


LANG 2030
Technical Communication (1)

Acknowledgements

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LANG 2030/H Course Schedule Spring 2022

Week	Lesson 1	Lesson 2	Assessment
1 Feb 4	CNY	**Introduction: Engineers and identity** *(Friday class only)*	
1 Feb 7 - 11	**Introduction: Engineers and identity**	**Part 1 Engineers and social responsibility.** 1.1 What are engineering ethics?	
2 Feb 14 - 18	1.2 Analyzing ethical issues in engineering	1.3 Analyzing causes (1)	
3 Feb 21 - 25	1.4 Analyzing causes (2)	1.5 Analyzing ethical implications (1)	
4 Feb 28 – Mar 4	1.6 Analyzing ethical implications (2)	1.7 Finalizing your analytical report and citing sources	
5 Mar 7 - 11	1.8 Presenting ethical issues	1.9 Taking part in a seminar discussion	Analytical report by **Mar 11 (Fri) 5:00pm**
6 Mar 14 - 18	Consultation / Practice Task 2	Assessed presentations and seminars	
7 Mar 21 - 25	Assessed presentations and seminars	**Part 2 Engineers and creativity** 2.1 The creative engineer	
8 Mar 28 - Apr 1	2.2 Introducing a creative project (1)	2.3 Introducing a creative project (2)	Library class week 8 or 9 (required)
9 Apr 4 - 8 Ching Ming Apr 5	2.4 Reviewing literature and comparing technologies (1)	2.5 Reviewing literature and comparing technologies (2)	
10 Apr 11 – 12	2.6 Technical description (1)	*Mid-term break Apr 13 - 18*	
10 Apr 19 - 22	2.7 Technical description (2)	2.8 Describing feasibility and benefits, concluding and putting together your proposal	VOLT (regular stream only) closes **Apr 22 (Fri) 5:00pm**
11 Apr 25 - 29	2.9 Presenting an innovation (1)	2.10 Presenting an innovation (2)	Proposal report by **Apr 29 (Fri) 5:00pm**
12 May 3 – 6 Labor Day May 2	Consultation	Assessed presentations	Peer evaluation by iPeer by **May 6 (Fri) 5:00pm**
13 May 10 – 11 Buddha Birthday May 9	Assessed presentations		

Course Overview

Technical Communication 1 is a three-credit course offered to students from the School of Engineering. Over one semester, students will attend three hours of class, and will be expected to complete up to six hours of out-of-class work, per week. The course focuses on three areas:

Engineers and identity: In this short introductory section, students will examine what characteristics make engineers different from other professionals and analyze the language that is typically used in engineering texts.

Engineers and social responsibility: Students will analyze and discuss some of the major ethical issues that engineers face in their work, with reference to real-world cases. They will work in a group to prepare and deliver a presentation and lead a seminar discussion on an engineering ethics issue. They will also write a short analytical report.

Engineers and creativity: Students will discuss and evaluate engineering innovations and will work in a group to devise an innovative engineering idea. They will present the innovation to their classmates and submit an individual proposal report.

Throughout the course, students will develop their ability to deliver presentations and take part in discussions on topics relevant to the work of a professional engineer. They will also enhance their ability to write about topics relevant to engineering, combining the use of sources with their own ideas. Language work will focus on helping students to use vocabulary and language structures appropriate for their engineering studies and for work as a professional engineer.

Vocabulary Learning Students will learn *120 assigned words* which are all taken from the texts they read in the course book. These words have been chosen for their relevance to engineering studies, and are grouped into Word Lists 1 to 3. Students are encouraged to develop their knowledge of these words making use of VOLT-2030 and the supplementary vocabulary resources at the LANG 2030 Canvas site.

Assessment

LANG 2030 Regular Stream

A group presentation and seminar discussion on an engineering ethics issue (group and individual)	**20%**
An analytical report on an engineering ethics issue (individual)	**20%**
A group presentation of a proposal for an engineering innovation (group and individual)	**20%**
A proposal report for an engineering innovation (individual)	**25%**
Vocabulary: Satisfactory completion of 10 vocabulary practice tests on VOLT-2030 at http://volt.cle.ust.hk	**5%**
Peer evaluation of contribution to TechVention group work by iPeer	**5%**
Practice tasks: Satisfactory completion of 4 practice tasks assigned on Canvas and attendance of the Library Workshop	**5%**

LANG 2030 H Stream

A group presentation and seminar discussion on an engineering ethics issue (group and individual)	**20%**
An analytical report on an engineering ethics issue (individual, additional details on Canvas)	**25%**
A group presentation of a proposal for an engineering innovation (group and individual)	**20%**
A proposal report for an engineering innovation (individual, additional details on Canvas)	**25%**
Peer evaluation of contribution to TechVention group work by iPeer	**5%**
Practice tasks: Satisfactory completion of 4 practice tasks assigned on Canvas and attendance of the Library Workshop	**5%**

Vocabulary Word List 1

These 50 words are taken from the texts you will read in the Introduction and Part 1 of the course. They have been chosen for their relevance to engineering studies.

Vocabulary exercises to help you learn these words can be found on VOLT-2030 and at the LANG 2030 Canvas site.

1.	**implement (v)**	p. 11	26.	**feasible (adj)**	p. 39
2.	**alternative (n)**	p. 18	27.	**dilemma (n)**	p. 39
3.	**migrate (v)**	p. 18	28.	**sustainable (adj)**	p. 39
4.	**retrieval (n)**	p. 18	29.	**occur (v)**	p. 41
5.	**transfer (n)**	p. 18	30.	**stakeholder (n)**	p. 41
6.	**profound (adj)**	p. 20	31.	**breach (v)**	p. 42
7.	**analyze (v)**	p. 24	32.	**proprietary (adj)**	p. 42
8.	**obligation (n)**	p. 28	33.	**rectify (v)**	p. 42
9.	**specification (n)**	p. 28	34.	**contamination (n)**	p. 43
10.	**exhaustive (adj)**	p. 30	35.	**concern (n)**	p. 43
11.	**formulate (v)**	p. 30	36.	**attributed (v)**	p. 51
12.	**inherent (adj)**	p. 30	37.	**disintegrate (v)**	p. 51
13.	**integrity (n)**	p. 32	38.	**prompt (v)**	p. 51
14.	**abide (v)**	p. 34	39.	**ignite (v)**	p. 55
15.	**undertake (v)**	p. 34	40.	**displacement (n)**	p. 55
16.	**regulation (n)**	p. 34	41.	**catastrophic (adj)**	p. 55
17.	**remuneration (n)**	p. 35	42.	**designated (adj)**	p. 56
18.	**overriding (adj)**	p. 35	43.	**corresponding (adj)**	p. 56
19.	**welfare (n)**	p. 35	44.	**incentive (n)**	p. 56
20.	**overrule (v)**	p. 35	45.	**evolving (adj)**	p. 56
21.	**nominal (adj)**	p. 35	46.	**compromise (v)**	p. 57
22.	**practicable (adj)**	p. 35	47.	**embed (v)**	p. 57
23.	**govern (v)**	p. 35	48.	**deteriorating (adj)**	p. 57
24.	**confidentiality (n)**	p. 39	49.	**flaw (n)**	p. 59
25.	**compensate (v)**	p. 39	50.	**account (for) (v)**	p. 80

Vocabulary Word List 2

These 50 words are taken from the texts you will read in Lessons 2.1-2.5 of the course. They have been chosen for their relevance to engineering studies.

Vocabulary exercises to help you learn these words can be found on VOLT-2030 and at the LANG 2030 Canvas site.

51.	**customized (adj)**	p. 104	76.	**robust (adj)**	p. 118
52.	**research (v)**	p. 104	77.	**execute (v)**	p. 118
53.	**integral (adj)**	p. 106	78.	**resilient (adj)**	p. 118
54.	**motivation (n)**	p. 107	79.	**surveillance (n)**	p. 118
55.	**replicate (v)**	p. 110	80.	**niche (n)**	p. 119
56.	**eliminate (v)**	p. 110	81.	**enhance (v)**	p. 121
57.	**breakthrough (n)**	p. 110	82.	**mitigate (v)**	p. 121
58.	**conventional (adj)**	p. 110	83.	**embellish (v)**	p. 122
59.	**feature (v)**	p. 110	84.	**intuitive (adj)**	p. 126
60.	**inception (n)**	p. 110	85.	**prosthesis (n)**	p. 126
61.	**enveloped (adj)**	p. 111	86.	**generate (v)**	p. 131
62.	**versatile (adj)**	p. 111	87.	**utilize (v)**	p. 131
63.	**surrogate (adj)**	p. 111	88.	**harvest (v)**	p. 131
64.	**essence (n)**	p. 111	89.	**abundant (adj)**	p. 131
65.	**disrupt (v)**	p. 111	90.	**infectious (adj)**	p. 132
66.	**dispatch (v)**	p. 112	91.	**prototype (n)**	p. 134
67.	**power (v)**	p. 112	92.	**realize (v)**	p. 137
68.	**monitor (v)**	p. 117	93.	**capture (v)**	p. 138
69.	**parameter (n)**	p. 117	94.	**viable (adj)**	p. 140
70.	**interfere (v)**	p. 117	95.	**applicable (adj)**	p. 141
71.	**cumbersome (adj)**	p. 117	96.	**prolong (v)**	p. 144
72.	**notable (adj)**	p. 117	97.	**constitute (v)**	p. 144
73.	**emerge (v)**	p. 117	98.	**aggravate (v)**	p. 145
74.	**induce (v)**	p. 117	99.	**exploitation (n)**	p. 145
75.	**fatigue (n)**	p. 117	100.	**exhibit (v)**	p. 147

Vocabulary Word List 3

These 20 words are taken from the texts you will read in Lessons 2.6-2.8 of the course. They have been chosen for their relevance to engineering studies.

Vocabulary exercises to help you learn these words can be found on VOLT-2030 and at the LANG 2030 Canvas site.

101.	**sturdy (adj)**	p. 153
102.	**fasten (v)**	p. 153
103.	**descent (n)**	p. 153
104.	**relay (v)**	p. 157
105.	**compose (v)**	p. 157
106.	**expertise (n)**	p. 160
107.	**modular (adj)**	p. 160
108.	**conceive (v)**	p. 161
109.	**elevated (adj)**	p. 162
110.	**recumbent (adj)**	p. 164
111.	**sedentary (adj)**	p. 165
112.	**emit (v)**	p. 165
113.	**negligible (adj)**	p. 165
114.	**limiting (adj)**	p. 168
115.	**resistance (n)**	p. 168
116.	**maximize (v)**	p. 168
117.	**initiative (n)**	p. 171
118.	**ameliorate (v)**	p. 171
119.	**endeavor (n)**	p. 178
120.	**actuate (v)**	p. 181

Introduction: Engineers and Identity

What's special about being an engineer?

You will:

- Get to know your classmates;
- Analyze the speaking styles of a presentation;
- Practice delivering a short presentation about yourself.

Getting to know each other

- Introduce yourself to your partner and try to find five things that you have in common, and five ways in which you are very different. Then work together to prepare a short presentation in which one of you will tell another pair about the ways you are similar, and the other will talk about the ways in which you are different.
- Join another pair and give your presentations, timing yourselves to ensure that you speak for two minutes each.
- As you listen to the presentations, give some feedback to the other group. Do you like their presentation?

Pre-task activity 1: Some views from working engineers

The following accounts are taken from personal blogs or interviews with engineers based in the US and UK, who answered the question, "Why did you become an engineer?"

Read these accounts and answer these questions:

- What reasons does this person give for being interested in engineering?
- Are any of these the same as your reasons for studying engineering?

Jack G. Ganssle, lecturer and consultant on embedded development issues in electrical engineering **1**

"Engineering is the art of solving problems. In order to make a machine that does X, I have to figure out how to design some hardware and firmware that does Y. Puzzling out these solutions is both an intellectual challenge and a game. Am I smart enough to do this? What will I have to invent? Problem solving is its own reward. But it's not enough, for me at least. I want to make something that works. Not push paper, not write proposals, not document someone else's creation, though all of those tasks are an inescapable and wearisome part of this profession. But I want the thrill of seeing the motor turn, the LEDs blink, or a message marqueeing across the display. A lot of developers work on large projects that take years of effort. I could never do that. I want to see something work, relatively soon. Invent solutions, see them implemented, and move on to the next project."

Quoted from: J. G. Ganssle, "Why I became an engineer", 22 June 2007. [Online]. Available: http://www.ganssle.com/rants/whyibecameanengineer.htm

Rebecca Robinson, clinical scientist **2**

"I have always enjoyed playing with gadgets such as mobile phones and games consoles. But I didn't just enjoy playing with these devices. I was always curious about the way they worked. Whenever something broke, I was the first to try and open it and 'fix' it. To be honest this rarely worked and my parents were often left with a video player that was irreparable! However, I really wanted to make a difference to people's lives. I knew that I could do that in medicine but I didn't want to become a clinician. I realized that engineering had the potential to change the way people live, it could make their lives easier; for example, the invention of the stair lift helps elderly people go upstairs. So I chose to combine my love of technology and engineering with medicine, leading me into a career in clinical engineering."

Quoted from: *Inspiration women: Rebecca Robinson* [Online]. Available: http://www.theukrc.org/get-involved/wise/inspirational-women/rebecca-robinson

Josephine Thomas, business process specialist at an engineering improvement center **3**

"I enjoyed maths and physics at school and wanted to have a career in accounting or computer programming, but could not make up my mind. My role model was a female electrical engineer called Irene Muloni and she made engineering sound very interesting and told me that engineering was a great foundation for a career in computer programming or accounting. Two of my uncles were engineers and I was always fascinated by what they did. Also, my brother helped me write my first computer program when I was eight and I guess I was always hooked to sciences after that! I ended up specializing in electrical engineering."

Quoted from: http://www.wisecampaign.org.uk/viewitem.cfm?cit_id=383545. Accessed August 20, 2011.

Mandy P.S., a US-based aerospace engineer **4**

"Before the seventh grade, I was pretty much determined to be a straight up scientist. In fact, I wanted to be an astrophysicist. Then, my seventh grade science teacher taught an entire six weeks about bridges. And it was the most fascinating six weeks I had ever experienced in school. So how did this love of bridges convince me to become an engineer? Well, scientists don't bother with something as mundane as bridges. They worry about the theoretical and abstract. I wanted to create things in the here and now that people could enjoy and use. I wanted to better society now, not several years from now after someone else applies the theoretical science I discovered. That was when I knew I would be an engineer. At the time I did not know about differences like civil engineering versus aerospace engineering. I just knew I had to be out there, building, creating, and adding to the betterment of mankind. Because that is what being an engineer is about. It's about creating technology that helps and furthers people. To be an engineer requires passion. Why else would a person suffer through five years of the sheer torture that is an undergraduate engineering degree? It certainly isn't for the fun. It's for the love."

Quoted from: "One reason why I became an engineer." [Online]. Available: http://bittersweetfountain.blogspot.com/2010/07/one-reason-why-i-became-engineer.html

Pre-task activity 2: How do engineers speak?

You will now watch a video by the Tech Twins on the topic “Why study engineering”. Then, in a small group, discuss the effectiveness of the Tech Twins as presenters. Think about what they say and how they say it.

Notes

Task: Why I chose to study engineering

Presentation: "Why I chose to study engineering"

Prepare a short presentation on one of the following topics to deliver to your classmates:

- Why engineers are the most important to our society
- Why engineering is a great career
- The challenges of an engineering career
- How engineering is different from business or science

You will first work in small groups, with each student delivering a 2-minute presentation to the group. Your lecturer will then ask a few students to deliver their presentations to the whole class.

You should ask any questions after the presenter has finished the 2-minute speech.

Notes

Follow-up activity: Reviewing your presentation

Your lecturer will ask a few students to give their 2-minute presentation, stating why they decided to study engineering, to the whole class at the beginning of the next lesson. Review your performance, and practice your presentation a few times before the next lesson.

Follow-up activity: Vocabulary learning

You are asked to learn 120 words related to engineering as part of your LANG 2030 assessment. The aim of the vocabulary learning is to enrich your knowledge of engineering-related words, and also to help you use vocabulary more effectively. Apart from the meaning of a word, you should develop an understanding of the different forms of the word as well as the prepositions that are used with that word.

Answer the four items below, using words from the short word list provided.

Word list

passionately transforming benefit transfer

1. Complete each sentence with the most appropriate word from the above list. You may have to change the form of the word or make other changes.

   a) An engineering-based education also allows students to develop a variety of skill sets, including problem solving, decision making, innovation, project management, team working and communication. These _____ skills are highly valued in an engineering career.

   b) As an engineer, you can choose to work on projects that are _____ to society, such as cleaning up the environment, developing clean and efficient transportation systems and finding new sources of energy.

2. Replace the underlined words with the best synonym from the list. You may need to change the form of the word or make other changes.

   a) Engineering is by its very nature a creative profession. Because we are in a time of rapid social and technological **change**, the need for engineers to think creatively is greater now than ever before.

   _____

   b) “During high school I was already **very interested in** topics concerning global climate change and greenhouse gas emissions and I participated in a few competitions relating to this.” Nafeezah, Year 4 Chemical Engineering student, Mauritius.

   _____

Texts and videos used in this lesson

Pre-task activity 1

TEXT 1

J. G. Ganssle, “Why I became an engineer”, 22 June 2007. [Online]. Available: http://www.ganssle.com/rants/whyibecameanengineer.htm

TEXT 2

Inspiration women: Rebecca Robinson [Online]. Available: http://www.theukrc.org/get-involved/wise/inspirational-women/rebecca-robinson

TEXT 3

http://www.wisecampaign.org.uk/viewitem.cfm?cit_id=383545. Accessed August 20, 2011.

TEXT 4

“One reason why I became an engineer.” [Online]. Available: http://bittersweetfountain.blogspot.com/2010/07/one-reason-why-i-became-engineer.html

Pre-task activity 2

The Tech Twins, “Why study engineering in university?” [Video file]. Available: https://www.youtube.com/watch?v=BjUk58dCC-A&t=176s

How do engineers write?

You will:

- Identify some of the characteristics of technical writing;
- Write a short technical description.

Pre-task activity: What are the characteristics of "technical writing"?

Work with your group to make a list of the characteristics of technical writing.

Task: Analyzing types of technical writing

Read one of the three examples of technical writing overleaf, and complete part of the table with information from your text.

Text no.	Type of writing	Potential audience and purpose	Special language features
	The introduction to an article from an academic journal		
	The iPad user guide		
	Introduction to an app on the app developer's homepage		

3. Share what you have learned with your group mates. Can you draw any conclusions about technical writing?

4. Which of these types of technical writing do you think you will write as a student engineer?

Text 1: What Is *Signal*, and why is everyone using It?

Signal is a secure encrypted messaging app. Think of it as a more private alternative to WhatsApp, Facebook Messenger, Skype, iMessage, and SMS. Here's why you should seriously consider switching to *Signal*.

Why *Signal* Is Special

Signal is available for Android, iPhone, and iPad. There's also a *Signal* desktop client for Windows, Mac, and Linux. To join, all you need is a phone number. It's free.

The user experience of *Signal* is just like WhatsApp, Facebook Messenger, and other popular chat apps. It's a messaging app with features like one-to-one messages, groups, stickers, photos, file transfers, voice calls, and even video calls. You can have group chats with up to 1000 people and group calls with up to eight people.

Signal isn't owned by a big tech company. Instead, *Signal* is developed by a non-profit foundation and is funded by donations. Unlike Facebook, *Signal*'s owners aren't even trying to make money. *Signal* doesn't try to gather a bunch of data on you or show you advertisements.

While *Signal* has a very familiar interface, it's very different under the hood. Your conversations in *Signal* are end-to-end encrypted, which means that not even the owners of *Signal* can monitor them. Only the people in the conversation can see them.

Text 2: EMYNOS: Next Generation Emergency Communication

Telecommunication networks are currently the primary infrastructure for providing emergency services. These emergency systems are based on old-fashioned telecommunication technologies that cannot cope with the IP-based services that the average European citizen uses every day. Furthermore, most telecommunication operators and providers have decided to migrate from circuit-switched networks to packet-switched networks after realizing the tangible benefits, which include convergence, rich services, cheaper maintenance, and improved user satisfaction. As next generation networks (NGNs) are replacing the current telecommunication networks, it follows that the current emergency systems also need to be upgraded in order to fulfill the NGN regulatory requirements for emergency services.

The goal of the EMYNOS project is to design and implement a next-generation platform capable of accommodating rich-media emergency calls that combine voice, text, and video, thus creating a powerful tool for coordinating communication among citizens, call centers, and first responders. Additionally, issues such as call routing/redirection to the closest available call center, retrieval of the caller location, hoax call prevention, support for people with disabilities, and integration of social media are addressed in this project.

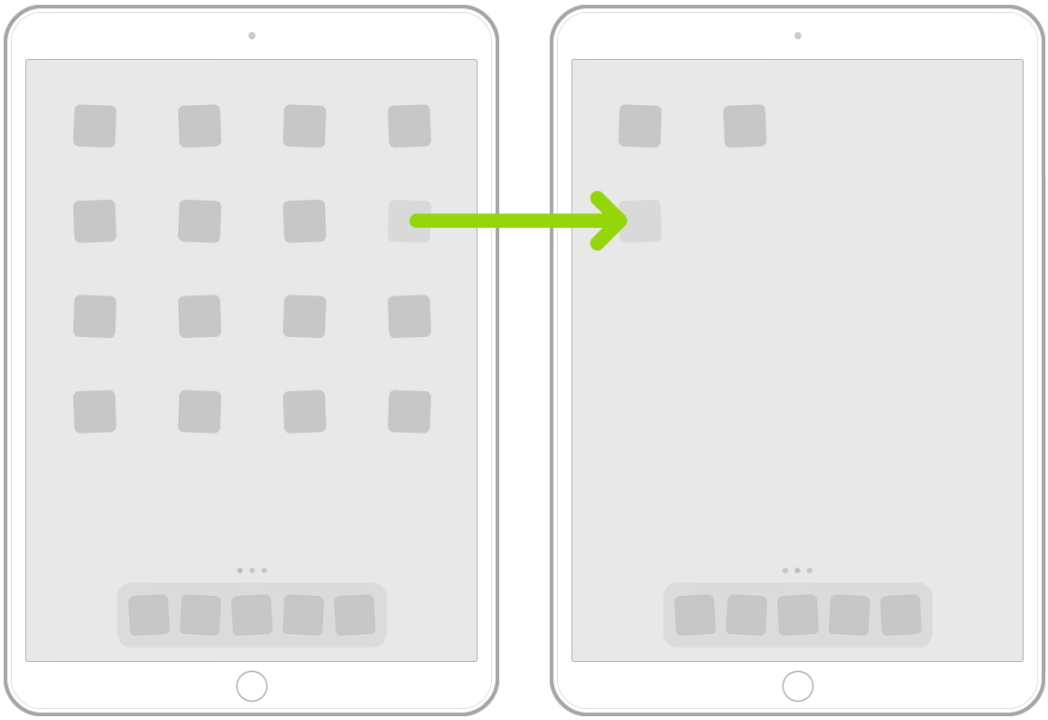
Text 3: Move and organize apps on iPad

Move apps around the Home Screen, into the Dock, or to other pages

1. Touch and hold any app on the Home Screen, then tap Edit Home Screen. The apps begin to jiggle.

2. Drag an app to one of the following locations:

   - Another location on the same page
   - The Dock at the bottom of the screen



   - Another Home Screen page
     Drag the app to the right edge of the screen. You might need to wait a second for the new page to appear. The dots above the Dock show how many pages you have and which one you're viewing.

3. When you're finished, tap Done at the top right.

Language focus: Describing technology using promotional vs. informative language

1. Work in pairs, with each person reading one of the following extracts about cochlear implants. Note down which of the following features of a technical description are found in your text.

Features	Text A	Text B
A definition which gives an overview of the device or system		
A list of the components		
A description of each component		
How the device or system works		
Benefits		
Limitations		

Text A: What is a cochlear implant?

A cochlear* implant is an implanted electronic hearing device, designed to produce useful hearing sensations to a person with severe to profound nerve deafness by electrically stimulating nerves inside the inner ear.

These implants usually consist of two main components:

- The externally worn microphone, sound processor and transmitter system.
- The implanted receiver and electrode system, which contains the electronic circuits that receive signals from the external system and send electrical currents to the inner ear.

Currently made devices have a magnet that holds the external system in place next to the implanted internal system. The external system may be worn entirely behind the ear or its parts may be worn in a pocket, belt pouch, or harness.

A cochlear implant receives sound from the outside environment, processes it, and sends small electric currents near the auditory nerve. These electric currents activate the nerve, which then sends a signal to the brain. The brain learns to recognize this signal and the person experiences this as "hearing". The cochlear implant somewhat simulates natural hearing, where sound creates an electric current that stimulates the auditory nerve. However, the result is not the same as normal hearing.

**In the ear*

Text B: What is a cochlear implant?

Advanced Bionics (AB) provides the world's most advanced cochlear implant system to help you or your loved one hear again—or experience the joy of sound for the first time.

A cochlear* implant is a highly advanced medical device which provides an effective alternative to hearing aids because it doesn't use amplification. Instead, it bypasses the damaged part of the ear and uses electrical stimulation to enable you to hear.

There are two main components to a cochlear implant system. The internal component is the implant. The external component is the sound processor, which can be worn on or off the ear. First, the cochlear implant system captures and processes the sound around you. **AB** sound processors use the industry's most advanced technology to make hearing easier.

Then, the processed sound is transmitted through the headpiece to the implant. **AB**'s implant family features the most advanced sound processing circuitry in the world, with programming flexibility that provides nearly unlimited ways to deliver sound.

Finally, the sound is sent through an electrode directly to your hearing nerve. Every **AB** electrode delivers focused stimulation through current steering technology for hearing that more closely resembles normal hearing.

Unique **AB** microphone technology allows you to use ear buds, headphones and telephones like everyone else, to hear in water, and to hear better in noise.

**In the ear*

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2. Read the two technical descriptions again. Discuss the following questions with your partner:

   a) What is the main purpose of each of the two descriptions?

   b) Both texts use many adjectives. What is the purpose of these adjectives? Do the two texts use these adjectives for the same reasons?

   c) Do the two texts use personal pronouns?

   d) Which is used more often: active or passive voice?

   e) Which tense is used?

   f) Are ideas organized in the same way in the two texts?

Follow-up activity: Writing a technical description

Engineers often have to write technical descriptions. When you write your proposal in Part 2, you will include a technical description of your proposed new technology or device. This activity gives you practice in writing in an appropriate style.

1. First watch a video about an application of GPS technology for tracking children and pets on Canvas. As you watch, note down the features of the technology and how it can help users to track people or objects important to them.

Trax, a GPS tracking system for children and pets

What is Trax?

What are the components of the system and what are its most important features?

How does Trax work?

2. Compare notes with your group members to ensure that you have noted down the main features of the system.

3. Discuss the purpose of the video? Is it purely descriptive? Is it promotional?

4. Write a technical description of Trax, based on the notes that you have made from the video. Imagine that you are the developer of the device and are writing a paper for academic readers. You will need to use a style appropriate for formal, academic technical writing. You should write 100 to 120 words.

Trax, a GPS tracking system for children and pets

5. Review your technical description of Trax and post your writing according to your lecturer's instructions. If you feel you need additional information, look at the company website at: http://www.traxfamily.com/ but be aware that the purpose of the website is to promote this technology.

Texts and videos used in this lesson

Pre-task activity

TEXT 1
Extracted from "What Is Signal, and Why Is Everyone Using It?" Available: https://www.howtogeek.com/708916/what-is-signal-and-why-is-everyone-using-it/

TEXT 2
Extracted from the introduction to E.K. Markakis ; A. Lykourgiotis ; I. Politis ; A. Dagiuklas ; Y. Rebahi ; E. Pallis, "EMYNOS: Next Generation Emergency Communication," *IEEE Communications Magazine: IEEE*, Jan. 2017. [Online].
Available: http://ieeexplore.ieee.org/document/7823352/?part=1

TEXT 3
Extracted from "Move and organize apps on iPad" *iPad User Guide*. [Online]. Available: https://support.apple.com/guide/ipad/move-and-organize-apps-ipad997db08a/14.0/ipados/14.0

Task

TEXT A
Extracted from "What is a cochlear implant?" The U.S. Department of Health and Human Services. [Online]. Available: http://www.fda.gov/MedicalDevices/ProductsandMedicalProcedures/ImplantsandProsthetics/CochlearImplants/default.htm

TEXT B
Adapted from "What is a cochlear implant?" Advanced Bionics. [Online]. Available: https://advancedbionics.com/us/en/home/about-cochlear-implants/what-is-a-cochlear-implant-system.html

Follow-up activity

M. Karlsson, "Trax next generation GPS tracker for children and pets," 14 Mar 2013. [Video file]. Available: https://www.youtube.com/watch?v=1PkMT2RyO3A&t=8s

Part 1 Engineers and Social Responsibility

''The safety of the people shall be their highest law.''

Cicero[1]

"Engineering has immense capacity to help provide benefits to society but it also has a similarly large capacity to be used to cause harm. It helps to provide basic needs such as water, food, shelter and energy, and does so on the scale necessary for industrial society to function. But engineering has also contributed to the huge increase in the destructiveness of weaponry and warfare seen over the centuries, to increases in inequality and to the global damage inflicted on the world's ecosystems."

Dr Stuart Parkinson[2]

Unit Overview

You will read about, analyze and discuss some of the major ethical issues that engineers face in their work, with reference to real-world cases and the ethical codes that guide the behavior of professional engineers.

You will learn presentation and seminar skills and will develop your ability to use written and video sources effectively to present and write about a topic.

The materials in the unit are taken from a variety of sources, including: journals, professional reports, government publications, popular science magazines, newspapers, television and on-line publications. Exposure to engineering-related materials from different sources will help you to develop your awareness of style in technical writing and speaking.

[1] Marcus Tullius Cicero, (106 BC –43 BC), Roman statesman, lawyer and political theorist. He was referring to judges and statesmen in this quotation, which was later applied to engineering ethics.

