

THE SEDUCTIVE QUEEN – MATHEMATICS TEXTBOOK PROTAGONIST

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I reflect on the difficulty of bringing human agency to bear in authoring a mathematics textbook based on curriculum outcomes that seem to demand closed text rather than text that presents open choices for dialogue. The language in the text seductively removes you and I from the subject, leaving only mathematics, the queen of the sciences, as the voice of authority.

During the time I was writing chapters for mathematics textbooks to be used in Bhutan, I was also reading *Teaching Positions: Difference, Pedagogy, and the Power of Address*, in which Ellsworth (1997) investigates the way teachers address students. The juxtaposition of my reading and writing made me ask questions about the form of address in mathematics textbooks, questions that spill over into reflections about my role as an educator, particularly in the context of international collaboration. In this paper I reflect on how my writing influenced my reading of Ellsworth's text.

THE CONTEXT - BHUTANESE TEXTBOOK WRITING

The University of New Brunswick (UNB) recently completed three consecutive five-year projects for the Canadian International Development Agency that supported the development of education in Bhutan, a small mountainous kingdom situated between India and China. One of the other international partners that supported the development of education in Bhutan was the World Bank, which provided soft loans for writing mathematics textbooks that correspond to curriculum changes that were supported by UNB's most recent project. I developed courses for mathematics teachers as part of the UNB project, and I co-taught these courses with the Bhutanese educators who would continue to teach them in subsequent years. As a writer for the *Understanding Mathematics* textbooks funded by the World Bank project, I did my writing in Canada and then co-facilitated a writer's workshop in Bhutan, in which Bhutanese mathematics teachers helped us revise drafts of the books.

Before curriculum reform, Bhutanese schools followed Indian curriculum. India is Bhutan's primary neighbour and trading partner, so it is sensible to have the curriculum to set students up for tertiary education in India. Education leaders in Bhutan sought to develop a uniquely Bhutanese curriculum that addressed Bhutanese contexts and aligned with international foci. The new mathematics curriculum closely resembles New Brunswick's curriculum, which explicitly follows principles and standards established by the National Council of Teachers of Mathematics (NCTM).

POSITIONING FOR SEDUCTION

In the dictionary, seduction is related to attraction. Some definitions suggest an element of intent; people are trying to make themselves or their ideas attractive to others. Some definitions include a sense of manipulation; the person being seduced is manipulated to be attracted to someone or something that she or he would not normally be attracted to. I note that intent and manipulation may or may not coexist in a case of seduction. I would add to these definitions that a seducer fulfils the needs, real or imagined, of the seduced. The seduced person is usually taken as passive.

Elizabeth Ellsworth (1997) used a theoretical lens informed by critical film studies to describe the positioning in typical classrooms. The part that most engaged my reflections as a mathematics textbook author related to the idea of seduction in cinematography. She drew my attention to modes of address in film and in classrooms. The operative question is “Who does this film think you are?” (p. 22) or, in my context, “Who does this teacher think you are as a student?”

Ellsworth’s question relates to Umberto Eco’s accounts of the model reader. Eco (1994) described how texts create a “model reader – a sort of ideal type whom the text not only foresees as a collaborator but also tries to create” (p. 9). In this sense, I think a seductive text says, “I know who you are. I am giving you what you want.” The text addresses the needs of a real reader enough to transform him or her into the reader imagined by the text. I say that the text, and not the author, imagines and addresses the reader because a text constructs a model reader regardless of the author’s intent.

When Eco (1979) developed the idea of a model reader, he noted that there are different kinds of model readers. A “closed text” imagines and constructs a single reader. Only one interpretation is recognized. By contrast, in an “open text” “the author offers [...] the addressee a work *to be completed*. [The author] does not know the exact fashion in which his work will be concluded, but he is aware that once completed the work in question will still be his own” (p. 62). The text invites the reader to choose from a variety of interpretations.

Eco’s sense of closed and open texts relates to the orienting distinction made in appraisal linguistics – linguistic resources can be “broadly divided into those which entertain or open up the space for dialogic alternatives and, alternatively, those which suppress or close down the space for such alternation” (White, 2003, p. 259). White connected texts that open dialogue to Bakhtin’s (1975/1981) notion of heteroglossic interaction, and he connected texts that close dialogue to the notion of monoglossic utterances. Appraisal linguistics contributes tools of analysis (which are also used in systemic functional linguistics) to help us understand how the grammar of texts opens or closes dialogue. Along with Beth Herbel-Eisenmann, I have used appraisal linguistics to analyze mathematics classroom oral interaction (e.g., Wagner & Herbel-Eisenmann, 2008).

