THE OHIO STATE UNIVERSITY

Department of Psychology

238 Townshend Hall
1885 Neil Avenue Mall
Columbus, OH 43210-1222

March 20, 2008

Dear Committee Members,

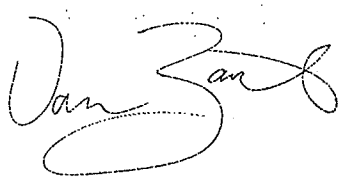
Please find attached a request to increase the number of credit hours for Psychology 608 (Introduction to Mathematical Psychology) from 3 to 4 credit hours.

Psy 608 is the only survey course on Mathematical Psychology in our department. It serves as the precursor to Psy 609 (Introduction to Mathematical Models) and Psy 617 (Neural Network Models in Psychology). It is a required course in the Quantitative Psychology Ph.D. program and our new Cognitive Modeling Concentration (a joint graduate curriculum with Cognitive and Quantitative Psychology). It is a required course in a submitted GIS proposal with Statistics and Marketing.

Previously, the number of contact hours for this course was two 48 minute lectures per week. It was impossible to cover the necessary material with so few contact hours. I was only able to get through slightly more than half of my proposed syllabus. This past Winter (2008) quarter I arranged for the lectures to be overscheduled, at two 108 minute lectures per week, and for the first time I was able to cover all the material in the syllabus. Because the course is an integral part of several graduate curricula, it must be extended to insure that these students are receiving training in areas that are relevant for their graduate program.

As you can see from the attached syllabus, the reading and homework assignments add a great deal to the students' workload. The course requirements are very similar to those of Psy 609 and 617 (syllabi also attached), both of which are 4-credit courses. For all these reasons, we request that the credit hours for Psy 608 be increased from 3 to 4.

Sincerely,



Dr. Trisha Van Zandt
Associate Professor
(614) 688-4081

The Ohio State University
Colleges of the Arts and Sciences Course Change Request

Psychology
Academic Unit

Psychology 608
Book 3 Listing (e.g., Portuguese) Course Number

Summer Autumn X Winter Spring Year 2008

Proposed effective date: choose one quarter and put an "X" after it; and fill in the year. See the OAA curriculum manual for deadlines.

A. *Course Offerings Bulletin* Information. Follow instructions in the OAA curriculum manual.
Before you fill out the "Present Course" information, be sure to check the latest edition of the Course *Offerings Bulletin* and subsequent Circulating Forms. You may find that the changes you need have already been made or that additional changes are needed. If the course offered is less than quarter or term, please also complete the Flexibly Scheduled/OffCampus/Workshop Request form.

COMPLETE ALL ITEMS THIS COLUMN

Present Course

1. Book 3 Listing: Psychology
2. Number: 608
3. Full Title: Introduction to Mathematical Psychology
4. 18-Char. Transcript Title: Intro Mathematical
5. Level and Credit Hours U G 3
6. Description: Survey of current topics in mathematical (25 words or less)
psychology; topics include measurement theory, scaling, ...
7. Qtrs. Offered : Winter
8. Distribution of Contact Time: 2 108-min cl
(e.g., 3 cl, 1 3-hr lab)
9. Prerequisite(s): Psy 321 or equivalent or consent of instructor
10. Exclusion: none
(Not open to....)
11. Repeatable to a maximum of 0 credits.
12. Off-Campus Field Experience: no
13. Cross-listed with: none
14. Is this a GEC course? no
15. Grade option (circle): Ltr S/U P
If P graded, what is the last course in the series?
16. a) Is an honors version of this course available? Y ☒ N ☐
b) Is an Embedded Honors version of this course available?
Y ☐ N ☒
c) Is this a Service Learning Course: Y ☐ N ☒
17. Other general course information:

COMPLETE ONLY THOSE ITEMS THAT CHANGE

Changes Requested

1.
2.
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5. U G 4 – increase credit hours by 1
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7.
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16. a)
b)
c)
17.

