

Term Information

Effective Term Autumn 2013

General Information

Course Bulletin Listing/Subject Area Psychology
Fiscal Unit/Academic Org Psychology - D0766
College/Academic Group Arts and Sciences
Level/Career Undergraduate
Course Number/Catalog 4509
Course Title Perception of Space and Motion in Sports
Transcript Abbreviation Percptn space&motn
Course Description Discussion of cognitive, perceptual, and statistical issues that have special application to performance in sports.
Semester Credit Hours/Units Fixed: 3

Offering Information

Length Of Course 14 Week, 7 Week, 4 Week (May Session), 12 Week (May + Summer)
Flexibly Scheduled Course Never
Does any section of this course have a distance education component? No
Grading Basis Letter Grade
Repeatable No
Course Components Lecture, Seminar
Grade Roster Component Lecture
Credit Available by Exam No
Admission Condition Course No
Off Campus Never
Campus of Offering Columbus, Lima, Mansfield, Marion, Newark

Prerequisites and Exclusions

Prerequisites/Corequisites Psych 2200 (220), 2300 (300), and 3310 (310)
Exclusions

Cross-Listings

Cross-Listings

Subject/CIP Code

Subject/CIP Code 42.0101
Subsidy Level Baccalaureate Course
Intended Rank Junior, Senior

Quarters to Semesters

Quarters to Semesters

New course

Give a rationale statement explaining the purpose of the new course

Psychology related to sport is a topic of interest to both researchers & students. This course will enhance our offerings in this area by studying cognitive, perceptual, human factors, & statistical issues that have application to sport performance.

Sought concurrence from the following Fiscal Units or College

Requirement/Elective Designation

The course is an elective (for this or other units) or is a service course for other units

Course Details

Course goals or learning objectives/outcomes

Content Topic List

- Interception of targets in 3-D space in the domain of sports
 - Cognitive processing in sports, especially baseball
 - Statistical misconceptions/misrepresentations in sports and applying statistics to raise performance
 - How the trajectories of targets in sports lead to false conclusions about where they are located in space
 - Linking animal interception to how baseball outfielders catch fly balls and football players chase one another
 - American football pursuit and interception, American football quarterbacks "intercepting" receivers and blindfolded folks chasing beeping balls
 - Perceptual factors affecting football (soccer) and baseball umpiring—making the right call
 - Handedness findings in sports
 - Cheating in sports: Does it really affect outcomes?
 - Choking, slumping, excelling, and performance under pressure in sports
 - Predicting wins, "bouncing back" from a loss, and other cognitive errors
 - Improving performance
- Psych 4509 Perception of Space and Motion in Sports AU13 Syllabus.doc: Course Syllabus

(Syllabus. Owner: Paulsen,Alisa Marie)

Attachments

Comments

Workflow Information

Status	User(s)	Date/Time	Step
Submitted	Paulsen,Alisa Marie	09/27/2012 09:46 AM	Submitted for Approval
Approved	Petty,Richard Edward	09/27/2012 10:10 AM	Unit Approval
Approved	Haddad,Deborah Moore	09/27/2012 10:23 AM	College Approval
Pending Approval	Nolen,Dawn Jenkins,Mary Ellen Bigler Vankeerbergen,Bernadette Chantal Hogle,Danielle Nicole Hanlin,Deborah Kay	09/27/2012 10:23 AM	ASCCAO Approval

PSYCH 4509
Perception of Space and Motion in Sports
Autumn 2013

Instructor: Dr. Dennis M. Shaffer
Office Location: 343 Ovalwood Hall
Office Phone: (419) 755-4274
Office Hours: By appointment only.

Class Time:
Class Location:
E-mail Address: shaffer.247@osu.edu

Prerequisites:

Psychology 2200 (220), 2300 (300), and 3310 (310)

Required Textbook:

There is no required textbook. Students will be assigned readings that will be available through the OSU Mansfield library in Adobe pdf format. The lecture schedule and assigned readings are posted along with this syllabus.

Course Overview:

In this class we will discuss cognitive, perceptual, and statistical issues that have special application to performance in sports. What makes professional baseball batters better than novices? What happened to the .400 hitter in baseball? How do football players know where to run to tackle someone? Do athlete's conscious perceptions of the world determine their performance? Do managers and fans know what builds a winning baseball team? The course will broach these and other topics. This course will examine how psychological principles can be applied to understand the behavior and enhance the performance of athletes, coaches, umpires, and fans.

