UWP 011: Popular Science & Technology Writing

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Course Description

UWP 011: Popular Science & Technology Writing is a sophomore-level course designed as an introduction to rhetoric of science at UC Davis, a science-focused land-grant university. The course fulfills the general education requirements for written literacy and for topical breadth in arts and humanities. The catalog describes the course as investigating the "positioning of science and technology in society as reflected and constructed in popular texts" (University of California, Davis, *General* 521). A main goal of the course is to foster students' critical scientific literacy and ability to read texts rhetorically.

Institutional Context

UWP 011 was created in the context of needs that, while especially strong at UC Davis, generalize to writing programs across the country. First, the course is intended to help define the University Writing Program's disciplinary identity, a perennial issue faced by Writing Studies programs of all kinds.[1] Second, the course addresses UC Davis's need for increased scientific literacy (SL) among graduates.

The University Writing Program (UWP) at UC Davis is an independent academic unit within the Division of Humanities, Arts, and Cultural Studies (HArCS). UWP separated from the English department in 2003, and since then our mission has shifted from an exclusive teaching focus to a shared teaching and research focus. This shift has taken two forms. First, the composition of the faculty has broadened. Prior to independence, all the UWP faculty were lecturers, mostly full time, with teaching appointments, whereas today the faculty also includes five professors (three full and two assistant) who have combined teaching/research appointments. In addition, we also have gone from having no minor, major, or graduate degree to having an undergraduate minor and a graduate Designated Emphasis in Writing, Rhetoric, and Composition Studies. We are working toward having a major and a Ph.D.

Despite these changes, we are still mainly focused on composition with the required lower and upper division writing courses making up over 90% of the program's offerings. As this figure suggests, we are in the early stages of defining what kind of department we will be and what kinds of degree programs we will develop. In creating courses, therefore, we are not only

expanding our curriculum, but making early steps toward deciding and signaling to others what our disciplinary identity or identities will be. We are especially working to complement our existing composition focus by adding courses on theory, history, and research methods, and UWP 011 is our first rhetorical theory course at the undergraduate level.

As we add courses, we also are thinking and talking about the future stability of the program. Our success so far as an autonomous unit springs, to a great deal, from our program's Writing the Disciplines (WID) and Writing in the Professions (WIP) focus and the visibility this gives us across campus, and we know that to continue growing while maintaining the support these courses bring us, we need to heed Richard Young and Edwin Steinberg's advice that an academic program is most stable when it is "responsive to durable needs of society" (395). As Young and Steinberg point out,

> in the case of rhetorical studies, the durable social needs are obvious. Rhetoric has long sought to address the need for literacy and the need to participate reasonably and effectively in the social conversation; that is, rhetoric has always been concerned with the use of language in community-sustaining action. (395)

I would amend this only to say that Rhetoric today concerns itself not with literacy, but with *literacies*; indeed, our emphasis on WID/WIP reflects the diversity of discourse communities students are expected to visit or to inhabit professionally. These courses meet university and social needs by teaching disciplinary and professional rhetorics, and in doing so they also provide the UWP with a stable institutional mission and standing. However, as much as students need literacy in particular discourses, they need broader literacies as well, including one that UWP 011 is designed to address: critical scientific literacy.

UC Davis was founded as the University Farm School (an extension of UC Berkeley) in 1908 and has focused on sciences, especially applied sciences such as plant biology and agricultural engineering, from its earliest years. In 1959, it became a "general campus," separate from UC Berkeley, with the understanding that it would maintain a focus on teaching and research in agriculture. In this context, it makes sense that concern for *scientific literacy* (or SL) is stated clearly in the UC Davis "Revised General Education Requirement" document:

> The objective is to create graduates who understand the fundamental ways scientists approach problems and generate new knowledge, and who understand how scientific findings relate to other disciplines and to public policy. (University of California, Davis "Revised")

But SL is not just important to science students or future scientists. One of the most common arguments for SL—that it enhances citizens' decision-making abilities—applies to everyone, regardless of their career paths. Thus, SL matters as much in a humanities-focused program or campus as

it does in an agricultural school like UC Davis. This is especially true of the second aspect of SL, the understanding of "how scientific findings relate to other disciplines and to public policy."

The problem, at Davis and elsewhere, is that science classes teach students how to solve scientific problems and create scientific knowledge, but many do not address the sciences' relationships to other areas of study and to society as a whole. Even when science classes do address this broader scope, they necessarily do so from an internal perspective. However, to truly understand these broader issues, students need to look at science from vantage points outside of STEM (Science, Technology, Engineering, and Math), vantage points provided by Science and Technology Studies (STS) disciplines such as sociology, history, philosophy, and rhetoric of science.

Even science educators agree that SL often is not, and cannot be, addressed solely within STEM disciplines. Science Education professor Jonathan Osborne writes in a 2010 issue of *Science* focused on SL that "[a]rgument and debate are common in science, yet they are virtually absent from science education" (463), and that

> Typically, in the rush to present the major features of the scientific landscape, most of the arguments required to achieve such knowledge are excised. Consequently, science can appear to its students as a monolith of facts, an authoritative discourse where the discursive exploration of ideas, their implications, and their importance is absent. Students then emerge with naïve ideas or misconceptions about the nature of science itself… (464)

Although it is understandable that many science courses emphasize content over critique—it is, after all, the point of "the programmatic goals of disciplinary classes—to become familiar with the content and issues that are salient in a given field" (Greene & Orr 149)—critical depth is exactly what is needed if students are truly to become scientifically literate—that is, if they are to attain a critical, not just an instrumental, scientific literacy.