B. General Information

1. Do you want the prerequisites enforced electronically (see the OAA manual for what can be enforced)?
   Yes

2. Does this course currently satisfy any GEC requirement? if so indicate which category.
   No

3. What other units require this course? Have these changes been discussed with those units?
   None

4. Have these changes been discussed with academic units that might have a jurisdictional interest in the subject matter? Attach relevant letters.
   N/A

5. Is the request contingent upon other requests? if so list the requests.
   No

6. **Purpose of the proposed change. (If the proposed change affects the content of the course, attach a revised syllabus and course objectives and e-mail to asccurrofc@osu.edu.)**

   To more accurately reflect the workload of the course.

7. Please list Majors/Minors affected by the proposed change. Attach revisions of all affected programs. This course is (check one): ☒ Required on major(s)/minor(s) ☐ A choice on major(s)/minors(s) ☒ An elective within major(s)/minor(s) ☐ A general elective:
   An elective for the Psychology minor, a graduate requirement in the Quantitative Psychology program

8. Describe any changes in library, equipment or other teaching aids needed as a result of the proposed change. If the proposed change involves budgetary adjustments, describe the method of funding:
   None

CONTACT PERSON: T. Van Zandt EMAIL: van-zandt.2@osu.edu PHONE: x84081

Approval Process The signatures on the lines in ALL CAPS (e.g. ACADEMIC UNIT) are required.

1.	Academic Unit Undergraduate Studies Committee Chair	Printed Name	Date
2.	Academic Unit Graduate Studies Committee Chair	Printed Name	Date
3.	**ACADEMIC UNIT CHAIR/DIRECTOR**	**Printed Name**	**Date**

4. **After the Academic Unit Chair/Director signs the request, forward the form to the ASC Curriculum Office, 4132 Smith Lab, 174 West 18th Ave. or fax it to 688-5678. Attach the syllabus and any supporting documentation in an e-mail to asccurrofc@osu.edu. The ASC Curriculum Office will forward the request to the appropriate committee.**

5.	**COLLEGE CURRICULUM COMMITTEE**	**Printed Name**	**Date**
6.	**ARTS AND SCIENCES EXECUTIVE DEAN**	**Printed Name**	**Date**
7.	Graduate School (if appropriate)	Printed Name	Date
8.	University Honors Center (if appropriate)	Printed Name	Date
9.	Office of International Affairs (study tours only)	Printed Name	Date
10.	**ACADEMIC AFFAIRS**	**Printed Name**	**Date**

Psychology 608 Introduction to Mathematical Psychology
Winter 2008
TR 2:00-3:48, Psychology 217

Instructor: Trisha Van Zandt
Lazenby 230, 8-4081
Office hours: MW 11:00 - 12:00, or by appointment
E-mail: van-zandt.2@osu.edu
Web site: Carmen

Students with Disabilities

This syllabus is available in alternative formats upon request. In addition, if you may need an accommodation based on the impact of a disability, you should contact the instructor immediately. Students with special needs should contact the Office of Disability Services (ODS) at 292-3307 for certification if they have not already done so. Upon such certification, the ODS and the instructor will make every effort to accommodate special needs. However, to ensure that evaluation of student performance in the course is conducted in a manner that is fair to all students, special accommodations will not be granted in the absence of ODS certification.

Academic Misconduct

All students at the Ohio State University are bound by the Code of Student Conduct (see http://studentaffairs.osu.edu/resource_csc.asp). Suspected violations of the code in this class will be dealt with according to the procedures detailed in that code. Specifically, any alleged cases of misconduct will be referred to the Committee on Academic Misconduct.

Having Problems?

Sometimes personal issues will get in the way of a student's abilities to complete their coursework. If you are in trouble, you will need to tell me about it as soon as possible if you want my help in managing your course responsibilities. If you wait until the end of the quarter hoping that things will just work out somehow, then I will not be able to do anything for you. Also keep in mind that the Student Advocacy Center can help you choose a course of action and will serve as a mediator between you and your instructors.