When Brian Rotman (1988) analyzed semiotics in mathematics, he noted a distinction among imperatives used in mathematics. This distinction relates to open and closed texts. He distinguished between inclusive commands that require a person to do something in interaction with others, and exclusive commands that direct a person to do something in isolation. He called exclusive imperatives (such as *write* or *put*) “scribbler” (p. 10) commands because one is expected simply to follow directions without questioning. He called inclusive imperatives (such as *explain* or *prove*) “thinker” (p. 10) commands because one is expected to engage with others, which requires a degree of responsiveness.

Ellsworth (1979) described how camera work in film has effects similar to texts that close and open dialogue. Like Eco, Ellsworth made clear that there is a difference between a real viewer and the viewer constructed by a film. “Multiple entry” (p. 27) is a necessity in the film industry because commercial viability depends on drawing in a diverse audience. Ellsworth used the example of *Flashdance*, which appeals to adolescent girls and boys for different reasons (p. 27). However, even while appealing to diverse needs director techniques can arouse the viewer’s “empathy for and imaginative collusion with a character’s intentions, experiences, goals” (p. 30) by, for example, filming shots from the principal character’s point of view. Ellsworth described how in alternative cinema directors often break typical forms to avoid seducing audiences to normalize one point of view: “The revolutionary hope was that changing modes of address in films might change the kinds of subject positions that are available and valued in society” (p. 30). “While audiences can’t simply be placed by a mode of address, modes of address do offer seductive encouragements and rewards for assuming those positions within gender, social status, race, nationality, attitude, taste, style, to which a film is addressed” (p. 28). Mathematics texts might seduce readers in similar ways to assume certain positions. In both mathematics and film, the hope is that alternative forms of address may encourage openness to multiple points of view.

With awareness of the possibility for seduction, I am prompted to reflect on how I engage in seduction when I write mathematics textbooks. How am I an agent of seduction? What tools have I employed to seduce? Do I draw mathematics students into a monoglossic world, positioning them as passive? How does this happen even when I do not intend to seduce?

AVOIDING SEDUCTION

Before authoring for the textbooks for Bhutan, I had done critical analysis of texts, which gave me a sense of some things to avoid in my authoring. In addition to building from real contexts that would be meaningful to the readers and writing to direct students to understand key mathematical concepts and procedures in the curriculum, I attended to grammatical features that had figured in my textbook criticism.

In critical analysis of a volume from the *Connected Mathematics Project* and a chapter from a text produced by the University of Chicago's *School Mathematics Project*, Herbel-Eisenmann and I drew attention to personal pronouns (Herbel-Eisenmann & Wagner, 2007). In particular, we noted that these volumes contained few personal pronouns and no first person singular pronouns; there were some instances of *you* and *we*, and no instances of *I* or *me*. The absence of first and second person personal pronouns masks human agency in the mathematics. When the oral discourse of mathematics classrooms includes these pronouns, teachers and students become aware of human agency in mathematics (Herbel-Eisenmann, Wagner, & Cortes, 2008). When the text shows people making choices, the reader sees that she or he too can make choices in mathematics. Thus the text is relatively open or heteroglossic. The absence of *I* and *me* is even more powerful in obscuring human agency than the absence of *you*, *we* and their related pronouns because *you* and *we* can be used in a generalizing sense. Rowland (2000) has described how *you* can mark generalizations in mathematics, not referring to anyone in particular, but to everyone in general. Pimm (1987) has described a similar generalizing sense of *we*, and Herbel-Eisenmann and I have given examples of this in our analyses.

LOCATING SEDUCTION

In the *Understanding Mathematics* series, for which I was authoring as I was reading Ellsworth (1997), I was pleased to find that the lead author had mandated the presence of an *I* voice in most of the lessons. The general structure of a lesson was a quick exploration called Try This, an Exposition, a return to the Try This, some Examples, and a series of questions called Practising and Applying. I will use excerpts from the Grade 7 book (Small et al, 2008) to consider how the structure of the text opened and closed dialogue. All of the excerpts are from chapters I authored.