At this point it is important to distinguish between different aspects of SL. The first, Instrumental SL, is a knowledge-centered approach characterized by most undergraduate science classes. As Bryan Brown, John Reveles, and Gregory Kelly explain, knowledge-centered perspectives on SL "value students' developing scientific knowledge, practices, habits of mind, and ways of using knowledge as citizens or individuals acquiring literacy for some extrinsic purposes" (780). Instrumental SL includes the kind of learning described in the first half of the UC Davis General Education requirements: how to "approach problems, pose questions, gather data, make conclusions, and then generate new hypotheses for testing" (*General* 3).

Instrumental SL, which is "confined to a surface-level recognition of scientific vocabulary and principles" (Zerbe 91), is good as a starting point. However, Zerbe points out that much science education stops here: "By and large, the contemporary curricular structure of science education leaves

little room for studying science as more than learning its experimental and observational methods" (91). Returning to Brown, Reveles, and Kelly, in such an outlook "scientific literacy remains abstracted from experience and ultimately disconnected from the lives of people engaged in their world" (780). To go beyond Instrumental SL,[2] it is necessary to situate science in its broader epistemic and social contexts by engaging in *critical scientific literacy* (CSL).

This second approach, CSL, is rooted in a sociocultural-centered perspective that "seeks to situate any definition of scientific literacy in the actions of accomplishing everyday life" and in so doing, "considers how literacy is relevant to particular tasks at hand in some relevant social context" (Brown, Reveles, and Kelly 780). They continue:

> The task of using knowledge to accomplish a particular undertaking requires consideration of the modes of interaction and sociohistorical contexts brought into play in the construction of the literacy event. (780)

Although it is possible to go into more depth about variations within sociocultural-centered SL, such fine-grained taxonomy is less important here than the general concept of distinguishing instrumental from critical SL. Therefore, for the purposes of this article, I lump together the various aspects of the sociocultural-centered perspective—critical, epistemic, and ideological SL (see Zerbe 93-96)—under the heading Critical Scientific Literacy, or CSL. What these different aspects of CSL have in common is attention to knowledge-making processes in science, to the construction of scientific authority, and to the interplay of science and society.

Explaining why CSL matters does not explain why I think Writing Studies is well positioned to foster CSL. Here I offer two reasons, one general and one specific. First, on a general level, much of what is touted as CSL is actually critical thinking, an area where Writing Studies curricula have long excelled. In 2010 *Science* article, P. David Pearson, Elizabeth Moje, and Cynthia Greenleaf acknowledge the overlap when they write that "Science and literacy use many of the same reasoning processes: setting purposes, asking questions, clarifying ambiguities, drawing inferences from incomplete evidence, and making evidence-based arguments" (460). Similarly, Osborne suggests that students need not only "explicit teaching of how to reason" but also "a knowledge of the meta-linguistic features of argumentation (claims, reasons, evidence, and counterargument) to identify the essential elements of their own and others' arguments" (466)—curricular needs that clearly fall within the domain of Writing Studies.

Second, more specifically, Writing Studies is uniquely suited to foster CSL because of its interest in critical literacies. The *National Science Education Standards* (*NSES*) state that scientific literacy "includes understanding the nature of science, the scientific enterprise, and the role of science in society and personal life" (Center for Science, Mathematics, and Engineering Education 21). A rhetorical approach can help reveal the discursive nature

of science and the role that texts play in mediating knowledge in and about science. In addition, as Zerbe notes, Rhetoric has a tradition of questioning dominant discourses and "a constant dedication to keep a close eye on powerful discourses" (2). He adds that in the early centuries of Rhetoric, the powerful discourse was the law. Later, religious discourse came to dominate, and rhetoricians focused their attention on the church. Today, science is one of the most powerful discourses—if not *the* most powerful discourse—in the world, and as such merits our scholarly and pedagogical attention.

Theoretical Rationale

I designed the curriculum with three main goals. The first goal was for students to see science as a sociocultural phenomenon, to see how it shapes and is shaped by the larger culture of which it is a part. The second goal, specific to rhetoric of science, was for students to recognize the discursive nature of science-related texts, and to be able to identify and critique the rhetorical moves in those texts in terms of how those moves construct popular understandings of science. The third goal, not specific to CSL, was for students to engage in scholarly practices: engaging in intellectual inquiry, seeking out and questioning evidence, understanding and questioning their own and others' perspectives, and articulating their findings and positions in clear and coherent prose.