The course will be taught as an advanced undergraduate seminar. We will discuss primary source articles in the fields of perception and sport. Students will be expected to read 8-10 articles per week, and discuss issues related to the articles in class. Students will be expected to pick three general topics and present the articles on each topic for which they will lead discussion.

Particular topics that will be considered will include baseball batting and fielding, basketball perception, handedness and eye dominance, perception of 3-D space, football tracking, expert-novice difference in sport, animal locomotion, predicting motion, naïve beliefs of athletes and announcers, perception and performance of baseball umpires, and statistical misrepresentation in sports. The course is intended to be very interactive, and will include at least one field trip.

My Expectations:

1. Students will complete the assigned readings before class.
2. Students will participate in class discussions, demonstrations and assignments.
3. Students will seek help, advice or information if they need it.

Evaluation:

Points
150

🕒 Research Project

- - During the course students will design and conduct a research study or analyze data that will investigate some aspect of perception of space and motion with special application to sports.
- - Students will choose topics either from the list of possible topics I will give you (Topics Handout) or another topic chosen on your own, in consultation with me. Make sure to get approval from me before deciding on a project not listed in the handout.
- - I expect a great deal of interaction with students in designing the study, setting up the methodology, analyzing the data, and interpreting the results.

🕒 Research Project Presentation

100

- - Students will give a 12-15 minute PowerPoint presentation on the project to the class on the scheduled exam day as their “Final Exam.”
- - Students must hand in a copy of their PowerPoint presentation to me.

Presentation Guidelines:

-Your presentation should be about 12-15 min long. **Practice it at home so you know it is roughly the right length. If you have reached the maximum time, I will stop you and you will not be allowed to finish.** It should have the following components:

1. Begin with a brief general Introduction about why you think this topic is important. **Make us interested! Capture our attention!**
2. Clearly explain your topic. Give the background about the topic, referring back to material we have already covered if possible.
3. Briefly describe what you did, why, and how you did it.
4. Give us the results—What did you find and how did you find it (e.g., what analyses were performed and what was found—please report exact statistics (i.e., t-values, p-values, χ^2 values, etc.)?)
5. Make conclusions/Inferences about what it all means—what is/are the take home messages.

Some Tips:

-Visual aids are always good (you know a picture is worth a thousand

words) but you don't have to use them.

-Don't put too much on one slide!

-Your aims when you are giving a talk should be:

Seize the audience's attention immediately

Be heard in the back row.

Speak slowly and clearly.

Look everyone in the audience in the eye.

Make clear points.

Don't go over time.

Don't read your presentation (but feel free to use a few notes or cue cards).

Finish clearly and strongly rather than fading out. We should know when you are finished!

① **Research Project Outline**

50

- - At the beginning of the first class of the week in week 7, each student will hand in a 1-2 page, typed, double-spaced outline about the research project they are planning to conduct. This should include the background/rationale for the project, Hypotheses about what is likely to occur given the background, methods, analyses, and inferences that can possibly be made. For every day it is late, the group will lose 10 points. If it is handed in at the end of class Wednesday, this will be considered 1 day late.

① **Leading Class Discussion Assignments & Participation**
(40 points x 3 presentations)

120

- - Primary source articles are assigned in the Reading List. Students will be expected to read the articles assigned for that day and participate in discussion about the articles.
- - Each student will be required to lead discussion for the articles for 3 topics. Students will choose topics from those listed in the Course Schedule at the end of this syllabus, and from the Readings List handout. Each class discussion that is led will be graded out of 40 points according to the following criteria: (1) Preparedness of the student, (2) Organization— does the student have a plan (in what order will we talk about the articles, if there is more than one), (3) Ability to ask some bigger picture questions concerning the article (like theoretically important questions as opposed to nitpicking about the methods), and (4) Any other commentary concerning the relevance of the work, ideas about future work, or “fatal flaws.”
- - Students should pick a topic in which they are

interested (makes understanding the material much easier), instead of picking a topic with fewer articles, fewer pages, or towards the end of the quarter.

