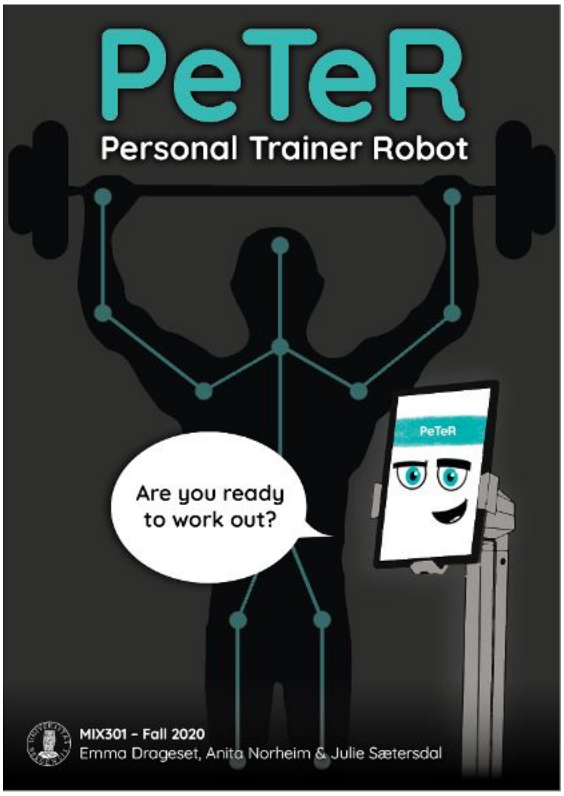
How intelligent does a robot need to be?

Challenges of developing an AI driven personal trainer robot



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1.0 Introduction

There is a constant evolution of robotics. Today, robots are used by thousands of businesses all around the world. From huge robotic machines in manufacturing, to small robotic surveillance cameras in the military. However, they also appear in society. For instance, drones filming the news and robotic vacuum cleaners in homes. There is no doubt robotics have come to stay. The question is: To which degree can a robot be made smart and autonomous? Artificial intelligence (AI) is a field with many unanswered questions. Nevertheless, autonomous and intelligent machines have been developed for decades, and AI researchers have come a long way. Saudi Arabia even has a robot with its own citizenship called Sofia (Reynolds, 2018). It is no wonder if people are frightened by the thought of artificial intelligence surpassing human intelligence. However, with today's technology, it is more reasonable to think that robots will work alongside humans, rather than replacing them.

This paper discusses a proposed personal trainer robot, named PeTeR. It highlights the technological challenges of making a humanoid robot based on theories from the field of human intelligence and artificial intelligence. The essay further argues whether it is possible to develop PeTeR based on today's research of artificial intelligence and debates on which intelligent elements and human-robot interaction it might need. Lastly, it focuses on how PeTeR could be developed in the future with two different scenarios; one realistic and one futuristic and provocative scenario.

2.0 PeTeR

2.1 Conceptual prototype

PeTeR (Personal Trainer Robot) is a concept aiming to improve and eventually replace today's offers of personal trainers. The intention with the concept is to build a life-imitating machine. This means that it will adapt to the world by having sensors imitating perception, actuators imitating motor action, and control based on feedback. The robot will be a humanoid robot, meaning it will look just like a human. PeTeR will also be anthropomorphized by being equipped with a face (on an iPad), a voice, and the possibility to behave like a human. He will therefore be referred to as a human throughout this essay. PeTeR will be placed in gyms where anyone can use him as an asset. His main goal is to prevent injury and increase motivation among young users. He will attempt to reach this goal by guiding the users through exercises and making sure their technique is correct. He will interact with the users and give motivational feedback through speech and work as a workout companion. The users can choose a specific mood for PeTeR to be in, depending on how strict and motivating they want him to be. Every user will have their own profile on the robot, meaning that PeTeR is aware if there is any crucial information about the user. PeTeR will, based on the user's profile, create a tailored workout routine to prevent injuries. PeTeR's custom made training program will hopefully also increase the user's motivation to return to the gym.

