**Read: Book 2**

**1. The team project**

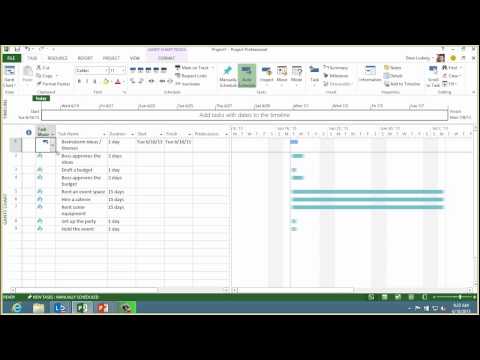
You will work in teams of 6 in most cases. You will work collaboratively to develop a product using a traditional waterfall methodology. This involves creating a specification, through consultation with a customer. Once a specification has been decided you will then proceed to develop a design. This design will then be implemented and tested. This traditional product development methodology is still use today although it is being superseded more and more by other product development methodologies such as Agile, Extreme, and Emertxe. Although we are looking at product development we can view these choices in broader project management terms. To see how broadly these ideas can be applied read the following blog, written by a construction engineer. Working in your teams will enable you to gain experience of team work and of project management. It will also enable you to learn about professional issues such as legal requirements, ethical concerns, and health & safety issues.

**2. The team roles**

All six members of the team need to fully engage with the product development and the related professional issues. However each team member will have a specific role with specific responsibilities regarding tasks to be completed and report chapters to be written. The different team roles are as follows.

**The team leader** takes the lead at team meetings and facilitates a team working environment. The person should have a range of skills that will be discussed later in this chapter. The team leader takes the lead on chapters 1 and 2 of the team report and contributes as a specialist to the product development.

**The project manage**r maintains the team logbook and the team project plan with timeline through the use of Microsoft Project. The following video outlines it use:

[](https://www.youtube.com/watch?v=FguzMlFW8pU)

The project manager also leads on chapter 4 and contributes to the product development as a specialist.

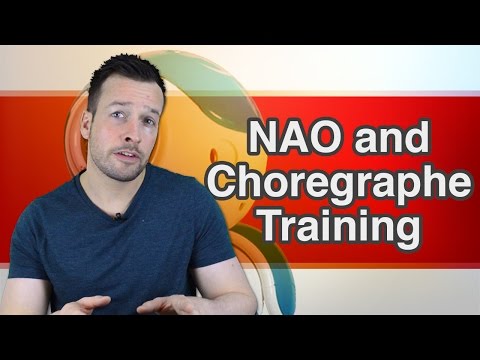
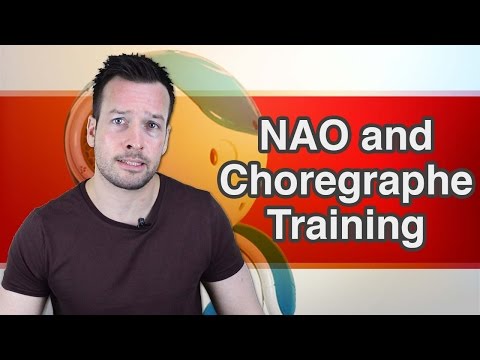
**The product development specialists** are the core product developers. Although all team members, including the leader and project manager, contribute to product development, the specialists take major roles and lead on chapter 3.

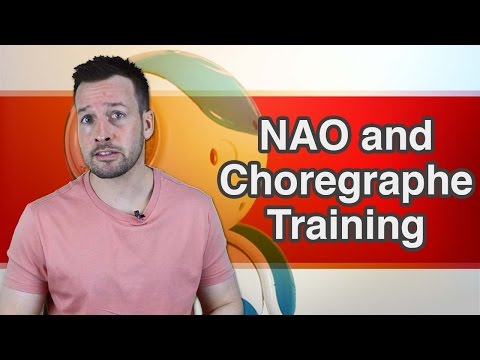
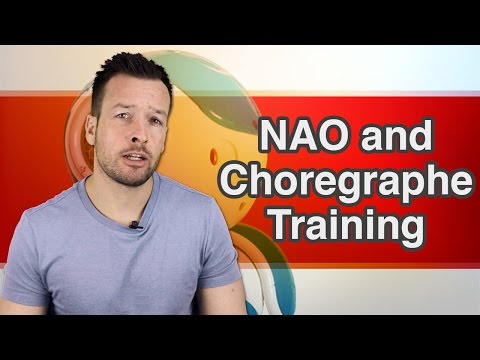
It is important that all team members contribute to the team by attending all team meetings and by undertaking tasks assigned to them at each team meeting. All completed tasks must be evidences by document(s) uploaded to the team "Reference/Précis and Team Task Database" in your Moodle team area. You will learn about the team Moodle area in the Week 5 laboratory session.

