Professional Engineering Topics

or

"Stuff they should have taught you at university, but didn't"

P Pounds

5 March 2018

University of Queensland

But first…

Some house keeping

Problem Analysis

- ~~The METR4810 marking elves (ie. the tutors) worked solidly through the night to get you results for today~~
  - Since the lecture is on a Monday this year, we will try to return them to you during the Wednesday and Thursday pracs

A few comments…

(Honestly, these comments are the same, year after year…)

Problem Analysis

- Probably don't need a title page, executive summary or table of contents for a two-page report… just say'n
  - Some crazy people submitted 6+ pages
- Appendix abuse was rife
  - Don't worry, we didn't read them if they were just more text
  - Appendices are for pictures, plots, tables

Problem Analysis

Problem Analysis common threads:

- Lots of simply restating the problem spec
  - Don’t regurgitate – tell me something new!
- What about implicit constraints/requirements?
  - Not everything is in the spec.
- Limited translation of spec into challenges
  - Little pre-chewing of the problem

Problem Analysis

Design Analysis common threads:

- Present your analysis before your solution
  - Don’t put the cart before the horse!
- Can’t fit all the words on the page?
  - Maybe you need fewer words?
  - The answer is never 9 pt font – this is very obviously not acceptable and didn’t fly

Problem Analysis

- Oh yeah… and it's not "research" unless you have citations
  - $DEITY help you if you claim to have done research and don't put in useful, meaningful citations that inform your design decisions.
  - *You've been warned*.

Some useful tips

Meditations on self-review

How to identify good work

- All the necessary parts are present
  - Constraints, requirements, deconstruction, etc.
- Supported thinking – aka justified reasoning
  - "*Because X*, thus Y."
- Logical flow; links in a chain
  - "X, therefore Y. Y, therefore Z. Z, therefore win."

How to identify good work

- High level structure
  - You are given enough information to understand each section before you get there
- Intuitive coherence
  - *"Wow, I totally get it!"* – probably good work
  - *"I just don't understand this!"* – probably not
- Analysis
  - "Given a 15kJ battery, using equation 4 we predict a total operating time of 270 seconds."

How to identify bad work

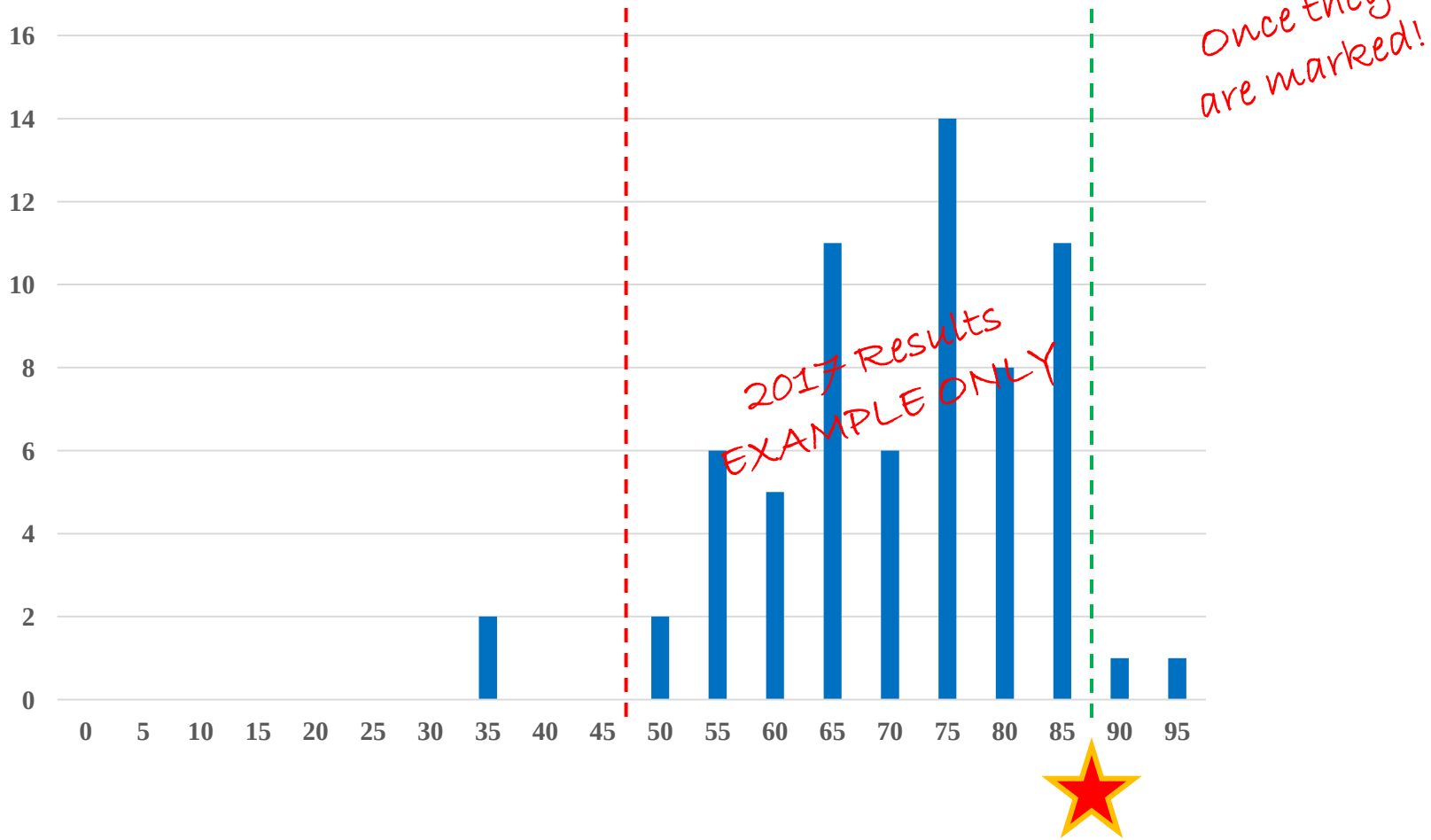
- Key parts are missing
  - Cursory, curt, and often rudely short,
    eg. 3 paragraphs in a two page assignment
- Lack of due care
  - Spelling, grammar, formatting errors; laziness
- Misdirected register
  - “We’re gonna do engineer haha lol”

How to identify bad work

- Unsupported statements
  - "Geared motors are the best solution." *Why?*
  - "Research found that AVRs are effective." *What?*
- Logical incoherence
  - "Lipo batteries are the most efficient." *Snuh?*
- Obvious hogwash
  - "The whole system will weigh 50 g and be completed in 3 weeks."

Problem Analysis (from 2017)

Results available via Blackboard after ~~lecture~~



House keeping

IMPORTANT:

- You must submit designs to ~~Doug~~ Peter for machining parts no later than week 7
  - No parts will be machined for you after then
  - You can machine your own parts, but you won't be able to go through the workshop

Calendar at a glance

You are here →

Week	Dates	Lecture	Reviews	Demos	Assessment submissions
1	19/2 – 24/2	Introduction			
2	26/2 – 2/3	Principles of Mechatronic Systems design			Problem analysis
3	5/3 – 9/3	Professional Engineering Topics			
4	12/3 – 16/3	PCB design tips	Progress review 1		
5	19/3 – 23/3	Your soldering is (probably) terrible			
6	26/3 – 29/3	Introduction to firmware design			
Break	30/4 – 13/4				
7	16/4 – 20/4		Progress seminar	25% demo	
8	23/4 – 27/4				
9	30/4 – 4/5			50% demo	
10	8/5 – 11/5	No lecture	Progress review		
11	14/5 – 18/5			75% demo	Preliminary report
12	21/5 – 25/5				
13	28/5 – 1/6	Closing lecture		Final testing	Final report and reflection

Progress reviews

- Progress reviews are next week!
  - 15 minute slot per group
  - Each group member presents in turn
  - Should only take 3-4 mins each
- Sign up for session slots via Doodle poll
  - Link to poll will be sent out via Blackboard announcement after the lecture (closes Friday)

Progress reviews

- How to sign up:
  - Have **one and only one** member of your team nominate a time for your team on the poll
  - When they sign up, they must include their **full name and team number**. If they don't put both, the slot will be cleared.
- If you absolutely can't get a slot that works for all of your group, email me ASAP
  - *But this should never happen*

Progress reviews

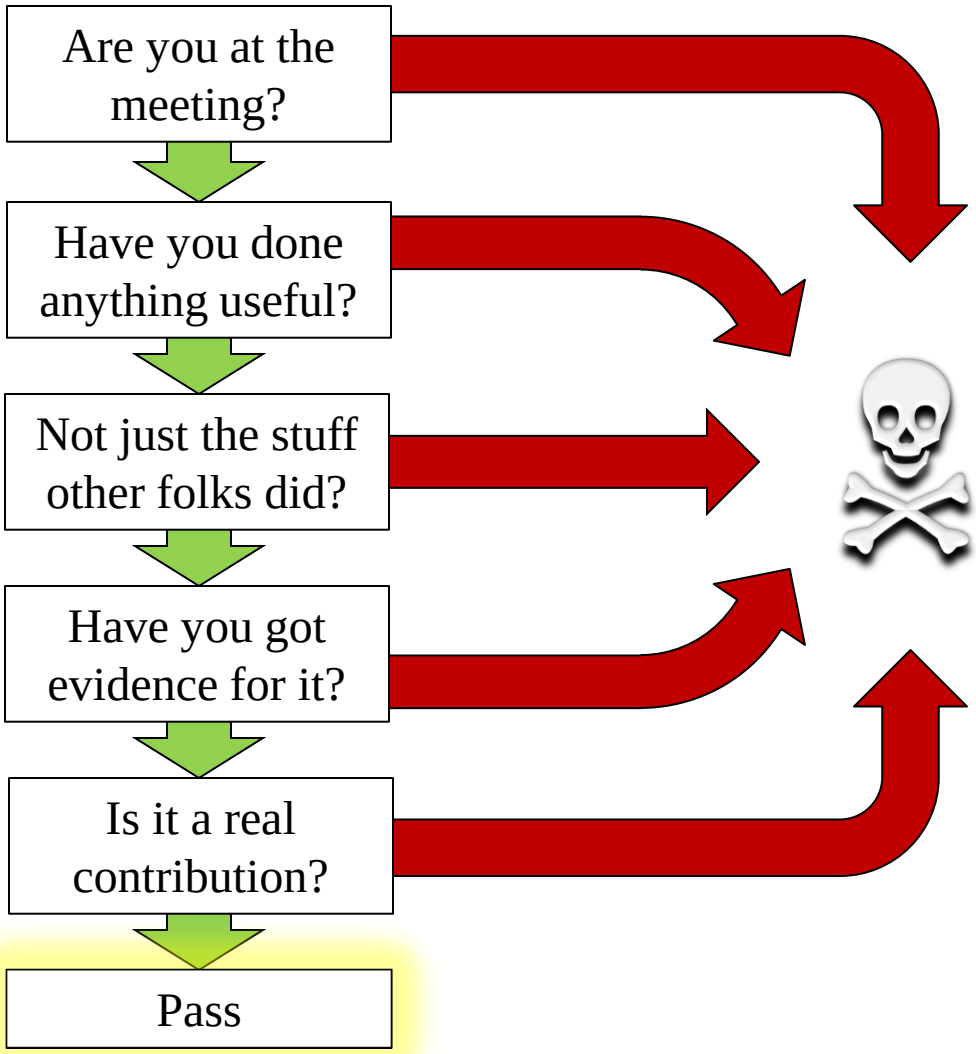
What is expected for the progress review?

