



THE UNIVERSITY
of NORTH CAROLINA
at CHAPEL HILL

**Department of Exercise and Sport Science (EXSS)
Sport Administration**

**Predictive Analytics in Sport
EXSS 327-001
Fall 2019**

Course Overview

Contact Information

Professor: Jonathan A. Jensen, Ph.D.
Email: jajensen@email.unc.edu
Office Phone: 919-962-0959
Class Time: 8:45 – 10:00 a.m. MW
Class Location: Fetzer 104
Office: Woollen 308
Office Hours: 10:00 a.m. -11:30 a.m. MW (*Appointments should be arranged via email*)

Prerequisite

STOR 151 or 155 (Grade of B or better)

NOTE: EXSS 327 assumes knowledge of descriptive statistics, basic probability concepts, graphical displays such as histograms and scatter plots, and statistical inference such as confidence intervals and hypothesis testing (i.e., Type I Error, Type II Error, Power)

Course Description

“Predictive Analytics in Sport” is designed to provide students with an introduction to predictive analytics utilizing linear regression-based modeling approaches to analyze sport-related data. As this is designated as a CURE (Course-based Undergraduate Research Experiences) course, students will learn the iterative process of model building through trial and error and by working with other students on hands-on problems and projects. At the conclusion of this course, students will be able to collect and analyze sport-related data using predictive analytics, whether the dependent variable is continuous (i.e., attendance) or binary (i.e., a win or a loss) in nature. Several processes that students will gain experience in include the decision of which type of model is appropriate given the data to be analyzed or research question to be answered, the selection of appropriate independent variables based on knowledge of the sport industry, theory, or the literature, interpretation of coefficients and measures of model fit, and the ability to communicate advanced statistical information to a lay audience.

Course Goals and Key Learning Objectives

This course is designed to provide students with the ability to develop and apply concepts of predictive analytics, such as building multivariate linear regression models. Upon successful completion of this course, active course participants should be expected to:

- 1) an awareness of both the recent trend of utilizing analytics in the sport industry, as well as of the key issues facing the continued adoption of advanced analytics within the industry
- 2) an understanding of the basic concepts that underlie analytics, and an ability to apply these concepts to the analysis of issues within the sport industry.
- 3) an understanding of how analytics may better inform managerial decision-making within the sport industry

Primary Content of Course – Statistical Concepts

- Correlation and collinearity
- Bivariate regression analysis
- Multiple regression analysis
- Hierarchical regression analysis
- Logistic regression analysis

Course Technology

Sakai

You need to check Sakai daily to see announcements notifying you of important class news (e.g., readings, required assignments, updates on required assignments, etc.). You are responsible for the work and/or information (e.g., power point slides, articles, etc.) posted to Sakai. Please do not use the digital drop box to submit any work unless specifically instructed to do so. I will make extensive use of the Poll Everywhere software during classtime, so you should bookmark the site www.pollevo.com/jajensen on your device to participate in polls during class.

Student Email Accounts

From time to time it may be necessary for me to provide important class announcements via email. All email communications from me will be sent to your school email address. Please be sure to check your school account daily, as emails will not be sent to personal accounts.

Statistical Package

In in-class demonstrations I will be using SPSS, which is a very user-friendly statistical software package and works well for cross-sectional regression modeling. If you are already proficient in another statistical package such as R, SAS, or Stata, you are welcome to use it for your assignments. My intention is to give you the opportunity to experience statistical computing as it is done in the industry, and to give you some experience that will be useful for future coursework and the work force. However, it is your responsibility as part of the course to become proficient in a statistical package, and there are a number of resources available to you throughout campus. You can access SPSS on campus at the [Odum Institute](#) as well as on your own machine through UNC's [Virtual Lab](#). For those interested in learning R, we will be welcoming a professor from the statistics department who will provide a tutorial during class, and the [R Open Labs](#) at the Odum Institute on campus are also recommended.

