

Summary of "Social Physics" by Alex Pentland

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How Good Ideas Spread: The Lessons from New Science.

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Introduction

Author Alex Pentland's first job was using computers to count beavers. This computer was a brand new space satellite called LANDSAT, which was created after several unexpected crop failures in India and Russia. LANDSAT held a large amount of data as it used high-resolution multisensor images of every place in the entire world every few days. Since these satellites were created, there have been no more large-scale unanticipated crop failures. Additionally, these satellites have contributed to a large amount of knowledge we have today about climate change, deforestation, weather, and many other environmental challenges. This source of "big data" has been a huge benefit to human society. Today, it is now possible to watch people instead of beavers using the digital data we create through cell phones, credit cards, and social media. Is it possible that we can use this big data to improve society? Furthermore, how can we use big data to its fullest potential while also protecting the privacy of the world's citizens? Pentland aimed to answer this question and so began a decade-long research program. From his scientific investigation, he learned that "many of the traditional ideas we have about ourselves and how society works are wrong. It is not simply the brightest who have the best ideas; it is those who are best at harvesting ideas from others. It is not only the most determined who drive change; it is those who most fully engage with likeminded people. And it is not wealth or prestige that best motivates people; it is respect and help from peers."

This new understanding of human behavior and society is what Pentland calls *social physics*. Through *Social Physics*, you'll see how modern mathematics and big data can tell us how humanity is driven by the flow of ideas between people and shapes behavior. In the past, social sciences depended on lab studies and surveys, generating little data. Today, however, we have big data as people leave "digital bread crumbs" anytime they do anything online. Analysts can now use these clues to detect patterns and study how social learning occurs.

Social Physics Uses Big Data to Help Us Analyze Human Behavior

In today's world, we are living in a society that has become a combination of humans and technology. The problem, however, is that we still don't quite understand the fundamental essence of these new human-machine networks. You see, our current understanding of society originated in the late 1700s during the Enlightenment. Back then, life moved slower and society typically moved forward thanks to traders, politicians, and wealthy families. So when we think about how to manage society, we typically speak about "markets" and "political classes."

Our world no longer fits this idea. Today, virtual crowds can form in minutes and can even consist of millions of people from all over the world. Each new day, millions more are contributing and commenting. "We are no longer in the era of financial exchanges with physical trading floors and political conventions with smoke-filled back rooms, where small groups of people haggle until they come to mutually acceptable deals." We live in a hyperconnected world now which means we need something new to understand human behavior and how ideas flow.

This is where *social physics* comes in. Social physics is an approach to understanding human behavior; it is a "quantitative social science that describes reliable, mathematical connections between information and idea flow on the one hand and people's behavior on the other. Social physics helps us understand how ideas flow from person to person through the mechanism of social learning and how this flow of ideas ends up shaping the norms, productivity, and creative output of our companies, cities, and societies." Furthermore, social physics allows us to predict the productivity of small groups and even entire cities. It can even help us tune communication networks to help us make better decisions and become more productive. Social physics uses big data to collect this information, such as our credit card purchases and our cell phone data to show what goods we're buying and who we're talking to. This means that social scientists no longer have to rely on surveys and lab experiments; instead, they can use data that spans broader and longer than data from the past. When we take a closer look and analyze this huge collection of data, we can begin to see patterns in social networks. This process called *reality mining* allows us to explore the properties and patterns of interactions between people and uncover everything we can about human behavior.

Our Peer Groups Shape Our Beliefs More Than We Realize

Do you fully understand yourself? You might think that you have full control over your decisions, but what if you are more influenced by your community than you think? "Are we, by the definition of economists, as much collectively rational as we are individually rational?" To answer this question, we need to understand more how the flow of ideas works. In other words, we must understand how the behaviors of those around us influence our own habits, preferences, and interests.

