

# A Point of Inflection

by Scott Gerlach

From calculus, an inflection point occurs wherever a graph experiences a change in curvature. Such a point is inherently accompanied by a change in the direction of acceleration. In models of natural phenomena, inflections can be difficult to identify without having a very broad view, as the curve most nearly resembles a straight line at these points. But it's in this subtle moment of equilibrium that the balance of force changes: altering the graph's behavior and determining its upcoming shape.

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For the last decade or so I've made tutoring math and physics my business. Like most professions, educational vernacular is ripe with memes and buzzwords. In education we really like to shine a light on things.

"I just love those lightbulb moments."

"You can see it in their faces when the light comes on."

"Education is not the filling of a pail, but the lighting of a fire."

Shuffle through any discussion on education and you are guaranteed to trip over an analogy about light. Our business LLC is no exception: *Candeo*, which is Latin for illuminate. Admittedly, it's true there are moments where you see recognition suddenly appear on a student's face. These are the flashy extremes of education. Not sur-

prisingly, it's common to primarily attribute understanding to these moments and to altogether miss the more subtle, but influential, inflection points.

Lightbulb moments, particularly in the realm of complex ideas, aren't the product of a single insight. It is not the flip of the switch, it's the entire circuit of wiring within the wall. And it's that facet of education that is most compelling to me: designing paths to recognition specifically in very complex problems. In my work with students in math and physics I'm afforded a great deal of observable feedback. I work with dozens of students every week and each hour offers new opportunities to see how people respond to complex ideas and techniques. In nine years I've been through hundreds of iterative cycles on how to teach every elementary math and physics concept. My experience has helped me internally debunk one of the most pervasive teaching archetypes: the "adjust for the student's learning style" theme. Yes, certainly there are differences in how people learn. However, at this point the individualized approach to education based on a belief in learning style difference doesn't stand up to scientific scrutiny. Freeing myself from a diagnosis driven mindset has helped me focus on two chief aims when I work with students: finding the clearest articulations of complex topics and balancing interaction & consideration throughout my sessions.

Sometimes I imagine that I am curating the braiding of a rope. We'll consider each strand as we lay it across the previous and leave room for the next. Then at the last, we'll pull everything taut and test it's strength. The interaction is essential because it probes and asso-

ciates each piece of a complex idea. But the real magic for me is in imagining that there is a “best” way to go about it... a way that consistently leads to tighter, stronger understandings.

My one hour iterative sessions are interesting from a design perspective. I am able to see how quickly a student can take ownership of a given concept on the heels of a particular explanation. Although my appointments are one-on-one, at any given time during the school year, many of my students are working on the same concepts. This means that I can make slight revisions to how I approach a topic from appointment to appointment. I am also exposed to many techniques and ideas from the various curriculums and teachers at different schools. High school math and physics are perfect problem sets in this regard because they are fairly stagnant (almost everything being taught has been around for hundreds if not thousands of years), and the knowledge builds on itself so gaps in understanding are always eventually exposed. Because I work with most of my students for at least one year at a time—and in many cases throughout their four years in high school—I am also able to see how well their understanding of each particular idea holds up under the weight of all of the other concepts and techniques they will hang from it. Some analogies or acronyms are quick to learn or easy to remember but obscure important associations or falter when applied to more exotic problems.

As a tutor, this is where the gap between fluency and mastery of a subject emerges. Fluency is the ability to delve into a subject at any given time (it’s one of the essential competencies I look for in poten-

tial tutors). Whereas mastery is evidenced by the ability to design a reliable understanding of that subject for others. After hundreds of iterations, I can only claim to have designed a handful of explanations in high school math and physics. Most of the design that I have contributed has been built on tried and traditional techniques where I have found small gaps for improvement that lead the student to a more agile understanding and sustained success with the concept. Again, elementary math and physics are fairly well trod at this stage so any improvements in technique are slight but significant.

The interactive process that promotes comprehension in these subjects is huge part of my contribution as a tutor. I greatly value a mix of humor, some distraction, and a rigorous adherence to explicit reasoning from my students (the first two help the last bit go down). Working one on one is crucial in that regard. In my two years as a classroom teacher I recognized that it is extremely difficult to achieve a strict adherence to rules that is balanced with risk-taking and play in group dynamics... lags in transitions with a group force instructors to subvert one in favor of the other and the result is usually overly chaotic or stale. But with just one student, it's entirely possible to bounce around and still ensure disciplined steps. And so the student gets the powerful associative benefits of play without losing the integrity of a complex idea.