- - Students should open discussion of the topic/articles by indicating why they chose the topic, and what they found interesting about the article. Students should then try to give some background or rationale for the work when leading a discussion. They should then summarize the article(s) (e.g., background, hypotheses, how questions were tested, what was found, and conclusions or inferences that were made). They should then ask some bigger picture questions about the article(s). Finally, they can bring up any specific points they might want to address about the article(s). When presenting more than one article, students should lead in the discussion of the second article with how, if at all, it is connected with the first.
- - Students should read the Background readings for these discussions, and talk to the instructor about any other material or information that might help in the presentation of the topic. Please come and talk to me about the topic and we can discuss the background, some interesting highlights, and why it might be important. Please read the articles before coming to me to talk about these things.
- - Feel free to come and talk to me before you have read the article(s) if you are unsure of the topic you would like to present.

① Questions to Lead Off a Discussion/Critical Commentary (5 points x 32 Topics)

160

- - Based on the readings for that day's class.
- - Each student must come up with at least 1 comment and 2 questions per topic that could lead off a discussion for each topic for which there are mandatory readings (**NOTED IN BOLD ON THE READINGS HANDOUT**). The comment should describe one thing that you liked about the article or thought the authors did well. The questions should be "bigger picture types of theoretically-based questions. They can also be ideas for the way the study should have been done (if there is a valid reason for why you think it was not done correctly), or "fatal flaws" to the study if you can discover them. They can also be ideas for new studies that make sense given the results and conclusions from the articles we read. **In general, I want your questions/comments to get at theoretically important questions, rather than to nitpick at more minor types of things (e.g., "More participants should have been used," "The study should have included women or men," "This should be done in the laboratory/real world instead," or "I don't like the apparatus that was used.") unless these things really bear on the legitimacy of the conclusions or inferences of the work.**

- - In some cases, the readings are magazine articles or book chapters that are not in the typical format of a scientific article. In these cases, the questions or comments should still have relevance to the topics discussed, but may address anything the student finds interesting.
- - Remember: Two questions must be prepared for **EACH TOPIC**. This means that for most classes you must come up with 4 questions, because there are typically 2 topics per class (this does not occur all of the time, but it does most of the time). The readings for which you are to write your questions/comments are in **BOLD** on the Readings list. If there are 2 articles, 1 question/comment must come from **EACH ARTICLE**. In cases where there is only one reading per topic, the two questions/comments must come from the same article. In cases where there are more than two articles per topic, students can choose on their own the two articles they use to form their questions/comments.
- - Students should list the reference of the article first (so I know for which article you are writing your comment or question, and then give the comment or questions underneath it. Alternatively, students can include the reference in the questions or comment (e.g., "In Shaffer et al., 2004,") so long as I can distinguish the articles.
- - There are 33 topics listed on the Readings list. When students are leading the class discussion, they do not have to hand in questions or comments ($33 - 3 = 30$) **FOR THAT TOPIC ONLY**. Students do not have to submit questions or comments for the FIELD TRIP on 10-11, but you do have to submit tips for yourself on hitting (see Readings list) ($30 + 1 = 31$). On 10-9, in addition to submitting the questions, students must also calculate and submit what the ideal bat weight and length is for him or her ($31 + 1 = 32$).

Total

580

Grading:

- A 94% - 100%
- A- 90% - 93%
- B+ 87% - 89%
- B 84% - 86%
- B- 80% - 83%
- C+ 77% - 79%
- C 74% - 76%
- C- 70% - 73%
- D+ 67% - 69%
- D 60% - 66%
- E Below 60%

Make-up Work:

Work (questions/comments, leading discussion, research project paper and presentation) can be made up only if the student has a medical or family emergency. Written evidence of the emergency must be provided either before the work is due or as soon as possible after the work is due. The instructor reserves the right to decide on the adequacy of excuses. *See me at once* if you miss any of the work or when you anticipate missing it. You must see me, in person, in my office for this.

Academic Dishonesty:

Plagiarizing someone else's work will not be tolerated. Plagiarism is when you cite or discuss another person's work as your own. If you would like to use someone else's ideas, summarize their work *USING YOUR OWN WORDS* and then *CITE THEIR WORK* using the accepted American Psychological Association's (APA) Guidelines. If you are caught being academically dishonest, I will report the incident to Ohio State and you will be subject to punishment from the university that includes, but is not limited to receiving a failing grade for that work. If you are still not sure what is considered academically dishonest, please see me.