As it turns out, our behaviors and decisions are largely influenced by the peer groups we belong to. This doesn't necessarily mean just our family and friends but also those who have similar interests and characteristics as us. Some of these peer groups can simply be acquaintances who hang out at the same restaurants, bars, and other social environments. For instance, eating too much might be something that we might naturally "absorb" from our surrounding peers. After all, "When in Rome we do as the Romans do." But can these peer groups influence our political preferences too? Well, author Alex Pentland completed an experiment in 2008 to answer this very question.

By giving a group of students smartphones that monitored their social interaction and tracked who they spent time with, Pentland was able to gather more than 500,000 hours of automatically generated data which was then combined with survey data about their beliefs, attitudes, personality, and more. They also asked questions about their political interests, including which candidate received their vote. When analyzing the hundreds of gigabytes of data, Pentland and his team found that the amount of exposure to people possessing similar opinions accurately predicted the students' level of interest in the presidential race and their political views. Most importantly, however, it wasn't friends and family who had the most influence on the students' political behavior, it was the surrounding peer group. It wasn't just the number of direct interactions that mattered, but the amount of exposure to other people's statements and attitudes. In other words, "overheard comments and the observation of other people's behaviors are effective drivers of idea flow." Even more, students would change who they spent time around in the time following and leading up to a televised presidential debate. If they were conservative, they avoided places with more liberals or vice versa. This selective exposure reinforced their political views and shaped their thinking to the point that they eventually became true believers.

In the end, "We can consciously reason about which flow of ideas we want to swim in, but then exposure to those ideas will work to shape our habits and beliefs subconsciously."

Humans Prefer Working Together As a Team

Of course, this influence from our peers doesn't happen immediately. For a behavioral change to spread throughout a peer group, it must be repeated often in a short time and result in a positive outcome. For instance, "if everyone in a work group starts drinking green tea rather than coffee, the odds are that others will pick up the green tea habit as well. Multiple exposures showing that a new behavior has a good outcome, like social approval, are needed before we pick up the habit as our own."

But why is this so? This is likely because human behavior is largely determined by social context. In fact, data today tells us that our desires and preferences are mostly based on what our peer community agrees is valuable rather than a reflection of our individual desires and morals. For instance, after the Great Recession of 2008, many houses were suddenly worth less than their mortgages. Researchers then found that it only took a few people walking away from their homes and mortgages to convince other neighbors to do the same. Behavior that was once deemed criminal or immoral, purposely defaulting on a mortgage, became common.

With this information, we can use social networks to influence the behavior of others and work together as a group. You see, the ability to work as a group is innate in us, and we have likely learned such behavior so that we succeed in social groups. For example, "capuchin monkeys use trilling sounds to cooperatively decide when and where the troop should move. Monkeys at the leading edge of the troop trill the most, encouraging others to follow the path they've found, and others take up the trilling in order to coordinate everyone's movements." This similar pattern of social decision making is common in many animals, including humans.

In Bob Kelly's Bell Stars study, Kelly looked at the difference between average and star performers within Bell Laboratories. Average performers believed teamwork meant doing their part on the team. On the other hand, star performers viewed teamwork differently. They pushed everyone on the team to work together towards goal setting, group accomplishments, and more. In other words, star performers promoted synchronized, uniform idea flow within the team by making everyone feel a part of it. In the end, synchronization and uniformity of idea flow within a group are critical because it convinces everyone, even skeptics, to go along with and adopt new ideas. Even better, when people work together, our bodies release endorphins that give us a pleasant high as a reward for working together.

What the Red Balloon Challenge Teaches Us About Motivation and Social Networks

What motivates you most? For some people, they believe individual rewards are best when motivating others, as can be seen through offering promotions and raises to the person who performs best. However, as we'll learn through the Red Balloon Challenge, this isn't necessarily the best strategy for success. In 2009, the Defense Advanced Research Projects Agency (DARPA) sponsored the Red Balloon Challenge to commemorate the 40th anniversary of the birth of the internet. The purpose was simply to discover the best strategies for how the internet and social networking can be used to solve time-critical search problems, like search-and-rescue operations following natural disasters or rallying supporters to vote in a political campaign.

