as part of Dieter

Figure 2. Students in a brainstorming session calculating the earth's path around the sun with several instantiations of representational engineering knowledge.

and Schmidt's (2013) concept generation stage (see again Figure 1's chart of the stages). They interact with different instantiations of "representational engineering knowledge" (Roth, 2014)—maps, sketches, diagram, and written notes. In the photo on Figure 2, one student points to [BR:CG] a section of a figure on the laptop screen [BI]. His talk, gesture, and bodily orientation (head and gaze turned to the screen) [PBO] invite two of his teammates to orient their bodies and their attention [PBO] to the display on the screen.

Again, due to the specifics of this design course, the patent is the text that centers their problem definition and information gathering methods and provides a bridge to concept generation. Students re-perform the professor's bodily interactions on and with the patent by physically attending to and highlighting the texts and technologies of their work. In their team meetings, for instance, students examine ideas often by trading laptops back and forth [BI], using deictic gestures [BR:CG] and multimodal assemblages of documents, websites, sketch books, and CAD [BI] to invent new ideas about system components.

The students also use documents, links, jpeg images, sketches, and technical information from across the web to build research documents they then share on platforms like Google Docs. Their uptake includes overlapping multitudes of notes, ideas, and documents into subject folders to arrange and stabilize their information about designing. One example of this work includes a patent for the "Optical Sensor Holder for Tracking Sunlight" (U.S.

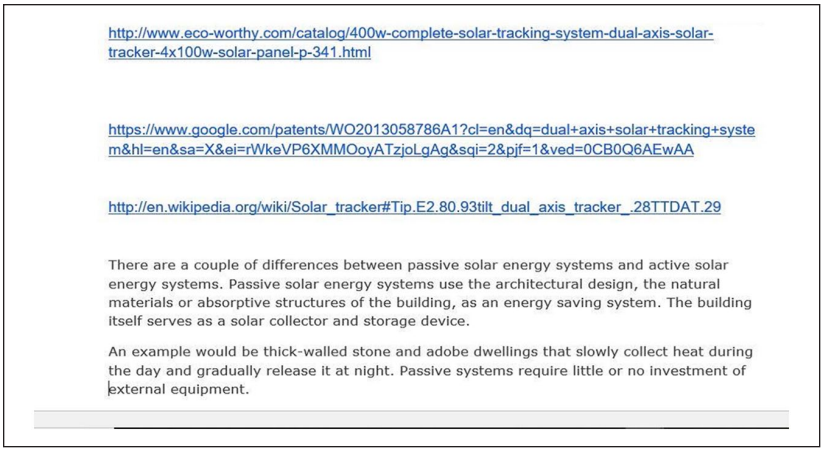

Figure 3. Image from a seven-page, student-authored document used to learn about solar trackers that shows several links to solar tracker jpegs, a patent for a solar tracker, a Wikipedia entry on passive and active solar energy systems, and students' notes.

Patent No. 8,882, 902, 2014) that one solar tracker team filed in Google Docs under "Research," along with another document titled "PDF links" that included two URLs. One of these URLs linked to a solar photovoltaic energy source and the other to a solar tracker design; both are from the engineering data analytics site Knovel. These links and the patent form an integrated complex for the group to later invent their own solar tracker components for their design. Through the embodied routines, orientations, and interactions the professor demonstrated, the patent is glossed (or perceptually reconfigured) with a particular salience that is adaptable to exigencies of design. In other words, the patent is now operationalized for the social ends of the design process.

A portion of one such document used in this physically interactive concept generation work is excerpted in Figure 3 below, which displays a portion of a seven-page, untitled Word document brought by a student to one of the solar tracker group's sketching sessions.

This Word document includes from top to bottom (1) a link to a solar tracker catalogue item with jpeg images of an actual solar tracker, (2) a patent for a dual-axis solar tracking system, (3) a Wikipedia entry that visualizes the description of passive versus active solar energy systems, and (4) student-generated written descriptions and explanations elaborating ideas from the above resources. The document and this particular moment of the team's

work is framed by research questions at the top of the first page of Figure 3 (not shown):

> Questions we have to ask ourselves: how much space are we willing to let [the solar tracker] take up? 4 panels in a horizontal setup take up more horizontal space. not top heavy. [versus] 2X2 panel setup. more top heavy when tilting.