Each Try This addresses the reader directly with imperatives and questions. These forms are intended to get students to do something, so there is a sense of student agency. But even with action the degree of agency can vary with the space allowed for making decisions. For example, in a lesson called "Area of a Trapezoid" the Try This shows a trapezoid drawn on dot paper. The instructions go like this:

This polygon is drawn on 1 cm dot paper.

A. i) Find its area by dividing it into a rectangle and two triangles.

ii) Find its area by dividing it into two triangles.

iii) Show another way you can divide the polygon into two triangles.

(Small et al., 2008, p. 144)

Using Rotman's (1988) distinction between inclusive, thinker imperatives and exclusive, scribbler imperatives, this Try This begins with scribbler imperatives (*find* and *divide*) and works toward a thinker imperative (*show*), at least nominally. There is only one way of performing part i and there are only two ways of performing part ii. A student in isolation can find the required divisions of shapes. He or she is only following directions, so the imperative in these parts are scribbler imperatives. For

part iii, the student is expected to show another possibility to someone else (perhaps a peer), so it seems to have a thinker imperative. However, because there is only one remaining possibility for dividing the polygon, there is little opportunity for different ways of thinking about the situation. Though the structure of working from independent scribbling to interactive thinking is sound (in my view), it still leads the model reader down a narrow path. Thus it is a closed text.

If the author's voice were recognized in the text (not hidden behind imperatives), it would be more open because the reader would be more likely to realize that someone decided what to instruct him or her to do. For example, if the text said, "I would like you to divide the polygon into two triangles" the reader might wonder why the author chose to give this direction. In oral mathematics classroom interaction, we see a person directing activity in this way all the time (Herbel-Eisenmann, Wagner, & Cortes, 2008). But when the author is masked, it is harder to question the text.

The Exposition is even more closed than the Try This, as it comprises a series of assertions about what trapezoids are and what the formula is. No person is shown to be naming the shape or developing the formula; the shape and formula simply exist. In the work to develop understanding of the trapezoid (still in the Exposition), I tried to draw the student in by using a *you* voice, asking the reader to imagine two congruent trapezoids fit together. With this thought experiment, I told the reader how to manipulate and think about the pair of trapezoids to develop the given formula. These are all scribbler commands. There is no interaction, and I presented only one way of doing things as if it were the only way. It is still a closed text.

For me, the most interesting part of the grammatical structuring of the mathematics comes in the Examples that follow the Exposition. Here the *I* voice appears. I do not think having a closed text up to this point would be so problematic if there were movement toward an open text, because the part of the text that is open would invite multiple points of view and serve to turn the earlier closed text into what White (2003) calls a retrospectively dialogic text; once a reader's attention is drawn to alternative possibility, even a text that is structured to be closed is open for question.

The Examples in this mathematics textbook were structured such that a question is followed by a two-column table showing a Solution in the left-hand column and the related Thinking in the right-hand column. In the top right corner of each Thinking section there is a photograph of a Bhutanese child apparently doing mathematics. There was a bank of six different photos to draw on, three girls and three boys. In each photograph the child is looking down at an open notebook and holding a pencil up to his or her right temple. (The one exception shows a boy holding the pencil in his mouth.) Each child is intended to embody thinking. Some of the Examples have more than one Solution and associated Thinking, each with a different student photograph.

Some of the curriculum outcomes were difficult to exemplify with open text. For example, the outcome "apply the formula for the area of a trapezoid" is by nature a

scribbling task, using Rotman's (1988) distinction. Thus the Thinking for the one Solution to an Example in this lesson does not open up alternative possibilities:

- I knew it was a trapezoid because the arrow marks showed that it had exactly two parallel sides.
- I identified the bases and the height. I noticed that the 6.8 cm side length was extra information that I didn't need.
- I used the formula.

(Small et al., 2008, p. 145)

All the verbs are exclusive, scribbler verbs because the student can do this in isolation. He or she "knows," "identifies," "notices," and "uses."

