

Diversity of Perspectives

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Those French, they have a different word for everything.

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Flatland

Edwin Abbott's classic *Flatland* describes the life and times of a certain A-square. A-Square lives on a two dimensional plane. His checkerboard existence consists of some atypical ups and downs. On the one hand, A-square never has to worry about backaches, but on the other hand to differentiate between a parallelogram and rhombus, he must walk half way around them. One day, A-Square meets Sphere. At first, A-Square trudges around Sphere within the confines of Flatland and believes Sphere to be a circle. But as Sphere raises himself in the unseen third dimension, A-square finds himself walking around a larger and larger circle. Eventually, the circle begins to grow smaller and smaller until converging to a point. At all times though, this object remains his new friend Sphere. A-square learns to think of Sphere as infinitely many circles of increasing and then decreasing size stacked upon one another. This enables him to experience the third dimension even though it is not part of his reality.

1 Introduction

Each person interprets the world differently (though perhaps not as uniquely as we would were we to live in a two dimensional projection of reality). In this lecture, we analyze the implications of that simple fact. We will see how the ability to see the world from multiple angles or perspectives enables a richness of understanding that could not be accomplished from hearing a single interpretation, and how it can improve our ability to solve problems and make predictions collectively.

We take on this task without any ideological agenda. We begin with three distinct perspectives on multiple perspectives from unrelated disciplines. The first pulls all punches. The second two lean rather heavily to the left and right.

1.1 A Journalism Assignment

To convince students that multiple perspectives exist and matter, journalism professors often ask beginning students to read a newspaper account of an event they attended and to compare what they experienced with what the journalist described. So long as the student doesn't choose a solar eclipse, the student will notice significant differences in what she saw and what the journalist reported. Some of this variation may occur from the journalist and the student experiencing the event from different

vantage points. A luxury box offers a more insulated experience than a mosh pit. But, the more meaningful differences may have more to do with how the journalist and the student interpret their respective worlds. The student's perspective of an event may be personal, and therefore individual, whereas the journalist may try to emphasize themes and ideas that touch as many individuals as possible.

1.2 Multi-(fill in here) studies

A more traditional diversity course's syllabus contains books and articles written from many perspectives. The motivation for this approach to learning is straightforward: If we want to understand an event, like the Protestant Reformation, we must look at more than its effect on white men. We must also consider how the reformation impacted women and people of non dominant cultures and ethnicities.

An historical event creates multiple and various effects on individuals. History is the aggregation of those singular reactions. Balanced and fair accounts must by definition be inclusive. A review that characterizes as incomplete an account of the American Revolution that does not include the revolution's impact on women and slaves is not making an ideological point. It's stating a fact. They were also a part of that history. Though Thomas Jefferson and Benjamin Franklin may have had larger impacts as individuals, the story of these other actors is not inconsequential.

1.3 Scientific Breakthroughs and Market Performance

Scientific breakthroughs both big and small drive human and economic progress. (Without the combustion engine and the corn flake, our economies and our lives would not be the same.) Accordingly, psychologists, sociologists, and historians have long studied how people and groups make these breakthroughs. Among the working hypothesis of these studies is that a diversity of perspectives drives innovations. To give just one example, Steven Toulmin (1962) writes "The heart of all major discoveries in the physical sciences is the discovery of novel methods of representation."

The role of diversity in economic growth was highlighted during the cold war when market based democracy and centrally planned systems competed in the world and ideological marketplaces. Diversity of perspectives was an oft stated advantage of markets and democracy. The argument was that these institutions provide individual freedoms that enable people to seek their own lights, their own solutions. These freedoms situated within an environment that includes incentive structures for hard work help to generate rates of innovation and growth that surpass those from a centrally planned economy that imposes a common way of thinking about problems.

Or so the story goes. If we think back to our first lecture on the determinants of diversity, we can construct a more structured explanation. Markets, through incentives, create more demand for diverse ideas and products and increase attainability by giving people freedom over their time. They also increase isolatability (people and teams can work alone) and functionality (an idea need only find a moderate market

as opposed to fit within the larger centrally planned system.) Markets even increase the dimensionality of the product space in so far as ideas create niches for new ideas.

There is a counter argument that markets promote diversity. Robert Frank's book *The Winner Take All Economy* argues that the new economy benefits the best extra marginally. An implication of this might be that there is less diversity.