In approaching the first goal, to help students see science as a sociocultural phenomenon, I was aware that a truly critical scientific literacy is interdisciplinary, characterized by knowledge and understandings not from the sciences but also from sociology, history, and philosophy of science (to name the most established science studies disciplines). Given the science-and-technology-oriented nature of the UC Davis student body, I could assume that most students had already begun acquiring instrumental scientific literacy. However, because UWP 011 is a lower division elective I could not assume students had any previous exposure to science studies. Therefore, I needed to provide some Science and Technology Studies (STS) perspectives, which I did during the first two weeks. To place our guiding questions in a historical context, I spent half of each class session explaining the history of science writing and of science popularization. I also introduced the two models of science popularization we would be using all term, models based on STS scholarship in Rhetoric, Communication, and sociology.

The first model goes by various labels, including the "deficit" model, the "Public Understanding of Science and Technology" (PUST) model, or in my own coining, the "Public Appreciation of Science and Technology" (PAST) model.[3] In this model, science communication is characterized as a one-way flow of reliable information from the scientific sphere to the public, with that public viewed as a "blank slate of ignorance on which scientists write knowledge" (Myers 266). The model is characterized by an uncomplicated view of science that promotes a "positivist view of the inexorably rational and progressive nature of scientific knowledge" (Taylor 115). It is also based on

"a pervasive but outdated and overly simplistic model of communication as a simple linear process" (Hansen 107) in which scientists produce knowledge, the knowledge is packaged in language, and the packages are opened by the public and the knowledge in them absorbed in its original form.

One especially problematic aspect of the PAST model is the way it fails to distinguish between hot and cold science. Cold science (a.k.a. "textbook" science) is certain. It's the knowledge that has stood the test of replication and peer review and time. Hot science (a.k.a. "frontier" science) is much less certain; it is science in the making. This distinction was important in UWP 011 for two reasons. First, it helped students see the difference between what happens in classrooms and what happens in reality. Science classes, especially foundational undergraduate classes, teach cold science. Reducing science literacy to this level tends to promote "a damaging illusion that real science is somehow like school science" and so risks "communicating naively inductivist and empiricist misunderstanding of how science creates knowledge" (Turner 63). Second, it circumvented a miniature replay of the science wars by acknowledging all the ways that science has contributed solid understandings of the world while also admitting that not all science is equally reliable. In other words, it gave us a way to talk about science as *both* certain and uncertain, a key element of the second model of SL.

The second model, dubbed the "Critical Understanding of Science in Public" (CUSP) model by Peter Broks, focuses on both of the "twin duties" of science communication: "to inform and educate the public about science on the one hand, but also to probe and criticize it on the other" (Russell xiii). In contrast with the deficit-minded PAST model, the CUSP model evaluates popular science texts in terms of how well they bring to discussions of science a much-needed set of "citizen views, which bring in notions of equity and access, ethics, control and sustainability" (Einsiedel 181). Given the importance of understanding hot science, a primary aim in UWP 011 was to help students see science and its institutions in context, and to begin thinking about how many aspects of science are socially constructed. Becoming aware of the constructedness of knowledge "changes the geography of all previous categories; it denatures them as heat denatures a fragile protein" (Haraway 157). This denaturing, or denaturalizing of what seems natural and inevitable, opens up texts to critical questions about demarcation (e.g., What is science? What distinguishes science from other knowledge-making endeavors?) and about science in society (e.g., What is the role of science in society, and the role of society in relation to science?). Asking such questions helps to break down a monolithic view of science and allows students to build more complex understandings of science as a set of practices, institutions, and relationships. In other words, the CUSP model of SL eschews the reductive distortions of the PAST model and offers a more useful framework for critical engagement.

The two models of scientific literacy informed how I approached the second goal—for students to be able to identify and critique the rhetorical

moves in texts about science—in terms of my text choices and the rhetorical lenses we used to analyze those texts.

The main course text was *The Best American Science and Nature Writing 2010* (*BASNW 2010*), a collection of 27 essays and articles edited by renowned physicist Freeman Dyson. A few supplemental articles from other sources were provided via the course SmartSite. I focused the course on popular science texts because these texts serve as "important components of the perception and practice of the contemporary cultural institution of science" (Zerbe 105) and therefore offer relatively easy insights into that cultural institution. Also, in contrast with primary scientific literature, popular science texts often show scientific issues in their social contexts while also being more accessible than scientific journal articles. As Zerbe argues, "in many ways, efforts to achieve a culturally informed, meaningful scientific literacy can be recognized and realized more quickly in popularizations than in original research" (106). Popular science texts allow students to engage with texts at the rhetorical level more readily than they would if they were struggling to learn the background science first.[4]

To teach a CSL-specific approach to rhetorical analysis, I introduced five analytic lenses[5] that are useful for identifying where popular science texts fall on the PAST/CUSP continuum. These lenses, in the order used in class, were demarcation, expertise, modes and stases, ethos and persona, and certainty/uncertainty and risk.

- The demarcation lens looked at how texts create a relationship between science and society. Using this lens, we looked at whether a given text supported the dominant view of science as something apart, or a critical view that situates science in its sociocultural context.
- The modes and stases lens illuminated how texts create subject positions, that is, the relationship between readers and science. This lens looks at what kind of stance readers are invited to take toward science.
- The expertise lens built on the modes and stases lens by showing how texts create a narrow or broad scope of participation in science-related decision-making.
- The ethos lens looked at how the relationship between the writer and science, that is, how a text creates the writer's technical credibility on science topics. Balancing this is the "persona" lens, which looks at how the writer creates a relationship with the reader.
- The certainty/uncertainty and risk lens revealed a writer's use of hedging, identified when hot science is being presented as more certain than it is, and helped students judge socioscientific issues such as the costs and benefits arising from particular courses of actions.

