Elements of Extreme Expertise: Explorations of Skill in Immediate Interactions with Dynamic Task Environments

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Please note that this is not the final syllabus but a work-in-progress

This is a graduate level course.

1 Description

Studying the immediate interactions of humans with a dynamic task environment requires three levels of theory:

- Architectural theories that discuss:
  - the basic endowment and capabilities of the modules of the mind,
  - the interconnections of these modules, and
  - the control mechanisms that mediate performance.

- Task-general knowledge that might be innate or might be generalizations from task-specific knowledge.

- Task-specific knowledge required for the particular task and particular situation.

Presumably all three types of knowledge are mediated via control mechanisms in the form of interactive routines, methods, and/or strategies which are in turn influenced by the capacity limits of individual modules.

Of course, trying to model (i.e., understand) these interactions is a bit like trying to model a “cascading domino effect” (Nyamsuren & Taatgen, 2013c). In trying to understand such interactions we will alternate between studies which have used the traditional simple and well-controlled paradigms of Experimental Psychology and those that venture into the emerging just-managable-complexity approach which uses computer games as their experimental paradigm.
2 Readings

New versions of this syllabus will be released during the semester. The new versions will reflect readings on topics and issues that arise during our in-class discussions. The readings will also reflect the new publications on topics related to this class.

2.1 Starters

2.1.1 Background Readings – 1 Session: Jan 24th

Week 1 – In Week 1 we will cover two papers in addition to talking about the plan for the semester. The first paper is Blanche M. Towne’s 1922 paper on the acquisition of skill in typewriting. Please come to class having read that one and being prepared to discuss it. The second paper is the Ericsson et al. (1993) paper on deliberate practice. I will lecture on the details of Ericsson’s studies but I would like you all to be prepared to discuss with me some of his ideas and their implications. Hence, please come to class having read the beginning (pages 363-373) and end (pages 387-400) of that work.


Movies! [https://www.youtube.com/watch?v=ee3p4canV8k](https://www.youtube.com/watch?v=ee3p4canV8k)

2.1.2 Background Readings – 3 Sessions: [Jan. 31 to Feb. 14th]

Problem Isomorphs:


MetaCognition


Perils of Ignoring and the Unconscious Discovery of Strategies


Milliseconds Matter


Information Displays and Decision-Processes


Motor Skills and Perceptual Learning


**There at the Beginning: Reflections on the Invention of Computer Games as Experimental Paradigm**


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**2.2 Expertise in Games and Tasks – 5 Sessions [Feb 21th to Mar 21th]**

**January 31**
- Cary & Reder (2002): J Ralph
- Gray & Boehm-Davis (2000) part 1: W Gray
- Gray & Boehm-Davis (2000) part 2: W Gray

**February 07**
- Siegler (1987): R Hope
- Kleinmuntz & Schkade (1993): D Arista

**February 14**
- Donchin (1995): C Sibert
- Kellman & Massey (2013): W Gray

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**All SET?**


**Scrabble**


**Space Fortress**


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2.3 Intelligence journal – On Expertise


**Ericsson’s Response:**


**Comments:**


### Claimed Papers

- **Ackerman (12pp):** KBurns
- **de Bruin, Kok, Leppink, and Camp (8pp):** JLindstedt
- **Grabner (8pp):** JRalph
- **Hambrick, Oswald, Altmann, Meinz, Gobet, and Campitelli (12p):** WGray
- **Plomin, R., Shakeshaft, N. G., McMillan, A., & Trzaskowski, M. (14pp):** RHope
- **Ruthsatz, J., Ruthsatz, K., & Stephens, K. R. (6pp):** CSibert
- **Simonton (8pp):** DArista
- **Wai (7pp):** CSibert

### 2.4 Big Data

**The Next Big Thing??**


**Data Analysis in Games**


Case studies of Video Game Expertise


SAX and other Statistical Methods


Claimed Papers for Section 2.4

- Huang et al (2013): tbd
- Harrison & Roberts (2011): tbd
- Ryzhov, Tariq, & Powell (2011): tbd
- Thompson et al, (2013): done

