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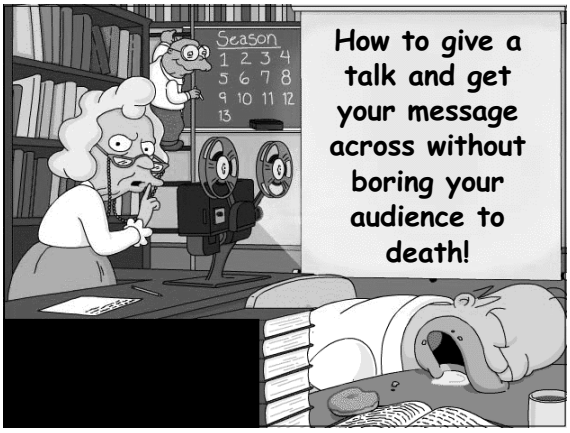


Outline

- Thinking about the audience
- What is your message?
- Building your structure
- Spoken vs. written reports
- Working with slides
- Choosing the right figures
- Preparing for performance

What's good communication?

- Expressing your ideas so that the other person understands.
- Explaining the concepts the other person needs to know.
- Preparing your thoughts and ideas well and expressing them clearly and concisely.
- Respecting your audience.

What's bad communication?

- Expressing ideas to make yourself look clever and your listener/reader feel stupid.
- Dwelling on irrelevant technical details.
- Wasting other people's time because you don't know what you want to say.

How do we implement these ideas?

Think about:

Message	***Medium***
Audience	Style
Content	Grammar
Level	Punctuation
Structure	Figures
Jargon	References

What about the audience?

- Who are they?
- What is their technical level?
- What is their technical background?
- What do they want to get out of your report?

If you don't ask these questions, you won't be able to prepare appropriately: you will be wasting your time and that of your listeners or readers. This will rightly be resented!

Level

- Do they understand why your topic is important?
- Do they understand the basics of the subject?

If not, explain!

Simplify and prioritise technical material: concentrate on what is most important, not the most impressive sounding! The point is to communicate, not look clever.

What is jargon?

Words that mean something specific in a given field, but when explained are not difficult to understand:

VCSEL:
Vertical Cavity Surface Emitting Laser

Neuromorphic:
Structured in a brainlike way

Correlator:
FT-based pattern matching system

Explain every word the audience doesn't know… and refresh their memory if appropriate.

Example of acronym ambiguity!

Just one example of an acronym (PCI) having many legitimate meanings in similar fields:

- Panel Call Indicator
- Peripheral Component Interconnect
- Peripheral Connection Interface
- Programmable Controller Interface
- Protocol Control Information

What's your message?

What are you trying to do?
- Persuade
- Educate
- Entertain

Get the audience from where they are to where you want them to be.

What point are you trying to make about the subject?
- Importance
- How it works
- Problems

You must decide and build your case.

Different audiences, different things to say

Potential investors for your start-up:
- Why your technology rocks.
- Why it will make money.
- Who your competitors are.
- *Why your company's best.*

Colleagues in your project team:
- Problems with your sub-system.
- What help you need.
- How this affects the schedule.
- *You're doing your job...*

How do you sell your message?

Explain the status quo

- What is the big idea/application?
- How do things work now?
- Why is this not ideal?
  - Too expensive
  - Too complicated
  - To big, slow, heavy
- What problems would have to be solved in order to push past this point.

Competing solutions?

Presumably there are lots of ways that people are trying to solve these problems:

- What are these solutions?
- What are their advantages and disadvantages?
- Are there particular application niches they can never satisfy?

Your new solution

- How does it work?
- How does it avoid the pitfalls of the others?
- Has it been proven to work in practise?
- How good were the results?
- What obstacles are there to its adoption in real systems?

Structure

Be methodical:

- *Tell them what you're going to tell them.*
- *Tell them.*
- *Tell them what you told them.*

This is true for both written and spoken presentations.

Example Structure Part 1

"Why my work is cool"

Intro: This is what I've done and this is what it might lead to in the future.

Section1: This is why the field is really important.

Section 2: People have had this problem in the past...

