COURSE GUIDE

PHL 324
CYBERNETIC/ARTIFICIAL INTELLIGENCE

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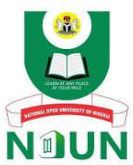

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14/16 Ahmadu Bello Way
Victoria Island, Lagos
Published by
National Open University of Nigeria

Printed 2022

ISBN: 978-978-058-263-0

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COURSE GUIDE FOR PHL 324 – CYBERNETICS/ARTIFICIAL INTELLIGENCE

INTRODUCTION

This is *PHL324 – Cybernetics/Artificial Intelligence.* PHL324 is a two-credit unit course which has minimum duration of one semester. It is a compulsory course for all undergraduate students in National Open University of Nigeria (NOUN). The course introduces students to the study of Artificial Intelligence (A.I.), a peculiar type of intelligence that emanates from machines. It is a broad survey of the ability of intelligent machines in storing information, resolving mathematical problems and its accuracy in acquisition of knowledge. Students shall be exposed to, the nature of A.I., that is, its capacity of knowledge representation in the area of simulation, dissemination of information, information retrieval and machine language, and the contribution of A.I. to the growth of human knowledge and various ways through which A.I. can promote better understanding of the sources, scopes and limits of human knowledge. Furthermore, the course shall examine the epistemological limitations of A.I. In other words, the kind of knowledge offered by Intelligent machines as well as the controversial debates on whether machines can be equated with men or not, and the irreducibility of human consciousness shall be subject of philosophical study.

COURSE OBJECTIVES

By the end of this course, you will be able to:

- Understand what Artificial Intelligence is.
- Know the historical development of Artificial Intelligence.
- Explain the ability of Artificial Intelligence in terms of receiving and storing information, resolving mathematical problems and its accuracy in acquisitionof knowledge.
- Explain the role and capacity of Artificial Intelligence in knowledgerepresentation in the area of simulation, dissemination of information, information retrieval and machine language.
- Outline the merits and demerits of AI
- Determine the contribution of A.I. to the growth of human knowledge
- Articulate the epistemological limitation of AI as compare to humanintelligence
- Evaluate the current and future prospects of AI.

WORKING THROUGH THIS COURSE

To successfully complete this course, read the study units, do all the

assignments, open the links and read, participate in discussion forums, read the recommended books and other materials provided and participate in the online facilitation.

Each study unit has introduction, intended learning outcomes, the main content, conclusion, summary and references/further readings. The introduction will tell you the expectations in the study unit. Read and note the learning outcomes (LOs). The intended learning outcomes tell you what you should be able to do at the completion of each study unit. So, you can evaluate your learning at the end of each unit to ensure you have achieved the intended learning outcomes. To meet the intended learning outcomes, knowledge is presented in texts, and links arranged into modules and units. Click on the links where provided as the case may be to either read or download texts, pictures etc. the conclusion gives you the theme of the knowledge you are taking away from the unit. Unit summaries are also presented for proper articulation of the salient points made in unit.

There are two main forms of assessments – the formative and the summative. The formative assessments will help you monitor your learning. This is presented as in- text questions, discussion forums and self-Assessment Exercises. The summative assessments would be used by the university to evaluate your academic performance. This will be given as computer Based test (CBT) which serves as continuous assessment and final examinations. A minimum of two or maximum of three Computer Based Tests will be given with only one final examination.

STUDY UNITS

There are 3 Modules with a total of 13 units. They are presented as follows:

Module 1 Introduction to Artificial Intelligence (AI)

Unit 1	Historical Evolution of Artificial Intelligence
Unit 2	The Nature of Artificial Intelligence
Unit 3	The Subject Matter of Artificial Intelligence
Unit 4	Intelligent Machines and Perception
Unit 5	Artificial Intelligence: A Consequent of the Metaphysical Problem of Mind

Module 2 The Significance of Artificial Intelligence (AI)

Unit 1 The Usefulness of Artificial Intelligence
Unit 2 Artificial Intelligence and the Quest for Knowledge
Unit 3 The Epistemological Significance of Artificial Intelligence
Unit 4 Machine Learning and Conflict Resolution: The Farmer-Herdsmen Conflict as Case Study

Module 3 Challenges of Artificial Intelligence

Unit 1 The Epistemological Limitations of Artificial Intelligence
Unit 2 Can Machines be Equated with Men? – Some Notable Debates
Unit 3 The Irreducibility of Human Consciousness
Unit 4 The Psycho-Moral Implications of Artificial Intelligence: Cyber-Bullying as Case Study

PRESENTATION SCHEDULE

This course has two presentations; one at the middle of the semester and the other towards the end of the semester. At the beginning of the semester, each student undertaking this course will be assigned a topic by the course facilitator, which will be made available in due time, for individual presentations during forum discussions. Each presenter has 15 minutes (10 minutes for presentation and 5 minutes for Question and Answer). On the other hand, students will be divided by the course facilitator into different groups. Each group is expected to come up with a topic to work on and to submit same topic to the facilitator via the recommended medium. Both attract 5% of your total marks.

Note: Students are required to submit both papers via the recommended medium for further examination and grading. Both attract 5% of your total marks.

ASSESSMENT

There are two segments on assessment for this course. These are: Tutor-Marked Assignments(TMAs) and a written examination. You are expected to submit your assignments to your tutor as at when due for 30% of your total course mark. Afterward, a final three-hour examination accounts for 70% of your total course work. Together, all of these amount to 100%.

To avoid plagiarism, students should use the followings links to test run their presentation papers before submission to their tutors:

- http://plagiarism.org
- http://www.library.arizona.edu/help/tutorials/plagiarism/index.html

Similarity index for submitted works by student must **NOT EXCEED 35%.**

If the student is unable to check, the course facilitator will do this after retrieving the electronic format from their student. Similarity index for submitted works by student must NOT EXCEED 35%. Finally, all students taking this course MUST take the final exam which attracts 70% of the total marks.

HOW TO GET THE MOST FROM THE COURSE

To get the most in this course, you need to have a personal laptop and internet facility. This will give you adequate opportunity to learn anywhere you are in the world. Use the Learning Outcomes (LOs) to guide your self-study in the course. At the end of every unit, examine yourself with the LOs and see if you have achieved what you need to achieve.

Carefully work through each unit and make your notes. Join the online real time facilitation as scheduled. Where you missed the scheduled online real time facilitation, go through the recorded facilitation session at your own free time. Each real time facilitation session will be video recorded and posted on the posted on the platform.

Work through all self-assessment exercises. Finally, obey the rules in the class.

FACILITATION

You will receive online facilitation. The facilitation is learner centered. The mode of facilitation shall be asynchronous and synchronous. For the asynchronous facilitation, your facilitator will:

- Present the theme for the week
- Direct and summarize forum discussions
- Coordinate activities in the platform
- Score and grade activities in the platform
- Score and grade activities when need be
- Upload scores into the university recommended platform
- Support you to learn. In this regard personal mails may be sent.
- Send you videos and audio lectures; and podcast

For the Synchronous:

There will be a minimum of eight hours and a maximum of twelve online real time contact in the course. This will be through video conferencing in the Learning Management System. The sessions are going to be run at an hour per session. At the end of each one- hour video conferencing, the video will be uploaded for view at your pace.

The facilitator will concentrate on main themes that are must know in the course. The facilitator is to present the online real time video facilitation time table at the beginning of the course.

The facilitator will take you through the course guide in the first lecture at the start date of facilitation.

Do not hesitate to contact your facilitator if you:

- Do not understand any part of the study unit or the assignment
- Have difficulty with the self-assessment exercises
- Have a question or problem with an assignment or with your tutor's commentson an assignment.

Lastly, use the contact provided for technical support.

Read assignment, participate in the forums and discussions. This gives you opportunity to socialize with others in the programme. You can raise any problem encountered during your study. To gain the maximum benefit from course facilitation, prepare a list of questions before the discussion session. You will learn a lot from participating actively in the discussions.

REFERENCES/FURTHER READINGS/WEB SOURCES

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The following links can be used to access materials online:

www.pdfdrive.net

www.bookboon.com

www.sparknotes.com

http://ebookee.org

https://scholar.google.com/

https://books.google.com/

MAIN COURSE

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MODULE 1 INTRODUCTION TO ARTIFICIAL INTELLIGENCE (AI)

UNIT 1 HISTORICAL EVOLUTION OF ARTIFICIAL INTELLIGENCE (A.I.)

Unit Structure

1.1 INTRODUCTION

Taking a critical look at the famous Socratic dictum that says "an unexamined life is not worth living," it could be seen that his dictum focuses its attention on humankind and its activities in the universe. There is no doubt that humankind is the measure of all things in the universe. If it is believed that philosophy is a critical reflection on human beings and their activities or experience in the universe, then it is timely that man reflects on his technological development to maximise the good Technology.

However, the maximisation of good Technology might not be meaningful unless we reflect on its historical evolution. Therefore, our focus in this unit is to understudy theevolution of Artificial Intelligence as the background to this course.