Course Objectives

This course will give students familiarity with mathematical reasoning and modeling in psychology. We will focus on some of the best applications of mathematics to psychology and discuss what made them successful. We will also cover issues of measurement (which go hand-in-hand with models). Topics will include scaling, psychophysics, signal detection, probabilistic choice, decision making, response selection, and model comparison. At the end of the course, students will have a broad overview of how mathematical models can provide insight about human behavior.

Readings

Though many people have promised that they will write a decent textbook on mathematical psychology, so far no such book is forthcoming. There are several texts that people use, including the classic by Coombs, Dawes and Tversky (1970), *Mathematical Psychology: An Introduction*, and Townsend and Ashby's (1983) *Stochastic Modeling of Elementary Psychological Processes*. These books are both very old, however, and do not reflect the current thinking in mathematical psychology.

On the other hand, because mathematical psychology has a firm grounding in mathematics and statistics, these books are important because they contain the foundations of the discipline. So don't feel too badly that many readings are old. For this course, I will draw on readings from these classics and from newer works in an attempt to provide both a firm historical background and an accurate picture of the issues that mathematical psychology addresses today.

Each day's reading assignments are provided on the class schedule. The readings marked with asterisks are *required*. I expect you to come to class already having read them. (I reserve the right to be bitchy and pissy if I think you haven't.) The unmarked readings are provided for completeness. I hope that you will explore them to satisfy your own curiousity. (If you expect me to serve on one or more of your committees, then you should read them like you read the other papers.)

Examinations and Homework

There will be two examinations in the course and homework assigned approximately weekly. Each exam is worth 30% of the total points available in the course and homework is worth 40%.

Policy on missing exams and late homeworks

Please note carefully:

1. If, because of an emergency, you cannot take an exam at the scheduled time, you must contact me BEFORE the exam.
2. There will be NO EXCEPTIONS to (1.) above.
3. I have voice mail (688-4081) so you can leave me a time-stamped message if I am not at my desk.
4. You must provide DOCUMENTATION that verifies the emergency that prevented you from taking an exam or quiz at the scheduled time. No documentation, no makeup.

Homeworks that are late for unexcused reasons will be marked down by 10% for each day past the due date.

Grading

For a variety of reasons, I do not grade on a curve. For example, when a curve is used, no matter how well everyone in the class does on an exam, only a small percentage of students can receive an A. Instead, I prefer to give everyone a chance to get an A. Therefore, I apply the following preset cutpoints:

A	A-	B+	B	B-	C+	C	C-	D+	D
93%	90%	87%	83%	80%	77%	73%	70%	67%	60%

Exams are designed to reflect what I think is an appropriate level of mastery of the material covered. So if everyone gets an A, that's great! I'll assume such performance reflects your hard work and intelligence (and, of course, my excellent teaching). If everyone does poorly, I'll assume it was my fault, and define an A by the top scores on the test: 100% will be given as the second highest test score. So, if the top two scores were 67% and 62%, and you scored 54%, your test grade would be 54 points out of 62, or 87%.

Tentative class schedule and reading assignments:

Week	Dates	Topics

1 Jan 3 **Introduction and History of Mathematical Psychology**

- *Coombs, C. H., Dawes, R. M., & Tversky, A (1970). *Mathematical Psychology: An Elementary Introduction*, Chapter 1. Englewood Cliffs, NJ: Prentice-Hall.
- *Estes, W. K. (2002). History of the Society. *Online Document:* `http://www.cogs.indiana.edu/socmathpsych/history.html`
- Thurstone, L. L. (1959). *The Measurement of Values*, Introduction. Chicago, IL: The University of Chicago Press.
- *Townsend, J.T. & Ashby, F.G. (1983). *Stochastic Modeling of Elementary Psychological Processes*, Chapter 1. New York: Cambridge University Press.