The next seven pages of the document are pictures and links (including a patent) to different solar tracker designs, some of which include descriptions. These links and the others that fill this document, and others like it, offer complex multimodal arrangement of images and information, to afford brainstorming and design sketching by providing models from which to generate ideas. This document is not only a product of design attention and orientation but also one of the means by which that attention and orientation is achieved. This mundane Word document represents how students integrated patent knowledge into the designing process through embodied and digital skills of indexing and arranging. Students draw on the embodied, typified performances learned from their professor (namely, how to structure a situation for the design process) and adapt them to structure the situation they now confront.

The typified performance can be seen in the arrangements of patents operationalized in the social action of the design process. That is, the typified embodied performances of the student, visible in their interactions with these documents and each other, are not identical to the teacher's, but they are a complex adaption—an embodied form of uptake—that incorporates the resources around them (texts, technologies, and people) to gloss the patent (to perceptually restructure it) and incorporate it into their design process in a way that follows from the professor's performance. Again, genre uptake, according to Bawarshi (2015), is "the taking up or performance of genres in moments of interaction and innovation" (p. 186). In this case, the students' genre uptake involves not just the re-performing of the moves, orientations, and bodily dispositions that the teacher previously performed on and with the patent. The students' uptake also involves a remediation of those forms into text-based, multimodal instantiations, namely, the URLs, notes, and questions that function just as the teacher's performance—as a gloss on the patent as an inventional resource for their design activity.

The design process enables the multimodal genre of the patent to take on a new rhetorical function, integrating it into a larger social action. Texts, like patents, that represent actions are recontextualized in genre-rich spaces that position that text as offering a new type of action to the situated participants of a new context (Berkenkotter, 2001). Patents are, of course, not the only

genres to be integrated into the design process: Gantt charts, presentations, decision matrices, client briefs, and many other genres overlap and refigure each other through performance and mediation (Orlikowski & Yates, 1994; Spinuzzi, 2004; Winsor, 1994, 1998, 1999).What is interesting about this particular instance, however, is the way one genred action (the professor's embodied performance of reading the patent) is taken up by others (the student's embodied actions during teamwork and the student's documents) through a particular form of reading. This uptake is usually accounted for in the recognition of how interaction grounds the meaning and action of genres (Freadman, 2002). But in this case, the genre uptake also performs what LeMesurier (2016) terms a "bodily uptake," a process of selecting and responding to genres that is "learned and enacted through bodies" (p. 301, 298). With the teacher's demonstration of the patent, the enactment (the gestures of attention and orientation the students are to imitate) becomes an embodied genred action, one that (1) rhetorically positions another genre (the patent) for uptake by another genre (the design process) by framing a situation as amenable to design and (2) invites or requires the students' bodily uptakes by repurposing the meaning that students are to learn as part of a metagenre's repertoires. Students will re-perform these actions first for a homework assignment and later in their design work as part of the information-gathering and idea generation portions of the conceptual design phase, as we see in the documents and situations discussed above. These embodied acts are tied to still others that frame situations as design situations while simultaneously enacting the design process itself. Students are taught these performances as typical, disciplinary ways of seeing, attending, and orienting that become disciplinary "patterning[s] of human experience" (Devitt, 1993, p. 573), "embodied routines" (Kimbell, 2011, p. 140) for structuring and reinvesting situations with disciplinary knowledge and values (Dannels, 2005).

Conclusion

Through a conceptual argument drawn from ethnographic data, we have argued that the engineering design process functions as a type of genre, specifically an embodied metagenre—a constellation of typified performances of bodies engaged in and through discourses, texts, and objects in genre-rich spaces. As the research we discuss has demonstrated, genres (as social action) are not just textually instantiated; they can be performed in and through the human body. More specifically, embodied practices can be understood as genred when they become typified performances that respond to a recurrent situation or construe a recurrent situation into a type, and when those typified bodily routines and performances are formalized in a pattern of meaning

making, such as the engineering design process. In all forms of engineering design activity, these acts of performing with texts and objects are demonstrated in class so that students might re-perform them later in design work, forming the all-encompassing embodied metagenre of the design process. As students learn to engage in those embodied orientations to objects and texts, they also learn to apprehend and respond to design situations.

