

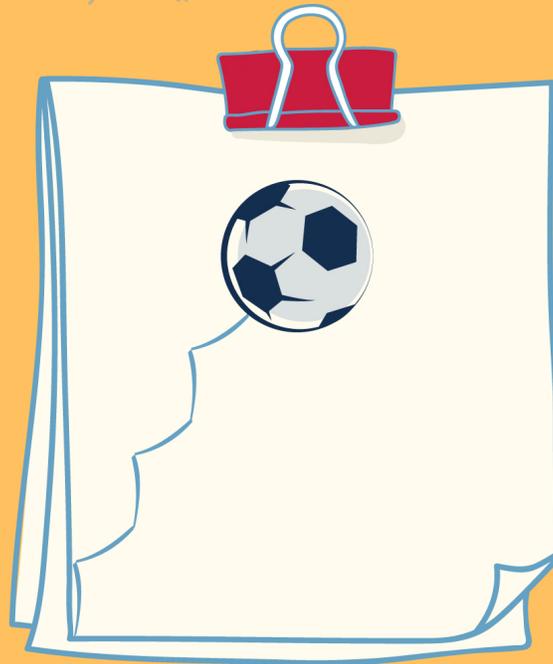
# SUMMARY

## SOCCERMATICS

DAVID SUMPTER

$$\sin(-a) = -\sin a$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$



$$a^2 + b^2 = c^2$$



$$\sin\left(\frac{\pi}{2} - \alpha\right) = \cos \alpha$$

# **Summary of “Soccermatics” by David Sumpter**

Written by Alyssa Burnette

Learn why math and soccer go hand in hand.

Introduction

5

What Math and Team Strategies Have in Common

6

How Math Can Help You Win Soccer Games

7

There's No "I" in TEAM

8

A Team is Not a Hive Mind

9

Math Can Improve Your Betting Odds

11

Final Summary

13



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# Introduction

Some call it football. Some call it soccer. Cultural differences may divide our terminology, but one thing is pretty universal: almost everybody loves soccer. But it might surprise you to learn that “everybody” even includes statisticians! Because recent studies have highlighted the intriguing relationship between soccer and math, mathematicians are falling in love with the game for reasons of their own. And over the course of this summary, we’re going to explore those reasons and learn why you should care about them.



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# What Math and Team Strategies Have in Common

In undergrad, I had a coffee mug that said, “I’m an English major-- YOU do the math!” The humorous little quip illustrated a common fact: many people are not fans of math, especially those whose brains are geared more toward creative or literary learning. And if that describes you, then-- like me-- you probably spent a good deal of your time in school wondering when you would ever use any of your math homework. It might take you hours of studying at the kitchen table to solve for the answer, but surely you would never need that algebraic equation beyond your high-school math class. And in many cases, that’s proven to be true, especially for those of us who grew up to pursue careers that have little involvement with math. (I personally can go an entire work week without ever needing to do a single math problem!)

But much to our surprise (or sometimes disappointment) math resurfaces in many areas of life outside our jobs or the classroom. In fact, just think for a moment about the things that require math. Cooking, for example, requires at least a basic understanding of fractions. Music is also intimately connected to mathematics. And, as it turns out, so is soccer. Indeed, soccer’s relationship with math transcends the simple act of keeping score. Mathematics are woven into the definitive rules of the game. Just look at the strategic formations of the players! Soccer players rely on an intricate network of triangular formations to construct their defense strategies and steal the ball from the opposing team. In this respect, you can easily see how geometry is a foundational part of the game! In fact, without math, soccer players would be unable to build the decentralized networks they rely on to succeed.



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# How Math Can Help You Win Soccer Games

Now that we've taken a look at the basic relationship between math and soccer, it's time to explore it in a little more detail. And we'll start with the best offense any sport has to offer: a good defense. The evolution of technology means that scientists are now able to gather data on a player's performance in real time and draw conclusions about their strategy and abilities as a result. In practice, this means that scientists can insert motion sensors in a player's sports equipment to track their movements on the field and learn more about how they play. And recent studies have confirmed the old adage that we've all heard for years: that the greatest defense is a good offense.

One of the most notable studies on this topic included the work of researcher Alina Bialkowski. Bialkowski is a leading specialist in the fields of machine learning, computer vision, and sensors. Her research interests center around using spatio-temporal data to enhance statistics and visualisation in sports analytics. Put simply, this means that she uses mathematics and statistics to analyze people's behavior and success rates in team sports. In 2014, Dr. Bialkowski conducted a study with University College London to learn about goal-scoring in soccer and which strategies were more likely to result in players scoring a goal. Bialkoswki spent weeks analyzing her focus team's movements, even down to a tenth of a second! And at the end of her study, her research proved that a strong offense was most likely to break down the opposing team's defenses.

In short, if you put a considerable amount of pressure on the opposing team, you can defend your team's position, ensure that you remain in a position of power, and weaken the opposing team's defenses. As you can see from this example, applying statistics to sports can help us identify the most powerful strategies and encourage teams to succeed.



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# There's No "I" in TEAM

We've all heard that old saying, right? When we say "There's no "I" in TEAM," we're typically using it to remind people of the importance of working together and getting along. That's because this phrase means that it's important to sacrifice your selfishness or personal interests in favor of decisions that are best for the group. Unless you're willing to work together and act in the best interests of the team, it's impossible to be successful in a team sport. Now, chances are, you already know this. Whether you play a team sport yourself or you know someone who does-- or even if you have no experience with sports-- everyone knows that you have to be a team player if you want to get along with others. But it might surprise you to know that science actually backs this up as well!