Explaining all five lenses would take more space than I have here, so I will focus on expertise as an example.

A PAST depiction reduces expertise to a binary in which scientists have it and non-scientists don't. In contrast, a CUSP depiction represents expertise as coming in different forms, with formal scientific training being one among several legitimate ways to learn about the world. Drawing on work by H. M. Collins and Robert Evans in sociology of science and Beverly Sauer in technical communication, I presented six categories of expertise. The first four come from Collins and Evans:

- Contributory expertise: The ability to do something well, or add to a body of knowledge. Researchers have contributory expertise within their research areas.
- Interactional expertise: The ability to use the language of a domain, but without "practical competence" (Collins and Evans 14). For example, a software project manager might not know how to program, but will know how to talk about programming well enough to communicate with programmers.
- Meta-expertise: The ability to judge others' expertise without having it oneself. An NSF grant committee includes members who do not have knowledge in the specific area of any given grant proposal but can still evaluate the quality of the proposal.
- Referred expertise: The "use of an expertise learned in one domain within another domain" (15). A student who learns good study habits in one discipline can apply those habits to another discipline after changing majors.

From Sauer, who argues for a greater understanding of "the interdependence of scientific knowledge and local experience, and the rhetorical presence of tacit knowledge" (20), I drew two additional concepts:

- Local expertise: The knowledge of "interested citizens" (79). Many California students have developed local expertise regarding the state budget and education funding.
- Experiential expertise: "Tacit or craft knowledge" (79). Many laboratory skills—for example, pipetting, preparing slides, and adjusting microscopes—require hands-on experience that cannot be provided via lectures or textbooks.

In deciding how to identify a text's representation of expertise, we asked questions such as: Who gets quoted? Are different kinds of experts quoted and critiqued in the same way? For example, whose contribution is given a positive label? A negative label? Whose assertions are weighted for their soundness, and whose are accepted as given? Authority comes in part through use of a specialized vocabulary. Who has one? Only scientists?

Others as well? Whose vocabulary is quoted? We asked these questions in class about Trevor Corson's "Stalking the American Lobster," a text that contains several kinds of expertise, then students applied them in their responses to a similarly broad-minded article, Burkhard Bilger's "Hearth Surgery." Asking such questions helps support SCL by looking at how "writing works in the world and how the 'tool' of writing is used to mediate various activities" (Downs and Wardle 558) and thereby encouraging readers to consider not only what a text says about its topic, but also how it construes scientific authority, and what kind of relationship between science and society it presents as normal.

Students responded to texts using the different lenses in classroom discussions and in their written assignments, the latter also supporting the third course goal: for students to engage in scholarly research and writing. Students wrote six responses and a research paper. The response assignments included three parts: a summary, a response, and an analysis.

The 200-300 word objective summary of the popular science text encouraged students to read for the writer's point of view, and it allowed them to practice summarizing, a foundational skill on which more critical skills are built.[6]

The 200-300 word response asked for their subjective reaction to any aspect of the text. Education experts suggest that good teaching helps students "see connections between what they are learning and their personal goals" (Glynn, Aultman, and Owens 164) or interests, and this part of the assignment was intended to help students make those connections. Additionally, the responses helped foster the critical aspects of scientific literacy. Given that science classes often train students to passively accept information, it was important to create a space in which they could break the sometimes-tacit rules of academia by saying whatever they wanted to about a text or an idea. I wanted to break them out of a passive reception mode and encourage opinions, no matter how subjective.

The 200-300 word rhetorical analysis gave students a chance to use that week's theoretical lens in practicing critical reading and analysis. Through this part of the Summary/Response/Analysis (SRA), students "become much more used to critical maneuvers with texts" (Downs and Wardle 572) such as asking about the writer's possible motives. For example, in the SRA using the expertise lens, students not only identified what kinds of expertise were represented in an article, but also speculated about why the writer might have chosen to cite those particular experts and about what effect those choices had on readers' perceptions of the scientific enterprise described in the article.

The overall idea behind the SRAs was to give students repeated opportunities to practice taking different stances toward texts, and to do so in a relatively low-stakes manner. Therefore, the grading criteria were geared toward clarity of expression, and I dropped the lowest of the six SRA grades.

The research paper included all three aspects of the SRA and added a research component. Each student chose a text from *BASNW 2010*, used one of the lenses to identify PAST elements in the text, and wrote about how the author could have made that aspect of the text more CUSP. This involved research, as the student had to find information the author had not included. Beyond requiring that students consult a range of sources and discuss them with me and with my TA, I wanted to leave open as many parameters as possible because "[w]hen students have the opportunity to help design their educational activities… they are more likely to benefit from them" (Glynn, Aultman, and Owens 158). Allowing students to choose any text, any aspect of that text, and any lens allowed them to pursue whichever of their own intellectual interests were sparked by the texts they had read and the concepts they had learned. The 27 pieces in Dyson's collection offered students a wide range of texts to choose from, while limiting their choices to those pieces ensured that students' workshop peers were familiar with the piece that any one student wrote about. The assignment included four stages—proposal, research report, draft, and final revision—with feedback at the proposal and draft stages.