We argue further that when the design process is understood as a typified bodily performance—a typified disciplinary action to address and structure recurrent situations—and taught as an embodied metagenre—one that involves an assemblage of embodied routines, orientations, and interactions—then the design process becomes a form of genre knowledge, a rhetorical and embodied form of situated cognition (Berkenkotter & Huckin, 1995). Typified performances, after all, are motivated performances of social action—always embedded in dynamic, recalcitrant, material environments offering particular affordances. Learning the design process, whether for wicked problem solving or more mundane design work, involves engaging in a rhetorical and embodied action of defining, framing, and structuring. Whether we teach engineering communication or the TPC service course, if we use a design process approach, we must consider the practices of framing and selection, their delineating power, and the texts and technologies that make them possible.

When considering our research applied to teaching, and specifically the teaching of writing, we take inspiration from Melonçon's (2018) call for TPC teachers to teach the actions of genre rather than merely the forms of genres. While teaching forms and conventions is a helpful way to structure a class for a variety of teachers with varying degrees of TPC training, that approach fails to provide students with the rhetorical capacities necessary to work in contexts structured by multimodal and embodied genres. Melonçon suggests that teachers use problem-based learning that embeds students in scenarios that call for responses to rhetorical situations. We contend that teaching the design process as an embodied metagenre merges problem-based learning and rhetorical genre-based instruction. It requires real attention to forms and conventions that must be performed through the creation, presentation, and enactment of textual, multimodal, and embodied genres. At the same time, it provides students opportunities to compose texts for gathering, sharing, distributing, synthesizing, and presenting information—that is, performing "the actions that produce things" in the design process (Melonçon, 2018, p. 212). By understanding design activity as an embodied genre, teachers of TPC or engineering communication can find ready-to-hand concepts for implementing design thinking in the genre-based classroom as well as better understand

how basic design processes in particular might augment how we teach design and genre (and design as genre).

Beyond pedagogical implications, we view our analysis and theoretical concept as a call for others to focus on scenes and processes where embodied genres are performed or bodily performances become genred. This may mean paying attention to mundane actions such as how deictic gestures highlight features of a text, how a speaker's orientation and gaze direct her teammate's attention, how certain words can indicate salience in the perceptual field of a team's task, and how the navigation of texts and objects are displayed and contextualized through talk and movement. After all, embodied actions, in spaces of instruction and cooperative work, frame situations, shape perceptions, and generate knowledge. Our analysis shows how the professor's performance directed students' attention not only in the obvious sense of asking them to focus their present awareness on her talk, routines, orientations, and interactions with objects. But through embodied actions that enacted, glossed, and exhibited her disciplinary ways of knowing and doing, she also taught students to attend to objects, problems, and situations through the lens of engineering design. And by observing and learning from the professor's embodied actions, students develop repertoires for "selecting and translating" (Rounsaville, 2012, n.d.) genres to new arenas of situated action. To understand this process, researchers must consider the role of embodied action in the execution and demonstration of genre.

Our work, however, is not without limitations. While we examine several perspicuous instances where action coalesces into genre, we stress that different design situations may unfold in different ways and may not, for instance, incorporate patent literature in the way we detail here (or at all). Inevitably, this study exhibits a concept (embodied genres) and assembles a framework (the engineering design process as an embodied metagenre); however, our concept and framework will inevitably need to be refined and adapted to be made portable for other research contexts. Also, the vocabulary we use to describe embodied action—routines, orientations, and interactions—should not be viewed as a rigid taxonomy but a provisional and adaptable scheme for coding and analyzing action, one that we suggest provides a useful level of granularity.

