# IN5480 Individual assignment fall 2019

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# 1 Concepts, definition and history of interaction with AI.

## 1.1 How AI came about

The term Artificial intelligence was first used by the American mathematician and logician John McCarthy. In 1956 he brought together a group of researchers from different disciplines to a workshop at Dartmouth College. From the workshop a paper was published where the definition was written.

## 1.2 Definitions

### 1.2.1 Definition 1

> *AI is the science and engineering of making intelligent machines especially intelligent computer programs. It is related to the similar task of using computers to understand human intelligence, but AI does not have to confine itself to methods that are biologically observable. (McCarthy, 1998)*

This definition was written by John Mccarthy in the paper from the workshop held in 1956. This is the first definition of the term “artificial intelligence”

### 1.2.2 Definition 2

> *The theory and development of computer systems able to perform tasks normally requiring human intelligence, such as visual perception, speech recognition, decision-making, and translation between languages.*
> *(The Oxford English Dictionary, n.d.)*

This is the definition from The Oxford English Dictionary (OED). Here the term is presented as a theory. The definition focuses on the technology's ability to do human-like tasks.

### 1.2.3 Definition 3

> *Artificial intelligence (AI), the ability of a digital computer or computer-controlled robot to perform tasks commonly associated with intelligent beings. (Copeland, n.d.)*

This definition is the start of an article written for the encyclopedia Britannica. This definition also focuses on the technology's ability to do tasks, but classifies the tasks as commonly performed by “intelligent being” rather than just “humans”.

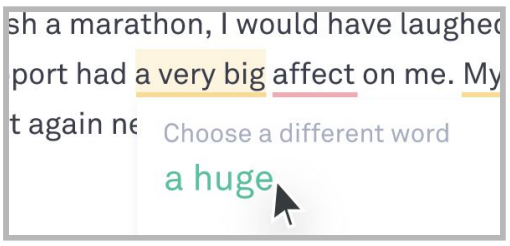
## 1.3 My definition

> *AI is software and computer systems that is able to perform human-like tasks on its own by mimicking human thought processes.*

This definition was made by combining the other definitions to my own. I focused on what I have perceived to be the 3 most important features. Firstly it has to be a machine. Secondly is what the machine does; tasks that humans normally do because of their level of complexity. Lastly the way the machine does this; by mimicking the human thought process.

## 1.4 Company that work with AI

“Grammarly” is a technology company that provides different ai powered products like text editors and browsers extensions for grammar. Grammarly present AI clearly in their main tagline on their website: “Compose bold, clear, mistake-free writing with Grammarly’s AI-powered writing assistant”(Grammarly, n.d.). In the explanations of their services on their page the word “AI” is often used as well as talking about their “powerful algorithms”. In their blog post: “How We Use AI to Enhance Your Writing” They explain how  is used and



why they chose this approach as well as the technology behind grammarly with advanced system that combines rules, patterns, and artificial intelligence techniques like machine learning, deep learning, and natural language processing. (Grammarly, n.d.)

## 1.5 The us of AI in entertainment

Humans is a tv series from 2015 set in a parallel present where highly functional human-like robots exist. These robots are used for several purposes like being servants in homes to being used in illegal fighting rings.The characters struggle with dealing with robots and how to act towards them. The series explores themes like ai and the social impact of anthropomorphic robots with some humans building emotional relationships to the robots while others treat them like machines. It also explores the science fiction theme: what if the robots gain consciousness. This fits well with the series tagline: Made in our image. Out of our control.


# 2 Robots and AI systems

## 2.1 The word “robot”

The word *robot* comes from the old church Slavonic word “robota”, meaning “servitude” or “forced labor”. This originates from the central European system in which rent was paid by a tenant by forced labor or service. Karel Čapek introduced the variation “robot”, from the latin root for labour “labori”, in his play R.U.R Rossum's Universal Robots, 1920). In this play a company mass-produces workers by using chemistry, that perform the mundane tasks that humans don't want to do.