1.2 Intended Learning Outcomes

By the end of this unit, you will be able to:

- critically examine the historical development in humanTechnology
- trace the historical evolution of Artificial Intelligence A.I.
- discuss the concept of Science and Technology
- state the relevance of technological development in human

society.

1.3.1 Concept of Science and Technology

Over the years, Science and Technology have made tremendous impacts on various human and societal developments. Having seen such results, one would have said thatScience is the best thing that has ever happened to humanity. Considering this, one may be tempted to think that Science as a way of creating a good life for humanity bymaking efforts to find solutions to every problem that confronts humans should be disregarded.

However, irrespective of the advantages or disadvantages of this field of study to humanity, the fundamental question of what Science and Technology are still calls for discussion in examining the historical evolution of Artificial intelligence. Since it is philosophically rational that nothing brought itself into existence, for anything to exist, a particular agent must be responsible for its existence. On this premise, the historical genesis of artificial intelligence is traced back to development in Science and Technology, but what is Science, and how does development in Science and technology aid in the evolution of the development of the field of study? These and many more beg for answers.

Science: Science is the first of all human activity. Historically speaking, technology is said to be older than Science as man-made tools; prior to his understanding of early technology, take for instance, the invention of fire-making by rubbing stones together. Man did not discover science; rather, according to Alman (1963), it was invented by him in an effort to understand nature and himself in the universe.

The word Science is derived from the Latin word “Scientia,” which can be interpreted as knowledge. It can also be defined as any systematic field of study or a body of knowledge that aims, through experimentation, observation, and deduction, to produce a reliable explanation of a phenomenon with reference to the material and physical world (Gowing, 1983:232). In his view, Morgan defined Science as any activity resulting in knowledge and understanding of the world around us. It is a systematic method of describing and controlling the material world. Uduigwowen (1992:73) posits Science as knowledge arranged in an organised or orderly manner, especially knowledge obtained by observation and experimentation. The above definition implies that Science is a body of knowledge about the universe which is systematically tapped or discovered by various methods. The mode of tapping this knowledge always involves experimentation, observation, and conclusion. Generally, Science is distinguished from all other human activities because it enables man to see the world as it really is.

Science was born out of curiosity, to understand and unlock the mysteries of the world. Over the years, scientific findings have increasingly influenced philosophical and religious thoughts about the nature of human beings and their place in the universe. With the regeneration of Science in the 14th- 16th centuries, which was more or less the period of conducting tests, many inquiries were carried out, many theories were also put forward, and with this, the old method or approaches in which the early man was compelled by daily activities became false. More so, during the 17th-century, attention shifted to the use of some theories to produce goods and products for the betterment of man, for instance, the discovery of electromagnetic induction theory by an American (Joseph Henry), which is the basis of electricity generation (1797- 1878).

Technology: Having discussed the concept of Science, it is imperative to further elaborate on the tools of Science, which is Technology. In a layman's understanding, Technology can be viewed as the systematic study of techniques for making and doing things. It is an activity resulting in procedures for building and creating things in prototypes and models of products in gadgets and inventions. On the other hand, it is referred to as the direct application of Science; that is, science is an abstract concept while Technology is the applicability of Science. In his view, Ogbinaka (1998: 331) posits that; Technology refers to the tools and artefacts which men use in daily activities to manipulate nature and their environment for their benefit. Such benefits can be for domestic or industrial purposes.

Technology can also be referred to as the study of those artefacts, tools, machinery, and others. Thus, it implies that technology is the systematic utilisation of natural resources and forces based on the knowledge of nature to take care of man's needs. On his part, Ryan (1971) is of the view that technology is one of man's efforts to cope with his physical environment, both that provided by nature and those that are created by man's technological deeds and his attempts to subdue or control the environment employing his imagination and ingenuity in the use of available resources. We can affirm that technology has existed since antiquity. It had existed with man before science, since the early man developed tools and artefacts out of the impulse to overcome his problems and difficulties in order to meet his basic human needs such as food, shelter and clothing.

In corroborating this view, Melvine (1977) asserts that technology refers to the various ways man uses his inventions and discoveries to satisfy his needs and desires. This is to say that it is man who, through his spiritual and intellectual powers, creates technology. One can therefore

affirm that technology is not to be understood only in terms of modern technology, in other words, the age of computers or complex machines. Alternatively, technology is the way people use resources to meet their needs and wants; technology is a product of man's invention and ability to make his life more meaningful. Thus, man produces technological objects and devices that will meet his daily needs and help him live a meaningful life.

In his view, Smith (1967:967) claims that technology is embracing a variety of practical activities that provide goods and services for man's use, enjoyment and welfare. Manufacturing, transportation, communication and the conversion of energy into useable forms are typical technological activities especially as they involve the application of the scientific understanding of natural phenomena and are complex, highly skilled, and involve technical expertise.

1.3.2 Historical Development in Science and Technology

With the rebirth of science in the 14th to 16th centuries, which is more or less the period of experimentation, a lot of research was carried out, many theories were also propounded such as Aristotle's Logic, Ptolemy's Geocentric system, Revolution and Cosmological hypothesis among others, and with this, the old methods or approaches in which the early man was compelled by daily activities became bogus. Then by the 17th century, attention shifted to the use of some of those theories to produce goods or products for the development and betterment of mankind.

For instance, the enlightenment of the Englishman known as Michael Faraday (1791- 1867), an American man Joseph Henry (1797- 1878) discovered electromagnetic induction theory and this theory is the basis of electricity generation. Joseph Henry was an American scientist who pioneered the construction of strong, practical electromagnets and built one of the first electromagnetic motors. During his experiments with electromagnetism, Henry discovered the property of inductance in electrical circuits, which was first recognised at about the same time in England (MagLab, 2022).

The basic idea of using electricity to create light was first investigated over 200 years ago by the English chemist Humphrey Davy. He showed that when electric current flowed through wires, their resistance caused them to heat up to the point where they gave out light. The discovery of the British scientist, Humphrey Davy about electricity led to the manufacturing of the first electric bulb for lighting (Science Focus, 2020). Today tall buildings (skyscrapers) are prevented from being struck by lightning by installing lightning conductors on them. These

and many more show the historical developments that have taken place in the field of science and technology.

Taking cognizance of the historical developments that have taken place in this field of study, one can conclude that there is no phenomenon in the contemporary world that has attracted so much attention within the realm of material development as technology. This field of human development aims to guarantee sustainabledevelopment, this is one of the reasons why Olaolu (2003) posits that science was designed to teach man how to live successfully rather than how to die, with the assurance of ultimate salvation and to control the physical world with a view of explaining man and the world. Above all, science is used to manipulate nature and the environment for human benefit. According to Adiele (2002), technology is the enhancement of well-being and influence of man through the creation of wealth. It makes man more productive in his environment, it helps man to control huge and wild animals like elephants, lions, and even man himself.

Without exaggeration, technology is the human developmental effort that has become an all-pervading phenomenon that concerns everybody in the society. It has greatly helped man gain better understanding of his environment; more so, enjoy a higher standard of living and authority. In furtherance to better understanding and control of his environment, technology gave birth to the idea of Artificial intelligence which man came about in the early twentieth century. This is one of the latest developments in the aspect of technological inventions by man. Although this invention is not to equate man with machine nor man seeing himself as creator, it is an attempt by man to produce an intelligent machine that can makes man's efforts minimal. It is on this surface that we give a general idea of what Artificial intelligence entails.

1.3.3 Idea and History of Artificial Intelligence

The word Artificial intelligence can be described or summarized as an intelligent machine created and invented by man through its technological process. It can also be described as machine learning. Artificial intelligence occurs when machines learn and adapt to different circumstances and environments, alternatively, it can be summarizedas a replica of intelligence that resembles human form of intelligence. Many Scientistshave defined and tried to conceptualise the idea and concept of artificial Intelligence particularly the nature and performance of machine learning and natural language. The basic fact of this form is that artificial intelligence is a peculiar type of intelligence that emanates from machines.

The idea of Artificial intelligence can be traced to new development in

technology dated to the first half of the 20th century; science and creative writing familiarized the world with the concept of artificially intelligent robots. To be precise, Alan Turing (1950), a young British polymath explored the mathematical possibility of artificial intelligence in his paper presentation titled "computing machinery and intelligence". Turing suggested that since humans used available information as well as reason to solve problems and make decisions, why can't machines do the same thing? At the beginning of 1950, John Von Neumann and Alan Turing did not create the term Artificial intelligence (AI) but were the founding fathers of the technology behind it: they made the transition from computers to 19th century decimal logic and machines to binary logic This was the logical framework of his 1950 paper which gave birth to the discussion on Artificial intelligence.

The unit thus exposes the reason to build intelligent machines and how to test the category of their intelligence. In furtherance to Turing's quest for intelligent machines, John McCarthy organized and hosted a research and development project on the subject matter of artificial intelligence and others related to intelligence. According to the Research and Development Corporation (RAND), logic theorist was the first artificial intelligence program designed to mimic the problem-solving skill that resembles human skill. Failure to agree on a specific standard method brought a set back to the conference. However, the significance of this event cannot be undermined as it catalysed the next twenty years of Artificial intelligence research.