The main technology implemented in PeTeR will be the Human Pose Estimation. Human Pose Estimation can be defined as the problem of localization of the human key points - elbows, wrists, knees etc. in images or videos (Babu, 2019). PeTeR will, with this technology, capture the user's key points on the body in real-time while the user is doing an exercise and analyze the correctness of the movement. Through speech, PeTeR will notify the user which key point is moved incorrectly during the exercise. When the set is done, the iPad will display a playback of the user doing the exercise so that the user can analyze their own technique. In machine learning, we distinguish between detection, recognition and identification. At first, PeTeR detects that something is present. Further, he recognizes that a human is present and eventually, he places the key points on the body. Identification is also implemented as he knows who is working out based on the user's profile. However, in the technical prototype, only detection and recognition is implemented.

2.2 Technical prototype

Today, PeTeR is a prototype of a robot, or more precisely, a padbot (see Figure 1). PeTeR consists of three wheels and a screen (iPad) as the actuators, as well as a camera as sensor. In addition, he is equipped with a box where the users can store their water bottle, training gear, headphones, etc. The prototype consists of two different padbots, where PeTeR is the main padbot and the one interacting with the user. Padbot 2 is placed where the user is conducting his exercise. This secondary padbot has its own screen, using the Human Pose Estimation technology to track the user's key points. In a typical scenario with the prototype, a user lets PeTeR know that he or she wants help with an exercise, or that he or she wants to workout. When PeTeR is not on duty, he is "asleep" at his base. To wake him up, the user has to tap on the iPad while saying something like “Peter” or “Hi, it’s me!”. The tap on the screen triggers PeTeR to wake up. However, the idea is that users will think it is their voice. PeTeR will wake up and guide the user to the station using the actuators to move while interacting with the user through speech.

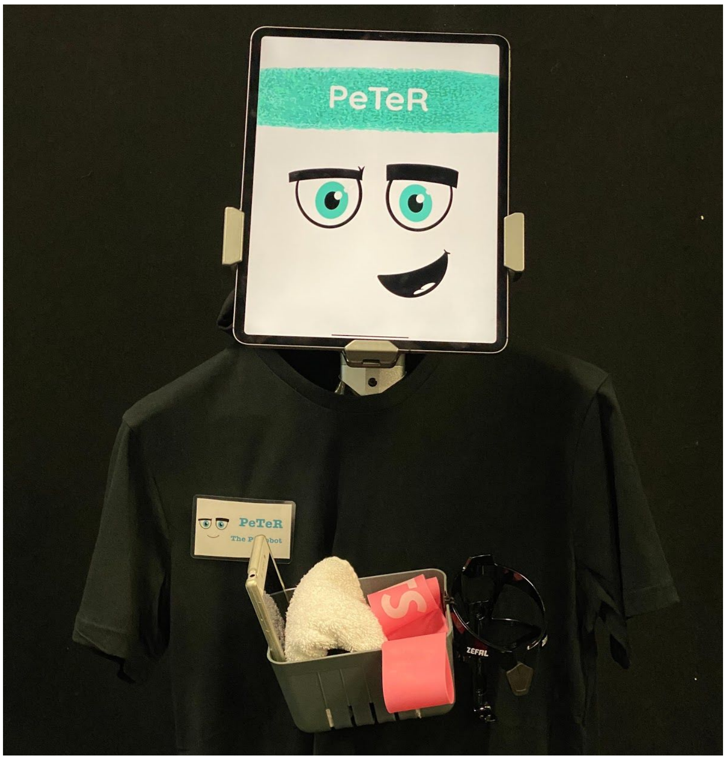

Figure 1: The technical prototype of PeTeR.

