Cognitive Systems 303

0.0: Introduction to the Course

"When we speak of improving the mind we are usually referring to the acquisition of information or knowledge, or to the type of thoughts one should have, and not to the actual functioning of the mind. We spend little time monitoring our own thinking…" —James L. Adams

1. Goal of the Course

To teach you critical, analytical, and scientific thinking—the skills needed to do effective analysis and research in the constituent disciplines of Cognitive Systems.

Not just techniques for particular problems in particular areas, but ***general ways of investigating the unknown—the <u>process</u> of doing science.***

Question: Why do some people have an impact on the world, and others don't?
- not a matter of IQ (beyond c. 110),
- not a matter of marks; high marks & degree won't help much (no Santa Claus)
  - maybe get you in the door for an interview, but that would be it

It's not entirely chance, though – ***there are patterns***
- commonalities of successful people/researchers in all areas (science, forensics, etc.)
  1. they think for themselves
  2. they do this well (follow the process described in B&K, ch.1)
  3. they keep evolving (***intensive, highly focused practice***); okay with mistakes

2. Main messages to learn:
  1. ***You can do it if you work at it***. Doing well in research is not governed by genetics, but by training. Most important factor is *curiosity*.
     - intelligence is dynamic. Results from a cognitive world that built up via deliberate practice. IQ is largely irrelevant.
     - an important part of this is learning from failure. **Don't be afraid to try**.
       - failure does not define you—***effort*** and ***learning from failure*** *do*
  2. ***It's all connected***. Skills needed are just more controlled forms of everyday thinking:
     - recognize the weaknesses of human reasoning, and guard against them
     - lessen the grip of your current beliefs; open your mind to alternatives
     - develop a robustness to let you "hang in there", and live with uncertainty.
     - learn to accept negative feedback—lets you continue to improve.
  3. ***Communication is key***. Community is an important part of doing research.
     - effectiveness = content * transmission
     - this can be improved by practice.

3. Relation to Other Courses:
The goal is to develop thinking skills to let you connect the dots
- *other courses*: vertical connections to a particular discipline (tactics)
- *this course*: horizontal connections to other disciplines (strategy)

(skills are general - useful for silo research as well)

4. Approach (how we'll get there)

Everyday thinking:

Based on reflexive pattern completion (e.g. where there's smoke, there's fire)
- works well in known environments
Doesn't always work well in unknown environments
- patterns are unlikely to match structure
Thus, need to go beyond what our reflexes are doing

Controlled Thinking:

To investigate new areas, need to control your thinking. (Panning for gold approach).
Need to *evaluate* beliefs – see if they're right (or at least, reasonably well founded), and
not just a result of simple pattern completion.
- **only need to do this sporadically – choose when to apply**
- note: avoid going too far, and having no beliefs at all
  o should still have beliefs, so that you can act

Types of Thinking Skills

1. Skills *for evaluating an argument: **controlled rational thinking** - Critical thinking*
- Much of thinking isn't optimal – need to guard against weaknesses
  o e.g., Darwinian algorithms , cognitive illusions

2. Skills for *finding an explanation* (investigation/analysis)*: **controlled imagination***
- *Generative thinking / creativity / insight*
- Guard against failures of
  - generation (don't imagine all possibilities)
  - evaluation (hold on to personal favourites)

3. Specialized skills for systematization *- **controlled questioning***
- Experiment Design
  o critical experiment
- Systems thinking
  o hierarchies,power laws
- The Right Research Question
  o Difference that makes a difference; MAGIC criteria
4. *Communications* skills (Background mode – distributed throughout class)
- Writing, Debates

5. Structure of Most Classes

- interactive: readings beforehand, use the knowledge in class

- for details, see syllabus (available on website)

6. Evaluation

- relatively "flat": all components weighted about the same

- for details, see syllabus (available on website)
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REAL-WORLD SEGMENT: Writing I – Basic Style
   (Based on Strunk & White, *The Elements of Style*)

Main goals of style:
   1. *Clarity* – communicate exactly what you have in mind
         - including the level of precision you intend
   2. *Conciseness* – do this with the fewest words possible
         - maximum signal-to-noise

1. Omit needless words.

Use whatever words are necessary. No others. Each word should do something critical.

- *See what happens if something is removed – is there a significant change?*
- *Alternatively, see if there's a simpler way of saying the same thing.)*

Thus,

the reason why is that…	**NO**
-> …because…	**YES**
on account of the fact that…	**NO**
-> as…	**YES**
if it is assumed that…	**NO**
-> if…	**YES**

2. Avoid fancy words and jargon

Use precision no higher than needed (i.e, to avoid confusion with other things discussed).

- *Each word should be precise enough convey an unambiguous meaning,*
- *but not beyond what is needed for the task at hand.*

Thus,

He established visual contact with the ungulate.	**NO**
-> He saw the cow.	**YES**

Also,

accomplish	->	do
additional	->	extra
subsequently	->	later
etc., etc.		

3. Use specific, concrete language.

- *Prefer the definite to the vague.*
- *Prefer the concrete to the abstract.*

Thus,

A period of unfavourable weather set in.	**NO**
-> It rained every day for a week.	**YES**

1A. Use ***strong nouns*** as often as possible

- pastoral environment	**NO**
- farm	**YES**

1B. Use ***strong verbs*** as often as possible

- made arrangements for	**NO**
- arranged	**YES**

Minimize *nominalizations*—nouns that are actually verbs
E.g., "made… arrangements" -> "arranged".

1C. Important actions should be *verbs*, not *nouns*.

- a walk occurred on the part of Sally.	**NO**
- Sally walked.	**YES**

4. Put statements in positive form.

- *Make definite, positive assertions.*
- *Minimize use of the word "not".*

Thus,

He was not very often on time.	**NO**
-> He usually arrived late.	**YES**

** For each rule, apply only *after* you've written something. **

Don't try using a rule during the writing process. Write first, then correct (systolic).

Don't focus on *avoiding* errors: focus first on ***writing***; then on ***correcting***.