1-3 8-17 **Statistical Background**

Statistical concepts important for the material in this course begin with random variables, distributions, expected values and variance, functions of random variables, convolutions, and generating functions. Readings are selected from Grinstead and Snell's *Introduction to Probability*, which is available online as a pdf document.

Jan 8. *Discrete and continuous random variables: pp. 18-40, pp. 55-74

Jan 8-10. *Conditional probabilities: pp. 133-136, 139-147, 162-168

Jan 10. *Expected value and variance: pp. 225-284

Jan 15. *Distributions : pp. 183-224

Jan 17. *Functions of random variables: pp. 210-211

Jan 17. *Convolutions: pp. 285-304

Jan 17. Generating functions: pp. 365-377, pp. 394-404

3-4 22-24 **Psychophysical Scaling**

What is the relationship between a physical stimulus and the extent of sensation that it evokes? Can this relationship be quantified? Is it regular or lawful?

Jan 22. *Falmagne, J. C. (1986). Psychophysical measurement and theory. In K. R. Boff, L. Kaufman, & J. P. Thomas (Eds.). *Handbook of perception and performance: Volume 1* (pp. 1-1 to 1-22).

Jan 22. *Goldstein, E. B. (1989). *Sensation and Perception*, 3rd Edition, Appendix A. Belmont, CA: Wadsworth.

Jan 22. Link, S. W. (1992). *The Wave Theory of Difference and Similarity*, Introduction and Chapter 1. Hillsdale, NJ: Lawrence Erlbaum, Associates.

Jan 22. Stevens, S. S. (1957). On the Psychophysical Law. *Psychological Review*, **64**, 153-181.

Jan 24. *Marks, L. E. & Gescheider, G. A. (2002). Psychophysical scaling. In J. Wixted and H. Pashler (Eds.), *Stevens' Handbook of Experimental Psychology (3rd Edition): Methodology in Experimental Psychology* (pp. 91-138)

Jan 24. Todd, J.T., Oomes, A.H.J., Koenderink, J.J., & Kappers, A.M.L. (2001). On the affine structure of perceptual space. *Psychological Science*, **12**, 191-196.

Week	Dates	Topics
4	29	**Probablistic Choice** Given exactly the same stimulus (or choices), a person will not respond the same way each time it is presented. How can we explain choice randomness? What mechanisms might produce it, and is it a good or a bad thing? • *Coombs, C. H., Dawes, R. M., & Tversky, A (1970). *Mathematical Psychology: An Elementary Introduction*, Chapter 5, pp. 148-164. Englewood Cliffs, NJ: Prentice-Hall. • Luce, R.D. (1977). Thurstone's Discriminal Processes Fifty Years Later. *Psychometrika*, **42**, 461-489. • Thurstone, L. L. (1927). A Law of Comparative Judgment. *Psychological Review*, **34**, 273-286.
5-6	Feb 31-5	**Signal Detection Theory** Signal detection theory was a huge advance in understanding choice behavior. Derived from statistical decision making, it is inextricably linked to Thurstone's discriminal processes. It has been used widely to characterize human performance, and is the foundation of many of the models of response selection we will discuss later in this class. • Balakrishnan, J. D. (1999). Decision Processes in Discrimination: Fundamental Misrepresentations of Signal Detection Theory. *Journal of Experimental Psychology: Human Perception and Performance*, **25**, 1189-1206. • Kadlec, H. (1999). Statistical Properties of d' and β Estimates of Signal Detection Theory. *Psychological Methods*, **4**, 22-43. • *Macmillan, N. A. (2002). Signal Detection Theory. In H. Pashler (Series Ed.) and J. Wixted (Volume Ed.) *Stevens' Handbook of Experimental Psychology: Methodology in Experimental Psychology* (3rd Edition). New York: Wiley Press. • Van Zandt, T. (2000). ROC Curves and Confidence Judgments in Recognition Memory. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, **26**, 582-600.
6	7	**Exam I**
7	12-14	**Risky Choice** People do interesting things when choices involve risk (like gambling). Patterns of choice behavior under risk motivated much of the research that composes work in modern decision making, including utility theory, prospect theory, and axiomatic decision theory. • *Coombs, C. H., Dawes, R. M., & Tversky, A (1970). *Mathematical Psychology: An Elementary Introduction*, Chapter 5, pp. 113-147. Englewood Cliffs, NJ: Prentice-Hall. • Luce, R.D. & Raiffa, H. (1958). *Games and Decisions*, Chapter 2. New York: Wiley Press.