## 2.2 Definitions

### 2.2.1 Definition 1

> *A machine capable of carrying out a complex series of actions automatically, especially one programmable by a computer.(The Oxford Dictionary)*

This definition focuses on the automation of the machine. The Oxford Dictionary has another definition that focuses more on robots in science fiction with the robots resembling human beings.

### 2.2.2 Definition 2

> *Robots are machines that can be used to do jobs. Some robots can do work by themselves. Other robots must always have a person telling them what to do. (NASA, 2009).*

This definition define robots by their use. The definition is then split into independent and dependent. The definition itself is both short and broad. By using this definition almost anything can be a robot.

## 2.3 My definition

> *A robot is an artifact made by humans designed to perform a spesific task automatically.*

This definition was made based on my knowledge acquired throughout this course. The definition is quite short and “to the point”. By using this definition a lot can be defined as robots, but I believe that that is how the word is being used in today's society.

## 2.4 The relation between AI and Robots

While a robot is an artifact designed and programmed to perform specific tasks, AI can be software. A robot can be powered by AI, but AI does not have to be a part of a robot. Both AI and robots perform tasks, but an AI does this by using human-like cognitive processing.

## 2.5 A specific robot

When thinking about commercial robots that we use in everyday life, robotic lawn mowers comes first to mind. These robots have one specific task: mowing the lawn. They follow preprogrammed instructions, but also a certain amount of ai to figure out what to do and how. To detect obstacles, sensors are used. Many people that buy these lawn mowers might think that all of their work is over, but that is not the case. To make sure the robot functions you have to facilitate its use by setting up the perimeter and regularly make sure that there are no obstacles in the grass.

# 3 Universal Design and AI systems

## 3.1 Definition

> *An approach to the design of products, buildings, and public spaces that enables the participation of all members of society, (The Oxford Dictionary)*

Universal design focuses on inclusion. It is about designing for all people regardless of their abilities and disabilities, including all and meeting the needs of everyone who wishes to use the design. Universal design was driven foreword by the social changes within our society in espect to civil and human rights in the 20th century, with a focus on equal rights and anti-discrimination.

## 3.2 The potential of AI

### 3.2.1 With respect to human perception, human movement and human cognition/emotions.

AI can be extremely useful in including users with disabilities both cognitive and physical, having a robot that respects a persons difficulties. Robots like the seal “Poro” is being used to treat elders with dementia by acting as a something displaying emotions that they can take care of.

### 3.2.2 For including and excluding people.

AI can easily be used to exclude people even without the designers doing it on purpose. AI is made from humans “teaching” the AI with the use of large dataset. If these datasets are not inclusive the AI won't be either. An example of this is facial recognition software where the ai is not able to detect all races because the dataset did not have enough inclusion. This can be looked at the other way where the AI is designed to be inclusive and then creating a software that everyone can feel represented in and be able to use.

# Module 2

## 4 Characteristics of AI-infused systems

The key characteristics that are identified in the first lecture of Module 2 is: learning, improving, black box and fuelled by large data sets.

**Learning**

An AI-infused system is a system that is being dynamic by constantly changing while learning from the user's behaviour. The system is constantly using the input to provoke procedures and behaviours.

**Improving**

The system is able to improve over time by interacting with the users of the system. This comes from user input, feedback, and from making mistakes. Incorporating this data making it more accurate over time.

**Black box**

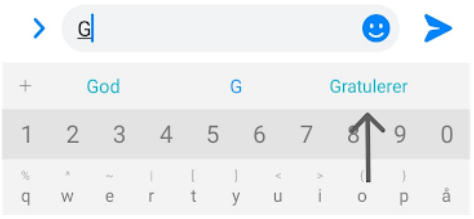
AI-systems can be seen as “black boxes” by their way of not giving the users insight into the system behind the interaction. The processes that goes on “behind the curtain” is not shown to the outside users.

**Fuelled by large data sets**

The knowledge of the AI comes from the datasets that power it. These datasets is how the system learns and improve over time to become better at its task. The datasets used by the AI will differ based on both user input, and the input being provided by the initial designers of the system.