Hence, it can be deduced that Artificial intelligence is a set of sciences, theories and techniques that aims to imitate the cognitive abilities of a human being. Initiated in the breath of the Second World War, its developments are intimately linked to those of computing and have led computers to perform increasingly complex tasks, which could previously only be delegated to a human. In his submission Herbert Simon (1957) asserts that Artificial intelligence would succeed in beating a human at chess in the next 10 years, there is no controversy in Simon's vision as it proved to be right 30 years later. The success in May 1997 of IBM's expert system in the chess game against Garry Kasparov (A Russian chess grandmaster and former world champion), fulfilled Herbert Simon's 1957 prophecy 30 years later.(Rockwell 2017).

History of Artificial Intelligence: John McCarthy defines artificial intelligence as 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 biologically observable methods" (McCarthy, 2004).

By the second half of the nineteenth century, Rosemblett developed a computer called ‘perception’ through which a new field called Artificial Intelligence, a peculiar type ofintelligence that emanates from machines, came into being. Since the invention, much emphasis has been laid on the ability of computers, in storing information. The invention of this computing machine led to the information explosion or information revolution, and through this, the keeping of our documents, information storage and retrieval techniques have been improved. Not only do we now have electronic computers that can solve mathematical problems quicker than human brains, but we can also now store a vast amount of information and disseminate them quickly (Balogun, 1991).

The first work now recognised as artificial intelligence can be traced back to Warren McCulloch and Walter Pits in 1943. The term was later coined by John McCarthy in 1956 during his conference in Hanover (Lewis, 2014). After the *Dartmouth Summer Research Project on Artificial Intelligence* (DSRPAI) organized by John McCarthy and Marvin Minsky which introduced the idea of AI, the most substantial work was that of Alan Turing in 1950. Subsequently, the earliest successful AI program was written in 1951 by Christopher Strachey, later director of the Programming Research Group at the University of Oxford. In 1955, McCarthy developed Lisp, the most popular and still favoured programming language for artificial intelligence research. Then in 1959, Samuel coined the term “machine learning” when speaking aboutprogramming a computer to play a game of chess better than the human who wrote its program.

Innovation in the field of artificial intelligence grew rapidly through the 1960s. The creation of new programming languages, robots and automatons, research studies, and films that depicted artificially intelligent beings increased in popularity (Reynoso, 2021). From 1957 to 1974, AI flourished. Computers could store more information and became faster, cheaper, and more accessible. Machine learning algorithms also improved and people got better at knowing which algorithm to apply to their problems. Early demonstrations such as Newell and Simon’s *General Problem Solver* and Joseph Weizenbaum’s *Eliza* showed promise toward the goals of problem solving and the interpretation of spoken language respectively (Rockwell, 2017).

But achieving an artificially intelligent being wasn't so simple. After several reports criticizing progress in AI, government funding and interest in the field dropped off – a period from 1974–80 that became known as the "AI winter." The field was later revived in the 1980s when the British government started funding it again in part to compete with efforts by the Japanese. The field experienced another major winter

from 1987 to 1993, coinciding with the collapse of the market for some of the early general-purpose computers, and reduced government funding.

However, research began to pick up again after that, and in 1997, IBM's Deep Blue became the first computer to beat a chess champion when it defeated Russian grandmaster Garry Kasparov. Among machine learning techniques, deep learning seems the most promising for several applications (including voice or image recognition). In 2003, Geoffrey Hinton (University of Toronto), Yoshua Bengio (University of Montreal), and Yann LeCun (University of New York) decided to starta research program to bring neural networks up to date. Experiments conducted simultaneously at Microsoft, Google, and IBM with the help of the Toronto laboratory in Hinton showed that this type of learning succeeded in halving the error rates for speech recognition (Council of Europe, 2022).

In 2001, Steven Speilberg directed and released a Sci-fi film *A.I. Artificial Intelligence* was released. The movie is set in a futuristic, dystopian society and follows David, an advanced humanoid child that is programmed with anthropomorphic feelings, including the ability to love (Reynoso, 2021). In the same year 2002, Honda released ASIMO, an artificially intelligent humanoid robot. Also, Professor Cynthia Breazeal developed Kismet, a robot that could recognise and simulate emotions with its face.

It was structured like a human face with eyes, lips, eyelids, and eyebrows. Another major Sci-Fi movie was in 2004, the film *I-Robot*, directed by Alex Proyas set in the year 2035, where humanoid robots serve humankind while one individual is vehemently anti-robot, given the outcome of a personal tragedy (determined by a robot. Then in 2011, the computer giant's question-answering system Watson won the quiz show "Jeopardy!" beating reigning champions Brad Rutter and Ken Jennings (Lewis, 2014).Today, a simple search on Google can find millions. Then the discovery of the very high efficiency of computer graphics card processors accelerated the calculation of learning algorithms. This new technological equipment has enabled some significant public successes and has boosted funding: in 2011, Watson, IBM's IA, won the games against 2 Jeopardy champions. In 2012, Google X (Google's search lab) will be able to have an AI recognise cats on a0 video. More than 16,000 processors have been used for this last task, but the potential is extraordinary: a machine learns to distinguish something. In 2016, AlphaGO (Google's AI specialized in Go games) beat the European champion (Fan Hui) and the world champion (Lee Sedol), then herself (AlphaGo Zero).

AI is projected to have a lasting impact on just about every industry imaginable. We're already seeing artificial intelligence in our smart devices; cars, healthcare system and favourite apps, and we'll continue to see its influence permeate deeper into many other industries for the foreseeable future. By 2030, AI will likely no longer be getting adopted with simple scenarios and applications. It will be expected to detect life-threatening diseases in the nascent stage, predict weather conditions of a large area over several months and become a digital collaborator to the human race (Agrawal, 2021).

Artificial Intelligence is one of the fruits of Psychology. And psychology was cleaved from the Philosophy of Mind, according to Anthony Kenny, around the beginning of the 20th century (Kenny, 2006). This plucking of one discipline from the other is a very common occurrence. It is on a related note that Paul Feyerabend informs that:

Scientific education as we know it today has precisely this aim. It simplifies 'science' by simplifying its participants: first, a domain of research is defined. The domain is separated from the rest of history (physics, for example, is separated from metaphysics and from theology) and given a 'logic' of its own. A thorough training in such a 'logic' then conditions those working in the domain; it makes their actions more uniform and it freezes large parts of the historical process as well (Feyerabend, 1992: 11).

The above is meant to serve as a justification for the fact that some disciplines emerge but may not even acknowledge Philosophy. This is true if we consider the long history and evolution of Artificial Intelligence which has Philosophy of Mind as a sub-structure. The aim of this long essay therefore is to assess the philosophical foundation of Artificial Intelligence as we pay attention to Gilbert Ryle's submission on the Philosophy of Mind. However, before we proceed to this, it is important that we ask: What is artificial intelligence? It is important to briefly articulate what this connotes before we engage with Ryle.

"Artificial intelligence" is the ability of machines to do things that people would say require intelligence. Artificial intelligence (AI) research is an attempt to discover and describe aspects of human intelligence that can be simulated by machines (Jackson, 1985: 1). For example, at present there are machines that can do the following things:

1. Play games of strategy (e.g., Chess, Checkers, Poker) and (in Checkers) learn to play better than people.
2. Learn to recognise visual or auditory patterns.
3. Find proofs for mathematical theorems.

4. Solve certain, well-formulated kinds of problems.
5. Process information expressed in human languages.

The extent to which machines (usually computers) can do these things independently of people is still limited; machines currently exhibit in their behavior only rudimentary levels of intelligence. Even so, the possibility exists that machines can be made to show behavior indicative of intelligence, comparable or even superior to that of humans.' Alternatively, AI research may be viewed as an attempt to develop a mathematical theory to describe the abilities and actions of things (natural or man-made) exhibiting "intelligent" behavior, and serve as a calculus for the design of intelligent machines. As yet there is no "mathematical theory of intelligence," and researchers dispute whether there ever will be (Jackson, 1985: 1).

Self-Assessment Exercise

1. Innovation in the field of _____ grew rapidly through the 1960s.

2. _____ can also be referred to as the study of those artefacts, tools, machinery, and others.