1.4 A synthesis

If we combine the three perspectives on perspectives, we see that all three say the same thing: *to really understand something, we need to interpret it from multiple perspectives.* Journalism and multi-()ism emphasize this point directly. Understanding requires embracing all (or almost all) interpretations. Economists and philosophers of science are more goal directed. They argue that the best among many outperforms the best among few. Therefore, even though there is an incentive to create multiple perspectives, once the best has been located it should be exploited. That is of course, until it is no longer the best and the only way that this can be tested is by constantly considering alternatives. This simple distinction may explain why people more concerned with "progress" appear to care less about preserving multiple perspectives than people concerned with history.

2 Gravity and Trains

We now turn to two examples where having the right perspective led to a breakthrough. In the first case, the new perspective fundamentally changed how we view the universe. In the second, it merely improved how the trains run. Each case is instructive in that a problem that seemed hard suddenly became easy.

2.1 Sir Isaac Newton

Most historians of science regard Isaac Newton as one of the greatest thinkers in human history. Newton made myriad contributions both pure and applied. His work on optics and the calculus though impressive is overshadowed by his theory of gravity. Alexander Pope wrote the following epitaph for Newton

*Nature and Nature's laws lay hid in night
God said, let Newton be! and all was light.*

Newton's genius stemmed from both a powerful mind and an ability to think about problems differently. Newton's life history is well known, but indulge a quick repetition with a peculiar spin. Newton was born prematurely on Christmas day 1642 in Woolsthorpe, Lincolnshire.¹ Prior to Newton's birth, his father died. Newton's

¹His date of birth using our modern calendar is January 4, 1643, but so far as he was concerned it was Christmas day.

mother subsequently remarried, and moved to a neighboring town. Young Isaac remained in Woolstrophe with his maternal grandmother. At age 10, Newton was shuttled off to the nearby town of Grantham for schooling and remained apart from his mother. His mother's second husband passed away in 1656 at which time she returned to Woolstrophe.

These facts may seem unimportant, but now let's give them a Freudian interpretation. Like all scientists (at least according to their Freudian biographers) Newton was strongly attracted to his mother. Yet the two of them rotated around one another much in the same way two planets might orbit a sun. Perhaps, the theory of gravity that he used to explain planetary orbits, so novel to all the rest of humanity, was obvious to Isaac just as Pope described. Though far fetched, I will make no further comments on this story, other than to borrow the last line from Hemingway's book with the apt title *The Sun Also Rises* "isn't it pretty to think so."

2.2 The "El"

Chicago's elevator trains carry thousands of passengers each day. The Chicago Transit Authority, a publicly run organization, does its best to keep costs at a minimum and service at a maximum. Though many people complain that the "El" suffers from poor management, a priori there is no reason to think it any better or worse run than any public bureaucracy.²

In 1992, the Chicago "El" was arranged as follows: There were two main routes. One beginning in Evanston going around the "Loop" in downtown Chicago and then proceeding to the south side of Chicago. The other route originated at O'Hare, Chicago's airport, went around the Loop and out to Oak Park. To determine the number of trains required, the relevant statistic is the maximum ridership on stretch of a route. If you need to move 80,000 people and 500 fit on each train, then you need 160 trains. Maximum ridership for the two lines was as follows:

Route	Maximum Ridership
Evanston-South Side	80,000
O'Hare-Oak Park	70,000

In 1993, the CTA figured out that they could save enormous sums of money each day. How? Instead of thinking of two lines that both traverse the Loop, they re-encoded the tracks as four lines that all end at the Loop. Now, the maximum ridership statistic looks as follows.

²We should note that many people believe that anything run by the government must be inefficient whereas anything privately run must be efficient (lest it be driven from the marketplace). Though this belief has a grain of truth one would be mistaken to apply it to all situations. Wilson (199?) has shown that while some government bureaucracies are quagmires of inefficiency not unlike Dickens's office of Circumlocution in *Little Dorritt* whose motto is "how not to do it" others run like clockwork. Moreover, markets are full of inefficiencies. If you enjoy more theoretical musings, Donald Wittman has written a persuasive book that will cause you to abandon the myth that markets work and governments don't.

Route	Maximum Ridership
Evanston-Loop	80,000
Loop - South Side	35,000
O'Hare-Loop	30,000
Loop-Oak Park	70,000

Looking at the data this way, an obvious solution emerges. Hook up the Evanston line with the Oak Park line and the O'Hare line with the south side line. The costs of doing so were minimal. A small section of track had to be altered and new signs had to be posted explaining the route change.