[2] UNESCO, "Engineering: Issues, challenges and opportunities for development," 2010, p. 44. [Online]. Available: http://unesdoc.unesco.org/images/0018/001897/189753e.pdf

Dr Stuart Parkinson is an expert reviewer for the Intergovernmental Panel on Climate Change (IPCC) and advised on the UK negotiators to the UN climate change convention. He is now Executive Director of Scientists for Global Responsibility, a UK-based campaign organization.

Assessed Tasks

1. ANALYTICAL REPORT

You will write an **individual analytical report** (around 700 up to 800 words).

To complete this task, you need to study a case (which will be assigned to you), summarize the events, identify causes, refer to codes of ethics, and express your opinions about the most important ethical issue(s) in the case. The case is an authentic story and links to the case materials can be found at your LANG 2030 Canvas site.

You will be given links to background information from popular articles and websites, but to make your arguments convincing, you also need to read and cite from academic articles and professional reports. When citing sources, you have to demonstrate your competence in paraphrasing and using IEEE style appropriately.

The activities in Part 1 of the course will guide you through the writing task in more detail. Here are some steps you may need to take.

Working as a group …

Step 1
Study the case, summarize the events, and identify causal relationships.

Step 2
Brainstorm some ideas about the case with your group members.

Step 3
Use relevant ethical codes to identify ethical issues relevant to your case. You are expected to refer to the WFEO Model Code of Ethics and/or the HKIE Rules of Conduct. You may also refer to the ethical codes in the country where the case occurs if appropriate.

Working individually …

Step 4
Select and organize your ideas. You should also establish the headings you will use in the report, such as *Introduction*, *Cause Analysis, Ethical Implications* and *Conclusion.*

Step 5
Elaborate on your ideas, using both background information from the non-academic articles about your topic AND the academic articles and reports.

Step 6
Draft your report at least 3 or 4 days before the deadline so that you can use the similarity report from *Turnitin* to check if you have accidentally plagiarized.

Step 7
Revise and edit your report, and evaluate your own writing using the assessment criteria. You may need to check your language for expressing cause and effect, and your citations and reference list. Make sure you have used appropriate section headings.

This report will be assessed on the criteria of Task Achievement, Organization, Vocabulary Range and Accuracy, and Grammatical Range and Accuracy. A detailed description of these can be found at the course site on Canvas.

2. PRESENTATION & SEMINAR

You will work **in groups** to deliver a **presentation** and lead a **seminar** on a real-life ethical case, involving one or more aspects of engineering ethics.

Presentation

Each group will be required to deliver a 14-minute group presentation, which should:

- Give a brief outline of the details of the case; and
- Discuss the ethical issues you have identified in this case.

You are expected to use PowerPoint slides or other visual aids to help you deliver the presentation.

Seminar discussion

After the presentation, students will take part in a 10-minute seminar discussion, led by the presentation group. Students should focus on the ethical issues in the case and discuss the relevance of these ethical issues to their local context. The group will prepare a list of questions to guide the discussion, which they will show to their lecturer before the presentation.

Guidelines for preparing the presentation and seminar

To prepare for this task, you should:

- Read the case materials in more detail, share your information and start dividing up the presentation content among group members.
- Devise seminar questions on the case and show them to your lecturer.
- Prepare for your presentation both individually and as a group. You should make time for at least one group rehearsal, making sure that you have a coherent structure and good time management.

This presentation will be assessed on the criteria of Task Achievement (group), Language (individual) and Delivery (individual). A detailed description of these can be found at the course site on Canvas.

1.1 What are engineering ethics?

You will:

- Learn about the importance of ethics to engineers;
- Gain understanding of two engineering codes of ethics;
- Examine the formal language used in ethical codes.

Pre-task activity 1: Ethics quiz

Complete the quiz below. Compare answers with your partner, and discuss which option is the most ethical choice for each question.

a) You see someone steal a small item from a shop. Would you:

A. Confront the thief?
B. Do nothing?
C. Inform the staff of the shop?

b) You have a part-time job working in a computer repair business. You are repairing the computer of a Hong Kong celebrity and find a number of explicit photos of this person. Would you:

A. Send the photos to a few of your friends?
B. Inform the shop owner?
C. Say nothing about what you have seen?

c) You are invited to be one of the judges for a design competition for secondary school students. When you attend the presentation of the shortlisted designs, you realize that one of the contestants is your best friend's sister. Would you:

A. Say nothing, but do your best to assess all the contestants fairly?
B. Tell the organizers about your relationship with one of the contestants?
C. Make an excuse to drop out of the judging panel?

d) You see an advertisement for a very well-paid summer job. Unfortunately, the job requires some technical skills that you do not have. Would you:

A. Apply for the job, explain that you lack some of the skills but try to convince the employer of your interest and enthusiasm?
B. Not apply for this job?
C. Try to give the impression that you have these skills when you fill in the job application form?

Pre-task activity 2: Analyzing ethical issues in an engineering case

Read the following case and, working in groups, answer the questions below.

Engineering Ethics Case

Jackie, an electrical engineer, works for a university on construction and renovation projects. Her immediate manager is an architect, and next in the chain of command is Charles, an administrator with no technical background. Charles, without talking to the engineers, often produces project cost estimates that he passes on to higher university officials. In cases where it becomes evident that actual costs are going to exceed these estimates, Charles puts pressure on the engineers to reduce design features. One such occasion involves the conversion of a storage shed into office space. Among the specifications detailed by Jackie is the installation of emergency exit lights. These are mandated by the building code. To try and cut down costs, Charles insists that the specification for emergency lights be deleted. Jackie strongly objects to this and refuses to obey Charles, who then accuses her of being a troublemaker and a disruptive influence in the workplace.

a) What is the problem?
b) What action should Jackie take?
c) Read the following extracts from the Rules of Conduct of the Hong Kong Institution of Engineers. Which of these rules apply to:

Jackie? _____ Charles? _____

Extract 1

Rule 3 Responsibility to Employers or Clients

A member of the Institution shall discharge his duties to his employer or client with integrity and in accordance with the highest standards of business ethics.

In pursuance of this rule a member shall, inter alia:

3.1 offer complete loyalty to his employer or client, past and present, in all matters concerning remuneration and in all business affairs and at the same time act with fairness between his employer or client and any other party concerned;
3.2 avoid engaging in business, investments or activities which conflict with the interests of his employer or client, and inform his employer or client in writing of any possible conflict between his own financial interests, or those of his immediate family, and the interests of his client or employer;
3.3 not accept any financial or contractual obligation on behalf of his employer or client without their authority;
3.4 where possible advise those concerned of the consequences to be expected if his engineering judgment, in areas of his responsibility, is overruled by a non-technical authority;

Extract 2

Rule 4 Responsibility to the Public

A member of the Institution in discharging his responsibilities to his employer and the profession shall at all times be governed by the overriding interest of the general public, in particular their environment, welfare, health and safety.

In pursuance of this rule a member shall, inter alia:

4.1 seek to protect the safety, health and welfare of the public;
4.2 when making a public statement professionally, try to ensure that both his qualification to make the statement and his association with any benefiting party are made known to the recipients of the statement;
4.3 seek to extend public understanding of the engineering profession;
4.4 seek to assess the environmental consequences of work for which he is responsible and to influence events so as to prevent or minimize damage to, and if practicable to improve, the environment;

Pre-task activity 3: Engineering ethics

Many professional organizations of engineers have devised their own codes of ethics. What is the purpose of a professional code of ethics? Brainstorm in your group and then read the following comments from engineering organizations to get more ideas.

Why ethics concerns you: comments from leading engineers in Hong Kong

"Most professional associations and technical societies, for self-regulating purposes, require their members to commit themselves to ethical practice in accordance with the guidelines set out in a written code of ethics. The HKIE has a set of Rules of Conduct to provide such guidance. If an engineer fails to comply with the code, his membership with the HKIE may be terminated or suspended and without such a qualification, he may be restricted from working for certain engineering projects, particularly those in the public sector."

"Although the Rules are not intended as exhaustive specifications of what one should or should not do, they provide clues on what is necessary and important for professional engineers to fulfil."

Introduction to the World Federation of Engineering Organizations (WFEO) Model Code of Ethics

The WFEO Model Code of Ethics is designed to assist member organizations in guiding ethical behavior by formulating their own Codes of Ethics. The exercise of professional judgment is often difficult and complex. The inherent nature of 'professionalism' is that as engineers we always have a duty to others and an obligation to 'do the right thing'. Exactly who the 'others are', and what the 'right thing' is, will be a matter of continual balance. We are expected to get the balance right. We also know that each situation may be different, requiring specific choices depending on the circumstances.

A Code of Ethics will not give us all the answers nor tell us what to do under all circumstances. The values and principles in the WFEO Model Code of Ethics are those which are deemed to be applicable universally to the practice of engineering, and the Model Code provides a framework for analysis and decision making.

Task 1 Understanding codes of ethics

Included in the next few pages are two ethical codes:

- World Federation of Engineering Organizations (WFEO) Model Code of Ethics (extracts)
- The Hong Kong Institution of Engineers (HKIE) Rules of Conduct

1. Your lecturer will allocate each group to read different sections of the codes. As you read, note down which of the rules of conduct in the table below appear in your section of the code.

Engineers should …	**WFEO**	**HKIE Rules 1, 2**	**HKIE Rules 3, 4**
i. promote health and safety in the workplace			
ii. continue to learn more about engineering			
iii. help colleagues in their professional development			
iv. only do work which they are qualified to do			
v. not take bribes			
vi. give credit for work that has been done to the people who have done the work			
vii. be loyal to employers and clients			
viii. seek, accept and offer honest criticism of work			
ix. warn employers and clients of the consequences of ignoring the advice of engineers			
x. keep confidential information about their employer or client safe			
xi. not waste natural resources			
xii. avoid damaging the environment			
xiii. repair damage caused to the environment during engineering work			

2. Your lecturer will now organize you into new groups. Share the information you have found and then answer the following questions:

a) Does each code of ethics include all the rules of conduct?

b) Can you see any important differences between the codes?

c) Which code assumes that all engineers are male? How do you feel about that?

d) Do you think there is a difference between behaving ethically as an ordinary person, and behaving ethically as an engineer?

WFEO (World Federation of Engineering Organizations) Model Code of Ethics

In the course of engineering practice, professional engineers will:

1. DEMONSTRATE INTEGRITY

1.1 Refrain from fraudulent, corrupt or criminal practices
1.2 Be objective and truthful
1.3 Practise fairly and with good faith towards clients, colleagues and others

2. PRACTISE COMPETENTLY

2.1 Practise in a careful and diligent manner in accordance with their areas of competence
2.2 Practise in accordance with accepted engineering practices, standards and codes
2.3 Maintain and strive to enhance the body of knowledge in which they practise

3. EXERCISE LEADERSHIP

3.1 Practise so as to enhance the quality of life in society
3.2 Strive to contribute to the advancement of the body of knowledge within which they practise, and to the profession in general
3.3 Foster the public's understanding of technical issues and the role of engineering

4. PROTECT THE NATURAL AND BUILT ENVIRONMENT

4.1 Create and implement engineering solutions for a sustainable future
4.2 Be mindful of the economic, societal and environmental consequences of actions or projects
4.3 Promote and protect the health, safety and well-being of the community and the environment

Each of the items in the Code is supplemented by more detailed guidelines. The following guidelines supplement #4.

4. PROTECT THE NATURAL AND BUILT ENVIRONMENT

4.1 Create and implement engineering solutions for a sustainable future

In practice, this means:

a) being aware that the principles of eco-systemic interdependence, diversity maintenance, resource recovery and inter-relational harmony form the basis of humankind's continued existence and that each of these poses a threshold of sustainability that should not be exceeded.
b) discussing in particular the consequences of proposals and actions, direct or indirect, immediate or long term, upon the health of people, social equity and the local system of values.
c) promoting a clear understanding of the actions required to restore and, if possible, to improve the environment that may be disturbed, and include them in your proposals.

4.2 Be mindful of the economic, societal and environmental consequences of actions or projects

In practice, this means:

a) making sure that your own perception of environmental issues is as accurate as possible.
b) striving to accomplish the beneficial objectives of your work with the lowest possible consumption of raw materials and energy and the lowest production of waste and any kind of pollution.
c) studying the environment that will be affected by your work, assessing the impacts that might arise in the structure, dynamics and aesthetics of the ecosystems involved - urbanised or natural - as well as pertinent socioeconomic systems, and selecting the best alternative for development that is both environmentally sound and sustainable.
d) rejecting any kind of commitment that involves unfair damages to human surroundings and nature and aiming for the best possible technical, social and political solution.
e) being aware of and making sure that clients and employers are aware of societal and environmental consequences of actions or projects and endeavouring to interpret engineering issues to the public in an objective and truthful manner.

4.3 Promote and protect the health, safety and well-being of the community and the environment

In practice, this means:

a) having due regard for the health, safety and well-being of the public and fellow employees in all work for which they are responsible.
b) trying with the best of their ability, courage, enthusiasm and dedication to obtain a superior technical achievement which will contribute to and promote a healthy and agreeable surrounding for all people, in open spaces as well as indoors.
c) informing your employer or contractor of the possible consequences if your recommendations on issues of safety, health, welfare or sustainable development are overruled or ignored.

Rules of Conduct of the Hong Kong Institution of Engineers

GUIDELINES

Contained within the Ordinance, Constitution, Regulations and Rules of the Institution are Rules of Conduct which are binding on the members of the Institution. These Guidelines are to assist members with the interpretation and implementation of the Rules.

Rule 1 Responsibility to the Profession

A member of the Institution shall order his conduct so as to uphold the dignity, standing and reputation of the profession.

In pursuance of this rule a member shall, inter alia:

1.1 discharge his professional responsibilities with integrity, dignity, fairness and courtesy;
1.2 not allow himself to be advertised in self-laudatory language nor in any manner derogatory to the dignity of his profession, nor improperly solicit professional work for himself or others;
1.3 give opinions in his professional capacity that are, to the best of his ability, objective, reliable and honest;
1.4 take reasonable steps to avoid damage to the environment and the waste of natural resources or the products of human skill and industry;
1.5 ensure adequate development of his professional competence;
1.6 accept responsibility for his actions and ensure that persons to whom he delegates authority are sufficiently competent to carry out the associated responsibility;
1.7 not undertake responsibility which he himself is not qualified and competent to discharge;
1.8 treat colleagues and co-workers fairly and not misuse the advantage of position;
1.9 when working in a country other than Hong Kong order his conduct according to the existing recognised standards of conduct in that country, except that he should abide by these rules as applicable in the absence of local standards;
1.10 when working within the field of another profession pay due attention to the ethics of that profession.

Rule 2 Responsibility to Colleagues

A member of the Institution shall not maliciously or recklessly injure nor attempt to injure whether directly or indirectly the professional reputation of another engineer, and shall foster the mutual advancement of the profession.

In pursuance of this rule a member shall, inter alia:

2.1 where appropriate seek, accept and offer honest criticism of work and properly credit the contributions of others;
2.2 seek to further the interchange of information and experience with other engineers;
2.3 assist and support colleagues and engineering trainees in their professional development;
2.4 not abuse his connection with the Institution to further his business interests;
2.5 not maliciously or falsely injure the professional reputation, prospects or practice of another member provided however that he shall bring to the notice of the Institution any evidence of unethical, illegal or unfair professional practice;
2.6 support the aims and activities of the Institution.

Rule 3 Responsibility to Employers or Clients

A member of the Institution shall discharge his duties to his employer or client with integrity and in accordance with the highest standards of business ethics.

In pursuance of this rule a member shall, inter alia:

3.1 offer complete loyalty to his employer or client, past and present, in all matters concerning remuneration and in all business affairs and at the same time act with fairness between his employer or client and any other party concerned;
3.2 avoid engaging in business, investments or activities which conflict with the interests of his employer or client, and inform his employer or client in writing of any possible conflict between his own financial interests, or those of his immediate family, and the interests of his client or employer;
3.3 not accept any financial or contractual obligation on behalf of his employer or client without their authority;
3.4 where possible advise those concerned of the consequences to be expected if his engineering judgment, in areas of his responsibility, is overruled by a non-technical authority;
3.5 advise his employer or client in anticipating the possible consequences of relevant developments that come to his knowledge;
3.6 neither give nor accept any gift, entertainment, payment or service of more than nominal value, to or from those having a business relationship with his employer or client without the consent of the latter;
3.7 where necessary co-operate with or arrange for the services of other experts wherever an employer's or client's interest might best be served thereby;
3.8 safeguard confidential information in relation to his employer or client and not disclose such information to third parties without his employer's or client's written consent. A member shall not receive any gift, entertainment, payment or service from third parties for disclosing such information nor make use of it for personal gain.

Rule 4 Responsibility to the Public

A member of the Institution in discharging his responsibilities to his employer and the profession shall at all times be governed by the overriding interest of the general public, in particular their environment, welfare health and safety.

In pursuance of this rule a member shall, inter alia:

4.1 seek to protect the safety, health and welfare of the public;
4.2 when making a public statement professionally, try to ensure that both his qualification to make the statement and his association with any benefiting party are made known to the recipients of the statement;
4.3 seek to extend public understanding of the engineering profession;
4.4 seek to assess the environmental consequences of work for which he is responsible and to influence events so as to prevent or minimise damage to, and if practicable to improve, the environment.

In particular in the exercise of the requirement to safeguard the public in matters of welfare, health and safety, engineers should:

a) strive to create through their projects a healthy and agreeable outdoor and indoor environment;
b) aim to minimise the use of non-renewable resources, to conserve energy and to minimise the generation of waste;
c) consider and take into account the consequences of any proposal upon public health and local custom;
d) assess the impacts of their proposals upon the environment, and select options that will ensure sustainable development;
e) consider and explain in their proposals the measures required to protect and improve the environment;
f) promote the concepts of interdependence of ecosystems, maintenance of the diversity of species, resource replacement and recovery, and sustainable development;
g) seek to balance costs with the best benefit to the environment and to human society, to achieve the most suitable practical environmental option, by utilizing the best available technology and techniques without entailing excessive cost;
h) encourage management to follow positive environmental policies by recognizing that a statement of intent is not sufficient to achieve legislative compliance.

Language focus: The language of ethical codes

The formal written language used in the HKIE Rules of Conduct is very different from that used when we speak about the ethical obligations of engineers.

1. Match the spoken language with the relevant sections from the HKIE Rules of Conduct.

HKIE Rules of Conduct	Spoken language
In pursuance of this rule a member shall, inter alia*:	"Engineers have to continue to learn and become better at their jobs."
1.1 discharge his professional responsibilities with integrity, dignity, fairness and courtesy;	"Engineers need to be polite to people."
1.5 ensure adequate development of his professional competence;	"The welfare of the public is the most important thing for engineers to consider in their work."
1.9 when working in a country other than Hong Kong order his conduct according to the existing recognised standards of conduct in that country, except that he should abide by these rules as applicable in the absence of local standards;	"If you are working outside Hong Kong, you must follow the standards of conduct in that country. But if there are no standards of conduct, then you have to follow the HKIE Rules of Conduct."
Rule 4 Responsibility to the Public	"Engineers should try their best not to waste resources."
A member of the Institution in discharging his responsibilities to his employer and the profession shall at all times be governed by the overriding interest of the general public …	"Engineers ought to avoid creating waste."
In particular in the exercise of the requirement to safeguard the public in matters of welfare, health and safety, engineers should:	"Engineers must be honest and fair in their work."
4.4.b. aim to minimise the use of non-renewable resources, to conserve energy and to minimise the generation of waste;	

Do the spoken versions convey exactly the same information as the written versions?

*The Latin phrase *inter alia* is used to show that the list that follows does not include everything that could be included in a list of ethical rules.

2. Work with a partner to decide if the following items from the HKIE Rules of Conduct are understandable or not. How could you express the items that are difficult to understand in appropriate spoken language?

HKIE Rules of Conduct	Spoken language
In pursuance of this rule a member shall, inter alia: 1.7 not undertake responsibility which he himself is not qualified and competent to discharge;	
2.2 assist and support colleagues and engineering trainees in their professional development;	
3.4 where possible advise those concerned of the consequences to be expected if his engineering judgment, in areas of his technical responsibility, is over-ruled by a non-technical authority;	
3.6 neither give nor accept any gift, entertainment, payment or service of more than nominal value to or from those having a business relationship with his employer or client, without the consent of the latter;	
4.3 seek to extend public understanding of the engineering profession	

3. Complete the table with the appropriate modal verbs.

HKIE Rules of Conduct	Spoken language
Modal verb used to show obligation:	Modal verbs used to show obligation: Must,
Modal verbs used to give advice:	Modal verbs used to give advice: ought to,

Follow-up activity: Engineers and moral dilemmas

There are many useful readings on the Internet on engineering ethics that can enhance your understanding of related issues, one of which is included overleaf. The title of the article is:

Engineering and the problem of moral overload

Read the article and think about the following questions:

- What problems does the author describe in the way that engineers tackle ethical dilemmas?
- Are any solutions suggested or implied in the article?
- What is your evaluation of these solutions?
- What do you think are the limits of the ethical responsibilities of an individual engineer?

Engineering and the problem of moral overload (adapted)

Engineers are often confronted with moral dilemmas in their work because they are presented with conflicting requirements. They are supposed to accommodate, for example, both safety and efficiency, security and privacy, accountability and confidentiality. The standard reaction to moral dilemmas is to try and weigh up the different moral considerations and establish which values are more important for the engineering task at hand, and to think about tradeoffs or justifications for giving priority to one of the values at play.

One way of handling an ethical dilemma is to look for the option that is best when all things are considered. This usually implies a trade-off among the various relevant value commitments. Value commitments can, however, not always be traded off: no money in the world can compensate for the loss of a dear friend. When trade-offs are used they often result in feelings of moral guilt or regret.

In some cases, it is possible to subsume the conflicting values under a higher order value. One example is the formulation of the value 'sustainable development' in response to the perceived conflict between the value of economic development and the abatement of poverty on the one hand, and environmental care and care for future generations on the other hand. Although higher order values, like sustainability, may be useful to decide how to act in a moral dilemma, they do often not resolve the dilemma. Even if a justified choice may be made in a dilemma on the basis of an overarching value, the result may still be unsatisfactory.

Sometimes making a trade-off is the only solution but sometimes our moral dilemmas are amenable to a technical solution. Since a moral dilemma is constituted by a situation in the world which does not allow us to realize all our moral obligations in that situation at the same time, solutions to a dilemma may also be found by changing the situation in such a way that we can satisfy all our value commitments. In fact, it could be argued that engineers have a moral responsibility to prevent situations which can lead to ethical dilemmas and which must inevitably lead to sub-optimal solutions or compromises and trade-offs from a moral point of view.

Technical innovation is an important means for reducing or even avoiding difficult moral considerations on a collective level and dealing with ethical dilemmas on an individual level. Innovation can make the impossible possible, in the sense of ''feasible'' or ''physically realizable.'' For example, environmental technology in Germany is among the most advanced in the world. One of the reasons why is because in Germany in the 1960s the Green Party was very influential and pressured the government to reconcile economic growth with the protection of the environment. This resulted in the development of technology which allowed Germany to produce and grow without polluting the environment, and avoided engineers and planners having to make difficult ethical choices between economic growth and environmental protection.

Texts and videos used in this lesson

Pre-task activity

The Hong Kong Institute of Engineers, "Why ethics concerns you?" in *Ethics in Practice E-Learning Package for Professional Engineers*. [Online]. Available: http://www.hkie.org.hk/cpd/icac/why_text.html

World Federation of Engineering Organizations, "WFEO Model Code of Ethics," [Online]. Available: http://www.wfeo.org/wp-content/uploads/code_of_ethics/WFEO_MODEL_CODE_OF_ETHICS.pdf

Task 1

World Federation of Engineering Organizations, "WFEO Model Code of Ethics," [Online]. Available: https://www.wfeo.org/code-of-ethics/

The Hong Kong Institute of Engineers, *Ethics in Practice E-Learning Package for Professional Engineers*. [Online]. Available: http://www.hkie.org.hk/cpd/icac/case_text.html

Follow-up activity

Adapted from J. Van den Hoven, G.J. Lokhorst & I. Van de Poel, "Engineering and the problem of moral overload," *Sci Eng Ethics (2012) 18*:143–155. https://doi.org/10.1007/s11948-011-9277-z

1.2 Analyzing ethical issues in engineering

You will:

- Analyze ethical problems faced by engineers in the workplace;
- Apply a systematic approach in ethics analysis;
- Examine vocabulary use in codes of ethics.

Pre-task activity: Analyzing an ethical dilemma

The following structure (the four "Ds") can be used to analyze an engineering ethics issue systematically.

(a) **Describe** the stakeholders, the facts of the case, causes of the problems and what harm has been, or is likely to be, caused.

(b) **Determine** the ethical issues arising from the case. How can the ethical problem be defined? What is wrong and what ethical codes have been breached?

(c) **Discuss** what options exist for the stakeholders. There may be several options.

(d) **Decide** which option is the most ethical. Each possible option should be evaluated and the best one selected.

Read the following summary of an ethical dilemma, and use the ethical decision-making process to analyze the situation, referring to the HKIE Rules of Conduct and the WFEO Model Code of Ethics.

A Sinking Situation

Roscoe is the head of engineering at a systems engineering company. His company has been contracted by a company, U-sub, to make firing assemblies for torpedoes. This contract calls for additional safety testing to ensure that the systems work properly.

The contract stipulated that it was the responsibility of Roscoe's company to pay for this expensive additional testing. However, the CEO reminds Roscoe that their company is in financial trouble and asks Roscoe to skip the extra testing and falsify the paperwork by saying that the testing had occurred and that the systems passed. He then goes on to tell Roscoe that if he doesn't sign off on the testing, he will be fired.

What should Roscoe do?

Task 2 Discussing ethical issues

Case Analysis and Presentation

Your group will be assigned one case, which involves an ethical problem.

1. Read the case and analyze the problem together, using the ethical decision-making process.

2. You will be assigned to different groups, and you will report your analysis of the case to your new group members. In your presentation, you should:

   - Establish the facts of your case with reference to the named engineer.
   - Explain the ethical problem and tell your new group which sections of the WFEO / HKIE codes of ethics have been breached.
   - Tell them your preferred solution and explain why you think it is the best solution.

Ethical Case 1

Allen is a senior software systems team expert, hired by INNOVATE, a start-up company, to help in the development of a new product. He soon realizes that the product is based on proprietary software for which INNOVATE does not have a license. Allen assumes that this is some sort of mistake and speaks to the CEO about the matter. He is assured that this is an oversight and this mistake will soon be rectified. But time passes and nothing is done. Allen then finds other instances of the same practice. What should Allen do?

Ethical Case 2

Michelle is the Regional Engineering Director for a multinational chemical company. After an explosion at a chemical plant, she is responsible for preventing similar accidents at 6 other plants in different Asian countries. The inquiry team has been unable to identify the cause of the explosion with complete accuracy, and they have recommended that she try to discuss the situation with competitor companies. This would enable all the companies to share knowledge and potentially avoid more disasters. But such sharing of information has never been done before, and sensitive technical and commercial information may be disclosed to the competitors.

Ethical Case 3

Eric works at an environmental engineering consulting firm. His main role is to advise clients on what type of action to take when they are faced with risks and liabilities while conducting projects. One client is a developer who has plans to build a residential complex and shopping mall within

approximately 50 meters of a wetland which is home to a variety of wildlife. The client needs to make sure that a proper waste management plan is in place so that contamination will have minimal effect on the environment. The client comes up with a cost-effective solution which satisfies, but does not go beyond the bare minimum of local environmental regulations. Eric estimates that the environment would be subject to a low level of contamination that would, within five to ten years, have a serious negative effect on the wetland.

Ethical Case 4

Anna is a partner in an environmental engineering firm and is requested by a developer client to prepare an analysis of a piece of land next to a wetlands area for potential development as a residential complex. During the firm's analysis, one of the engineering firm's biologists reports to Anna that in his opinion, the development project could threaten a bird species that inhabits the protected wetlands area. The bird species is considered a "threatened species" but not an "endangered species." In subsequent discussions with the developer client, Anna verbally mentions the concern, but she does not include the information in a written report that will be submitted to the public authority that is considering the developer's proposal.

Ethical Case 5

Michael is asked to investigate the structural integrity of a 60-year-old, occupied, apartment building, which his client is planning to sell. Under the terms of the agreement with the client, the structural report written by Michael is to remain confidential. In addition, the client tells Michael that he is not planning to repair or renovate the building before selling it. Michael performs several structural tests on the building and determines that the building is structurally sound. However, the client confidentially informs Michael that there are problems with the building's electrical and mechanical systems which violate safety standards. While Michael is not an electrical or mechanical engineer, he realizes those problems can cause injury to the occupants of the building and tells this to the client. He also mentions these problems in his written report for the client. However, he does not report the safety violations to any third party.

Ethical Case 6

Steve is an engineer who is well-known for his expertise in sustainable design issues. A local company, "Green Solutions," which supplies the construction industry with "green" building materials, invites him to give a presentation at an industry educational conference on green building design and related sustainable design issues. The conference will take place in an Asian city and Steve agrees to participate. "Green Solutions" offers to pay Steve's expenses: return air ticket, all meals and hotel accommodation, and Steve accepts the offer. While travelling with the representative of "Green Solution," Steve shows his PowerPoint slides and explains his views about sustainability. The representative then requests that Steve include within his slide presentation some slides that highlight his company's green building products.

Language focus: Vocabulary use in codes of ethics

Read these pairs of sentences from the WFEO and the HKIE codes of ethics. Each pair of sentences is about the same ethical issue but the two codes have a slightly different perspective on the issue.

1. Responsibilities to the public and the environment

Do the underlined words have the same meaning?

WFEO
4.3 Promote and protect the health, safety and well-being of the community and the environment
In practice, this means:
a) <u>having due regard for the health, safety and well-being of the public and fellow employees</u> in all work for which they are responsible.

HKIE
A member of the Institution in discharging his responsibilities to his employer and the profession <u>shall at all times be governed by the overriding interest</u> of the general public, in particular their environment, welfare, health and safety.

2. Responsibilities to avoid waste and environmental damage

Could you replace the underlined words with, "taking reasonable steps to accomplish"?