Text and Course Grading

Required Textbook and Other Readings

Moskowitz, Tobias J. & L. Jon Wertheim, "Scorecasting: The Hidden Influences Behind How Sports Are Played and Games Are Won." New York, NY: Crown Archetype, 2011. ISBN 978-0-307-59179-1.

Harrison, C. Keith & Scott Bukstein. "Sport Business Analytics: Using Data to Increase Revenue and Improve Operational Efficiency." Boca Raton, FL: CRC Press, 2017. ISBN 978-1-4987-6126-0.

Other readings (e.g., academic journal articles, articles, case studies, etc.) will be posted on Sakai. Hard copies will not be handed out during class and it is expected that any reading posted to Sakai will be read.

Grading

Your course grade is determined as follows:

Journal Article Presentations – 50 points
Problem Sets – 75 Points
Group Project Progress Reports – 100 points
Group Project Presentation – 100 points
Class Participation (including in-class assignments) – 25 points

*Attendance (see the course policies: attendance policy)

1. Presentation of Journal Article: Students will pair up and present to the class a short overview of an article (of their choice) applying regression-based approaches to sport data from either the finals of the research papers competition at the [MIT Sloan Sports Analytics Conference](#) or academic journals such as [Journal of Sports Analytics](#), [Journal of Quantitative Analysis in Sports](#), or [Journal of Sports Economics](#). A helpful guide to understanding and interpreting a scientific paper is linked [here](#). The presentation should be no more than 10 minutes and should outline the key aspects of the paper: its purpose, its relationship to the existing literature, its approach, and its findings. Students should also comment on what they think the managerial implications of the paper might be (if any). The presentations will occur throughout the course at the beginning of class. Presentation days will be assigned during the first day of class.

2. Problem Sets: Multiple problem sets will be distributed during the semester. These assignments will be given to you at least 5 to 7 days before their due date. My expectations and requirements will be explicitly stated in each assignment. These assignments must be turned in by their deadline or a 20 percentage-point penalty will be assessed for each day they are late.

3. Analytics Group Project: In teams of four, students will be required to initiate and complete a sport analytics project of their choosing. The project will involve the development of each group's own predictive analytics model analyzing data utilizing the university's subscription to the [Sports Market Analytics](#) website or from another source, such as Rod Fort's Sports Business [database](#). The final product will demonstrate competency in predictive analytics as applied to an important issue in either intercollegiate or professional sport. The final deliverables will be a report in PowerPoint form, as well as an in-class presentation during the last week of class that will be attended and evaluated by the UNC Athletic Department's Director of Business Intelligence Andrea Johnston. After receiving feedback from Andrea and the professor, each team will then share their work as a poster at the QEP Research and Making Expo held at the Great Hall of the Carolina Student Union the last week of class.

Each team will also be responsible for submitting a progress report in line with the following general schedule to ensure that all teams are able to successfully complete their project.

Progress Report No. 1 (Weeks 1-4):	Previous literature and idea generation
Progress Report No. 2 (Weeks 5-8):	Data collection and preliminary analysis
Progress Report No. 3 (Weeks 9-11):	Completion of data analysis
Progress Report No. 4 (Weeks 12-13):	Writing report and creating presentation
Progress Report No. 5 (Weeks 14-15):	Presentations

Graduate Research Consultants (GRCs)

In this research-exposure course, you will be working with two Graduate Research Consultants (GRCs) who will assist you in your research project. The GRC program is sponsored by the Office for Undergraduate Research (our.unc.edu). I encourage you to visit this website to see other ways that you might engage in research, scholarship and creative performance while you are at Carolina.

Both GRCs are graduate students at UNC-Chapel Hill and have extensive statistical knowledge to assist you in this project. It is important to note that GRCs do not grade assignments, their sole purpose is to assist you in your group projects, every step of the way. They will be in attendance when you present updates on your projects and will be available during classtime to assist in questions related to methods, statistical issues, model building problems, and helping to communicate your findings.