Conduct:

University college students, like all members of the OSU community, are expected to conduct themselves maturely. A student who infringes on the rights of others or who in any way disturbs orderly academic functions may be subject to probation, suspension, or dismissal. Physical or verbal abuse of any person, theft of, or damage to University property, unauthorized entry of University facilities, disruption of teaching or administration, misuse of University documents, or knowingly furnishing false information to the University is grounds for such disciplinary action.

I also expect that: Students will not talk when the instructor or leader of discussion is talking so it disrupts the concentration of other students or the instructor, and that cell phones will be turned off or turned to vibrate while class is in session.

It is the responsibility of the Committee on Academic Misconduct to investigate or establish procedures for the investigation of all reported cases of student academic misconduct. The term "academic misconduct" includes all forms of student academic misconduct wherever committed; illustrated by, but not limited to, cases of plagiarism and dishonest practices in connection with examinations. Instructors shall report all instances of alleged academic misconduct to the committee (Faculty Rule 3335-5-487). For additional information, see the Code of Student Conduct http://studentlife.osu.edu/pdfs/csc_12-31-07.pdf.

Students with Disabilities:

Students with disabilities that have been certified by the Office for Disability Services will be appropriately accommodated and should inform the instructor as soon as possible of their needs. The Office for Disability Services is located in 150 Pomerene Hall, 1760 Neil Avenue; telephone 292-3307, TDD 292-0901; <http://www.ods.ohio-state.edu/>.

In accordance with University policy, if you have a documented disability and require accommodations to obtain equal access in this course, please contact me privately at the beginning of the semester, or when given an assignment for which

an accommodation is required, to discuss your specific needs. You will also need to speak with Michelle McLane at the Office of Disability Services to discuss your special needs. You can contact Michelle by calling (419) 755-4304 or visit her at C-100E Conard Learning Center in order to coordinate reasonable accommodations.

Special Requests:

1. Stop by my office and visit me sometime.
2. Bring me comics related to the course.

Class Schedule

Reading Assignments are due for the week they are listed below.

<u>Day:</u>	<u>Topic & Reading Assignments</u>
Week 1	<i>Introduction to the Course</i> <i>#1 Catching Fly Balls Headed to the Side—The LOT Strategy</i> <i>#2 Catching Frisbees Headed to the Side—The LOT Strategy</i> <i>*****Dr. Shaffer Will Present *****</i>
Week 2	<i>#3 & #4 Catching Fly Balls in the Plane Directly at Fielders—The OAC & GOAC Strategies</i> <i>*****Dr. Shaffer Will Present*****</i> <i>#5 “Keep Your Eye on the Ball”: Eye Movements in Fast-ball Sports.</i> <i>#6 Anticipation and Expert-novice Differences in Search Strategies in Tennis.</i>
Week 3	<i>#7 How to Get a Batter Out: Using Their Cognitive Processing to Your Advantage</i> <i>#8 Wow, That’s Sweet: Perceiving the Sweet Spot of a Baseball Bat</i> <i>#9 How Heavy Is Too Heavy?: Recommending Bat Weight and Length</i>
Week 4	<i>FIELD TRIP—BATTING CAGES—Swing Away (with new knowledge)!!</i> <i>#10 Moneyball: The Science of Winning for Less in Baseball</i>
Week 5	<i>#11 Where Have You Gone Joe DiMaggio (or Ted Williams)?: The Decline of the .400 Hitter in Baseball</i> <i>#12 Did Shoeless Joe Throw the Series?</i> <i>#13 Should I Pass the Basketball to Whomever Has the Hot Hand?: Misrepresentation of Runs/Sequences</i> <i>#14 A Silver Medal’s Better than Bronze, Right?</i>
Week 6	<i>#15 Where is the Ball? Rising Fastballs & Identifying the Apex</i> <i>#16 The Axis-Aligned Motion (AAM) Bias and Its Applications</i> <i>#17 Predicting Where Fly Balls Will Land and Where Footballs Are Going</i>
PROJECT OUTLINES ARE DUE BY THE BEGINNING OF THE FIRST CLASS THIS WEEK	
Week 7	<i>#18 Why Dragonflies & Tethered Flies are Like Baseball Players: Animal Tracking & Interception</i> <i>#19& #20 Intercepting By Tricycle and by Foot: Using a Constant</i>