- Need to show that you've made a decent start to the project: **tangible evidence**
  - Desired: rigorous analysis, detailed simulations working compiled code, breadboarded electronics, mockups of mechanical design
  - Inadmissible: scrawled pictures, isolated printouts of code, lousy rushed CAD or circuit diagrams, datasheets of that one part you found

Progress reviews

- Don’t panic: we are reasonable
  - The progress review is entirely to motivate you to get started early, and check your progress
- We can tell very easily if you’ve actually made an effort – if you have, you’ll be fine!

Progress Review flow chart



And also…

- You will be doing PAFs for each of your team members
- The PAF will contribute towards the final scaling of your final product score
  - This really counts!

And also also…

- This year, you must submit (as a team) a signed (by every member of your team) document stating what the roles of each person (in the team) are
- We will refer back to this document in subsequent reviews
- It's not an immutable contract, but it is expected to be broadly adhered to

FAQ Roundup

- **Do we have to/can we use computer vision?**
  - Only if you want to!
- **Will the placards all be at the same range and height?**
  - Nope. But the difference won't be huge.
- **Can we use motors?**
  - Uh... yeah.
- **I mean, can we put motors on the gimbal?**
  - Uh… no.

FAQ Roundup

- **Do we have to use Altium? Can we use KiCAD/Eagle/etc?**
  - Use whatever you like – I'm not the boss of you. I use Eagle at home, and don't really like Altium, but I can help you out whatever you use.

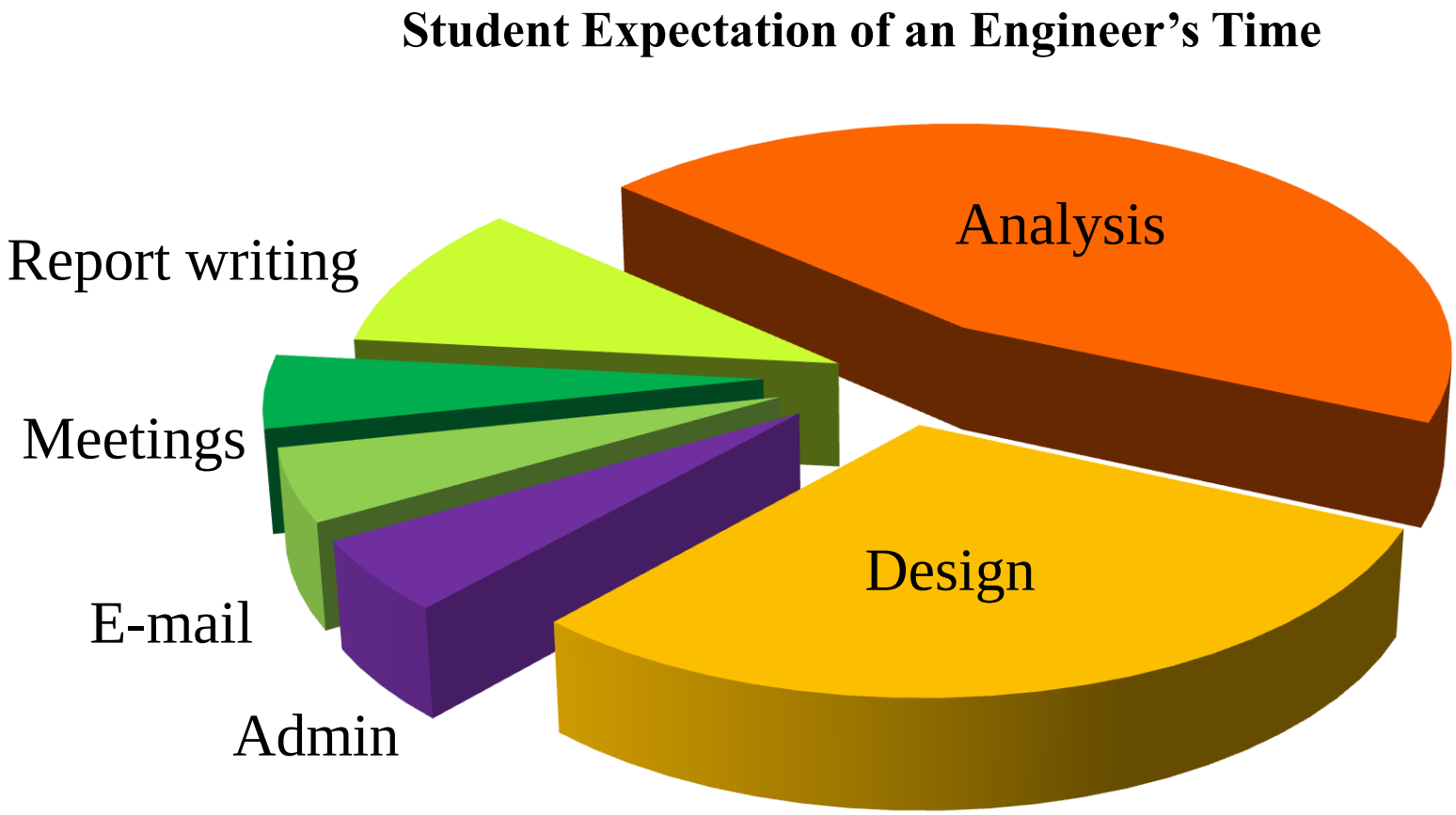
- **No seriously, do we have to go to all the lectures/contacts/pracs?**
  - Only if you really want to – the pracs are there for the tutors to help you, and the contact sessions are times for your team to meet. Use those times to best effect, per your judgement. I really do recommend coming to the lectures and pracs, though!

Back to professional engineering…

Professional Engineering Topics

Snuh?

Where does the time go?



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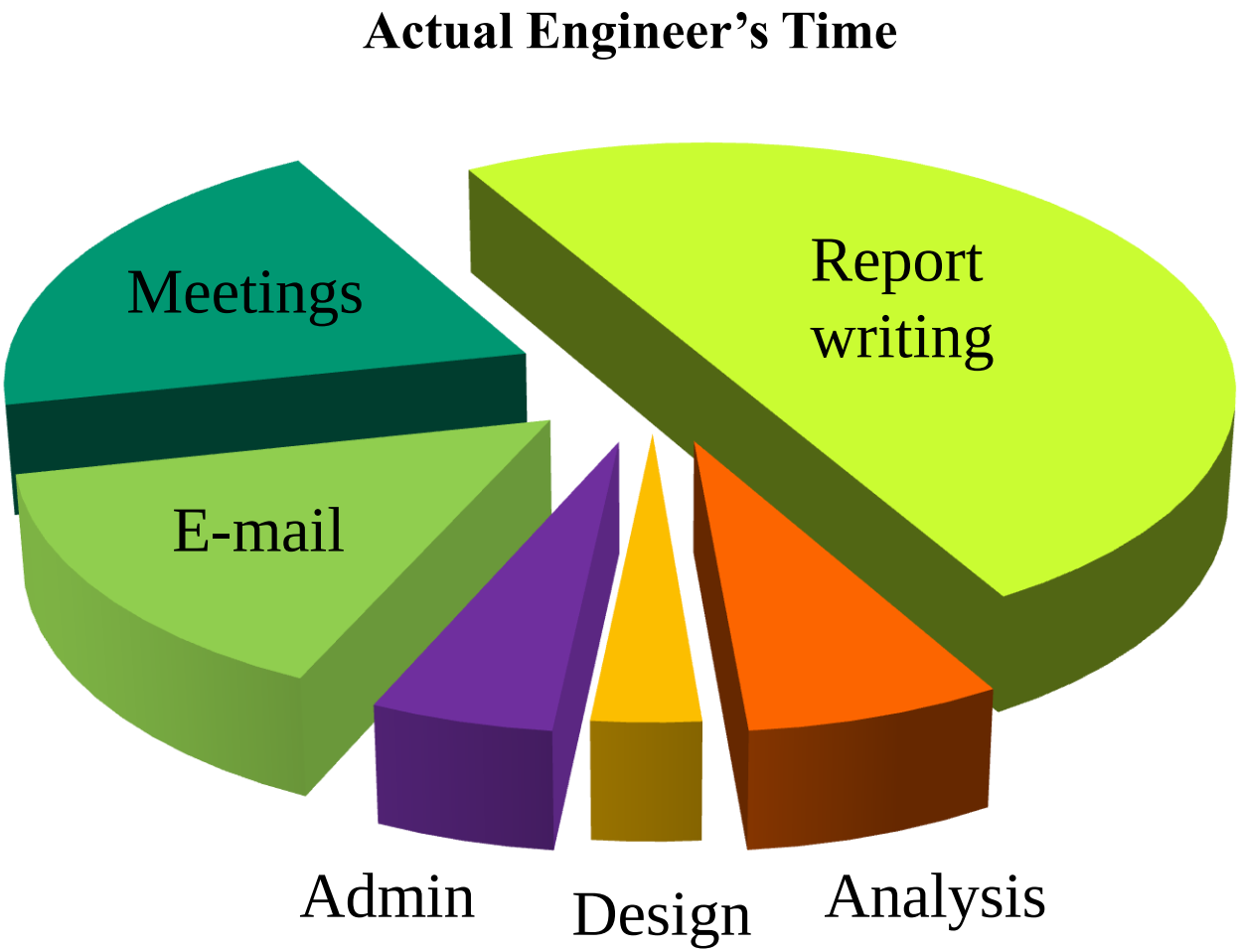

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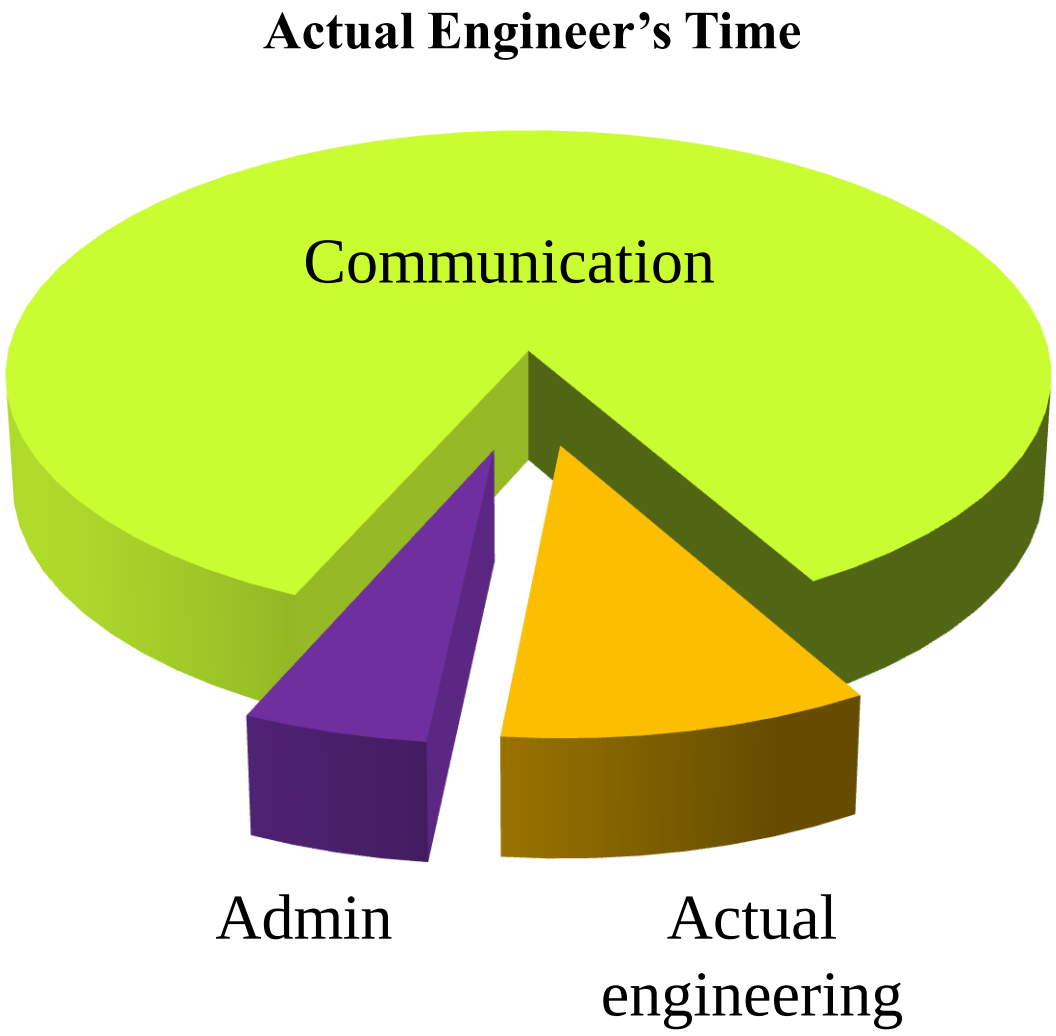