4. Class Participation (including in-class assignments): Particularly given that this course is designated as a CURE (Course-based Undergraduate Research Experiences) course, hands-on participation by all class members is required. You should be prepared to provide thoughtful comments in class. Being a thoughtful, insightful and analytical contributor is a valuable trait in the sport industry. Students will often be called on in class and are expected to be ready to make a relevant and thoughtful response. In addition, students are encouraged to show initiative in adding relevant and thoughtful contributions to the current class discussion.

Grade Scale

Grades in the course will be assigned according to the grade scale below:

A Excellent	B Very Good	C Good	D Poor	F Unacceptable
Exceptional achievement combined with extraordinary insight into and command of course material.	Superior achievement that exceeds the norm expectations of a college student.	Competence; Achieving standard performance expected of a college student	Minimal achievement allowable for course credit, passing but not satisfactory	Performance fails to achieve minimal expectations for college students
A 93+ 324-350 A- 90-92 313-323	B+ 87-89 303-312 B 83-86 289-302 B- 80-82 278-288	C+ 77-79 268-277 C 73-76 254-267 C- 70-72 243-253	D+ 67-69 233-242 D 63-66 219-232 D- 60-62 219-210	Below 60

Academic Integrity

Academic and personal misconduct by students in this class are defined and dealt with according to the UNC Honor Code. Students with questions about any activity that may be interpreted as academic dishonesty should see their instructor *before* the assignment is due. Students may be videotaped by instructors through the use of classroom or handheld monitoring devices during any exam or graded assignments taken in class. Please see the following link to access related information on UNC's Honor Code (<http://honor.unc.edu/>).

Attendance Policy

In this course, you are expected to actively engage in the learning process. This means that you must be prepared for class by doing the readings, and be willing to share your ideas and questions with the class. Because you will learn not only from the lectures and readings, but from the class discussion, it is imperative that you attend every class. There are no free passes; the only excused absences are those allowed by the University, provided that you contact the professor prior to your absence. With an excused absence, it is your responsibility to get notes and make up any missed in-class work or assignments. Attendance will be taken at every class meeting, and any absence will impact your total attendance and class participation grade.

Accommodations

The University of North Carolina at Chapel Hill facilitates the implementation of reasonable accommodations, including resources and services, for students with disabilities, chronic medical conditions, a temporary disability or pregnancy complications resulting in difficulties with accessing learning opportunities. All accommodations are coordinated through the Accessibility Resources and Service Office. Please contact ARS immediately through their website <http://accessibility.unc.edu>, call 919-962-8300 or email accessibility@unc.edu.

Course Modifications

In certain instances, it may be necessary to make changes to the course. The professor reserves the right to make changes to the syllabus, including project due dates and test dates, when unforeseen circumstances occur. Any changes will be announced as early as possible to that students can adjust their schedule. Updates, announcements or changes will either be posted to Sakai and/or sent via UNC email.

Communication Policy

Feel free to communicate with me at any time via e-mail at jajensen@email.unc.edu. Typically, I respond to email as soon as possible and usually check email in the morning during weekdays.

Practicing Professionalism

This course helps motivate students to develop their professional marketing skills. It is imperative that students begin learning professionalism now, as opposed to waiting until they enter the workforce. In the spirit of promoting a professional ethic, we will not tolerate arriving late, leaving early, surfing the internet, talking to classmates, sleeping, talking on cell phones, texting or use of social media. Tobacco use of any kind in the classroom is prohibited. Beyond these basic rules of professionalism, we hope you can work at being attentive and try your hardest to keep yourself focused on what is going on in class.