There was one possible stumbling block for this plan. If a substantial number of passengers were going from Evanston through the Loop to the south side or from Oak Park to O'Hare, then the costs of these people having to switch trains might outweigh the benefits to the Chicago Transit Authority (CTA). Fortunately, this was not true. Most traffic was to and from the loop, so the plan was implemented.

Upon hearing this story, someone distrusting of all government activities might think that the CTA knew they could improve efficiency but chose not to for some political or bureaucratic reason. While it is possible that they did, it is improbable that anyone else did. The CTA had regular public hearings where ideas could be presented for cost savings measures. Had this plan been brought up by a citizen (even a CTA employee) the political pressure would have been overwhelming. So, it's probably safer to say, that no one in Chicago had thought of this.

This may seem incredible in light of the fact that many people had to know that the trains to Evanston and Oak Park were crowded and the trains to O'Hare and the South side were not. The problem was that everyone was seeing the problem the wrong way. This is roughly equivalent to asking people to think about their pant legs as a separate entity from the pants themselves. (Interestingly, this very idea arose in the late 1990's in the form of conversion pants: shorts with attachable pant legs.)

3 Models

Our next step is to construct some models of how people interpret the world differently and to study the implications of those models.

3.1 The Hong-Page Perspective Model

The first model we consider is due to Hong and Page [2001]. In their framework, "reality" consists of a denumerable set of objects. Any finite set is denumerable. Many infinite sets including the integers are denumerable.

Def'n: **Reality** equals $\Omega = \{\omega_1, \omega_2 \dots\}$

Each person also possesses an *internal language*, which is a set of words a person uses to describe their world.

*Def'n: An **Internal language** equals $L = \{\ell_1, \ell_2 \dots\}$*

A perspective is then a one to one map from the world to a person's internal language.

Def'n: A Perspective is a map $H : \Omega \rightarrow L$ such that if $\omega_1 \neq \omega_2$ then $H(\omega_1) \neq H(\omega_2)$

This last condition is restrictive. It forces people to have a word for every object. In reality, none of us have sufficient vocabularies or internal models to differentiate all of the realities within which we live. Let's continue with some examples:

Simple Example: Reality consists of three objects a red apple, a red pear, and a gold pear. Adam's internal language consists of the words { apple, red, gold }. Bella's internal language consists of the words { delicious, bartlett, bosc }. Each maps reality into his or her language.

Implicitly, a perspective and its attendant internal language are assumed to have an inherent structure so that it makes sense to talk about similarity and dissimilarity of objects. This structure is what gives a perspective purchase on problem solving and interpretation.

Elaborate Example: When Ben and Jerry were searching for a good recipe for New York Super Fudge Chuck Ice Cream, they created a two dimensional array of pints in order to conduct their search. The two dimensions that they considered were the number of chunks and the size of the chunks.

(# Chunks, Size Chunks)

4,1	4,2	4,3	4,4
3,1	3,2	3,3	3,4
2,1	2,2	2,3	2,4
1,1	1,2	1,3	1,4

In the context of the model, this array was Ben and Jerry’s perspective on reality. Alternatively, a consultant might have arranged the pints according to total calories. Using that perspective, the pints that Ben and Jerry created might have been ordered as follows:

Calories

3,2	2,3	4,2	3,3	2,4	4,3
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Notice that these two perspectives create distinct spatial relationships between the pints of ice cream. For example, the pint with two chunks of size three is adjacent to the pint with four chunks of size two (they are typed in **bold** in both perspectives) in the consultant’s perspective, but they are far apart in Ben and Jerry’s perspective.

This second example shows the value of diverse perspectives. What may seem like a large cognitive leap in one perspective may be a small step in another. Thus, two objects that appear unrelated to one person may be closely related to another.

3.2 The Interpretation Model

In the next model, we relax the assumption that the perspectives are one to one mappings from reality to internal languages. We call these cloudier mappings *interpretations*.

Def’n: An **Interpretation** is a map $\hat{H} : \Omega \rightarrow L$.

Interpretations allow for greater divergences in understandings of reality. One person may fail to distinguish between two things that another person sees as importantly different. In Flatland, initially at least, A-square’s interpretation of reality does not distinguish between spheres and circles. Much of our earlier discussion of multiple views of historical or current events can be understood in terms of interpretations.

Our first example considers projections. Each person sees only one dimension of a multidimensional event.