## 4.1 Swiftkey Keyboard as an AI-infused system

I have chosen *SwiftKey keyboard*. This is an application that uses a blend of different artificial intelligence technologies to predict the next word that the user is going to type. This application definitely embodies the characteristic *Learning* and *improving.* The system learns form usage and improves the predictions over time. This function is what makes thee users want this application instead of the keyboard that is already implemented on the phone. The improvements the system makes over time from the usage is not visible for the user. The user can only see the suggestions getting better but there is no information of when this happens and how. This fits well with the characteristic *black box* as the users have no insight into the process. The last characteristic *fuelled by large datasets* is how the system learns and improves. The datasets that the user provides can be seen as quality sets as this data is provided directly from the users that are going to use the suggestions later. The users are particularly affected by the *learn* and *improve* characteristics. This is what makes the application desirable and better over time.




# 5 Human-AI interaction design

## 5.1 Guidelines for human-AI interaction

In the article (Amershi et al. 2019) they propose 18 generally applicable guidelines for the Design of human-ai interaction. The guidelines are categorized into these 4 different parts;-Initially, drug interaction, when wrong, and over time. They validated the guidelines by going through multiple rounds of evaluating them, including a use study with 40 design practitioners that went through the guidelines against 20 different AI-infused products. The guidelines were made in the hope that applying these will result in better systems and that they will “serve as a resource for

designers working with AI and will facilitate future research into the refinement and development of principles for human-AI interaction”.(Amershi et al. 2019)

## 5.2 Will You Accept an Imperfect AI?

In the paper “will you accept an imperfact AI” Kocielnik et al. investigate the relation between the expectations of users and their acceptance of the AI systems, and different design techniques for adjusting the expectations, The present five hypotheses. One of them is rejected, one is partially supported, and three are supported. The three techniques for expectation adjustment are: accuracy indicator, example-based explanation and control slider (Kocielnik et al. 2019). They conclude that their findings “open the way to shaping expectations as an effective way of improving user acceptance of AI technologies” (Kocielnik et al. 2019)

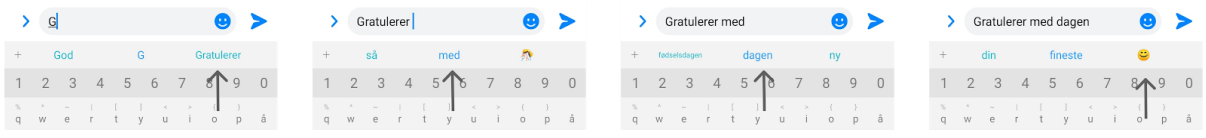
## 5.3 Swiftkey Keyboard relating to the design guidelines

The guidelines I have chosen to discuss in regards to the SwiftKey keyboard is from the category “over time” and “when wrong”. form the paper “Guidelines for human-AI interaction.” (Amershi, et.al, 2019)

**Learn from user behaviour**

*Personalize the user’s experience by learning from their actions over time.*

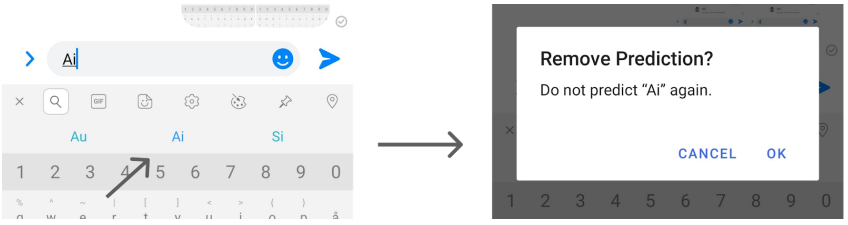
The main reason that i use this keyboard is the predictive keyboard feature that suggest words based on what i am starting to type. This keyboards ability to learn from my behaviour over time is very good. It can “guess” the word i am typing and It also has the ability to create sentences based on the previous word that I wrote.