Tentative Course Schedule

(This schedule is tentative and may change based upon guest speakers or other circumstances)

Week	Statistical Concept to Be Discussed	Reading / Class Materials
1	8/21	Objectives of Course, Class Policies
2	8/26	Class Introductions
	8/28	In-Class R Tutorial by STOR Assistant Professor Mario Giacomazzo <i>Scorecasting</i> : Introduction, Whistle Swallowing; <i>Sport Business Analytics</i> (SBA) Chapter 1
3	9/2	Labor Day (No Class) <i>SBA</i> Chapter 2
	9/4	Review of Hypothesis Testing, Type I/II Error, Statistical Inference <i>Scorecasting</i> : Go for It; <i>Statistical Concepts</i> Ch. 10
4	9/9	Correlation / Collinearity <i>Scorecasting</i> : How Competitive Are Competitive Sports? <i>SBA</i> Chapter 3; <i>Statistical Concepts</i> Ch. 17
	9/11	Correlation / Collinearity Continued <i>Scorecasting</i> : Tiger Woods is Human; <i>SBA</i> Chap. 4
5	9/16	In-Class Exercise: College Football Attendance Data <i>Scorecasting</i> : Offense Wins Championships, Too; Problem Set No. 1 Due
	9/18	Bivariate Regression <i>Scorecasting</i> : The Value of a Blocked Shot; <i>SBA</i> Chapter 5; Progress Report No. 1 Due
6	9/23	Guest Speaker: Boston Celtics Sr. Dir. Of Analytics Richie Smith <i>Scorecasting</i> : Rounding First; <i>Statistical Concepts</i> Ch. 18
	9/25	Multiple Regression Introduction <i>Scorecasting</i> : Thanks, Mr. Rooney; <i>SBA</i> Chapter 6
7	9/30	Multiple Regression Continued <i>Scorecasting</i> : Comforts of Home; Problem Set No. 2 Due
	10/2	In-Class Exercise: Professional Baseball Promotions Data <i>Scorecasting</i> : So, What Is Driving the Home Court Advantage; <i>SBA</i> Chapter 7
8	10/7	<i>Scorecasting</i> : There's No I in Team
	10/9	Multiple Regression Continued <i>Scorecasting</i> : Off the Chart; <i>SBA</i> Chapter 8 Progress Report No. 2 Due
9	10/14	Guest Speaker: Hurricanes Business Intelligence Analyst Alston Meadows <i>Scorecasting</i> : How a Coin Toss Trumps All; <i>SBA</i> Chapter 9
	10/16	Interactions Introduction <i>Scorecasting</i> : What Isn't in the Mitchell Report
10	10/21	Two Time Point Designs <i>Scorecasting</i> : Do Athletes Really Melt When Iced? <i>SBA</i> Chapter 10; <i>Statistical Concepts</i> Ch. 19
	10/23	Logistic Regression Introduction <i>Scorecasting</i> : The Myth of the Hot Hand;
11	10/28	Logistic Regression Continued <i>Scorecasting</i> : Damned Statistics; <i>SBA</i> Chapter 11; Problem Set No. 3 Due
	10/30	In-Class Exercise: Won/Loss Data <i>Scorecasting</i> : Are the Chicago Cubs Cursed?; Progress Report No. 3 Due
12	11/4	Probit Models <i>SBA</i> Chapter 12
	11/6	Overview of Fixed and Random Effects Models <i>SBA</i> Chapter 13
13	11/11	In-Class Group Project Work
	11/13	In-Class Group Project Work Progress Report No. 4 Due
14	11/18	In-Class Group Project Work
	11/20	Group Project Presentations Progress Report No. 5 Due
15	11/25	Group Project Presentations
	11/27	Thanksgiving (No Class)
16	12/2	Apply Input on Presentations
	12/3	QEP EXPO (3-5 p.m., Blue Zone)
Exam Days		

Recommended Additional Courses and Readings (By Topic)

Below are some additional courses at UNC that you might consider taking after completion of this course:

- STOR 320 - Introduction to Data Science
- STOR 390 - Sports Analytics
- STOR 455 - Statistical Methods
- ECON 485 - Economics of Sports