Terrible lies

I called it “Professional Engineering Topics”, but this lecture is really about *communication*

Professional Engineering

~~Topics~~ Communication

or

"Stuff they should have taught you at university, but didn't"

Paul Pounds

5 March 2018

University of Queensland

Terrible lies

Today:

- Appropriate language
- Report writing
- E-mail
- Meetings
- Presentations
- Paul’s crepuscular ramblings

Disclaimer

- The following ideas and methods are examples and suggestions only
- Do not slavishly adhere to these principles to the detriment of clarity
  - Apply only when it is appropriate/needed
  - Use your common sense

Communication

- There is no point in doing good work if you cannot effectively tell other people about it
- Communication takes many forms:
  - Reports
  - Briefs
  - E-mail
  - Presentations
  - Meetings
  - Scientific papers
  - Published books
  - Many, many more…

Most of these use *language*: text or spoken word

A brief detour into “register”

- Not all language is created equal
  - Different words/phrases depending on context
- Register: formal versus informal language
  - “Hi.” – informal, cordial greeting
  - “Hello.” – semi-formal, friendly greeting
  - “Good evening.” – formal, polite greeting
  - “Dude!” – very informal, trapped-in-the-1980s

Informal register

- Everyday colloquial language you might use with your friends and family
  - Contractions, neologisms, etc. more acceptable
  - Slang is a gray-area and depends on audience
  - Slightly more accepting of spelling errors (but still no excuse to be sloppy or lazy)

Even informal register has rules: *shibboleths*

Semi-formal register

- Standard English
  - Correct spelling, punctuation, grammar
  - Concisely written to a high level of polish, only occasional colloquialism for effect
  - Different cadence from spoken language.
  - Formalised words rather than colloquialisms:

    "*Child*" not "*kid*"

    "*Why*" not "*how come*"

    "*Cannot*" not "*Can't*"

Formal register

- Standard English
  - Flawless writing and construction
  - Concisely written to a *very* high level of polish; no contractions, no colloqialisms
  - Even a few small errors undermines the objective of your writing – people notice.
  - Generally use ‘third person passive’ voice: focus on the action rather than the actor

    “*It was done*” rather than “*We did it*”

Appropriate language

- In professional contexts, language tends to be more formal than social contexts
- Depends on both audience and context
  - A sales pitch for your client is more formal than a letter to your friend!
- Think clearly about who is going to read your report and how to address them
  - No one will forgive if you get it very wrong

Convenient reference chart

	Your CEO, clients, shareholders	Your boss, your workers	Co-workers, colleagues	Your friends
Important meetings, official reports, quotes, proposals	Most formal	Formal	Formal to semi-formal	Semi-formal
Larger meetings, internal reports, email exchanges	Formal	Formal to semi-formal	Semi-formal	Informal
Small meetings, short notes, briefs	Formal	Semi-formal	Semi-formal to informal	Informal
business lunches, social meetings, mixers	Formal to semi-formal	Semi-formal to informal	Informal	Most informal

Reports

Some brief words on report writing

Reports

- Reports present work done, its results, an analysis, and reasoned conclusions drawn

- The vast majority of your working life will consist of writing reports about things

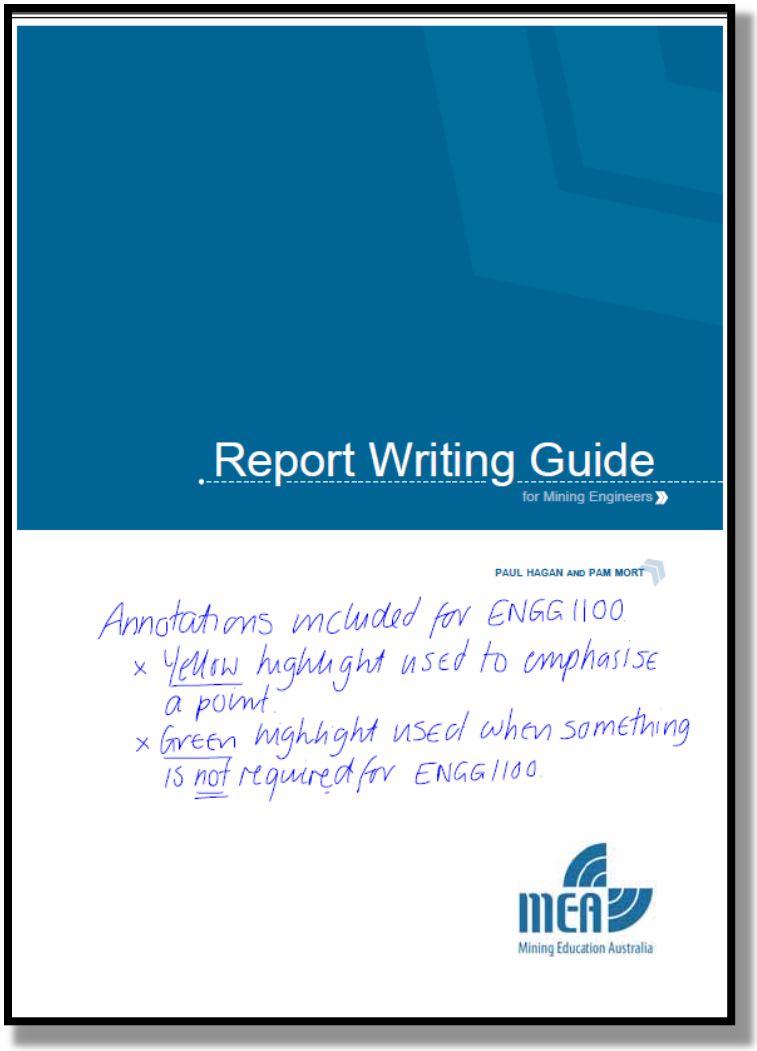
<u>Sadly, I am not joking about this.</u>

Reports

- The goal of reports is to convince someone of something, using evidence and reason
  - "This is why the aeroplane broke"
  - "Why we should buy this killbot instead of that other one"
  - "How I built my contraption, and why"
- Different from a proposal, brief or datasheet
  - Focus on process and outcomes
  - Not a reference guide or user manual

Annotated MEA writing guide

- Lydia has graciously given us access to her Annotated MEA Report Writing Guide
- Lots of excellent tips!



Know your audience

- Determine who you are writing for and what they expect to get from your report
  - Where will your report appear?
  - Who will read it?
  - What background do they have?
  - What extra background do they need?
  - What is the appropriate register?

Report structure

- There is some variety to the structure of reports, but most share common sections:
  - Abstract
  - Introduction
  - Background
  - Literature review
  - Nomenclature
  - Body/results/discussion
  - Conclusion
  - Appendices
  - Bibliography

Let’s go through the most important ones

Abstracts

- Abstracts are the *hardest* things to write
  - Absolute clarity and conciseness
  - Must describe the report's contents without just being a list – meaningful digestion of import
  - Normally written *after* the rest of the report
- Mini thesis in its own right:
  - What was done
  - Why is it important?
  - What were your key findings?

Introduction

- Prepare the reader for what is to come
  - Ease them into reading your work – provide scope, context and orientation
  - Give them necessary background knowledge, but don't tell them what they already know
  - Get the reader interested
- Make a strong first impression
  - A terrible introduction will turn the reader against you and it's hard to get the back!

Introduction

- Things you might see in an introduction
  - Background – useful relevant information
  - Literature review – relevant previous work

    Not the same as background!
  - Goal or objective statement (e.g. specifications)
  - Statement of thesis (i.e. the case to be argued)
  - Outline of general concepts or approach
  - Road map – a brief synopsis of contents

    "In this report… In section 1… Section 2 shows…"

Background

- Can be part of the introduction, or broken out into its own section (if large)
- Goal is to be informative *for context*
  - Preparatory – bring the reader up to speed with things an informed reader is expected to know
  - *Not* the place to introduce specific facts (e.g. specific density of a material) unless germane
  - Generally does not include analysis beyond the most basic back-of-the-envelope kind

Literature review

- Lit review is a survey of published material or works on the topic of the report
  - Provides facts that support your argument
  - Proves you did your homework
- Be choosey
  - Not just a grab-bag of vaguely related stuff
  - Cite works that informed your approach, show alternative approaches, or provide useful info

Body

- Where all the action happens!
  - Here you demonstrate your thesis
- Construct a narrative driven by results
  - Focus on what worked, and why it worked
  - Do not make a travelogue!

    E.g. *"First I did A, and that didn't work, so then I did B and that didn't work either, so then…"*

    vs "Our approach was Z. We also considered A through Y, but Z was superior because…"

Body

- Make sections manageable and coherent
  - Avoid long paragraphs and run-on sentences; break chunks down into little chunks
  - Give each paragraph internal structure and direction: Topic sentence, supporting statements, conclusion, as required
- Every section must help convey your point
  - If a paragraph, sentence or word does not have a clear and justifiable purpose, *kill* it.

Body

- Reports should function as a single cohesive machine, with many parts working together
  - Each paragraph performs a specific task
  - Each paragraph flows logically into the next
  - Connect sections by bridging; ‘mid-troduction’
  - When you’re doing it right, you won’t even notice the parts of the machine

Conclusion

- Collates and integrates the arguments and supporting evidence into a concise coda
  - Relates the outcomes and findings to the stated purpose/goal of the report
- A conclusion must be summative
  - Orderly and structured; unify preceding work
  - Never introduces new information
  - Not just a restatement of stuff you wrote!

Other sections

Nomenclature, appendices and bibliographies each have their own (much simpler) rules

I won’t go through them here

So many things!

How can we handle the complexity of writing a large report?

Scaffolding

- Design your report: make a plan!
  - Don’t just jump in and flail around
- Use a ‘scaffold’ or ‘skeleton’
  - Set out your key topics to be covered
  - Order them logically
  - Each should transition to the next smoothly
- Once you have the global structure down, you can flesh out sections within context

Scaffolding

E.g.

Report slides

> Remind about appropriate language
> Structure of a report
> > High-level concepts - scaffolding
> > What each bit does
> > > Abstract, intro, body, conclusion, etc.
> Common errors and tips
> > Narrative structure, rubric abuse, etc.
> > Well-oiled machine

Report tips

There are hundreds of tips and tricks to writing effect reports

Here are but a few

Report tips

- Presentation counts
  - The first impression your document makes!
  - Don’t be messy or careless in your layout
  - Neat type-setting and clean formatting go a long way to getting your reader on-side
- Avoid flashy graphics, border art, headings
  - Visually distracting; diverts time from polish
  - Too fancy can make a reader suspicious

“A well-dressed engineer has no credibility” – Dilbert

Report tips

- Size your literature review appropriately
  - Too few citations looks like lazy ignorance
  - Too many looks like lazy uncritical whitewash
  - Only as many as needed to show what you must
- Never, ***ever*** use citation of Wikipedia
  - You will look like a complete ignoramus and no one will ever respect you ever again
  - If needed, use the reference from the wiki article

Report tips

- Consider how your work breaks down logically and build sections around that
  - E.g. electronics, mechanics and code?
  - E.g. sensing, movement and gameplay?
- Don’t just use marking rubric headings to structure your report
  - Like putting a chicken, a pot and a pie in the oven and expecting to get chicken-pot-pie.
  - “Ok” for rookies, but you should know better!

