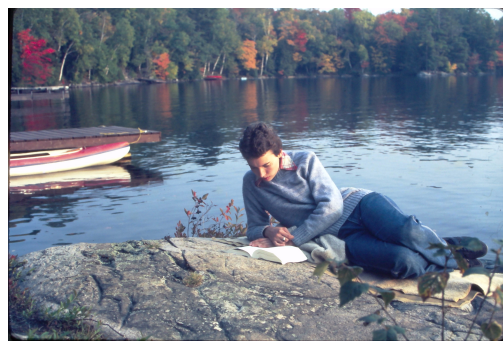


A Wordsmith among Scientists: Cultural Identity and Scholarly Work

HEATHER GRAVES

I grew up a wordsmith among scientists and mathematicians. I spent hours listening to disquisitions at the dinner table on how to, among other topics, derive the formulae to calculate the rates of acceleration and deceleration of a billiard ball dropped off a bridge into the Grand River. Given these dinnertime lessons, I had no choice but to study English or Fine Arts. And, as an undergraduate English major at the University of Waterloo 1976-1981, my courses in English Studies were the focus of my Arts degree; other required Arts courses constituted a nuisance and a distraction from the reading and writing I did in English. I left Waterloo having learned to write a solid English essay (thanks Keith Thomas, Mary Gerhardstein, Bob Gosselink, Neil Hultin, and Jack Gray) and never thought about whether my writing skills transferred to other disciplines. I assumed they did, despite my co-op undergraduate degree, during which work as a writer in the Ontario Premier's Office and the Bank of Canada had shown me that academic writing skills did not transfer seamlessly to business.

During my school terms as an undergraduate, I lived at home. To get a ride to our house on Township Road 12, I would meet my dad, a physics professor on campus, in his lab. Often I chatted (while I waited) with his many graduate students about their research and then observed him spending several minutes coaching them on their work. This experience, coupled with a



Heather Graves, Reading the Oxford Anthology of English Literature

childhood in which numerous graduate students and visiting physicists from Chile, Latvia, Lithuania, Iran, India, China, and Britain flowed through our home at welcome dinners and end-of-term celebrations, meant that I knew something about physics and its culture. This familiarity is the source of my abiding interest in the rhetoric of science, sparked during H. Lewis Ulman's 'Rhetoric of Inquiry' class at Ohio State University in 1990. It seemed that the scholarship in this area largely focused on historical texts; very little dealt with contemporary scientists 'doing science.' I felt the area's philosophical and theoretical bases required some input from contemporary scientists/science.

Therefore, my dissertation research focused on experimental physicists conducting research in the laboratory. My book based on this study explored how they used language, especially rhetorical figuration including metaphor and analogy to create new knowledge and metonymy to create scientific facts (Graves, 2005; 2012). The final chapter examined how the physics graduate students learned to write publishable research articles in a hierarchical mentoring and drafting process (Lunsford and Ede, 1990). At that time, my terministic screen that "good" writing resembled English Studies disciplinary discourse blinded me from attending to the argumentative structure of the drafts that I observed the physicists revising.

When I started teaching writing at Illinois State University and then DePaul University (1993–2005), I took a rhetorical perspective, focusing on argument structure, whether the course was advanced composition, technical communication, or business communication. I adopted and adapted theory mainly from Aristotle and Toulmin in my approaches in those classes and in the textbooks that I later co-wrote (Graves & Graves, 2007; 2012; Faigley, Graves & Graves, 2008; 2011; 2014; 2017; Faigley, Graves & Graves, 2009; 2012; 2015; Graves & Graves, 2016). All the instructional material that I encountered and used fit well with my literature/rhetoric and composition background: I felt that I had a handle on writing and arguing and on how to teach others to do these well too.

English Disciplinary Discourse is Not the Gold Standard

However, in 2007 our daughter was writing an MSc thesis in epidemiology and biostatistics at the University of Western Ontario. She laid out her literature review the way that her writing-teacher parents had taught her—from what I now recognize is an English Studies/Arts perspective—and we were all shocked when her supervisor rejected it wholesale, insisting that she start over and summarize her sources in point form: no argument, thank you very much! This incident was my first inkling that perhaps Arts was not the gold standard for all good disciplinary writing.