In addition, should you wish to learn more about predictive analytics in sport above and beyond this course, below are a number of additional resources. In addition to the below books and/or articles, there are a rapidly growing number of websites dedicated to thinking and writing about sports from an analytics perspective. Regardless of your interest in the particular sport, reading each of these sites will challenge you to think analytically about sports. While there are many more, here is a short list of some of the more popular sites:

- [Football Outsiders](#)
- [Nylon Calculus](#)
- [KenCom.com](#)
- [Society for Baseball Research \(SABR\)](#)
- [Fan Graphs](#)
- [FiveThirtyEight](#)

BASEBALL

1. Albert, Jim. "Teaching Statistics Using Baseball." Washington, DC: Mathematical Association of America (MAA) Press, 2017. ISBN 978-1-93951-216-2.
2. Albert, Jim. "Visualizing Baseball." Philadelphia, PA: Taylor & Francis Group, 2018. ISBN 978-1-4987-8275-3.
3. Baumer, Benjamin & Andrew Zimbalist. "The Sabermetric Revolution: Assessing the Growth of Analytics in Baseball." Philadelphia, PA: University of Pennsylvania Press, 2014. ISBN 978-0-8122-2339-2.
4. Costa, Gabriel B., Michel R. Huber, & John T. Saccoman. "Understanding Sabermetrics: An Introduction to the Science of Baseball Statistics." Jefferson, NC: McFarland & Company, Inc., 2008. ISBN 978-0-7864-3388-9.
5. Keri, Jonah. "The Extra 2%: How Wall Street Strategies Took a Major League Baseball Team from Worst to First." New York, NY: ESPN Books, 2011. ISBN 978-0-345-51765-4.
6. Lindbergh, Ben & Sam Miller. "The Only Rule Is It Has to Work: Our Wild Experiment Building a New Kind of Baseball Team." Henry Holt and Company, 2016.
7. Marchi, Max & Jim Albert. "Analyzing Baseball Data with R." Boca Raton, FL: CRC Press, 2014. ISBN 978-1-4665-7022-1.
8. Sawchik, Travis. "Big Data Baseball: Math, Miracles, and the End of a 20-Year Losing Streak." New York, NY: Flatiron Books, 2015. ISBN 978-1-06350-2.
9. Tango, Tom M., Mitchel G. Lichtman, & Andrew E. Dolphin. "The Book: Playing the Percentages in Baseball." TMA Press, 2006. ISBN 978-1-494-26017-0.
10. Thorn, John & Pete Palmer. "The Hidden Game of Baseball: A Revolutionary Approach to Baseball and Its Statistics." Chicago, IL: The University of Chicago Press, 1984. ISBN 978-0-226-24248-4.
11. Wheeler, Lonnie. "Intangiball: The Subtle Things That Win Baseball Games." New York, NY: Simon & Schuster, 2015. ISBN 978-1-4516-9602-8.

BASKETBALL

12. Carver, Johnny, with Steve Carter & William J. Hudson. "Ranketology: A New Way of Determining Basketball's Greatest Player." Johnny Carver, 2014. ISBN 978-0-578-15636-1.
13. Glockner, Andy. "Chasing Perfection: A Behind-the Scenes Look at the High-Stakes Game of Creating an NBA Champion." Philadelphia, PA: Da Capo Press, 2016. ISBN 989-0-306-82402-9.
14. Oliver, Dean. "Basketball on Paper: Rules and Tools for Performance Analysis." Dulles, VA: Potomac Books, Inc., 2004. ISBN 978-1-57488-688-7.
15. Shea, Stephen. "Basketball Analytics: Spatial Tracking." Stephen Shea, 2014. ISBN 978-1-503-23627-1.
16. Shea, Stephen M. & Christopher E. Baker. "Basketball Analytics: Objective and Efficient Strategies for Understanding How Teams Win." Lake St. Louis, MO: Advanced Metrics, LLC., 2013. ISBN 978-1-492-92317-6.