Other outcomes were easier to author as open texts. For example, for determining the area of composite shapes, I gave one of the Examples two Solutions. In one Solution, my fictional student used addition, dividing a polygon into a rectangle and three triangles. In the other Solution, my fictional student used subtraction, drawing a rectangle around the shape and identifying the triangles outside of the polygon. By showing two methods, I meant to suggest that multiple approaches are possible, but a reader could also assume that there are exactly two ways of performing the task. Again, the relevant curriculum outcome is performative; the outcomes are structured as imperatives, many of which are scribbler imperatives. In this case, the outcome reads, "estimate and calculate the area of shapes on grids."

In general, outcomes that required understanding or generalization were easier to develop with open text. They used thinker imperatives. For example, to address the outcome "determine if certain combinations of [triangle] classifications can exist at the same time" my Example asked, "Is it possible for a right triangle to also be isosceles? How do you know?" (Small et al., 2008, p. 112). The respondent has significant latitude. The Thinking I wrote went like this:

- Before I tried to draw it, I thought about whether it was possible.
- I knew an isosceles triangle had two equal angles and a right triangle had a 90° angle.
- I also knew the sum of the angles of a triangle was 180° .
- So, in a right isosceles triangle, there had to be a 90° angle and two 45° angles.
- I sketched the triangle and it looked possible. My sketch also helped me draw the triangle.

(Small et al., 2008, p. 112)

I had resigned myself to writing mostly closed text for scribbler curriculum outcomes. But then relatively open Examples like this one became interesting to me from the perspective of appraising the way text can seduce a reader.

HOW SEDUCTION WORKS

Ellsworth (1997) pointed out that realist representations can develop and maintain an illusion of difference. She focused on the illusion of dialogue in classrooms, and claimed that the use of dialogic forms of interaction masks an undercurrent of

control. With this illusion, understanding is the goal and conscious intention and consensus are valued while desire, conflict, and ambiguity are scorned: “By presenting themselves as desiring only understanding, educational texts address students as if the texts were from no one, with no desire to place their readers in any position except that of neutral, benign, general, generic understanding” (p. 47).

My question is whether something similar is at work in the *Understanding Mathematics* textbook, which is explicitly oriented to develop understanding. Do the dialogic, or open forms of text, such as the multiple *I* voices in the examples (and the thinker imperatives in other parts of the text), work as an illusion? In other words, does the text seduce the reader by suggesting open dialogue while maintaining closed positioning?

Any real reader is different from the model reader projected by a text. Even if the text is closed and seductive, a reader can resist being positioned in the way the text initiates the positioning. This is an important principle of the positioning theory developed by Harré and van Langenhove (1999). However, as an author I am interested in how the text initiates positioning. It was as I was writing the Thinking portion of the Examples that were structured to be the most dialogically open that I was especially conscious of the normalizing force of these sections.

In the Thinking about isosceles right triangles shown above, for example, the model student portrayed in the Thinking listed things he knew (the picture for this one is a boy) and he drew a sketch. His sketch included markings that showed the things he knew. I promoted these actions because I saw them as effective strategies to help students develop an understanding of the parameters and then form a generalization related to the parameters. It seems to me that educators are usually expected to promote effective strategies in this way.

A good way to reflect critically is to think about alternatives. In this case, I could have promoted certain choices explicitly by writing in the Exposition, “It is a good idea to draw diagrams when you think about a mathematics problem. You should list what you know and mark those attributes on your diagram.” This alternative would explicitly draw attention to the choices, whereas the Thinking format normalizes the behaviour without drawing attention to the choice being made.

The normalizing *I* voice is similar to the seductive camera technique Ellsworth (1997) described. Writing from the point of view of a model student is like positioning a camera from the point of view of the protagonist in a film. The seduction comes from the ease with which readers or viewers can see themselves in the place of the model student or protagonist.

Reflecting on my observations about open, closed, and seductive text in this mathematics textbook, I notice that the underlying structuring power of official curriculum. If a textbook is to “follow” the official curriculum, which is the norm for textbook structuring, then it seems inevitable that closed texts will result from performance-based curriculum outcomes. It seems clear to me that imperatives that

Rotman (1988) would call scribbler imperatives call for performance of narrowly-defined procedures, and would thus result in closed texts. Thinker imperatives may also be deemed as performance-based outcomes, but they are different. They seem to invite more latitude, and thus give an author of a curriculum-following textbook more latitude in structuring text. Though in my earlier analysis of mathematics textbooks I have decried the lack of an *I* voice, my experience as an author trying to use an *I* voice leads me to recognize that there are further subtle dangers. Using this dialogical form may seduce students who read the text to take up the one point of view I present to them even though I might intend for it to represent the possibility of multiple points of view.