**Support efficient dismissal.**

*Make it easy to dismiss or ignore undesired AI system services. Example applications:*

When pressing the suggested words for a longer period of time it triggers the pop-up “remove prediction”. This allows for the user to remove the suggested word so that the keyboard does not predict it again. This feature is not obvious to the user as it only appears when pressing the suggestion for a longer time. I only found this feature myself as a mistake. This could definitely be improved by making the option more clear and maybe have it in the settings menu for the application.




# 6 Chatbots/conversational user interfases

## 6.1 Key challenges

Luger and Sellen (2016) write about the challenge when the users expectations exceeds the systems and how this worsens the user experience. When the users don't know what the system can and can't do it makes them feel “overwhelmed by the unknown potential, or leads them to assume that the tasks they accomplished were highly limited” (Luger et al. 2016).

Føstad and Brandtzæg (2017) talk about the biases in the datasets. The ASI-infused systems are based on the datasets, so if that is biased the resulting system will be to. This poses a challenge in creating inclusive and open technology. They talk about the importance of making chatbots that fits all and including diversity among users by

making it possible to communicate with users of all genders, age language and preferences (Følstad et al. 2017)

## 6.2 Using the guidelines to resolve the key challenges

**G1 make clear what the system can do**

*Help the user understand what the AI system is capable of doing*

One of the challenges mentioned in “Like having a really bad PA” (Luger et al. 2016). is that the expectation of the users is central to their experience. When using chatbots there is a big difference in how developed and capable they are. As a user it can be hard to perceive how well the chatbot is able to answer without testing it. This can create bad user experiences if the expectations turns out to be disappointed. If the system makes it clear to the user what the system is capable of doing before hand, the users expectations is also managed.

**G2 Make clear how well the system can do what it can do**

*Help the user understand how often the ai system may make mistakes*

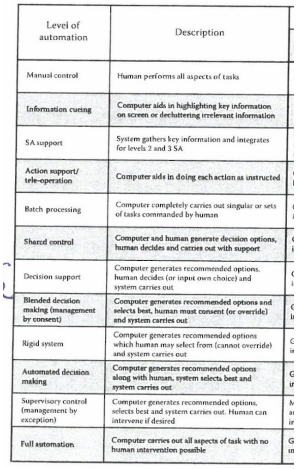
This also applies to the managing of expectations. A system can apply this by making it clear that mistakes will occur and that the product will be better over time by user input. This entails that the user does not expect the ai to always get it right.

# Module 3

## 7 Collaboration and levels of automation

### 7.1 Levels of autonomy

In the book “Designing for situational awareness” (Endsley, 2011), Endsley describes 12 levels of automation between manual control and full automation. The levels of automation are sorted into four primary roles. These are; monitoring and information presentation, generation of options, decision making/selection of actions and implementation of actions



| Level of automation | Description |
|---|---|
| Manual control | Human performs all aspects of tasks |
| Information cueing | Computer aids in highlighting key information on screen or decluttering irrelevant information |
| SA support | System gathers key information and integrates for levels 2 and 3 SA |
| Action support/ tele-operation | Computer aids in doing each action as instructed |
| Batch processing | Computer completely carries out singular or sets of tasks commanded by human |
| Shared control | Computer and human generate decision options, human decides and carries out with support |
| Decision support | Computer generates recommended options, human decides (or input own choice) and system carries out |
| Blended decision making (management by consent) | Computer generates recommended options and selects best, human must consent (or override) and system carries out |
| Rigid system | Computer generates recommended options which human may select from (cannot override) and system carries out |
| Automated decision making | Computer generates recommended options along with human, system selects best and system carries out |
| Supervisory control (management by exception) | Computer generates recommended options, selects best and system carries out. Human can intervene if desired |
| Full automation | Computer carries out all aspects of task with no human intervention possible |