BUSINESS & ECONOMICS

17. Alamar, Benjamin C.. "Sports Analytics: A Guide for Coaches, Managers, and Other Decision Makers." New York, NY: Columbia University Press, 2013. ISBN 978-0-231-16292-0.
18. Bradbury, J.C. "Hot Stove Economics: Understanding Baseball's Second Season." New York, NY: Coopernicus Books, 2011. ISBN 978-1-4419-6269-0.
19. Bradbury, J.C. "The Baseball Economist: The Real Game Exposed." New York, NY: Penguin Group, 2007. ISBN 978-0-452-28902-4.
20. Carter, David M. "Money Games: Profiting from the Convergence of Sports and Entertainment." Stanford, CA: Stanford University Press, 2011. ISBN 978-0-8047-5955-7.
21. Delaney, Kevin J. & Rick Eckstein. "Public Dollars, Private Stadiums: The Battle Over Building Sports Stadiums." Piscataway, NJ: Rutgers University Press, 2003. ISBN 978-0-8135-3343-8.
22. Euchner, Charles C. "Playing the Field: Why Sports Teams Move and Cities Fight to Keep Them." Baltimore, MD: The Johns Hopkins University Press, 1993. ISBN 0-0818-4973-X.
23. Fried, Gil, & Ceyda Mumcu, Editors. "Sport Analytics: A Data-Driven Approach to Sport Business and Management." Oxon, UK: Routledge, 2017. ISBN 978-1-138-66713-6.
24. Kuper, Simon & Stefan Szymanski. "Soccernomics: Why England Loses, Why Spain, Germany, and Brazil Win, and Why the US, Japan, Australia -- and Even Iraq -- are Destined to Become the Kings of the World's Most Popular Sport." New York, NY: Nation Books, 2014. ISBN 978-1-56858-481-2.
25. Rein, Irving, Ben Shields, & Adam Grossman. "The Sports Strategist: Developing Leaders for a High-Performance Industry." New York, NY: Oxford University Press, 2015. ISBN 978-0-19-934383-6.
26. Sheehan, Richard G. "Keeping Score: The Economics of Big-Time Sports." South Bend, IN: Diamond Communications, Inc., 1996. ISBN 0-912083-96-4.
27. Zimbalist, Andrew. "May the Best Team Win: Baseball Economics and Public Policy." Washington, DC: The Brookings Institute, 2003. ISBN 0-8157-9729-X.

FANTASY

29. Bales, Jonathan. "Fantasy Football for Smart People: How Fantasy Football Pros Game Plan to Win." Jonathan Bales, 2014. ISBN 978-1-499-73783-7.
30. Signore, Martin. "Fantasy Football for Dummies." Hoboken, NJ: John Wiley and Sons, 2007. ISBN 978-0-470-12507-6.

