GENED 1031: Finding Our Way

Lectures: Mondays and Wednesdays, 10:30-11:45 AM, SC B10

Instructors

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Introduction

Well before the modern era, humans have made amazing feats of navigation. Polynesians were able to find remote islands like Rapa Nui (Easter Island), a needle in the haystack of a vast ocean. The Norse found, in succession, Iceland, Greenland, and North America. Gold traders crossed the expanses of the Sahara in camel caravans. Aboriginals found their way across relatively featureless terrain in what is now Australia. How did they do this? How did they guarantee success?

Back in the day, people could predict the weather with uncanny accuracy, using aphorisms to describe cloud formations, and patterns.

Mostly, these days we rely on GPS and weather forecasts that we put our faith in. Will these changes affect the way we think?

We are living in an era where we increasingly outsource our native cognitive abilities to technology. This can go hand-in-hand with something called ***automation bias***: the idea that because an answer comes from a computer, it ***must*** be correct. Physicians rely on computers to diagnose illnesses and can sometimes miss things right in front of their eyes. Airplane pilots rely on auto-pilots to the point where their instincts have dulled, sometimes resulting in disaster when the auto-pilot turns off. We often make the mistake of thinking that technology equals sophistication.

In this course, we focus on what it means to engage our minds in certain tasks that are often outsourced to technology: wayfinding by natural means, as opposed to using GPS, identifying stars, as opposed to using a cell-phone app, understanding time, as opposed to using a watch.

Although the workings of the mind are not fully understood, there are known linkages in our thought processes. Long term memories, a mental map of our surroundings, planning for the future, and imagining scenarios all reside in the same part of the brain. There is a saying, â€œuse it or lose it,â€ which means that abilities are dependent on regular use. Studies have shown that the parts of the brain associated with navigation go silent when people rely on GPS for directions. Conversely, London taxi drivers who must memorize routes through the city have developed strong abilities to find their way without artificial aids.

Another aspect of the course is the question of knowledge and uncertainty. Sometimes we think of knowledge as binary: either we know something with absolute precision or it is completely unknown. In real life, the â€˜answerâ€™ to a question is rarely in the back of the text or in an answer key. We have to be able to find an answer and be able to bracket knowledge. This is related to navigation in the sense that we often have an imprecise, but quantifiable idea of where we are. Say we set off in the fog toward a destination over the water. We know where weâ€™re heading, and how long weâ€™ve gone, but some

uncertainty creeps into our knowledge.

Finally, thereâ€™s this aspect called â€˜mindfulnessâ€™ â€“ which is simply an awareness of the workings of oneâ€™s own mind. While doing the assignments, I ask that you do some introspection about how you go about doing things and bring some awareness to the exercises.

Navigation means answering the questions: â€œWhere are we?â€ and â€œWhere are we going?â€ The process of wayfinding can be thought of as a simplified case of other endeavors where we have to deal with inherent uncertainties. Because navigation is a simplified version of other activities in life (e.g. future planning), there is a kind of sustained metaphor to the larger aspects of finding your way.

In the course, we will examine:

- The underlying physical principles involved in navigation through observation of natural phenomena.
- How to observe and interpret these signs.
- Precision and how to handle navigation in the face of uncertainty.
- Navigation in other cultures, such as the Pacific Islanders, the Norse, and medieval Arab traders.
- Weather, prediction of weather, and climate change.
- How time is reckoned.

Math preparation

_Most course work will rely on either graphical solutions or the use of addition, subtraction, multiplication, and division.

Course Structure

Lectures

Mondays-Wednesdays from 10:30-11:45 AM

Science Center B 10

Weâ€™ll have some in-class exercises where it will be helpful to have a pencil, ruler, and protractor with you. Weâ€™ll announce in advance when you need to bring these.

Sections

Sections will meet starting the 2nd week of classes. In addition to consolidating material in lecture, we'll go over assignments in detail, and perform some assignments.

The section schedule will be announced when we have a solid idea of everyone's schedule.

Course Materials

All course materials can be purchased from the Harvard Coop.

Readings

The Lost Art of Finding Our Way is the core text for this course. The book is available at the Coop, along with the standard notebook we expect people to use. All assignments and work supporting the assignments are to be done in a computational notebook, also available at the Coop on the second floor or with the link above.