As of today, PeTeR does not logically operate with the world through feedback as mentioned in the conceptual prototype. The prototype is tested with the so-called “Wizard of Oz” method, in which a person is controlling PeTeR’s movement. PeTeR is designed to ask leading questions to the user so their answers match his next comment. While the user is interacting with PeTeR, there is a person controlling when PeTeR will move. His route is pre-programmed, but has to be activated at a specific time to match his comments. On the way to the station, he will inform the user on which exercise they are doing as well as tell jokes. At the station, the user finds padbot 2 which has been placed there beforehand (see Figure 2). This padbot works as an extension of PeTeR, doing the scanning of the key points, although PeTeR is the one giving feedback. The user gets information about the role of the second padbot when arriving at the station and receives instructions from PeTeR on which actions to perform. PeTeR will ask the user to do squats and further continue to motivate the user afterwards by complementing their technique. On the screen of padbot 2, the user can watch their movement in real-time and see that key points are detected on their body. However, PeTeR is not technically connected to padbot 2, it just looks like he is. The station looks like a smart gym, and everything PeTeR says simulates that the two padbots are connected to each other. When the workout is finished, PeTeR will motivate the user to exercise regularly through speech, end with "goodbye" and return to his station.

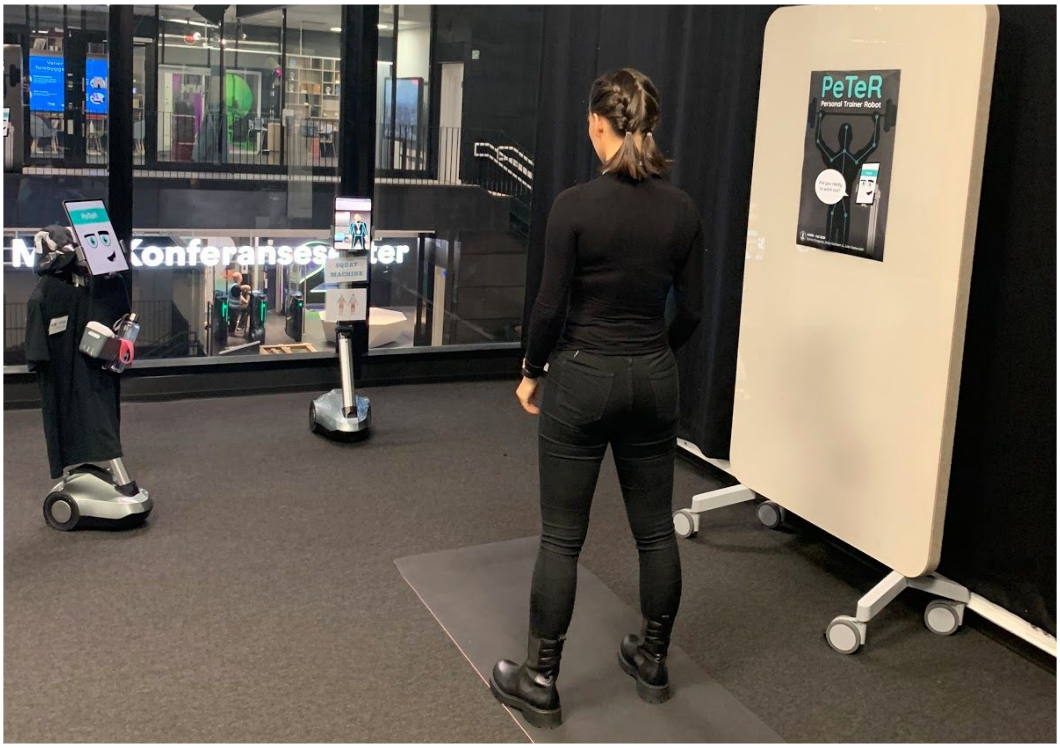

Figure 2: At the training station, the user finds padbot 2.

3.0 Historical background

For many people, the word "robot" is associated with action movies and science fiction. WALL-E is a famous science fiction movie about a robotic trash compactor and the plot takes place within the 29th century (Pixar, n.d.). It is a common idea that robots belong in the future, but in fact, the technology has been around us for decades. One of the first robots was an industrial robot built by George Devol in 1954 (Malone, 2011). The robot, Unimate, was basically a giant helping *arm* and was the first programmable robot. Since then, millions of industrial robots have been developed and, today, robots play an essential role in the automotive industry.