WFEO
4.2 Be mindful of the economic, societal and environmental consequences of actions or projects
In practice, this means: … <u>striving to accomplish</u> the beneficial objectives of your work with the lowest possible consumption of raw materials and energy and the lowest production of waste and any kind of pollution.

Could you replace the underlined words with, “strive to avoid”?

HKIE
A member shall…
1.4. take reasonable steps to avoid damage to the environment and the waste of natural resources or the products of human skill and industry.

3. Restoring a damaged environment

Do these two sentences mean the same? Underline any key words or phrases.

WFEO
4.1 Create and implement engineering solutions for a sustainable future
In practice, this means: … promoting a clear understanding of the actions required to restore and, if possible, to improve the environment that may be disturbed, and include them in your proposals;

HKIE
A member shall …
4.4 seek to assess the environmental consequences of work for which he is responsible and to influence events so as to prevent or minimise damage to, and if practicable to improve, the environment.

4. Taking account of environmental and social issues in their work

Do these two sentences mean the same? Underline any key words or phrases.

WFEO
4.2 Be mindful of the economic, societal and environmental consequences of actions or projects.
In practice, this means … rejecting any kind of commitment that involves unfair damages to human surroundings and nature and aim for the best possible technical, social and political solution;

HKIE A member shall … seek to balance costs with the best benefit to the environment and to human society and aim for the best possible technical, social, and political solution;

5. Compare the provisions on environmental protection in the WFEO and HKIE codes.

Discuss with your group:

- Can you see any more differences in the attitude to environmental protection in the two codes?
- Which code has the strongest position on environmental protection?

Follow-up activity: “Incident at Morales”

“Incident at Morales” is a fictional account of an engineering ethics dilemma, based on real-life cases. The drama was produced by the National Institute for Engineering Ethics at Texas Tech University.

Watch the video and be prepared to work on tasks related to the video in Lesson 1.5.

Texts and videos used in this lesson

Pre-task activity

C. Bartlett, “A Sinking Situation,” Markkula Center for Applied Ethics, Santa Clara University, 26-Aug-2015. [Online]. Available: https://www.scu.edu/ethics/focus-areas/more/engineering-ethics/engineering-ethics-cases/a-sinking-situation/

1.3 Identifying causes in engineering disasters (1)

You will:

- Analyze the possible causes of engineering disasters;
- Present on an engineering disaster paying attention to clarity and coherence;
- Revise the language of cause and effect.

Pre-task activity: Engineering disasters

1. Name at least 3 engineering disasters that you can think of.

2. Discuss with a group:

   - What causes engineering disasters?
   - Why is it important to study engineering disasters?
   - What are the roles of engineers in handling engineering disasters?

Task 3 Understanding engineering disasters

1. Work in groups, each of which will be assigned one of the engineering disaster cases below.

2. Read the extract and watch the video, paying attention to the key events, the possible causes and the responsibility of various personnel involved.

Hyatt Regency walkway collapse
[Video] https://www.youtube.com/watch?v=VnvGwFegbC8 (4.20 mins) On July 17, 1981, two walkways directly above one another collapsed at the Hyatt Regency Kansas City Hotel in Kansas City, Missouri, United States. They crashed onto a tea dance being held in the hotel's lobby, killing 114 and injuring 216. This disaster contributed many lessons to the study of engineering ethics and errors, and to emergency management. The event remains the deadliest non-deliberate structural failure in American history.

Texas City Refinery explosion
[Video] https://www.youtube.com/watch?v=c9JY3eT4cdM (5.56 mins) The Texas City Refinery explosion occurred on March 23, 2005, when a hydrocarbon vapor cloud was ignited and violently exploded at the isomerization (ISOM) process unit at BP's Texas City refinery in Texas City, killing 15 workers, injuring 180 others and severely damaging the refinery. The Texas City Refinery was the second-largest oil refinery in Texas, and the third-largest in the United States with an input capacity of 437,000 barrels (69,500 m3) per day as of January 1, 2000.

3. Each group should prepare a 5-minute presentation in response to the following questions:

a) What happened? (Key events)	
b) Why did it happen? (Possible causes)	
c) Who was at fault? (Stakeholders)	

4. Prepare a short outline (or a PowerPoint slide) and then practice your presentation. You will give your presentation to another group.

Outline

While watching, complete this short evaluation form for each presenter.

Were the details of the case presented clearly?	
Was the overall structure of the presentation logical and coherent?	
Was the language used appropriately?	

5. After all the presentations are finished, give verbal feedback to the presenters, using your notes.

Notes

Language focus 1: Summarizing the events

In a case analysis, you should summarize the important events to your audience, so that they have a clear idea of what happened in the disaster. You should be able to convey the most important information concisely and accurately. Read the two examples below which summarize the Toyota Recall Scandal that shook the industry in 2009 to 2011.

- Which summary is more effectively written? Comment on if the writer has used the following strategies:

1. **Select** the most important information
2. **Split** up the information into logical parts
3. **Sequence** the parts to tell a compelling story

- What tenses are used? Why do you think these tenses are used?

Example 1

Toyota, a Japanese automobile company, began its manufacturing in the US in 1986. Since then, it gained reputation as a firm that produces stable and safe vehicles. Nevertheless, its fame did not last long as the "Toyota Recall" incident took place. In 2007, some consumer complaints were reported about the entrapment of accelerator pedals in the floor mats. After a period of time, more accidents happened to Toyota vehicles. The National Highway Traffic Safety Administration (NHTSA) asked Toyota to recall their vehicles after more cases were reported regarding problems in repaired cars. Due to its failure to notify NHTSA about the defects in the cars in the given period, Toyota had to pay a huge fine. In 2010, Toyota's president apologized and implemented pedal repair in more than 5,000,000 vehicles. In 2014, Toyota was fined for $1.2 billion for misleading customers and providing them inaccurate information.

Example 2

In January 2010, the Japan-based automotive manufacturer Toyota Motors Corporation launched the largest recall ever in its history, involving almost 12 million of vehicles sold worldwide, which threatened its reputation in the automotive market. An investigation led by the National Highway Traffic Safety Administration (NHTSA) since 2007 hinted at the probability of flaws present in Toyota vehicles. In March 2014, Toyota was fined $1.2 billion by the US Justice Department for providing misleading information to their customers in order to protect the company's image.

Language focus 2: Describing cause and effect

When writing a case analysis, you often need to describe cause and effect. Read the following accounts of some well-known engineering disasters. Circle the best item to complete the incident summary.

Famous Engineering Disasters	
Hindenburg disaster (1937) – The LZ 129 Hindenburg was a German passenger airship that caught fire and crashed during its attempt to dock in New Jersey. 36 people died in the disaster. Decades of tests came to the same conclusion: the airship caught fire **owing / resulted / because of** an electrostatic discharge that ignited leaking hydrogen from the 200 million liters of hydrogen gas.	
Tacoma Narrows Bridge collapse (1940) – The first Tacoma Narrows Bridge was a suspension bridge in Washington State that opened in 1940 and collapsed in the same year. The bridge was known to move vertically in windy conditions, and on November 7, 1940, under a 40-mph wind, it collapsed. The failure was **because / attributed to / produced** aeroelastic flutter – a dynamic instability of an elastic structure.	
Hyatt Regency Hotel Walkway Collapse (1981) – On July 17, 1981, two vertically walkways collapsed at the Hyatt Regency in Kansas City, falling into the hotel's lobby. 114 people were killed. Serious flaws in the design of the walkways **contributed / resulted / led** to the accident.	
Space Shuttle Challenger disaster (1986) – On January 28, 1986, the NASA Space Shuttle Challenger broke apart 73 seconds into its flight, killing all 7 astronauts on board. The catastrophe was **caused / generated / ascribed** to aerodynamics forces which broke the shuttle apart.	
Chernobyl disaster (1986) – The Chernobyl disaster was a nuclear accident at the Chernobyl power plant. On 26 April 1986, during a systems test, there was an unexpected power surge that began a chain of events which subsequently **precipitated / resulted from / prompted** explosions.	
Space Shuttle Columbia disaster (2003) – On February 1, 2003, the Space Shuttle Columbia disintegrated during its re-entry to the Earth's atmosphere. The investigation showed that during the launch, a piece of foam insulation broke off from the shuttle and hit the left wing, damaging the tiles that protect the shuttle from the incredible heat produced during re-entry. Upon re-entry, these tiles failed, **causing / making / due to** the disintegration of the shuttle.	

Follow-up activity: Case work

Read the materials for your case and identify the key information. Discuss the possible causes and related problems with your group members.

Texts and videos used in this lesson

Task 3

"Hyatt Regency walkway collapse," *Wikipedia, The Free Encyclopedia*, 20 June 2021. [Online]. Available: https://en.wikipedia.org/wiki/Hyatt_Regency_walkway_collapse

VIDEO 1

"The Disaster That Changed Engineering: The Hyatt Regency Collapse," 14 March 2017. [Video file]. Available: https://www.youtube.com/watch?v=VnvGwFegbC8

"Texas City Refinery explosion," *Wikipedia, The Free Encyclopedia*, 21 April 2021. [Online]. Available: https://en.wikipedia.org/wiki/Texas_City_Refinery_explosion

VIDEO 2

"CSB Safety Video: Explosion at BP Refinery," 6 March 2007. [Video file]. Available: https://www.youtube.com/watch?v=c9JY3eT4cdM

Language focus

Adapted from "10 Most Famous Engineering Disasters," 10MostToday.com. [Online]. Available: https://10mosttoday.com/10-most-famous-engineering-disasters/

1.4 Identifying causes in engineering disasters (2)

You will:

- Read investigation reports of a major engineering disaster;
- Learn to achieve depth and coherence in a cause analysis;
- Examine the features of analytical writing.

Pre-task activity: The Deepwater Horizon disaster

Deepwater Horizon

Gulf of Mexico

In this lesson, you will analyze an engineering disaster which is considered one of the world's largest man-made catastrophes: the Deepwater Horizon oil spill.

1. The accident happened on 20 April 2010 in the Gulf of Mexico. Do you know what happened in the disaster? Do your classmates know? Tell each other.

2. View the first minute of a video of the Deepwater Horizon disaster. The man in the clip asked, "Why did this happen? What could possibly have gone wrong?" What causes do you think will be discussed in the video?

Task 4 What caused the Deepwater Horizon disaster?

"Complex systems always fail in complex ways."

You will now analyze the Deepwater Horizon blowout by following the ethical decision-making process that was introduced in Lesson 1.2. Do you remember the four steps of this process?

1. Begin your analysis by establishing the facts and causes of the case. Do the following:

   - Work in groups of three. Each student should read one of the extracts on pp. 55 - 57 to identify the critical events and causes of the disaster.

   - Report your findings to the rest of the group. Together, discuss the interlinked events that led to the explosion.

   - Consolidate all the causes, and then classify them into three categories.

Extract 1	The causes were …… factors.
Extract 2	The causes were …… factors.
Extract 3	The causes were …… factors.

2. Continue your analysis by assessing the importance of the causes. Remember that while causes may be interlinked, some factors may be more significant than others.

   In groups, discuss these questions, giving reasons or evidence for your opinion:

   - Which cause was the immediate or initiating cause that led to the explosion?
   - Which causes contributed to it?
   - Which was the most important cause?

   Listen to the reports by the other groups. Which analysis is the most logical and convincing?

3. What ethical issues in engineering does this case bring up?

4. Now write a short paragraph analyzing the causes of the Deepwater Horizon oil spill for an Internet forum on engineering ethics. You may begin your paragraph with the following sentence, or choose a different opening:

> "There are three main causes for the Deepwater Horizon disaster."

As you write, remember to:

- explain the significance of what happened
- analyze the causes by evaluating their relative importance
- use evidence to support your analysis
- draw a conclusion

5. Type up your paragraph on the causes of the Deepwater Horizon disaster, and post it at Canvas as Practice Task 1.

Final Report of the Deepwater Horizon Study Group from the Center for Catastrophic Risk Management (CCRM) of the University of California at Berkeley, March 2011 (extract) 1

Analyses of currently available evidence indicate the single critical element precipitating the blowout was the undetected entry of high pressure – high temperature 'highly charged' hydrocarbons into the Macondo well. This important change in the 'environment' was then allowed to exploit multiple inherent weaknesses in the system's barriers and defenses to develop a blowout. Once the blowout occurred, additional weaknesses in the system's barriers and defenses were exposed and exploited to develop the Macondo well disaster.

The Macondo well blowout most probably was initiated with a breach in the well structure at its bottom – some 18,000 ft below the sea surface and approximately 13,000 ft below the seafloor. Undetected, a large quantity of hydrocarbons entered the bottom of the well as it was being prepared for temporary abandonment. Multiple tests failed to disclose the breach or the entry of hydrocarbons into the well.

Due to the displacement inside the well of the upper 8,300 ft of heavy drilling fluids with lighter seawater, there were large reductions in pressures inside the well that allowed substantial quantities of gases to evolve from the hydrocarbons.

As the gases rose inside the well bore, they rapidly expanded in volume as they entered the lower pressures near the surface. Seawater, drill mud, and other fluids in the well bore were pushed ahead of the rising and expanding gases. This stream of gases and fluids were followed by high-pressure oil, gases, and other fluids from the reservoir.

The volumes and pressures of the seawater, gases, drilling mud, and other fluids in the well bore overcame the separator allowing gas and the other well fluids to escape onto the drill deck and surrounding facilities. Emergency alarms and shut-down equipment and processes failed to function. The gas ignited resulting in two or more explosions that ultimately reached the drill deck – killing the eleven workers who were struggling to stop the blowout.

National Commission on the Deepwater Horizon Oil Spill and Offshore Drilling – Chief Counsel Final Report (Extract) 2

The full report by the National Commission on the Deepwater Horizon Oil Spill and Offshore Drilling examines in depth the history and current status of Minerals Management Service (MMS) regulatory programs, and makes specific recommendations for regulatory reform.

MMS Background

MMS, now the Bureau of Ocean Energy Management, Regulation and Enforcement, employs approximately 600 individuals to run operations in the Gulf of Mexico region. About one-fifth of that staff is distributed among five district operations offices. Each district office has a small cadre of engineers, including drilling engineers. Drilling engineers review drilling permit applications.

The MMS office that supervised drilling in Mississippi Canyon Block 252 had one designated drilling engineer for the review of permits. That individual thus reviewed several hundred permits each year and approved BP's initial application for a permit to drill (APD) a well at Macondo, as well as subsequent applications modifying that permit.

Findings

The Commission finds that:

- MMS had a built-in financial incentive to promote offshore drilling that was in tension with its mandate to ensure safe drilling and environmental protection;
- revenue increases dependent on deepwater drilling came with increased safety and environmental risks, but those risks were not matched by greater, more sophisticated regulatory oversight;
- MMS was unable to maintain up-to-date technical drilling-safety requirements to keep up with industry's rapidly evolving deepwater technology. As drilling technology evolved, many aspects of drilling lacked corresponding safety regulations; and
- at the time of the blowout, MMS systematically lacked the resources, technical training, or experience in petroleum engineering that is critical to ensuring that offshore drilling is being conducted in a safe and responsible manner.

Final Report of the Deepwater Horizon Study Group from the Center for Catastrophic Risk Management (CCRM) of the University of California at Berkeley, March 2011 (extract) — 3

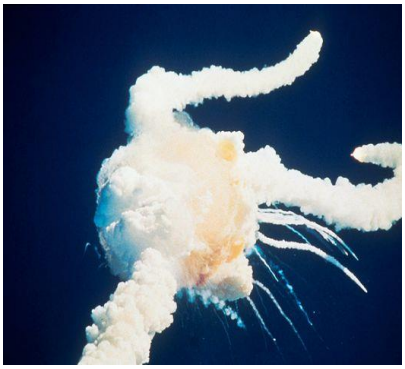
This disaster was preventable if existing guidelines and practices had been followed. BP's organizations and operating teams did not possess a functional safety culture. Their system was not propelled toward the goal of maximum safety but was rather geared toward compliance rather than being focused on the big picture. BP lacked the willingness and competence to draw the right conclusions from the system's safety signals.

The Macondo well disaster was an organizational accident whose roots were deeply embedded in imbalances between the system's provisions for production and those for protection. The multiple failures that unfolded and led to this disaster appear to be deeply rooted in a multi-decade history of organizational malfunctions and shortsightedness. There were many chances to do the right things in the right ways at the right times, but the management failed to recognize and accept its own shortcomings.

Analysis of the available evidence indicates that when given the opportunity to save time and money – and make money – poor decision making played a key role in accident causation. The safety tradeoffs that were made were perceived as acceptable with no recognition of the possible consequences of failure. There were no effective industry or regulatory checks and balances to counteract the increasingly deteriorating and dangerous situation on Deepwater Horizon. Thus, safety was compromised to the point that the blowout occurred with catastrophic effects.

Literacy focus: Features of analytical writing





The Challenger explosion, in 1986, was another major engineering accident. Read the following summary about the event.

The Space Shuttle Challenger disaster occurred on January 28, 1986, when Space Shuttle Challenger broke apart 73 seconds into its flight, leading to the deaths of its seven crew members. The spacecraft disintegrated over the Atlantic Ocean, off the coast of central Florida, United States, for a number of reasons.

You will now read two extracts which analyze the causes of the Challenger explosion. Discuss the questions below them in groups to find out the qualities of an effective cause analysis.

Extract 1

Several factors contributed to the Challenger accident. First, communication was felt to be an issue as the engineers could not convince the management team at NASA that the launch of the space shuttle should be terminated [3]. It was apparent that the management faced major problems, right from the beginning, but they tried to resolve them themselves rather than communicating them with others.

Another cause was leadership. NASA adopted an organizational structure in which everyone had to adhere to their assigned roles rigidly. No exceptions were allowed. The management's actions were motivated by their own needs and beliefs, and they appeared to put self-image before other equally important issues.

A third cause was the influence of the media. Their 24/7 coverage of NASA put the space organization under tremendous pressure to launch the shuttle on time. It was feared that an unnecessary delay would lead to a tarnished public image. The pressure to achieve laudable flight rates also played a role. Thus the potential risks associated with the launch were disregarded.

Extract 2

Investigation carried out into the disaster revealed that the accident could be attributed directly to a design flaw [3]. The O-rings that were supposed to seal the aft field joint on the right solid rocket booster had become brittle in the low temperature of the day, causing pressurized hot gases to leak and eventually flames to “blow by” the O-rings. The flame ignited the adjacent external tank causing major structural failure.

That the O-ring problem was left to persist in the system suggested the presence of other contributing factors, the most salient of which being the failure of both NASA and its contractor, Morton Thiokol, to respond adequately to the design flaw. It was found that as early as 1977, NASA managers already knew about the flawed O-ring but they did not address the problem adequately. The Presidential Commission investigating the accident concluded that the Challenger disaster was "an accident rooted in history" [4].

More broadly, the decision-making process that led to the launch of the Challenger was strongly criticized. Evidence was found that engineers’ concern about the O-rings and their plea to delay the launch did not reach the highest circle of NASA. The NASA management structure also lacked major checks and balances to ensure that the opinions of all members were heard and thoroughly considered [5]. Such deep-seated issues in the management indirectly led to the decision to launch the flight based on incomplete and misleading information.

- Which extract is more effectively written? Why?
- Are the causes well-chosen and convincingly explained? Why or why not?
- Are the paragraphs easy to follow? If yes, what has the writer done to achieve this? If no, make suggestions for better focusing in paragraphs.
- Is there a progressive development in the whole text? How is this development, if it exists, brought to the reader? If no, make suggestions to bring some connection to the text.

Texts and videos used in this lesson

Pre-task activity

W. May, “Mega Disasters - The Deepwater Horizon,” 13 Nov 2016. [Video file]. Available: https://www.youtube.com/watch?v=oLp9Bx43tho

EXTRACTS 1 & 3

“Final Report on the investigation of the Macondo Well blowout,” Deepwater Horizon Study Group of the Center for Catastrophic Risk Management, Mar 2011. [Online]. Available: http://ccrm.berkeley.edu/pdfs_papers/bea_pdfs/DHSGFinalReport-March2011-tag.pdf

EXTRACT 2

National Commission on the Deepwater Horizon Oil Spill and Offshore Drilling, “Chief Counsel Final Report,” 1 Nov 2011. [Online]. Available: http://www.oilspillcommission.gov/sites/default/files/documents/C21462-407_CCR_for_print_0.pdf

Literacy Focus

EXTRACT 2: Adapted from: “Rogers Commission Report,” *Wikipedia, The Free Encyclopedia*, 3 Jun 2013. [Online]. Available: http://en.wikipedia.org/wiki/Rogers_Commission_Report

1.5 Analyzing ethical implications arising from engineering incidents (1)

You will:

- Identify ethical issues in engineering incidents;
- Explore the scope of ethical analyses;
- Learn useful vocabulary and expressions for talking about ethical rules, conflicts and obligations.

Pre-task activity: Analyzing ethical implications

In groups of 3 or 4, examine the following scenario and discuss its ethical implications.

Winston is an electrical engineer at Interests Engineering Company, where he is responsible for overseeing the work of subcontractors and handling their invoices and other claims. His performance has been considered excellent and he has recently been recommended for promotion by his immediate boss Ryan. In the meantime, he is on an assignment to supervise the wiring works for an audio system at a very large commercial complex. One day, he accidentally discovers that an invoice for $140,000 has been filed from a subcontractor called First-line Cable Works, but the company is not involved in the project. Eventually he finds out that it is all to do with Ryan who intends to pocket the money after conspiring with the client's engineering staff to inflate the project's costs. In fact, Ryan asks him to keep quiet and promises to secure his promotion. Not wanting to jeopardize his job, Winston …

Useful questions for discussing ethical implications of engineering cases:

- What is the ethical issue in question? How significant is this issue in the engineering profession?
- What rules of engineering ethics are relevant to the situation? Are there rules of obligation that would seem to be in conflict with each other in this case?
- Why has it been hard for Winston to decide what to do? Is he involved in a dilemma?
- Different options are open to Winston, such as he can decide to or not to blow the whistle. What would be the outcomes of his action on different parties – himself, Ryan, the client, Interests Engineering, the profession?

Task 5 Discussing ethical issues in "Incident at Morales"

"Incident at Morales" is a fictional account of an engineering ethics dilemma, based on real-life cases. The drama was produced by the National Institute for Engineering Ethics at Texas Tech University.

Here are the synopses of the episodes:

Episode 1

Fred Martinez is responsible for designing a chemical plant in Morales, Mexico for his employer, a U.S.-based company called *Phaust*. One of the reasons for locating the plant in Mexico is to cut construction costs by avoiding U.S. regulations on the treatment of waste water and environmental pollution. Fred learns that the budget for constructing the plant will now be cut by 20%. He is advised to save money on basic components by finding cheaper, Mexico-based suppliers. He is also advised to make the plant size smaller, even though in the long term that will raise the cost of manufacturing.

Episode 2

Under the tight financial environment imposed by *Phaust*, Fred is asked to reduce construction costs of the new chemical plant. Fred confronts several engineering decisions in which ethical considerations play a major role. One of these is, he needs to decide whether to use expensive controls manufactured by Lutz and Lutz, which has an inside connection at *Phaust*. Another is, he needs to decide whether to line the evaporation ponds to prevent the seepage of hazardous substances in the effluents into the groundwater, although local regulations do not require this level of environmental protection. In his visit to the *SuisseChem* plant in Texas, he is reminded that environmental laws in Mexico are more relaxed than in the US.

Episode 3

When samples of *Chemitoil*'s new paint remover, "EasyStrip," become available, it is clear that to be competitive with "EasyStrip," *Phaust* must change the formulation of its new paint remover, which requires higher temperatures and pressures than originally anticipated. However, under pressure of the budget, Fred cannot afford using pipes and connectors made with high pressure alloy. As the plant starts its test runs, some unexpected problems arise. Not only that the automatic control system fails, leading to the plant manager offering to control the process manually, leakage also occurs in one of the connections. After the plant goes into full operation, an accident occurs, and the plant manager is killed while manually controlling the manufacturing process.

A number of ethical issues are illustrated in the video, such as:

- Ensuring safety of operation
- Protecting the environment
- Protecting the safety, health and welfare of the public
- Being fair and responsible to colleagues and co-workers
- Being fair and responsible to clients and employers
- etc.

1. Work in groups of three with each group focusing on one of the episodes of “Incident at Morales”:

    - Discuss what ethical issues are illustrated in your episode.
    - Enhance your understanding of the issues by referring to relevant rules in either the HKIE or the WFEO codes of ethics.

Ethical issues identified and related rules of ethics		
Ethical issue 1		Related rules:
Ethical issue 2		Related rules:
Ethical issue 3		Related rules:

2. In the pre-task activity, 4 questions were introduced to guide you in discussing the ethical implications of Winston's case. Now apply what you have learnt to "Incident at Morales" and hold a discussion in a seminar style.

   - Discuss these questions with respect to the ethical issues that you have identified. You can choose one or two of these.

   - Members of the group will take turns to lead the discussion of the questions. Try to elicit the opinions of the other group members, and follow up on their responses if possible, to explore the questions.

Guiding questions for exploring ethical implications in your episode	**The group's ideas**
1 2 3	

3. Now you are ready to give a presentation regarding the ethical implications of an episode of "Morales". Form a new pair with a classmate who has worked on a different episode to yours. Organize your content so that your presentation is coherent to your listener.

Follow-up activity 1: Considering alternative actions

The tense system of English provides an important means for users of the language to locate events in time. Correct use of different tenses is imperative to anyone who needs to communicate ideas clearly and accurately.

1. Some events that take place in "Incident at Morales" are described below, with some of the verb tenses underlined. Explain to your classmate the effect of using these tenses.

a) It wasn't a good idea for Wally to tell Fred that the Lutz and Lutz representative in the U.S. was Chuck's family member. Lutz and Lutz controls are the best in the market and Fred would most likely have chosen them if Wally hadn't made him suspicious about the company.

b) Wally notices that there is a leak in the couplings in the chemical plant, and he knows this is dangerous. He needs to stop production immediately. If he does that, he can avoid an accident.

c) Wally shouldn't have allowed Manuel to make the decision to control the system manually. He could've delayed the opening of the plant until the problems had been resolved.

d) Environmental regulations are more relaxed in Mexico than in the US, but Fred is well aware that if he does not line the evaporation pond, Mexicans who live in the vicinity of the chemical plant will be poisoned by the seepage from the pond.

In items (a) and (c), _____

In items (b) and (d), _____

2. Practicing unreal conditionals

When you analyze an ethics case, you may need to use unreal conditionals to imagine a different past and a different result.

e.g. *The landslides would have been averted if adequate routine maintenance had been carried out.*

If soil nails had also been used, the failures might not have occurred.

If BP had explained how crucial the test was to the safety of the rig and its personnel, the crew members might have been more cautious in interpreting the results.

Sometimes, we use "had" with inversion:

e.g. Had the ground conditions been carefully considered in the design of the construction method, the severe pile movement could have been avoided.

The sinking of the Titanic is another famous engineering failure. How much do you know about this disaster? Skim read the following text to confirm your facts.

Warning Factors

Although it was considered a technological masterpiece at the time, the sinking of the Titanic revealed many engineering flaws (both in the design of the ship and the implementation of safety procedures) that led to catastrophic failure and the loss of over 1500 passengers. Many of those involved in the disaster believed that the R.M.S. Titanic was such an advanced vessel that it could never sink. However, flaws in the design of the ship together with poor environmental conditions and insufficient rescue equipment ended the ship's maiden voyage, resulting in one of the most catastrophic marine failures in history.

Errors

The Titanic collided with a 150,000- to 300,000-ton iceberg at 11:40 PM on 14 April 1912. Although the collision resulted from environmental conditions, other ships in the area had been sending warnings of ice for 60 hours before the collision. However, the Titanic was cruising at its maximum speed (22 knots), on a moonless night, which made it difficult for the crew to spot icebergs.

The design of the Titanic was problematic. The original design had two rows of lifeboats, enough for every passenger on the ship. However, one row was removed to improve the aesthetic appeal of the vessel, as it was believed that the ship was unsinkable. This action should never have been approved as it put the lives of the passengers at risk.

Another engineering flaw that was directly related to the sinking of the ship was the design of the "watertight" compartments that were located in the hull of the boat. There were 16 compartments that were supposed to be individually sealed, in case of water intake into the vessel. However, these compartments were not in fact sealed and the dividing walls between them did not extend all the way to the ceiling. Therefore, if a sufficient amount of flowing water entered a compartment, the water would flow over the walls and begin to fill the adjacent compartment. Unfortunately, the portion of the hull that was damaged by the iceberg filled with water quickly and tipped the bow forward. Water then rushed into the other compartments, preventing the ship from remaining afloat.

Complete these statements about the Titanic. Exchange your work with a classmate and give some feedback to each other.

a) If the ship had received warnings of ice, ……

b) If it had been a moonlit night, ……..…….

c) Had there been enough lifeboats, ……..……..…….....

d) …… if the compartments that kept the ship afloat had been sealed individually.

Follow-up activity 2: Describing ethical rules, conflicts and obligations

When you write your analytical report, you will need to refer to ethical rules and identify the obligations of engineers.

- Complete the gaps in the sentences with the words given. You may have to change the form of the words.
- Pay attention to useful collocation (e.g. the verb-noun collocation in “uphold the values”).

The following sentences describe ethical rules and obligations of engineers. Complete the gaps in the sentences with the words given. You may have to change the form of the words.

uphold	subject	state	arise
recognize	balance	precede	oppose
high	accord		

1. Rule 1.1 of the HKIE Rules of Conduct _____ that engineers should carry out their duties with integrity and dignity.
2. The situation can be resolved by looking at Rule 1.5, which _____ the importance of the professional development of engineers.
3. Professionals are increasingly _____ to organizational conflicts.
4. Engineers’ concern for public welfare may place them in _____ to their employers.
5. A professional engineer’s judgment could be called into question if disputes _____ in connection with his or her work.
6. The Code of Ethics lacks a clear answer as to which of the principles takes _____ in case of conflict.
7. It is difficult to _____ the obligations to the public and the obligations to the client.
8. This action was not in _____ with the mandate of the WFEO Code of Ethics.
9. In coming to a decision we must consider: loyalty to our coworkers, fidelity to our company, and honesty. Not all of these values can be _____, one or more may have to be violated in order to reach a decision.
10. Where the conflict is between loyalty and the protection of the public, the latter must be viewed as the _____ obligation for the engineer.