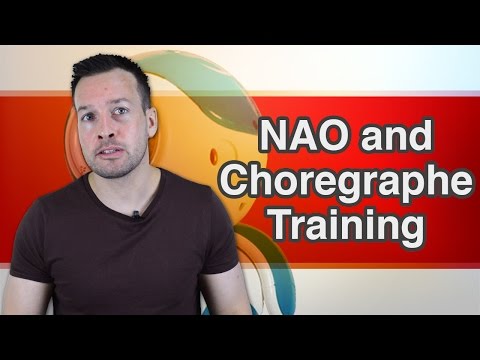
### 3. The team product

In your team you are asked by your customer, Dr Vishuu Mohan, to produce a software product using the python programming language. The product should be a python module within a behaviour created for the Nao robot. The python module should demonstrate data gathering, analysis, and reporting. The complete behaviour should be designed to impress potential students who come on Visit Days to the School.  You must assume that I, your customer, have no knowledge of python programming or computer programming in general. You can ask me for clarification regarding the product but it is for you to eventually create the specification. You will be introduced to the IEEE specification standard in the lectures on product development in week 6. From your specification you will develop a design solution. This design solution will then be implemented and tested. The fully implemented and tested product will form part of your team report. I will now provide some background information regarding data gathering, analysis, and reporting.

The following tutorials (five videos in total) will provide you with a good starting understanding of the Nao robot and how to use the tools Choregraphe and Webots.

[](https://www.youtube.com/watch?v=4gNjbKPRg-U)[](https://www.youtube.com/watch?v=JBcIPmtCOGY)

[](https://www.youtube.com/watch?v=VuBuGpCVlg0)[](https://www.youtube.com/watch?v=auOQpSu-GdM)

[](https://www.youtube.com/watch?v=bsmq1SWQQXY)

**4. Data gathering, analysis, and reporting**

Firstly it is useful to provide some definitions for data gathering, analysis, and reporting.

**Data gathering:** The process of acquiring data including the design of the acquisition such that the data is of sufficient quality to enable professional standard analysis and reporting.

**Data analysis:** The process of analyzing a data set to provide information. The analysis could be observational, mathematical, including comparison with modelling/simulation.

**Data reporting:** The process of reporting the results of data gathering and analysis exercises. Data reporting should provide clarity to the results such that their validity is clear.

Looking firstly at **data gathering** one needs to ask a series of questions.

* What is the problem to be solved?
* What evidence (data) needs to be acquired to solve the problem?
* How will the data be gathered?
* Is the data gathering experimental or by simulation?
* How will you ensure the quality of the data gathered?
* What plans have you made to ensure the data gathered can be analyzed and reported?
* What are the risks?

**Data gathering examples**

**a. Current -voltage characteristics of a light emitting diode (LED**)

IMAGE NEEDED

The circuit below can be used to gather the current-voltage data for a light emitting diode. The table below the circuit shows the gathered data. ***How might you analyze this data and then report it?***

|  |  |  |  |
| --- | --- | --- | --- |
|  | Current | | |
| Voltage (V) | At -100oc | At 0oc | At 50oc |
| 0.5 | 36860.59 | 0.170147 | 0.006337 |
| 0.6 | 30190810 | 11.93961 | 0.230296 |
| 0.7 | 2.47E+10 | 837.8288 | 8.36887 |
| 0.8 | 2.03E+13 | 58792.28 | 304.122 |
| 0.9 | 1.66E+16 | 4125583 | 11051.69 |
| 1 | 1.36E+19 | 2.9E+08 | 401614.9 |
| 1.2 | 9.11E+24 | 1.43E+12 | 5.3E+08 |
| 1.4 | 6.11E+30 | 7.02E+15 | 7E+11 |
| 1.6 | 4.1E+36 | 3.46E+19 | 9.25E+14 |
| 1.8 | 2.75E+42 | 1.7E+23 | 1.22E+18 |
| 2 | 1.85E+48 | 8.38E+26 | 1.61E+21 |
| 2.2 | 1.24E+54 | 4.13E+30 | 2.13E+24 |
| 2.4 | 8.31E+59 | 2.03E+34 | 2.81E+27 |
| 2.6 | 5.57E+65 | 1E+38 | 3.71E+30 |
| 2.8 | 3.74E+71 | 4.93E+41 | 4.91E+33 |
| 3 | 2.51E+77 | 2.43E+45 | 6.48E+36 |