A common definition of a robot is “a machine controlled by a computer that is used to perform jobs automatically” (Cambridge Dictionary, n.d.). An advantage with robotics is that it can help with jobs considered challenging for humans; i.e. heavy lifts, precision and efficiency. A clear downside with the evolution of robotics is the discussion regarding replacement of humans. One might be afraid of robots stealing one’s jobs as they grow smarter and more autonomous. However, there is an important aspect that robots are lacking, namely a brain. More specifically, it lacks emotion and would not be able to operate logically alone.

“Human-Robot Interaction (HRI) is a field of study dedicated to understanding, designing, and evaluating robotic systems for use by or with humans” (Kanda, 2012-a). Although we say that robots can be fully autonomous, it seems that there is some sort of interaction between the robot and the human after all. In the HRI field, there are two ways of interaction between the human and the robot; proximate and remote interaction, depending on the locations of the human and the robot. Proximate interaction refers to when the human and the robot are co-located, interacting or communicating in the same room or environment. This could be a robot bringing you coffee in a café, or a robot assistant in your home. The other category, remote interaction, means that the human and the robot are separated spatially or temporally. For instance, a doctor doing a surgery through a robot in a different country. Within remote interaction, we differ between teleoperation and supervisory control (Kanda, 2012-b). For a robot considered as autonomous, the interaction might consist of supervision and directions given by the human, ergo the robot will not be fully autonomous. The interaction between the user and PeTeR will be proximate as they are located and interacting within the same gym. The aim with the conceptual prototype of PeTeR is that he will be autonomous. However, the user still has to interact and activate PeTeR by logging in to use him. In other words, he will not be fully autonomous.

3.1 PeTeR vs. Pepper

The personal trainer robot concept has been explored before. In 2019, Bristol Robotics Laboratory (BRL) developed the world’s first socially intelligent robotic fitness coach named “Pepper” (Crouch, 2019). Pepper is a robot companion guiding the user through an exercise and giving feedback to the user, similar to PeTeR. The main goal with Pepper was to test if it could be as intelligent as a personal trainer and become an effective coach. This is the same goal as we are aiming for with PeTeR. Pepper personalizes the workout based on the user's mood, fitness level, heart rate etc. It is also programmed to show sympathy, tell jokes, and change eye color to express emotions. However, a difference between PeTeR and Pepper is the scanning of the correctness of exercises. Pepper only guides the users through a workout on the treadmill. PeTeR will additionally scan key points on the body and adjust the workout accordingly. Despite the differences, Pepper is the robot resembling PeTeR the most. What BRL has managed to accomplish with Pepper within the artificial intelligence field, is exactly what we dream of doing with PeTeR.

4.0 Intelligence

Intelligence is a complex and heavily debated term. Is intelligence what we can measure in intelligence tests, the ability to learn from past experiences, or the general ability to solve problems? Deary (2020, p. 20) states that tests of mental abilities do not assess all important aspects of humans' psychological differences. There are several categories within intelligence. However, we distinguish between two *sciences* of intelligence, namely human intelligence and artificial intelligence. Scientific explorations of human intelligence began in the late 1800s. The science was divided into two different perspectives, empirical and philosophical. Later, in the 1950s, the science of artificial intelligence evolved as part of the development of the computer. The similarities of human intelligence and artificial intelligence is that the two concepts both share the quality of being a system processing information (Brey, 2001, p. 40). However, the question remains as to whether the artificial intelligence of a machine can resemble the intelligence of a human being.