At the University of Alberta in 2009, I taught academic writing for science graduate students. Embarrassing though it is to relate now, I used Kamler and Thomson's *Helping Doctoral Students Write* because I believed that their advice applied to all disciplines. However, three weeks in, after asking my students to interrogate their thesis topics' ideological foundations, they looked at me uncomprehendingly. Finally, during the lesson on Toulmin's theory of argument (1958), I realized that I was in uncharted territory: they were analyzing a sample thesis literature review to identify the argument when a geology student raised his hand, saying he couldn't find any of

Toulmin's concepts in his sample. After skimming through nearly ten pages, I had to admit I couldn't find them either. Later, I reviewed several more geology theses and found his sample was representative.

A New Model for Argument in Science

I felt compelled to look further into this anomaly. A rhetorical analysis of the thesis introductions randomly selected from the major science disciplines—chemistry, biology, physics (plus geology)—revealed that these writers structured their arguments in ways that existing rhetorical theory did not acknowledge or account for. My analysis identified two type of argument structures based on scientific facts and only secondarily on Toulmin's beliefs and values-based model from the discipline of law. I developed an alternate model based on one of these types and then used theoretical sampling to determine whether it reflected the argument structure used in research articles in these disciplines. It did. I have presented this research to numerous scientists in chemistry, physics, geology, and mathematical biology and taught it to several dozen graduate students from disciplines in science, engineering, and medicine at the University of Alberta. Using it, they have revealed additional insights into disciplinary argument structures in their areas. Other graduate writing instructors have embraced this research when it was presented at conferences (Graves, 2013; 2014a,b,c; 2015). Some undergraduate writing instructors, however, have dismissed these findings, scoffing that scientists are just "lousy writers." Further, this research has been rejected by multiple United States journal editors and their reviewers. Novel findings generate novel theoretical models, and novelty is uncomfortable.

Six years ago, I started working with an applied linguistics doctoral student, Shahin Moghaddasi, on the rhetorical structures in theoretical mathematics research articles, which she approaches from rhetorical genre studies and English for Specific Purposes (ESP) perspectives. Her work first on research article introductions (RAIs) and then on niche establishment strategies in

theoretical mathematics draws on, among other sources, John Swales' 'create a research space' (CARS) model (1990, 2004). Much of the work in this area of genre analysis highlights variations in the CARS's move and step model across a variety of disciplines, but some research also inclines towards a one-size-fits-all-disciplines model that would make it easier for ESP and English for Academic Purposes (EAP) instructors to teach novice disciplinary experts to publish their research in English-language journals.

In contrast, our research has demonstrated how mathematics researchers structure their articles in ways that explode the possibility of a generic rhetorical model (Graves et al 2014; Graves et al 2015; Moghaddasi and Graves, 2017). Recently, we published an alternate version of the CARS model for discrete mathematics in an international journal, but in the initial review of the manuscript, one of the referees torched our work before rejecting it, I suspect, in part, because of the alternate model. Fortunately, the journal editor sought a more open-minded alternate reviewer, and the manuscript was ultimately accepted (Moghaddasi and Graves, 2017).

Cultural Identity and Scholarly Identity are Intimately Connected

This work on argument in science disciplines and discrete mathematics undermines the position of writing instructors who teach a curriculum that assumes that 'generic' academic writing exists and rhetoric and composition or writing studies courses can teach it. They further assume that students can easily adapt these "generic" academic writing skills to the courses they take in other disciplines. However, the research that I've been doing for the past decade suggests differently. Writers in science disciplines approach the task of persuasion less directly than do writers in arts and humanities (and some social sciences) disciplines; the former see their task as explaining the context around scientific facts, which rely primarily on a shared understanding of scientific knowledge and, only secondarily, shared beliefs and values related to the disciplinary culture (Graves, 2013; 2014a,b,c; 2015).

My scholarly work over the course of my nearly 40-year career is intimately connected to my cultural identity and personal experiences. My scholarly “upbringing” in English Studies at a Canadian university meant that I thoroughly internalized my disciplinary discourse, which shaped my view of writing instruction for several decades. Additionally, my familiarity with the Canadian physics culture in the late 20th century shaped my response to the scholarship in rhetoric of science at that time and motivated me to bring a perspective from contemporary experimental physics research into the conversation. This work, coupled with the cultural knowledge, laid the foundation for my later willingness to take a hard look at what science writers were actually doing when they built the context for their thesis research and to acknowledge what I saw there, irrespective of the received wisdom that English Studies disciplinary discourse is “generic” academic discourse that can serve as the model for all disciplines.

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