Example Structure Part 2

Section 3: Then came our cool new idea on how to fix it.

Section 4: We designed the new system like this,...

Section 5: ...then we built it,...

Section 6: ...then we tested it,...

Section 7: ...and this is how it performed in the end.

Example Structure Part 3

Section 8: We did have some problems with it,...

Section 9: ...but we have various ideas about fixing them.

Conclusion: Our ideas are cool, we're working on solving our problems, and the technology has potential in a crucial area.

Content dos

What should you include?

- Info that moves the argument along.
- Data that illustrates your point.
- Details that will help make the system, device, or phenomenon real to your audience.
- Follow-up info (reference/URL).

And start by choosing a topic that you can explain to your audience!

Content don'ts

What should you *not* include?

- Interesting but irrelevant tangents to your main argument.
- Data that just shows you worked with/looked at lots of data.
- Details that just show you have picked up a lot of jargon.
- Opinions you cannot back up.

Be ruthless!

Only use information that is really relevant to your message and structure. If it's not, save it for later. The point is not to tell everything you know, but to get your point across: use every word efficiently!

Medium: Written word

Advantages:

- Audience can go at own pace (look up things, re-read).
- Writer can go at own pace, make things perfect.
- *Permanent.*

Disadvantages:

- No feedback if audience is lost.
- No chance to convince if given argument doesn't suit that audience.
- *Permanent.*

Medium: Spoken word

Advantages:

- Verbal feedback improves ideas.
- Audience confusion clear.
- *Permanent (?) impression, ephemeral information.*

Disadvantages:

- Requires performance.
- Many factors outside control of speaker.
- *But impression left may be permanent.*

How do I write my talk?

Really confident?

- Research!
- Sketch out talk.
- Make cards with bullet points or draft slides.
- Go over several times to refine.
- Revise slides.

Not so confident?

- Write out as a speech.
- Make logical, clear, perfect.
- Practise, does it read easily?
- Reduce to bullets?

How many slides?

Count on roughly:

- 1-2 min for each written slide
- 3-5 min for each figure slide.
- 30s for your introductory slide (with your name and talk title)

But make sure you time your talk so you know exactly how much you need/how long it takes.

Designing visuals

Always go for:

- Simplicity
- Legibility
- Elegance

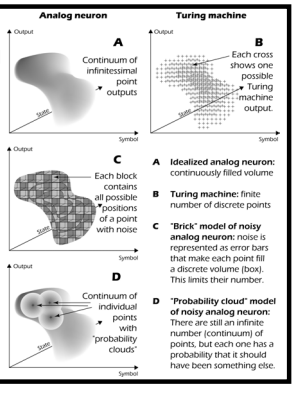
Everything should be essential. Ask yourself: what's the point of this element?

- Avoid complex lines or patterns
- Name and date not necessary on every page
- No "peek-a-boo" on OHP slide
- Point size no less than 24!

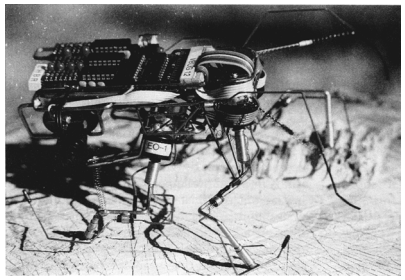
Figures

- Don't make them too complex.
- Make sure they illustrate a point that you will explicitly discuss.
- Show only when relevant.
- Make sure the writing is big enough to read at a glance.
- Make sure the figure is robust enough to look good whatever...

Scenarios for analog versus digital precision



Bad figure: too much writing, too much going on, too complicated!



Tilden/Hasslacher *Lobster.* Made from 68 transistors, it learns to walk in just 3 seconds.

Good figure: cool, uncluttered, lots to talk about, and makes the subject more real for the audience.

Spoken style

- **Keep your sentences short, less formal than you would write.**
- **Avoid clichés and filler phrases such as "like" and "you know."**
- **Don't be too informal or jocular: you may not be taken seriously.**
- **Get to the point quickly, and indicate where you'll go next.**

Giving a performance

You must have strategies to make sure that you are:

- **Being heard: Ask someone in the audience to give you a sign if you become inaudible.**
- **Being clear: Look at faces to see if people understand you.**
- **Relaxed, pleasant, convincing.**

Worried about English?