Texts and videos used in this lesson

Pre-task activity

Adapted from: The Hong Kong Institute of Engineers, Ethics in Practice E-Learning Package for Professional Engineers. [video file]. Available: http://www.hkie.org.hk/cpd/icac/case_text.html

Task 5

National Institute for Engineering Ethics, “Incident at Morales: An engineering ethics story,” 2005. [Online]. Available: http://www.niee.org/ProductsServices-IncidentMorales.htm

1.6 Analyzing ethical implications arising from engineering incidents (2)

You will:

- Identify the role of engineers in an engineering incident;
- Express your opinions in a suitable style in a formal report;
- Build up your analysis by applying different perspectives.

Pre-task activity 1: Identifying the role of engineers

In lesson 1.1, you learnt that engineering codes of ethics should be applied only to engineers – what they did and what they failed to do. Thus, in the case of Jackie and the Emergency Lights, it would be inappropriate to apply these rules to Charles who is an administrator.

Following this, it would be necessary for you to pay attention to the role of the engineers in your analysis of engineering ethics in your cases.

Think about the case of the Deepwater Horizon oil spill, the causes of which you already had some understanding of in lesson 1.4. Identify how engineers (in different positions, in different organizations, or at different times leading to the incident) were involved in the incident.

Engineers were involved in the following ways:

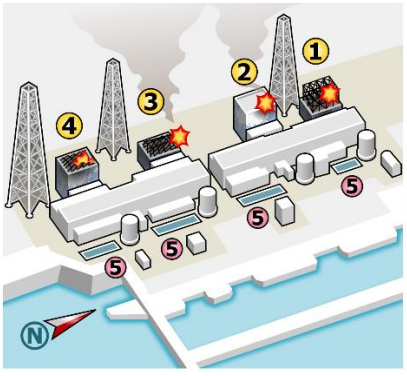
Pre-task activity 2: Writing about ethical implications

The genre of the analytical report gives you much freedom in selecting and organizing your content. While you are preparing yourself for the writing of your analytical report, you may want to consider different possibilities related to the ethical implications.

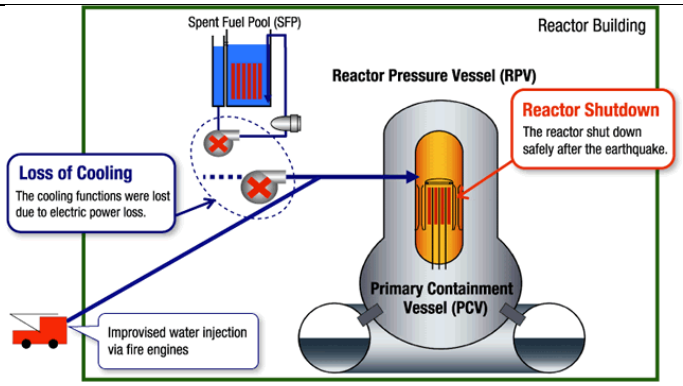
Discuss the following strategies regarding the ethical implications section. Do you want to adopt them in your report?

Strategy of writing	Yes	No	It depends
1. Cover the roles of various parties including government, company and technical personnel			
2. Refer to the rules only by number to save space in the report			
3. Discuss the application of the rules to the case in detail			
4. Support analysis with evidence in the case			
5. Include counter arguments			
6. Include balancing ideas			
7. Keep to one focus only in a paragraph			
8. Express personal opinions			

Task 6 Fukushima and engineering ethics



Layout of the Fukushima Daiichi NPS



Accident overview

Unit 1: Explosion, roof blown off (Mar 12); Unit 2: Explosion (Mar 15), contaminated water in underground trench, possible leak from suppression chamber; Unit 3: Explosion, most of concrete buiding destroyed (Mar 14), possible plutonium leak; Unit 4: Fire (Mar 15), water level in spent fuel pools partly restored; Multiple trenches at (5): probable source of contaminated water, partly underground, leaded stopped (Apr 16)

The Fukushima Daiichi nuclear disaster was a 2011 nuclear accident at the Fukushima Daiichi Nuclear Power Plant in Okuma, Fukushima Prefecture, Japan. The two diagrams on p. 70 summarize the events that took place.

The accident was primarily caused by the 2011 Tohoku earthquake and tsunami but in the Parliamentary report, the event was concluded to be a man-made disaster.

1. What do you know about the causes of the incident? What were the parties involved?

2. What is a good analysis of the engineering ethical implications of the Fukushima incident? Comment on these paragraphs drafted by 3 students who are working on the report. Put your comments in the form of dos and don'ts in the table overleaf.

Draft paragraph by student A

The main ethical issue arising from the accident is the failure of the engineers and relevant authorities to take the responsibility of securing the safety of the plant and protecting the welfare, health and safety of the public. Among them, the engineers at TEPCO have failed to practice a safe working culture and adhere to safety guidelines. They had known of the risks posed to the plant by a large tsunami, but the likelihood of one hitting the plant was disregarded [1, 3-4]. It is unacceptable for the engineers to risk the safety of the plant workers and of the public, especially if they had known about the possible consequences. They should have performed their duties with care and diligence, in accordance with article 2.1 of the WFEO Code [11].

Draft paragraph by student B

Since TEPCO is an electrical engineering company in Japan, the code of ethics of the Institute of Electrical Engineers of Japan is applicable. As can be seen in the last section, the company did not discharge its duty to uphold the security and sustainability of society and environment [5], because a significant number of residents were evacuated due to the radiation risk, and the soil and water in the area were contaminated by radionuclides. Abnormal levels of radioactive materials were detected in vegetables and fish, showing such substances entered the food chain and led to biological hazard [6]. TEPCO was critically liable for the accident because it planned the construction, monitored the operation and executed the safety measures of the nuclear plants.

Draft paragraph by student C

Some may argue that the inaction of the engineers was due to the TEPCO management's decision not to retrofit the older units because of the high expenditure associated with the upgrading process. However, this should not remove entirely the liability of the engineers, as they were obliged to express their honest opinions to their employers about the possible repercussions within their area of competence (WFEO articles 2.1, 4.3 in [11]). They should have explained to the management team the complications and threats that the flaw presented to the reactors. Admittedly it was a challenging situation that they operated in, and their obligations to the employers and their self-interest could have weighed heavily in their consideration, but they should also be aware that the interest of the public was paramount.

Use this table to record your comments about the 3 student paragraphs. Put the comments under "Dos" and "Don'ts" as appropriate.

Paragraph	**Dos**	**Don'ts**
Paragraph 1	Start with a topic sentence	
Paragraph 2		
Paragraph 3		

3. Discuss the ethical implications of your own case study. These generalized questions based on those used in the Winston case may be useful:

- What are the ethical issues in question? How significant are these issues in the engineering profession?
- What did the engineers do / fail to do? Why was it hard for the engineers concerned to decide on what to do? Were they involved in a dilemma?
- What rules of engineering ethics were relevant to the situation? Were there rules of obligation that conflicted with each other?
- Different options are open to the (groups of) engineers? What would be the outcomes of these actions on different parties (e.g. the public, the company, the profession, the engineers themselves, etc.)?

Follow-up activity 1: Using concession statements in an argument

Real life engineering incidents are often complex. It is common that actions taken, or decisions made are not entirely right or wrong. It is therefore quite important that you examine extents of responsibility rather than the presence or absence of it.

Using concession statements is a useful way to state your position without over- or under-committing yourself. In a concession statement, you accept some validity in a different view while you assert your own viewpoint. This is a way to make your reasoning stronger because you do not pretend that another side of your argument does not exist.

> *e.g.* ***While*** *Mexican environmental law does not require that an evaporation pond be lined,* ***it was only ethical*** *of Fred to do so, because it was the safety of the residents that was at stake.*

Here are some concession statements used to comment on ethical cases. Complete the sentences with the following expressions.

on the other hand	though there is	this fact might be taken to mean
at first glance it appears	despite not having	though it may be true that
admittedly		

1. _____ a few gallons of chemical spill over the limit would have no discernible effects on the public, we should consider what the effects would be if everyone in the industry bent the rules.

2. _____ that environmental concerns go beyond a concern for human health. This conclusion, however, requires close examination.

3. _____all the technical details, he made his report to the management.

4. One might argue that the hoisting lug design was inadequate. _____, the company which built the tower had been shown the design. They should have realized that the placement of the hoisting lugs was not in accordance with industry standards.

5. _____, such actions are permissible, but they are not consistent with an engineer serving her employer as a faithful agent.

6. Michael was at fault for forgetting about the valve, _____ not enough information to show how serious the impact of this error was.

7. _____ that the engineers undertaking this work were blameless as they were simply following their supervisor's instructions. Yet, as engineers test designs for ever-increasing speeds and loads, they must remember their social obligations to protect public welfare.

Follow-up activity 1: Writing in an objective and cautious tone

When discussing ethical issues, you often need to tell your reader your opinion about the issue. In formal academic writing, you would express this opinion in objective language, and you would also state the evidence that you have considered to arrive at the opinion. In other words, the "personal" opinion expressed in an analytical report is not strictly "personal". It is a piece of "informed" opinion that has grown out of your understanding of the facts.

Apart from objectivity, academic writing often indicates caution in judgment with hedging, which refers to the use of linguistic devices to express hesitation or uncertainty so as to demonstrate politeness and indirectness.

e.g. ***It appears that*** *a cautious approach should be followed.*

According to *the WFEO ethical code, engineers should not provide free engineering services.*

Here is another paragraph that has been drafted to discuss an ethical implication of the Fukushima case. Complete the paragraph by choosing the more appropriate expression.

The most important ethical issue involved in this case is the lack of foresight on safety concern especially in Japan, a country located along the active earthquake belt. It **is obvious to me** / **appears** that the engineers involved in this incident made two **dreadful** / **fatal** decisions. The first was the underestimation of the magnitude and frequency of earthquakes that might happen in the area during the operation life of the plant. Rule 4.1 of WFEO states that engineers should create solutions for a sustainable future [5]. In this case, **we can see that** / **Ø** the engineers from TEPCO **did not give any** / **failed to give adequate** attention to safe, sustainable operation. They **did not estimate** / **could have properly estimated** the potential risk of earthquakes in Fukushima. No security system is ever perfect. If they had fairly judged the situation and told the headquarters the danger that the Fukushima Nuclear Plant could face, they **might help to** / **would definitely** bring about corresponding maintenance to preempt this accident. The second wrong decision made was about the design of the MARK I reactor by General Electronics engineers. The MARK I reactor was discovered to have many problems after operation started. We **believe that** / **Ø** these engineers **held sole responsibility** / **should be deemed responsible** for providing technical solutions to these problems. If they **had insisted on** / **suggested** helping TEPCO fix the problems of the reactor, the nuclear meltdown and radiation emission **would not happen** / **could have been prevented** …

Follow-up activity 3: Useful Internet resources

Manipulating the tone and style of a piece of writing for a particular purpose is a continuous effort for any writer. The following resources are useful because they explain the principles underlying an academic style as well as provide useful practice tasks to help you develop your skills.

- **Using academic style and tone in writing**

  Practice strategies about how to eliminate personal pronouns, emotive language and phrasal verbs from writing, with practice tasks

  https://www.lc.cityu.edu.hk/ELSS/Resource/Academic%20Style%20and%20Tone%20ICOSA%20Version/

- **Hedging as a feature of academic writing**

  A good focus on the language of hedging, with practice items

  http://www.uefap.com/writing/feature/hedge.htm

Texts and videos used in this lesson

Task 6

Watch this documentary for an in-depth analysis of the causes of the Fukushima nuclear meltdown

“Inside Japan’s nuclear meltdown,” Frontline, PBS, 17 Mar 2021. [Video file]. Available: https://www.youtube.com/watch?v=qRKScRgsUaE

1.7 Finalizing your analytical report and citing sources

You will:

- Review how to write an effective introduction and conclusion to a report;
- Learn to acknowledge other people's ideas;
- Study the features of the IEEE citation style.

Pre-task activity: Understanding assessment criteria

Your analytical report will be assessed in four domains: task achievement, organization, vocabulary, and grammar. In groups, discuss what you need to do in order to perform well in each domain. Report your discussion to the whole class. Your lecturer will tell you whether you have missed anything.

Task achievement	Organization	Vocabulary	Grammar

Literacy focus 1: Writing the introduction

Like other text types, your analytical report needs an introduction. In groups, discuss:

1. What are 2-3 things you would include in this introduction?
2. How long should this introduction be?
3. Do you typically write the introduction first? Why/why not?

Now look at two introductions for two ethical reports on the topics of the Deepwater Horizon disaster and fracking respectively. Do the introductions include the 2-3 things you identified above? Which introduction do you like better? Why?

Introduction 1

On 20 April 2010, the Deepwater Horizon oil rig exploded. Now regarded as the worst environmental disaster in the history of the U.S., it resulted in 11 deaths and an ecosystem-level catastrophe in the Gulf of Mexico. Approximately 170 million gallons of oil flooded into the Gulf, killing whales, dolphins, seals and sea otters. Five years after the disaster, the environmental effects still linger and recovery is slow. This report will investigate the causes of the accident and explore its ethical implications.

Introduction 2

As natural resources continue to dwindle, the need for sustainable alternative energy becomes a greater issue. Thus, companies have been quick to invest in the extraction of natural gas through hydraulic fracking. However, in the process of drilling for natural gas, methane—a greenhouse gas—can escape and leak into the atmosphere, causing global warming. This is illustrated in the case of high methane emissions in southwestern Pennsylvania in 2014. This report will investigate the ethical implications that follow from fracking, and cover contamination reports and inappropriate treatment of fracking fluids.

Reflect on the above activity. Write your answer to the following question.

What should you do to write a helpful introduction for your analytical report?

Literacy focus 2: Writing the conclusion

1. What would you include in a conclusion?

2. The following conclusion is taken from a report that discusses the recall of motor vehicles by Toyota from 2007 to 2011. Is this conclusion effective? Is it helpful? Discuss with your classmates. Do you have any suggestions for improvement?

Conclusion

In conclusion, this report has analyzed the causes of the Toyota recall and investigated the ethical implications. It was found that Toyota didn't have a good design for the acceleration and braking systems because of cost consideration, and this caused the pedal to become stuck. Toyota also tried to hide their fault and responded to public inquiries slowly to escape from their responsibility. It was only right that they were fined in the end. I hope that this case will give a lesson to the vehicle manufacturing industry.

Literacy focus 3: Writing concisely

Being concise is essential in technical writing. When writing, don't use words and phrases which serve no real purpose.

Study the sentences below. Delete any unnecessary words or phrases. You may need to make some other changes.

1. The explanation for these trends is that warming will intensify the already existing mechanisms.
2. The process involves inserting a cylindrical in shape robot that fits inside the pipeline.
3. It is known that proteins perform many functions within organisms.
4. It should be pointed out that mercury poisoning can result from exposure to water-soluble forms of mercury.
5. We know from past experience that this solution will not work.
6. It should be borne in mind that there may be a high environmental contamination level.
7. Table 5 shows all the information relevant to costs.
8. This takes place for the period of time between May to August.
9. The affected skin turns red in color.

Literacy focus 4: Acknowledging other people's ideas

When writing an analytical report, you may need to draw on common knowledge (i.e. general knowledge that most people know). Common knowledge does not need to be cited. Other times, you may also need to rely on data, analysis and conclusions from various sources to support your points. These sources do need to be acknowledged; otherwise you may be accused of plagiarism.

1. Which of the following would need a citation?

a) The invention of the elevator made it possible for tall buildings to be constructed.

b) In Learning Space Theory (LST), the basic unit of knowledge is a parameterized question.

c) Animals have the benefit of millions of years of evolution, which has optimized their design towards efficient locomotion.

d) When the operators were on duty, they did not have enough communication with each other.

2. Now read the following text. Indicate where sources need to be mentioned.

In late 2015, mandatory drone registration went into effect in the United States. Since then, anyone who wants to fly a drone weighing over 0.25 kilogram must register with the U.S. Federal Aviation Administration to receive a unique identification number. This number needs to be placed on the drone, but there is no requirement for the tiny aircraft to broadcast signals to allow for remote identification. That might change in the future.

The FAA Extension, Safety, and Security Act of 2016 required the FAA administrator to "convene industry stakeholders to facilitate the development of consensus standards for remotely identifying operators." Earlier this year, DJI, the world's largest commercial drone manufacturer, outlined a general scheme for doing just that.

The Chinese company's proposal attempts to balance the public's interest in being able to identify who is using a drone with the privacy interests of the drone's owner or operator. As DJI points out, drone operators may want to maintain anonymity even if there are people around to witness their flights. Suppose, for example, a drone is being flown for the purpose of investigative journalism. In that case, the journalists involved might not want others to know what they are looking into.

3. In-text citations are often used to support the author's views or opinions. Consider the two examples below. In which example is the in-text citation more effectively used? Why?

Example 1

According to a report [7], an employee does not give up all of his or her privacy when entering the workplace. In other words, employees have the right not to be monitored by their employer as a means to increase the overall profits.

Example 2

Email surveillance in the workplace is necessary because individuals often overuse the Internet for purposes other than work. As reported in [6], Internet activities such as reading personal emails, visiting chat rooms, and checking personal finances may account for up to 51% of employees' time spent online. This indicates that the problem is very serious and appropriate measures must be introduced.

Literacy focus 5: Citing references in IEEE style

The Institute of Electrical and Electronics Engineers (IEEE) citation style is a popular format for writing technical papers and reports, especially in computer science. According to the IEEE Citation Style Guide, this style has three main features:

- Citations are numbered and enclosed by square brackets.
- Author names in in-text citations are optional.
- In the Reference list, the references are arranged according to the order that they are cited in the text.

A sample paper written in the IEEE style is available at Canvas. Pay attention to the format of the in-text citations and reference list. Follow this style when writing your assignments for this course.

The IEEE style differs from the APA style which you learned in Year 1. Compare:

APA	**IEEE**
One of the most challenging issues facing human-robot interaction is ethics (Ulam & Wagner, 2012).	One of the most challenging issues facing human-robot interaction is ethics [1].

What are the advantages of citing references in the IEEE style?

……

……

……

Engineering professors expect citation conventions to be used ***correctly*** and ***consistently***. If mistakes are made, the authors may be considered sloppy or unprofessional.

To learn the IEEE format, study the examples provided on pp. 86-88. Two online resources prepared by HKUST are:

- Basic Referencing (Making Citations): IEEE Style
  http://libguides.ust.hk/basic-citation/ieee-style

- IEEE Reference Style
  https://www.cse.ust.hk/ct/fyp/reports/content/ieee_style.html

To test your understanding, complete at Canvas the IEEE Citation Style Quiz, which will alert you to some common mistakes in citing in the IEEE style.

Follow-up activity: Citing in the IEEE style

Study the IEEE citation style guide on the following pages to help you cite your sources correctly in your report. Print out your reference list and bring it to the next class.

IEEE citation style

Many technical publications use the IEEE (Institute of Electrical and Electronics Engineers) citation style. You should follow this style when citing references in your report.

In-text citations using the IEEE style

Corrigan [1] has argued that …

According to [2] …

One study [3] examined the level of …

As [2], [3] and [4] demonstrate …

The theory has been criticized for a number of reasons [1].

The data are supported in [5]–[7], but have been questioned in more recent studies [8], [9].

… as shown by Wood *et al.* [10].

Note:

- Numbers, referring to references in the reference list, are enclosed by square brackets.
- The in-text citation square brackets should appear on the line, inside the punctuation.
- Author names are optional.
    - If author names are included, use *et al.* when three or more names are given for a reference cited in the text.
    - If author names are not included, the in-text citation square brackets can be treated as nouns.
- The publication date of the references cited is not required in in-text citations.

Reference list using the IEEE style

References

Book	[1]	W. K. Chen, *Linear Networks and Systems*, 2nd ed. Belmont, CA: Wadsworth, 1993, pp. 123–135.	Book title in italics
Book with editor	[2]	B. Cantor, P. Grant, and C. Johnston, Eds., *Automotive Engineering: Lightweight, Functional, and Novel Materials*. Boca Raton, FL: Taylor & Francis, 2008, pp. 10-15.	Ed. = one editor Eds. = two or more editors
Book electronic book	[3]	L. Bass, P. Clements, and R. Kazman, *Software Architecture in Practice*, 2nd ed. Reading, MA: Addison Wesley, 2003. [E-book]. Available: Safari e-book.	Web source is given
Journal print	[4]	R. U. Aslip, “Surface and leaky wave antennas,” *IEEE Trans. Circuits Syst. I*, vol. 30, pp. 545–546, Jan 2000.	Name of paper in quotation marks Journal title in italics
Journal online	[5]	P. H. C. Eilers and J. J. Goeman, "Enhancing scatterplots with smoothed densities," *Bioinformatics*, vol. 20, no. 5, pp. 623-628, Mar 2004. [Online]. Available: www.oxfordjournals.org.	Website address provided

Journal online with DOI		M. M. Chiampi and L. L. Ziberti, "Induction of electric field in human bodies moving near MRI: An efficient BEM computational procedure," *IEEE Trans. Biomed. Eng.*, vol. 58, no. 10, pp. 2787-2793, Oct 2011, doi: 10.1109/TBME.25011.2158315.	DOI (digitial object identifier) = a unique alphanumeric string that provides a persistent link to a document's location on the Internet
Patent print	[6]	G. Brandli and M. Dick, "Alternating current fed power supply," U.S. Patent 4 084 217, 4 Nov. 1978.	Use issued or publication date
Patent online	[7]	L. M. R. Brooks, "Musical toothbrush with adjustable neck and mirror," U.S. Patent D 326 189, 19 May 1992. [Online]. Available: http://www.google.com/patents?id=wEgqAAAAEBAJ&dq=Patent+D326189	Website address provided
Online document with author	[8]	K. D. Sherwood, "Beginner's guide to effective email," 2007. [Online]. Available: http://www.webfoot.com/advice/email.top.html	Author name is given
Blog no author	[9]	"Reinforcement learning is cool," blog; 24 Oct 2007; http://smart-machines.blogspot.com/2007/10/reinforcement-learning-is-cool.html	
Wikipedia	[10]	"General atomics avenger," *Wikipedia,* 17 May 2012. [Online]. Available: http://en.wikipedia.org/wiki/General_Atomics_Avenger	To retrieve the date, click on 'Toolbox' to the left of the article in Wikipedia, then click on 'cite this page'.
Online magazine article with author	[11]	E. Strickland, "How a Taiwanese fab went green," *IEEE Spectrum,* Sept 2011. [Online]. Available: http://spectrum.ieee.org/green-tech/buildings/how-a-taiwanese-fab-went-green	Begin with author name
Online magazine article no author	[12]	"Paradise lost," *Economist,* 17 May 2008. [Online]. Available: https://www.economist.com/special-report/2008/05/17/paradise-lost	Begin with the title
Newspaper article from a full-text database	[13]	"Labor defends its $43b broadband network," *The West Australian*, p. 5, 14 May 2010. [Online]. Available: Factiva: http://global.factiva.com	State the day, month & year
Online ethical code	[14]	Hong Kong Ethics Development Centre & Hong Kong Institution of Engineers, *Ethics in practice: A practical guide for professional engineers,* 2001. [Online]. Available: http://www.hkie.org.hk/docs/downloads/membership/HKIE RulesofConduct%282001Version%29.pdf	Treat as an online document. Use organization name as author name
Video	[15]	"China postpones Green Dam web filter," *ReutersVideo,* 1 July 2009. [Video file]. Available: http://www.youtube.com/watch?v=iIg2-hUZb-k	State producer name if known. Otherwise, begin with the title.

Notes:

- You need to compile a list of all the references you have cited in your report.
- The reference list is numbered. Reference numbers are enclosed in square brackets, set flushed left and form a column of their own, hanging out beyond the body of the reference.
- References are arranged in the order in which they appear in the report.
- Your reference list should resemble the sample list in the shaded section above. You do NOT need to categorize the references.
- If in doubt, refer to the official IEEE Reference Guide: http://journals.ieeeauthorcenter.ieee.org/wp-content/uploads/sites/7/IEEE-Reference-Guide-Online-v.04-20-2021.pdf

Texts and videos used in this lesson

Literacy focus 4

Adapted from: D. Schneider, “Whose drone was that anyway? Should drones be required to broadcast an identifying code by radio?” *IEEE Spectrum*, May 2017. Available:http://spectrum.ieee.org/robotics/drones/whose-drone-was-that-anyway

Analytical Report Checklist

Introduction
- ❑ Have you described the situation or the problem related to the case?
- ❑ Have you explained why the situation or the problem is important?
- ❑ Have you related the case with this problem?
- ❑ Have you stated your purpose of writing and (optionally) given a brief outline?

Cause Analysis
- ❑ Have you identified the causes of the case?
- ❑ Have you explained these causes and showed how they contributed to the engineering incident?
- ❑ Have you examined the nature of the causes and showed how they were related to each other?
- ❑ Have you included suitable evidence to support your analysis?

Ethical Implications
- ❑ Have you identified *the most important* ethical issue(s) involved in the case?
- ❑ Have you pointed out the role of the engineers in the incident and analyzed the courses of action open to them?
- ❑ Have you identified relevant rules from engineering codes of ethics and applied them in your analysis of the case?

Conclusion
- ❑ Have you restated the purpose of writing at the beginning of the conclusion?
- ❑ Have you given a summary of your evidence?
- ❑ Have you given an overall conclusion to the report?

References
- ❑ Have you included in-text references using the IEEE style to credit other people's ideas?
- ❑ Have you effectively paraphrased information from your sources rather than just copying directly?
- ❑ Have you cited your sources *effectively*?
- ❑ Have you included a reference list at the end of the report that clearly shows the sources of information you have used?

Academic style
- ❑ Have you avoided an excessive use of personal pronouns (*I, we, you*)?
- ❑ Have you used the passive voice where appropriate?
- ❑ Have you used section headings?

Vocabulary
- ❑ Have you used a wide range of vocabulary accurately and precisely?
- ❑ Have you used formal and precise vocabulary?
- ❑ Have you avoided informal words (e.g. *guys, cool*)?
- ❑ Have you used full forms (e.g. *are not*) rather than contractions (e.g. *aren't*)?

Grammar
- ❑ Have you used a range of structures (both simple and complex sentences) accurately?
- ❑ Have you used the right tenses to express the right meanings?
- ❑ Have you carefully proofread and corrected any grammatical errors?

1.8 Presenting ethical issues

You will:

- Discuss the impacts of hacker attacks on robots;
- Analyze the structure of a presentation on an ethical issue;
- Prepare and deliver a short presentation on an ethical issue.

Pre-task activity 1: Hacking a surgical robot

Machines are used to meet human needs and do the heavy, dirty and dangerous jobs which human beings wish to avoid. Robots are being built and used worldwide, and their adoption is increasing rapidly. But if these "smart" machines are not well-protected, hackers could take advantage of their vulnerabilities and make them into dangerous tools, which could cause substantive harm to their surroundings and the human beings they are designed to serve.

- Watch a video showing an experiment where a surgical robot is hacked.
- What are the possible impacts of hacking a surgical robot?

Pre-task activity 2: What could happen if a robot is hacked?

You will work with a group to brainstorm ideas on **one** of the following topics:

A. What are the potential negative impacts of a hacker attack on a home robot?
B. What are the potential negative impacts of a hacker attack on a workplace robot?

Notes

Task 8.1 Signposting organization in a presentation

1. Using transition phrases

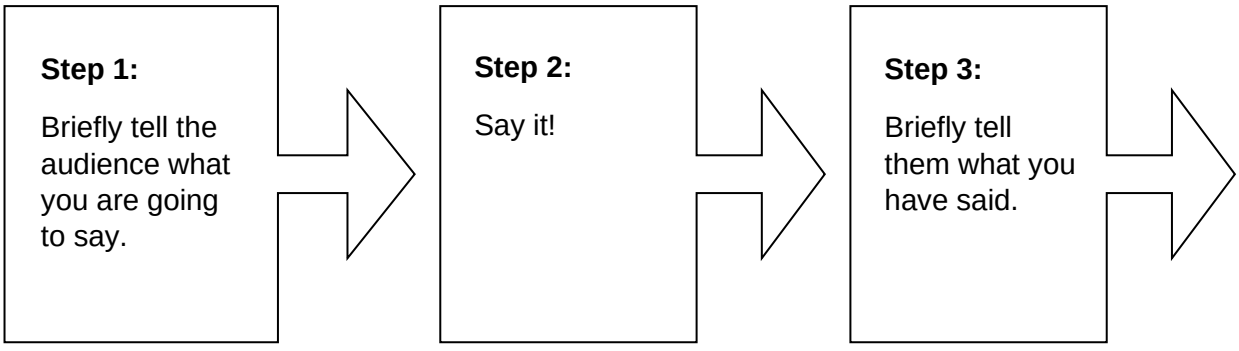
You are going to watch a presentation about the importance of whistleblowing to engineers. The following sentences are used in the presentation to mark the transitions from one topic to another. Put the sentences in the correct order when you watch the presentation.

Opening sentences for each section of the presentation	Sequence
First I'd like to talk about Fred's situation. In the opening section of "Incident at Morales" we see him being briefed by his supervisor, Wally.	
Now that we know the consequences that failing to blow the whistle could have, let's look at the advice given in the HKIE Rules of Conduct.	
Today I am going to talk to you about whistleblowing, and why this concept is so important for engineers.	
Now Wally's "one rule" seems very reasonable on the surface.	
Now that I've reviewed some of the issues around whistleblowing, I'd like to make some suggestions for how Fred should respond to Wally's "one rule" …	
There are plenty of examples from the world of engineering to show that failure to blow the whistle can have disastrous consequences.	
I'll be analyzing a fictional situation in an engineering company, which is dramatized in the film "Incident at Morales".	
This brings me to another important issue: the potential negative impact of whistleblowing on the whistleblower and their family.	