Week	Dates	Topics

8-9 19-26 **Cognitive Architecture**

Cognitive psychology is an area of experimental psychology that concerns itself with how thinking happens. Performance measurements are taken while people do very simple tasks in an attempt to determine how critical mental events unfold. Much of mathematical psychology has concentrated on how these events can be uncovered and modeled.

Feb 19. *Logan, G.D. (2002). Parallel and Serial Processing. In H. Pashler (Series Ed.) and J. Wixted (Volume Ed.) *Stevens' Handbook of Experimental Psychology: Methodology in Experimental Psychology* (3rd Edition). New York: Wiley Press.

Feb 19. *Sternberg, S. (1966). High-speed scanning in human memory. *Science*, **153**, 652-654.

Feb 21. *Schweickert, R. (1993). Information, Time, and the Structure of Mental Events: A Twenty-Five Year Review. In D.E. Meyer and S. Kornblum (Eds.), *Attention and Performance XIV: Synergies in Experimental Psychology, Artificial Intelligence, and Cognitive Neuroscience* (pp. 535-566). Cambridge, MA: MIT Press.

Feb 26. Townsend, J. T. & Ashby, F. G. (1983). *Stochastic Modeling of Elementary Psychological Processes*, Chapter 4. New York: Cambridge University Press.

Feb 26. Van Zandt, T. (2002). Analysis of response time distributions. In H. Pashler (Series Ed.) and J. Wixted (Volume Ed.) *Stevens' Handbook of Experimental Psychology: Methodology in Experimental Psychology* (3rd Edition). New York: Wiley Press.

9-10 Mar 28-4 **Stochastic Latency Mechanisms**

The models we discuss in this module are unique in that they can explain several behavioral variables simultaneously. Often they are paired with other models of cognition, that feed their outputs into an accumulation mechanism, resulting in comprehensive models of a task. These are, it can be argued, the most successful models of human performance we have today.

Feb 28. Audley, R.J. (1960). A stochastic model for individual choice behavior. *Psychological Review*, **67**, 1-15.

Feb 28. Grice, G.R. (1972). Application of a variable criterion model to auditory reaction time as a function of the type of catch trial. *Perception and Psychophysics*, **12**, 103-107.

Feb 28. *Vickers, D. (1979). *Decision Processes in Visual Perception*, Chapter 3. New York, NY: Academic Press.

Mar 4. Ratcliff, R. (1977). A theory of memory retrieval. *Psychological Review*, **85**, 59-108.

Mar 4. *Ratcliff, R. & Smith, P. (2004). A comparison of sequential sampling models for two-choice reaction time. *Psychological Review*, **85**, 59-108.

Mar 4. *Schall, J.D. (2001). Neural basis of deciding, choosing and acting. *Nature Reviews: Neuroscience*, **2**, 33-42.

Week	Dates	Topics
10	6	**Model Comparison and Evaluation** Okay, so now you have a model. How do you know it's a good one, and, more importantly, how do you show that it's better than some other researcher's model? • *Myung, I.J. & Pitt, M. A. (2002). Mathematical modeling. In H. Pashler (Series Ed.) and J. Wixted (Volume Ed.) *Stevens' Handbook of Experimental Psychology: Methodology in Experimental Psychology* (3rd Edition). New York: Wiley Press. • *Pashler, H. & Roberts, S. (2000). How persuasive is a good fit? A comment on theory testing. *Psychological Review*, **107**, 358-367.
	10	**Exam II** (Psy 217 1:30-3:18)

Introduction to Mathematical Models in Experimental Psychology, Fall 2007, Class number 609

Roger Ratcliff, Rm. 291B Psychology Building, Class meetings: W 11:30-1:48Rm 219 Psychology Building

Course Objectives

This course provides an introduction to basic cognition with a focus on memory research while viewing the material from a theoretical perspective. There will be evaluation of models of processing and representation, where reasonable models exist.