4.1 What is human intelligence?

There are two scientific divisions of human intelligence; (1) the cognitive, rationalist approach and (2) the phenomenological, existential approach. Cognition refers to the mental processes related to gaining knowledge and comprehension (Cherry, 2020). These mental processes are, in the cognitive approach, measured and compared with psychometric methods. The approach emphasizes that reason rather than experience is the basis of knowledge. Cognitive sciences relates to artificial intelligence because they both presume that human intelligence is measurable, rationalist, mental and mechanistic. On the contrary, we find the second approach regarding phenomenology and existence. This approach focuses on embodied and situated experience. Maurice Merleau-Ponty, a famous philosopher of embodiment and situatedness, argues that “The body is the vehicle of being in the world and, for a living being, having a body means being united with a definite milieu, merging with certain projects, and being perpetually engaged therein” (Merleau-Ponty, 2013). An important phenomenologist, heavily inspired by Merleau-Ponty’s vision, is Hubert Dreyfus. Dreyfus is famous for his critique of artificial intelligence and rationalism. He claims that “Knowable reality itself lacks a rational structure; its features are co-determined by human needs and actions. The most fundamental way of knowing is intuitive rather than rational” (Brey, 2001, p. 38). In short, Dreyfus argues that human intelligence is situated in the world. It is not applied by rules, but partly determined by the situations humans find themselves in.

4.2 What is artificial intelligence?

As discussed, intelligence is not just a single dimension but rather a complex and structured area of information-processing. Artificial intelligence can be understood as an imitation of human intelligence. In fact, Boden (2018, p. 1) describes the aim of artificial intelligence as seeking to make computers do the sort of things that the mind can do. This involves all psychological skills such as perception, planning, prediction, association and motor control. AI is not only about making robots talk and behave like a human, as discussed regarding PeTeR. AI technologies are embedded in a range of services. For instance, a Google search includes AI, as well as applications on your phone, internet sites, and computer games. However, making computers do useful things is only the technological aim of AI, and the methods applied here are often quite unlike those in our minds. Namely, there are two different aims of AI. The other, scientific aim of AI makes use of AI concepts and methods in the attempt to understand and answer questions about human beings (Boden, 2018, p. 2). AI has helped biologists and philosophers, among others, in explaining existence, behavior and the mind-body issue.

Computers used in AI are often referred to as virtual machines. It is not referring to the physical machine, but rather the “mind” of the machine, also known as the “information-processing systems” (Boden, 2018, p. 3). When an unexpected event occurs with a robot, for instance, it is the virtual machinery you have to look into, not the physical robot. It is basically the software of the machine. The aim with the virtual machine is to make the program connect and make changes in the computer-world interface as well as process information. We distinguish between five types of AI, each of them with many variations.

Classical, or symbolic AI is called “GOFAI” (Good Old Fashioned Artificial Intelligence) and it is the type that we discuss in this essay. This type, including neural networks (connectionism), evolutionary programming, cellular automata and dynamical systems, all have different purposes (Boden, 2018, p. 5). Classical AI models learning, planning and reasoning. Neural networks are helpful for pattern recognition and learning. Evolutionary AI focuses on biological evolution and brain development, and lastly, cellular automata and dynamical systems can be used to model development in living organisms (Boden, 2018, p. 5-6). Researchers often use one of these methods exclusively. However, hybrid virtual machines also occur.

5.0 Discussion

The distinction between human intelligence and artificial intelligence is highly relevant for our prototype, PeTeR. As mentioned earlier, the goal with PeTeR is to replace current offers, namely a human. The question is whether it is possible for PeTeR to become as “smart” as a humane personal trainer, and which aspects should be considered during the development of PeTeR. The cognitive approach of human intelligence is quite similar to AI. However, the phenomenological approach differs greatly from the AI field. In this section, we will look into the different arguments from a phenomenological point of view and discuss whether it is possible, and how it is possible, to develop PeTeR with artificial intelligence.

5.1 Situated experience

Dreyfus would probably argue that it is very unlikely that PeTeR will be an intelligent personal trainer. Dreyfus’ theory about situatedness emphasizes that the “world” is based on human experience. “This ‘human’ world is a world that is not entirely objective, as it is filled with experienced structures, like smells, feelings, frustrations, threats, obstacles, and goals” (Brey, 2001, p. 43). Brey (2001, p. 44) points out that intelligent behavior depends on us discovering these meaningful structures in the situations we find ourselves in, which further requires meaningful behavior. PeTeR is not born into the world, and does not learn, perceive, nor behave like we do. Nevertheless, is it impossible to teach PeTeR how to react and behave to these experiences, and thereby make him a worthy citizen of the world?