2. The three-step method

Listening to a presentation can be hard work. You can make life easier for your audience if you follow the three-step method:

Preview → Tell → Review



Example from the presentation on whistleblowing:

"There are plenty of examples from the world of engineering to show that failure to blow the whistle can have disastrous consequences.	**Step 1**
Let's first consider the case of the Challenger. In 1986, the US space shuttle Challenger exploded a few seconds after it was launched, killing all the people on board. Engineers had expressed concerns about the safety of the shuttle in meetings, and they'd advised against going ahead with the launch. But their advice was overruled and the launch went ahead, with tragic results. Another tragic incident happened in 1974, when a plane crashed in Paris and killed 346 people. Problems with the plane were apparently well-known within the company, but no-one took the initiative to blow the whistle.	**Step 2**
So we can see that to avoid disasters, it may be necessary for engineers to speak out candidly about potential dangers."	**Step 3**

Read the following example from the same presentation. The sentences have been jumbled. Re-order them, and then identify which sentences belong to which part of the three-step method.

(a) Blowing the whistle often has a disastrous effect on the career of the whistleblower.	**Step 1**
(b) This is likely to result in loss of earnings for that person and their family and this is why some argue that the whistleblower should consult their family before making the decision to tell all.	**Step 2**
(c) People who are accused of wrong-doing, usually hit back.	
(d) This brings me to another important issue: the potential negative impacts of whistleblowing on the whistleblower and their family.	**Step 3**
(e) The potential negative impacts are indeed very serious, and this is another reason why engineers have to think very carefully about the consequences before they blow the whistle.	
(f) A whistleblower may also lose work friends and the support of an informal professional network.	

Task 8.2 Using signposts in a practice presentation

Presentation practice

Work with your group to prepare a set of short notes for a presentation on the possible negative impacts of a robot being hacked.

- *Aim and content*: The aim of your presentation is to give your groupmates your analysis of the possible impacts of a robot hack in the context you have been given. Use the ideas you came up with in pre-task activity 2 and add further ideas, if you like, from the fact sheets on p.91 or p. 92.

- *Structure*: You need to plan how to begin and end your presentation, and you should organize your presentation according to the three-step method. There is a reference list of commonly-used transitional phrases on p. 93.

- *Practice:* When you have prepared a set of notes, you should take it in turns in your group to practice individually by delivering your presentation to each other. You should aim to talk for 2-3 minutes each.

Performance

Your lecturer will assign you to work with a student who has focused on a different robot hack context. You should deliver your presentation, without using notes, to your partner. Evaluate each other's presentations using the criteria below:

Has the presenter used the three-step method?
Has the presenter made clear transitions between points?
Areas for improvement:

FACT SHEET 1	Robots in the home

Most home robots come with built-in camera systems: in fact such systems are one of the most attractive features of home robots. If the robot's systems fall under the control of a hacker, it gives that person unrestricted access to the video surveillance of the home robot and the hacker can spy on the family in many different private situations.

If robots are used as security and monitoring systems for unattended homes, they will be loaded with important data, such as alarm codes. Robots that are integrated with smart home automation could unlock and open doors and deactivate home alarms, helping thieves to gain access to the home. Even if robots are not integrated, they could still interact with voice assistants, such as Alexa or Siri, which integrate with home automation and alarm systems. If the robot can talk or allow an attacker to talk through its speaker, it could tell voice-activated assistants to unlock doors and disable home security systems.

An attacker could also use a robot's mobility to cause physical damage in the house, and even hurt those living in the home, since hacked robots can bypass safety protections that limit movements. Hacked robots could start fires by tampering with electricity, or could attack family members and pets by mixing toxic substances with food or drinks. Any living being in the home could be in great danger if a hacked robot was able to grab and manipulate sharp objects.

Home robots may be used to monitor children when they are asleep, play with them and even teach them. The more time children spend with the robot the more they may become emotionally attached to the machine. Robots may also be used to help elderly or disabled people, using proximity sensors and cameras to monitor their activity and guide them. This will mean that they will become highly dependent on the robot. Medical records and prescription medicine schedule may be stored on the robot, making an adequate security mechanism very important as confidential medical data may become available to hackers.

A hacked, inoperable robot could be a lost investment to its owner, as tools are not yet readily available to "clean" malware from a hacked robot. It could be difficult, or even impossible, to reset the robot to factory defaults and recover it. If the core robot software is hacked, it may not be possible to recover the robot.

When a home robot has been hacked, in effect it is no longer the family's robot, but a tool of the attacker. The use of "ransomware" has been increasing and home owners may in the future find themselves having to pay a ransom to hackers to regain control of their robots.

FACT SHEET 2	Robots in the workplace

Many robots use the same operating systems as computers, so many of the same attacks and vulnerabilities in those operating systems also apply to robots; for example, when a robot allows installation of applications, it can also allow installation of custom malware. Malicious software could cause the robot to execute unwanted actions when interacting with people, and could also be used to steal trade secrets or other sensitive company information.

When dealing with customers in a business, a hacked robot could be made to use inappropriate language, deliver incorrect orders, or go offline. All of these would be likely to harm the business, and result in loss of customer confidence and declines in sales. An attacker could even exploit a robot to physically hurt customers or company employees, causing even greater problems and if robots have access to customer information, such as personal and credit card data, that data could also be at risk.

A hacked robot in a business or industrial setting could also be used to access other robots. Robots sharing the same network could have the same configuration (permissions, passwords, services, etc.) making them easier to hack once the first robot is compromised. This means that an attacker gaining control over one robot may be able to quickly hack all of the other robots on the network. Compromised robots could be used to hack other computers or Internet of Things devices on the same network so that a hacked robot becomes an attack platform to exploit vulnerabilities in other network devices and further propagate the attack.

Robots could start fires or physically damage business assets, causing destruction of valuable property. Industrial robots in particular are usually large, powerful, and programmed to make precise movements and actions. A hacked industrial robot could easily become a lethal weapon. A number of people have already died in accidents caused by industrial robot malfunction: a worker was killed by an industrial robot in 2015 at the Ajin USA plant in Cusseta, Alabama, when an industrial robot restarted abruptly. A hacked industrial robot could be even more dangerous.

Business and industrial robots are generally very expensive. A company with several hacked robots could suffer losses of hundreds of thousands or even millions of dollars. If a company’s industrial robots are hacked, that company will probably have to stop production. Robots that are not usable will result in financial loss due to business disruption and replacement or repair costs.

Example transition phrases

Giving the aim of the presentation

- I'm going to talk about / introduce / discuss …
- I'd like to talk to you today about …
- I'd like to show you …

Giving an overview of the presentation

- I've divided my presentation into … parts / sections.
- First, I'd like to talk about / explain / point out …
- After that / then / next / second, I'll move onto …

Signaling where you are in a presentation

- Moving on to my next point …
- Turning now to …
- This brings me to …
- Having examined X, let me discuss Y …
- Now that we understand X …
- Now let's consider …
- The next point I'd like to make is …
- Now that I've reviewed X, I'll describe Y …

Signaling a conclusion

- So …
- In short / in brief …
- To sum up …
- To conclude …
- In conclusion …
- I'd like to leave you with a couple of thoughts …

Follow-up activity: Preparing for your assessed presentation

By now, you should have already analyzed your group's engineering disaster case. To help you organize your assessed oral presentation, you can use the form "Prepare your oral presentation for Part 1: Graphic Organizers" downloadable from Unit 1.8 Presenting ethical issues at the course Canvas site.

Texts and videos used in this lesson

Pre-task Activity

"Watch researchers hack a surgical robot," 14 July 2016. [Video file]. Available: https://www.youtube.com/watch?v=qSgj-foL7ps

Task 8

Fact sheet material based on a number of sources, including:

C. Cerrudo & L. Apa, "Hacking Robots before Skynet," Cybersecurity Insight, IOActive, Inc, 2017. [Online]. Available: https://ioactive.com/pdfs/Hacking-Robots-Before-Skynet.pdf

D. Miglani & A. Hensman, "Vision for secure home robots: Implementation of two-factor authentication," *IEEE International Symposium on Technology in Society (ISTAS) Proceedings*, 2015. [Online]. Available: http://ieeexplore.ieee.org/document/7439425/

1.9 Taking part in seminar discussions

You will:

- Analyze the ethical issues involved in the hacking of robots;
- Take part in and evaluate a seminar discussion;
- Formulate a set of questions to ask in your seminar.

Pre-task activity 1: What is a seminar discussion?

1. In week 7, after the presentation of your engineering case to the class, your team will lead a small group of classmates in a seminar discussion talking about various issues arising from the case.

   Refer to the following dictionary definition of a typical academic seminar. Is your seminar the same or different to this? Think about the way the seminar is conducted, the purpose, etc.?

A seminar is a group of advanced students studying under a professor with each doing original research and all exchanging results through reports and discussions. ~ Merriam-Webster Dictionary

Your thoughts:

2. What makes a successful seminar discussion in our context? What should the leaders do? What should the participants do?

What should the leaders do?	What should the participants do?

Pre-task activity 2: Ethical issues in robot security

You will explore the ethical issues connected with robot security in this lesson. Discuss these questions in a small group:

1. The HKIE and WFEO codes of conduct are supposed to apply to engineers in all disciplines. Are there ethical issues that concern software engineers in particular?

2. Here is an extract from the Engineering Code of Ethics from the Association for Computing Machinery (ACM) of the US. Share the extract between yourselves. Do you agree that a software engineer should fully comply with all these clauses?

Association for Computing Machinery (ACM) Software Engineering Code of Ethics (USA) (extracts)

Principle 1: PUBLIC

Software engineers shall act consistently with the public interest. In particular, software engineers shall, as appropriate:

1.01. Accept full responsibility for their own work.

1.02. Moderate the interests of the software engineer, the employer, the client and the users with the public good.

1.03. Approve software only if they have a well-founded belief that it is safe, meets specifications, passes appropriate tests, and does not diminish quality of life, diminish privacy or harm the environment. The ultimate effect of the work should be to the public good.

1.04. Disclose to appropriate persons or authorities any actual or potential danger to the user, the public, or the environment, that they reasonably believe to be associated with software or related documents.

1.05. Cooperate in efforts to address matters of grave public concern caused by software, its installation, maintenance, support or documentation.

1.06. Be fair and avoid deception in all statements, particularly public ones, concerning software or related documents, methods and tools.

Task 9A: Seminar discussion 1

1. You will work in a group of three to conduct a 10-minute seminar discussion. Choose a seminar leader from your group, who will use the following questions as a basis for your discussion:

a) What do you think the most common causes are for a hacker attack on a home/workplace robot?

b) How can engineers prevent a home/workplace robot being hacked?

c) Do you think engineers are the only people who have an ethical responsibility to ensure that a robot system is secure?

2. A partner group will act as evaluators for your discussion. Each evaluator will focus on one member of your group and complete the evaluation form below. After your discussion, your partner will share the evaluation form with you.

Did the seminar leader…	Did the participants…
Lead appropriately?	Elaborate their ideas?
Keep the discussion focussed?	Express their opinions appropriately?
Ask relevant follow-up questions?	Respond to each other's ideas?

3. When you are a leader, you will field questions to the participants as a way to guide the discussion. You will also listen actively in the process and ask follow-up questions when appropriate.

   Here are some examples of follow-up questions:

- Can you explain why you feel that way?
- So what's wrong with …?
- Do you want to add something to that?
- What exactly do you mean by that?
- Could you tell us more about …?
- Could you give an example of …?
- What did you mean when you said "a lower standard of safety"?

4. When you are a participant, you will express opinions in response to the questions. You can more effective if you indicate your position to the others by using appropriate language.

Use the following words and phrases only if you are completely certain that you are correct:

obviously	of course	everyone knows that…	it is obvious that …	this proves that …

Use the following words and phrases if you are speculating or hedging your opinions:

Maybe …	Perhaps …	this could be because …	it's not clear whether …	to me …
possibly …	I think …	this may indicate that …	it doesn't seem to be …	you could argue that …

Task 9B: Seminar discussion 2

1. You will now swap roles with your partner group. The previous evaluation group will now conduct a 10-minute seminar discussion. Again, choose a seminar leader from the group, who will use the following questions as a basis for the discussion:

a) Could there be situations in which an engineer cannot prevent a robot being hacked?

b) Do you think robots will ever be able to take ethical responsibility for their own behaviour?

c) If you were the engineer who designed a robot which has been hacked and used for unethical purposes, should you be held responsible?

Each member of the new evaluation group will focus on one member of the discussion group, completing the evaluation form below.

Did the seminar leader….	Did the participants…
Lead appropriately?	Elaborate their ideas?
Keep the discussion focussed?	Express their opinions appropriately?
Ask relevant follow-up questions?	Respond to each other's ideas?

Task 9C: Reflection on seminar discussions

There are different ways to set up seminar questions. Two common approaches are: (a) the thematic approach and (b) the general/specific approach.

(a) Thematic approach

In the thematic approach, you may set questions for your engineering disaster case by theme or focus area, such as causes, consequences, prevention, etc. Several questions can be developed around a theme or focus to allow enough exploration into it.

Match these focus areas to the questions used in Task 9A:

- Focus A: Prevention
- Focus B: Cause
- Focus C: Engineer's ethical dilemma

Question	Focus
1. What do you think are the most common causes for a hacker attack on a home/workplace robot?	
2. How can engineers prevent a home/workplace robot being hacked?	
3. If you were the engineer who designed a robot which has been hacked and used for unethical purposes, should you be held responsible?	

(b) General/specific approach

You may start by asking a general question, which stimulates participants' thoughts, followed by specific questions. Alternatively, you can start with a specific question, followed by general questions. You will need to think about the participants and decide on an approach that is suitable.

Decide if the questions are general or specific questions.

Question	General/Specific
1. Could there be situations in which an engineer cannot prevent a robot being hacked?	
2. Do you think robots will ever be able to take ethical responsibility for their own behaviour?	
3. If you were the engineer who designed a robot which has been hacked and used for unethical purposes, should you be held responsible?	

Literacy focus 1: Establishing the flow of your seminar

The questions in the table below are all related to the topic of whistleblowing as discussed in "Incident at Morales". Suppose you are going to use these questions in a seminar. Consider these questions:

- What is the overall theme of these questions?
- Which of these questions are general, and which are specific?
- Order the questions from 1 to 6 for use in a seminar. What is the logic underlying your sequence?

Order	Questions on whistleblowing
	Do you think Wally's "one rule" is appropriate?
	Do you think there might be situations in which it is better for an engineer not to blow the whistle?
	How do you think engineers can balance loyalty to their company with the responsibility to blow the whistle?
	If you were in Fred's situation, how would you respond to Wally?
	Do you think Fred could have prevented the tragedy if he had acted differently?
	Did Fred behave ethically, in your opinion?

Literacy focus 2: Using correct grammar in the questions

1. Grammar is an essential means to realize the meanings of the following sentences. Refer to the "Questions for a seminar" below. Which of the question(s):

   a) ask the seminar group to think about a general situation, which any engineer might face?

   _____

   b) ask the group to put themselves in the position of another person?

   _____

   c) ask a question about something that has already happened?

   _____

Questions for a seminar

i. Do you think Wally's "one rule" is appropriate?

ii. In your opinion, what was Fred's first bad decision?

iii. What can engineers do if their supervisor is not following safety regulations?

iv. If you were Chuck, what would you do after you received the news of the accident?

v. Do you think Fred could have prevented the accident if he had made different decisions?

vi. Could there be situations where engineers need to tolerate a lower standard of safety in their work?

2. Complete these sentences with appropriate words:

a) "If you _____a robotics engineer, what _____ to ensure that the robots you design are secure?"

b) "What problems _____ occur if robots _____ read human beings' thoughts and act accordingly?"

c) "Sometimes corrupt businesspeople offer bribes to government engineers. If an engineer _____ a bribe, what should that engineer _____?"

d) "We've all read about the plane crash which killed 346 people in Paris in 1974. Do you think the crash_____ avoided if the company _____ encouraged its engineers to report technical problems promptly?"

Follow-up activity: Your own seminar questions

Work with your group to create 10 seminar questions. You will ask these questions to your seminar group after you have given your presentation.

- Your questions should ask for students' opinions and suggestions about the ethical issues you have raised in your presentation. They should encourage students to give in-depth answers. Do not ask questions about the facts in your case.

- You should also think about the follow-up questions you could use. Study the examples in this lesson, and think of some possible follow-up questions. In the real seminar, however, most of your follow-up questions will come up in response to other students' ideas.

Texts and videos used in this lesson

Pre-task activity 2

Association for Computer Machinery (ACM), "Software Engineering Code of Ethics," Available: http://www.acm.org/about/se-code

1.10 Consultation

In this lesson you will meet with your lecturer to discuss your work for the presentation.

Assessed presentations and seminars

In the following two lessons you will work in groups to deliver a presentation and take part in a seminar on a real-life ethical case.

Part 2 Engineers and Creativity

''Every engineer's mission is to try to improve the utility of things, to design products or processes that will solve problems better, faster, and cheaper.''

Carl Selinger[3]

Overview

In this unit you will work in a group to devise an engineering innovation. During the process, you will have to research and evaluate existing technologies; class activities and a customized library class will help you to do this. You will also learn how to describe a technical innovation and compare it with similar technologies, in both spoken and written English. As in Part 1, reading materials and videos are taken from many different sources to expose you to a variety of communication styles.

Assessed Tasks

Proposal report
An individual, 1,000-1,200 word proposal report which includes the following: • An i**ntroduction** • A **literature review** section, in which you review similar designs and establish the need for your innovation • A detailed **description** of your idea • A discussion of the **feasibility and benefits** of developing your innovation • A **conclusion**
A group presentation
A 14-minute presentation which includes the following: • An **introduction** that provides background to the project • A survey of **existing solutions** as a way to set up a niche • A **detailed description** of your innovation • A discussion of the **feasibility and benefits** of your solution • A **conclusion** You are expected to use PowerPoint slides and / or other visual aids to help you deliver the presentation and host a Q&A session after it.

[3]C. Selinger, "The creative engineer: What can you do to spark new ideas?" *IEEE Spectrum,* Aug 2004. [Online]. Available: http://spectrum.ieee.org/geek-life/profiles/the-creative-engineer

Scenario

TechVention is an annual student inventors' competition. Its aim is to nurture creativity and imagination as well as to provide a platform to showcase innovative concepts to potential investors. This year, the theme of TechVention is "Engineering the Future".

TechVention accepts entries that demonstrate a unique and innovative concept that represents advancement in technology or new applications of existing technologies. Innovations can pertain to a broad range of industries, including but not limited to:

- Communication and information products
- Consumer products
- Electronics
- Environmental devices
- Health and medical devices
- Software

All students of LANG 2030/H are eligible for the competition, which will proceed in **three** rounds:

- In Round 1, participating teams will submit a design form as their initial application.

- The formal submission of the application will take place in Round 2. Each participant in a team will submit a formal proposal of 1,000 to 1,200 words which:

  a) describes a unique and innovative concept;
  b) articulates the purpose of the innovation;
  c) outlines alternative approaches and establishes that their innovation represents the best solution;
  d) demonstrates an understanding of the engineering theories and knowledge that underline the innovation;
  e) includes appropriate sketches, models, design drawings or other visual aids; and
  f) evaluates the innovation in terms of benefits and limitations.

- In Round 3, each team will have 14 minutes to present their invention in front of a panel of judges including professors and industry parties, during which they need to explain the rationale behind the invention and demonstrate its feasibility. A short Q&A session will follow.

2.1 The creative engineer

You will:

- Consider the criteria for evaluating technical innovations;
- Examine creativity in the engineering projects of HKUST faculty;
- Present the essential content of technical, innovative projects.

Pre-task activity 1: Innovations at HKUST

Prepare this before the lesson:

Innovation is integral to the culture of HKUST. On pp. 110-112 there are three press releases that describe various innovative activities carried out by the faculty of the University. Read one of these to learn about the projects following the arrangements of your lecturer. You will be using the content of these press releases in an in-class activity.

Pre-task activity 2: Evaluating innovations

Creativity is a much-valued attribute for engineers of all disciplines and creative competitions are often held to promote and nurture this important quality.

In HKUST, for example, students have many opportunities to take part in design or entrepreneurship competitions, including the ones listed below:

1. Hong Kong Information and Communications Technology (ICT) Award
2. Asia-Pacific Broadcasting Union (ABU) Asia-Pacific Robot Contest
3. International Student Remotely Operated Vehicle (ROV) Competition
4. Hong Kong Occupational Safety and Health Best Project Award

1. What criteria do you think the judging panels of these competitions might use to judge innovations? Working in groups, make a list of five possible criteria and rank them in order of importance.

Compare and contrast your criteria with those suggested by another group. Explain your understanding of the criteria to each other. Is there a difference in the priority you accord to different criteria?

2. Your lecturer will give you two innovations to consider. Apply your set of criteria to these innovations, and determine between yourselves which of these is more appealing to you.

Innovation 1	Innovation 2

Task 1 Talking about a technical project

1. Essentials of a technical project

Engineers need to share their ideas with others. This is especially important when they are involved in a technical project where there will be frequent need for them to explain their ideas, summarize their work and highlight the outstanding features of the projects to others.

There are many things that one can say about a technical project, but if you have only a few minutes, what would you include? Choose the most essential items for inclusion from the following:

motivation (reasons) for the project	technical challenges	history of the project
personnel involved	funding for the project	purpose and objectives
future developments	technical innovation	benefits of the project
project description	limitations of the project	existing solutions

2. Mapping Hong Kong in 3D

In 2016, HKUST celebrated its 25th anniversary, and launched 25 projects for public support. One of these was a civil engineering project for the production of 3D maps of Hong Kong using drones. Watch the promotional video to see how this project was presented to the university community and the public.

Take notes about the essentials of this project as you watch. Share these with your classmates.

Key information from the video

3. Creative engineers in HKUST

Before the lesson, you have read a HKUST press release (pp. 110-112) that reports outstanding achievements of the School of Engineering of HKUST. You will summarize one of these success stories, and then re-tell the story to another student in a 3-minute oral summary.

Try to strike the right level of technicality that will interest this audience and satisfy their inquisitiveness for technical details.

Note the following as you plan your oral summary:

- Select your information carefully. You do not need to include every detail.
- You may want to emphasize certain qualities of the project, such as the innovation, or its benefits.
- A press release is a type of journalistic writing. It usually opens with a lead that contains the gist of the story, followed by important details first, and then by less important details. In your short account, you may want to organize the details differently.

Notes for your oral summary

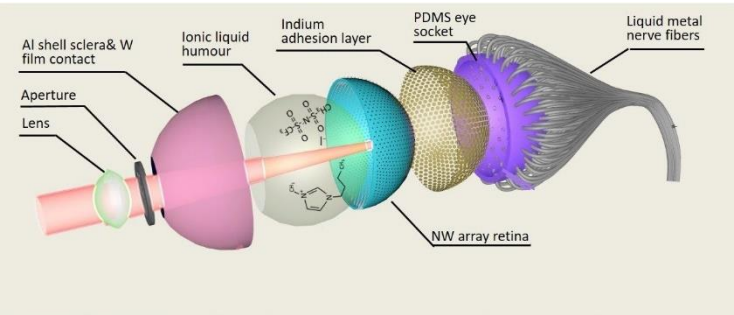
After you have prepared your oral summary, you will form new groups in which each member has read a different story. Tell each other the story you have read. You may look at your notes but do not look back at the press release.

Task 1 Creative engineers at HKUST – Press release (1)

9 June 2020 **HKUST Scientists Develop World's First Spherical Artificial Eye with 3D Retina**

An international team led by scientists at the Hong Kong University of Science and Technology (HKUST) has recently developed the world's first 3D artificial eye with capabilities better than existing bionic eyes and in some cases, even exceeding those of human eyes, bringing vision to humanoid robots and new hope to patients with visual impairment.

Scientists have spent decades trying to replicate the structure and clarity of a biological eye, but vision provided by existing prosthetic eyes – largely in the form of spectacles attached with external cables – are still in poor resolution with 2D flat image sensors. The Electrochemical Eye (EC-Eye) developed at HKUST, however, not only replicates the structure of a natural eye for the first time, but may actually offer sharper vision than a human eye in the future, with extra functions such as the ability to detect infrared radiation in darkness.



The key feature allowing such breakthroughs is a 3D artificial retina – made of an array of nanowire light sensors which mimic the photoreceptors in human retinas. Developed by Prof. FAN Zhiyong and Dr. GU Leilei from the Department of Electronic and Computer Engineering at HKUST, the team connected the nanowire light sensors to a bundle of liquid-metal wires serving as nerves behind the man-made hemispherical retina during the experiment, and successfully replicated the visual signal transmission to reflect what the eye sees onto the computer screen.

In the future, those nanowire light sensors could be directly connected to the nerves of visually impaired patients. Unlike in a human eye where bundles of optic nerve fibers (for signal transmission) need to route through the retina via a pore – from the front side of the retina to the backside (thus creating a blind spot in human vision) before reaching the brain – the light sensors that are now scattered across the entire man-made retina could each feed signals through its own liquid-metal wire at the back, thereby eliminating the blind spot issue as they do not have to route through a single spot.

Apart from that, as nanowires have even higher density than photoreceptors in human retinas, the artificial retina can thus receive more light signals and potentially attain a higher image resolution than a human retina – if the back contacts to individual nanowires are made in the future. With different materials used to boost the sensors' sensitivity and spectral range, the artificial eye may also achieve other functions such as night vision.

"I have always been a big fan of science fiction, and I believe many technologies featured in stories such as those of intergalactic travel, will one day become reality. However, regardless of image resolution, angle of views or user-friendliness, the current bionic eyes are still no match for their natural human counterpart. A new technology to address these problems is an urgent need, and it gives me a strong motivation to start this unconventional project," said Prof. Fan, whose team has spent nine years to complete the current study from idea inception.

Task 1 Creative engineers at HKUST – Press release (2)

11 Mar 2020 **New Smart Anti-Microbial Coating in the Fight Against COVID-19**

Researchers at The Hong Kong University of Science and Technology (HKUST) have developed a Multilevel Antimicrobial Polymer (MAP-1) coating that is effective in killing viruses, bacteria and even hard-to-kill spores. MAP-1 can inactivate up to 99.9 per cent of highly-infectious viruses such as measles, mumps and rubella, and 99.99 per cent of the surrogate feline calicivirus (FCV) – a gold standard for disinfection efficiency – and is more resistant than coronaviruses such as the one responsible for the COVID-19 epidemic.

MAP-1 coating was confirmed to be effective against drug-resistant microorganisms during two field studies in the Kowloon Hospital and Haven of Hope Woo Ping Care and Attention Home. Its use in hospital privacy curtains saw over 98.7% reduction in drug-resistant bacteria in 3 weeks. Beyond hospitals, the team works with the Water Supplies Department and the Drainage Services Department to field test MAP-1 in coating materials for water pipes and sewage drainages to prevent microbial contamination and infrastructure corrosion.

Developed by a team led by Prof. YEUNG King Lun, Professor of the Department of Chemical and Biological Engineering and the Division of Environment and Sustainability, the new MAP-1 coating is highly versatile with an effective period of up to 90 days. MAP-1 coating provides lasting protection and surface disinfection against microbial contamination. This product is designed for use on different surfaces including metals, concrete, wood, glass, plastics as well as fabrics, leathers and textiles without changing the materials' appearance and tactile feel. According to the Technical Standards for Disinfection issued by the National Health Commission in Mainland China, the coating is proven to be non-toxic and is safe for skin and the environment, hence it also allows MAP-1 to be made into hand sanitizers, paints and coating, filter materials for air and water purification, as well as clothing and surgical masks to safeguard the health of individuals and the public.

The essence of the new coating technology lies with the creation of surface moieties that actively disrupt the microbial envelope and biomolecules, rendering the microorganisms nonviable upon contact. The coating also prevents microbial adhesion on the surface and thus keeps it clean from microbial contaminants. Using a special blend of antimicrobial polymers, the new coating effectively kills up to 99.99 per cent of bacteria and viruses through contact killing and anti-adhesion technology, including Rubella, avian influenza, H1N1 and FCV – a non-enveloped virus which is among the hardest to kill. According to the U.S. EPA (Environmental Protection Agency) guidelines in 2016, being effective against FCV is equivalent to being able to inactivate the coronavirus – an enveloped virus which is easier to sterilize than non-enveloped ones.

In efforts to help society fight the Covid-19 outbreak, HKUST, in collaboration with its industrial partner Chiaphua Industries Limited (CIL), has applied the smart coating to over 70 daycare centers, elderly homes, kindergartens, primary and secondary schools. Other venues include shopping malls, school buses, churches and sports training facilities.

Task 1 Creative engineers at HKUST – Press release (3)

29 Aug 2019 **Rechargeable Liquid Fuels to Power Electric Vehicles and Electricity Grid**

A cross-university research project led by The Hong Kong University of Science and Technology (HKUST) has successfully developed an environment-friendly rechargeable liquid fuel that promises to have impact on a global scale. It can fully recharge an electric vehicle in a matter of minutes – a great enhancement from existing battery technology which usually takes hours.

This fuel – called 'e-fuel' – is carbon-neutral if charged with solar or wind energy. Like fossil fuels, it can be readily dispatched to the power grid, and also rapidly recharged to vehicles.

The research, entitled 'Creation of Rechargeable Electron-fuels for Stationary Power Supplies and Electric Vehicles', is led by Prof. ZHAO Tianshou, who is Cheong Ying Chan Professor of Engineering and Environment, Chair Professor of Department of Mechanical and Aerospace Engineering, and Director of the HKUST Energy Institute. The five-year research project – from 2018 to 2022 – is funded by the Research Grants Council Theme-based Research Scheme to the tune of HK$50 million.

"We have successfully developed a stable lithium-sulfur battery that promises to be energy-dense and capable of storing energy at low cost, and can be applied to both electric vehicles and grids transmitting a high fraction of solar and wind energy," Prof. Zhao explained.

"The biggest excitement for us is that we can transform the lithium-sulfur battery to a flow system, or e-fuel as we call it."

Unlike recharging a battery for hours for an electric vehicle, recharging the vehicle with e-fuel takes a matter of minutes. And since it's rechargeable, e-fuel won't go away like fossil fuels do after consumption. At the recharging station, the energy-depleted e-fuel is removed from the fuel tank, which then is refilled with fully-charged e-fuel.

The e-fuel system adopts the chemistry of a lithium-sulfur battery for the high capacity of the lithium metal and the low cost of the sulfur cathode. While the research team made great progress in developing e-fuel, they still had challenges to overcome. First, dendrites forming on the lithium surface may shorten the battery life. Second, the discharged sulfur will dissolve and diffuse to damage the lithium anode.