Lab. component of the course. This involves taking part in about six 20 minute experiments with data analyzed in class and discussion of intuitions about processing. One experiment encourages students to cheat to see if the analysis techniques of the instructor can uncover strategies that uncooperative students might adopt. There are also two computer simulation exercises that use computer programs already developed: students alter parameters of the models to represent changes in processes that the models are designed to mimic.

The course will require preparation prior to each class: reading chapters from the textbook and 2-4 original papers from the literature. These will require significant effort and short summaries of the readings will be collected each week IF there is evidence that the readings have not been done. All the work is presented with the aim of showing both the good and bad points of the models and approaches, and the last class presents an evaluation of the state of this research area of cognitive psychology. We will ask 1. How good is the model? 2. Is it fundamentally rejected in core assumptions? 3. Is it worth using in more applied/practical domains?

Student Evaluation

Students will be expected to present 1-2 articles (or parts of article) (10%), write up results from two computer simulation experiments (1-2 pages plus graphs) (two at 20% each), and two research papers (25%, 25% each). Students will be evaluated on an absolute scale.

Topics

Sept. 19: Introduction, Modal memory model, STM, LTM. (Read Chs. 1,2 (iconic memory section only),3,4, N&S). Separating STM and LTM (Ch 3,4, N&S), Levels of processing (Ch. 5, N&S).

Sept. 26: Critiques of levels of processing, Forgetting (Ch. 6, N&S). Cue dependent forgetting, Implicit memory. (Baddeley, 1978; Tulving, 1974; Ch. 7, 8, N&S). ***Implicit memory experiment.***

Oct. 3: Brain, amnesia, counter model for implicit memory. Recognition memory, Introduction to global memory models (Ch. 8, 9, Optional Ch., N&S; Ratcliff & McKoon, 1996; Gillund & Shiffrin, 1984). ***SAM model exercise.***

Oct. 10: Global memory models, rejection, new models (Ratcliff & McKoon, 2000; Ratcliff, Shiffrin & Clark, 1990, Shiffrin & Steyvers, 1997). ***Memory experiment.*** **Gillund & Shiffrin (SAM) model exercise due.**

Oct. 17: Models for associative priming (Optional Ch. p. 372, N&S; Readings). Knowledge, memory for text, (Ch. 10, N&S; Ratcliff & McKoon, 1981, 1992, McKoon & Ratcliff, 1986). ***Priming experiment.***

Oct. 24: Reaction time models, diffusion model, RT and memory (Optional Ch., N&S; Ratcliff & Rouder, 1998). ***Simple random walk and counter model exercise.*** **Paper 1 due.**

Oct. 31: Aging, RT, death, and aging (general slowing), Review of RT models. (Ch. 14, N&S; Deary & Der, 2005; Ratcliff, Thapar, Gomez, & McKoon, 2004, Ratcliff & Smith, 2004, Smith & Ratcliff,2004). ***RT expt. (dots).*** **Simple random walk and counter model ex. due.**

Nov. 7: Categorization, instance based models, decision bound models, connectionist models, hybrid models (Nosofsky, 1986; Ashby & Ell, 2001; Erickson & Kruschke, 1998; Rouder & Ratcliff, 2004).

