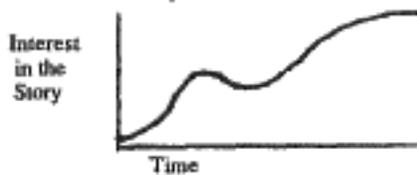


**Behavior-Over-Time Graphs  
as Literature and Writing Tools  
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Oct. 7, 1992**

This paper describes an English curriculum activity developed, in part, by Jay Barwell, an eighth grade English teacher at Orange Grove Middle School (Draper and Barwell, 1992), and implemented in various forms (at this date) by sixth grade English teachers at Orange Grove Middle School and a ninth grade English teacher at Catalina Foothills High School. In all three cases, I co-taught the classes with the literature teachers.

The activity involves the use of Behavior-Over-Time Graphs (BOTGs). BOTGs are one of a group of systems thinking tools that are useful in fostering the analysis of phenomena, systems or events and the synthesis of new structures for changing the behavior of such phenomena, systems or events.

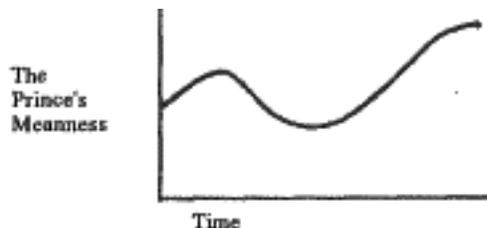
Simply put, BOTGs are numberless graphs that show the behavior of a phenomena over time. The following graph, showing the change in a student's interest while reading a short story, is an example of a typical Behavior-Over-Time graph.



**Marveen Dickey's Sixth Grade Classes**

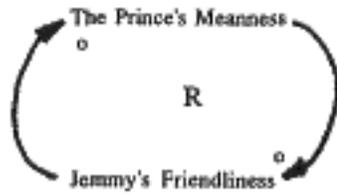
In Marveen Dickey's sixth grade language classes at Orange Grove Middle School students used BOTGs as tools to understand the dynamics of character traits in the book, *The Whipping Boy*. Students quickly learned to graph behavior over time by first plotting my progress as I walked across the room. They were asked to share and discuss their graphs with the rest of the class. They then graphed the strength of my smile as I grimaced over a three second interval, again sharing and discussing graphs.

The students then graphed the changes in the "the Prince's meanness" over the course of the story so far (they had not finished reading it yet). Students shared their graphs with their desk groups (four students to a group) first, then with the rest of the class. This time, there was much less similarity between the graphs than there was with the two demonstration phenomena. As volunteer students drew their graphs on the board, they pointed out the plot elements that precipitated a change in their graph. For example, a student said: "His meanness started high in the beginning, then went down a little when they were kidnapped, then went up again when they started arguing .." as she drew the following graph on the board.



Students then graphed and discussed two more traits, "Jemmy's friendliness" and "The number of friends the Prince has". Marveen and I wandered around the room, asking questions and listening to the student conversations. This made five total graphs the students had drawn within twenty minutes. I then put two of the character traits, "the Prince's meanness" and "Jemmy's friendliness" on the board, one underneath the other. After I connected the two phrases on the board with arrows, the students described the relationship between the two phrases: when the Prince's meanness increases, what happens to Jemmy's friendliness?

As students described the relationship, I drew causal loop symbols on the board and defined the symbols for what the students were describing. The following loop emerged:



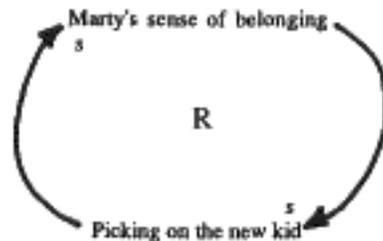
In other words, causal loop technology emerged from the BOTGs the students had generated. This differs from our (Orange Grove's) previous sequence of teaching causal loops and then determining the BOTGs. Students then brainstormed the options available to the book's characters to break out of the destructive reinforcing relationship modeled above. The students generally felt that if Jemmy could persist in being friendly (based on his experiences with other people) then he could help foster a lessening in the Prince's meanness. They felt the Prince's meanness had such a strong history that it would be difficult for this to be a leverage point. Students then predicted the outcome of the story, both in terms of words and graphs.

Marveen has since had students, for a different piece of literature (the novel *The Outsiders*) choose their own traits or events and then graph the changes in them over time. The students, as with *The Whipping Boy*, were actively engaged from the beginning, finding this an easy and meaningful way to accurately portray their understanding of a book.

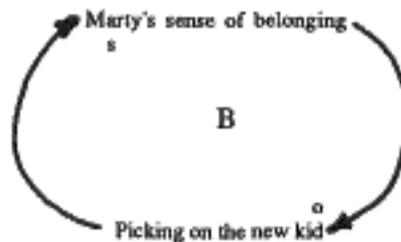
### Scott Baker's Sixth Grade Class

Scott's classes did nearly an identical activity but with a different piece of literature. Their story was *The New Kid*. This story also had interactions between children, some of them destructive, but unlike *The Whipping Boy* the characters were American kids and the conflict was left unresolved and in an escalating mode.

By the time Scott's classes tried the activity they had been introduced to causal loop technology in their science classes. When I wrote the two character traits on the board, one underneath the other, the students themselves said it looked like a causal loop and began spontaneously shouting out that it was a reinforcing situation.