I had two specific goals for this assignment. First, I wanted students to see texts as *rhetorical*, as being the result of a series of decisions the writer made. Looking at texts in terms of what the writer might have done differently really brought home to them that writers leave things out. Articulating those decisions in terms of the rhetorical concepts made students connect those textual decisions to social dynamics beyond the text. Thus, they became more able "to recognize texts not as information but as the words of real people" (Downs and Wardle 572).

I also wanted the assignment to help students see science, in Zerbe's words, "as more than learning its experimental and observational methods" (91). In the research paper, each student delved more deeply into a specific aspect of science. Those who chose to look at texts in terms of demarcation learned more about how texts create expectations about what the relationship between science and society is or should be. Those who chose to look at texts in terms of modes/stases, or in terms of certainty/uncertainty and risk, learned more about knowledge making in science. Those who chose to focus on textual representations of expertise, or on ethos and persona, learned more about constructions of scientific authority and of its relationship to other forms of knowledge. No matter which lens they selected, students had to find out more about the broader epistemic and social contexts for the science in their chosen articles.

Critical Reflection

Based on changes I saw in students' work and in class discussions, I think the class met its two main pedagogical goals—to increase students' CSL and their rhetorical understanding of texts—quite well. Although I don't have IRB approval (which I did not think of getting) and so cannot quote

directly from student writing or evaluations, I can talk about the *kinds* of changes I saw.

The first major change was that students started asking critical questions about the readings and about science such as: What is the author's background? Where was this article first published? How might that have affected the writer's focus? Where was the scientific study published? Has the study been replicated? Has it been refuted? And what is the "n" on this study?

These kinds of questions are essential for critical literacy in general, but especially for scientific literacy. The *NSES*, whose definitions of SL I quoted earlier, also defines SL in terms of "being able to read with understanding articles about science in the popular press and to engage in social conversation about the validity of the conclusions… [and] to evaluate the quality of scientific information on the basis of its source and the methods used to generate it" (Center for Science, Mathematics, and Engineering Education 22). As a group, the class moved from a generally one-dimensional view of scientific studies as either right or wrong, to a more nuanced understanding of science as a process in which there are varying degrees of accuracy that must be judged in context.

The second change was that students grew comfortable using the lenses as a heuristic and approaching texts analytically. For example, when reading an expert's comment on a topic they would ask questions like "Is the scientist being quoted on a topic a contributory expert in that area? If not, does the scientist have some other kind of relevant expertise (e.g., metaexpertise or referred expertise) that makes the scientist credible on this topic?"

They also learned to read rhetorically, considering authors' choices and asking questions about a text's composition. They also, in the words of Downs and Wardle, "became much more likely to recognize texts not as information but as the words of real people" (572). Their research papers were especially revealing on this front as, in searching for answers to some questions, they sometimes found answers to questions they hadn't thought to ask. In a few cases, those unexpected findings turned out to be more interesting to them than their original queries had been. One student, looking for information on the research methods used in a study, was surprised to learn that the research team included not just Americans, as the *BASNW 2010* article had implied, but people from several other countries as well. This discovery prompted an interesting discussion of nationalism (or provincialism) in science popularization and a new look at other texts to see if they did the same thing.

As they grew more comfortable looking at science critically and at texts rhetorically, students also increased the complexity of the views they adopted and expressed during class discussions and in their writing. Specifically, their textual analyses grew more nuanced as they moved from blanket reactions to texts, labeling a given text as PAST (bad) or CUSP (good), to discussing texts in terms of a combination of PAST and CUSP elements.

The writing assignments helped students develop a critical stance toward texts and toward science. With the weekly SRAs, I showed students that any thoughtful, well-supported claim was acceptable by playing Elbow's "believing game" as I read and responded. In one early SRA, a student talked about how little he cared about the topic, a comment I considered just as valid as other students' more enthusiastic responses. Allowing students to express themselves freely in the "response" sections, and making sure to respond positively to any response, reinforced the message that challenging dogma was acceptable, and even favored.

The SRAs also helped students learn and/or practice foundational skills such as summarizing texts and conducting rhetorical analyses. This practice was helpful when they wrote their research papers because they were already in the habit of thinking about texts in terms of the writer's choices. The research paper then built on this foundation by having them do an inquiry-driven investigation into what writers weren't saying. The stages described above—proposal, research report, draft, and final revision—worked well. None of the students had trouble choosing an article, topic, or lens, and collectively they chose the full range of lenses. For example, some students selected highly epideictic texts and explored the forensic detail that the author might have included. In some cases, the students showed how that detail would have supported the author's claims; in other cases, the students showed how the epideictic prose was hiding some unsavory facts. Other lenses were similarly used to guide students' research and to help students critique the primary texts.