In addition, we will post a series of supplemental materials on the course website and will occasionally add useful external websites and links.

In the past, students have reported that the course requires about 1 hour of reading per week.

In addition to the aboveâ€”the book and the computational notebook, youâ€™ll need some drafting tools and a magnetic compass â€“ also available as part of the course package at the Coop.

Tools

Drafting compass and magnetic compass

Protractor

Ruler with centimeter and inch scales.

Although not necessary, I also recommend a set of parallels, which can be ordered online.

Parallels

Grading Scheme

Assignments

There will be roughly 8 assignments over the course of the semester. Many/most of these will be an activity performed in the environment. The assignments will be turned in during the Monday lecture in the course notebook and will be returned at the Wednesday lecture. A grading rubric will be made available ahead of time. All assignments must be performed in order to pass.

Attendance

In accordance with the Gen Ed policies in-person attendance in all components of the course is required.

Quizzes

There will be two quizzes on the locations of stars in the sky during section as a prelude to the star assignment.

Midterm exam

Topics covered on the midterm will be announced about two weeks in advance.

Final project

There will be a final project due at the end of reading period. This will be an investigation into some aspect of navigation that requires data taking and analysis. The format of the report will be on a video that will be uploaded for the class to view. The project can be done in groups no larger than three people, although they can also be done individually. The rubric for assessment will be posted.

Important dates for final projects:

Oct. 16th â€“ groups should be declared (match making can be arranged for those who wish)

Oct. 30th â€“ final project should be declared (groups can/should consult with Prof. Huth for feasibility)

Dec. 9th â€“ final projects due

Overall Grade

Each component will be assigned a score of 100. The assignment scores will be weighted to an average out of 100.

Overall score will be derived from:

Score = (0.4)*Assignments+(0.25)*Midterm+(0.05)*Quiz+(0.3)*Final project

The letter grade will be assigned using the â€˜classicâ€™ 92-100 = A, 90-91= A-, 88-89 = B+, 82-87=B etc schema. If a person is at the borderline between two letter grades, we will consider boosting them to the next highest letter grade based on participation in class, including attendance, asking questions etc.

A note on assignments

Unlike some other classes, the assignments arenâ€™t something that can be done at the last minute. Most of them will involve going outside and doing some activity. Some of them will have a component that will be done in section. Here is a list of some of the particulars:

Assignment 1: This will be outdoors and the outdoor component will take roughly 45 minutes, and will have an analysis that is to be done later. It will have to be carried out some time between 8 AM and 4:30 PM (although this may change)

Assignment 2: This will be done in section, with an analysis to be done later.

Assignment 3: This will be done mostly in section.

Assignment 4: This will be done outside, and one component of this has to be done between 9AM-5PM Mon-Fri., it will last approximately one hour, and then there is an analysis component.

Assignment 5: This is the star gazing exercise, which will be done in the evening when there is clear weather. We will need some flexibility to find a good weather-window for this. Make-ups may be a possibility but should be arranged.

Assignment 6: This is finding latitude and longitude from observing the sun over the course of a day. It will require a day with minimum cloud cover, and a series of observations. The observations each take about 30 seconds, and can be interspersed with other activities (e.g. between classes). There should be at least 10 observations over the course of the day. There is an analysis component.

Assignment 7: This is a weather diary and analysis of weather trends. It will be observations carried out over the course of a week.

Assignment 8: This is a construction of a sun compass. We will supply you with the raw materials, and a spread sheet for making it. Once made, you will take it outside on a sunny day and use it to take sightings.

Honor Code Policy Reminder

Members of the Harvard College community commit themselves to producing academic work of integrity â€“ that is, work that adheres to the scholarly and intellectual standards of accurate attribution of sources, appropriate collection and use of data, and transparent acknowledgement of the contribution of others to their ideas, discoveries, interpretations, and conclusions. Cheating on exams or assignments, plagiarizing, or misrepresenting the ideas or language of someone else as oneâ€™s own, falsifying data, or any other instance of academic dishonesty violates the standards of our community, as well as the standards of the wider world of learning and affairs.

For mid-term: **Do all your own work, no external aids, including calculators, are allowed**.

For assignments: You can do assignments with others, but all data taken must be taken by you, not copied from another person, and most certainly not made up.

For final project: You and your group must take data. This can be shared but cannot be made up.