In the decades following Miller's (1984) path-forging insight that genre is a form of social action, scholarship in RGS has cast greater light on the ways in which genres, through our use of them, "constitute" and "simultaneously reproduce" the "social structures" of disciplines, professions, organizations, and institutions (Berkenkotter & Huckin, 1995, p. 17; see also Bawarshi, 2003, p. 25; Freadman, 2012, p. 553). Each day, we make and remake the social world through our recognition, uptake, and even transformation of

genres. Much of what we do and who we are is made possible by and through genres of all types. As Schryer (2002) reminds us, "we genre" and "we are genred all the time" (p. 95). Some of those genres, as we have argued here, can only be accomplished by and through the body—the physical routines, orientations, and interactions of bodies on, in, and through discourses, texts, objects, environments, and constraints. It may be more apt, then, to say not just that we *use* and *are used by* genres but instead that we *live* genres and that genres *live through* us.

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Notes

1. Throughout the article, we use the term *design activity*, which we take from Sriram et al. (1989), to describe categories or types of design This term is commonly used in engineering design research to categorize forms of design work (see Cardella et al., 2006; Dieter & Schmidt, 2013).
2. While the thesis that bodily actions can be genred is implicit in Miller's (1984) description of genre as rhetorical action, and embodied genres have been described and classified as such by genre researchers in the past (e.g., Artemeva & Fox, 2011 and others detailed in the article), there remains, in TPC research, a persistent focus on textual, discursive, and digital media genres at the expense of an investigation of embodied and multimodal genres.
3. We use the term *object* to mean three-dimensional, physical entities that one interacts with by holding, manipulating, pointing to, and so on—for example, a pen, an electrical circuit, a keyboard, a miniature model of a car, or a solar tracker. As Fountain (2014) demonstrates, disciplinary and professional settings of situated action involve not only talk (that situates, frames, and explains) and texts (visual, verbal, and multimodal displays that one must view, read, or interpret) but also objects in the environment that must be used, made, or remade.
4. We note that these distinctions can be less stark at a particular level of detail. For instance, engineering can have features of performance too, such as in classroom lectures, makerspace workshops, or industry-funded design competitions. Additionally, the engineering design presentation can include similar ends to the architectural design critique (Dannels, 2009).
5. Carter's concept is distinct from Giltrow (2002)'s earlier articulation of "meta-genre," which she defines as "situated language about situated language"

(p. 190) or "atmospheres of wordings and activities, demonstrated precedents or sequestered expectations" that surround genres (p. 195). Guidelines are one type of meta-genre for Giltrow (p. 190). Recently, McNely (2017) demonstrates the importance of returning to Giltrow's original formation, especially when tracing the circulation of "multigenre writing in organizations" (p. 447). However, McNely's critique of Carter's notion as "broader rhetorical and structural patterns" that can be "difficult to infer from any written instances" (p. 448, 449) underscores the utility we find in Carter's formation—namely, that Carter's term aptly describes the type of genre engineering design is—one that is enacted not through texts alone but through recurrent and typified bodily performances on, with, and through texts and objects.

6. The research project was conducted with institutional review board approval (Case Western Reserve University IRB Protocol Number: IRB-2014-840).
7. While there may be an unintentional Foucauldian or Lacanian resonance in our use of the term *gaze*, we use it, instead, in the conventional sense common to multimodal analysis and discourse analysis (Goodwin, 2007; Norris, 2004).
8. By reflexive enaction, we mean how participants' actions and understandings are embedded in and constitutive of a situation.

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Author Biographies

Scott Weedon is an Assistant Professor of English at Texas Tech University. He researches engineering communication and eductation, science and health communication, and the intersections between design and rhetoric. His publications can be found in *Technical Communication Quarterly, Journal of Business and Technical Communication, Poroi, IEEE Transactions of Professional Communication, and IEEE International Professional Communication Conference Proceedings*.

T. Kenny Fountain is an Associate Professor of English at the University of Virginia. His research interests include writing and rhetoric in the disciplines, the history of rhetoric, and the intersection between rhetoric, cognition, and embodiment. He is the author of *Rhetoric in the Flesh: Trained Vision, Technical Expertise, and the Gross Anatomy Lab* (Routledge, 2014).