Nov. 14: Word recognition models. (McClelland & Rumelhart, 1981; Seidenberg and McClelland, 1989; Grainger & Jacobs, 1996; Ratcliff, Gomez, & McKoon, 2004). ***RT screw the experimenter experiment (dots)***

Nov. 28: What progress in psychology: 20 questions paper, Newell (1973), Tulving & Madigan (1970), Roberts & Pashler (2000), Ratcliff (2002). **Paper 2 due.**

Students with Special Needs

Any student who feels that he/she may need an accommodation based on impact of a disability should contact Professor Ratcliff (2-7916) privately to discuss his/her special needs. Also contact the Office of Disability Services (1-3307) to coordinate such accommodations.

Teaching Method.

Classes will be part lecture and part discussion/tutorial. There will be a number of in-class demonstrations. Students will participate in experiments in the lab. to provide data for examination in class. The course will be flexible so as to reduce emphasis on some topics and spend more time on others depending on demand, background, interest, etc.

Paper 1. Evaluate a model of implicit memory, Contrast the implicit memory views, OR Evaluate a global memory model

Paper 2. Topics. Any topic from what was studied but with a theory or model based interpretation

Text: Neath & Suprenant, Human Memory, Second Ed., Thomson Wadsworth, 2003. (In readings above - N&S)
Reading packet of about 2-3 new papers per class.

Office Hours: I am in most of the time, say 9:30 to 4:00. Office hours by appointment (call, 2-7916) or email ratcliff.22@osu.edu. If I am in (i.e., I have not wandered off) I am available. Call or email to be sure I am in (you can chance it of course and drop by).

Psychology 617 (Spring 2008)

Neural Network Models in Psychology

Time & Place: Mon & Wed at 1:30 - 2:48 pm, PS 217

Instructor: Jay Myung, 240B Lazenby, 2-1862, myung.1@osu.edu,
Office hours: Monday & Wednesday at 11:00 - noon

Description

This is an introductory course on connectionist (neural network) models in psychology, with focus on the theoretical foundations of neural network modeling. The course is intended for the students who have no prior experience with connectionist modeling and will emphasize mathematical properties of various connectionist models. Topics to be covered include: perception, linear associators, backpropagation networks, Hopfield net, Kohonen's maps, Grossberg's ART net, and oscillatory networks. Examples of connectionist simulation using the user-friendly simulator *t-learn* for models of classification, temporal processing of sentence, word reading, language acquisition, cognitive development, and neuropsychology will be discussed.

Prerequisites

- Psychology 321 and 608; or graduate standing; or permission of instructor

Text books and Website

1. MPR (Required book): P. McLeod, K. Plunkett, & E. T. Rolls (1998). *Introduction to Connectionist Modelling of Cognitive Processes*. Oxford.

2. JAA (Highly recommended) J. A. Anderson (1995). *An Introduction to Neural Networks*. MIT Press.

3. (Recommended): S. Haykin (1999). *Neural Networks: A Comprehensive Foundation* (2nd edition). Prentice Hall. Technically rigorous, comprehensive theory, written for engineers.

4. (On-line course in neural nets): Neural Nets by Kevin Gurney
(http://www.shef.ac.uk/psychology/gurney/notes/index.html)

Evaluation

Students will be evaluated based on one exam, four homework assignments, one class presentation, and class participation in discussion.

Homework (four)	40%
Exam (Mon, May 19)	30%
Class paper presentation*	20%
Class participation of discussion	10%

To get an A or A-, your total percentage must be at least 85%.

(*: 1-hr 2-person joint presentation of an assigned chapter and accompanying simulation results)

Tentative Course Schedule

Week 1 (Mar 24 & 26):

Mon: Introduction to neural networks

Wed: Single neuron computation; history of connectionism, Chs 1, 2 & 15 (MPR), Chs. 1 & 2 (JAA)

Week 2 (Mar 31, Apr 2):

Mon: Linear associator network, Ch3. 3 & 4 (MPR), Chs. 6 & 7 (JAA)

Review of vector and matrix algebra

(**t-learn exercises**, pp. 65-71, pp. 88 - 95, MPR)

Wed: Perceptron, Ch. 5 (MPR), Ch. 8 (JAA)

Background Reading: M Minsky & S. Papert (1969). *Perceptron*, pp. 1- 20. MIT Press.