Don't worry about being perfect, people will understand. If you want to write it out as a speech:

- **Practise many times to make it sound natural.**
- **Make the voice move up and down, emphasise right words.**
- **Remember what you're saying.**

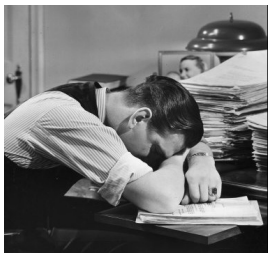
Attitude

- If you are an ignorant know-it-all (bluffing about stuff you don't understand) people will catch you out. Be modest and honest.
- Just because people don't know things elementary to your field doesn't make them stupid.
- If your audience doesn't get it, its your fault, not theirs!

What you should know

- **How to pitch your report to the audience's level**
- **How to plan your message**
- **How to build structure and explanation**
- **How to prepare your presentation and slides**
- **How to get ready to perform**

Technical Communication II



How to write without boring, confusing or infuriating your reader.

Outline

- How to consider basic structure and argument flow.
- Style and voice.
- The paragraph's importance.
- Keeping things short.
- Avoiding repetition.
- Formatting, figures and other niceties.

Resources

- *The Economist Style Guide:* Worth buying the print edition, though it is available online

http://www.economist.com/research/StyleGuide/

- *The Elements of Style*, by William Strunk and E.B. White.
- Adobe's typography tips:

http://www.adobe.com/type/topics/

The right structure for the material?

- Start with the big picture: what are you trying to say?
- What is the logical argument that leads you to this conclusion?
- Which facts must you present to prove your argument?
- What must they know first?

Argument flow

- Prime your reader.
- Start from the lowest level of knowledge and build up.
- Introduce new concepts when needed, and in the order necessary for understanding.
- Know where you're going.
- Get there and stop.

Hierarchy of structure

You will need to make structural decisions at every level:

- Does the overall report structure make sense?
- Does the structure of each sub-section make sense?
- Are individual paragraphs and sentences in a logical order?

Writing with style

What defines style?

- Voice
  - Active or passive?
  - First, second, or third person?
  - Formal, witty or jocular?
- Vocabulary
  - Using jargon or not?
- Figures of speech
  - Metaphors, analogies, etc.

Voice

Use the active voice wherever possible: it generally makes statements stronger.

- Active: ***"Imperial College engineers invented the system"***
- Passive: ***"The system was invented by Imperial College engineers."***

Which person?

- For formal documents (newsletters, proposals, papers), the first person (I or we) should be used.
- Telling someone how to do stuff? Use the second person. "You turn it on, then…"
- Some people use the third person, "The IIS Group did this…," for journal papers. Use only if necessary: this should be reserved for documents that are not supposed to look like they were written by you (like press releases or web blurbs)!

Time and tense

- Pay attention to tense and keep it consistent throughout the article.
- Generally, use the perfect tense ("we did this, we did that") for the body of technical reports.
- May use present tense ("things are like this, we are doing that") for the introduction, conclusion, or ongoing statements ("our interests are…").
- Imperfect/pluperfect ("we were doing/ we had done" are for previous work.

Grammar and punctuation

- Impossible to give a full briefing on these subjects: go brush up!
- Bear in mind that weakness in this area can lead to:
  - ambiguity at best, or, at worst
  - complete miscommunication.
- Journals no longer sub-edit!

Paragraphs: the basic units of your argument

- One topic/idea to a paragraph.
- Paragraphs should usually be 50-150 words long.
- Each paragraph should be:
  - Internally logical
  - Logically connected to those leading and following it
  - Somewhat independent

Clothes-line metaphor

Clothes-line metaphor

- The introduction and conclusion are the poles.
- The garments are steps in the argument (the paragraphs).
- Clothes-pegs represent:
  - Topic sentences, which introduce the new paragraph;
  - Final sentences, leading into the next paragraph…

Topic sentence tests

- By skimming through the first sentences of each paragraph *only,* you should be able to get the gist of the whole argument.
- Every sentence should have some logical connection with the topic sentence.