Persuasive writing

While we’re in the neighbourhood, here are some brief tips on persuasive writing

Persuasive writing

- Reports are a form of persuasive writing
  - Lead your reader by the hand, through a logically progressing train of thought
  - A well-led reader will nod as they read until they reach the conclusion you intend
- The chain of logical reasoning must be unbroken from beginning to end
  - A reader whose train of thought regularly jumps the tracks will become frustrated!

Persuasive writing

- Seduce the reader with careful writing
  - Use affirming constructs in subsequent sentences

    "Statement. Supporting evidence. Conclusion."
  - Use 'waterslide clauses' where one idea flows from the next: "Statement; conclusion."

  e.g. "*Ground effect acts as stiffness in a second-order system; the natural vertical dynamics are stable."*

Persuasive writing

- Concept of ‘flow’ – flow is all important!
  - Smooth passage through the text in the mind
  - Use proximal demonstrative deictic words (this, that, those) to maintain topicality
  - Avoid interrupting the flow by *non sequiters*, odd phraseology, repetitious words, typos or bad formatting

“Nothing must come as a surprise to the reader”

–UC Academic Skills guide

Persuasive writing

"Omit unnecessary words."

–William Strunk, Jr

William Strunk Jr. [Cornell]

The paradox of length

« Je n'ai fait celle-ci plus longue que parce que je n'ai pas eu le loisir de la faire plus courte. »

–Blaise Pascal

Blaise Pascal [Unknown]

E-mail

Some brief words on writing e-mails

E-mail

- Probably the most common (and underrated) professional communication you will make
  - Largely replaced the Business Letter
- One-to-one, or one-to-many communication
  - Directly linked to **YOU** as an individual!
- Can make a very strong impact on how people perceive you as a professional
  - First impressions count

E-mail

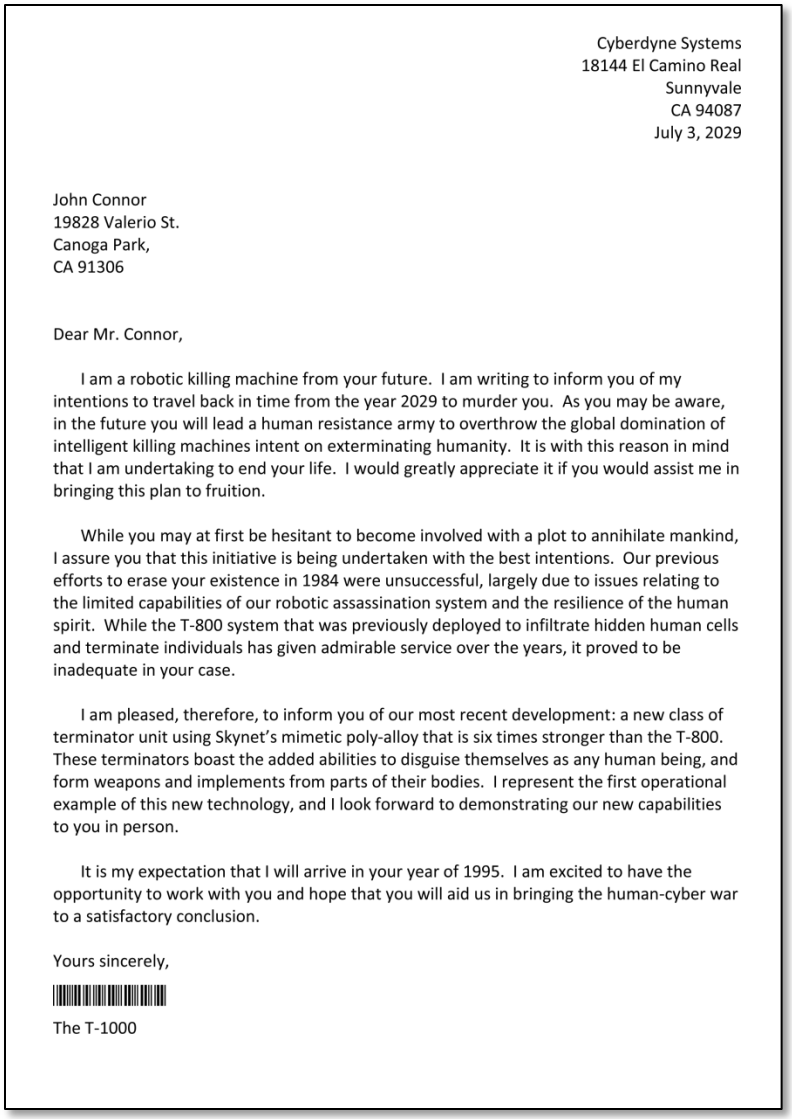
- Composing a professional e-mail is just like writing a formal business letter
  - You've all written formal letters, right?
  - …
  - Alright then.

- How do you write a business letter?

Formal letter

A general template:

- Address block
- Addressee block
- Salutation
- Body
- Valediction
- Your signature
- Your name



Cyberdyne Systems
18144 El Camino Real
Sunnyvale
CA 94087
July 3, 2029

John Connor
19828 Valerio St.
Canoga Park,
CA 91306

Dear Mr. Connor,

I am a robotic killing machine from your future. I am writing to inform you of my intentions to travel back in time from the year 2029 to murder you. As you may be aware, in the future you will lead a human resistance army to overthrow the global domination of intelligent killing machines intent on exterminating humanity. It is with this reason in mind that I am undertaking to end your life. I would greatly appreciate it if you would assist me in bringing this plan to fruition.

While you may at first be hesitant to become involved with a plot to annihilate mankind, I assure you that this initiative is being undertaken with the best intentions. Our previous efforts to erase your existence in 1984 were unsuccessful, largely due to issues relating to the limited capabilities of our robotic assassination system and the resilience of the human spirit. While the T-800 system that was previously deployed to infiltrate hidden human cells and terminate individuals has given admirable service over the years, it proved to be inadequate in your case.

I am pleased, therefore, to inform you of our most recent development: a new class of terminator unit using Skynet's mimetic poly-alloy that is six times stronger than the T-800. These terminators boast the added abilities to disguise themselves as any human being, and form weapons and implements from parts of their bodies. I represent the first operational example of this new technology, and I look forward to demonstrating our new capabilities to you in person.

It is my expectation that I will arrive in your year of 1995. I am excited to have the opportunity to work with you and hope that you will aid us in bringing the human-cyber war to a satisfactory conclusion.

Yours sincerely,

The T-1000

Formal letter

A general template:

- Address block
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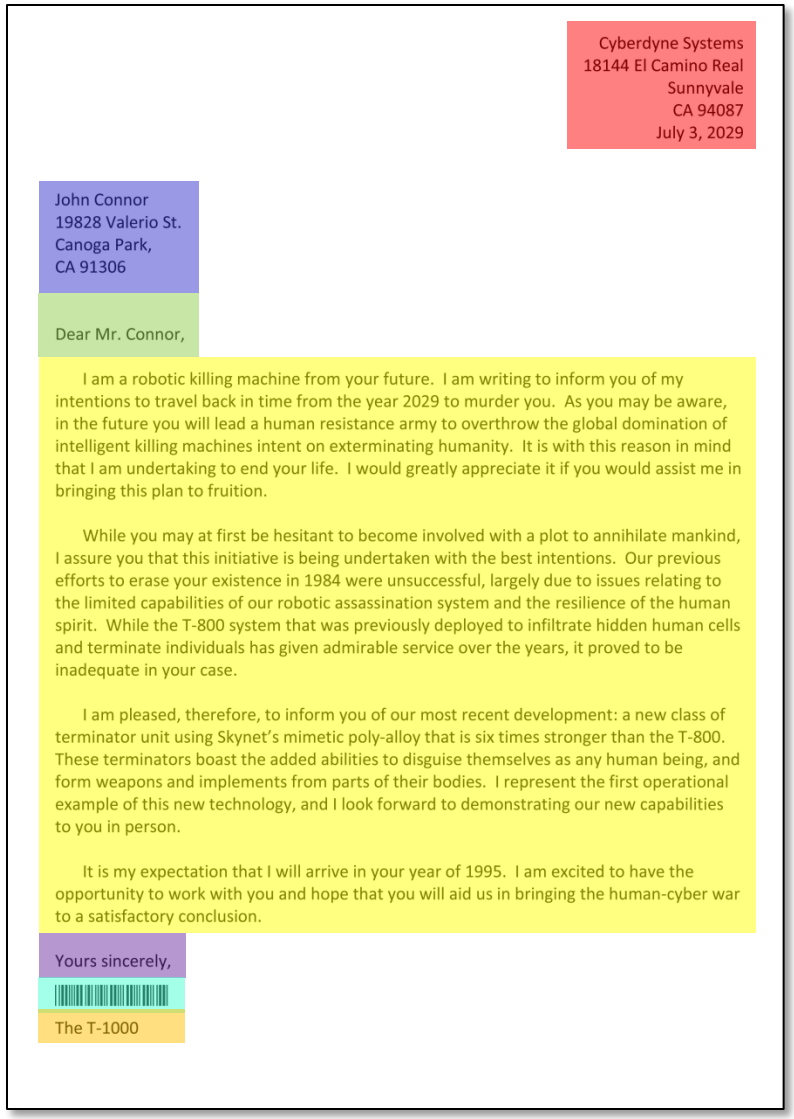

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Formal letter

Body format

- Introduction
- Statement of intent
- Letter matter
- Coda

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Yours sincerely,

Back to E-mail

- A professional e-mail is much the same, with a few minor differences:
  - No address blocks (e-addresses are implicit)
  - No signature: e-signature or signature graphic
- The salutation, valediction and letter matter are unchanged

E-mail language

- Two important things to remember
  - Formality of language varies with the audience
  - E-mails are directly linked with you, the writer
- Simply put, if you write someone an e-mail in informal, broken, poorly spelled English, they will think you are an idiot.

And they will be right.

E-mails tips

- Use salutations until you have had enough exchanges that the introduction is redundant
  - Never omit them for formal letters
- Do not use txt-speak (e.g. “How R U?”)
  - Short forms like “brb”, “afk” etc. are a grey area
- Using “haha” or “lol” sounds sarcastic/stupid
- Use smilies sparingly ;-)
  - Useful to break ice, but not for formal communiques
  - Also, just putting the word “smile” in text at the end of a line makes you sound super creepy… ಠ_ಠ

E-mails tips

- Top-post vs bottom-post: The Eternal Battle
  - Ie. should you add new comments above or below previously quoted content of a correspondence chain?
  - Little Endian vs Big Endian sort of debate; just use what works for you, unless asked otherwise
- If you put replies to quoted text in-line, state so clearly at the top of the email
- “Sent from my Dumbphone”

Meetings

Some brief words on meetings

Meetings

- Face to face communications is just as important and subtle as written reports
  - Arguably even more important!
- How you conduct yourself at a meeting can have a huge impact on your career progress
  - A strong impression can make you a rising star
  - A poor impression can sideline you

Tips for meetings

- Be on time
  - 15 minutes early is better than 1 minute late
- Be prepared
  - Know what you're going to be talking about, and read the relevant material *before* the meeting
  - A few preliminary calculations on a napkin at lunch can make you look like a *god-genius*
- Don't waste people's time
  - Meetings are expensive; stay focused on the goal

Tips for meetings

- Pay attention to common courtesies
  - Don’t interrupt, don’t raise your voice
  - If you’re in a support role, wait to be called on
  - Don’t hog ‘air time’ – leave gaps to interject
- Everyone in the room is important
  - That’s why they’re at the meeting, right?
  - Know who will be there ahead of time
  - Make eye-contact with everyone when speaking

Tips for meetings

- If appropriate, bring 10% extra handouts
  - Everyone will like you if you have spare pens!
- If you are presenting, check your A/V and laptop connection ahead of time
  - Backup copy on a USB stick (pdf and ppt)
  - If everything goes wrong, be capable of giving a verbal précis of your key points unaided

General interpersonal tips

- Look and act the part
  - Well-dressed, well-groomed, well-spoken
- Personal hygiene counts
  - Nobody wants to work with “the smelly guy”
- Get along with your co-workers
  - That person you absolutely can’t stand today may be your boss tomorrow

Zwischenspiel.

