Neural Engineering

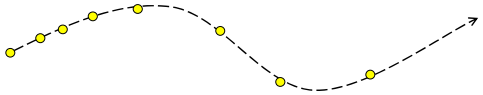
npeixoto@gmu.edu

Office hours:

- Thursdays 2-4 (STII 211)
- And by appointment.

Why do you care?

- If you want to be here: commit to learning.
- Read ***more***: web; papers; textbooks.
- Ask, answer, participate – it will count (how?)
- Where I come from.
- What do you want to be in 5 years? (HW1a)



Course details

- Structure: weekly lectures, homework, two exams, project/paper.
- Syllabus of ECE 590 available online: http://complex.gmu.edu/people/peixoto
- Textbook: Neural Engineering, by Bin He (ISBN 0306486091)

BAKING IS A **MUST**!!

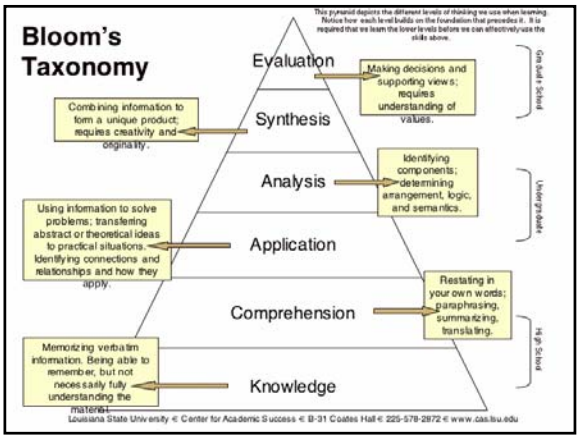
(Maybe you need a boy-girlfriend / wife / husband / S.O. who can bake?)

Rules:

- Everybody has to bake.
- Bring your stuff either cut or … bring a knife too.
- Bring napkins!
- You can leave it by my office in the morning.

Why 499 and/or 590?

- ECE499: if you are interested in the BENG track, or if you need more electives. ☺
- ECE590: if you are a graduate student, or a GRADUATING senior.
- Difference: weekly hours of dedication:
  - ECE590 = 590h
  - ECE499 = 499min



Bloom published his taxonomy in 1956.

- More sources of information on Bloom's taxonomy of educational objectives:
- http://faculty.washington.edu/krumme/guides/bloom1.html
- http://www.coun.uvic.ca/learning/exams/blooms-taxonomy.html

Evaluating, grading, "feedbacking"

- There will be at least four rubrics:
  - Class participation
  - Homework assignments
  - Exams
  - Projects
- Course evaluations:
  - Mid-course survey
  - Teacher evaluation (end of semester)
  - All other feedback you can provide is valuable: I need to know ASAP if something is going wrong. *Default*: you are enjoying/learning/having a tough time (having a fun time).

Class participation (or oral communication) rubric

- **Excellent**:
  - Attempts to answer questions in class, cites references during these answers.
  - Poses questions at the right time; refers to homework problems or to other reading material in the questions.
  - Understands the questions posed, and can advance to deeper questions.
  - Oral communication proceeds with no hesitation.
  - Uses unexpected technical terms during oral communication.
  - Cell phone never seen.
- **Medium**:
  - Attempts to answer questions in some classes.
  - Has posed at least one question during the last four classes.
  - Attentive most of the time.
  - One cell phone call during the semester.
  - When expressing a thought, can formulate a full sentence in English with no problems.
- **Low**:
  - Never answers questions in class.
  - Never lets anybody else have a turn.
  - Multiple SMSs or calls during the semester.
  - When prompted to answer a question, does not have a clear understanding of the English language (uses words in the wrong place, does not capture the meaning of single words).
  - Never poses questions in class.
  - Sleeps in class.
  - Surfs the internet.
  - Does not have a clue about what the instructor is saying (poses questions as answers to instructor's questions such as: "hhuhh? I was not paying attention".

How are homework assignments graded? (or "why did I get 80?")

- (handout)
- Please keep this handout.
- Questions?

How to get A's!