### 7.2 Example 1 - PARO robot

The PARO robot is a seal shaped robot, mainly used for elderly with dementia In “Human-Animal Teams as an Analog for Future Human-Robot” (Philips et.al. 2016) The PARO robot is described as a robot designed to provide comfort. We gain emotional benefits of companionship and comfort by “animals that provide social support or comfort by reducing loneliness for their human counterparts “ (Philips et.al. 2016) The Poro robot aims to provide this comfort by having elderly people take care of the seal and forming a companionship with it . Using the physical appearance of the seal, giving it the zoomorphic characteristics of an animal, have been found to impact trust.(Philips et.al. 2016)

According to the products own website PARObot.com “PARO can learn to behave in a way that the user prefers, and to respond to its new name” (parorobots, n.d.) This indicates its ability to *batch process* as the robot is able to carry out sets of tasks commanded by humans (Endsley, 2011) It is the elderly that “commands” PARO to do actions by touching it. Furthermore it is designed to avoid negative responses and encourage positive. For example “if you hit it, PARO remembers its previous action and tries not to do that action (again)” PARO has a certain ability to modify its own actions. This indicates a higher level of automation. The system learns from the user and then makes independent decisions on its own without the user giving it a specific command. It also has the ability of “showing your prefered behaviour” which also indicates that it learns from the users input, interprets them and categorizes what the user prefers. I would therefore categorize this as showing the 10th level of automation; *Automated decision making*. The description of this category is. “Computer generates recommended options along with human, system selects best and system carries out.”(Endsley, 2011) PARO reacts to the type of user input and then chooses what output to give based on what it has learned from the users previous behaviour.
I would not categorize it as a high level of automation because PARO does not make actions without input from the users. The users have to either call the robots chosen name, or touch it for the robot to carry out an action.

By decreasing this level of autonomy PARO might not be very effective. The goal of the robot is to act as natural as possible so the elderly feels that their care for it has an impact. PARO is intended to mimic a live animal and the users that have for instance dementia would not see it as alive if it did not respond and learn in a way they would expect an animal companion to do. If the elderly would have to give it specific commands that gave specific feedback the feeling of an animal like reaction might have been lost. It would also be hard for elderly with dementia to remember these specific commands. If the level of autonomy would increase that could make the robot “seek” interaction. PARO is meant to react to the elderly when the elderly want to interact with it, remaining passive if not. If the robot would carry out tasks with no human intervention it is possible that it would defeat the purpose of PARO.

## 7.3 Example 2 - Big Dog Robot

The BIg Dog Robot goes under the category “replace physical capabilities” in the “Human-Animal Teams as an Analog for Future Human-Robot” (Philips et.al. 2016) The robot is shaped like a big dog and also walks as a dog would. It is used to reduce soldier load by carrying big cargo. I think that this robot is at the level; *Batch processing*, described as: “Computer completely carries out singular or sets of tasks commanded by human.” (Endsley, 2011) The robot can navigate itself, but it has to be told where to go. Its sole job is to move to the destination across its prescribed ground. The robot has the capability of adjusting to the environment and the ground it is “walking on”. In my opinion this does not indicate a higher level of automation because it is a pure feedback on the inputs generated by the environment that the robot then.

A positive outcome of increasing the level of autonomy is that the robot can be more independent and thereby used for other things, but it can also have negative effects. In an episode of the TV show “black mirror”, it shows a future where this robots level of autonomy is increased. Here the robots are used for warfare. Their goal is to kill humans. They do this by being able to track them down, hunt them, and then eventually killing them or putting trackers in them so that other robots can find them. This example is a very dystopian future, but by increasing the level of autonomy to full automation where the computer carries out tasks with no human intervention possible, many possibilities for use arises.

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# 9 Appendix

## 9.1 Changes made based on the feedback

Getting feedback from a peer has been quite helpful. Writing with this in mind has helped me have a critical view on my writing. Going back later on when writing the next iteration has also helped me see my text with new eyes.
I took the feedback into consideration when writing my answers for module 2 and 3. I corrected some mistakes made in iteration 1 and filled out where i got feedback on my writing.