1.4 Summary

In this unit, we have considered the meaning, history and types of artificial intelligence. In the definition of AI, we have seen that AI refers to a type of intelligence demonstrated by machines. We also observed through history that artificial intelligence as a growing field has developed rapidly over the years and likewise has raised various concerns as it passes through different times and discoveries. Today, it is no longer a fiction that the impact of science and technology on human innovation has contributed in a larger form to the development of his society. Historical development in science and technology paved the way for the subject matter of this course with emphasis on Cybernetics and Artificial intelligence. Our conclusion in this unit is that science and technology are the basis of any human innovation and more so that human innovations aim towards human happiness and not to mire the society. This unit has systematically discussed the origin of science and technology as tools in man’s hands. The following points were critically elucidated: The idea of science and the origin of technology. The relationship between science and technology. Technological development and the history of Artificial intelligence. The word AI is used to make reference to Artificial intelligence in its shortened form. The first work now recognised as artificial intelligence can be traced back to Warren McCulloch and Walter Pits in 1943. The term was later coined by John McCarthy in 1956 during his conference in Dartmouth,

Hanover. Artificial intelligence was developed out of the need to create intelligent machines that can be used to perform human tasks and assist man in his daily life. Philosophically, it has progressed further into the field of the Philosophy of Mind and Epistemology; in trying to use machines to store information and arrive at knowledge.

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1.6 Possible Answers to SAE

1. Artificial intelligence
2. Technology

UNIT 2 THE NATURE OF ARTIFICIAL INTELLIGENCE

Unit Structure

1.1 Introduction

Having posited the argument in our previous unit that the impact of science and technology in human life cannot be underrated, it is pertinent to examine the nature of artificial intelligence being one of the latest inventions of man. The unit shall examinethe rationale behind the development of Artificial intelligence and its contribution to human happiness.

1.2 Intended Learning Outcomes

By the end of this unit, you will be able to:

- discuss artificial intelligence
- differentiate between natural and artificial intelligence
- discuss the rationale for invention of artificial intelligence.

1.3.1 General Description of Artificial Intelligence

A precise definition of Artificial Intelligence has remained a controversial issue among the scholars, in the sense that there is no straight forward definition given on the concept. However, for the purpose of clarification and clarity the term shall be conceptualized in its simplest form. The formation of artificial intelligence is derived from the combination of two words which are “Artificial” and “intelligence”. Generally speaking, the word “Artificial” connotes a replica or imitation of something; it is described as human attempt in copying things in its original state but not in absolute perfect state like the real thing. In other words, it could be defined as human intellectual efforts in bring out a replica of thing given by nature. The historyof the evolution of human development has moved from different epoch to the other; from Stone Age till jet age. History reflects that from one age to the other, man comes up with one unique thing or the other in an attempt to make

his life easier or stress free, man develops tools; create his own world and many more. Thus, the word "artificial" connotes an image or replica of a natural thing according to manmade effort.

On the other hand, "intelligence" is a wider concept that one cannot come up with a straight forward definition. Academically, the word intelligence is derived from the Latin word "intellegere" meaning the acquirement, processing and storage of information (2005). However, in its generic notion, intelligence is that uniqueness that makes man differ from all other living creatures. It is the mental capacity that involves the ability to reason, to plan and to solve problems. Intelligence helps man to comprehend complex ideas, learn quickly and learn from experience. Intelligence can also be described as higher-level abilities, it is the ability to learn, and it is known as emotional knowledge, creativity and adaptation to meet the demands of the environment effectively. Thus, intelligence is a state above normal thinking capacity. According to Baumert (2009), intelligence refers to the relatively decontextualized ability to reason and to address new problems without content-specific knowledge. Wechsler (1958) asserts that intelligence is the global capacity of a person to act purposefully, to think rationally and to deal effectively with his or her environment.

Philosophically speaking, the idea of intelligence is traced back to the days of Plato and Aristotle; the two great philosophers who were so much concerned about the source of human knowledge or way of knowing. In his view Plato highlights intelligence as being housed in the soul rather than the body (Blaise 2013), Plato maintains further that intelligence is that which distinguishes the different social classes and is unevenly endowed by God. Asides from Plato and Aristotle other philosophers such as Avicenna, Darwin and Bacon discussed extensively on the controversy about the idea of intelligence.

It is called an artificially intelligent system because it essentially imitates or mimics the way the human mind thinks, responds to and solves problems. This is what makes AI unique. Artificial Intelligence aims at producing a computer that can program itself, that is, a self-programming machine. According to Newell (1990:90), "a system is intelligent to the degree that it approximates a knowledge-level system." The goal of Artificial Intelligence is to embody in a machine a repertoire of intelligent behaviour comparable with human behaviour in similar contexts.

At this juncture, it is very essential to consider some of the rationale for the use of Artificial Intelligence even till the present time despite the fact that Artificial Intelligence is still wrestling with what has come to be called the common-sense knowledge problem. In fact, the

representation of knowledge is always a centralproblem in Artificial Intelligence.

Another reason for the use of Artificial Intelligence is that it has enabled us to acquire knowledge about the world and be able to apply knowledge to problems at any time. For example, through Artificial Intelligence, computers can now solve Mathematical problems faster than the human brain; through expert systems, all the knowledge in a particular field can be stored and then be used in case of emergency in future (Balogun, 1991).

Having conceptualized the two terms understudy in this lecture note, a critical analysisof the combination of the terms is the main focus of our lecture. While the analysis given above indicates that there can be two dimensions of intelligence which are natural and artificial intelligence, our main aim in this course is to examine what Artificial intelligence entails.

Artificial intelligence etymologically can be defined as human made intelligence or a machine made by man with the goal of performing the same duty like natural intelligence. It can be defined as human made machine in likeness to human conscious brought into existence from human consciousness. Balogun (2005) in his works asserts that Artificial Intelligence is a sort of intelligence that emanates from machines that are capable of performing intelligent actions like that of human beings. According to McCarthy (2007) artificial intelligence is the science and engineering of making intelligent machines, especially intelligent computer programs.

Artificial intelligence is related to the similar task of using computers to understand human intelligence, but Artificial intelligence does not have to confine itself to methods that are biologically observable. McCarthy's definition on the concept of Artificial intelligence indicates that it is advancement in science or development in genetic engineering. This implies that Artificial intelligence is a theory and development of computer systems that can perform tasks that normally require human intelligence. Speech recognition**,** decision-making**,** visual perception**,** for example, is features of human intelligence that artificial intelligence may possess (Christensson, 2010). At this point, it must be stated clearly that Artificial Intelligence is not the same as computers or any kind of machine, but the intelligence that comes out as a result of the activities of such computers or machines. Thus, one can say that computers, machines and robots are the tools of Artificial Intelligence. From the above definitions, we can deduce some basic facts on the idea of Artificial intelligence whichinclude that it is:

- An intelligent entity created by humans.
- Capable of performing tasks intelligently without being explicitlyinstructed.
- Capable of thinking and acting rationally and humanely

Generally according to Joseph Weizenbaum (1976), "Artificial Intelligence can be seen as an attempt to build a machine on the model of man, a robot that is to have its childhood, to learn language as a child does, to gain its knowledge of the world by sensing the world through its own organs and ultimately to contemplate the whole domain of human thought.

1.3.2 Types of Artificial Intelligence

According to different experts in the area of Artificial intelligence, there are varieties of artificial intelligence depending on the particular aspect of relevanceof such intelligence to where it will function. There is no consensus on the specific number of the types of artificial intelligence, as it is often characterized as two or seven. Different Artificial Intelligence entities are built for different purposes, and that's how they vary.

However, Artificial intelligence is majorly in most cases classified in two classes or types. Under type one we have the Artificial General Intelligence (Strong AI), Artificial Narrow Intelligence (Weak AI), and Artificial Super-intelligence Intelligence. In the type 2; There are four types of artificial intelligence; Reactive Machines, Theory of Mind AI, Limited AI, Self-Aware AI. These categories of AI are referred to more as a philosophy than mere classification.However, Artificial Intelligence is generally classified into these seven types basedon their functioning, there are:

Artificial Narrow Intelligence (ANI)
Artificial General Intelligence (AGI)
Artificial Super Intelligence (ASI)
Reactive AI
Limited Memory AI
Theory of Mind AI
Self-Aware AI

Artificial Narrow Intelligence (ANI): This form of intelligence is the most common form of Artificial intelligence found in the market places. These Artificial Intelligence systems are designed to solve one single problem and would be able to execute a single task really well. By definition, Artificial Narrow Intelligence (ANI) has narrow capabilities, likerecommending a product for an e-commerce user or

predicting the weather. They're able to come close to human functioning in very specific contexts, and even surpass them in many instances, but only excelling in very controlled environments with a limited set of parameters.

Artificial General Intelligence (AGI): Artificial General Intelligence on the other side is still a theoretical concept. It is defined as Artificial Intelligence which has a human-level of cognitive function, across a wide variety of domains such as language processing, image processing, computational functioning and reasoning and so on. General AI is a type of intelligence which could perform any intellectual task with efficiency like a human. The idea behind the general AI is to make such a system which could be smarter and think like a human by its own. According to McCarthy, an Artificial General intelligence AGI system would need to comprise of thousands of Artificial Narrow Intelligence systems working in tandem, communicating with each other to mimic human reasoning.