In addition to having knowledge about training and nutrition, today’s personal trainers need to be creative, critical, spontaneous and have the ability to recognize emotion. They have to use their common sense in the situated experience they find themselves in. The virtual machinery of PeTeR needs a special type of AI to become a situated personal trainer robot. Artificial general intelligence (AGI) is spoken of as the "common sense" of AI (Boden, 2018, p. 19). AGI is referred to as the field's "Holy Grail". If researchers could make machines benefit from reasoning and perception, and less on programming tricks, the field would change tremendously. To achieve AGI, researchers have to model language, creativity and emotion. Today, the AI field *does* manage to model these aspects, but only to a certain degree. For instance, many AI systems use natural language processing (NLP) to process both speech and text. "Siri", implemented in iPhones, recognizes words and sentences, and replies with relevant information. However, Siri is based on facts and is sensitive to personal relevance (Boden, 2018, p. 57). This would also be the case for PeTeR. He might be programmed to know everything about every user, but will the conversations be spontaneous *and* relevant when he is not "present" in the situation? Although systems are programmed to recognize languages and reply accordingly, it is not situated in the world in the sense that it can judge whether the information is relevant or not. If such relevance, or common sense, is rooted in human experience, and AI researchers still have no answer to the big AGI issue, Dreyfus' theory about intelligence being situated becomes an essential and plausible argument.

5.2 Is intelligence embodied?

In addition to the situated view, Dreyfus also argues that intelligence is embodied. In other words, it requires a human body. "To be embodied is to be a living body situated in, and actively engaging with, a dynamical environment" (Boden, 2018, p. 122). It is a common thing to assume that intelligence is centered in the brain. However, the discussion as to whether sensorimotor intelligence is localized in the brain is highly disputable. "Sensorimotor intelligence is the skill which human beings use in perceiving, recognizing, moving, and manipulating objects, as well as in coordinating and integrating perception and movement" (Brey, 2001, p. 44). A child's first use of language and numbers is strongly integrated with their sensorimotor intelligence in which they perceive and behave. Through many years of being situated and embodied in the world, we go through a learning trajectory and develop a complex human brain. It seems that the *development* of sensorimotor intelligence itself needs a body. However, that is not equivalent to stating that sensorimotor intelligence is *localized* in the body. It might be more suitable to say that a body is not required for the *possession* of intelligence, but rather that a body is required for the *development* of intelligence (Brey, 2001, p. 45). Philosophers would argue that no on-screen AGI robot would be intelligent because it does not have a body. Even if it was a fully autonomous system connected to a physical environment and adapting to the real world, it would still not be countable as embodied. Dreyfus is one of these philosophers and argues that it would be impossible for a digital computer to possess the broad scope of the human brain as they are neither situated nor embodied. However, human beings can be paralyzed or have limbs amputated and still be able to engage in abstract thought. This indicates that higher levels of intelligence does not need a physical body even if the *development* of intelligence does.

5.3 Will PeTeR benefit from being a humanoid robot?

In the previous section, we found that PeTeR may be intelligent to a certain extent without a physical human body. However, another question emerges: Will PeTeR benefit from having a human body *form*? Why should he be a humanoid robot when a body does not matter to his intelligence? Imagine going to the gym, and a robot dog approaches you and says he is a personal trainer robot ready to assist you. It does not appear very reliable getting exercise guidance from a dog, and the human-robot interaction would probably be unnatural as we have learned to treat dogs as pets. Through evolution, we have learned how to interact with other human beings, to make eye contact and to read signals. An advantage with a humanoid robot is that people naturally know how to interact with it (Brooks, 2002, p. 68). Another benefit is that we might think that a humanoid robot has the same representation of the world as we do. They are the same size as us, they can be recognizable as if they were another human being and thus, they appear to share our perspective on reality.