It's no secret that soccer-- like any sport-- is highly competitive. And as a result, it's natural for players to want to stand out and show off their unique abilities. But this attitude is in direct contrast to team spirit. As a result, when players bring this selfish mentality into the game, the entire team's performance suffers. For example, one player might choose to execute a move that is not in the best interests of the team but that will showcase her strengths. The research of statisticians like Dr. Bialkowski indicates that when this happens, the team is less likely to score goals or operate as an effective and collective whole. So, from this example, we can conclude that even math is not only useful for analyzing statistics and player performance, it's also helpful for identifying the qualities of a successful and effective team. And as we can see from this chapter, math supports the need for teamwork and character-building in soccer!



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## A Team is Not a Hive Mind

Now that we've discussed the importance of working together as a team and prioritizing the team over the individual, it's time to talk about the importance of thinking for yourself. If that sounds like this chapter is about to be the polar opposite of its predecessor, that's not necessarily true! That's because both are equally important-- and because strong individuals create strong groups. Here's why: we all know the saying "two heads are better than one," right? Well, the principle we'll be discussing in this chapter is basically just that saying, applied to the team dynamics of soccer. Put simply, the author posits that groups are stronger when people are able to work together while maintaining their originality.

That's based on a principle that mathematicians have tried and tested for centuries. And over these centuries of research and experiments, they've concluded that in almost every case, a group decision is more likely to be accurate or solid than that of any one individual. Why? Well, let's think about what happens when you get a group of people together. When you're making decisions with the input of others, you have an opportunity to consider perspectives that are different from your own. You can benefit from others' information and experiences that you might lack. You can then think through all of this information and come to a more informed conclusion or a prediction of what might happen on your own. And if every single person in a group does this, then the odds of you all reaching the right conclusion are even greater!

But as you can see from this example, that doesn't mean that everyone operates as a hive mind. You may be familiar with the term "hive mind" after encountering it in science fiction novels. In the dystopian context, this term typically refers to individuals who appear to share one collective consciousness that is characterized by conformity. Rather than an open exchange of different viewpoints and opinions, a hive mind operates on one unquestioned wavelength where everyone shares the exact same views. Therefore, it's obvious that a hive mind is the enemy of critical thinking and

it will never lead you to any new or original solutions. But if you and your group are able to pool your individual strengths and experiences, you can all come together and add something new and helpful to the group estimate of any given situation.

Therefore, the key takeaway from this chapter is that being a team player is important; you should always be considerate and ready to sacrifice for the best interest of your team. But that doesn't mean that you have to surrender your individuality or your original thoughts and opinions for the good of the team. In fact, being a strong individual will help you be a better team player! Just learn how to balance both aspects of your identity and know when to exercise your individuality and when to prioritize the group.



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# Math Can Improve Your Betting Odds

It's now time to turn our attention to a very common element of any sport: betting. For as long as sports have been around, bets have been around too. In fact, on the first day that two guys started kicking a soccer ball around, it's highly likely that two other guys were there, betting on who would win. But although it might surprise you to learn that soccer and math have something in common, everyone knows that math has a tremendous power to improve your betting odds. In fact, if you can use statistics to figure out the odds of any given bet, you're much more likely to come out the winner! But what's the "right" way to bet? What tips will really help you? Luckily, the author has a few suggestions to answer those questions.

For starters, he suggests that you only want to bet based on your personal subjective predictions. It's no secret that bookies have a (not so) hidden agenda of their own; every bookie will tell you you'll win so you'll bet your money with him! But his prediction is subjective in the wrong way; it's geared to promote his interests, not yours. So, when it comes to placing your own bets, you want to rely on your subjective prediction rather than his. For example, maybe you're betting on a soccer game or a horse race. If you have prior knowledge or experience with either of these sports, you might have insider knowledge that he doesn't. That means you know more about your odds of winning in this particular case. So, if you've evaluated the situation in light of your own critical thinking and information and you've concluded that you have a high chance of winning, then it's a great idea to bet. But if your estimation is lower than the bookie's, don't take the bait! Hold off and wait for a safer time to bet.

Another good tip is to avoid placing your trust in experts. That might sound like a nonsequitur at first; after all, isn't that what experts are there for? But the author observes that experts aren't always quite as right as they think they are. And often, they don't fare any better than an average guy with a talent for betting. If you're familiar with the betting scene, you probably know this already; you've probably seen that person who somehow always

calls it, no matter what. He doesn't have any formal training as an official expert and he doesn't have any underhanded deals going on; he's just really good at bets or statistics or both! So, bear in mind that putting your trust in experts isn't always a foolproof plan. Experts aren't guaranteed-- or even likely-- to be more accurate than you or your betting buddies. So, sometimes it's better to simply trust your instincts!



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# Final Summary

When we think about soccer, we think of the World Cup or the cheering fans. We think of soccer legends like Cristiano Ronaldo or Lionel Messi. We think of young girls and boys' aspirations to follow in their footsteps and be the next legends. But we don't often think of math. However, the author argues that we should!

Blending soccer with statistical analysis to create what he calls "soccermatics," Duhigg argues that mathematics can help us understand this electrifying game. Indeed, whether we're learning how soccer players rely on geometry, why team spirit is important, or how an applied knowledge of mathematics can help us win bets, "soccermatics" can help us in every aspect of our relationship with soccer!



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