"A solution is to form a porous lithium anode with surface protection, previously achieved through impractical, strenuous fabrication procedures," Prof. CHEN Qing, Assistant Professor in the same department who works on this project with Prof. Zhao, explained. "We make thermodynamics work for us. With two spontaneous reactions, we formed a porous lithium anode on a carbon skeleton, and coated it with a protective, composite layer."

This simple yet effective approach led to one of the best performance records ever achieved for a high-loading lithium-sulfur battery. The loading – meaning the amount of active materials per area of the device – has to be high so that the high performance on paper can eventually translate into a practical, high-performance system.

Follow-up activity 1: Library Workshop for TechVention

The Library Workshop for LANG 2030/H is a special event designed to support your research for TechVention. It covers essential research skills for technological innovations, which are useful not only for TechVention but also for your engineering studies in general. The workshop is accompanied by a LibGuide available at: https://libguides.ust.hk/lang2030.

The Library Workshop constitutes part of your coursework contributing to the Practice Tasks score.

Follow-up activity 2: Group work for TechVention

Read pp. 104-105 to learn about the two assessment tasks that you will have to deliver for Part 2 of the course. Arrange a meeting with your group members soon to generate some ideas for your innovation.

Texts and videos used in this lesson

Task 1

"HKUST 25 projects - Mapping the World with Drones," HKUST, 16 June 2016. [Video file]. Available: https://www.youtube.com/watch?v=-SCEJykKex4

Press release 1: "HKUST scientists develop world's first spherical artificial eye with 3D retina," HKUST press release, 9 June 2020. [Online]. Available: https://hkust.edu.hk/news/research-and-innovation/hkust-scientists-develop-worlds-first-spherical-artificial-eye-3d?highlight=spherical%20artificial%20eye

Press release 2: "New smart anti-microbial coating in the fight against COVID-19," HKUST press release, 11 Mar 2020. [Online]. Available: https://hkust.edu.hk/news/research-and-innovation/hkust-develops-new-smart-anti-microbial-coating-fight-against-covid-19?highlight=microbial%20coating%20in%20the%20fight%20against%20COVID-19

Press release 3: "Rechargeable liquid fuels to power electric vehicles and electricity grid," HKUST press release, 29 Aug 2019. [Online]. Available: https://hkust.edu.hk/news/research-and-innovation/hkust-led-research-successfully-develops-rechargeable-liquid-fuels?highlight=Rechargeable%20Liquid%20Fuels%20to%20Power%20Electric%20Vehicles%20and%20Electricity%20Grid

2.2 Introducing a creative project (1)

You will:

- Learn about strategies for introducing a creative engineering project;
- Practice introducing an innovative technology to a lay audience;
- Identify moves in the introduction to research articles.

Pre-task activity 1: Evolution of the mobile phone

Engineers are always pushing the limits to develop new technologies. Successful engineering is in essence an iterative process of problem identification and problem solving.

Watch a video entitled “Evolution of the mobile phone” and discuss with a classmate:

- Name 3 important landmarks in the development of the mobile phone.
- What new features do you predict for future mobile phones?
- What technical breakthroughs are needed to realize these features?

Pre-task activity 2: The introduction to a creative project

You will soon be writing a proposal report for the innovative idea you develop for TechVention. What do you think a writer should do in the introduction to a creative project? Tick the relevant items:

In the introduction to a creative engineering project, the writer should:

____ Start with an attention-getter
____ Provide background to the topic
____ Tell a personal story
____ Specify key technical problems
____ Show that there is a gap in the research
____ Show how the project addresses specific problems
____ Challenge the readers with questions
____ Outline the scope of the project

Compare your answers with those of your classmates. Do you agree with each other in all the items? When your opinions differ in any of the items, explain to your classmates why you think an item should, or should not be included.

Task 2 The introduction to a creative project

1. You have looked at some developments in mobile technologies. You will now look at 2 research projects that seek to realize a technological innovation in this field.

   The extracts overleaf represent the introduction sections to two research projects on the development of mobile applications. Work in a pair:

   - Each of you will read about one of the projects.
   - When you read, identify how the extract helps to introduce the project to its readers, using the items listed in pre-task 2.
   - Share the content of the extract with your partners and work together to answer the questions on p. 119.
   - Decide what would be the best order for the extracts in the introduction.

Project 1

A Wrist Sensor Sleep Posture Monitoring System

Extract 1A

The current project aims to develop an easy-to-wear wrist sensor that can accurately quantify sleep postures. Motion data of the patient are first collected in a training stage with the use of chest accelerometer sensors. The data are then compared with the movement recorded in the wrist-worn system to continuously monitor four sleep postures of the patient.

Extract 1B

At present, sleep monitoring is an expensive and cumbersome medical procedure. Patients typically sleep overnight in a sleep monitoring room, with multiple sensors attached to them to collect biological data, including electrocardiography (ECG), blood pressure, sleep postures, and so on [0]. However, most current sleep monitoring devices are complex and inconvenient, as well as requiring the supervision of professionals. Some monitoring equipment may cause considerable sleep disturbance, thus interfering with the accuracy of the test.

Extract 1C

In recent years, a variety of consumer technologies have emerged to assist individuals to track sleep in the comfort of their own beds. Some mobile apps support sleep tracking through digital diaries [0]; others are capable of monitoring movement and sound during the night through built-in accelerometers and microphones [0]. These devices are notable for their ability to yield continuous sleep data, and yet they lack robustness to guide medical diagnosis. They also fail to track sleep postures, which is a crucial parameter for diagnosing several sleep-related illnesses.

Extract 1D

Sleep is one of the most important daily activities. A night of poor-quality sleep can make a person feel fatigue on the next day. Long-term sleep disorders will even induce a range of health problems, such as being a risk factor for cardiovascular disease [0]. Besides sleep duration, sleep habits are another indicator of sleep quality that have health implications [0]. For example, obstructive sleep apnea (OSA) can cause breath pauses during sleep. Hence, sleep research is gaining importance all over the world.

*The numbering of the references in the extracts has been replaced by [0].

Project 2

LoRa for Smart Home Indoor Localization

Extract 2A

The indoor home environment presents specific challenges to localization. Since the surfaces in a building block and reflect signals, the Global Positioning System (GPS) is unavailable indoors. Several tag-based localization technologies have been applied in the home setting, including ultra-wideband (UWB), Bluetooth low energy (BLE) and radio-frequency identification (RFID). Such technologies, however, face fundamental limitations such as low accuracy, packet loss or the need to install many sensing devices.

Extract 2B

This study investigates the application of LoRa for indoor localization in a furnished residential apartment with only three static LoRa anchors. The aim is to attain a sufficient level of accuracy for ranging and trilateration without continuously retraining the system or adjusting system configurations, so as to support various smart home applications.

Extract 2C

A smart home is a dwelling that interconnects and manages intelligent devices to provide a comfortable, automated living space to occupants. Some applications of the smart home, such as health monitoring and surveillance, require real-time indoor positioning of users [0]. Localization is also essential for intelligent devices to execute more complex commands and flexibly interact with residents [0]. Thus, accurate indoor localization is an essential prerequisite for implementing an automated and convenient smart home environment.

Extract 2D

Long Range, or LoRa, has great potential as a robust and feasible solution to indoor localization for smart home applications. With relatively low cost and power consumption, the LoRa signal with city-level range is resilient to multipath effect or noise, thus guaranteeing good penetration ability and stability. Despite the promising potential, most of the existing studies [0] and commercial applications [0] use LoRa for rapid collection of sensing data from remote locations. No study has rigorously evaluated LoRa's performance as a home-level indoor localization system that tracks the location of objects in a home with light walls, heavy furniture, and electronic devices that cause different degrees of signal intensity.

*The numbering of the references in the extracts has been replaced by [0].

	Project 1	Project 2
What is the general background that leads to a need for this innovation?		
What kind of progress has been made to address this need?		
What further work is still required for a better solution to the problem?		
What is the innovation reported in the paper?		
The correct order of the extracts in the introduction is:		

The organization of the key elements in the introduction section of an academic research report can be usefully represented in an inverted triangle.

- Complete the following diagram which represents the introduction as a three-part structure.

- Project developers are often concerned with the identification of the niche for a project, which can be described as a gap in previous or existing work that presents a worthy area for further investigation.

Refer to the two introductions in the task and see what strategies are used to establish the niche.

2. Presenting the introduction to an innovative technology

You have examined the organization of an introduction to a technical project. Now plan your own introduction for different innovative projects.

Your lecturer will be giving you some information about an innovative technology. Work in groups to prepare *the introduction section* of the presentation for the technology. Use the following grid to help you gather relevant ideas.

(a) Provide **background** to your technology. Explain why this area is important.	
(b) **Create a niche** for the present project. You may point out problems in the area that are yet to be solved. You may also demonstrate a gap in existing research, or highlight new opportunities that can be exploited.	
(c) **Occupy the niche**. State what your present technology is, and show how your present work addresses the problems / research gap / opportunities stated in (b).	

Follow-up activity 1: Identifying moves in the introduction

In technical academic writing, the most important function of the introduction is to establish the need for and the value of the project.

This is in contrast to the introduction in journalistic writing, which often has arousing the attention of the reader as its primary purpose.

The niche is the key concept in academic technical project introductions. A niche is the shortfall in the existing solutions to a problem, or a gap in previous work. The existence of such a shortfall or gap indicates that a specific area needs further investigation. The establishment of a niche in the introduction highlights the contribution the researcher is making to the field.

Sample 1

Read the following extract from the abstract of a research paper on mobile applications.

- Identify the background, the niche and the project statement.
- Note the transition markers that signal these moves.

Aggregating social media data with temporal and environmental context for recommendation in a mobile tour guide system

Manufacturers of smartphone devices are increasingly utilizing a diverse range of sensors. This innovation has enabled developers to accurately determine a user's current context. One area of work that has been significantly enhanced by the increased use of context in mobile applications is tourism. Traditionally, tour guide applications rely heavily on location and essentially ignore other types of context. This has led to problems of inappropriate suggestions and tourists experiencing information overload. These problems can be mitigated if appropriate personalization and content filtering is performed. This research proposes an intelligent context-aware recommender system that aims to minimize the highlighted problems.

Sample 2

Read the following extract from the abstract of a research paper on using WeChat as a mobile technology for learning.

- Can you identify the background, the niche and the project statement?
- Improve the abstract by completing the missing move.

The Impact of Social Mobile Applications on Students' Learning Interest and Academic Performance in Hong Kong's Sub-Degree Education

Using social mobile applications for communication is common in this generation and development is driving innovation. Social mobile applications take many social forms depending on a particular application. In addition to Facebook and WhatsApp, WeChat is one of the most popular social mobile applications nowadays, especially in China and Hong Kong. WeChat is a mobile text and voice messaging communication service developed by Tencent in China, which was released in 2011. It can exchange contacts with people nearby via Bluetooth, as well as providing various features for contacting people at random if desired, next to integration with social networking services such as those run by Facebook. Photographs may also be embellished with filters and captions, and a machine translation service is available. It is now very common in both China and Hong Kong. This study will investigate the differences in academic performance and learning interest between students who used WeChat and those who did not. Academic performance was examined by their scores in continuous assessments, while students' learning interest was indicated by questionnaires. The aim of this research is to evaluate the impact of social mobile applications on students' learning interest and academic performance.

Write the missing move here:

Follow-up activity 2: Your own TechVention project

You have formed a group to work on the TechVention project. The group will start to look around for inspiration.

Identify an engineering area that you and your group members are interested in working on for your assessed task. Try to identify a focused area, rather than a very general one. Before the next class, each group member should find at least one article in the area that you are interested in. As you read the article, you should note down the problems or technical gaps that are addressed in your article and any solutions that are given.

Make notes in the following table and bring both the article and your notes to class on a date specified by your lecturer.

Problems	Solutions (attempted / to be developed)

Follow-up activity 3: Useful Internet resources

For a detailed explanation of the niche concept, which is essential to an effective introduction, you can visit the following two sites where you will find sentence-by-sentence analysis of introductions and useful expressions for use in introduction writing.

- **Structure of the introduction in academic writing**

  (Explains the 3 main parts of the introduction, with examples and useful expressions)

  http://www.uefap.com/writing/genre/introd.htm

- **"Introductions" by Engineering Communication Program, University of Toronto**

  http://ecp.engineering.utoronto.ca/online-handbook/components-of-documents/introductions/

Texts and videos used in this lesson

Pre-task activities

"Evolution of the cell phone (1973-2015)," The Kim Komando Show, 28 Sep 2015. [Video file]. Available: https://www.youtube.com/watch?v=-fWmbcDeWMw

Task 2

P. Y. Jeng, L. C. Wang, C. J. Hu, & D. A. Wu, "Wrist sensor sleep posture monitoring system: An automatic labeling approach," Available: *Sensors 21*(1), 258. https://doi.org/10.3390/s21010258

K. Kim, S. Li, M. Heydariaan, N. Smaoui, O. Gnawali, W. Suh, M. J. Suh & J. I. Kim, "Feasibility of LoRa for smart home indoor localization," *Appl. Sci. 21*(11), 415. Available: https://doi.org/10.3390/app11010415

Follow-up activities

K. Meehan, T. Lunney, K. Curran, A McCaughey, "Aggregating social media data with temporal and environmental context for recommendation in a mobile tour guide system", *Journal of Hospitality and Tourism Technology*, Vol. 7 Issue: 3, pp. 281-299. doi: 10.1108/JHTT-10-2014-0064

K. K. Ng, C. H. Luk and W. M. Lam, "The impact of social mobile application on students' learning interest and academic performance in Hong Kong's sub-degree education," *2016 International Symposium on Educational Technology (ISET)*, Beijing, 2016, pp. 18-22. doi: 10.1109/ISET.2016.10

2.3 Introducing a creative project (2)

You will:

- Establish the context for an innovative project;
- Practice writing the introduction to a research report;
- Examine writing strategies that are commonly used in introductions.

Pre-task activity 1: NEXA – The next-generation prosthesis

You learned about the 3 moves in the introduction section in the last lesson. Can you still remember what they are?

https://www.youtube.com/watch?v=CFff8qOf4kI

Here are 9 sentences that make up a short introduction to a creative project for a prosthesis that can feel sensations.

(1) Arrange the sentences into the correct order.

(2) Which of these tell you the background, the niche and the project? Highlight the expressions that help to signal the moves.

a) This report describes the development of an innovative prosthesis, NEXA, through the use of advanced neural interface and sensor technology.

b) NEXA aims to deliver an intuitive feel and a natural control not seen in current prostheses.

c) But even modern prostheses are primarily tools that do not possess sensitivity and do not respond spontaneously to a wearer's intentions.

d) With an estimated number of 10 million amputees worldwide, the development of life-like prostheses will significantly improve their quality of life.

e) In recent years, technical innovations have combined to make prostheses much more comfortable and functional.

f) One such breakthrough has been in the material connecting the body part and the prosthesis.

g) Losing a limb is devastating.

h) The most common way to address the loss is an artificial limb, or prosthesis, which attempts to at least give back to the wearer some of the lost dexterity.

i) The availability of suitable prostheses is crucial to patients' re-integration into the community.

The correct order is:	
The background is made up by:	
The niche is indicated by:	
The project is described in:	

Pre-task activity 2: Providing relevant background

In today's lesson, you will be writing the introduction to a technical project about using flexible circuits for health monitoring. Before you start, think about what is suitable background for the project? What are some possible ways to start this introduction?

Consider the NEXA opening, together with the opening sentences of the introductions we have looked at so far for some inspiration:

Sleep Posture Monitoring System (p. 117)

Sleep is one of the most important daily activities. A night of poor-quality sleep …

Mobile Tour Guide System (p. 118)

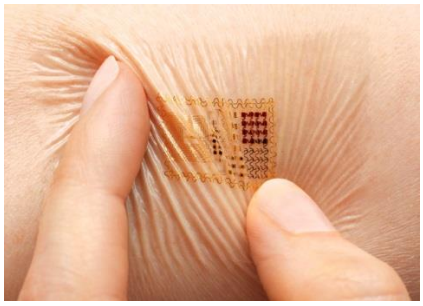
Manufacturers of smartphone devices are increasingly utilizing a diverse range of sensors. This innovation has enabled developers to …

Write some ideas here that may be used to contextualize the project on flexible circuits for smart health monitoring. If possible, suggest two different ways to open the introduction.

Task 3 Introducing an innovative technology: Flexible circuits

1. Writing the introduction to an innovative project: Flexible circuits

Watch a video in which Professor John Rogers, a material scientist at the University of Illinois at Urbana-Champaign, talks about his flexible electronic circuits, which can be used to detect and record signals from the skin and other body organs by simply adhering to them.



As you watch the video, expand the “skeleton notes” below:

Electronic circuits have become faster and smaller, but they are mechanically limited. Why?

What motivates Dr Rogers to develop flexible and stretchable electronics?

How is biology different from conventional electronics?

Most electronic devices perform their functions using silicon, a semiconductor. Why is this a problem for the development of flexible electronics?

What can be done so that silicon can become flexible?

On top of flexibility, why do electronic circuits need to be stretchable?

According to Dr Rogers' team, what can be done so that circuits can be stretched?

2. Imagine that you are Professor John Rogers and you are writing a report to explain your work to non-specialist readers. You intend to follow the conventional design of a research report, but in consideration of the nature of your readers, you will exclude most of the technical complexities.

   Write the introduction to the report in around 120 words. As you write, remember to:

   - establish the context for the project, as well as identify a niche
   - describe your innovation briefly
   - make use of the ideas presented in the video, but also add ideas if necessary.

3. Exchange your introduction with a partner. Look at each other's writing and give comments.

Follow-up activity 1: Useful expressions for the Introduction section

1. Useful expressions to signal the 3 moves

You have been introduced to the 3 moves in the Introduction section in the last lesson. Here are some expressions that are closely associated with the moves.

In the background move, you can highlight the importance of the topic or point out a problem that demands attention.

Useful expressions:

- … has always been / is vital for / is an essential part of / is a fundamental requirement of …
- With continuous improvements in … , there is a lot of potential for ….
- In view of … , there is a pressing need for …

In the niche move, you can reveal a gap in existing research, perhaps with a negative expression.

Useful expressions:

- However, …
- What remains unclear is …
- Little attention, however, has been given to …
- There is a strong need for …

In the project move, you can state the purpose of your project or outline your innovation's key characteristics.

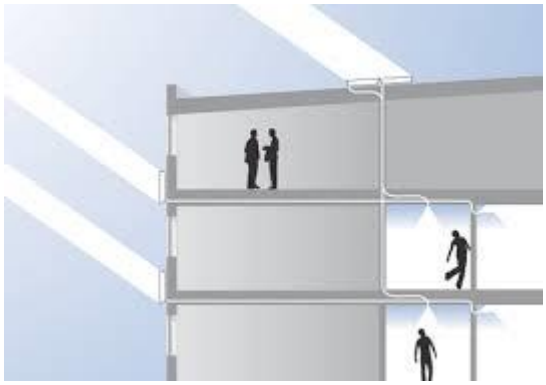
Useful expressions:

- In the current project, …
- This project is concerned with …
- This project further develops …
- Our proposed technology is …

2. Using optical fibers for skylighting

Sunlight is abundant in Qatar, a Middle Eastern country. It has therefore been proposed that this sunlight can be brought inside buildings for skylighting.

Here is the introduction to a research paper written on the idea. Complete the gaps with the expressions given. Pay attention to the development of the 3 moves. You will need only 6 of the expressions provided.



a) as a partial remedy to	e) there is a need for … to take advantage of
b) this study will shed light on	f) there is a significant potential to
c) what is often neglected is that	g) becoming an increasingly serious problem
d) will be of great benefit	h) if solar power could be efficiently tapped

Ecological Sustainability of Fiber Optic Solar Lighting in the Future of the State of Qatar

In many countries, indoor lighting accounts for a significant portion of electrical energy consumption. Generating such electricity, however, also leads to the production of greenhouse gases, which is (1)_____. (2)_____, at the same time as electricity is being expended to light up our buildings, natural light is hitting the exterior of the same buildings. A technology capable of collecting this abundant sunlight and distributing it, via optical fibers, into the interior of a building (3)_____.

Sunlight is an abundant and infinite source of energy that is under-utilized in Qatar, where temperatures range from 12°C to 48°C throughout the year. (4)_____ _____ harvest and utilize this energy source extensively. (5)_____, the country's reliance on fossil fuel generated electricity would be relatively reduced.

The present study examines fiberoptic-daylighting and its potential use in a very sunny climate, such as that of Qatar. It is expected that (6)_____ _____ the feasibility of a lighting system based on fiber optics as an alternative light source.

Follow-up activity 2: Use of “we” in the introduction

An objective style is often preferred in engineering reports. Here is the draft of an introduction to a proposal report for a portable UV disinfector for use in hospital settings. Instances of personal pronouns are highlighted.

- Do these pronouns refer to the same persons?
- What is the effect of the presence of personal pronouns in this academic, technical report?
- Rewrite the introduction to avoid using personal pronouns.

Portable UV Disinfector

Infectious diseases have been (1) **our** greatest enemy for thousands of years. Traditionally, (2) **we** send patients with infectious diseases to hospitals. However, as the meeting point of patients with various infectious diseases, hospitals are the breeding ground of bacteria. (3) **We** can sometimes find patients cured of one disease getting infected by another. Doctors and nurses are also vulnerable working in such an environment. One example was that as Covid-19 struck, medical practitioners were among the earliest casualties [1]. (4) **We** can see that there is always a great need to keep hospitals aseptic to ensure the safety of patients and health practitioners. To address this need, (5) **we** are developing a portable disinfector that can disinfect hospitals efficiently without disturbing patients. (6) **We** believe that this innovation will improve public hygiene significantly.

Follow-up activity 3: TechVention Design Form

You have been researching technologies related to the focus area you chose for TechVention. Your lecturer will give you a Design Form to help you develop your ideas further. Complete the form and bring it to class on a date specified by your lecturer.

Texts and videos used in this lesson

Task 3

"Flexible, stretchable electronics," *The Economist*, 17 Mar 2011. [Video file]. Available: https://www.youtube.com/watch?v=jlEIvGzthsk

Follow-up activity 1

M. AhsanShaikh and M.S. Mahfoud, "Ecological Sustainability of Fiber Optic Solar Lighting in the Future of the State of Qatar," *ASME 4th International Conference on Energy Sustainability, Volume 2*:399-406, 2010. doi:10.1115/ES2010-90484

2.4 Reviewing literature and comparing technologies (1)

You will:

- Examine the purpose of a literature review in a technical project;
- Critically analyze technologies to inform the development of a technical solution;
- Learn strategies to organize information for effective reader orientation.

What is a literature review?

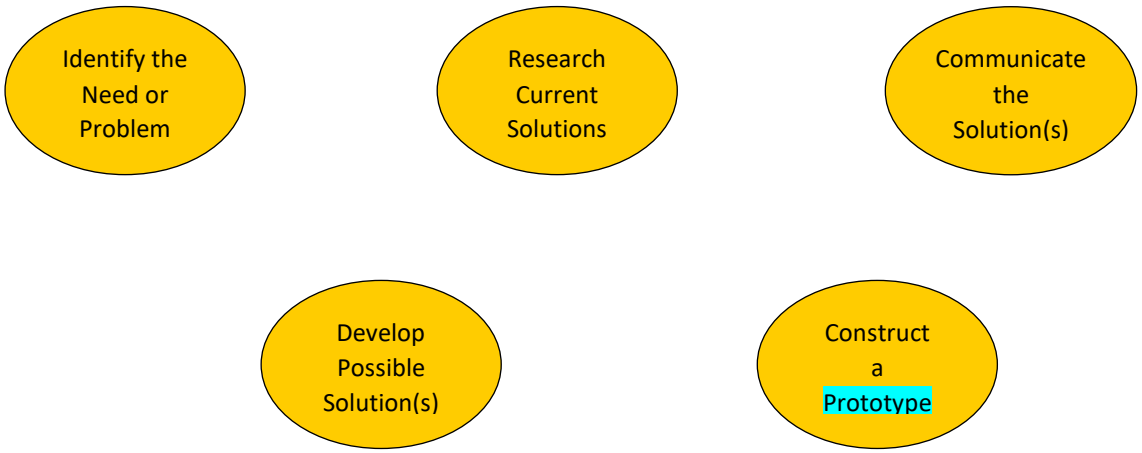
Synthesizing information is the main concern of the writer in a literature review. The research process has taken place and a number of relevant sources have been identified. Rather than simply summarizing the sources obtained in the research process, one has to work out how the multiple sources can be seen altogether and how the present research fits in.

Similar to the introduction, a main purpose of the literature review is to strengthen the niche so that readers are better oriented to the current project.

Pre-task activity 1: The engineering design process

By participating in the TechVention Project, you are involved in the initial stages of a process of engineering design. What steps does an engineer-designer need to go through and how do the steps relate to each other?

1. Listed here are some major steps in the engineering design process. Use these to draw a diagram to show how the steps are connected with each other. You are free to add more steps that you consider essential to the process.



2. Give three reasons why research is important for the engineer-designer in this process.

   Reason 1: To become familiar with the selected focus of the project

   Reason 2: _____

   Reason 3: _____

3. The engineer-designer may be called upon to communicate their work to other interested parties in the form of a proposal or a report. Give three reasons why the readers of these documents would be interested in not only the engineer-designer's work, but also related work that has been carried out by others.

   Reason 1: To know about the latest developments in this field

   Reason 2: _____

   Reason 3: _____

Task 4.1 Analyzing a literature review

In Lesson 2.2, you read the introduction to a research article entitled "A wrist sensor sleep posture monitoring system". The aim of the project is to:

> … develop an easy-to-wear wrist sensor that can accurately quantify sleep postures.

You are going to read the literature review of the same research article. This is how the section opens:

> This section gives a brief survey of the existing sleep posture monitoring research, which can be divided into non-contact and contact systems.

Work in a group of 3:

1. As seen on p. 137, the body of this literature review consists of 3 paragraphs. Each of you will read one of these paragraphs.

   The primary functions of the literature review are to summarize and review previous work. As you read your paragraph, identify where existing solutions are summarized, and where they are commented on by the authors. Bracket the summaries and underline the comments.

   Share your analysis of the paragraph with your groupmates.

2. Together, explore the following questions in the group:

a) Referring back to the functions of a literature review on p. 135, which of these functions does this literature review fulfill?

b) The process of synthesizing information involves categorizing by theme, summarizing sources, comparing and evaluating information and identifying gaps.

   This literature review involves sources [5] to [12]. How is information from these sources synthesized in the literature review?

c) Examine the comments made on each of the technologies. Are these positive or negative comments? Should researchers comment on other people's work favorably or critically?

Paragraph 1

One of the ways to monitor sleep using the non-contact approach is by adopting a surveillance camera that continuously records images of the user. An image taken from the camera is processed in real-time using an image recognition-based algorithm to obtain a sleep posture [5]. The non-contact approach ensures a high level of comfort for the user, which is greatly desirable in sleep studies. However, sleep posture monitoring systems in this category may face the difficulty of interference from some body-irrelevant objects such as blankets or clothes. In addition, the recognition results of non-contact body devices will be affected by the position and angle of the monitoring equipment [6]. Therefore, such systems are usually not portable and require sophisticated deployment processes.

Paragraph 2

The contact body systems represent a more direct approach to monitoring sleep postures and thus most current sleep posture monitoring systems belong to this category. Some of these systems are realized by non-wearable equipment. For example, the pressure mat can be used to measure the user's weight on different parts of the mat via dozens of built-in pressure sensors. A lot of research adopted pressure mats as the primary monitoring equipment for sleep posture recognition [7-8]. For example, in [8], 55 types of features from the raw data were extracted and four classification algorithms were applied for sleep posture estimation. Since the data from such research can only be in the form of pressure points, it is not easy to establish a reliable relationship between the data and the actual posture of the users which is the target of the study.

Paragraph 3

Along with the advances in electronics, wearables, which require the user to wear a monitoring device on the body, are increasingly used for sleep posture monitoring. An important strength of this approach is that it can provide more accurate results than other methods. For example, it is common for researchers to place an accelerometer on the chest of the user for inertial data collection [9-11]. In the sleep of the user, a camera records his/her sleep postures. Then a linear discriminant algorithm can be adopted for training a posture prediction model, which can then be deployed in real-time posture monitoring during sleep. In general, wearable systems are irritating during sleep. However, changing the location of the sensors could significantly reduce the inconvenience. In [12], the subject wore a tilt sensor on the wrist for recording the wrist position, which is much less interfering than a strap across the chest.

Task 4.2 Planning a literature review for a human energy harvester

The human body contains enormous quantities of energy. You are a TechVention participant who is interested in the potential of the human body for energy generation. Your initial plan for the competition is to develop a human-powered energy converter.

The literature review is an important section in your proposal report because it strengthens the niche that is identified in the introduction and provides the background that guides the reader to appreciate your innovation. The way the literature review is written is closely related to the project idea in the proposal.

1. Work in a small group. Take up ONE of the following project ideas and write an outline for the literature review section making use of the 3 sources provided.

Project idea A	Project idea B	Project idea C
A portable energy harvester to be worn on the body to charge mobile phones or other wearable gadgets.	A harvesting device to be installed in a gym room to partially power the facility.	A harvesting facility that can be used in a school both to provide energy and to enhance student interest in STEM.

2. You have already identified a few references that report different approaches to capture human energy. Share the reading between the group members. Highlight relevant information and make comments about the technologies from the perspective of your project idea.

Source 1 – thermoelectricity (suggest reading paras. 1 to 3)

https://phys.org/news/2019-03-team-thermoelectric-device-electricity-human.html#:~:text=The%20Electronics%20and%20Telecommunications%20Research%20Institute%20(ETRI)%20in%20South%20Korea,it%20to%20power%20wearable%20devices

Source 2 – piezoelectricity (suggest reading paras. 1 to 3)

https://science.howstuffworks.com/environmental/green-science/house-music-energy-crisis1.htm

Source 3 – kinetic energy (suggest reading paras. 1 to 3)

https://www.extremetech.com/extreme/161079-kinetic-energy-harvesting-everyday-human-activity-could-power-the-internet-of-things

Use this space to jot down notes while you read:

Technology you are reviewing: _____

Pros and cons of using this approach to capture human energy:

3. Information synthesis is what you need to carry out before the writing of a literature review. Discuss the three technologies the group has looked at. With your project idea in mind, how would you synthesize the information so that your readers can benefit from the section? Try to arrive at an outline for a literature review.