Data Analysis in Games

- Hock-koon (2012): tbd
- Mason & Clauset (2013): tbd
- Reeves, Brown, & Laurier (2009): tbd

SAX and other Statistical Methods

- Herbrich, Minka, & Graepel (2007): tbd
- Lin et al. (2003): tbd
- Wallner & Kriglstein (2012): KBarry

2.5 The Methodology of Game Studies?
Point, Worked Example, Counterpoint, Reply – An Exchange.


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### Claimed Papers for Section 2.5

- Boot, Blakely, & Simons (2011): tbd
- Strobach, Frensch, & Schubert (2012): tbd
- Boot & Simons (2011): all
- Schubert & Strobach, (2012): all

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### 2.6 Misc Papers on Skill

#### Bavelier and Green on Skill


#### Miscellaneous skill papers:


### 2.7 Interlude – Ackerman on Skilled Performance


### 2.8 Skilled Eyeballs


### 2.9 Some Modeling – 5 Sessions

#### 2.9.1 Misc Mods


#### 2.9.2 Salience, Objects, and Skilled Eyeballs – Top-Up, Bottom-Down

Some background:


More background:


Then we pick from here:


Balancing between Internal vs External Control


2.9.3 Reinforcement Learning Models of Skilled Performance


2.10 Acquiring/Selecting/Deploying Strategies

2.10.1 Non-Modelers


2.10.2 Modelers


3 Reference Material

Combination of citations from some of the above and other citations that seem possibly relevant to the course topic.

3.1 Tools


3.2 From Nyamsuren and Taatgen (2013) PLoSOne - General Recognition Theory


3.3 From Nyamsuren and Taatgen (2013) Cognitive Science - A Role for Predictability?


3.3.1 Skilled Eyeballs


3.3.2 Important Theoretical Developments


*Please note that the above list of topics and papers is not the reading syllabus but is meant to be suggestive of the topics that will be covered.*

4 Participation

The class will be run as a graduate seminar. On some weeks, all students will be expected to read and be prepared to lead a discussion on any or all assigned readings. On other weeks, different students will read and present different papers. (On those weeks, it will not be expected that each student reads all papers but it will be expected that each presentation will be support by slides.)

All students will be expected to comment and discuss the readings based on how the author frames and presents his or her work. That is, all of our grad students are capable of free-associating and generating, at times, interesting ideas without reading the material. However, that is not acceptable. If you have not done the work expected for that week’s class, do not come to class.

5 PreRequisites

Permission of the instructor. This is a graduate research seminar. However, interested undergraduates are encouraged to contact the instructor to discuss their participation in the seminar. Responsibilities and assignments for undergraduates will be discussed and agreed on, in writing, by the student and the instructor.

6 About the Instructor

Professor Gray has been a member of the Cognitive Science Department at RPI since the Fall of 2002. For details on his research interests and activities see his homepage.

7 Honors Policy

My expectation is that all of the work you do for me in this class will be the work of one individual. Exceptions to this rule will be broadcast to the class by email.

As you will all find out, I explicitly encourage you to engage in public (using email and other media to broadcast a message to the entire) or private (one-to-one) discourse regarding the readings and topics raised in this class. Study groups are encouraged.

If any of you have any questions regarding current situations or future situations, remember that I am your first contact on this. Please contact me.

8 Grading Policy

8.1 Examinations

There are no examinations
8.2 Active Participation

65% For reading papers and for active participation in all discussions on all weeks in which the seminar is held. Exceptions due to professional travel or other activities need to be discussed with the instructor ahead of time.

45%¹ Formal presentations based on assigned readings.

In general, 1-2 students will be assigned the discussion leaders for each week’s readings. The discussion leaders will prepare slides to organize and structure the discussion of their paper. All students are expected to join in the active discussion.

9 References

Please note that this listing includes both misses and false alarms! That is, it excludes some papers that will be read and discussed and includes some that will not be read and discussed. Please consider this list as representative of the types of papers that will be read and discussed.


¹Yes. I expect 110% out of you!


Wai, J. (2014). Experts are born, then made: combining prospective and retrospective longitudinal data shows that cognitive ability matters. *Intelligence, 1–7*.