RELATED SEDUCTIONS

My sense is that the closed and sometimes seductive nature of typical text in mathematics textbooks, and in particular the text that I authored, is connected to other seductions. Thus I ask what other apparent needs seem to be met by the process of my authoring, and how the fulfilment of these needs relates to the seduction or narrowness of mathematics as it is presented.

I have a personal need to be relevant. In particular, being relevant in the development of mathematics education in an exotic location feels good. The exotic connections seem to support my reputation as an educator. How does this need connect with the text I produced? For the teachers who mediate the text in mathematics classroom, I lend them expertise and authority so that they too can be relevant. And part of the explicit purpose of education is to equip students to be relevant to society.

With all this valuing of relevance, I have to ask what relevance is. It seems to be closely related to particular values though the word itself seems values-free. In this way, the goal of relevance is seductive. Relevance in general seems like an unquestionable need but any particular act of trying to be relevant would index a particular value set that is masked by the grammar and lexicon of objectivity. For example, me “helping” Bhutan revise its curriculum suggests that the curriculum needs revision, and it suggests that I know what Bhutan needs. So it seems that Bhutan’s culture is being privileged, but at the same time my culture and experiences are privileged even more. The superiority of my culture is reinforced by the idea that the Bhutanese need my kind of help to foreground their own culture.

Related to the exotic connections, I have noticed that I need to experience other cultures – other points of view – to develop my understanding of the people in the world around me. This need is what draws me to travel and work alongside people in Bhutan and elsewhere. I found it challenging to write text that provides readers with the experience of diverse points of view while writing to follow a curriculum that aims for particular kinds of performance mandated for “all” by the NCTM.

This tension is central to intercultural work and also to the work of an educator. The key questions are: Am I standing alongside the people I work with as we address

together the needs in a local context? Or am I standing in front of them, leading them (“helping” them) toward outcomes promoted outside the local context?

POSSIBLE PROTAGONISTS IN MATHEMATICS TEXTBOOKS

The difficult experience of writing mathematics texts for school in a dialogically open way prompts me to consider possible alternatives. It seems that the central problem to structuring an open text is the normalizing power of official curriculum. I see two ways of overcoming this power. One is to ignore it, as done by some innovative texts. Stocker’s (2006) *Maththatmatters* is such an innovative text as it comprises a collection of lessons that centre on social injustices and direct students to do mathematics that helps them understand the injustices in a particular way. As much as I approve of Stocker’s attention to social justice concerns that I share, I recognize that ignoring curriculum would be difficult for a teacher who is required by law to “deliver” curriculum. Stocker’s book would have to be supplemented by other resources.

A second way to overcome the normalizing force of curriculum would be to challenge it in the text. This approach, which resembles writing under erasure as described by Derrida (1976), allows for the possibility of presenting the curriculum while at the same time questioning it. This would require an authentic *I* voice – an author who reveals him- or herself to be reflecting on the things society expects of students. It would require the revelation of values outside mathematics itself as a stance from which to think critically about mathematics. Social justice concerns, such as those raised by Stocker, might provide an appropriate orientation.

This is an approach I am trying to use in this paper (though the content is not mathematics, but rather mathematics education). I am using an *I* voice. I am presenting analysis not in a detached way that implies objectivity, but rather as self-critical reflection. In this way, the text is open to dispute and different interpretations. I am vulnerable. I raise sore points, which may undermine my authority because of the of moral complexities of authoring pedagogical text, but may also substantiate my authority by positioning myself as a self-aware author.

If mathematical texts are closed and seduce students to accept unquestioningly a single point of view, the student is passive and cannot be an active subject or protagonist. And if the text hides its author, the author is not a protagonist either. I argue that only one protagonist remains: mathematics, which Gauss named the queen of the sciences. This is the queen who reigns and sits in judgment.

I prefer to think of the queen as the chess queen, which is the most powerful tool in chess a player’s repertoire. The player uses the queen (mathematics) to exercise his or her intentions. The player is not subject to the queen, but rather the queen is subject to the player. This is the way I would like to see mathematics portrayed in mathematics texts. This kind of portrayal requires a radically different stance on curriculum.

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