**b. Internet traffic**

The two traces on the following slide contain two weeks’ worth of all HTTP requests to the ClarkNet WWW server. ClarkNet is a full Internet access provider for the Metro Baltimore-Washington DC area. The logs are an ASCII file with one line per request, with the following columns:

1. Host making the request. A hostname when possible, otherwise the Internet address if the name could not be looked up.
2. Timestamp in the format "DAY MON DD HH:MM:SS YYYY", where DAY is the day of the week, MON is the name of the month, DD is the day of the month, HH:MM:SS is the time of day using a 24-hour clock, and YYYY is the year. The time zone is -0400.
3. Request given in quotes.
4. HTTP reply code.
5. Bytes in the reply.

* 204.249.225.59 - -   [28/Aug/1995:00:00:34 -0400] "GET /pub/rmharris/catalogs/dawsocat/intro.html   HTTP/1.0" 200 3542
* access9.accsyst.com - -   [28/Aug/1995:00:00:35 -0400] "GET /pub/robert/past99.gif HTTP/1.0" 200 4993
* access9.accsyst.com - -   [28/Aug/1995:00:00:35 -0400] "GET /pub/robert/curr99.gif   HTTP/1.0" 200 5836
* world.std.com - -   [28/Aug/1995:00:00:36 -0400] "GET /pub/atomicbk/catalog/sleazbk.html HTTP/1.0" 200   18338
* cssu24.cs.ust.hk - - [28/Aug/1995:00:00:36 -0400] "GET /pub/job/vk/view17.jpg HTTP/1.0" 200 5944
* er6.rutgers.edu - -   [28/Aug/1995:00:00:37 -0400] "GET /pub/rjgula/network.htm   HTTP/1.0" 200 2017

Turning to the **analysis of the data** gathered. Firstly you may have gathered the data or it may have been provided for you. In both cases you need to decide how you will analyze the data. You will also need to analyze the quality of the data, especially in cases where you did not design the data gathering to ensure good quality. The analysis of data is usually considered to be a process that converts data into information, so consider what information you wish to present eventually in your data recording. What calculations can be undertaken, what modelling can be done to compare with the data, and finally can the data be transformed in some way?

Once you have analyzed your data and extracted the required information you must decide **how to report the information**. The reporting of the data should provide clarity. You might consider if the information is best represented in tables, graphs, with or without supporting written statements. Will you provide comparison between experimental results and simulation/modelling? Will the report be dynamic, giving the user an opportunity to make choices? Will you provide access to the original data so that your analysis can be tested and verified?

### 5. What is a team?

Every one of you will have an answer to this question and I hope you will all start by stating that a team is more than just a group of people. You can search for definitions of the word team. These are two I found,

"A team is a small number of people with complementary skills who are committed to a common purpose, performance goals, and approach for which they are mutually accountable."  
Katzenbach, J.R. & Smith, D.K. (1993). *The Wisdom of Teams: Creating the High-performance Organization.* Boston: Harvard Business School.

"A group in which members work together intensively to achieve a common group goal."  
Lewis-McClear, Kyle and Taylor, M.S. (1998) "Psychological contract breach and the employment exchange: perceptions from employees and employers" *Paper Presented to the Academy of Managemen*t, San Diego, August 1998.

***Search the internet/library to find these articles. See if you can access the actual articles or just references to them.***

##### Why work in a team?

Team working is very common in industry, sometimes because a team is needed to bring together a range of skills in order to develop a product or sometimes to solve a particular problem. It can also be very beneficial to learn in a group because through the group you can broaden your experience, solve a wider range of problems, build your self-confidence, adopt different ways of thinking, and hopefully enjoy the experience. In order for a team to be most effective its members need to act in a professional manner.