Artificial Super Intelligence (ASI): This is the third types of Artificial intelligence, but here Artificial super intelligence ASI is seen almost entering into science-fiction territory here as the logical progression from Artificial General Intelligence AGI. It is noted here that an Artificial Super Intelligence (ASI) system would be able to surpass all human capabilities. This would include decision making, taking rational decisions, and even includes things like making better art and building emotional relationships. The focus of this type of intelligence is that once Artificial General Intelligence is achieved, AI systems would rapidly be able to improve their capabilities and advance into realms that we might not even have dreamed of.

Reactive Artificial Intelligence: According to Bernard Marr, the most basic type of artificial intelligence is reactive AI, which is programmed to provide a predictable output based on the input it receives. Reactive machines always respond to identical situations in the exact same way every time, and they are not able to learn actions or conceive of past or future.

Limited Memory Artificial Intelligence: Limited memory AI learns from the past and builds experiential knowledge by observing actions or data. This type of AI uses historical, observational data in combination with pre-programmed information to make predictions and perform complex classification tasks. It is the most widely-used kind of AI today. For example, autonomous vehicles use limited memory AI to observe other cars' speed and direction, helping them "read the road" and adjust as needed.

Theory of Mind Artificial Intelligence: Theory of Mind AI should understand the human emotions, people, beliefs, and be able to interact socially like humans. This type of AI machines is still not developed, but researchers are making lots of efforts and improvement for developing such AI machines. With this type of AI, machines will acquire true decision-making capabilities that are similar to humans. Machines with theory of mind AI will be able to understand and remember emotions, then adjust behaviour based on those emotions as they interact with people.

Self-Aware Artificial Intelligence: Lastly, the most advanced type of artificial intelligence is self-aware AI. When machines can be aware of their own emotions, as well as the emotions of others around them, they will have a level of consciousness and intelligence similar to human beings. This type of AI will have desires, needs, and emotions as well. Machines with this type of AI will be self-aware of their internal emotions and mental states.

1.3.3 The Relevance of Artificial Intelligence on Human or Natural Intelligence

The quest for the relevance of Artificial intelligence on human intelligence has becomes a serious issue in the field of philosophy. This has prompted many philosophers to ask a fundamental question of whether man can be equated to machine. The ultimate effort of Artificial intelligence is to make computer programs that can solve problems and achieve goals in the world as well as humans. This implies that the matter of Artificial Intelligence can be divided into four categories, namely: perception, problem solving, natural language understanding and learning. However, many people involved in particular research areas are much less ambitious to this task. In Alan Turing's 1950 article titled "Computing Machinery and Intelligence" he discussed conditions for considering a machine to be intelligent. He argued that if the machine could successfully pretend to be human to a knowledgeableobserver, then you certainly should consider it intelligent.

This test would satisfy most people but not all philosophers. The observer could interact with the machine and a human by teletype (to avoid requiring that the machine imitate the appearance or voice of the person), and the human would try to persuade the observer that it was human and the machine would try to fool theobserver. The Turing test is a one-sided test. A machine that passes the test should certainly be considered intelligent, but a machine could still be considered intelligent without knowing enough about humans to imitate a human. Daniel Dennett's book "Brain children" has an excellent discussion on various partial Turing tests that have been implemented, i.e. with restrictions on

the observer's knowledge of AI and the subject matter of questioning. It turns out that some people are easily led into believing that a rather dumb program is intelligent (Dennett, 1998).

In quest for the relevance of Artificial intelligence on human intelligence some philosophers such as John Searle argues that the idea of a non-biological machine being intelligent is incoherent, while Hubert Dreyfus (1999) says that Artificial Intelligence is impossible. More so, the computer scientist Joseph Weizenbaum (1976) says the idea is obscene, anti-human and immoral. Various people have said that since artificial intelligence hasn't reached human level by now, it must be impossible, thus it is irrelevant. The above assertion cannot justify the irrelevance of Artificial intelligence in totally. There are some relevancies that can be deduced from it.

The purpose of Artificial Intelligence is to aid human capabilities and help us make advanced decisions with far-reaching consequences. That's the answer from a technical standpoint. From a philosophical perspective, Artificial Intelligence has the potential to help humans live more meaningful lives devoid of hard labour, and help manage the complex web of interconnected individuals, companies, states and nations to function in a manner that's beneficial to all of humanity. Currently, the purpose of Artificial Intelligence is shared by all the different tools and techniques that we've invented over the past thousand years – to simplify human effort, and to help us make better decisions. Artificial Intelligence has also been touted as our final Invention, a creation that would invent ground-breaking tools and services that would exponentially change how we lead our lives, by hopefully removing strife, inequality and human suffering. That's all in the far future though – we're still a long way from those kinds of outcomes. Currently, Artificial Intelligence is being used mostly by companies to improve their process efficiencies, automate resource-heavy tasks, and to make business predictions based on hard data rather than gut feelings. As all technology that has come before this, the research and development costs need to be subsidized by corporations and government agencies before it becomes accessible to the everyday laymen.

1.3.4 Benefits of Artificial Intelligence

There's no doubt in the fact that technology has made our life better. There is no human being on earth in this contemporary time that will deny the usefulness of technology in his life. From music recommendations, map directions, mobile banking to fraud prevention, Artificial Intelligence and other technologies has taken over. There's a fine line between advancement and destruction of

artificial intelligence. There are always two sides to a coin, and that is the case with Artificial Intelligence (AI) as well. Let us take a look at some advantages of Artificial Intelligence.

Among the various problems that man encounter on his daily activities include the problem of forgetfulness; man forgets things quickly because he learns new idea on daily basis, but Artificial intelligence cannot forget but rather store information accurately. Although consciousness of man makes him a distinct being among others, his abilities to recollect everything he learnt is really having negative influence on his existence, Artificial intelligence to a larger extent has replace the effect of forgetfulness imbibed in man, today artificial intelligence serves as backed up for human intelligence. In the area of storing information, the artificial intelligence is helping so much that the whole knowledge system has been changed. The knowledge representation generated by Artificial Intelligence has brought a crisis and that is the fact that machines are now being taken as more reliable in our quest for knowledge than human beings. Herbert Simon puts it better: It is not my aim to surprise or shock you… but the simplest way I can summarize it is to say that there are now in the world machines that think, that learn, and that create. Moreover, their abilities to do these things are going to increase rapidly in a feasible future, the range of problem they can handle will be co-extensive with the range to which human has been applied (Simon: 1958).

Artificial intelligence has helped in the area of symbolic logic. There is need for symbolic representation, especially in the area of Logic and Mathematics. This type of symbolic representation, which is mostly profound in Mathematics and Logic, has been foreseen by philosophers like Pythagoras and Plato, "when they argued that mathematics constituted not only the route to trustworthy knowledge but reality itself"(Anyanwu 1982).

Balogun (1991) also argued that everything, including instructions, could be encoded into symbols and numbers. With the growing complexity of Mathematical problems and the use of symbols and numbers in giving instructions, especially in the military and in some offices in this modern time, there is a need to develop some intelligent machines that are capable of solving such mathematical problems faster than the human brain; solve them and reproduce them at the appropriate time; and give instructions through symbols even when men are not around. Aside the above, other advantages of artificial intelligence can be summarized as:

- Reduction in human error
- Helps in repetitive work

- Digital assistance
- Faster decisions
- Rational Decision Maker
- Medical applications
- Improves Security
- Efficient Communication

Self-Assessment Exercise

1. AI helps in all but one of the following: (a) Reduction in human error (b) Helps in repetitive work (c) Diminishes digital security effectiveness (d) Efficient Communication

2. _____says that Artificial Intelligence is impossible.

1.4 Conclusion

Having understudied the nature of artificial intelligence in this unit, it should be concluded that the main purpose is not to replace man with machine, relatively Artificial Intelligence aims at producing a computer that can program itself, that is, a self-programming machine. The subject matter of Artificial Intelligence can be divided into four categories, namely: perception, problem solving, natural language understanding and learning. Artificial Intelligence also tends to produce a super brain in computers that must have sophisticated language ability and must be able to translate from one spoken language to another and must be able to infer meaning in order to understand human commands. In this study unit, an attempt has been made towards conceptualizing the idea of artificial intelligence, here we assert that artificial intelligence is a sort of intelligence that emanates from machines that are capable of performing intelligent actions like thatof human beings. We also made it clear that Artificial Intelligence is not the same as computers or any kind of machine, but the intelligence that comes out as a result of theactivities of such computers or machines. In furtherance to the nature of Artificial intelligence we tried to identified types of intelligence, and finally the benefits of artificial intelligence

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1.6 Possible Answers to SAE

1. (c);

2. Hubert Dreyfus

UNIT 3 THE SUBJECT MATTER OF ARTIFICIAL INTELLIGENCE

Unit Structure

1.1 Introduction

Our previous unit critically discussed the nature and advantages of artificial intelligence in the lives of humans. The implication of this is that there is no doubt in saying; research on further development regarding artificial intelligence has come to stay. Not only that, it has really helped man to re-discover himself as a conscious being with unique attitude but also brought a breakthrough in the field of science and technology. However, having understudied the nature of artificial intelligence, we still need some clarification on the subject matter and that has to do with the subject matter of artificial intelligence itself. In doing that there is need for further clarification between intelligence machine and perception, can machine see things in like way with human intelligence? Can a machine think on its own? In other words, can intelligence machine portray its own knowledge? These and many more shall be the focus of this unit.