If PeTeR was designed with no human body, then he might as well be an application anyone could download on their phones. However, with a human body, the human-robot interaction will appear as more persuasive. As PeTeR will be a sociable robot, it is important that he is convincing as an illusion of life, and by applying a human body to the system, chances of being perceived as a human being will be increased. Another argument for the application of a humanoid design is that training involves a physical body. Personal trainers have knowledge of every aspect of the body and with PeTeR’s intended intelligence, he will be just like a personal trainer; demonstrating exercises and commenting on the user’s body movement. He will be someone the user can relate to when it comes to physical activity.

PeTeR will ideally appear so intelligent and realistic that he might fool the users saying he has had the same knee injury as them. We can summarize the embodiment issue by saying that PeTeR does not need a physical human body to be intelligent. However, he will definitely benefit from being a humanoid robot as the human-robot interaction will appear as more intelligent.

5.4 Competence vs. common sense

PeTeR's long-term goal is to replace current offers of personal trainers, and to become an expert in the field with the same knowledge and intelligence as a personal trainer. Although Dreyfus criticized AI, he was confident that computers could perform tasks in formalized domains which required little common sense. Tasks that require facts and little common sense introduces the opportunity of developing a so-called expert system. An expert system refers to a computerized system that has acquired knowledge from an expert within the field (Brey, 2001, p. 48). An example is a chess-game on a computer. This game is programmed to know which piece has the highest value, it can make decisions based on the situation on the board, and it is based on rules. For PeTeR, relevant rules would be regarding exercise and nutrition. For instance, when you do a squat, the muscles involved are in your legs. This is fact-based competence that can be translated into a computer program.

Dreyfus later reconsidered his assumption of expert systems. He conducted a study with his brother and found that humans apply rules only in the early stages of learning (Brey, 2001, p. 48). A chess grandmaster would not apply rules as beginners do. The expertise would consist of an evaluation of past experiences where he had succeeded, and not only of rules of thumb. Expert systems are not able to perform such expertise and to do such evaluations and judgement. Brey (2001, p. 48) points out that expert systems might only be applicable in systems that do not call for performance at expert level. The question we must ask ourselves when developing PeTeR is if he calls for expertise or only competence? As discussed, he clearly needs competence. A personal trainer is educated for years and needs to have a lot of anatomical knowledge as well as training theory. However, being a personal trainer does not only include being an expert in different exercises. Working as a personal trainer, you have to continuously estimate the client's performances and needs. The client's general physical and psychological health needs to be taken into consideration as well. For instance, if a person with a hip injury uses PeTeR as a personal trainer, PeTeR will not have the ability to perform the kind of expertise that this specific person needs. It would require a careful evaluation of the injury as well as adjustments in the exercises' intensity and strength. PeTeR would have trouble with telling this person to go home and rest for two weeks without the use of common sense and being in the situation. To be a complete personal trainer, PeTeR needs both competence and common sense.

6.0 Future potential

Imagine that the mystery of AGI and all the other issues in making a computer similar to the human mind had been solved by researchers. In addition to all the moral questions coming to life, envision all the possibilities arising. There is no doubt that there are both positive and negative consequences of the AI field evolving. However, sooner or later it might be a good idea to prepare oneself to work and live alongside robots. They are already here and they have come to stay. In the future, there will probably be an endless discussion about limits. Can computers outsmart humans? Is there any moral limit to stop the development of AI? For PeTeR, there are several moral questions if he were to be developed as a personal trainer. Let us look at two different futuristic scenarios, one realistic idea that could be developed in, for instance, 20 years from now, and one provocative idea that belongs to the imagination - for now.

6.1 Scenario 1: PeTeR - The Smart Gym

In the conceptual prototype, the idea is that users can register on the iPad and have their own profile in PeTeR so he would know who is working out. This idea could be pushed even further. Imagine everything in the gym was connected to PeTeR, or PeTeR was connected to all the equipment in the gym. When the user enters the gym, they register by the door, for instance by looking at a screen or scanning their thumb. PeTeR, The Smart Gym, would know exactly who has entered the building and which workout routine this person is going to carry out. PeTeR has detailed information about every user and makes custom made training programs. On all the equipment in the gym, the user gets help from PeTeR and he coordinates where each person goes next. There will never be a queue by a training machine. If several persons are training the same muscle groups, PeTeR always finds alternative activities once the main equipment is occupied.