4. Present your outline to another group who has worked with a different project idea. Comment on the effectiveness of the literature review for the purpose of establishing the niche of the project.

Follow-up activity 1: Giving critical and favorable reviews of previous work

In Lesson 2.2, you read the introduction to a research article entitled “LoRa for smart home indoor localization”. The aim of the project was to investigate:

> … the application of LoRa for indoor localization in a furnished residential apartment with only three static LoRa anchors.

a) In a literature review, the writer is concerned with carving out a niche for the present project. Find out how the writer points out inadequacies in existing solutions. Highlight the negative wording that is used to do so.

Another indoor localization system [58] for smart homes adopted Bluetooth technology and RSSI values for positioning. The research team used range average calculation as the smooth filter to deal with considerable RSSI value fluctuation while using delta-based sampling to collect persuasive samples. Despite the improved accuracy, several limitations remain unsolved. For example, the accuracy of measurement results depends on the size of valid samples, due to delta-based sampling implementation affecting performance consistency. Blas and López-de-Ipiña [6,59] used BLE beacons with improved trilateration to enhance the estimated location’s outcome. This system is examined in university faculties to locate a professor or staff member. The application range of a BLE beacon is up to 30 or 70 m depending on the properties provided by its manufacturers. The mean value of measurement error is close to four meters, which does not meet the requirement of accuracy. As a result, the performance of the BLE is not attractive in the indoor localization field.

b) In a literature review, the writer needs to relate the current project with the literature. Find out how the writer expresses appreciation of (some aspects of) an existing solution. Highlight the positive wording that is used to do so.

Since LoRa uses chirp spread spectrum (CSS) modulation, which provides resilience against interfering and multipath effects, and broadens the communication range significantly [17], the maximum reception range would reach fifteen km in suburban and five km in urban areas [25,26]. The LoRaWAN specification also defined that LoRa transmits over the industrial scientific medical (ISM) bands [47,65], which are license-free bands. It reduces the implementation cost of LoRa. Moreover, the cheap nodes, end devices, and infrastructure further lower the implementation threshold. Another advantage of LoRa is the lower center frequency compared to WiFi, BLE, and UWB. Signal attenuation increases with increasing center frequency [66], in both free space and through objects. Lower center frequency allows LoRa signals to penetrate through heavy objects in buildings (such as walls, floors, furniture, and electronic devices) [67], which is not possible with other sensing technologies. The capability to penetrate objects causing NLOS, combined with the long-range reading, makes LoRa a viable sensing technology for robust localization in large indoor spaces with various NLOS situations using a small number of static anchors.

Follow-up activity 2: Useful Internet resources

1. A lot of useful resources are available on the Internet to support the writing of the literature review section. The following two links provide general explanation about the purpose and writing of literature reviews in the engineering discipline:

   "Goals of literature reviews" from the University of Queensland at:
   http://www.uq.edu.au/student-services/learning/goals-of-literature-reviews

   "Literature reviews – common problems" from the University of Queensland at:

   http://www.uq.edu.au/student-services/learning/lit-reviews-common-problems

2. We have paid some attention to the use of positive and negative wording in this lesson. The following is an extensive phrase bank applicable to academic writing from the University of Manchester. The section applicable to literature reviews is "Being critical":

   https://www.phrasebank.manchester.ac.uk/being-critical/

Texts and videos used in this lesson

Task 4

P. Y. Jeng, L. C. Wang, C. J. Hu, & D. A. Wu, “Wrist sensor sleep posture monitoring system: An automatic labeling approach,” Available: *Sensors 21*(1), 258. https://doi.org/10.3390/s21010258

Follow-up activity 1

K. Kim, S. Li, M. Heydariaan, N. Smaoui, O. Gnawali, W. Suh, M. J. Suh & J. I. Kim, “Feasibility of LoRa for smart home indoor localization,” *Appl. Sci. 21*(11), 415. Available: https://doi.org/10.3390/app11010415

2.5 Reviewing literature and comparing technologies (2)

You will:

- Learn further strategies to organize information in a literature review;
- Examine the use of tenses in literature reviews;
- Evaluate the quality of sources for a technical project.

Pre-task activity: Synthesizing information in a literature review

In the last lesson, it was said that synthesizing information involves: categorizing by theme, summarizing sources, comparing and evaluating information, and identifying gaps.

1. Revisit these techniques in the following literature review sample. The topic of the research is:

A sustainable water filtering system using the Moringa oleifera seed

In many places around the world, the supply of clean water cannot be taken for granted. Many people living in rural areas struggle to secure supply of clean drinking water. The Moringa seed is used in some Southeast Asian countries as a quick and simple method for cleaning dirty river *water*.

The literature review section consisting of 8 items has been jumbled below. Arrange the items so that they represent a logical development.

(1) The silver-impregnated ceramic filter [0] that can be produced locally by villagers represents a filtration method that is affordable and easily accessible to rural dwellers. The pores in the ceramic filter out impurities and torpidity whereas silver provides an effective way to remove bacteria in the water.

(2) Nevertheless, just like the problem with silver-coated ceramic filters, filtering with MO protein extracts releases undesirable organics, which need to be removed to prevent the potential regrowth of pathogens and prolong water storage life.

(3) Treating water in the rural setting presents its own challenges and there is a preference for point-of-use filters as they can be applied by households directly. Major criteria for a rural point-of-use filter include cost of technology, performance and environmental impact [0].

(4) However, the water throughput is relatively slow, as it typically takes days for the water to seep through the pores in the ceramic.

(5) The present research investigates the use of different absorbents for the removal of organics from a point-of-use MO water filtering system, so as to identify the factors affecting the absorption and disinfection processes.

(6) Also, it does not constitute a sustainable solution as silver ions are released into the treated water, thus requiring further water treatment [0].

(7) The protein component of the MO seed is mainly responsible for the action, as it can separate unwanted particulates from water sedimenting impurities (i.e. coagulation) and inactivate the microbial particles in the water (i.e. disinfection) [0].

(8) The Moringa tree is abundant in Southeast Asia, and many communities have developed ways to use different parts of the tree [0], one of which being the use of the MO seeds for inexpensive water purification.

*The numbering of the references in the extracts has been replaced by [0].

The correct order is:	
Four sources are referred to in this literature review. How is the information synthesized? is there anything notably different from the wrist sensor sample you read in the last lesson?	
How does the current project fit in the existing solutions?	

Task 5 The Rooftop Challenge

Rooftop Challenge Scenario

As a science and technology university, HKUST has always been keen to promote sustainable initiatives that demonstrate applications of new technologies while at the same time improving the life quality of its community.

The rooftops of the many buildings on the HKUST campus present such an opportunity. Rooftops pose a problem because they aggravate the heat island effect. In recent years, innovative exploitations of the rooftops have been implemented, yielding both environmental and financial benefits while mitigating the heat island effect. The challenge is which technology is the most suitable for HKUST.

All members of HKUST are invited to participate in this Challenge. Proposals are invited for innovative and feasible solutions to the creation of a green and smart campus.

A group of students decide to rise to the Challenge and submit a proposal. They have derived an innovative solar energy solution for the University and are drafting the literature review section after considering the most important rooftop technologies.

Work in a group. Read the draft literature review below and suggest improvements. Make your suggestions in terms of content, organization and language.

Literature review for Rooftop Challenge proposal (draft)

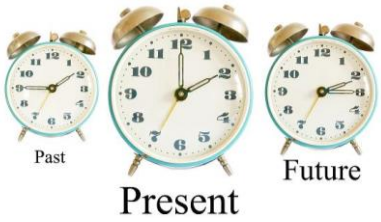
The best approach is the application of thin-film photovoltaic solar panels. Solar panels directly convert sunlight energy into electricity. In recent years, the efficiency of thin-film solar cells ha improved significantly, reaching 21% in laboratory settings [0]. Deployment of large-scale photovoltaics is on the rise [0] because they are efficient, quiet, modular, easy to install and require little maintenance. Given suitable location and planning, electricity production by PV systems can be even cheaper than conventional generation from fossil fuels.

Another approach is to turn the bare roofs into a garden. Roof gardens are an effective way to improve air quality and reduce overall heat. For example, a study conducted by the University of Michigan [0] revealed that the presence of roof gardens can reduce ambient temperature by 4 to 5 degrees Celsius. This temperature reduction would significantly relieve the reliance on air conditioning on hot summer days. On top of that, roof gardens promote drainage efficiency by delaying surface runoff [0]. They also provide additional space for amenities and relaxation. All these explain the reason why roof gardens are growing in popularity in many cities.

A less common approach is to install fish farms on rooftops. This is to be realized as a system of aquaculture in which the waste produced by farmed fish or other aquatic creatures supplies the nutrients for plants grown hydroponically, which in turn purify the water [0]. The practice of aquaponics is environmentally friendly, because unlike normal fish farms, the closed system uses no harmful manure that runs off into the watershed. In order to be effective, aquaponics farms need to be professionally run [0]. There is also much restriction for the kinds of crops that can be grown through aquaponics [0]. Another disadvantage of aquaponics fish farms is that electricity consumption is significantly higher than traditional crop or fish farming.

Problems in the draft literature review	Suggestions

Follow-up activity 1: Using correct tenses in the literature review



If a literature review simply discusses existing technologies, we might expect it to be written in the present tense. However, literature reviews often also refer to projects or research that have been undertaken before the current investigation. In such cases, a variety of verb tenses to refer to these sources will be needed.

The following extract is part of the literature review of another study conducted on Moringa oleifera seeds. Complete the gaps with a suitable form of the given verb.

Moringa-Functionalized Rice Husk Ash for Potential Use in Water Disinfection

Literature Review

(…)

A technology that (a)_____ (can potentially increase) access to safe drinking water is water treatment using MO seeds. MO seeds (b)_____ (know) to exhibit coagulation and flocculation properties and these (c)_____ (study) extensively in the literature. Researchers (d)_____ (report) that the MO seed is able to remove turbidity [6] and (e)_____ (demonstrate) bactericidal activity [7]. MO seeds (f)_____ (show) to improve water quality by reducing water hardness [8] and removing toxic metal ions such as arsenic in drinking water [9]. Furthermore, high removal of anionic dyes observed (g)_____ (indicate) its versatility in various wastewater applications [10]. Collectively, these facts (h)_____ (support) the use of MO seeds as an alternative water treatment technology.

(…)

Follow-up activity 2: Using quality sources in your report

You will be referring to a number of sources in your literature review. (Of course, perhaps to a lesser extent, you may also be referring to sources in other sections of your proposal.) Using quality sources has a direct impact on the quality of the work that you can eventually deliver.

Evaluating sources is a fundamental literacy skill. The LANG 2030 LibGuide at https://libguides.ust.hk/lang2030/evaluate prepared by the Library has a very useful section on the topic. It draws attention to 5 aspects of an information source.

- who - author
- what – content and coverage
- when - timeliness
- why – purpose or bias
- what – suitability

"Rescue Giant" is a student TechVention project that is about a drone swarm that uses LiDar technology to generate 3D maps in real time to help firefighters understand the architecture of a building on fire.

The sources cited in two proposal reports written by different students are reproduced here. Many of the sources are about different sensing technologies which are discussed and compared in the literature review. Comment on the quality of the sources for the purpose of supporting the proposal.

References

[1] Hong Kong Fire Services Department, “Classification of fires in Hong Kong,” 2019. [Online]. Available: https://www.hkfsd.gov.hk/eng/source/statistics_2019eng_20191028_160530.pdf

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[6] S. Liao, “A shape-shifting drone suggests the future of rescue missions” *The Verge*, 2018, Dec 20. [Online]. Available: https://www.theverge.com/2018/12/20/18150454/shape-shifting-drone-future-rescue-missions

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[2] Z. Soo, “Hong Kong orders building inspections after deadly fire,” AP News, 2020 Nov 17. [Online]. Available: https://apnews.com/article/hong-kong-fires-carrie-lam-30cfb90bc1b1cf9ad5969264c498fb23

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[5] "What is an IR sensor," FierceElectronics, 2020. [Online]. Available: https://www.fierceelectronics.com/sensors/what-ir-sensor

[6] "Why LiDAR,” LeddarTech, 2020. [Online]. Available: https://leddartech.com/why-lidar/

[7] "What is 5G | Everything you need to know about 5G,” Qualcomm, 2020. [Online]. Available: https://www.qualcomm.com/invention/5g/what-is-5g

[8] "What is machine learning,” Expert.ai, 2020. [Online]. Available: https://www.expert.ai/blog/machine-learning-definition/

Texts and videos used in this lesson

Follow-up activity

J. R. Barajas, S. A. Pagsuyoin, F. Bacani, J. Santos, R. G. Tan, A. Orbecido, L. Razon, M. Almendrala and J. S. Latayan, “Moringa-functionalized rice husk ash for potential use in water disinfection,” *DLSU Research Congress* 2016, 7-9 Mar 2016. Available: http://www.dlsu.edu.ph/conferences/dlsu-research-congress-proceedings/2016/GRC/GRC-SEE-I-003.pdf

2.6 Giving a technical description (1)

You will:

- Learn to describe your innovation clearly and fully;
- Review an innovative design in a critical yet constructive way;
- Revise the use of active and passive verbs in technical descriptions.

In a proposal report, the technical description section is a core section that draws much attention, because this is where you describe your solution to the problem set out in the introduction. In this section, you need to describe your invention clearly and fully. You should also be writing in a formal and precise style.

Pre-task activity: What is a technical description?

1. Writing a definition is a common way to describe a product, an invention or a mechanism.

   A roller coaster ride is an experience that is familiar to most people. Based on what you know about roller coasters, write a short definition.

A roller coaster is .....

.....

2. Look at p. 158 for two definitions of a roller coaster, taken from two different sources. Which one of these would you consider to be a technical description? Why?

Task 6.1 What should be included in a technical description?

1. A roller coaster has no engine or power source of its own. For most of the ride, the train is moved by gravity and momentum. One of the most common ways to build up this momentum is to take the train to the top of the first hill (the lift hill) by a lift system.

   Read the following extract for a technical description of the chain lift and watch the accompanying video. Complete the following table to understand the content and organization of information in a technical description.

Extract: What is a chain lift?

The traditional lifting mechanism is a long length of chain (or chains) running up the hill under the track. The chain is fastened in a loop, which is wound around gears at the top of the hill and at the bottom of the hill. The gear at the bottom of the hill is turned by a simple motor. To prepare for a journey, the motor turns the loop so that the chain continually moves up the hill like a long conveyer belt. When the train rolls to the bottom of the hill, the coaster cars grip onto the chain with sturdy hinged hooks, or chain dogs. Once the chain dogs are hooked, the chain simply pulls the train to the top of the hill. At the summit, the chain dogs are released and the train starts its descent down the hill.

Video: "The chain lift explained"

https://www.youtube.com/watch?v=06jLTR6NVrM

Structure	What is a chain lift and how does it work?
What is the item and what does it do?	
What are the main components?	(What does each component look like? What is its function? How do the components relate to each other?)
How does it work?	(What is the process involved? What happens in each stage of the process? What is the engineering principle that drives the operation?)

2. Technical descriptions answer specific questions that readers have about a product / invention / mechanism. Which of the following questions do they answer?

Questions about a product / invention / mechanism	Relevant to a technical description?
a) What is the purpose of the item?	
b) What are the component parts? How are they related to each other?	
c) What does each component part look like? (appearance, weight, size, etc.)	
d) What is the function of each component part?	
e) What is special about some of the component parts? Why are they designed in this way?	
f) What are some comparable designs and why are they not chosen?	
g) How does the item work?	
h) What are the benefits of the item?	
i) What are the processes / engineering theories involved in the operation?	
j) What are some limitations of the item?	

Task 6.2 Presenting a technical description

You have been working with your project group on the development of an innovation for TechVention. Now you have a chance to present your innovation to your classmates to collect their initial responses to your innovation.

1. First of all, prepare a clear technical description for your innovation taking advantage of what you have learnt in this lesson. Use the following outline to help you. Your description should complement the diagram you have prepared in the Design Form.

Structure	Your TechVention innovation
What is the item and what does it do?	
What are the main components? (What does each component look like? What is its function? How do the components relate to each other?)	
How does it work? (What is the process involved? What happens in each stage of the process? What is the engineering principle that drives the operation?)	

2. You will now pair up with a classmate from a different TechVention group and present your innovations to each other.

   a) Use the Design Form to guide you in the presentation. Start your presentation with the problem you want to address and include a survey of existing solutions so that your audience knows the niche your innovation aims to fill.

   b) Use the diagram and the notes you have prepared in (1) above to help you give a clear and accurate technical description.

   c) Get feedback about your innovation from your classmate to help you improve your innovation.

3. When you have finished discussing both innovations with your classmate, complete side 2 of the Design Form for each other. Give critical yet constructive comments to help each other develop the innovation further.

Language focus: Active and passive verbs in a technical description

1. Study the underlined verbs in the following extract. Explain the use of the active or passive form of the verbs.

Chain Lift

The traditional lifting mechanism is a long length of chain (or chains) running up the hill under the track. The chain is fastened in a loop, which is wound around a gear at the top of the hill and another one at the bottom of the hill. The gear at the bottom of the hill is turned by a simple motor.

To start the train, the motor turns the chain loop so that it continually moves up the hill like a long conveyer belt. The coaster cars grip onto the chain with several chain dogs, sturdy hinged hooks. When the train rolls to the bottom of the hill, the dogs catch onto the chain links. Once the chain dog is hooked, the chain simply pulls the train to the top of the hill. At the summit, the chain dog is released and the train starts its descent down the hill.

The passive form is used for: _____

The active form is used for: _____

2. The following extract describes the braking system of roller coasters. At the moment, all the verbs take the passive form. Put some of the verbs in the active form as appropriate. You may need to make changes with the subject and the object of the sentence accordingly.

The Brakes

Like any train, a brake system (1) is needed on a roller coaster so it (2) can be stopped precisely at the end of the ride or in an emergency. In roller coasters, the brakes (3) are not built into the train itself; they (4) are installed into the track.

This system is very simple. A series of clamps (5) are positioned at the end of the track and at a few other braking points. A hydraulic system (6) is operated by a central computer to make sure that these clamps (7) are closed when the train (8) is needed to stop. The clamps (9) are closed in on vertical metal fins which (10) are run under the train, and the train (11) is gradually slowed down.

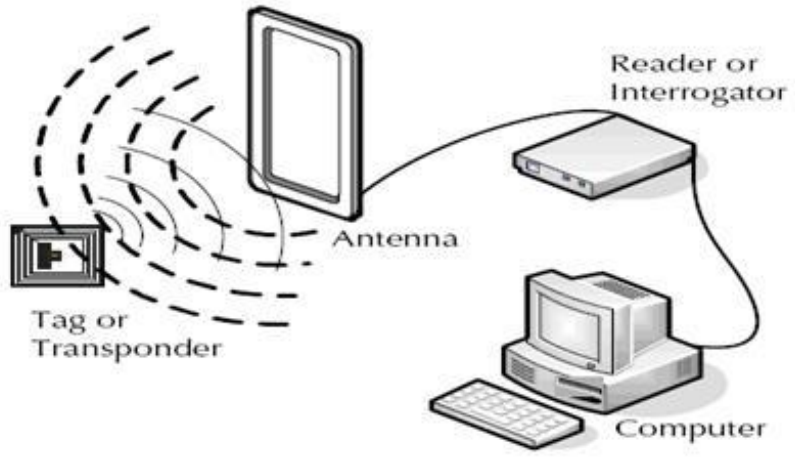
1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____
11. _____

Follow-up activity: Information flow in technical descriptions

In this lesson, we learnt that a technical description can be usefully organized in a three-part structure:

- What does the technology do?
- What are the main components?
- How does it work?

1. This diagram explains the RFID technology, which is widely in use for tracking and payment. Give a short description of the technology using the suggested 3-part structure.



2. Compare your account with the following extract that is taken from a book on the subject. Identify the 3 parts and pay attention to the language that is used to write each part. (The sentences in the paragraph are numbered to enable you to refer to them easily.)

(1) Radio frequency identification, or RFID, is a form of wireless communication that uses radio waves to identify and track objects. (2) There are three basic components to an RFID system: a tag, which is composed of a semiconductor chip and an antenna, a reader, which is composed of an RF electronics module, and a host, which most often takes the form of a workstation running database and control software. (3) The tag and the reader communicate information between one another via radio waves. (4) When a tagged object enters the read zone of a reader, the reader signals the tag to transmit its stored data. (5) Once the reader has received the tag's data, that information is relayed back to the host, where the data can be stored in a database and analyzed at a later time.

Sentences that are related to the 3 parts are:

- What does the technology do? _____
- What are the main components? _____
- How does it work? _____

Sentences that illustrate the following functions are:

- definition: _____
- partition (dividing things into their component parts): _____
- description of mechanism: _____
- description of process: _____

(It should be noted that a technical description is primarily descriptive. Do not overuse sentences that reason or justify (e.g. with expressions like “as a result”, “in order that”, etc.)

Extracts for Pre-task activity: Two definitions of a roller coaster

Definition 1
A roller coaster is an exciting entertainment in an amusement park, which is like a fast train that goes up and down very steep slopes and around very sudden bends.

Definition 2
A roller coaster is a specialized railroad system, consisting of a track that rises in designed patterns that turn the rider briefly upside down. The cars on a typical roller coaster are not self-powered. Instead, they are pulled up with a chain or cable along the lift hill to the first peak of the coaster track. The potential energy accumulated by the rise in height is transferred to kinetic energy as the cars race down the first downward slope. Kinetic energy is then converted back into potential energy as the train moves up again to the second peak.

Texts and videos used in this lesson

Pre-task activity

Adapted from T. Harris, “How roller coasters work,” HowStuffWorks. [Online.] Available: http://science.howstuffworks.com/engineering/structural/roller-coaster2.htm

“Chain Lift Hills: Explained,” Coaster Bot. [Online]. Available:

https://www.youtube.com/watch?v=06jLTR6NVrM

Language Focus

V.D. Hunt, A. Puglia, M. Puglia. *RFID: A guide to radio frequency identification*. John Wiley & Sons, 2007. Available: ftp://tor.ntu-kpi.kiev.ua/pub/pershin/LIBRARY/BOOKS%20AND%20GOST/BOOKS/_ENGLISH/RFID%20A%20Guide%20To%20Radio%20Frequency%20Identification.pdf

2.7 Giving a technical description (2)

You will:

- Select and organize information for describing a technical innovation;
- Review the use of precise vocabulary for technical descriptions;
- Review the grammar of relative clauses.

Pre-task activity 1: Talking about urban transportation

Urban transportation is growing in importance as more and more people live in cites. City dwellers already enjoy a wide range of transportation facilities, but scientists and engineers are working hard to explore new ways of moving around cities.

Watch this video about PopUp, a new urban transporter which is still in the concept stage. As you watch, jot down information that describes the technical design of the vehicle.

The following items of information are taken from the video. If you were going to write a technical report for PopUp, would you include these, and in which section?

Information about PopUp	To include or not? In which section?
a) More than two thirds of the world's population will live in cities in the future.	
b) PopUp is the brainchild of Airbus and Italdesign working in collaboration.	
c) PopUp is conceived as a modular flying car that travels both on ground and in the air.	
d) PopUp combines the expertise of the two best players in the fields of air and ground transport.	
e) PopUp takes advantage of the underutilized urban sky.	

Pre-task activity 2: Introducing Shweeb

You will watch a video about Shweeb, which has also been conceived as a component of an urban transportation system. Currently this innovation has only been implemented as a ride in an amusement park in Rotorua, New Zealand.

1. Work with a partner to describe the characteristics of this ride. You may use the headings to guide you.

Power source? Rider's position? Advantage? How fast (for three laps of a 200m track)? What affects the speed? Shape of the Shweeb pod? Why?

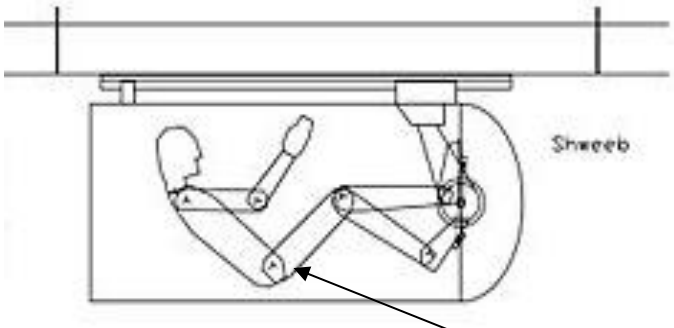
2. You will now watch another video in which Shweeb's inventor Geoff Barnett explains the concept, design and vision of Shweeb. Answer the following questions after watching the video.

Shweeb combines two technologies for urban transportation. What are these? What features are built into Shweeb to make it energy efficient? According to Barnett, what makes it particularly suitable for Shweeb to be used as an urban transportation system?

Task 6 A technical description of Shweeb

You are helping the developer of Shweeb to prepare a proposal that will be sent to potential investors. You are responsible for the technical description section. This section should be no more than 150 words.

1. You have already made some notes from various Shweeb documents. You will need to decide if the information is relevant to a technical description.



elevated, ultra-thin rails measuring 200mm x 200mm and spanning 20m

a healthy way to travel

rider in a laid-back reclining position; comfortable for the rider

At the station, incoming pods slide up a 2m ramp to come to a natural stop

Each pod from the station gains momentum as it glides down to join the main line

2. Write an outline of your Shweeb description below, based on the structure suggested on p. 154.

Overview of Shweeb	Description and Function of Parts	Operation of Shweeb (one cycle of operation)

Write a draft of your technical description for the Shweeb proposal. Remember that you should describe the system rather than evaluate it or any of its parts. Post your draft to Practice Task 4 at Canvas for your classmates to comment.

Checklist

Your technical description should demonstrate:

- ❒ Clear identification of the item and its function
- ❒ Appropriate level of technicality for the audience
- ❒ Objective description with no evaluation
- ❒ Use of precise technical language
- ❒ Use of visuals (if appropriate)

Language focus: Using precise formal vocabulary

A proposal is a formal document that aims to convey meaning in a precise and professional way. Use of formal, scientifically precise vocabulary will help to achieve the right style.

The following is an explanation of the Shweeb technology that is found on the Shweeb website. It is meant to be scientific and precise while being accessible to a general reader. The 12 words underlined, however, do not have very precise meanings. Replace these words with a more precise and formal choice from the suggestions provided.

The Shweeb Technology

Aerodynamics and Efficiency

Vehicles (1) **get** speed either by employing more powerful engines or by reducing the resistances acting against the vehicle. The Shweeb proves that by intelligently removing resistances, the energy required can be minimized to such an extent that it becomes possible to (2) **do away** with the mechanical engine and utilize solely human muscle power.

Two main resistances acting on any moving vehicle are aerodynamic drag and rolling resistance. At high speeds, aerodynamic drag is by far the greatest, with around 80% of a cyclist's energy used to (3) **cut** wind resistance. By placing the rider feet-forward, recumbent cycles halve the amount of wind resistance. In addition, running hard wheels on hard rail greatly reduces rolling resistance. The Shweeb's specialized transmission system (4) **passes** power from the pedal to the rail with (5) **the least** friction losses.

Terminus Station

The Shweeb station acts as an energy storage system that (6) **changes** kinetic energy into potential energy by ramping the incoming pods up two meters into the platform area. Riders (7) **getting off** roll down into the mainline, thereby gaining a gravity boost. In this way, the only power requirement from the rider is that of maintaining the momentum.

Sustainability

The Shweeb is a zero-emission transportation system. Because it is so easy to pedal, the rider will not even (8) **give out** much more carbon dioxide than he/she would if using a more passive transportation model. The Shweeb network makes use of the airspace above existing rights-of-way and takes up almost no space at ground level. This (9) **frees up** the ground area for more economically and ecologically valuable uses such as promenades, markets and parkland.

Last century the human body was viewed as a piece of cargo that had to be carted, immobile, to its destination. This view is quickly changing. A (10) **lazy** lifestyle is now understood to create a host of problems. Opportunities to exercise are harder to find, leisure time is shrinking, and open space is (11) **becoming less and less**. Thus the Shweeb adds value to the daily commute by giving riders mobility and fitness (12) **at the same time.**

(1)	gain/ attain/ increase	(2)	remove/ dispense/ take away
(3)	overcome/ handle/ remove	(4)	transforms/ translates/ transfers
(5)	no/ minimal/ negligible	(6)	converts/ transforms/ modifies
(7)	descending/ disembarking/ decelerating	(8)	produce/ exhale/ emit
(9)	reveals/ releases/ allows	(10)	sedentary/ inactive/ immobile
(11)	decreasing/ declining/ diminishing	(12)	simultaneously/ together/ in parallel

Follow-up activity: Using relative clauses to provide information

Relative clauses are common in technical descriptions as the structure provides a way to give essential or additional information. Often relative clauses start with the relative pronoun "which".

1. There are several ways to use the relative pronoun "which". In the following, match the usage patterns with their corresponding examples:

   (A) In a defining relative clause giving essential information
   (B) In a non-defining relative clause giving additional information
   (C) To refer to a whole clause that comes before it
   (D) To be used with a preposition

Usage	Example
	Roads in Hong Kong are usually narrow or saturated with traffic, which discourages use of bicycles for the daily commute.
	Shweeb refers to an urban transit network which relies on human energy to power pods suspended from monorails.
	The bullet-shaped Shweeb pod has been designed to reduce aerodynamic drag, which could take up as much as 90% of the total mechanical power output to overcome.
	The Shweeb system consists of a monorail network on which transparent capsules for single riders are run.