Breaking ideas down

- The longer a paragraph is, the less well-defined the steps in the argument. ***If you need more than 150 words to explain something, it must be complex: break it down into two or more ideas.***
- The longer a sentence is, the greater the number of concepts you are expecting the reader to swallow in one gulp. Keep it to 40 words or less!
- Difficulties following these rules can show up fuzziness in your thinking.

Paragraph length

In general, as we increase the distance between the object and the aperture plane of the imaging system, the angle that the object subtends towards the imaging system (*i.e.*, the numerical aperture, NA) decreases. As result, lateral resolution becomes worse like 1/(NA). Longitudinal resolution depends on aperture even more strongly, like 1/(NA)2. We have developed a novel class of imaging elements, based on volume holography, to meet this challenge. Holographic imaging [Barbastathis et al] is based on using a "smart" holographic lens to replace elements of an imaging system (e.g. the objective lens). The holographic lens is pre-recorded as the interference pattern of two appropriately defined simple waves (e.g. two plane waves or a plane wave and a spherical wave) in a volume holographic material (e.g. lithium niobate or photopolymer). The hologram is then fixed and aligned with the rest of the imaging system. When light scattered from a target enters the imaging system, the hologram selectively diffracts the Bragg-matched modes of the...

Paragraph length

...incoming illumination, while the remaining modes propagate undiffracted. Therefore, the hologram can be thought of as a matched filter, which "sees" some selected aspects of the object and "rejects" other aspects. This property allows the real-time extraction of complex information from objects, e.g. in the three spatial dimensions (3D) and the spectral dimension combined, which in most other types of imaging systems would require scanning. Real-time spatial-spectral microscopic imaging has already been demonstrated with fluorescent microspheres by our group in collaboration with the Caltech Optics group [Liu, Psaltis, and Barbastathis].

Length of sentences

Multiple layers of pixellated silicon VLSI chips (chips that are divided into arrays of nearly identical devices or functional regions) are densely interconnected by a combination of electronic, optical, and photonic devices to produce either a space-invariant or space-variant degree of fan-out and fan-in to each individual pixel (neuron unit, or processing node).

Multiple layers of pixellated silicon VLSI chips (—chips that are divided into arrays of nearly identical devices or functional regions)—are densely interconnected by a combination of electronic, optical, and photonic devices, to **This** produces *either* a space-invariant or space-variant degree of fan-out and fan-in to each individual pixel (neuron unit, or processing node).

Multiple layers of pixellated silicon VLSI chips—chips that are divided into arrays of nearly identical devices or functional regions—are densely interconnected by a combination of electronic, optical, and photonic devices. This produces a space-variant or -invariant degree of fan-in and fan-out to each individual pixel (neuron unit, or processing node).

Variety enriches experience

Repetition (and its many guises)

- **Don't endlessly repeat:**
  - **Ideas (you should say it once, move on, and only reiterate when really necessary)**
  - **Words**
  - **Sentence constructions or beginnings of sentences**
  - **Sentence length**

Repeating words

The prototype of our *wearable user* interface will **address** *lead to a solution to* these demands: . Fig. 2 shows a larger view of **it** *our wearable user interface*. The user "wears" combined gyro and acceleration sensors on the back of the hand, which measure the three-dimensional orientation *of the hand* with respect to the ground, and *also "wears"* a gyro sensor on each fingertip, which measures the angular motion of the finger with respect to the back of the hand. Note that the relative bending angle *of the figer* is computed by comparing the outputs of the**se** gyro-sensor**s** *on the fingertip and the gyro-sensor on the back of the hand*. Since *there is* no other external device **is** necessary *to wear, particularly no device on the palm of the hand*, the user can wear this compact interface anywhere and anytime, and even can hold other objects or take notes with **a** pen.