##### Team working skills

Working in teams provides an opportunity for you to enhance your intellectual skills, issue orientated thinking, planning and management, research skills, flexible learning, and finally your ability to analyse complex problems. Working in your teams you should all aim to improve your communication skills, both in terms of speaking and listening. You should think about "getting on the same wavelength" and standing in the other person's shoes". You should respect other opinions and viewpoints, be constructive in negotiations and mediation within your team. You should all be sensitive to the social health of your team and facilitate contributions from all team members. Every team member should consider if the team is focused on the goal and you all should take responsibility for your own performance and for that of the team.

##### Team leadership

A team leader needs to keep in mind consistence, respect, inclusion, and honesty. If you take on the leader role these attributes will help your team develop as a healthy team. Make sure you are consistent in your treatment of all team members, that you show respect and encourage respect among team members that you make sure you include all team members, even if this means working out how to include some. Lastly you should be honest about what is going well and what is not going well.

##### Optimum team size

The size of a team do effect the team process such as communication and the overall outcomes. The optimal size and composition will be very dependent on the goal of the team. Some authors state that 4 is the optimal size whereas other work suggests between 5-12 members. Research the topic of team size and discover what other authors claim, and if they provide evidence for their claim.

##### Motivation types

You might ask yourself from time to time about you motivation. You might sometimes recognise that you are highly motivated to a task and on other occasions you are so demotivated that you fail to complete the task. You might or might not have considered what motivation type you are. Here are three motivation types. Which are you?

* Task-orientated: The motivation for doing the work is the work itself.
* Self-orientated: The work is a means to an end which is the achievement of individual goals - e.g. to get rich, to play tennis, to travel.
* Interaction-orientated: The principle motivation is the presence and actions of co-workers. People go to work because they like to go to work.

##### Personality types

Myers Briggs developed a classification of personality types using four pairs of poles to characterise a person's interactions. The four pairs of poles are as follows;

* Focus of energies - Extroversion/Introversion (E/I)
* Processing information - Sensing/Intuition (S/N)
* Decision based - Thinking/feeling (T/F)
* Ways if organising - Judgement/Perception (J/P)

Each person can then be characterised by a four letter set such as ENFJ. You might like to consider how you characterise yourself. There are many online articles and published work on the Myers-Briggs personality types. You can start by looking [here](http://www.myersbriggs.org/my-mbti-personality-type/mbti-basics/). Reading the information on that page will provide all the information you require at this stage of your professional life.

### 6. Team formation

#### 6.1 Tuckman

In 1965 Bruce W. Tuckman published an article entitled, "Developmental sequence in small groups". You can find this article online in the University library. In the article Tuckman created four stages of team formation, forming, storming, norming, and performing. Later a fifth stage was added, adjourning. You can probably guess some descriptions of these stages but here is a summary.

**Forming**: At this stage the team members learn about each other and the task at hand. Indicators of this stage are unclear objectives, confusion, poor listening.

**Storming**: At this stage there may be arguments about group structure and a struggle for status. Indicators at this stage include lack of cohesion, hidden agendas, conflicts, confrontation, volatility, resentment, anger, inconsistency, and failure.

**Norming**: At this stage one can expect the establishment of implicit/explicit rules and communications to achieve the set goal. Some indicators are questioning, reviewing/clarifying, changing/confirming roles, opening risky issues, listening, testing new ground, identifying strengths and weaknesses.

**Performing**: At this stage the team will achieve conclusions and implement solutions. Indicators are creativity, initiative, flexibility, open relationships, pride, and concern for people, learning, confidence, high morale, and success.

**Adjourning**: At the project end the group disband.

***You can research Tuckman's team formation. See what publications you can find that*** [***cite***](https://www.google.co.uk/search?hl=en&q=definition+cite&meta=&rlz=1I7SKPT_enGB405&gws_rd=ssl#q=definition+cite&hl=en&tbs=ctr:countryUK%7CcountryGB&cr=countryUK%7CcountryGB) ***Tuckman's original article published in 1965.*** Watch the following video which summarises the five stages of team forming.

#### 6.2. Cogs ladder

In 1972, while working for Procter and Gamble, George Charrier wrote 'Cog's ladder: A model of group growth'. This model of team formation is very similar to Tuckman's. He envisaged teams climbing a ladder, each rung of which was one of the following stages.