That said, nine years is longer than I thought I would ever spend doing one thing. I value the time I have spent tutoring and the insight I have gained, but I'm no longer accelerating in that role. Over time, I have become consumed by the prospect of designing under-

standing in other areas that have less resolved techniques and problem scopes. I realize now that I had been playing this idea out through my hobbies long before I could articulate it. Enter my fascination with college football and climatology.

People are often surprised to learn about my obsession with football. By all accounts, I come off like a guy who listens to indie rock alone inside a hollow tree and nurses abandoned baby birds back to health. They're *way* off. In reality I'm a guy who layers indie rock into video football analysis and none of the birds I have tried to nurse back to health have survived more than a day. I haven't taken up residence in a hollow tree yet, but I can't guarantee it won't happen. So why football? My appreciation of football stems from the interplay of three competing questions: What does a coach know? What can a coach teach? What is his team mentally and physically capable of? Football's complex action is an expression of layers of strategy, tactics, physical ability, teamwork, training, and politics. The sport also happens to have a huge, devoted following. And due to a stunted approach to commentating in conjunction with a less than forthcoming coaching culture, the majority of football fans have been insulated from many of the game's most compelling aspects. Blogs, online forums, and social media are all useful channels for addressing this void with my own analysis of strategic trends and critical commentary. The interactive format also offers instant gratification in the form of feedback, discussion, and virtual pats on the back.

My experiences during the bloom of online communities over the last 15+ years is an interesting delve into human behavior and

group dynamics through different online formats. It's also been exciting to see those interactions translate into relationships away from the computer. During the season, many online communities also throw tailgates leading to an oscillation each week between shared ideas online and shared beers before the game. I've seen people emboldened by their familiarity online who are able jump across social boundaries with ease.

I've migrated over the years from public forums to private message boards to widely read web blogs. And the format of my formal contributions has evolved over that time as well: from traditional plain text narratives of football practice during my college years toward—most recently—video breakdowns with graphical overlays after each game. In symmetry with my experience in tutoring, my explanations have not had to diagnostically diversify to reach different audiences: just the opposite... the format needed to be honed and refined. Abstract diagrams and still shots were replaced by variable speed video with graphical overlays. Meandering webcast style explanations were reigned in and planned out with audio scripts. Each iterative design change has actually led a higher density of interesting details and tightened the overall presentation rather than sacrificing one for the other; yet the product is still campy and authentic. The feedback I get from football fans is overwhelmingly positive. Consistently, people relay that they have learned more from my analysis in a few years than they did from decades of watching football: the spoils of venturing into a popular domain that does not already have well-defined teaching techniques.

On a more abstract level, the work that I put into football analysis exemplifies many of the benefits that attract me to outsider thinking. I am applying techniques that were carved out in other fields (technological fluency and meticulous teaching of complex problems) to an arena that doesn't naturally attract or promote those skillsets. The potential for innovation that can result from outsider thinking is obviously appealing. I am also a big fan of the pressure it puts on the traditional experts in the affected field. The people and organizations who can rapidly adopt and improve upon outsider insights can fracture the competitive landscape: outing their less adaptive peers in the process.

Football coaching is an ongoing success story in outsider thinking; another Michael Lewis's exposé is surely in the works. Many of the most productive outlying offenses in the last decade were the brainchildren of coaches who did not even play football at the college level (a significant departure from traditional grooming): Mike Leach, Chip Kelly, and Charlie Weis to name a few. Perhaps the most successful coach in the sport, Bill Belichick, studied economics in college and has repeatedly employed outside consultants from other fields of expertise to probe and challenge the inner workings of his organization. It's rumored this has led to several tactical shifts that have kept the Patriots franchise at the forefront of professional football including critical modifications to how they value personnel in the draft and how they evaluate potential changes in schematic architecture during the offseason. And that is precisely how outsider



thinking can be the most influential: as a catalytic disruptor in a stale environment.