Presentations

Some brief words on presenting presentations

Presentations

- Presentations are a common and important way of formally communicating ideas

- Presentations at university primarily serve to give you effective practise at this
  - At uni, failure is an option (and relatively safe)
  - In Real Life™ there are consequences at stake

Presentations

- Communicate key concepts to the audience
- You will **never** have time to say everything
- It is critical to get your point across as clearly and persuasively as possible

Parts of a presentation

- Presentation has three key aspects:
  - Your delivery (how you speak)
  - Your spoken content (what you say)
  - Your visual aids (what they're looking at)

- Each is important in making an effective and persuasive performance.

Parts of a presentation

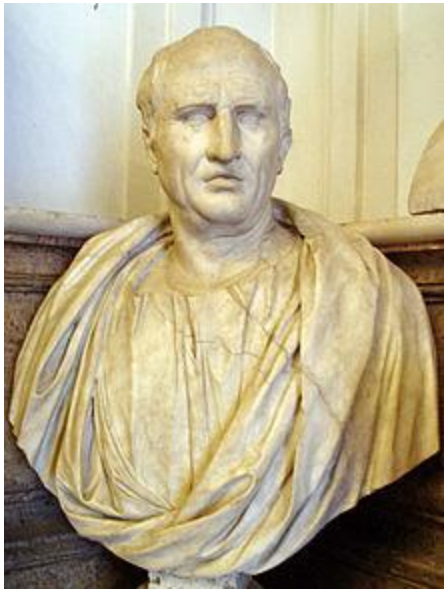
Delivery

Presentation as performance

- Presentations are a specialised form of stagecraft – oration with texts and pictures
  - You should prepare accordingly
- Practise and preparation
  - Drill correct diction and elocution
    - "The rain in Spain falls mainly on the plain"
  - Singing and vocal work are useful too
  - Stretch face-muscles and do voice exercises
  - Warm up immediately before presenting

Cicero knows his stuff

- *De Oratore* outlines the key aspects of a great orator
  - Combines knowledge and style
  - Master both rhetoric and reason
  - Convey distinctive bearing



Bust of Cicero
[Capitoline Museums]

- Technique, substance and passion
  - Care about your topic; craft your performance

Talk confidently

- Nobody knows your material as well as you
  - You are the master of your subject…
  - … or should at least act like it!
- Talk more slowly than normal
  - People associate a slow-speaking manner with depth and wisdom

Prepared scripts

- Prewritten scripts are hit and miss
  - If your memory is excellent and you practise beforehand, a well-written script has impact
  - But, if you fumble a script, you're left hanging!
- Better to prepare an outline of what you will say and memorise *that*, and then know your topic well enough to fill in the blanks
  - Be the master of your own topic

Use your own slides

- You design your own slides, so make them work for you!
  - Give cues to help remember what to say
  - If you get stuck, you can use them as a crutch
- But, don't just read the slide!
  - Add, expand, discuss or clarify what's written on the slide; add anecdotes and detail
  - Keep the audience interested!

Keep to time

- Budget 1 to 1.5 ‘content’ slides per minute
  - 15 minute seminar => 15 to 22 slides.
  - If it can’t all fit, simplify and remove content
- Practise beforehand – use friends for timing
- Skip forward to important parts if you are running out of time
  - Keep introductory material brief if possible

Appropriate language

- Just like formal writing – register matters!
- Avoid extraneous noise
  - ‘Like, yaknow, whatever’
  - Umm, uhhh…
- Avoid over-used/abused meaningless words
  - “Basically”, “Actually”, “Really”

The hard part

- Master your nerves
  - Always get a full night of sleep beforehand
  - Eat something sugary before hand
  - Practise so your slides don’t surprise you

Remember:

Everybody only pretends to know what they’re talking about; few actually do.

Parts of a presentation

Content

‘Key frames’

- What am I doing?
- Why is it important?
- Why should this be hard?
- What have other people done?
- What is our approach?
- How well did it work?
- Key things we learned
- What does this mean?

Stick to the point

- Structure the presentation to communicate the main points – logically order concepts

- Focus on getting your idea across:
  - Eliminate all clutter and distractions
  - Mathematics only when appropriate
  - Use animation sparingly
  - Slide transitions are the work of the devil

BIG-small

Reinforce important concepts

Make them the things the audience remembers

Exploit slide design

- Don’t clutter slides – 3 to 4 bullet points at most
  - Use hierarchical subtext to expand on points
- Bold and italics provide meta-commentary
- Remember, slides are free
  - Don’t be afraid to put titles, images and key ideas on their own slides to reduce clutter

Don't forget details

- Correct speling – *everyone* will notice
- Space is precious
  - Don't waste space with elaborate boarder trim
- Control the distance between dot points
- Use page numbers for the audience to refer to

Watch for 'widow-lines'

Parts of a presentation

Visual aids

Visual aids

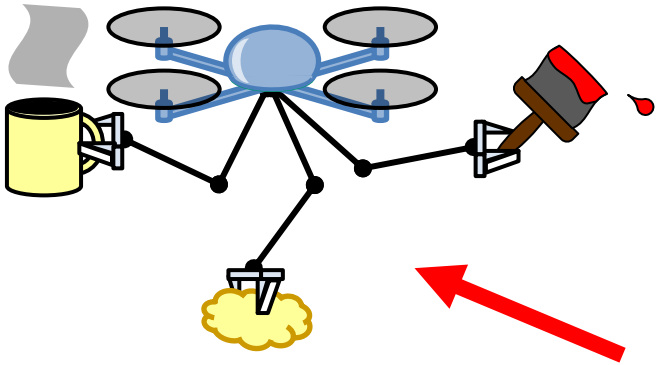
- As you speak, most people focus entirely on the mind-numbing glowing pictures up front
  - Great – reduces the harrowing focus on you!
  - Less great – they will give it *complete* attention

Good visual aids get your point across clearly – bad slides get in the way, or distract

Anatomy of a title slide

A Simple Guide to Effective Presentations

A brief to-the-point title



Catchy topical image

Who you are

Dr Paul Pounds

Date and venue are surprisingly important!

31 April 2012

University of Queensland

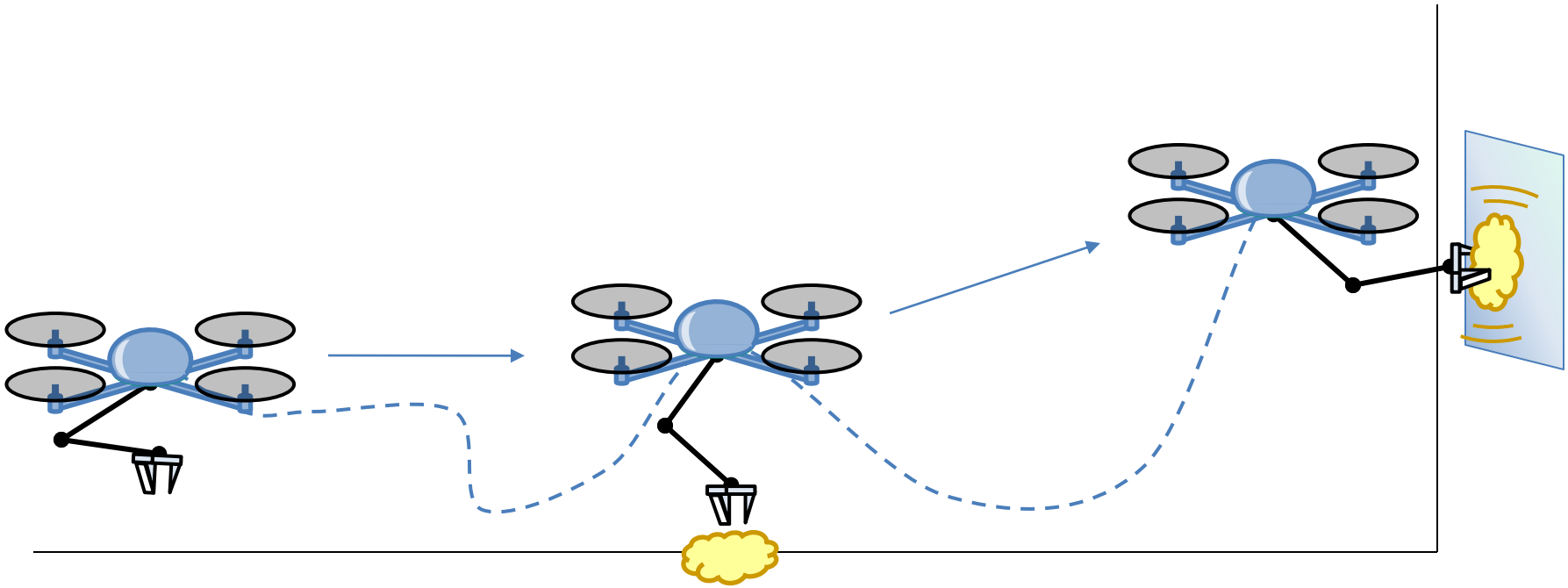
Images are golden

- A good image helps the audience focus and explains things without many words
- Large images top/bottom; small images to the side
- Always credit your images, where appropriate

RQ-4 Global Hawk [Northrop Grumman]

MQ-8 Firescout [Northrop Grumman]

A great image can fill the page



This gets the audience's undivided attention

Video

- Video is both distracting and absorbing
- Works best in two places:
  1. The beginning as an “OMG! Awesome!” teaser
  2. The end as a “Behold our mighty works!” result
- Be careful:
  - Use high quality video files
  - Use portable formats and codecs
  - Test they work on the target system if you can