To test these strategies, DARPA hid ten red weather balloons in mysterious locations across the continental United States. The first team to correctly locate each balloon would win \$40,000. On the day of the challenge, 4,000 teams had signed up and the competition was fierce. Of course, Pentland and his team were confident in their strategy; after all, they were experts at this! Most other teams in the competition incentivized participation by simply rewarding people who correctly reported a balloon; this assumption is that people work best when they are motivated by rewards and self-interest. Pentland and his team, however, came up with another strategy.

Should their team win the money, they would allocate \$4,000 per balloon. They promised \$2,000 per balloon to the person who sent in the correct coordinates, but they also promised \$1,000 to the person who invited that balloon finder onto the team, \$500 to whoever invited the inviter, \$250 to whoever invited that person, and so on. This social incentive approach differs from simply giving away \$4,000 per balloon in that it doesn't deter people from spreading the word about the team and it doesn't limit the number of people who can participate. Anyone in the world can spot a balloon!

These factors were critical to the success of the team, as can be seen through recruitment chains that were up to fifteen people long; even more, 1/3 of the tweets spreading information about the team originated *outside* the United States. In the end, their team had almost two million people helping them search for red balloons. This strategy allowed them to win the competition in just 8 hours, 52 minutes, and 41 seconds! The point isn't that it's possible to join millions of people for a common goal, but that it's possible to get people to build an organization that works.

By rewarding people for both finding balloons and recruiting people to help in the search shows that both tasks are equally important for success.

The Ideal Society Has a Balance of Exploration and Engagement

Today, social physics allows us the power to learn how to best organize our society. As we have seen, humans rely on interaction with one another and work best when everyone benefits. And when it comes to creating a productive society, we must rely on two facts: exploration and engagement.

The standard way of thinking might predict that people's exploration within a city would diminish as they get to know a neighborhood, figure out where to buy products, and discover purchasing patterns that best suit their lifestyle. But that's not what happens at all. In fact, people's exploration is constant and they never seem to stop sampling new stores and services. Data shows that people explore to find better deals and to satisfy their sense of curiosity. Additionally, exploration occurs when people seek out ideas from a diverse range of people. As a result, exploration allows us to introduce new ideas and develop them more efficiently. Too little exploration, however, leads to a lack of innovation and creativity.

Engagement is what happens when people interact with people from different backgrounds and areas of society. As we increase engagement, we begin to see stronger norms of behavior. The key to designing the ideal city is finding the balance between exploration and engagement. This is a bit harder than it sounds. For instance, when we increase engagement in residential areas, we don't automatically increase the amount of exploration. Pentland states, "The failure of most city zoning is that if cities segregate by function, then exactly the wrong change in the structures of social ties occurs: engagement decreases locally (people rarely get out and meet each other), and exploration increases (since people have to go elsewhere to do anything), and as a consequence, the social fabric of the neighborhood is pulled apart. So what's the solution?

The goal is to create self-contained towns in which people meet each other regularly and have many connections between friends of friends; therefore,

the best solution is a small-to-medium-sized town in which everyone is within walking distance of a town center, stores, the school, and clinics. In fact, the city of Zurich, Switzerland is the perfect model. The key is a quick and cheap light-rail transportation system that enabled people to quickly and conveniently travel into Zurich's city center. This system encouraged citizens to live in the smaller, less expensive towns surrounding Zurich. Today, over 60 percent of Zurich's population uses this transportation system, which has resulted in the perfect balance between exploration and engagement!

Interaction and Engagement Are Crucial for Productivity

Balancing engagement and exploration in cities is key, but the same principles can also be applied to smaller groups, like businesses. Groups of people, like communities, have a collective intelligence that is different from the individual intelligence of each group member. Even more, this group intelligence can predict group performance in the same way an IQ can predict an individual's performance.

When asked the most important factors that drive group performance, most people believe factors like cohesion, motivation, and satisfaction are significant; however, this isn't quite the case. Instead, the largest factor in predicting group intelligence is the equality of conversational turn-taking. The second most important factor is the social intelligence of a group's members, as measured by their ability to read each other's social signals. In fact, women tend to be better at reading social signals; therefore, groups with more women tend to perform better.