GENERAL

31. Adler, Joseph. "Baseball Hacks: Tips & Tools for Analyzing and Winning with Statistics." Sebastapol, CA: O'Reilly Media, Inc., 2006. ISBN 0-596-00942-9.
32. Albert, Jim, Jay Bennet, & James J. Cochran, Editors. "Anthology of Statistics in Sports." Philadelphia, PA / Alexandria VA: SIAM / ASA, 2005. ISBN 0-89871-587-3.
33. Barrow, John D. "Mathletics: 100 Amazing Things You Didn't Know About the World of Sports." New York, NY: W.W. Norton & Company, Inc., 2013. ISBN 978-0-393-34550-6.
34. Berri, David J. Martin B. Schmidt, and Stacey L. Brook. "The Wages of Wins: Taking Measure of the Many Myths in Modern Sport." Stanford University Press, 2007. ISBN 978-08047-5844-4.
35. Langville, Amy N. & Carl D. Meyer. "Who's #1? The Science of Rating and Ranking." Princeton, NJ: Princeton University Press, 2012. ISBN 978-0-691-15422-0.
36. Miller, Thomas W. "Sports Analytics and Data Science: Winning the Game with Methods and Models." Old Tappan, NJ: Pearson Education, Inc., 2016. ISBN 978-0-13-388643-6.
37. Minton, Roland B. "Sports Math: An Introductory Course in the Mathematics of Sports Science and Sports Analytics." Boca Raton, FL: CRC Press, 2017. ISBN 978-1-4987-0626-1.
38. Severini, Thomas A. "Analytic Methods in Sports: Using Mathematics and Statistics to Understand Data from Baseball, Football, Basketball, and Other Sports." Boca Raton, FL: CRC Press, 2015. ISBN 978-1-4822-3701-6.
39. Silver, Nate. "The Signal and the Noise - Why so many predictions fail, but some don't." New York, NY: Penguin Books, 2015. ISBN 978-0-14-312508-2.
40. Winston, Wayne L. "Mathletics: How Gamblers, Managers, and Sports Enthusiasts Use Mathematics in Baseball, Basketball, and Football." Princeton, NY: Princeton University Press, 2009. ISBN 978-0-691-15458-9.
41. Wright, Mike, Editor. "Operational Research Applied to Sports." New York, NY: Palgrave Macmillan, 2015. ISBN 978-1-137-53454-1.

GOLF

42. Broadie, Mark. "Every Shot Counts: Using the Revolutionary Strokes Gained Approach to Improve Your Golf Performance and Strategy." New York, NY: Gotham Books, 2014. ISBN 978-1-592-40750-7.

HOCKEY

43. Vollman, Rob, with Tom Awad & Iain Fyffe. "Hockey Abstract Presents: Stat Shot: The Ultimate Guide to Hockey Analytics." Toronto, ON: ECW Press, 2016. ISBN 978-1-77041-309-2.
44. Walter, Ryan and Mike Johnston. "Hockey Plays and Strategies." Champaign, IL: Human Kinetics. 2010. ISBN 0-7360-7634-4.

SOCCER

46. Anderson, Chris & David Sally. "The Numbers Game: Why Everything You Know About Soccer is Wrong." New York, NY: Penguin Books, 2013. ISBN 978-0-14-1332456-6.
47. Palacios-Herta, Ignacio. "Beautiful Game Theory: How Soccer Can Help Economics." Princeton, NY: Princeton University Press, 2014. ISBN 978-0-691-14402-3.
48. Wilson, Jonathan. "Inverting the Pyramid: the history of soccer tactics." New York, NY: Perseus Books, 2013. ISBN 978-1-56858-737-7.

SPORT SCIENCE

49. Fainaru-Wada, Mark & Steve Fainaru. *League of Denial: The NFL, Concussions, and the Battle for Truth.* New York, NY: Three Rivers Press, 2013. ISBN 978-0-770-43756-5
50. Martin, Lorena. *Sports Performance Measurement and Analytics: The Science of Assessing Performance, Predicting Future Outcomes, Interpreting Statistical Models, and Evaluating the Market Value of Athletes.* Old Tappan, NJ: Pearson Education, Inc., 2016. ISBN 978-0-13-419330-4.
51. McClusky, Mark. *Faster, Higher, Stronger: How sports science is creating a new generation of superathletes - and what we can learn from them.* New York, NY: Hudson Street Press, 2014. ISBN 978-1-59463-153-5.

OTHER SPORTS

52. Elo, Arpad E. *The Rating of Chessplayers, Past & Present.* New York, NY: American Chess Foundation, 1978. ISBN 0-668-04721-6.
53. Kleshnev, Valery. *The Biomechanics of Rowing.* Wiltshire, UK: Crowood Press, 2016. ISBN 978-1-78500-133-8.
54. Skiena, Steven. *Calculated Bets: Computers, Gambling, and Mathematical Modeling to Win.* Cambridge, UK: Cambridge University Press, 2001. ISBN 0-521-00962-6.