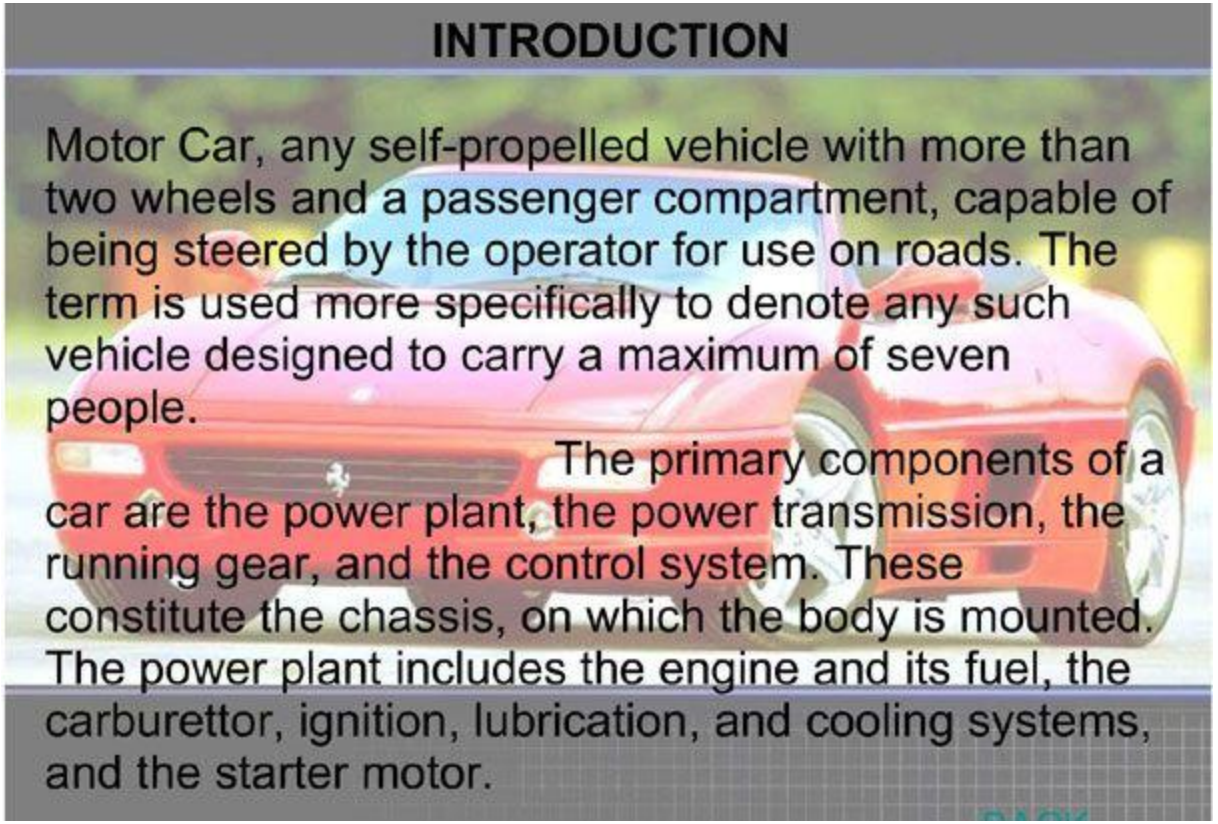
Here are some terrible slides

- The internet is awash with terrible terrible PowerPoint slides
  - Learn from their dire warnings
- Do not make your slides look anything like the following…

Terrible PowerPoint

Weird paragraph break?

So much text!



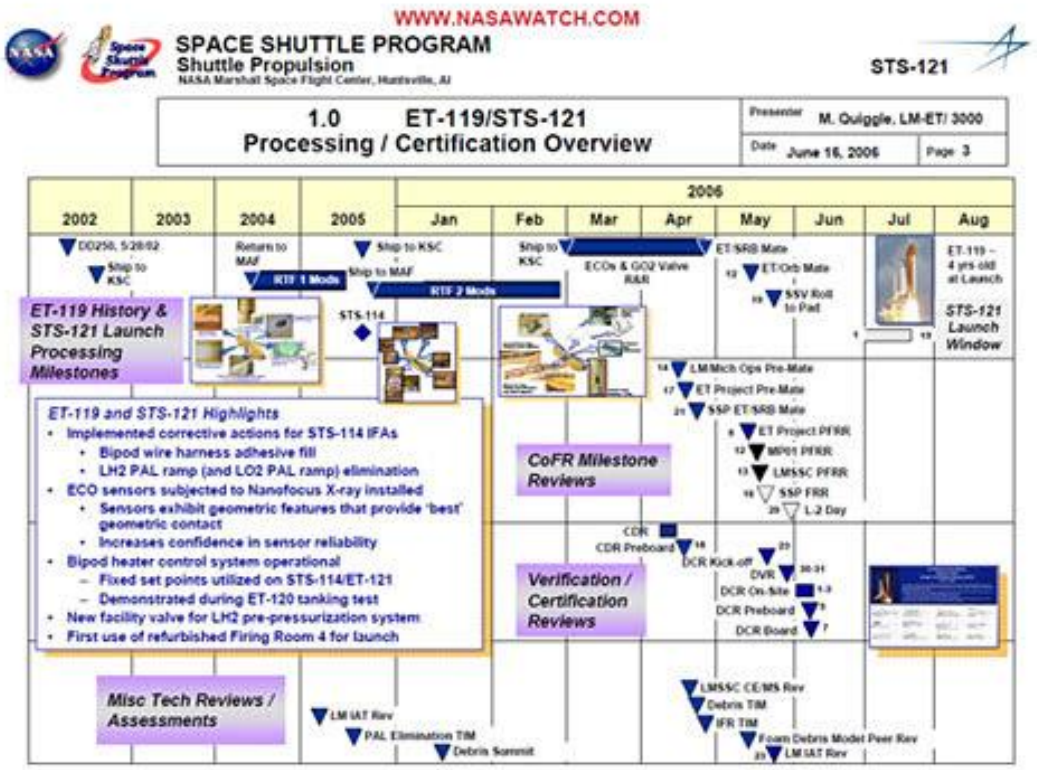
Can't read over background!

From PC World "The World's Worst PowerPoint Presentations"

Terrible PowerPoint

What the I don't even?

Tiny graphics are impossible to see or read

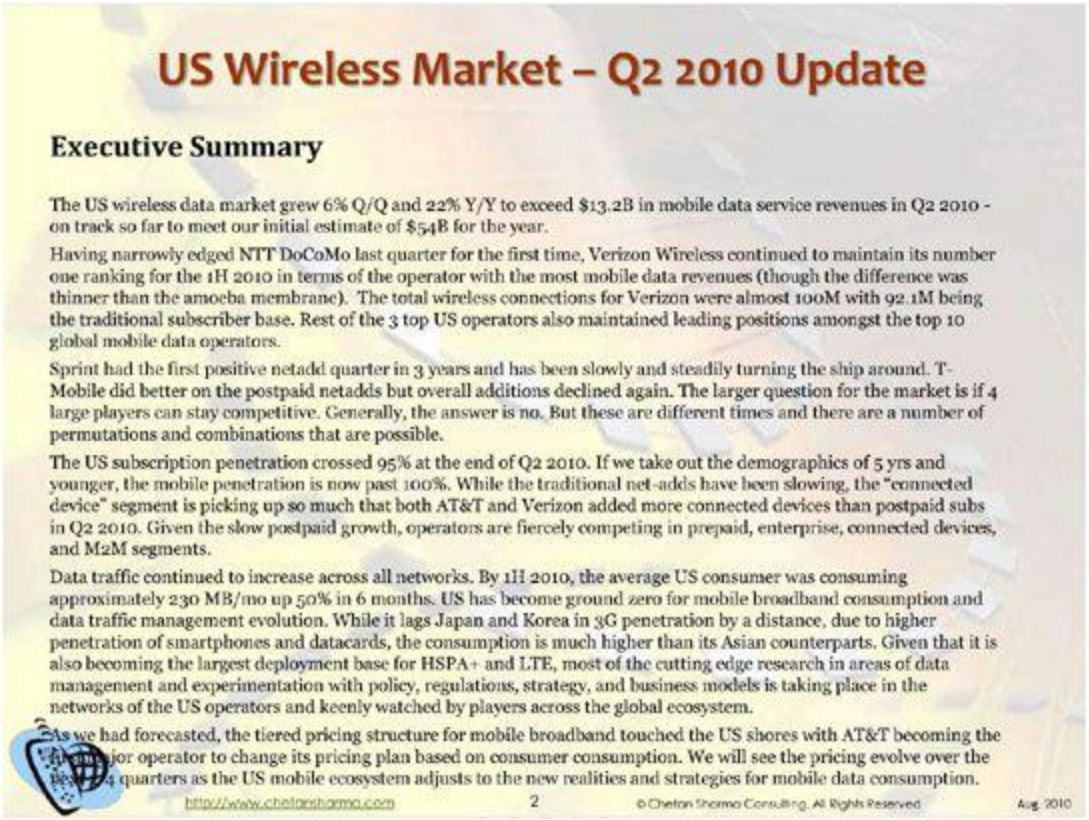


What does it mean?

From CIO.com "8 PowerPoint Train Wrecks"

Terrible PowerPoint

"Summary" does not mean what you think it means



US Wireless Market – Q2 2010 Update

Executive Summary

The US wireless data market grew 6% Q/Q and 22% Y/Y to exceed $13.2B in mobile data service revenues in Q2 2010 - on track so far to meet our initial estimate of $54B for the year.

Having narrowly edged NTT DoCoMo last quarter for the first time, Verizon Wireless continued to maintain its number one ranking for the 1H 2010 in terms of the operator with the most mobile data revenues (though the difference was thinner than the amoeba membrane). The total wireless connections for Verizon were almost 100M with 92.1M being the traditional subscriber base. Rest of the 3 top US operators also maintained leading positions amongst the top 10 global mobile data operators.

Sprint had the first positive netadd quarter in 3 years and has been slowly and steadily turning the ship around. T-Mobile did better on the postpaid netadds but overall additions declined again. The larger question for the market is if 4 large players can stay competitive. Generally, the answer is no. But these are different times and there are a number of permutations and combinations that are possible.

The US subscription penetration crossed 95% at the end of Q2 2010. If we take out the demographics of 5 yrs and younger, the mobile penetration is now past 100%. While the traditional net-adds have been slowing, the "connected device" segment is picking up so much that both AT&T and Verizon added more connected devices than postpaid subs in Q2 2010. Given the slow postpaid growth, operators are fiercely competing in prepaid, enterprise, connected devices, and M2M segments.

Data traffic continued to increase across all networks. By 1H 2010, the average US consumer was consuming approximately 230 MB/mo up 50% in 6 months. US has become ground zero for mobile broadband consumption and data traffic management evolution. While it lags Japan and Korea in 3G penetration by a distance, due to higher penetration of smartphones and datacards, the consumption is much higher than its Asian counterparts. Given that it is also becoming the largest deployment base for HSPA+ and LTE, most of the cutting edge research in areas of data management and experimentation with policy, regulations, strategy, and business models is taking place in the networks of the US operators and keenly watched by players across the global ecosystem.

As we had forecasted, the tiered pricing structure for mobile broadband touched the US shores with AT&T becoming the [illegible]jor operator to change its pricing plan based on consumer consumption. We will see the pricing evolve over the [illegible]4 quarters as the US mobile ecosystem adjusts to the new realities and strategies for mobile data consumption.

http://www.chetansharma.com 2 © Chetan Sharma Consulting. All Rights Reserved Aug. 2010