Bearing Angle for Intercepting Targets

- Week 8 ***#21 & #22 Football Pursuit & Interception by Football Players Chasing Others, Quarterbacks Intercepting Receivers, & Blindfolded Players Chasing Beeping Balls***
- Week 9 ***#23 You're Out!! Perceptual Factors Affecting Baseball Umpiring***
#24 Perceptual Factors Affecting Football (American Soccer) Umpiring

#25 A Tie Goes to the First Baseman: Social (Normative) Factors Affecting Baseball Umpiring
- Week 10 ***#26 I Wish I Were Taller: Perception in Basketball***
#27 Sinister Strategies in Baseball and Which of Your Eyes Dominates?

#28 Corking Bats & Scuffing Balls: Baseball's Dirty Tricks
#29 Where Is It Headed?: Predictions About the Landing Location of Tennis Balls
- Week 11 ***#30 & #31 Under Pressure: Choking, Slumps, & Performing Under Pressure***

#32 & #33 Naïve Beliefs in Football: What Comes Down must Also Look Like It's Going Up
- Week 12 ***#34-#37 The Compression of Space & Embodied Perception, and Their Relationship to Perceiving Geographical Slant, Lines on the Road, and Kicking to Bigger Uprights***
- Week 13 ***#38-#41 Predicting Wins in a Season, Streaks in Baseball, "Bouncing Back" in the World Series, & Other Cognitive Errors***
- Week 14 ***#42 & #43 Building a Better Athlete I***

#44 & #45 Building a Better Athlete II

FINAL EXAM DATE & TIME
RESEARCH PROJECT PRESENTATIONS

*******PAPERS SHOWN IN BOLD ARE THE PAPERS TO WHICH YOUR TWO QUESTIONS/COMMENTS (PER TOPIC) MUST BE RELATED*******

#1 *Catching Fly Balls Headed to the Side—The LOT Strategy*

Mandatory Readings

McBeath, M. K., Shaffer, D. M., & Kaiser, M. K. (1995, April 28). How baseball outfielders determine where to run to catch fly balls. *Science*, 268, 569-573.

Background Reading

Cipra, B. (1995, April 28). Catching fly balls: A new model steps up to the plate. *Science*, 268, 502.

#2 *Catching Frisbees Headed to the Side—The LOT Strategy*

Mandatory Readings

Shaffer, D. M., Krauchunas, S. M., Eddy, M., & McBeath, M. K. (2004). How dogs navigate to catch Frisbees. *Psychological Science*, 15, 437-441.

Sugar, T. G., McBeath, M. K., & Wang, Z. (2006). A unified fielder theory of interception of moving objects either above or below the horizon. *Psychonomic Bulletin & Review*, 13, 908-917.

#3 *Catching Fly Balls—The OAC Strategy*

Mandatory Readings

Dienes, Z., & McLeod, P. (1993). How to catch a cricket ball. *Perception*, 22, 1427-1439.

#4 *Catching Fly Balls—Comparing OAC & LOT Strategies*

Fink, P. W., Foo, P. S., & Warren, W. H. (2009). Catching fly balls in virtual reality: A critical test of the outfielder problem. *Journal of Vision*, 9(13), 1-8.

#5 *Eye Movements in Cricket and Baseball*

Mandatory Readings

Land, M. F., & McLeod, P. (2000, December). From eye movements to actions: How batsmen hit the ball. *Nature Neuroscience*, 3 (12), 1340-1345.

Kato, T., & Fukida, T. (2002). Visual search strategies of baseball batters: Eye movements during the preparatory phase of batting. *Perceptual and Motor Skills*, 94, 380-386.

Background Reading

Horne, J. Keep your eye off the ball. *Nature*, 3 (12), 1236.

Watts, R. G., & Bahill, A. T. (2000). *Keep your eye on the ball: Curve balls, knuckleballs, and fallacies of baseball* (pp. 171-188). New York: W. H. Freeman & Company.