I will make changes in the concepts I cover when I teach the course again. Shawn Glynn, Lori Aultman, and Ashley Owens suggest that faculty engage students' interest "by introducing them to concepts that are moderately novel and moderately complex… [to] pique the students' curiosity, while avoiding boredom or anxiety" (164). In designing the course, I had tried to aim for a middle ground between boredom (too little complexity) and anxiety (too much), and at the end I felt I had aimed too far toward the anxiety end of the spectrum. There were a few reasons I felt this way. First, on a purely subjective level, I felt rushed. Perhaps in response to this feeling, during the course I found myself merging some concepts that seemed close enough to warrant their not being taken separately. More importantly, many students didn't quite grasp a fundamental concept of the course, a rhetorical understanding of genre in which texts are viewed as "mediating artifacts rather than things in themselves" (Bazerman and Russell 1). It was clear in retrospect that I need to slow down and give more time to the concept of genre. At the same time, I want to keep the course complex, not only to hold students' interest but also to accurately convey the complexity of the popular science writing genre and of issues of science in society.

Ultimately, I have decided to maintain the basic framework of the course, but to streamline it by removing one concept, merging two others, and changing the order in which we use the lenses. The topic I removed

is the distinction between science and technology (not mentioned on the syllabus but brought up in the initial lecture); we didn't have enough time to address it well, and the distinction turned out not to be germane for the issues we discussed. As physicist and philosopher Gerard Fourez notes, although science and technology are different, the importance of the difference depends on the context; sometimes the differences matter and other times the similarities matter (909).

The topics I merged, in action last Winter and in the plan for this Winter, are risk and certainty/uncertainty (week 6 in the syllabus). I also plan to move these from the end of the course to near the start. That is, after the opening material (sociohistorical context, the PAST and CUSP models, and hot versus cold science, covered in weeks one and two), I will move directly to talking about risk and uncertainty. Addressing risk and uncertainty together makes sense as the two generally blur into each other—uncertainty matters most when there is something at risk, and risk is harder to talk about in conditions of uncertainty than when likely outcomes are known. Addressing these first makes sense because in Winter 2011, these were the concepts that really cemented students' understanding that science is not just something that happens in a lab but instead is an inseparable part of our lives. Having that understanding come in week two or three, instead of in week six, should result in more productive discussions earlier in the quarter. If we can reach a level of critical understanding in week three that last time came in weeks six and seven, we should be able to push the critical reading and analysis aspects of the class even further.

Shifting the risk and certainty/uncertainty lens earlier also makes sense because talking about risk and uncertainty immediately after introducing the idea of hot and cold science will demonstrate why the distinction matters when discussing science in society; distinguishing hot from cold science lets us acknowledge the many contributions of science while maintaining a critical perspective. Or, as Michael Ford puts it, seeing science in these terms allows us to escape from the "positivist endeavor" that "casts the success of science in terms of universal logic and scientific methods" (Ford 406), while still realizing that the various sciences have, over the years, "resulted in considerably reliable knowledge claims" (407).

Along with changing the order of the lenses, I plan to change the order of the readings. In Winter 2011, I started with some models of good (CUSP) popular science writing, thinking they would provide a positive benchmark against which students could measure other texts. That turned out to be a mistake; until they saw the problematic aspects of popular science writing in the PAST model, students were confused about why the PAST/CUSP distinction mattered. When they did read an overtly PAST-model text, they expressed immediate comprehension and they became more actively engaged in exploring where other texts fell on the PAST-CUSP continuum.

A quick illustration comes from the first article in *BASNW 2010*, Andrew Corsello's "The Believer," which we read in week eight. Although we had

talked and read *about* the problem of popular science writing that describes scientists in godlike terms, the class didn't fully appreciate this problematic trope until they read descriptions of the scientist-entrepreneur Elon Musk that cast him in blatantly religious terms. For example, in his childhood, when his siblings and cousins were afraid of the dark, six-year-old Musk knew better, and Corsello shows the scene through the eyes of Musk's aunt Maye:

> The light has mostly waned, but Elon, he's so *white,* skin as pale as a fish's belly, and Maye Musk can see his face so clearly. Beaming. Euphoric. Because he *knows.*
>
> Elon hasn't been bickering with his sister and brother; he has been evangelizing. And now he raises both arms to make sure they can see, as well as hear, the good news.
>
> "Do not be scared of the darkness!" Elon Musk calls out to them from the wilderness. "There is nothing to fear—it is merely the absence of light!" (3, emphasis in original)

From his early years as miraculous child, "a child with freakish talent" (3), to his adult mission "to give the human race its biggest upgrade since the advent of consciousness" (5), Elon is shown as nothing less than godlike in his abilities and his scope. Once students had read and discussed the problems with this kind of presentation, including the fact that setting up scientists as gods can easily lead to disillusionment when they fail to produce miracles, they had a better sense of how other texts better served science and readers of popular science texts by presenting scientists in more measured, reasonable, and human terms. In Winter 2012 I plan to use a similarly blatant example from the *Best American Science Writing 2011*, assigning it during week one so I can refer to it while explaining the PAST model of scientific literacy.