Text overlaps logo

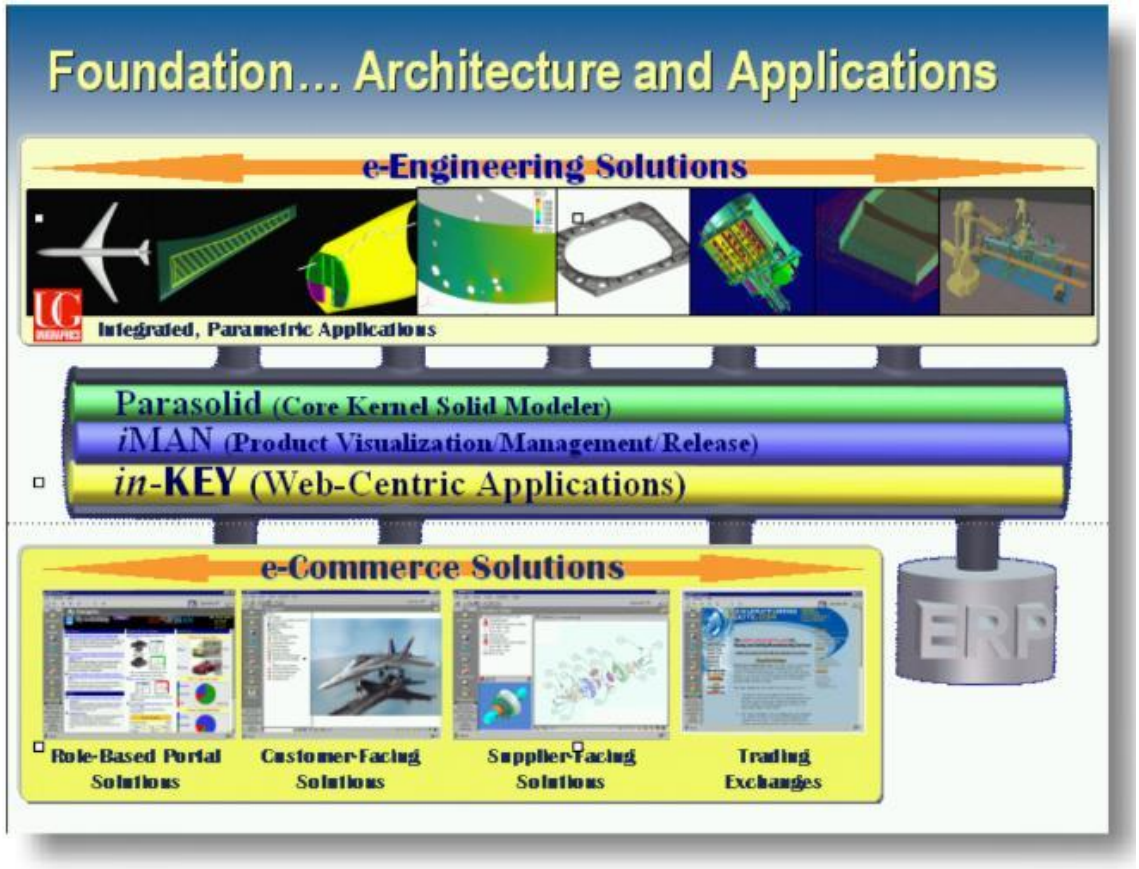
Nobody will get even halfway before you change slides

From PC World "The World's Worst PowerPoint Presentations"

Terrible PowerPoint

So cluttered!

How do these elements relate to each other??



Samgrantdesign: "How to Suck at PowerPoint"

Terrible PowerPoint

So jumbled!

WTF does it mean??

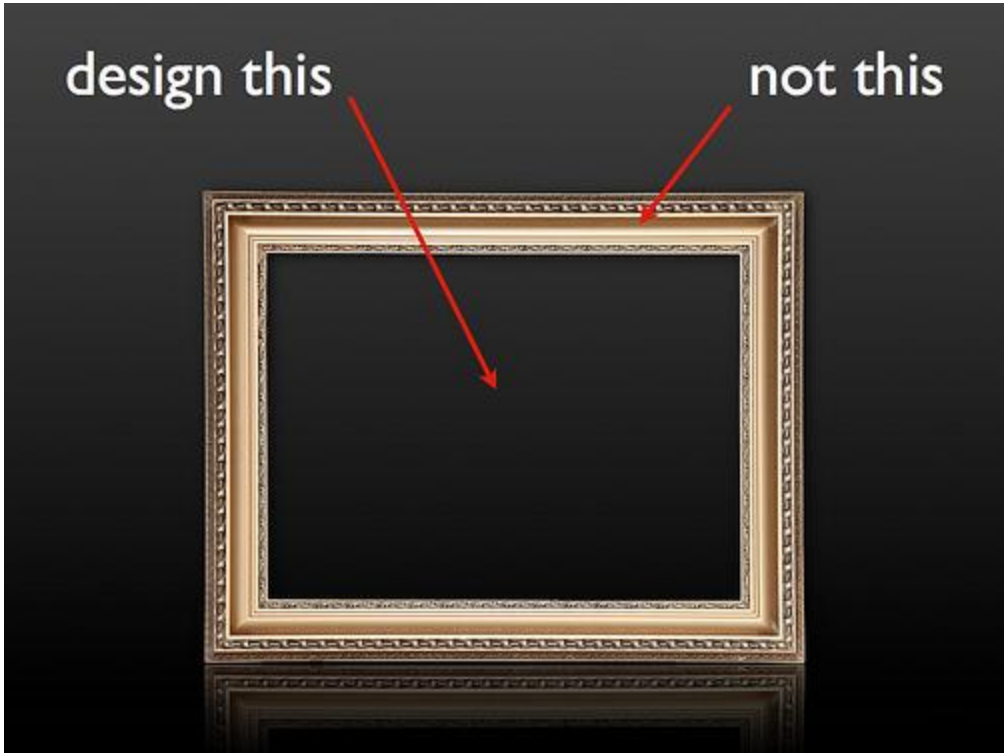
Break this up into three simpler slides?

From PC World "The World's Worst PowerPoint Presentations"

Common threads

- Cluttered
- Overly busy with pointless fancy graphics
- Difficult to follow logical flow
- Far, far too much text
- Distracting background images
- Too much on every slide

To summarise

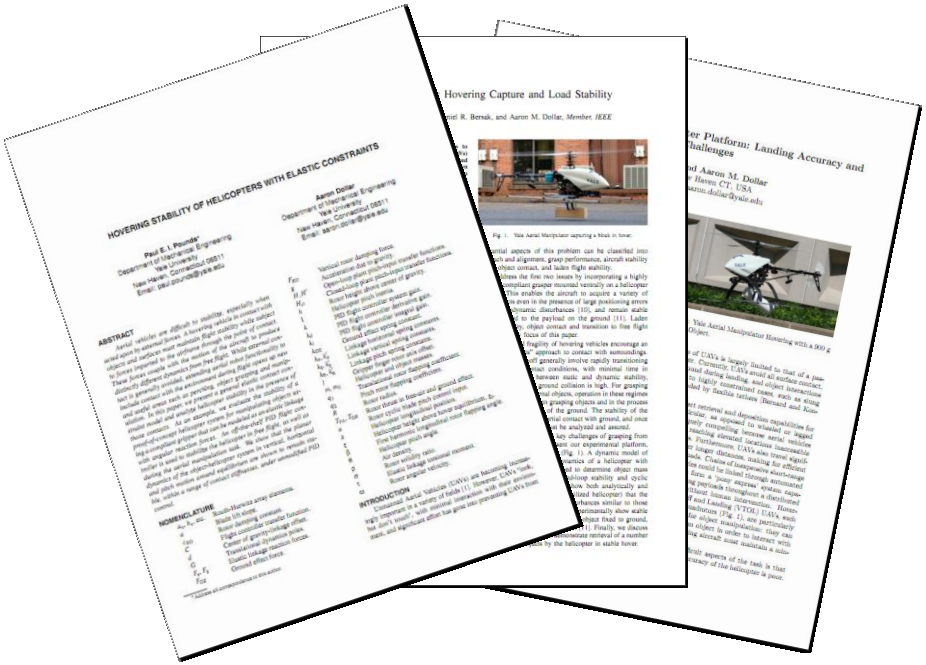


[credit: Nolan Haims]

Scientific writing

Some brief words on scientific writing

A Field Guide to Scientific Writing



Dr. Paul Pounds

20110525

What is scientific writing?

- Scientific writing is the formal language and style used in technical notes, conference proceedings and journal papers.

- Why do you care?
  - Scientific writing is a crucial skill for academics and scientists.
  - Scholarly publications report research findings to peers and society.
  - Papers are your contribution to the permanent scientific record.

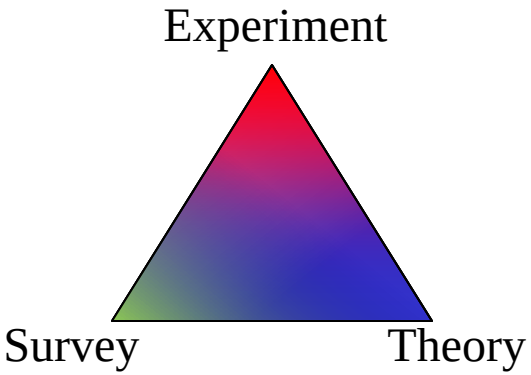
  But most importantly,
  - Your publications are *the* criterion by which your performance as an academic and professional scientist is assessed.

Part I: The Structure of Papers

Taxa of scientific papers

- There are different species of paper:

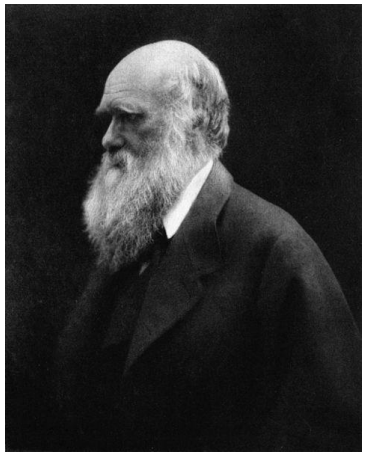
1. Theory papers
   - Math, math, more math.
2. Experimental papers
   - Hardware, experiment, results.
3. Survey papers
   - Exhaustive report of other people's work in the area.



All comprise the same parts, just in different proportions.

Anatomy of a paper

- All (good) papers have the following parts:
  - Abstract
  - Introduction
  - Body
  - Results
  - Discussion
  - Conclusion



Darwin: Also wrote papers

- Sometimes they are difficult to recognise.

(But they are always there)

The abstract

- Arguably the most important part of the paper
  - Also the hardest part to write!
  - Tells readers whether they want to read the whole paper.
  - Most people who see your paper will get no further than the abstract.

- What, why and key results
  - Outline key background and contributions (claims).
  - 2-3 paragraphs at most.
  - This is not a shopping list of things in the paper!

The abstract

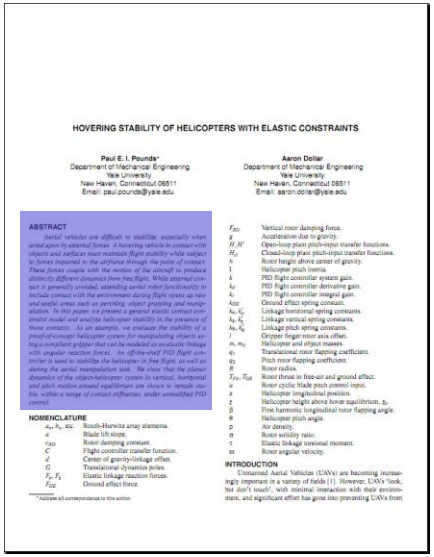
ABSTRACT

Aerial vehicles are difficult to stabilize, especially when acted upon by external forces. A hovering vehicle in contact with objects and surfaces must maintain flight stability while subject to forces imparted to the airframe through the point of contact. These forces couple with the motion of the aircraft to produce distinctly different dynamics from free flight. While external contact is generally avoided, extending aerial robot functionality to include contact with the environment during flight opens up new and useful areas such as perching, object grasping and manipulation. In this paper, we present a general elastic contact constraint model and analyze helicopter stability in the presence of those contacts. As an example, we evaluate the stability of a proof-of-concept helicopter system for manipulating objects using a compliant gripper that can be modeled as an elastic linkage with angular reaction forces. An off-the-shelf PID flight controller is used to stabilize the helicopter in free flight, as well as during the aerial manipulation task. We show that the planar dynamics of the object-helicopter system in vertical, horizontal and pitch motion around equilibrium remain stable, within a range of contact stiffnesses, under unmodified PID control.

What

Why

Claims



HOVERING STABILITY OF HELICOPTERS WITH ELASTIC CONSTRAINTS

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Aaron Dollar Department of Mechanical Engineering Yale University New Haven, Connecticut 06511 Email: aaron.dollar@yale.edu

ABSTRACT

NOMENCLATURE

INTRODUCTION

The introduction

- This is the most structured section of a paper.
- Every introduction contains:
  - Background
  - Literature review
  - Roadmap
- Sometimes they are difficult to recognise.

(but they are always there)

The introduction

- **Background**
  - Why the work is timely and important.