#6 College Players Batting Virtually

Mandatory Readings

Gray, R. (2002). Behavior of college baseball players in a virtual batting task. *Journal of Experimental Psychology: Human Perception and Performance*, 28 (5), 1131-1148.

Background Reading

Watts, R. G., & Bahill, A. T. (2002). *Physiological predictors of batting performance. Keep your eye on the ball: Curve balls, knuckleballs, and fallacies of baseball* (pp. 211-224). New York: W. H. Freeman & Company.

Williams, T., & Underwood, J. (1986). *The science of hitting* (pp.29-33). NY: Simon & Schuster, Inc.

#7 Anticipation, Expert-novice Differences and Pitch Count

Mandatory Readings

Williams, A. M., Ward, P., Knowles, J. M., & Smeeton, N. J. (2002). Anticipation skill in a real-world task: Measurement, training, and transfer in tennis. *Journal of Experimental Psychology: Applied*, 8 (4), 259-270.

#8 The Sweet Spot of a Baseball Bat

Mandatory Readings

Watts, R. G., & Bahill, A. T. (2000). *Keep your eye on the ball: Curve balls, knuckleballs, and fallacies of baseball* (pp. 130-133). New York: W. H. Freeman & Company.

#9 Recommending Bat Weight and Length

Otsuji, T., Abe, M., & Kinoshita, H. (2002). After-effects of using a weighted bat on subsequent swing velocity and batters' perceptions of swing velocity and heaviness. *Perceptual and Motor Skills*, 94, 119-126.

*****Each student must calculate their ideal bat weight and length given the readings assigned for the day*****

Field Trip—Batting Cages

*****Each student must bring a list of 3-5 things to remind themselves when they are batting to improve their batting ability. Each student will hand these in at the end of that “class.”*****

Background Reading (for Advanced Tips on How to Hit)

Williams, T., & Underwood, J. (1986). *The science of hitting* (pp. 33-65). NY: Simon & Schuster, Inc.

#10 Misperception by GM’s and Managers in Baseball of What Wins Games

Mandatory Readings

Lewis, M. (2003). How to find a ballplayer. In *Moneyball: The art of winning an unfair game* (pp. 14-42). New York: W. W. Norton & Company.

Lewis, M. (2003). The science of winning an unfair game. In *Moneyball: The art of winning an unfair game* (pp. 119-137). New York: W. W. Norton & Company.

Lewis, M. (2003). The Jeremy Brown blue plate special. In *Moneyball: The art of winning an unfair game* (pp. 97-118). New York: W. W. Norton & Company.

Lewis, M. (2004, March 4). Out of their tree. *Sports Illustrated*, 66-74.

#11 The Decline of the .400 Hitter in Baseball

Mandatory Readings

Gould, S. J. (1986, August). Entropic homogeneity isn’t why no one hits .400 anymore. *Discover*, 7, 60-66.

Background Reading

Watts, R. G., & Bahill, A. T. (2000). *Baseball batting statistics: Were yesterday’s players better? Keep your eye on the ball: Curve balls, knuckleballs, and fallacies of baseball* (pp. 225-246). New York: W. H. Freeman & Company.

#12 Did Shoeless Joe Jackson Throw the 1919 World Series?

Bennett, J. (1993). Did Shoeless Joe Jackson throw the 1919 World Series? *The American Statistician*, 47 (4), 241-250.

#13 Misrepresentation of Runs/Sequences

Mandatory Readings

Gilovich, T., Vallone, R., & Tversky, A. (1985). The hot hand in basketball: On the misperception of random sequences. *Cognitive Psychology*, *17*, 295-314.

Additional Related Reading

Gilovich, T., & Savitsky, K. (2002). Like goes with like: The role of representativeness in erroneous and pseudo-scientific beliefs. In *Heuristics and biases: The psychology of intuitive judgment* (pp. 617-624). (T. Gilovich, D. Griffin, & D. Kahneman (Eds)). New York: Cambridge University Press.

#14 Misrepresentation of Runs/Sequences

Mandatory Readings

Medvec, V. H., Madley, S. F., & Gilovich, T. (2002). When less is more: Counterfactual thinking and satisfaction among Olympic medallists. In *Heuristics and biases: The psychology of intuitive judgment* (pp. 625-635). (T. Gilovich, D. Griffin, & D. Kahneman (Eds)). New York: Cambridge University Press.