Repeating words

The prototype of our interface will address these demands: Fig. 2 shows a larger view of it. The user "wears" combined gyro and acceleration sensors on the back of the hand, which measure the three-dimensional orientation with respect to the ground, and a gyro sensor on each fingertip, which measures the angular motion of the finger with respect to the back of the hand. Note that the relative bending angle is computed by comparing the outputs of these gyro-sensors. Since no other external device is necessary, the user can wear this compact interface anywhere and anytime, and even can hold other objects or take notes with a pen.

108 words

Beginnings of sentences

The choice of neighborhood is defined by the available *a priori* information on the processed image. If *a priori* information about the geometrical size *K* of the details to be preserved is known, then the *CKNV*-neighborhood can be used. The parameter *K* is chosen of the order of the detail area to be preserved after further processing. The choice of the *CEV*-neighborhood helps us to take into account *a priori* information about either the spread of the signal to be preserved or noise fluctuation to be suppressed. The *CER*-neighborhood is often used in edge extraction algorithms and for suppression of noise with a distribution having heavy tails. The output of filtering is a value computed as a basic operation (sample mean, median value, minimum and maximum values) over the neighborhoods. The spatially connected neighborhoods are not formed across region boundaries; therefore, noise suppression will not blur image edges as often happens with other techniques.

Formatting

- **Adobe recommends no more than 55-60 characters per line.**
  - **Having small text, then use columns!**
- **To justify or not to justify?**
  - **Ragged right is easier to read…**
- **What font?**
  - **Generally recommended: serif for text, san-serif for headlines. Also, never mix serif fonts on a page!**

Heads and subheads

Heads and subheads

- **Make them informative rather than clever.**
- **Keep them short.**
- **Think of them as bullet points in your outline (ie. they should work on their own).**
- **Have enough so no section is too huge (will make it less daunting for both you and the reader!).**

Figures

- **Make them interesting to look at!**
- **Don't make them too complex.**
- **Make sure they illustrate a point that you explicitly discuss.**
- **Make the captions are self-contained: detailed, with all jargon and acronyms spelled out.**
- **Don't assume the reader understands your conventions!**

References

- **Use only if they are relevant.**
- **See how many are expected for a given publication.**
- **Use the pub's style for submission, but use software that will allow you to reformat and change order easily.**
- **If you are using the superscript style,[1] the number goes *after* the period or comma.[2]**

Mathematics

- Use only what's really crucial.
- Different fields use symbols and conventions in different ways: define everything before use.
- *Make sure that it's perfect.*
- *Make sure you've carefully spelled out any assumptions you've made.*
- *Maths = Words? Translate by considering the lines used.*

Physical quantities

- Different fields can express concepts and quantities in different ways. Be careful:
  - Physicists prefer *wavelength*, EE's tend to prefer *frequency*.
  - Use *% efficiency* or *dB loss*?
  - *Angstroms* or *nanometres*?
  - Most important: never mix them!
- If you have no space between the number and unit (4nm, 20ms^{-1}) you won't have to worry about line breaks!

Checklist 1: Message

- Do you know you want to say?
- Have you identified your audience?
- Have you made sure you are giving your readers the information they need, when they need it?
- Have you broken down the steps in the argument, and put them in order?
- Have you outlined at the beginning and concluded at the end (of the document, chapter, section, paragraph, etc.)?

Checklist 2: Writing

- Have you eliminated repetition in your prose (words, constructions, etc.)?
- Does each sentence follow from the last?
- Are your sentences simple to follow, and less than 40 words long?
- Are your paragraphs on a single topic, and less than 150 words long?
- Is your writing varied and interesting?
- Does your personality come across the way you want it to?

Checklist 3: Language

- Have you used all the words correctly?
- Have you removed all hype, clichés and mixed metaphors?
- Are the jargon words you used either familiar to your audience or spelled out in your text?
- Have you made sure to use the active voice where possible, and written using the right tense and person?
- Is the text grammatically correct?

Checklist 4: Format

- Is the line-length no more than 60 characters? (Complain if you are having to follow a bad specification.)
- Are the references pertinent, fully specified, and in the required form?
- Are the mathematics necessary, clear, and well-defined?
- Are the units you use appropriate?
- Are figures interesting, relevant, and independently captioned?