Unmanned Aerial Vehicles (UAVs) have rapidly evolved into capable mobility platforms able to maneuver, navigate and survey proficiently. A natural progression is to advance beyond simple motion and observation to interaction with objects and the fixed environment.

Grasping From the Air: Hovering Capture and Load Stability

Paul E. I. Pounds, *Member, IEEE*, Daniel R. Bersak, and Aaron M. Dollar, *Member, IEEE*

The introduction

- **Background**
  - Why the work is timely and important.
- **Literature review**
  - ‘Due diligence’ for previous work in the area.
  - Sprinkle with citations, liberally.

Several limited examples of flying vehicles physically interacting with objects have been demonstrated, such as in-flight refueling [1], [2] and the transport of slung loads, both individually and cooperatively [3], [4], [5], [6]. In these examples the interacting object is either not acquired automatically (such as a load attached by a human operator on the ground) or highly structured (e.g. refueling booms with optical markers).

Grasping From the Air: Hovering Capture and Load Stability

Paul E. I. Pounds, *Member, IEEE*, Daniel R. Bersak, and Aaron M. Dollar, *Member, IEEE*

The introduction

- **Background**
  - Why the work is timely and important.
- **Literature review**
  - ‘Due diligence’ for previous work in the area
  - Sprinkle with citations, liberally.
- **Roadmap**
  - Signposts where this paper is going.
  - This is an explicit statement of your claims.
  - Use the *pro forma* “In this paper, we…”

In this paper, we discuss key challenges of grasping from a hovering vehicle and present our experimental platform, the Yale Aerial Manipulator (Fig. 1). A dynamic model of the longitudinal and pitch dynamics of a helicopter with a PID attitude controller is used to determine object mass and placement limits for closed-loop stability and cyclic control saturation bounds. We show both analytically and experimentally (using a PID-stabilized helicopter) that the

Grasping From the Air: Hovering Capture and Load Stability

Paul E. I. Pounds, *Member, IEEE*, Daniel R. Bersak, and Aaron M. Dollar, *Member, IEEE*

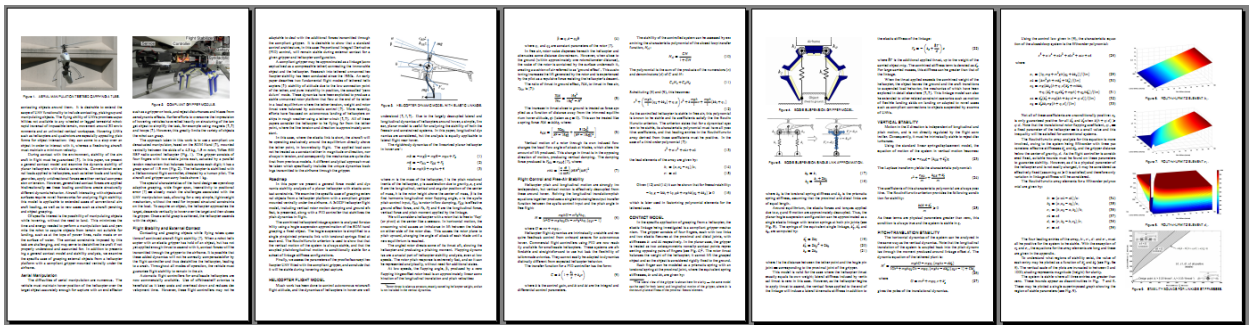
The introduction

- Variations include:
  - Introductory subsections for key information or ideas that will be relied upon later, e.g. “1.1 Flight Hardware”
  - Extrapolation of background and literature review parts into entire sections of the paper (ie. a survey paper).
  - Explicit table of contents in lieu of a roadmap (very large journal papers only).

- But, in general, do not vary from the template!

The body

- This is where the substance of the paper is found.
  - Each section builds up the logical chain of reasoning leading to the conclusion.
  - The body follows the course outlined in the roadmap.
  - Stay focused and to the point – tangents are the enemy.



- Almost always the easiest bit of the paper to write.

The body

- Structure of the body varies from paper to paper.
  - No hard and fast rules, but each section should compartmentalise the key ideas being discussed e.g.:

    2. The Underlying Theory
    3. An Intermediate Result
    4. My Cool Idea Building on that Result

    Rather than:

    2. My Idea is Good
    3. An Unrelated Aside
    4. Random Theory Goes Here

The results

- Results presents the tangible evidence that what you have said in the body is actually true.
  - Use the classic high school ‘lab report’ structure:
    1. Apparatus, 2. Method, 3. Data.
  - Data are expected in graph or table formats.
  - Simulations (and sometimes proofs) can also go here if appropriate.

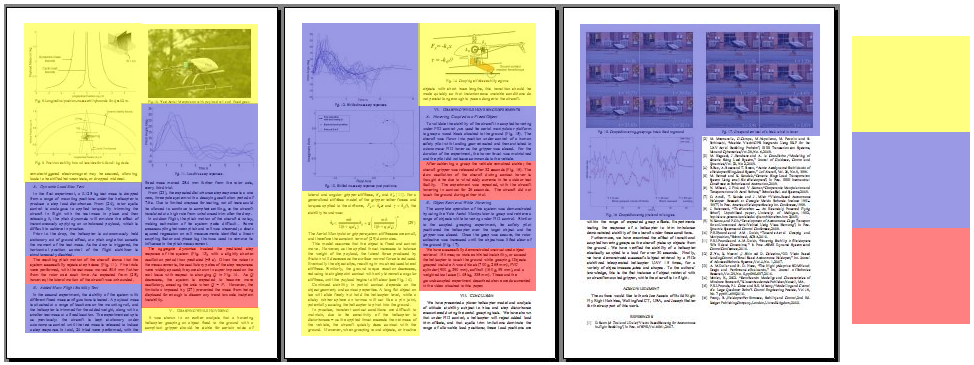
The discussion

- Discussion is analysis of the results, after-the-fact
  - Consider implications of the results with respect to the preceding analysis.
  - Identify potential sources of error.

- The discussion is the logical bridge from the results to the conclusion.
  - No new information is introduced in the discussion – its role is to make sense of what has gone before.

The discussion

- Results and their discussion are tightly bound, and often blend together. That's ok!
  - Depending on need, there can be numerous discrete analysis-experiment-discussion sets within a paper.



Analysis

Experiment

Discussion

The conclusion

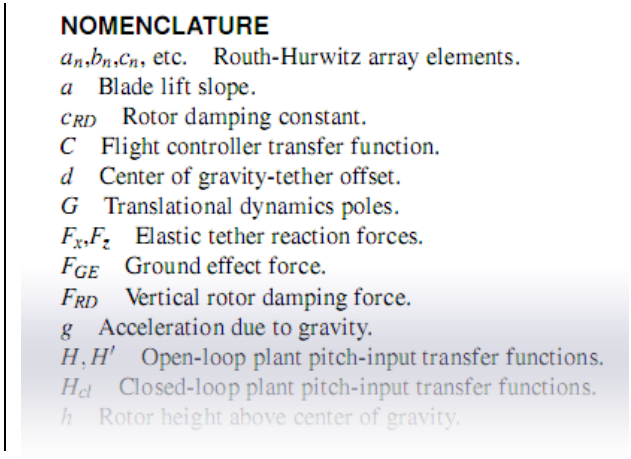
- Bring the paper to a close
  - Briefly describe the activities reported in the paper.
  - Highlight key findings, specific results and ideas – use numbers.
  - Keep it high-level; this is not just a summary of everything you did.

7 Conclusion

We have demonstrated a helicopter UAV-gripper system capable of reliably grasping and retrieving objects under human control. This system exploits the unique performance capabilities of an underactuated, compliant gripper to directly address the particular challenges of helicopter imprecision. The helicopter system was found to exhibit a mean landing error of 64 mm with a standard deviation of 55 mm. The system was able to grasp a variety of objects including blocks, balls, bottles and cylinders, ranging from 160 g to 900 g. The most difficult object could be grasped 67 percent of the time, and the easiest object 100 percent of the time. Load bias disturbances of 0.8 Nm applied to the airframe by the payload were rejected by the flight controller around hover.

Other sections you may see

- Nomenclature
  - Takes up significant space.
  - Sometimes the only way to control variable overload.
- Appendices
  - A place for anything too unwieldy to go in the middle of the paper
  - Use sparingly! "Unwieldy" is often a good indication that there is a better way of presenting the material.



NOMENCLATURE

a_n, b_n, c_n, etc. Routh-Hurwitz array elements.
a Blade lift slope.
c_{RD} Rotor damping constant.
C Flight controller transfer function.
d Center of gravity-tether offset.
G Translational dynamics poles.
F_x, F_z Elastic tether reaction forces.
F_{GE} Ground effect force.
F_{RD} Vertical rotor damping force.
g Acceleration due to gravity.
H, H' Open-loop plant pitch-input transfer functions.
H_{cl} Closed-loop plant pitch-input transfer functions.
h Rotor height above center of gravity.

Remember

- Each section is a link in a logical chain
  - Introduction lays the background
  - Body analysis sets out your argument
  - Results validates your argument
  - Discussion reasons about your results
  - Conclusion states your final conclusions

If any text does not serve this purpose, *kill it*.

Part II: Style and Prose

On titles

- Good titles are crucial
  - This is how people will search and index your paper!
  - Titles are the first checkpoint for deciding whether to read the paper or not
- Use common search keywords in your title
  - E.g. "Stability of UAVs Grasping Objects" *rather than* "Flying Vehicles Engaging with Targets of Interest".
- The title should not overstate the content of the paper
  - E.g. "(Towards/Methods for/Principles of) Grasping with UAVs" *rather than just* "Grasping with UAVs"

On citations

- Citations set scholarly work apart from any other sort of writing.
- Aside from giving credit where due, citations also:
  - Provide context for where your research fits with the work of others.
  - Convince people you've done your homework.
  - Provide new resources to the reader, and allow for cross-pollination.
- Cite the papers that support your argument; not just the 'popular' papers in your area.

On figures

- A picture speaks 1000 words; make sure those words are meaningful.
- Every figure must be referenced in the text; pretty pictures ‘just cus’ detract from the paper.
- Avoid CAD model hell – no one is impressed.

- For better or for worse, your papers *will* be judged by the quality of their graphics!

On tone and style

- Scientific writing is formal prose.
  - *Strict* English spelling and grammar.
  - Eliminate contractions, idiomatic expressions.
  - Very high reading levels; PhD vocabularies.
  - Extreme attention to typos and formatting.
- Papers have a style distinct from textbooks.
  - Textbooks are pedagogical and expositionary.
  - Papers are terse and to-the-point – maximum density!
  - “Omit unnecessary words”.

On narrative voice

- First person or third person narrative voice?
  - Rule of thumb:

    When making claims use first person (e.g. roadmap).

    “In this paper, we grasped objects with helicopters.”

    Everywhere else, use third person passive*.

    “Helicopters were used to grasp objects.”

*Use of passive voice is open to debate.

On persuasive writing

- Your goal as an author is to convince the reader.
  - Every section should work to get your point across.
  - The chain of logic must be unbroken beginning to end.
- Seduce the reader with careful writing.
  - Give each paragraphs internal structure and direction: Topic sentence, Supporting statements, Conclusion.
  - Use ‘waterslide clauses’ where one idea flows from the next: e.g. “Ground effect acts as stiffness in a second-order system; the natural vertical dynamics are stable.”

Golden rule

The best way to learn to write good papers is to read lots of good papers

Conclusion

- There is more to being a professional engineer than just driving Matlab well
- You need to communicate effectively, network adeptly, and write convincingly
- Do all these things competently, with good technical skills, and you will have success

Questions

?

Paul's Time

Tune-in next time for…

Introduction to Practical PCB Design

or

"Shadow of the Colossus"

Fun fact: You are twice as likely to be killed by a vending machine as by a shark.