2. Correct the following sentences which contain mistakes related to relative clauses. The problematic parts of the sentences are underlined. Remember that a relative clause should follow the noun that it explains.

a) RFID which uses radio waves to identify and track objects is a form of wireless communication.

b) RFID tags are small and require very little power which makes it easy and cheap to apply tags to all kinds of goods or objects.

c) Passive tags are smaller and less expensive to implement, which must be powered up by the RFID reader before they can transmit data.

d) Active RFID tags have a battery used to run the microchip's circuitry and to broadcast a signal to a reader.

e) Information collected from the RFID tags is transferred to a host computer system, which the data can be stored and analyzed at a later time.

f) All existing RFID systems use proprietary technology. This means that the RFID tag embeds information only a designated reader rather than any third party devices can read and extract it.

Texts and videos used in this lesson

Pre-task activity

"Urban mobility takes shape with Italdesign and Airbus' Pop.Up," Airbus, 7 Mar 2017. [Video file]. Available: https://www.youtube.com/watch?v=-FseeVy7uvU

A. Hodge, "Shweeb - Agroventures, Rotorua, NZ," 16 Aug 2008. [Video file]. Available: http://www.youtube.com/watch?v=GDpwkZirSNU

Johnebing, "The Shweeb human-powered monorail featured on pop sci's future," 16 Nov 2009. [Video file]. Available: http://www.youtube.com/watch?v=lhxVtUFZVzk

Language Focus

Shweeb. "Aerodynamics and efficiency," [Online]. Available: http://shweeb.com/index.php?m=transport

2.8 Describing feasibility and benefits, concluding and putting together your proposal

You will:

- Explore the concept of feasibility and apply it to the evaluation of technical innovations;
- Examine the strengths of claims in a proposal report;
- Review how to write an effective conclusion to a report;
- Revisit the style and tone suitable for a proposal report.

Pre-task activity: Feasibility of an innovation

1. How would you evaluate the feasibility of a technological innovation? Discuss your criteria with your group members.

2. Your lecturer will show you some criteria for evaluating the feasibility of technological projects. Did you propose the same criteria? Which criterion is the most important?

Task 8 Evaluating technical innovations

Imagine you are investors who are considering the feasibility of innovations. You want to see if you should commit your money and resources into the product.

1. Work in groups. Each group will watch a 1-min video about an innovation. Find out what the innovation does and the technology involved.

Groups 1 & 2:	**DRESIO (I.T & Smart Tech)** DRESIO's AI and AR products help brick and mortar stores turn customers into influencers, discover insights, and generate traffic.
Groups 3 & 4:	**Crazy Wall (Robotics & AI)** Crazy Wall has developed a smart exterior wall spraying robot that can be used in construction sites
Groups 5 & 6:	**UVify (Healthcare)** UVify is an automatic and portable UV-C light-based disinfection device for medical staff to actively cleanse stethoscope diaphragms.

2. Evaluate the innovation using at least 3 different concepts of feasibility. Are there favorable or limiting factors for the innovation? How important is each factor?

3. Summarize the results of your discussion in the table below, in terms of favorable and limiting factors that impact on the overall feasibility of the project.

Feasibility concept	Favorable factors that make you feel optimistic about the innovation	Limiting factors that make you feel cautious about the innovation
1.		
2.		
3.		

4. Present your ideas to the other groups. Discuss which innovation is considered to be the most feasible one. Some of you will be asked to share your ideas with the whole class.

Literacy focus: Strength of a claim

When you write a proposal, you are making a claim that your proposed idea would work. However, strong claims do not always lead to a strong position. Writers often have to adjust the strengths of their claims so that they appear more reasonable and thus more convincing.

1. How strong are the following claims about Shweeb? Would they convince the readers of a proposal report?

Strength	Claim
	Shweeb is a revolutionary mode of personal transportation that will transform urban transportation in cities all around the world.
	Shweeb is a human-powered vehicle that attempts to maximize efficiency by reducing air resistance.
	Shweeb is the most efficient human-powered vehicle that has ever been invented.

Read the following extracts written for a proposal about a futuristic cooling technology named CoolWave, which cools down food to exact temperatures in an instant using laser.

In each extract, analyze:

- what kind of feasibility the writer is concerned about
- whether favourable (F) or limiting factors (L) are involved
- how language is used to make reasonable and cautious statements

Extract	**Your observations: kind of feasibility / F/L factors / language**
Extract 1 Indeed throughout the history of laser cooling technology, most of the experiments and related applications involve cooling on a micro-scale, such as improvements on an atomic clock. However, a rising trend of research has verified that the cooling of macro-objects is possible in laboratory environments.	
Extract 2 While the cost of CoolWave may be a limitation at this prototyping stage, by identifying the market need for a conveniently available cooling device especially in regions with a sub-tropical climate like Hong Kong, it is foreseeable that continuous optimization of CoolWave and thus a reduction in cost would be possible.	
Extract 3 By continual monitoring of the inner temperature, CoolWave promises a finer degree of food temperature control. This not only caters to user preferences regarding their food, but also facilitates the expansion of diversity in cooking styles since ambiguous descriptions of food temperature can be substituted with concrete measurable units.	

2. Evaluating your own TechVention innovation

You will soon be writing the feasibility section for your TechVention proposal. Examine two different aspects of feasibility and write a few sentences for each. Include both favourable and limiting factors as appropriate, and use suitable language to indicate your position.

Aspect of feasibility	Favorable factors	Limiting factors
1.		
2.		

Language focus: Language for discussing feasibility and benefits

It is common in the feasibility section that the writer boosts the appeal of the proposed innovation by using positive words and expressions. Complete the blanks with a suitable word, paying attention to the form of the word and its collocation.

Mapping Hong Kong in 3D

1. 3D mapping _____ (excel / compare) over traditional 2D town planning maps in that it provides a more accurate translation of real-world complexities. This should vastly _____ (facilitate / ameliorate) the design and building processes.

2. 3D models can be used to identify a city's solar energy potential and plan tree planting initiatives, thus _____ (pave / lead) the way for a greener future.

3. The technology has a wide range of current and potential applications, and readily _____ (lend / transform) itself to commercialization.

Shweeb

4. Shweeb offers a _____ (probable / viable) solution to many challenges of urban transportation.

5. Being a zero-emission system, Shweeb commands _____ (a definite advantage / ideal) over almost all other kinds of urban transportation.

6. It _____ (significantly / completely) alleviates air pollution, a serious problem in overcrowded cities all over the world.

7. An emission free vehicle such as Shweeb is also _____ (ideal / practicable) for green zones and residential areas, where conservation of the natural environment is given a premium _____ (opportunity / consideration).

8. Shweeb creates new _____ (opportunity / chance) in land use. The Shweeb network makes use of the airspace above existing rights-of-way. This frees up the ground area for more economically and ecologically _____ (cost-effective / advantageous) uses such as promenades, markets and parkland.

9. Shweeb adds _____ (value / vision) to the daily commute by giving riders mobility and fitness simultaneously.

10. Promoting the wider use of Shweeb reflects the _____ (vision / mission) of a government that cares enough to invest in the health of its citizens in the long run.

Literacy focus: Writing the conclusion

An effective conclusion can reinforce the main idea that you presented in the proposal report.

1. Which of these elements should be included in the Conclusion?

Elements	Yes	No
1. Restate the aims of the proposal.		
2. Summarize the main ideas.		
3. Introduce new information.		
4. Explain the significance of the contribution of the design.		
5. Point out the limitations of the current design.		
6. Make recommendations for further work.		

2. The following conclusion is taken from a proposal report of a portable UV disinfector. Is this conclusion effective? Do you have any suggestions for improvement?

Conclusion

To conclude, the portable UV disinfector has great potentials as there are no similar products in the market of public health. With this proposed device, the bacteria can be killed effectively by the ultraviolet rays. All in all, this innovation can be widely used in different sectors such as hospitals, hotels and airports preventing people from contacting diseases and bringing more convenience into their life.

Follow-up activity: Proposal writing – Style and tone

These extracts are taken from a draft proposal for a portable UV disinfector. Analyze the problems in style and tone and make suggestions to improve them.

Introduction

Do you know that infectious diseases have been the greatest killers of mankind for thousands of years? Traditionally, if you are so unlucky as to have caught an infectious disease, you will be sent to hospital. However, don't you know that the hospital is more dangerous than you think? Often when you are healed of one infectious disease, you get infected by another. Doctors and nurses are in even more danger. According to statistics from China's Ministry of Health, more than 1/3 of those killed by SARS were medical practitioners. This is where our amazing ultraviolet disinfector comes in!

Literature review

Hospitals are regularly deploying various methods to disinfect the environment. Many studies are being conducted to examine the efficacy of these methods. For example, Smith (2010) reported that the air in hospital wards was a lot cleaner after the cleaning staff replaced brooms with vacuum cleaners. In another study [4], researchers were disappointed to find that that vacuum cleaners and oiled mops do not remove many bacteria from floors. In yet another study [5], Gordon claimed that scrubbing and disinfection were helpful. Then in another study [6], washing floors with detergent did not make a difference in bacterial counts.

Technical description

The secret of our invention is ultraviolet rays. As everyone knows, all pathogens die or lose the ability to reproduce once they are hit by ultraviolet rays. So what is our disinfector like? Actually it is rather simple. There is an ultraviolet light tube, a parabolic reflector and a handle. When you switch the device on, UV rays are emitted by the UV lamp. The clever thing is that all the rays will turn parallel because the reflector is a parabola. Then as you glide the device along the floor, the UV rays will shoot out from the bottom, attacking all kinds of harmful bacteria that come its way.

Feasibility and benefits

My revolutionary disinfector will set a new standard in the maintenance of public health. This will have a monumental effect on curbing the spread of infections on a global basis. With this wonderful device, disinfection can be carried out several times a day. You need not worry about disturbing patients. A beam of light can travel to any gap or corner. You need not worry that some corners cannot be reached. Our invention is safe for any users, even non-professionals, because we are using low intensity UV lamps. This, however, may mean that the UV rays generated may not be strong enough to kill all the germs in the hospital.

Conclusion

In short, our portable UV disinfector has great potential. Because of its high efficiency, you can expect to see this product in hospitals, hotels, airports or anywhere with disease outbreaks!

Texts and videos used in this lesson

Task 8

The videos for this activity are from the HKUST Entrepreneurship Center: HKUST-Sino One Million Dollar Entrepreneurship Competition 2020 [Video]. Available: https://onemilliondollar.ust.hk/2020/awards_announcement

Innovation Proposal Report Checklist

Introduction
- ❑ Have you provided enough background information to orient your readers?
- ❑ Have you established a niche to demonstrate the value of your innovation?
- ❑ Have you related your project to the niche?

Literature Review / Existing Technologies
- ❑ Have you evaluated and compared existing and/or related technologies?
- ❑ Have you shown how these technologies are related to what you want to achieve in your innovation?
- ❑ Have you cited the sources referred to in this review?

Technical Description
- ❑ Have you included an overview of your innovation at the beginning?
- ❑ Have you described the components that make up your innovation and how they work together?
- ❑ Have you convinced your readers that your innovation works?
- ❑ Have you included a diagram to illustrate your design and labelled it properly? (optional)

Feasibility / Benefits
- ❑ Have you considered the feasibility of your innovation from different perspectives such as technological, socio-economic and costs?
- ❑ Have you evaluated how your innovation addresses the problem set out at the beginning and what benefits it brings?
- ❑ Are there any limitations or constraints to your innovation?

Conclusion
- ❑ Have you provided a summary of the problem, solution, and benefits of the innovation?

References
- ❑ Have you included in-text references using the IEEE format to credit other people's ideas?
- ❑ Have you effectively paraphrased information from your sources?
- ❑ Have you included a reference list at the end?
- ❑ Have you cited the sources properly to avoid plagiarism?

Organization
- ❑ Are the Introduction and the Conclusion effective?
- ❑ Have you used clear sub-headings for the different sections of your proposal?
- ❑ Are the sections balanced and well-connected?
- ❑ Are ideas and information well connected using suitable cohesive devices?

Vocabulary and Grammar
- ❑ Have you used a wide range of vocabulary accurately and precisely?
- ❑ Have you explained/defined any technical terms?
- ❑ Have you used formal language and avoided contractions and the use of a personal tone?
- ❑ Have you used a range of sentence structures and made sure they are appropriate for the sections?
- ❑ Have you used the right tenses to express the right meanings?
- ❑ Have you carefully proofread and corrected any grammar errors?

Format & Presentation
- ❑ Have you formatted your proposal report (appropriate font, title page, page numbers, etc.) to make it appear professional?

2.9 Presenting an innovation (1)

You will:

- Use different strategies to open an innovation presentation;
- Use signposts to guide the audience in a presentation;
- Examine other rhetorical strategies for presentations.

Pre-task activity 1: A creative opening for a technical presentation

At the beginning of a technical or scientific presentation the speaker needs to orient the audience to the presentation. You will be shown the opening of two TED presentations. Analyze how the speakers prepare the audience to follow the rest of the presentation.

a) What is the focus of each presentation? What specific aspect of the topic does the speaker want to talk about?

b) What strategies does the speaker use to arouse the interest of the audience? Common strategies are:

- Telling a story
- Identifying a problem
- Making a contrast
- Drawing an analogy
- Using a metaphor

c) What is the likely response of the listeners to each opening? Surprised? Concerned? Worried? Curious? Angry?

Dennis Hong: A car for the blind

Many believe driving is an activity solely reserved for those who can see. A blind person driving a vehicle safely and independently was thought to be an impossible task, until now. Hello, my name is Dennis Hong, and we're bringing freedom and independence to the blind by building a vehicle for the visually impaired.

So before I talk about this car for the blind, let me briefly tell you about another project that I worked on called the DARPA Urban Challenge. Now this was about building a robotic car that can drive itself. You press start, nobody touches anything, and it can reach its destination fully autonomously. So in 2007, our team won half a million dollars by placing third place in this competition. So about that time, the National Federation of the Blind, or NFB, challenged the research committee about who can develop a car that lets a blind person drive safely and independently. We decided to give it a try, because we thought, "Hey, how hard could it be?" We have already an autonomous vehicle. We just put a blind person in it and we're done, right? We couldn't have been more wrong …

Andrew Steele: 3D Spiral Polarization Glasses

You're off out on a first date to the cinema, you've got hot tickets to the premiere of the critically-acclaimed new release “Aliens vs Giant Dinosaur Peace in Space 5”, in 3D. But how to fill the awkward conversational vacuum before the film begins? What better way than to explain to your beloved to-be how 3D glasses work?

Things are 3D out here in the real world because you have two eyes. Hold your finger up in front of you like this. Then close your left eye and look at it with just your right, and then swap eyes. Can you see that when you swap back and forth your nearby finger seems to move against the faraway background? Judging the difference between the image seen by each eye is one of the ways that your brain constructs a three-dimensional model of the world around you. So if you want to make a 3D movie, all you have to do is film every scene with two identical cameras about the same distance apart as human eyes. But when you're playing it back, how can you make sure the right image gets to the right eye? We're going to need a property of light. Like jam, light comes in different flavors, but unlike jam, there are only two. These flavors are called polarizations. And they arise because light is a wave. If I shot a beam of light at you guys now it can either wobble from side to side, that's horizontally polarized; or up and down, that's vertically polarized. As it travels forwards most light is a mishmash of the two, but we can use a polarizing filter to select just one flavor of light at a time. You can even make a pair of 3D glasses which use horizontally polarized light for the left eye and vertically polarized for the right, and then you could play the film back on a corresponding pair of projectors.

Pre-task activity 2: Introducing technical presentations

Previously you have learnt how to introduce technical projects in a written form. Would you do it similarly or differently when it comes to introducing them verbally? Tick the boxes for the elements you would include in a verbal introduction to a technical project.

Technical Presentation	Element
☐	Start with an attention-getter
☐	Provide background to the topic
☐	Tell a personal story
☐	Specify key technical problems
☐	Show that there is a gap in the research
☐	Show how the project addresses specific problems
☐	Challenge the audience with questions
☐	Outline the scope of the project

The following introduction from a TED talk uses some of the above elements. Write what these are in the space provided.

Todd Coleman: A temporary tattoo that brings hospital care to the home	Elements
Please meet Jane. She has a high-risk pregnancy. Within 24 weeks, she's on bed rest at the hospital, being monitored for her preterm contractions. She doesn't look the happiest. That's in part because it requires technicians and experts to apply these clunky belts on her to monitor her uterine contractions. Another reason Jane is not so happy is because she's worried. In particular, she's worried about what happens after her 10-day stay on bed rest at the hospital. What happens when she's home? If she were to give birth this early it would be devastating. As an African-American woman, she's twice as likely to have a premature birth or to have a stillbirth. So Jane basically has one of two options: stay at the hospital on bed rest, a prisoner to the technology until she gives birth, and then spend the rest of her life paying for the bill; or head home after her 10-day stay and hope for the best. Neither of these two options seems appealing. As I began to think about stories like this and hear about stories like this, I began to ask myself and imagine: Is there an alternative? Is there a way we could have the benefits of high-fidelity monitoring that we get with our trusted partners in the hospital while someone is at home living their daily life? With that in mind, I encouraged people in my research group to partner with some clever material scientists, and all of us came together and brainstormed. And after a long process, we came up with a vision, an idea, of a wearable system that perhaps you could wear like a piece of jewelry or you could apply to yourself like a Band-Aid. And after many trials and tribulations and years of endeavors, we were able to come up with this flexible electronic patch that was manufactured using the same processes that they use to build computer chips, except the electronics are transferred from a semiconductor wafer onto a flexible material that can interface with the human body.	

- What do you think about this structure? Would it be applicable to your project?
- Do you like the style of this presenter's delivery?

Task 9 Practice in introducing a technical idea

In a technical presentation, you will be judged not by how well you understand the content in the beginning, but how well your audience understands the content in the end. You may be very familiar with your project but your audience probably needs a clear and focused introduction to know what your project's purpose is.

1. Working in your project group, consider what you have learned about introducing a technical project from the three presentation openings. Do you want to include any of these elements in your introduction?

2. Prepare a 2-minute introduction for your project, which should:

   - engage the audience and prepare them to understand your project;
   - introduce the technical content, at a level that can be understood by a non-specialist but educated audience.

3. You will be re-grouped by your lecturer to present your introduction to another group.

4. As you listen to the presentations given by others, make constructive suggestions for improvement. You will fill in a peer evaluation form for the speaker afterwards.

Language focus 1: Guiding your audience in a presentation

1. In Part 1 p. 88, you saw how signposts signal the main stages of a presentation and make the structure of a presentation clear to the audience.

   Arrange the following key transitions in the '3D Spiral Polarization Glasses' talk in the correct order. How useful were these signposts in helping you keep track of the presentation when you watched the talk for the first time?

Order	Key transitions in 3D Spiral Polarization Glasses' Talk
	But when you're playing it back, how can you make sure the right image gets to the right eye?
	The solution is to use circularly polarized light, a kind of a mixture of horizontally and vertically polarized.
	Things are 3D out here in the real world because you have two eyes.
	Sadly there's a problem with this, and the problem arises if you tilt your head.

2. In Part 1 p. 88, you were introduced to a simple method for organizing content in presentations: the three-step method. What are the three steps?

- _____
- _____
- _____

Here is a transcript of part of 3D Spiral Polarization Glasses' presentation. Identify the three steps and label them in the margin.

Key element	Transcript
	But when you're playing it back, how can you make sure the right image gets to the right eye? We're going to need a property of light. Like jam light comes in different flavors, but unlike jam there are only two. These flavors are called polarizations. And they arise because light is a wave. If I shot a beam of light at you guys now it can either wobble from side to side, that's horizontally polarized; or up and down, that's vertically polarized. As it travels forwards most light is a mishmash of the two, but we can use a polarizing filter to select just one flavor of light at a time. You can even make a pair of 3D glasses which use horizontally polarized light for the left eye and vertically polarized for the right, and then you could play the film back on a corresponding pair of projectors.
	Sadly there's a problem with this, and the problem arises if you tilt your head. Imagine you're leaning on your date's shoulder and they're bizarrely long way away. Maybe this date isn't going so well. So your head is at 90 degrees. You'll get the left eye's image to the right eye, and the right eye image to the left, which will make you feel sick and you'll probably vomit all over your date's lap. And you don't need a scientist to tell you that is a cinema date disaster. The solution is to use circularly polarized light, a kind of a mixture of horizontally and vertically polarized. Circularly polarized light spirals through space instead of wobbling, and we could use it to make a different pair of 3D glasses, one which uses light spiralling clockwise in the left eye and anti-clockwise in the right eye. And this comes with a big advantage. Clockwise and anti-clockwise don't change as you tilt your head, so the correct information is always delivered to each eye. So no vomiting and the perfect ice breaker. That's how science could save your date at the cinema.

Language focus 2: Rhetorical strategies for presentations

1. Read these extracts from Dennis Hong's talk and identify the strategies he is using to make his talk interesting and accessible to the audience.

Extracts	Strategies
"So how does it work? Well, it's a rather complex system, but let me try to explain it, maybe simplify it. So we have three steps. We have perception, computation and non-visual interfaces."	
"So all this vast amount of information is then fed into the computer, and the computer can do two things. One is, first of all, process this information to have an understanding of the environment – these are the lanes of the road, there's the obstacles – and convey this information to the driver."	
"So we're moving away from the instructional cue devices, and we're now focusing more on the informational devices. A good example for this informational non-visual user interface is called AirPix. So think of it as a monitor for the blind. So it's a small tablet, has many holes in it, and compressed air comes out, so it can actually draw images. So even though you are blind, you can put your hand over it, you can see the lanes of the road and obstacles."	

Follow-up activity 1: Use of precise technical language

1. Read this extract from Dennis Hong's talk and guess which of the words in each pair he actually used.

Another device is called SpeedStrip. So this is a chair – as a matter of fact, it's actually a massage chair. We **gut it out/remove** the existing internal parts and we rearrange the vibrating elements in different patterns. And we **make them work/actuate them** to **give/convey** information about the speed, and also instructions how to **use/utilize** the gas and the brake pedal. So over here, you can see how the computer understands the environment. And because you cannot **see/visualize** the vibration, we actually **put/placed** red LED's on the driver, so that you can see what's happening. This is the sensory data, and that data **goes to/is transferred to** the devices through the computer.

2. Listen and check if your guess was correct. What is the difference between the words?

3. What reasons do you think Dennis Hong has for choosing particular words?

Follow-up activity 2: Your TechVention presentation

1. During this week, meet your TechVention group members and plan for your upcoming presentation. You need to:

   - Identify the key ideas of your proposal presentation. In particular, is there a technical idea crucial to your project that needs to be explained skillfully?
   - How deep will you take your audience into the technologies involved in your project?
   - How will you ensure that these ideas can be properly understood and appreciated by your audience?

2. Soon you will be presenting your project proposal with the following key elements: introduction and establishment of a niche (such as by comparing existing solutions); technical description; evaluation (feasibility, benefits and limitations) and conclusion.

   Think about some key elements you will incorporate in your presentation. Script your presentation using the following template:

Key element of your proposal presentation	What you will say
(e.g. establishing a niche)	Step 1: (Script it here.)
	Step 2: (Write a few key words to summarize the key ideas.)
	Step 3: (Script it here.)
(e.g. technical description)	Step 1: (Script it here.)
	Step 2: (Write a few key words to summarize the key ideas.)
	Step 3: (Script it here.)

3. You will be doing a 5-min practice presentation (an individual presentation that focuses on introducing the project and one aspect of its technical description) in the coming lesson. Prepare and rehearse before coming to class.

Texts and videos used in this lesson

Pre-task activity 1

D. Hong, “Making a car for the blind,” TED Talks, Mar 2011. [Video file]. Available: https://www.ted.com/talks/dennis_hong_making_a_car_for_blind_drivers

“Andrew Steele UK,” Fame Lab, 9 July 2012. [Video file]. Available: https://www.youtube.com/watch?v=vrgMM9aPej0&t=1s

Pre-task activity 2

T. Coleman, “A temporary tattoo that brings hospital care to the home,” TED Talks, Nov 2015. [Video file]. Available: https://www.ted.com/talks/todd_coleman_a_temporary_tattoo_that_brings_hospital_care_to_the_home

2.10 Presenting an innovation (2)

You will:

- Practice delivering a technical presentation and get feedback from peers;
- Examine the effective use of visual aids in technical presentations;
- Have a presentation practice with a focus on delivery skills.

Task 10.1 Your TechVention presentation

1. Pair up with a student not in your project group. Deliver your presentation (simplified version, individually, 5 minutes) to your partner.

2. As you listen to the presentation given by your partner, help him/her video-record the talk.

3. Discuss the strength(s) and weakness(es) of your presentations and give constructive suggestions.

   - Is the niche established clearly?
   - Is the technical description clear enough?
   - Is the 3-step method used?
   - Is the use of technical language appropriate? Is there a balance between being technically accurate and being understandable?

4. You will be re-grouped with your project group. Share the suggestions each of you have got and discuss how you are going to organize your group presentation.

Suggestions received by student 1:	Ideas for organizing your group presentation:
Suggestions received by student 2:	
Suggestions received by student 3:	
Suggestions received by student 4:	

Task 10.2 Analyzing the use of visuals

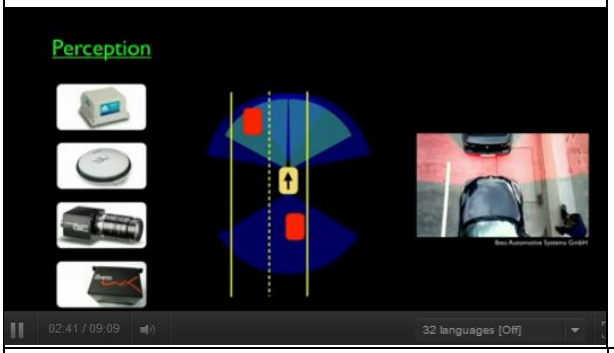
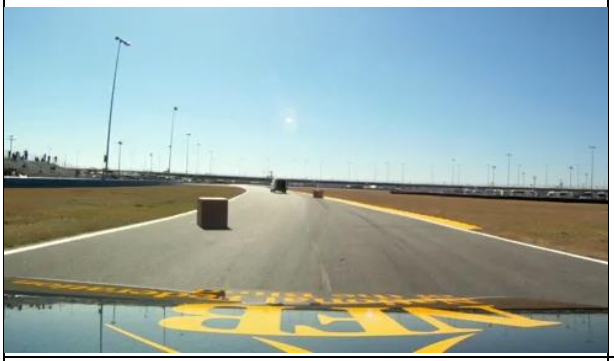
We live in a world of multimedia. Most presentations nowadays are given with some kind of visual aids, which often play a central role in technical and scientific presentations. Some commonly used forms of visual aids are:

- Photos
- Diagrams
- Graphs
- Text
- Bullet points
- Animation
- Videos
- Realia (real objects)

The effectiveness of visual aids can only be measured by the extent to which they help to deliver the content of the presentation.

You have viewed the opening of Dennis Hong's presentation on a car for the blind. Now you will watch the whole presentation with a focus on the visuals. Evaluate Hong's use of visuals with special reference to the following selected visuals:

Selected visuals	Types of visuals used and effectiveness
Visual 1 	
Visual 2 	
Visual 3 	

Selected visuals	Types of visuals used and effectiveness
Visual 4 	
Visual 5 	
Visual 6 	
Visual 7 	

Language focus 1: Expressive speaking with pausing, stress and intonation

Practice 1

This is Dennis Hong's opening to his TED talk on the driverless car. How could you use appropriate pausing, stress and emphasis to open the talk? Use // to show where you think a pause is needed and underline the words that you want to emphasize. Read the text a few times to get used to using the appropriate intonation.

Many believe driving is an activity solely reserved for those who can see. A blind person driving a vehicle safely and independently was thought to be an impossible task, until now. In the following, I'm going to show you how we bring freedom and independence to the blind by building a vehicle for the visually impaired.

Now listen to Dennis Hong saying this and note where he pauses and stresses words. Did he pause and stress words in the same way as you?

Many believe driving is an activity solely reserved for those who can see. A blind person driving a vehicle safely and independently was thought to be an impossible task, until now. Hello, I'm Dennis Hong, and we're bringing freedom and independence to the blind by building a vehicle for the visually impaired.

Practice 2

You will be given an extract from Dennis Hong's talk. You will share the extract with your group members, and work together to discuss how to deliver this content effectively, using appropriate pausing, emphasis and intonation. You will perform your reading to the whole class as a group.

Language focus 2: Using verb tenses to signal transitions

Dennis Hong's talk is delivered in an informal style and he frequently uses "so" and "but" as transitions. However, he also uses different verb tenses as transitions. What information do you expect to precede or to follow these transition phrases? Which part of the talk are they from?

1. So before I talk about this car for the blind …

2. So in 2007, our team won half a million dollars by placing third place in this competition.

3. So with this success, we decided to take the next big step.

4. But today we're going to talk about three of these non-visual user interfaces.

5. But the problem is these are instructional cue devices. So this is not really freedom, right?

6. So since we started this project …

7. And I truly believe that this can happen.

8. So today, the things I've shown you today, is just the beginning.

Literacy focus: Tackling questions in a Q&A session

1. At the end of a presentation, it is quite common that a Q&A session is held. Do you welcome this chance to interact with the audience? What can presenters achieve in a Q&A session?

2. Think about the strategies for use in a Q&A session. Which of the following are helpful and which are not? Put the following under "Dos" or "Don'ts'" in the table below. Discuss what you think about these strategies.

- prove the questioner wrong
- show interest in the question
- say that it is a "good question"
- make answers as long as possible
- all members answer the same question
- discuss the question, maybe not the answer
- stress that you have already explained it
- tell the audience "I don't know"

Dos	Don'ts

3. How would you respond to the following situations in a Q&A session?

a) "I'm not sure if your device works …"

b) "I'd read about another technology that may be better …"

c) It seems there is a security / safety issue with your device …"

4. There are many materials on the Internet offering useful advice for tackling questions. Here is a good one that comes in a set of 6 videos covering a range of strategies for handling the Q&A.

https://www.youtube.com/watch?v=b4kLTqbxVUU&list=PLiObSxAItudJKYHabQ5XnLg53JuhM3t5j&index=1

Texts and videos used in this lesson

Task 10

D. Hong, "Making a car for the blind," TED Talks, Mar 2011. [Video file]. Available: https://www.ted.com/talks/dennis_hong_making_a_car_for_blind_drivers

End of Coursebook