1.2 Intended Learning Outcome

By the end of this unit, you will be able to:

- explain the concept of perception in detail
- differentiate between human perception and intelligence machine perception
- differentiate between the problem-solving method in intelligence machine and human method
- discuss the task of intelligence machines in human society.

1.3.1 Philosophical Perspectives to Artificial Intelligence

From our discussions in the last unit, we assert that the main aim of Artificial Intelligence is an attempt to build a machine on the model of man. In other words, according to Weinbaum (1976), artificial intelligence aims to develop robots has the attributes of human; in this regards, this implies that an intelligent machine such as a robot would

have its childhood, learn a language as a child does, gain knowledge of the world by sensing the world through its own organs and ultimately to contemplate the whole domain of human thought. The ability to do the above by machines is to show that they are capable of performing intelligent actions like that of man. However, one of the major questions that the issue of machine intelligence poses before us is whether man truly needs machine intelligence; can machine intelligence develop or work outside human intelligence? Does machine intelligence have the ability and capability of self-knowledge outside what man implanted in it?

To be able to meet the growth in all these fields of endeavour, we must have a machine that one can talk to directly and that has the functions of human eye, ear and mouth, that can learn on its own; a machine intelligent enough that we can put a lot of knowledge and then tell it to make judgment based on what it knows. This can be buttressed with Momoh's position that the focus of Artificial Intelligence is to develop machines that can think independently of any help from man and work efficiently.

The idea of perception is one of the vital concepts in the field of philosophy that many philosophers have considered so important in the human quest for knowledge and reality. In the quest for knowledge, a branch of philosophy known as epistemology has given serious consideration to the epistemic justification of human knowledge. Going by historical analysis, Perception as an academic concept is dated back to the time of the ancient Greek philosophers who were interested in how people know the world and gain understanding. In general view, perception is defined as the ability to see, hear or become aware of something through the senses. It is the way in which things or something is regarded. This implies that perception is the sensory experience of the world. In other words, Perception is not only creating our experience of the world around us; it allows us to act within our environment.

In his view Merleau-Ponty conceives Perception as a system of meanings by which a phenomenal object is recognised. The intentions of the person who perceives an object are reflected in the field to which the phenomenal object belongs. Merleau-Ponty argues that consciousness is not merely a representative function or a power of signification, Perception therefore includes the five senses; touch, sight, sound, smell, and taste. It also includes what is known as proprioception, a set of senses involving the ability to detect changes in body positions and movements. Descartes however argues that we can have certain knowledge about objects and states of affairs in the external world, even though all we directly perceive are the contents of our

ownminds.

His main argument on the idea of perception implies that the concept of perception is beyond senses. He affirms that in most cases, senses data provide error; error is possible because my will exceeds my understanding. My will is potentially infinite;my understanding is finite (Searle, 2004: 36). Objects do not really have colour, taste, or smell, nor do they give off sounds, even though colour, taste, smell, and soundseem to us perceptually to be part of the world. The point is that we can be certain thatthere is an external world causing our perceptions and we can get certain sorts of accurate information about it from our perception, even though much of our perceptual experience is illusory (Searle, 2004:37).

Given the analysis that perception plays a unique role in human consciousness, and then can intelligence machine be human, in terms of perception, is it possible for intelligence machine to perceive its own objects of external world as described by Searle. Intelligence machine can be in form of Turing machine that was developed in its simplicity form. It has an endless tape on which the symbols are written. It has a head that reads symbols on the tape. The Turing machine head will move to the left or to the right, it can erase zero, it can print one, it can erase a one, it can print a zero.

It does all of these things in accordance with a program, which consists of a set of rules. By implication it implies that the rules always have the same form. It thus implies that the motive of developing an intelligence machine is to develop some intelligent machines that are capable of solving such mathematical problems faster than human brain; to solve problem and reproduce them at the appropriate time; and give instructions through symbols even when men are not around. However, the basic question that needs clarification is this; can intelligent machines solve problems outside what it perceives.

Among the salient issues being discussed in philosophy, is the role of the mind and its impact on the knower or perceiver. Berkeley even maintains that knowledge of the physical world means that one must possess a mind and be able to perceive objects with his senses, that is, everything comes into existence immediately we perceive them and perception is directly the real object before our minds and not any representation of it. If this position is affirmed, does the intelligence machine affirm this? There is no doubt saying that it will be impossible for intelligence machine to develop its own perception outside what its programme.

In his argument Balogun (2005) asserts that the scope of human

knowledge has been widened in that one needs not be in a special state of mind to establish the truth of any proposition or lay claim to any knowledge. That is why the intelligent machines can now follow a process already programmed into them to establish the truth of any fact about human knowledge when necessary for use even when the human beings are not around with their minds and senses to perceive them, and such knowledge can be judiciously used in any field of endeavour.

In consonance, Rapaport in his review of John Searle's book, *Mind, Brain and Science* argues that the equation of man with machine is possible, since there is no information that can be gotten from man that cannot be gotten from computers. It must therefore be noted that despite all bid to produce a connectionist machine, a powerful computer that consists of thousands of simple processors that are densely connected, machines cannot be said to see or perceive the way human beings do.

1.3.2. Issues on Intelligence Machine and Perception

Recognition: Perception doesn't just involve becoming consciously aware of the stimuli. It is also necessary for the brain to categorize and interpret what you are sensing. The ability to interpret and give meaning to the object is the next step, known as recognition.

Action: The action phase of perception involves some type of motor activity that occurs in response to the perceived and recognised stimulus. This might involve a major action, like running toward a person in distress, or something as subtle as blinking your eyes in response to a puff of dust blowing through the air

Intelligent Machines and Problem Solving: Next on the subject matter as regards the issue of artificial intelligence is the idea of intelligent machines and the issue of problem solving. Problem solving can be defined as the ability to formulate a problem in a suitable representation, to plan for its solution and to know when new information is needed and how to obtain it. Given concession to our modern-day experience, one could conclude that Artificial intelligence has really made man and to a large extent Artificial Intelligence is serving as aid to man.

Take for instance, Google's predictive search algorithm used past user data to predict what a user would type next in the search bar. Netflix uses past user data to recommend what movie a user might want to see next, making the user hooked onto the platform and increasing watch time. Face book uses past data of the users to automatically give suggestions to tag your friends, based on their facial features in their images. AI is used everywhere by large organizations to make an end user's life simpler. The uses of Artificial Intelligence would broadly

fall under the processing category, which would include the following:

- Searching within data, and optimizing the search to give the mostrelevant results
- Logic-chains for if-then reasoning, that can be applied to execute a stringof commands based on parameters
- Pattern-detection to identify significant patterns in large data set forunique insights
- Applied probabilistic models for predicting future outcomes etc.

With all the above identification, there is still a fundamental question that calls for philosophical evaluation, and this cantered on intelligence machine and problem- solving matter. In actual fact, among the focus and expectation is that Artificial Intelligence tends to produce a super brain in computers that must have sophisticated language ability and must be able to translate from one spoken language to another, and most necessarily must be able to infer meaning in order to understand human commands. Problem solving is neither unique to man nor differentiates him from any other creature, but we must however ask ourselves the process it involves in an attempt to genuinely solve or resolve a problem.

Human's mind plays a vital role in problem solving, a field of study in philosophy known as critical thinking indicates that human mind passes through rigorous before a particular position is affirmed. Human mind is not like the combination of what Momoh identified as "expect system" as it being seen in Artificial intelligence. In his assertion, Momoh claims that an expert system combines knowledge of all experts in agiven field into a computer data base consisting of all the rules and facts that these experts use to make decision. The implication of this form of problem solving is that the expert system can only resolve any problem that is related or align with the one we have in the system. Thus, it is very difficult for Artificial intelligence to have its own mind aside what is programmed in the system.

Although some argue that some computer now has the cognitive aspect of man, which invariable consent the proof that Artificial intelligence has its own mind.

Today, we now have intelligent computers that have theories and help in showing how the cognitive process go on human being. So, to some people there are now machines or computers that have mind and such minds are the explanation of these cognitive processes, there are now computers, robots that think and behave intelligently; robots can be sent to marketand even work in factories. In fact, in highlyindustrialized societies like United States of America, Japan and Germany, for

example, companies and factories now prefer robots to man because they are capable of doing what humans would do in a limited time and at the same time, they are easier to maintain more than human beings.

The truism is the fact that what is called artificial is concluded to be imperfect things; this implies that what is described as the mind of artificial intelligence is still part of human programming language imbibed in a machine. To argue that they operate properly is to say that they follow the laws of whatever program that they are made of. For example, electronic computers that are capable of solving mathematical problems must abide by the law of mathematics based on how it has been programmed.

Self-Assessment Exercise

1. _____uses past user data to recommend what movie a user might want to see next, making the user hooked onto the platform and increasing watch time.