In my own navigation of the Longhorn Football political landscape, I have often had to clarify the gap between my own self-taught understanding of the game and the practiced expertise of football that most college coaches employ. The format of online forums and blog discussions tends to lead to a lot of authority by association and parroting of themes. I would posit this is a direct result of two factors at work in these communities: co-opted logic and the desire to participate. As people read a well-reasoned opinion they often times co-opt as they read it. By the end of the article there's almost a feeling that they had a very similar view if they had just fleshed it out. I know because I've often nodded my head as I've read something, actually physically manifesting a "yep, that's what I think too". Co-opted logic gives the added benefit of allowing someone to layer observations on top of the foundation that's already there. In that action they have not only made their voice heard, but also taken some ownership of the original author's work without actually having done any of the legwork. In my experience, if conflict later arises over one of the original author's premises, it's actually the co-opters who tend to most staunchly defend those ideas. Over time this can lead to territorialism and cults of personality.

For the most part I have been successful in the realm of football at addressing conflict and disagreement simply through precise explanation. The data in question is usually fairly contained (game tapes) and so convincing people is just a matter of preparing the de-

tails in a way they can digest. Conflict resolution is simplified into an educational exchange. Not surprisingly, I have experienced that this is decidedly not true of problems with much larger scopes and less centralized data. Where “truth” is highly obscured, people seem to feel more entitled to their version of it.

Political and social issues bleed into almost any discussion forum, regardless of it’s primary topic. When it comes to Longhorn Football, the participants tend to be older and decidedly conservative; demographics I wouldn’t normally have sustained interaction with. On message boards, I usually avoid off-topics because it’s more difficult to resolve specific claims where conflict arises and people are quicker to entrench than in other areas. But I broke from the norm a couple of years ago and ventured into discussions concerning climatology on one of the private football message boards. In part, this was because the claims that were becoming pervasive among a group of people that I had been communicating with for more than a decade were so outlandish. Thread titles like “The Biggest Hoax of Modern History” and “The Largest Cottage Industry in America” are hard to ignore. Whatever differences I had with them demographically, these were still for most part reasoned observers (of football at least). This was a group of people who respected my voice; an issue that was scientific in origin. There was data to get at here and surely if I could just clarify it, the board would move toward a more relevant discussion: like what to do in the face of anthropogenic global warming... instead of insisting it was a fabrication. It seemed like an

opportunity for a thoughtful exchange between opposing views. It's hard not to chuckle at myself in retrospect.

The first thing that became clear is that although I felt informed on the issue, I was ill prepared to address all of the objections that were raised. And as criticisms were leveled, I was forced into the role of a co-opter to respond to many of them: finding relevant articles, studies, or blog posts. Interestingly, expert analysis that I linked or quoted seemed to carry less weight in the discussion than if I just deconstructed and rephrased arguments myself. Since the details of almost any particular of climate science involve an overwhelming intersection of statistical analysis, computer modeling and physics just to get your foot in the door, I found myself on many occasions trying to defend arguments that I didn't even fully comprehend.

I know that my efforts were not completely in vain, a handful of observers set me private messages of encouragement. I don't know that I actually changed anyone's mind in the discussion. If anything I think the skeptics of climate science ended up more committed in their position than when we started. I didn't even succeed at discouraging the posting of vitriolic or misinformed articles concerning climate science... they still pop up fairly regularly. People who are much smarter, better informed, and more articulate than me continue to experience similar results in this debate in public and private forums across the country. I'd like to better understand why.

Underlying almost all of my efforts in my life is the belief that not only do people want to better understand the world around them but that better understanding leads to people to better behavior.

Typed out like that, I can't help but label myself as somewhat naive. We are surrounded by counter-examples of that notion, cases where people act in defiance or denial rather than change their behavior, myself included. Why do I eat fast food? Why do people continue to smoke cigarettes? Why do we, as a country, continue to feed into a national debt cycle that we know will eventually cripple our economy? Can we separate the motive strands of such tangled behavior and if so, is the distillation instructive? Intuitively, I think there are designs worth striving toward: that co-opt from experts and iterate with outsider thinking, that touch complicated issues without entrenching people in their preconceptions. Designs that eventually reshape our behavior.

A very compelling aspect of the the Austin Center for Design program is that it doesn't balk at problems that are twisted up in a complicated weave of psychological, cultural, and economic factors. Instead it embraces them and turns them to inspiration for new approaches even if they are not all direct ripostes. I know that my time in the program would serve as an inflection point in my own life, an intense process that will force me to accelerate in a new direction. I don't think behavior is something that can be "solved" but my goal in the program would be to learn more about design inflection points for other people: shifting their calculus and eventually helping their lives take on new shape.