A user flow could be as follows; when the user has registered by the door, he goes to the wardrobe to change and locks his personal things in a locker. A locker has already been assigned to the user when the user entered the gym. In the wardrobe, each locker has a screen. On the screen the user can see which workout routine PeTeR has set up, and make changes if desired. When the user has approved his workout, he can decide which mood and how strict he wants PeTeR to be. If the user wants, he can also change the personal trainer, it does not have to be PeTeR. Additionally, from the screen, the user can also order a smoothie from the Smart Bar in the gym. This bar is of course an autonomous bar and will have the user's smoothie ready by the time his workout is finished. When everything is set up, the user can press "Ready!" on the screen, and receive instructions from PeTeR on where to go first.

At the first station, for instance by the shoulder press machine, PeTeR pops up on a screen. He guides the user through the exercise and counts the repetitions (if the user wants to). The user can control everything on the screen. PeTeR's voice is connected via Bluetooth to the user's headphones, and the user can decide which and how much feedback it wants from PeTeR. Through a camera and sensors on the machine, PeTeR will have the Human Pose Estimation technology and scan the user's key points on the body. For instance, if the user's elbow is out of line, PeTeR will lower the user's music on the headphones and suggest to do the next repetitions with lighter weights to prevent injury. When the user is finished at the shoulder press machine, he is directed to the next training station. The user walks to the next station, and PeTeR is already waiting on the screen by the machine. This will be the case for each station; PeTeR, or your desired personal trainer, will join you at each station helping you through your training program. When the workout is finished, the user collects his things from the locker and picks up his smoothie on the way out.

6.2 Scenario 2: PeTeR - Your future self

Another futuristic scenario, which is slightly more provocative, is PeTeR being your future self. What if your physical and psychological experiences could be implemented in the system? In this way, PeTeR would know exactly how you are feeling and how much intensity to put into the workout. PeTeR could for instance have your health journal in the system, and transform into your future self based on your current health situation and goals.

A typical flow in this scenario could be; the user enters the smart gym. When entering, PeTeR approaches you and immediately knows who you are by scanning your face and body. When the user is detected, PeTeR transforms into the user's future self. If the user has not been at the gym before, PeTeR transforms into a suggested body, based on the user's weight, height, physical and psychological condition and other information from the user's health journal. The user can easily change the ideal body, by telling PeTeR about his goals and challenges, if any. Now that PeTeR looks like the user, the workout can begin. Similar to scenario 1, PeTeR has modified workout routines for each user. However, this time he will be joining the user as a companion.

The future self is supposed to function as a motivation for the user, showing how the user could look like if he works out regularly, and follows PeTeR nutrition and training program. Nevertheless, scenario 2 already includes countless moral questions, both regarding privacy matters for the user, and humanity in general. Who would be held morally accountable if anything were to happen? Would PeTeR be considered a citizen of the world with his own personality? How provocative is it to look at a better version of yourself, with a different and even nicer personality? PeTeR with citizenship, and the ability of transforming into any person, fortunately belongs to the future.

7.0 Conclusion

In the present paper, the aim was to assess the challenges of developing a humanoid robot and whether the proposed personal trainer robot PeTeR could eventually replace human personal trainers. The main challenges are reflected in the lack of common sense, the ability to learn from past experiences, and situatedness. PeTeR might not be able to operate logically alone because he is neither situated nor embodied, and has not experienced life by learning, perceiving and developing a complex human mind. Nevertheless, he is not entirely useless today. The proposed technology could still be a contribution to gyms and personal trainers. PeTeR might not be a fully autonomous robot, but he could become an extension of today's personal trainers helping with scanning techniques and encouragement. With the limitations of modern technology and the mystery of AGI remaining unsolved, PeTeR will not be able to replace current offers. However, with the constant development in the field, it may only be a matter of time until AI researchers have solved the puzzle.

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