* Polite stage: at which team members get to know one another. The basis of the group structure is established. There are 'polite' interactions, simple ideas, avoidance of controversy, and judgements formed setting the scene for future interactions.
* Why we're here stage: At this stage the team may question the need to meet and the individuals need for approval diminishes. The leader needs to communicate a firm agenda, goals are set and aligned, cliques may emerge, and members begin to 'fit in'.
* Bid for power stage: At this stage individuals can try to impose their views, members strive for power, which may lead to a decline in contributions/discussions, usually resulting in poor solutions. There is a need for structure and patience at this stage.
* Cooperation/Constructive stage: At this stage there is an acceptance of other's opinions, team spirit replaces individual interests. The stage is characterised by creativity and productivity. New member joining the team can be viewed as outsiders or intruders.
* Esprit stage: There is team spirit, harmony and unity. The stage is characterised by mutual acceptance, cohesiveness, and the team is most productive at this stage. The stage is not reached by all teams.

**7. Behavioural team roles - Belbin**

In 1981 Meredith Belbin published his book, "Management teams-Why the succeed or fail". This book is still available today from amazon, in its third edition, and its principles are still taught around the world. Belbin proposed a set of behavioural team roles. Any one person might align with a number of role types. The role types are;

* Plant: A creative, imaginative, unorthodox person with brilliant ideas; but ignores detail and is not a good communicator.
* Resource investigator: The networker for the team, finder of resources, providing information or ideas; but is overoptimistic and loses enthusiasm.
* Chairman/ (Co-ordinator 1988): A leader, ensuring contributions and fairness, and is likely to improve ideas; but can be seen as manipulative, slow in making decisions, and prone to delegate personal work.
* Shaper: A dynamic person who loves challenge, thrive son pressure, and had driven and courage to overcome obstacles; but can provoke and hurt people's feelings.
* Monitor-evaluator: A person who is sober, strategic, measured and dispassionate. Has objectivity, and keeps the team 'on track'; but lacks drive and inspiration and can be critical.
* Team worker: A person who is supportive, sensitive to interpersonal relationships, and ensures cohesion within the team; but may be indecisive, and easily influenced.
* Company worker/ (Implementer 1988): A practical person who creates processes and results and is rooted in the real world; but does not have inspiring visions and radical thinking, and is prone to be inflexible.
* Completer finisher: A person that likes detail, spots flaws and gaps, and is aware of timescales; but can be seen as nit-picking, worries a lot, and is not a delegator.
* Specialist (1988): Brings specialist knowledge with a passion; but is little interested in anything outside their specialism.

Again there is a wealth of published work citing the original book by Belbin. There are also a number of websites dedicated to the topic. The following video goes over the 9 Belbin roles.

<https://youtu.be/-efhOLVgEvM>

**8. Dysfunctional teams**

In 2002 Patrick Lencioni published his book, "The five dysfunctions of a team". He gave the five areas of dysfunction as;

* Absence of trust
* Fear of conflict
* Lack of commitment
* Avoidance of accountability
* Inattention to results
* Watch the following video in which Patrick outlines the five dysfunctions of a team

<https://youtu.be/6sqvWEI1CVg>

### 9. Some guiding principles

When you start working together in your teams you should try to ensure you have clear overall goals, agree a common plan, be clear about ownership of tasks and be committed and trusting.

You should

* Respect differences, and don’t discount others' ideas.
* Be supportive rather than judgmental.
* You are responsible for what you get from the team experience, be a contributor.
* Criticize only ideas, not people.
* Everyone is expected to help facilitate, critique, and evaluate the meeting.
* Everyone is expected participate and to respect the right to be heard –listen!!!
* If need be, agree to disagree.
* Everyone is responsible for success

##### Communication

You need to set the right time for all your communications which need to be frequent. Every team member should keep the team fully informed at all times, whether the news is good or bad. Try to create a blame-free culture. We all make mistakes and we can all learn from them. The whole team should be included in deciding every aspect of the project. Specific roles should be assigned that provide satisfaction for the role holder. There should be clarity in who should do what and by when.

##### Negotiation

If (when) a dispute arises you must resolve them professionally without ill-will. It is important to separate the people from the problem and always try to put yourself in the other person's shoes. Try to communicate carefully, listen to what is being said, and look for what you have in common. Look for options with mutual gain, insist on objective criteria, and above all have fun!

<https://youtu.be/DI4zp7yeuMU>