Simply put, when group members are encouraged to interact and engage, ideas are easily built upon, resulting in an improvement of productivity and efficiency. For example, let's take a look at a study conducted with call center workers at Bank of America. In 2008, Pentland and his team targeted four teams, each consisting of around 20 employees. They each wore sociometric badges all day for six weeks. During that time, tens of gigabytes of behavior data were collected. Like most call centers, the most important measure of productivity is known as average call handle time, or AHT. This factor dominates the dollar cost of running a call center.

When analyzing the data, Pentland found that the most important factors for predicting productivity were the amount of interaction and levels of engagement. For instance, Pentland proposed that instead of allowing employees to take separate coffee breaks at different times, they should give all the employees on a team a break at the same time. This allowed employees to mix more during breaks and raised the amount of interaction within each group. As a result, the AHT decreased dramatically, meaning the employees were being more productive. This simple change, when implemented at *all* of their call centers, resulted in a forecasted \$15 million per year productivity increase!

The New Deal on Data Can Lead to a Data-Rich Society

The digital bread crumbs that we leave behind provide clues about who we are and what we want. Each purchase we make online, each transaction with our credit card, each Google search, and more leaves a small sliver of data about us. These slivers of data, however, are valuable for private companies. As European consumer commissioner, Meglena Kuneva said recently, "Personal data is the new oil of the Internet and the new currency of the digital world." Unfortunately, if data ever gets into the wrong hands, you risk giving someone too much power over you. So how can we maintain the protection and personal privacy of our data?

A data-rich society must guarantee that our data will not be abused, which requires us to have a New Deal on Data. This new deal means "workable guarantees that the data needed for public goods are readily available while at the same time protecting the citizenry. We must develop much more powerful and sophisticated tools for privacy and reach a consensus that allows us to use personal data to both build a better society and to protect the rights of the average citizen." The aspects of this new deal are as follows:

- *You have the right to possess data about you.* Regardless of what entity collects the data, the data belongs to you, and you can access your data at any time.
- *You have the right to full control over the use of your data.* The terms of use must be opt-in and clearly explained in plain language. If you aren't happy with the way a company uses your data, you can remove it just like you would close your account with a bank that isn't providing satisfactory service.
- *You have the right to dispose of or distribute your data.* You have the option to have data about you destroyed or deployed elsewhere.

Of course, massive amounts of personal data are already on the Web, consisting of information contributed by social networking sites, blogs, forums, transactions, browsing histories, and more. As a result, "the Web has evolved in an unregulated environment with no coherent privacy standards about personal data. Consequently, the rights to such data are unclear and vary from site to site." Fortunately, companies like Google are working towards a solution for protecting the privacy of data. Through Google Dashboard, people can see what data Google has about them. Furthermore, the company also formed the Data Liberation Front which consists of a group of Google engineers whose mission statement says that "users should be able to control the data they store in any of Google's products" and "make it easier to move data in and out."

When we can safely share data, we will inevitably begin to produce governance and policies driven by data. Additionally, social physics will enable us to use big data to help us see just how well or how poor those governance and policies are performing. For instance, in the future, maps like Google Maps will show more than just roads. One such example would also show maps of poverty, infant mortality, crime rate, change in GDP, and other social indicators to help society quickly see where new government initiatives are working and where they are not. In the end, we need social physics to move from systems based on averages and stereotypes to ones based on individuals and individual interactions in today's modern world.

Final Summary

Today, we must think about society as a network of individual interactions rather than as the markets or classes of the past. To do this, "we will need to use social physics as a framework to outline how the flow of ideas from person to person shapes the norms, productivity, and creative output of our companies, cities, and societies." When we create social systems based on using big data, we can better predict how social dynamics will influence financial and government decision making. In the end, the rewards of a data-rich society are worth both the effort and the risk. "Imagine: We could predict and mitigate financial crashes, detect and prevent infectious disease, use our natural resources more wisely, and encourage creativity to flourish and ghettos to diminish."



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