Week 3 (Apr 7, 9):

Mon: **HW#1 due**

Backpropagation network, Ch. 5 (MPR), Ch. 9 (JAA)

Background Reading: F Crick (1989). The recent excitement about neural networks. *Nature, 337*, 129-132.

Wed: Backpropagation network (continued); momentum; simulated annealing

(**t-learn exercises**, pp. 117 - 126, MPR)

Background Reading: T J Sejnowski & C R Rosenberg (1986). NETtalk: A parallel network that learns to read aloud. *Johns Hopkins University Electrical Engineering and Computer Science Technical Report* JHU/EECS-86/01.

Week 4 (Apr 14, 16):

Mon: **HW#2 due**

Model evaluation and model selection in connectionist modeling

Background Reading: I J Myung & M A Pitt (2003). Model fitting. In L Nadel (ed.), *Encyclopedia of Cognitive Science, Vol 3*, pp. 47-51.

Wed: Recurrent networks, Ch 7 (MPR)

(**t-learn exercises**, pp. 148-151, MPR)

Background Reading: J L Elman (1990). Finding structure in time. *Cognitive Science, 14*, 179-211.

Week 5 (Apr 21, 23):

Mon: **HW#3 due**

Reinforcement learning network, Ch. 9 (JAA)

Background Reading: A G Barto & R S Sutton (1981). Landmark learning: An illustration of associative search. *Biological Cybernetics, 42*, 1-8.

Wed: Hopfield network, Ch. 12 (JAA)

Background Reading: J J Hopfield & D W Tank (1985). "Neural" computation of decisions in optimization problems. *Biological Cybernetics, 52*, 141-152.

Week 6 (Apr 28, 30):

Mon: Kohonen's feature maps, Ch. 14 (JAA)

Wed: **Class presentation & discussion #1**: Reading aloud network (Ch8, pp. 172-177, MPR).

Background Reading: D Plaut, J McClelland, M Seidenberg & K Patterson (1996). Understanding normal and impaired reading: Computational principles in quasi-regular domains. *Psychological Review, 103*, 56-115.

Week 7 (May 5, 7):

Mon: **HW#4 due**

Grossberg's ART network

Background Reading: G A Carpenter & S Grossberg (1992). A self-organizing neural network for supervised learning, recognition and prediction. *IEEE Communications Magazine, 30*, 000-000.

Wed: **Class presentation & discussion #2**: Language acquisition network (Ch 9, pp. 202-209, MPR).

Background Reading: K Plunkett & V Marchman (1991). U-shaped learning and frequency effects in a multilayered perceptron: Implication for child language acquisition. *Cognition, 38*, 43-102.

Week 8 (May 12, 14):

Mon: Neural oscillators and perception

Background Reading: : W Singer et al (1997). Neuronal assemblies: Necessity, signature and detectability. *Trends in Cognitive Science, 1*, 252-260.

Wed: **Class presentation & discussion #3**: Balance beam problem (Ch 10, 222 - 242, MPR).

Background Reading: J McClelland (1989). Parallel distributed processing: implications for cognition and development. In R Morris, *Parallel Distributed Processing: Implications of Psychology and Neurobiology*. Clarendon Press, Oxford.

Week 9 (May 19, 21):

Mon: **Exam** (May 19, Mon at 1:30 - 2:48)

Wed: **Class presentation & discussion #4**: Lesioning network (Ch 11, pp. 265-267, MPR).

Background Reading: M. Farah & J McClelland (1991). A computational model of semantic memory impairment: Modality specificity and emergent category specificity. *Journal of Experimental Psychology:General, 120*, 339-357.

Week 10 (May 26, 28):

Mon: No class (Memorial Holiday)

Wed: Neural networks as theories of mind

Background Reading: M McCloskey (1991). Networks and theories: The place of connectionism in cognitive science. *Psychological Science, 2*, 387-395.

(No final exam during finals week)