#15 Naïve Beliefs in Baseball

Mandatory Readings

McBeath, M. K. (1990). The rising fastball: Baseball's impossible pitch. *Perception*, *19*, 545-552.

Shaffer, D. M., & McBeath, M. K. (2005). Naïve beliefs in baseball: Systematic distortion in perceived time of apex for fly balls. *Journal of Experimental Psychology: Learning, Memory, & Cognition*, *31* (6), 1492-1501.

#16 The Axis-aligned Motion (AAM) Bias and its Applications

Mandatory Readings

Dolgov, I., McBeath, M. K., & Sugar, T. (2009). Evidence for axis-aligned motion bias: Football axis-trajectory misalignment causes systematic error in projected final destinations of thrown American footballs. *Perception*, *38*, 399-410.

Dolgov, I., Birchfield, D. A., McBeath, M. K., Thornburg, H., & Todd, C. G. (2009). Amelioration of axis-aligned motion bias for active versus stationary judgments of bilaterally symmetric moving shapes' final destinations. *Attention, Perception, & Psychophysics*, *71*, 523-529.

#17 Predictions About the Landing Location of Tennis Balls

Mandatory Readings

Shaffer, D. M., Maynor, A. B. Utt, A., & Briley, B. A. (2009). Predicting where fly balls will land (lack of conscious awareness of how we navigate to catch baseballs). In E. B. Hartonek (Ed.), *Experimental Psychology Research Trends*. Hauppauge, NY: Nova Science Publishers, Inc.

Jones, C. M., & Miles, T. R. (1978). Use of advance cues in predicting the flight of a lawn tennis ball. *Journal of Human Movement Studies*, 4, 231-235.

Isaacs, L. D., & Finch, A. E. (1983). Anticipatory timing of beginning and intermediate tennis players. *Perceptual and Motor Skills*, 57, 451-454.

Gray, R., Beilock, S. L., & Carr, T. H. (2007). "As soon as the bat met the ball, I knew it was gone": Outcome prediction, hindsight bias, and the representation and control of action in expert and novice baseball players. *Psychonomic Bulletin & Review*, 14, 669-675.

#18 Animal Tracking & Interception

Mandatory Readings

Olberg, R. M., Worthington, A. H., & Venator, K. R. (2000). Prey pursuit and interception in dragonflies. *Journal of Comparative Physiology A*, 186, 155-162.

Collett, T. S., & Land, M. F. (1978). *How hoverflies compute interception courses. Journal of Comparative Physiology*, 125, 191-204.

Background Reading

Bruce, V., Green, P. R., & Georgeson, M. A. (1996). *Visual perception: Physiology, psychology, and ecology* (pp. 271-274). East Sussex, UK: Psychology Press.

#19 Using a Constant Bearing Angle for Intercepting Targets/ American Football Pursuit & Interception Strategies

Mandatory Readings

Shaffer, D. M., & Gregory, T. B. (2009). How football players determine where to run to tackle other players: A mathematical and psychological description and analysis. *The Open Sports Sciences Journal*, 2, 29-36.

O'Connell, J. (1995). Pursuit and evasion strategies in football. *The Physics Teacher*, 33, 516-518.

Umpiring/Judging

#20 You're Out!! Perceptual Factors Affecting Baseball Umpiring

Mandatory Readings

Ford, G. G., Goodwin, F., & Richardson, J. W. (1995). Perceptual factors affecting the accuracy of ball and strike judgments from the traditional American league and National league umpiring perspectives. *International Journal of Sports Psychology*, 27, 50-58.

Ford, G. G., Gallagher, S. H., Lacy, B. A., Bridwell, A. M., & Goodwin, F. (1999). Repositioning the home plate umpire to provide enhanced perceptual cues and more accurate ball-strike judgments. *Journal of Sport Behavior*, 22 (1), 28-44.

#21 Social (Normative) Factors Affecting Baseball Umpiring

Mandatory Readings

Rainey, D. W., Larsen, J. D., Stephenson, A., & Coursey, S. (1989). Accuracy and certainty judgments of umpires and nonumpires. *Journal of Sport Behavior*, 12 (1), 12-22.

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