2. The idea of _____ is one of the vital concepts in the field of philosophy that manyphilosophers have considered so important in the human quest for knowledge and reality.

1.4 Summary

This unit will be concluded on the premise that the machines are intelligent but often dependable on the intelligence of others which is either originated from or dependent on human intelligence. Considering the subject matter of artificial intelligence in this unit which focuses on intelligent machines and perception, as well as intelligence machine and problem solving; the two subject matters are very crucial in human affairs and if proper care is not taken, intelligent machines might lead to a future thatis very different from today and we may not like it. An instance of such scenario is robots and machines replacing humans in the workforce, which advent leads to loss of jobs, unemployment and poverty. Next one is that the robotics technology may enable weapons of mass destruction to be deployed by psychopathic individuals. And that this is more of a threat from biotechnology and Nano technology than from robotics. This study unit has taken a critical look into the subject matter of Artificial intelligence, where the issue of intelligence and perception was discussed. Here welooked into the philosophical notion of perception and some philosophical views inrelating to human being. We also discussed some distinctions and similarities between human and machine perception. Furthermore, the issue of intelligence machine and problem solving also came into limelight. We emphasized in this areathat the human mind plays an important role in problem solving. We

also emphasized that intelligence machine does not produce its own mind; therefore its problem solving is at the minimal. Intelligence machine does not go beyond itsprogramming.

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1.6 Possible Answers to SAE

1. Netflix; 2. Perception

UNIT 5 ARTIFICIAL INTELLIGENCE: A CONSEQUENT OF THE METAPHYSICAL PROBLEM OF MIND

Unit Structure

1.1 Introduction

In this unit, we are going to discuss the extent to which a philosophical problem – the problem of mind can be said to be instrumental in the development of ideas on consciousness and artificial intelligence. Are brains the source of consciousness? Do machines have brains? Are machines conscious? These are some of the questions that the present unit contends with. It looks at how the philosophical debates over this spilled into artificial intelligence So, in this unit, we provide a brief overview of the idea of mind-body problem before stating how it escalated into a discourse on artificial intelligence through the ideas of John Searle and Gilbert Ryle.

1.2 Intended Learning Outcomes

By the end of this unit, you will be able to:

- explain the mind-body problem
- establish how the mind-body problem informed artificial intelligence
- show the role of Gilbert Ryle on the philosophic relationship between mind-body problem and artificial intelligence.

1.3.1 Mind-Body Problem as a Perennial Issue of Philosophy

Commencing the mind-body problem with Rene Descartes is not to say that Descartes is the first to delve into the discourse. It had been hinted earlier that the problem had always been with man. Perhaps it must have been out of curiosity and wonder – the quest to know everything about everything. Ancient black Egyptians have pondered over the question and their answer could be one of the themes resonating throughout *The Egyptian Book of the Dead*. The ancient Greeks, the Romans, the Arabs, and many civilizations have looked at this ‘mystery’. So, to say that

discourse originates with Descartes is to say the opposite of the truth. We think that one of the reasons why a discourse on the mind-body dilemma cannot escape Rene Descartes is due to the fact that he was one of the very few that gave brilliant answers to the question without a recourse to religion as a starting point. We shall examine the major tenets expressed in the mind-body solution of each of these scholars shortly.

Rene Descartes: The French man Rene Descartes is a thorough philosopher as we perceive the philosophic spirit in his attempt to get to the root of the mind-body problem. This philosophic spirit has been described by W. Dilthey that it "leaves no valuations and aspirations unexamined and no piece of knowledge isolated; it seeks the grounds for the validity of whatever is valid" (Rickman;1979:129). This is what Rene Descartes attempted during his time and made his contribution to the mind-body problem truly different.

It is Rene Descartes' conviction, having applied the 'methodic doubt' and arrived at the 'ergo sum' that there are two realities: mind and body. He makes a demarcation between both of them by revealing that while the former is private, the latter is public. In other words, by this Rene Descartes mean to say that the activities of the human mind are private while the body's activities are open to observation. In this connection, Anthony Kenny summarises the Cartesian enterprise as follows:

Indeed, his main ideas can be so concisely expressed that they could be written on the back of a postcard; and yet they were so revolutionary that they changed the course of philosophy for centuries. If you wanted to put Descartes' main ideas on the back of a postcard you would need just two sentences: man is a thinking mind; matter is extension in motion. Everything, in Descartes' system, is to be explained in terms of this dualism of mind and matter. Indeed, we owe to Descartes that we think of mind and matter as the two great, mutually exclusive and mutually exhaustive, divisions of the universe we inhabit (Kenny;2006:208).

In the Cartesian sense, a human being is a thinking substance and it is this notion that informs his analysis of the body as a material substance and the mind as an immaterial substance. Thomas Hobbes, however is among the earliest critique of Rene Descartes who had provocatively cited Descartes's mental 'immaterial substance' as a paradigm contradiction in terms. In other words, Hobbes sees the words 'immaterial' and 'substance' not to be sensible enough in describing the mental as Rene Descartes had done. Descartes recognises that the whole essence of man is to think. In our present life, the mind is intimately united with the body, but it is not our bodies that make us what really

are. It is the mind. It is the mind that 'causes' the body. Hence, there is a causal connection between them. The implication in this mode of thought is that the mind is capable of independent existence and at death, it is the body that perishes, the mind does not.

This model has been dealt serious blows from the English scholar John Locke in his *Essay on Human Understanding* and his criticisms are still much relevant when we come to latter part of this work that would deal with re-incarnation.

Rene Descartes faces the ultimate question of how these distinct 'personalities' relate. Put otherwise, Rene Descartes has difficulty informing us of where the mind and the body interact. How can the non-physical relate with the physical and still maintain a single identity? Is it the case that when we say 'I', it is the mind that is actually using the body to utter such propositions (such as those used to commence this work)? Do animals have minds in the same way that humans do? Can their minds also live before and after their unities with their bodies? Is it true that when we say "…My leg…!" it is the mind that is actually laying ownership to the body? If a Cartesian is willing to affirm this question, then what do we mean when we say "…My God…"? If we are willing to grant the existence of a God, do we own that God in the same way we lay ownership to our body? These questions are very tricky and it would require much care examining them. Nevertheless, the Cartesian answer to the question: what do we mean when we say 'I'? is as follows: I do not now admit anything which is not necessarily true: to speak accurately I am not more than a thing which thinks that is to say a mind or a soul or an understanding, or a reason which are terms whose significance was formerly unknown to me. I am, however, a real thing and really exist; but what thing? I have answered: a thing which thinks (Vesey;1964:24).

Where is the connection between the mind and the body? How can a mental process such as willing, thinking, influence spatial corollaries such as movement? Rene Descartes informs us that the point of connexion between the mind and the body is the pineal gland. Is the pineal gland a non-material substance or a material substance? The pineal gland is located in an area of the human brain and this evinces it as a material substance. The logical implication in the Cartesian answer is this: the place of interaction between the material substance and the immaterial substance is in a part of the material substance. This is far from an answer in the logical domain but in the fields of mysticism, it could be plausible.

Attempts to improve upon the ideas of Rene Descartes have caused scholars such as Benedict Spinoza, Gottfried Leibniz, Nicolas

Malebranche, and Maurice Marleau Ponty et al. It has birthed theories such as occassionalism, epiphenomenalism, pyscho-physical parallelism etc. The common denominator in the view of these scholars is dualism. Even before they laced their boots, they started with the assumption that mind and body are distinct entities and a reconciliation has been evasive but this is about to change.

John Searle: In his 1984 work, *Minds, Brain and Science*, John Searle gives us a thorough materialistic resolution of the mind-body problem. His view is very similar with that of Gilbert Ryle (Ryle, 1951) but he does not concern himself with Rene Descartes directly as Gilbert Ryle had done. He recognises that contemporaneously the mind-body discourse has evolved into the relation between the mind and the brain. John Searle is convinced that:

I believe that the mind-body problem has a rather simple solution, one that is consistent both with what we know about neurophysiology and with our commonsense conception of the nature of mental states – pains, beliefs, desires and so on (Searle; 2003:12).

He holds that the problem we had all along had was the way this aspect of philosophy has been handed down to us and the vocabulary inherent therein. He reveals in his own words that:

I believe that the mind-body problem has a rather simple solution, one that is consistent both with what we know about neurophysiology and with our commonsense conception of the nature of mental states – pains, beliefs, desires and so on (Searle; 2003:12).