(91-100) A

1. Writes in concise English.
2. Proper use of language.
3. Includes adequate information (not previously offered by the instructor neither discussed in class).
4. Text flows and is clear.
5. Level C or higher of Bloom's taxonomy (application – analysis – synthesis)
6. If a design is expected, for example, a surprisingly creative and well-rounded design idea is presented.
7. In a design-based homework assignment, problems discussed are the main problems for that idea, and creative solutions are proposed.
8. Bibliography is presented in right format, and it matches the information presented in the text.
9. Less than 10% of references are web-based.
10. More than 50% of references are from high impact and relevant journals (Science, Nature, Journal of Neural Engineering, Neuroscience Methods, Journal of Neuroscience, Neuron, etc)

How to get B's

(81-90) B

1. Writes in complete and understandable sentences.
2. Proper use of language (one or two mistakes).
3. The full text can be followed with no problems. There is an underlying "story" to it (text flows).
4. Level B of Bloom's taxonomy (comprehension).
5. Includes some new information (new = not previously discussed in class).
6. Bibliography with 20% of references from the internet.
7. References match with written text; 10% or more from high impact and relevant journals.
8. Significant percentage of references from non-traceable or media-based (low impact) sources.
9. If a design is required, idea is based on researched bibliography, and it is well presented.
10. In a design-based homework, pitfalls presented are reasonable, albeit not necessarily exhaustive. Solutions to problems may not be complete.

How to get C's

(50-79) C

1. Does not complete sentences, or sentences are not understandable.
2. Does not write in proper English,
3. Level A of Bloom's taxonomy of educational objectives (knowledge)
4. Sentences are verbatim from class or text given in homework.
5. Improper use of language.
6. Poor bibliographic citation. Poor formatting.
7. Over 50% of references from the internet.
8. In a design-based homework, an idea already discussed in class is used.
9. In a design-based homework, identified problem is not a major problem for the design presented.
10. References do not match with written text.

Feedback from last time (1/2)

- "I don't like homework every week, I prefer every other week."
  - *…hmmmm. Something like a really hard homework assignment?*
- "The project was due when all my other projects were also due: that made it much harder to work on it."
  - *Should we have the final presentations happen one month early?*
- "I really enjoyed the guest speaker, and when we had to go to the Arts Center."
  - *I will try to invite more people. (Suggestions accepted.)*

More feedback (2/2)

- "I wish there was more hands-on stuff."
  - *E.g. hands on brains? (Suggestions also accepted!)*
- "In the beginning of the semester I almost dropped this class because of the baking requirement. Then during the midterm week I missed it so much I thought I was crazy. I am glad I didn't withdraw: it was my best class. Baking was a great idea."
  - *Let's bake then.*
- *Do you have anything to add?*

What is Neural Engineering

- What is Bioengineering/Biomedical Engineering?
- **Neural engineering**: interdisciplinary field where tools and methods from electrical, mechanical, chemical, and computer engineering are applied to neuroscience related problems.

Finding more resources

- Journals:
  - J. Neural Engineering;
  - IEEE Conf. Neural Engineering
  - Neural Networks journals (various)
  - Neural Processing Letters
  - Science, Nature, Scientific American
  - IEEE Transactions on Neural Systems and Rehabilitation Engineering
  - IEEE Transactions on Biomedical Engineering
- Web:
  - http://bioeng.berkeley.edu
  - http://www.bme.jhu.edu/
  - http://www.ucsd.edu/catalog/0506/curric/BENG.html
  - http://bioengineering.stanford.edu/education/
  - http://www.bioe.psu.edu/
  - www.bmecentral.com
  - http://www.bmes.org/
  - http://www.whitaker.org/home.html

Project / Paper

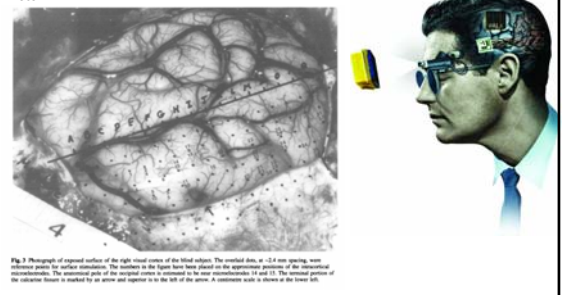
- Deadline for picking your subject: 2/7.
- If you know what you want to work on: select paper, come talk to me. If you have no clue: look at the chapters of the book and then come talk to me.
- Groups of 2 people! *Obs: 2=1+1, and 2≠1.5+0.5*.
- We will discuss project objectives in detail on 2/14.

Selecting a subject

- Previous projects:
  - Deep brain stimulation
  - Epiretinal implants
  - Carbon nanotubes for single cell analysis
  - Microarrays with Si-pyramids
  - Electrophoretic manipulation of cells
  - MRI for IQ determination in children
  - Control of prosthetic devices

Neural prosthesis

Two types:
- Sensory
- Motor



From Schmidt et al, Brain, 1996.

Today's cool part

- A real pacemaker.
- Medtronic's teaching pacemaker.
- Let's do it.

The following companies are manufacturers of pacemakers:
* Medtronic
* Biotronik
* Pacesetter/Telectronics/St.Jude
* Guidant (formerly known as CPI)
* ELA Medical
* Vitatron
* Medico
* Sorin