Projection Example: Suppose that reality takes place on three dimensions. Call them x , y , and z . Suppose that any one person can see at most one dimension. Let a history of events be a sequence $\{(x_1, y_1, z_1), (x_2, y_2, z_2), \dots\}$. To understand that history, we have to know all three dimensions and therefore at least three people would

have to tell their stories. The first would provide the partial history $\{x_1, x_2, x_3, \dots\}$. The other two would provide the partial histories $\{y_1, y_2, y_3, \dots\}$ and $\{z_1, z_2, z_3, \dots\}$. Combined, they would preserve a complete account of what transpired.

In our next example, each person has a rather coarse partitioning of reality. However, the fact that their interpretations differ enables them to collectively make good predictions.

Two Dimensional Problem: There are two dimensions D1 and D2 that describe the state of the world. Each dimension takes on one of four values L, LM, RM, or R denoting left, left middle, right middle, and right. Some deterministic process (many scientists call this an act by Nature) maps each state into one of two outcomes. We will call the possible outcomes good (G) and bad (B) and assume that the mapping from states to outcomes looks as follows:

		D1/D2			
		L	LM	RM	R
States and Outcomes	L	G	G	G	B
	LM	G	B	G	G
	RM	G	B	B	B
	R	B	B	G	B

There are three policy analysts and each has a different interpretation of reality. Policy analyst 1 only sees dimension 1. With this interpretation, he correctly predicts outcomes 75% of the time.

		D1	prediction
		Analyst 1	L
LM			G
RM			B
R			B

Policy analyst 2 only sees dimension 2. He also can predict outcomes three times out of four.

Analyst 2		D2			
		L	LM	RM	R
prediction		G	B	G	B

Policy analyst 3 has a rather complicated interpretation of the world. He sees as “extreme” any states of the world in which both D1 and D2 are either L or R, and he sees as “boring” any environments in which neither D1 or D2 is L or R. He therefore predicts that extreme and boring states lead to bad outcomes. He interprets as moderate any states in which one dimension is L or R and the other dimension is LM or RM. He will also predict correctly 75% of the time. His predictions are in the table below:

		D1/D2	L	LM	RM	R
Analyst 3	L	B	G	G	B	
	LM	G	B	B	G	
	RM	G	B	B	G	
	R	B	G	G	B	

Suppose we have these three analysts make a collective prediction by voting. If the state of the world is (L,L), then analysts 1 and 2 will predict G and analyst 3 will predict B. The collective prediction will be G. Their collective predictions will be as follows:

		D1/D2	L	LM	RM	R
Collective Predictions	L	G	G	G	B	
	LM	G	B	G	G	
	RM	G	B	B	B	
	R	B	B	G	B	

Notice that the group of three predict correctly 100% of the time. This is because they have a diversity of interpretations.

3.3 Diversity of Interpretations

The previous example demonstrates how a diversity of interpretations can enable a collective to make better decisions than individuals. An alternative way to think about this example is that each person had diverse information. The advantage of adding the structure of interpretations is that we can see how diversity matters.

As a thought experiment, suppose we assume that each analyst gets a signal that is correct 75% of the time and that their signals are independent of one another. The probability that they would predict correctly by voting would equal the probability

that all three got the correct signal plus the probability that exactly two got the correct signal or

$$(0.75)^3 + 3 \cdot (0.75)^2(0.25)$$

which equals 27/32 or a little over 84%. In the example, the three analysts were able to be correct 100% of the time because their interpretations were so different.

The idea that people have different information underpins a large body of work in economics, political science, sociology, and decision theory. The typical assumption is that signals are independent. This is intended to capture diversity. Yet, as we have just seen although independence implies some diversity more is possible. It may well be the case that markets and democracies, to name just two institutions, create incentives for diversity that exceed that implied by an independence assumption.

Assignment Choose any familiar object, commodity, or idea. Describe two distinct interpretations that are more than just projections. Describe why someone might make each of these interpretations and why using both interpretations might be better than using just one. An example follows.

Doors A builder might interpret doors by their characteristics whereas an interior designer might focus on functionality. A builder might classify doors according to whether they are interior or exterior doors, the material, the number of panels, and the color. An interior designer might use different dimensions. He might look at the weight of the door, the door's style (modern, colonial, craftsman), soundproofing.

Possible Ideas: Burritos, shoes, candy bars, shirts, dance steps, personality types, hair styles, game plans, advertising strategies, birthday parties, etc..

Hint: This assignment can be difficult if attempted alone. It is easy if you casually ask a friend or two, "how would you describe all of the possible types of (blank)." You'll find that they interpret reality quite differently than you.