All the students except one group in the afternoon class agreed on the reinforcing situation. This one group refused to stop thinking about the relationship where the book ended. They chose to continue the relationship beyond the book and thought it would eventually balance out.

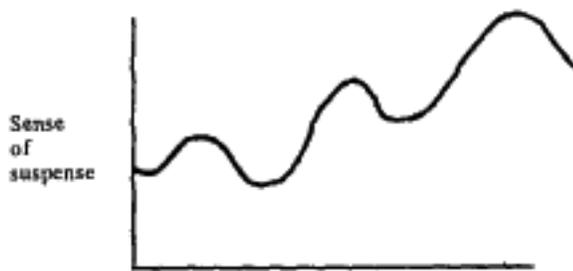


Scott then asked the students to apply the relationship to real life. The students gave examples of a recent teenage suicide in the news, the playground and other school examples.

### Nancy Linnon's Ninth Grade Class

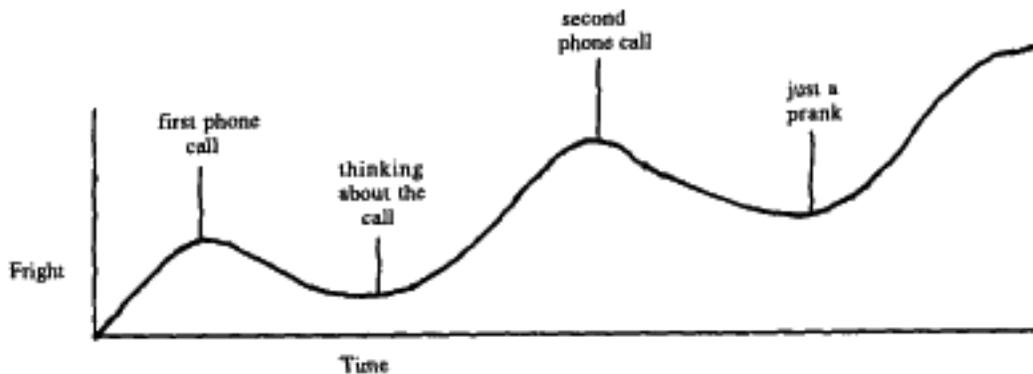
In Nancy's class the activity took on a different look and purpose. First of all, the two practice graphs of walking across the room and smiling were not done. It was felt that the graphing being done in ninth grade math classes was practice enough in graphing technology. Second, an entire double period of 90 minutes was devoted to the activity, compared to 20 minutes for the sixth grade classes. The students, in pairs, started in on graphing character and plot traits for the short story *The Most Dangerous Game*.

As with the sixth grade classes, students compared their graphs on the board, reciting the plot events that precipitated changes in their graphs. For the last graph, the teacher asked students to try to guess Connel's intentions: what was he trying to do to the reader? The students quickly chose a feeling of suspense as Connel's intentions. They then graphed and compared their sense of how the suspense changed over the course of the story. Almost all of the graphs looked like something this:



The students were immediately aware that Connel did not build a constant sense of suspense, but allowed it to ebb and flow in a generally building sense.

The next step was to use BOTGs as a prewriting exercise. Given the fact that an author has intentions for what they want to invoke in the reader, the teacher asked students to choose an emotion they wanted to invoke or manipulate in a reader, create a BOTG for that emotion as a goal for their writing, then identify plot events that will cause each change in inflection in the graph. An example was:



Students were then asked to write a very short story (no more than a couple of paragraphs or so) that would include the plot events they identified and the emotions they described. Every team of students wrote much more than two paragraphs. One pair of girls, after asking me if they couldn't do the whole thing in just one paragraph, proceeded to write over two pages of story.

After the stories were written, they were traded between author teams. The students, minutes ago purposeful writers, now became purposeful readers. Their job was to read the story, intuit the authors' intentions -- i.e. which emotions or feelings the authors were trying to invoke -- then draw a graph of their

impressions of the authors' intentions. The goal, as it was explained to the students, was to see how close an author and reader could come to knowing the same story

Sometimes the graphs were very similar, other times the graphs were very different. In either case, the writer and reader had some very definite things to talk about -- which things evoked high emotions, where the authors' intentions went awry, what the reader saw in the story. The discourse between the students was richer than the usual "I liked it" sorts of critiques common to ninth graders. Discussions of emotion, suggestions for rewrites, amusement at the differences in the graphs were evident around the room.

I fully intended to have the students swap stories around one more time, but they pleaded to have stories read aloud by the authors. I deliberately chose to have small group interactions rather than large group interactions because of the tendency for one or two students to dominate classroom discussions. I really wanted to keep everyone engaged and involved, but the students negotiated firmly and persuasively with me.

The students again and again asked to read their stories out loud. With 15 minutes left in the class period, one pair of students began to read their story. Contrary to their stated goal or intention and/or excitement, the story was hilarious. Before I could ask if anyone could graph out the authors' intentions, a student jumped up and, walking to the board, said he thought he knew what they were after. As soon as he was done, a different student said he disagreed and drew his graph. The concerns of non-engagement melted away.

By the time the class ended, students were disappointed that there was not enough time to hear all the stories. The engagement of the students was nearly 100% and the quality of criticism and discussion were as high or higher than the small group discussions.

The follow-up in Nancy's class is going to be more long term and will entail planning a sequence of activities that will promote the author/reader relationship we saw developing in one class meeting.