Having narrowed the course's conceptual breadth and reordered the readings should let me add a few secondary sources to the mix. Not having taught this kind of class before, and being new to teaching lower division courses at UC Davis, I was initially unsure about what kinds of secondary texts would be appropriate, or whether they would fit into a quarter already stuffed full of reading popular science texts. After teaching the class, I think that my initial instinct to focus on primary texts was sound, but that I can work in some secondary sources. In particular, I plan to add two articles.

The first article is Kelly Dirk's 2010 "Navigating Genres" article from *Writing Spaces: Readings on Writing*. Unlike more theory-heavy genre texts I considered and rejected as being at too high a level for UWP 011—for example, Carolyn Miller, Amy Devitt, and Anis Bawarshi and Mary Jo Reiff—Dirk's article introduces the concept of genre in terms suitable for an undergraduate course. It also uses easily grasped examples to illustrate how genres function socially and epistemically (without ever resorting to the word "epistemically"!). I also plan to use "Science's New Social Contract

with Society," a short (four-page) *Nature* article in which physicist Michael Gibbons argues that scientists need to be more concerned with how their work affects others, and should "ensure that scientific knowledge is 'socially robust', and that its production is seen by society to be both transparent and participative" (C81). While the article by Dirk should help students better understand genre, Gibbons' article shows that scientists as well as humanities scholars care about open communication between scientists and the public.

UC Davis is on the quarter system, and the limitations of a ten-week term meant I had to leave out assignments I would like to have included. If I had more time, I would make three significant changes. First, I would add more secondary sources. Second, I would add some scientific research articles. An ideal text for this is *A Century of Nature: Twenty-One Discoveries that Changed Science and the World* (Garwin and Lincoln), which brings together 21 original articles published in *Nature* during the twentieth century with commentaries written on them today. The book would be excellent because it reflects "a relatively common popularization goal… of promoting a more holistic view of science and highlighting its inextricable connections to culture at large" (Zerbe 109). And third, I would add a stylistic imitation exercise. I have done this in previous creative non-fiction classes, and it is immensely effective for helping students understand the way that tone and stance are created at the level of word choice. Basically, an imitation piece would do at the micro level what the research paper does at the macro level—show students how different decisions create different textual effects.

In terms of disciplinary identity, I would like to say that UWP 011 has helped establish the writing program as a disciplinary unit that is dedicated to but goes beyond its service function in teaching required composition courses, but I know better. Even the most well-received class is a fraction of the curriculum needed to create and sustain disciplinary status, and the struggle for recognition is much bigger than one class, or one professor, or even one program. That said, UWP 011 does complement and support our existing curriculum by adding a theory course that dovetails nicely with a WAC-based view of writing as always rooted in a particular context.

Over all, despite the bumpy aspects in Winter 2011, and the new bumps I am sure I will encounter in Winter 2012, I think that UPW 011 and courses like it are well suited to meet important social and academic needs for critical and rhetorical scientific literacy. Even though students in UWP 011 did not fully grasp a central concept of the course (genre as social action), they did learn to view texts as rhetorical artifacts, and to see science as embedded in and influenced by its sociohistorical context. And while I initially resisted paring back what seemed like an overly narrow conceptual toolkit, reviewing student papers to write this Course Design has reminded me that the goal is not to teach students to do everything. Rather, it is to broaden their understanding of what can be done, and to teach them to do some aspects of it well in the hope that they will maintain and build on those skills.

Notes

1. I use "Writing Studies" as an umbrella term that includes Writing, Rhetoric, and Composition Studies.
2. As Brown, Reveles, and Kelly note, valuing sociocultural-centered SL does not devalue information-centered SL, and vice versa. Thus, my emphasis on CSL does not reflect a desire to get rid of instrumental SL, but rather a recognition of its limitations.
3. I started out referring to it as PUST, but changed the label to the more accurate "Public Appreciation of Science and Technology" (PAST) after explaining for the umpteenth time that the "understanding" part of PUST was really about appreciation.
4. Zerbe does discuss ways to use scientific texts in first-year composition, and I refer interested readers to his excellent book.
5. Other concepts introduced during the course included: anthropomorphism and mechanomorphism, eugenics, the Mertonian norms, and various kinds of scientism (axiological scientism, epistemic scientism, existential scientism, ontological scientism, and political scientism).
6. Roger Ochse notes that "Single system reasoning is prerequisite to higher level reasoning, since reading comprehension and understanding of texts is the very basis of forming judgments and assessments in a multi-system reasoning environment" (4).

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UWP 011: Popular Science & Technology Writing

Course Description

The positioning of science and technology in society as reflected and constructed in popular texts. Topics include genre theory, demarcation, rhetorical figures, forms of qualitative and quantitative reasoning, and the epistemic role of popularization in science.

Course Texts

Dyson, Freeman, ed. *The Best American Science and Nature Writing 2010*. New York: Houghton Mifflin, 2010.

Articles on SmartSite (in the Resources à Readings folder):

Corson, Trevor. "Stalking the American Lobster." *The Best American Science Writing 2003*. Ed. Oliver Sacks. New York: Harper, 2003. 138-59. Print. (on SmartSite)

Franklin, H. Bruce. "The Most Important Fish in the Sea." *The Best American Science and Nature Writing 2002*. Ed. Natalie Angier. New York: Houghton, 2002. 80-88. Print.