Week-by-week breakout of course

This should be regarded as approximate.

Week 1

Wed. Sept. 4 - Lecture 1: Introduction and course organization

Sections will be organized

Week 2

Mon. Sept. 9 â€“ Lecture 2: How the brain makes maps; uncertainties

Wed. Sept. 11 â€“ Lecture 3: Lost person behavior

Assignment 1 available: baseline of navigation skills, due Mon. Sept 16th

Reading: Chap 1,2, Handouts on uncertainties, dimensional analysis, significant figures, and notebook formatting.

First week of sections

Week 3

Mon. Sept. 16 â€“ Lecture 4: Distance and dead reckoning 1, Assignment 1 due

Wed. Sept. 18 â€“ Lecture 5: Distances, dead reckoning 2, and maps

Assignment 2 available: pacing and angular measures, due Mon Sept 23, done in section

Reading: Chap. 3,4, Handouts on dead reckoning, angular measures

Note that a lot of the material on dead reckoning can be found on the hyperlinked website HERE.

Week 4

Mon. Sept. 23 -Lecture 6: Compasses and working with compasses, Assignment 2 due

Wed. Sept. 25 â€“ Lecture 7: Triangulation and stars 1

Assignment 3 available: work with compasses, due Mon. Oct 7^{th}, done in section

Reading: Chap. 5,6, Handouts on small angle approximation, topographic maps, triangulation

Week 5

Mon. Sept. 30 â€“ Lecture 8: Stars 2

Wed. Oct. 2 â€“ Lecture 9: Stars 3

Reading: Chap 7

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Week 6

Mon. Oct. 7 â€“ Lecture 10: Sun 1, motion in sky from different places on earth

Assignment 3 due

Wed. Oct. 9 â€“ Lecture 11: Sun 2

Assignment 4 available: measuring a walk, making a map to scale, due Monday October 21st.

Reading: Chapter 8, guide to final project

Star quiz 1 in section

Week 7

Mon. Oct. 14: Holiday

Mon. Oct. 16: Lecture 12: Moon, Latitude and longitude 1

Star quiz 2 in section

Reading: Chap 9, 10, equation of time, declination of the sun, details about latitude and longitude, decimal degrees and arc minutes,

Groups for final project should declare

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Week 8

Mon. Oct. 21- Lecture 13: Latitude and longitude 2, Assignment 4 due

Wed. Oct. 23 â€“ Midterm exam

Assignment 5: identifying stars, due week of Oct. 29 â€“ depends on weather

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Week 9

Mon. Oct. 29 - Lecture 14: Latitude and longitude 3, radios, espionage, GPS

Wed. Oct. 30 â€“ Lecture 15: Weather 1â€”Physics of weather, warm fronts

Do assignment 5 this week, need weather window

Assignment 6 available, due Monday, Nov. 11

Reading: Chapter 11

Topics for final project should be declared

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Week 10

Mon. Nov. 4 â€“ Lecture 16: Weather 2â€”Cold fronts, thunderstorms, derechos, lightning

Wed. Nov. 6 â€“ Lecture 17: Weather 3â€”Occluded fronts, stationary fronts, cyclonic storms, tornadoes

Reading: Weather forecasting

Assignment 7 available: weather journal, due Mon. Nov. 18th

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Week 11

Mon. Nov. 11- Lecture 18: Weather 4â€”Forecasting weather, non-linear systems

Assignment 6 due

Wed. Nov. 12 - Lecture 19: Weather 4â€”Forecasting weather, non-linear systems

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Week 12

Mon. Nov. 18- Lecture 19: Ocean waves, Assignment 7 due

Wed. Nov. 20 - Lecture 20: Ocean currents

Available: Assignment 8, due Monday, Dec 2

Reading: Chap 12, 14, Dealing with currents

Week 13

Mon. Nov. 25 â€“ Lecture 21: Climate

Wed. Nov. 27: Holiday

Reading: Astrology, Calendars and time, precession of the equinox

Week 14

Mon. Dec. 2 â€“ Lecture 22: Origins of units of time, calendars, Assignment 8 due

Wed. Dec. 4 â€“ Lecture 23: Instruments of time, and course summary

Thu. Dec. 5: Start of reading period

Mon. Dec. 9: Final project due

Tue. Dec. 10: End of reading period

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