Hirsh, Aaron E. "Signs of Life." The Best American Science Writing 2004. Ed. Dava Sobel. New York: Harper, 2004. 79-88. Print. (on SmartSite)

Margulis, Lynn, and Emily Case. "The Germs of Life." *The Best American Science and Nature Writing 2007*. Ed. Richard Preston. New York: Houghton, 2007. 123-26. Print.

Assignments

Assignment	%
Participation	10
Summary/Response/Analysis (SRA) on six essays (lowest grade dropped)	25
Midterm exam	15
Paper (proposal = 5, draft = 5, revision = 20)	30
Final exam	20
Total	100

Calendar

W = Week

D = Date ("J.04" = January 4th)

SRA = Summary/Response/Analysis

W	D	Reading Due	Writing Due
01	J.04		
	J.06	Dyson, "Introduction" Franklin, "The Most Important Fish in the Sea" (on SmartSite)	
02	J.11	Kolbert, "The Catastrophist" Osnos, "Green Giant"	SRA 1 = Demarcation (a.k.a. Science and Society, or Context)
	J.13	Corson, "Stalking the American Lobster" (on SmartSite)	
03	J.18	Bilger, "Hearth Surgery"	SRA 2 = Expertise
	J.20		
04	J.25	Kolbert, "The Sixth Extinction?" Weinberg, "The Missions of Astronomy" Hirsh, "Signs of Life" (on SmartSite)	SRA 3 = Stases/Modes
	J.27		
05	F.01	Carrier, "All You Can Eat" Manning, "Graze Anatomy" Margulis & Case, "Germs of Life" (on SmartSite)	SRA 4 = Ethos/Persona
	F.03	MIDTERM EXAM	
06	F.08	Stap, "Flight of the Kuaka" Stover, "Not So Silent Spring" Flannery, "The Superior Civilization"	SRA 5 = Certainty/ Uncertainty & Risk
	F.10		
07	F.15	Kunzig, "Scraping Bottom" Specter, "A Life of Its Own"	SRA 6

W	D	Reading Due	Writing Due
	F.17		Paper Proposal
08	F.22	Corsello, "The Believer"	
	F.24		Paper Research Report
09	M.01		
	M.03		Paper Draft
10	M.08		
	M.10		Paper Revision

Supplemental Materials

Instructions and Evaluation Criteria for the SRAs

Description

For each article, write:

- A 200-300 word objective summary of the article. Include its main point(s), and write this entirely in your own words (no quoting).
- A 200-300 word response to the article in which you share your personal reactions to or thoughts about any aspect of the article.
- A 200-300 word analysis of the article using the theoretical lens assigned for that SRA (see below).

Use the following headings to separate the sections: Summary (# words), Response (# words), Analysis (# words). For "# words," include the number of words in that section. Write each section separately, without any overlap.

Writing SRAs will help you:

- Practice shifting between three stances toward a text: An objective stance in which you simply report, a subjective stance in which you offer personal reactions, and a scholarly stance in which you evaluate the text.
- Practice writing concisely and clearly.

Evaluation Criteria

SRAs will be evaluated on content and professionalism.

Content:

- The summary is objective and includes the article's main points/ideas.
- The response includes your subjective reactions to or thoughts about the article.
- The analysis is insightful and is well supported with examples from the article.
- The writing throughout is clear and unambiguous.

Professionalism:

- The document heading includes your name, the date, and the title of the article you are writing about.
- The SRA file is named according the file naming conventions described in the syllabus.
- The SRA is written and formatted according to instructions.
- Grammar, mechanical, or spelling problems (if any) are minor and do not interfere with meaning.

Instructions and Evaluation Criteria for the Research Paper

Proposal

The proposal should be 1-2 pages (300-500 words) and answer these questions:

- What text you will examine from *The Best American Science and Nature Writing 2010*?
- Why are you are interested in that text?
- What lens will you use?
- Why is that an appropriate lens for your analysis? That is, what PAST element of the text does that lens allow you to see? Provide at least 2 examples from the text to show why this lens is appropriate for this text.
- What sources do you expect to use in your research? (This can be speculative, but please list at least 3-4 potential sources.)

Research Report

Write about a page (300 or so words) sharing the information you have found through your research. Please include citations.

Draft and Revision

The draft should be a *complete* draft of 4-5 pages (1200-1500 words) and should include:

- A brief summary (200-300 words) of your chosen article.
- An analysis of the article using your chosen lens, clearly explaining how that aspect of the article is more PAST than CUSP.
- An explanation, using your research, of how that aspect of that article could be more CUSP.

Evaluation criteria for the research paper:

- The draft is complete; it is 4-5 pages, and it includes all the elements listed above.
- The summary is objective and includes the article's main points/ideas.
- The analysis is insightful and is well supported with examples from the article.

- The research findings are used to support your explanation of how the article could be more CUSP.
- The writing is coherent, with explicit connections between points, evidence, and explanations.
- The writing is clear and unambiguous throughout.
- Sources are cited in an academic citation format.
- Grammar, mechanical, or spelling problems (if any) are minor and do not interfere with meaning.
- The revision thoroughly responds to and incorporates feedback given on the draft.