Searle is convinced that there are four features of the mental phenomena. They are: consciousness, intentionality, subjectivity of mental states and the problem of mental causation. Consciousness for John Searle is "central fact of specifically human existence because without it, all of the other specifically human aspects of our existence – language, love, humour and so on would be impossible" (Searle; 2003:14). He defines intentionality as the "feature by which our mental states are directed at, or about, or refer to, or are of objects and state of affairs in the world other than themselves" (Searle; 2003:14). Subjectivity as holds by John Searle has to do with personalism or has Rene Descartes calls it 'ergo'. Mental causation has to do with our belief that our thoughts and cogitations have some measures of causal effects on the physical world. These four put together are impossible to be admitted in our scientific framework according to John Searle. These four features for John Searle are what made answers to the mind-body problem so elusive. In his proposed solution to the mind-body problem, John Searle advances that:

Mental phenomena, all mental phenomena whether conscious or unconscious, visual or auditory, pains, tickles, itches, thoughts, indeed, all of our mental life, are caused by processes going on in the brain (Searle; 2003:16).

John Searle describes the structure of the human mental life as a connection of neurons to the brain. He hints that "our sensations of pains are caused by a series of events that begin at free nerve endings and end in the thalamus and in other regions of the brain" (Searle; 2003:16-17). It is when the brain begins to process these that the mental aspect becomes evidential. This implies, on the other hand that "if the events outside the central nervous system occurred, but nothing happened in the brain, there would be no mental events" (Searle; 2003: 17).

At this point, one comes to a crucial point in the analysis of John Searle on the mind-body solution. He claims that all what Rene Descartes are mental activities and private are merely brain processes. This means that the Cartesian division between the mental and the observable is erroneous. It also denies the possibility of an immortal soul that can outlive the body. But wait a minute! John Searle has made two statements that do not seem go hand in hand. In his arguments to evince the solution to the mind-body problem these two statements would need a marriage:

i. All mental phenomena are caused by brain processes
ii. All mental phenomena such as pain, thoughts etc are just features of the brain.

The above (i) and (ii) do not appear to be so easy to merge. For how can it be conceived that brains cause mind and yet minds are just features of the brain? John Searle believes that it is the impossibility to see a merger to both propositions that has blocked a solution to the mind-body problem all along. In his resolution, John Searle uses the analogy of the formation of some material substances. He expounds:

In the case of liquidity, solidity, and transparency, we have no difficulty at all in supposing that the surface features are caused by the behaviour of elements at the micro-level, and at the same time we accept that the surface phenomena just are features of the very systems in question. I think the clearest way of stating this point is to say that the surface feature is both caused by the behaviour of microelements, and at the same time is realised in the system that is made up of the micro-elements. There is a cause and effect relationship, but at the same time the surface features are just higher level features of the very system whose behaviour at the micro-level causes those features (Searle;

2003:19).

Now, when he returns to the brain-mind problem (otherwise construed as mind-body problem), Searle informs us that the four features of mental phenomena mentioned earlier are actually the causes of mental activities as well as the features in association with the brain and the entire nervous system. With this he claims to have given a satisfactory answer to the mind-body problem. He states that: “To summarise : on my view, the mind and the body interact, but they are not two different things, since mental phenomena just are features of the brain” (Searle; 2003:24).

1.3.2 Gilbert Ryle, Consciousness and Artificial Intelligence

The extent to which machines (usually computers) can do these things independently of people is still limited; machines currently exhibit in their behavior only rudimentary levels of intelligence. Even so, the possibility exists that machines can be made to show behavior indicative of intelligence, comparable or even superior to that of humans.' Alternatively, AI research may be viewed as an attempt to develop a mathematical theory to describe the abilities and actions of things (natural or man-made) exhibiting "intelligent" behavior, and serve as a calculus for the design of intelligent machines. As yet there is no "mathematical theory of intelligence," and researchers dispute whether there ever will be (Jackson, 1985: 1).

From the discussion on Artificial Intelligence, some philosophical questions therefore arise: What is the soul or mind? Does it and can it exist outside or without the body? If it does, what kind of existence does it pursue? Several philosophers have been taken various positions. But for this essay, we engage with Gilbert Ryle.

Gilbert Ryle is one of the astounding philosophers of the 20th century who opposed this profound philosophy of mind that mind and body are distinct entities. He recognises this as a categorical mistake and accuses Rene Descartes idea that it is the mind that ‘powers’ the body as the ‘fallacy of the Ghost in the Machine’. Gilbert Ryle seems to be showing us that the problem with the mind-body debate is linguistic rather than validity of arguments. This is a position that is somewhat similar to that of the philosophical psychologist John Searle. What are the bases of this claim? What are the strengths and weaknesses implied in his submission? How does his philosophy overcome the snares that stopped previous scholars? What makes the human being different from the machine given Gilbert Ryle’s submission? His 1949 masterpiece *The Concept of Mind*, commenced with the following words:

The philosophical arguments which constitute this book are intended not to increase what we know about minds, but to rectify the logical geography of the knowledge which we already possess (Ryle;1951:7).

What the above excerpt informs us about is that the mind-problem is not to be solved by arguments but by logic and language. This is his reaction to the thoughts of Rene Descartes:

Descartes left as one of his main philosophical legacies a myth which continues to distort the continental geography of the subject. A myth is, of course, not a fairy story. It is the presentation of facts belonging to one category in the idioms appropriate to another. To explode a myth is accordingly not to deny the facts but to re-allocate them. And this is what I am trying to do (Ryle;1951:8).

He informs us as the above reveals that the enterprise of Rene Descartes is a myth. He calls it the "Myth of the Ghost in the Machine". Having discovered this so called myth, what did he do? In response, Ryle reiterates that:

I try to use *reductio ad absurdum* arguments both to disallow operations implicitly recommended by the Cartesian myth and to indicate to what logical types the concepts under investigation ought to be allocated. I do not, however, think it improper to use from time to time arguments of a less rigorous sort, especially when it seems expedient to mollify or acclimatise. Philosophy is the replacement of category-habits by category-disciplines, and if persuasions of conciliatory kinds ease the pains of relinquishing inveterate intellectual habits, they do not indeed reinforce the rigorous arguments, but they do weaken resistances to them (Ryle;1951:8).

It is the conviction of Gilbert Ryle that Rene Descartes has missed the point entirely for assuming as his theory reveals that something where it is not. This is why the "Myth of the Ghost in the Machine" is seen by Gilbert Ryle as category mistake. What is category mistake? Gilbert Ryle expounds:

Gilbert Ryle move on to cite some cases that illustrates the category mistake but due to the limitation of time and space, we shall be limited to the oxford illustration which is as follows:

A foreigner visiting Oxford or Cambridge for the first time is shown a number of colleges, libraries, playing fields, museums, scientific departments and administrative offices. He then asks 'But where is the University? I have seen where the members of the Colleges live, where the Registrar works, where the scientists experiment and the rest. But I

have not yet seen the University in which reside and work the members of your University (Ryle;1951:16).

If Descartes is immersed in the fallacy of the Ghost in the Machine, what implication does this assertion have on Artificial Intelligence? Ryle seems to be convinced that the mind is nothing but the functioning of the brain. This position has been assumed and also defended by John Searle (1984).

From the discussion so far, we can infer that:

(1) If for Gilbert Ryle, the functioning of the brain is the mind, then there is nothing like a soul or mind that can live independently of the body or survive after bodily death;
(2) If we accept (1) then it may be inferred that Artificial Intelligence is on the same plane as humans because humans have no souls. One may even borrow from Descartes who saw humans as "complex machine" (Descartes, 1968) to justify this proposition.

This unit finds that there has a large gap between the machine and human. Gilbert Ryle's argument has the erroneous implication of passing humans as machines by denying the existence of a soul or mind. This is because of his scientific and materialistic outlook.

Nevertheless, it is the case that Ryle does not factor in some realities such as astral projection, telepathy, reincarnation, time-travel and some other mystical experiences that are suggestive of the existence of the human mind or soul. If the soul is the working or function of the brain according to Ryle who is supported by Searle, then what is responsible for these mystical experiences?

Self-Assessment Exercise

1. "Myth of the Ghost in the Machine" is seen by _____ as category mistake.
2. _____ informs us that the four features of mental phenomena mentioned earlier are actually the causes of mental activities as well as the features in association with the brain and the entire nervous system.

1.4 Summary

In this unit, we have been able to understand how the idea of artificial intelligence and the issues surrounding consciousness had bothered philosophers. This unit has used scholars such as Descartes, Searle and Ryle to show that the discourse on consciousness can be traced to the

mind-body problem. Incidentally, this problem is central for artificial intelligence and to understand how it emanated from philosophy has been the principal occupation of this unit.

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1.6 Possible Answers to SAE

1. Gilbert Ryle;

2. John Searle

End of Module Questions

1. _____ is a set of sciences, theories and techniques that aims to imitate the cognitive abilities of a human being.

2. _____argues that the idea of a non-biological machine being intelligent is incoherent

3. Human's _____ plays a vital role in problem solving, a field of study in philosophy known as critical thinking indicates that human mind passes through rigorous before a particular position is affirmed.

4. Who defined perception as a system of meanings by which a phenomenal object is recognised? (a) Merleau-Ponty (b) Rene Descartes (c) Weinbaum (d)Aristotle

MODULE 2 THE SIGNIFICANCE OF ARTIFICIAL INTELLIGENCE

UNIT 1 THE USEFULNESS OF ARTIFICIAL INTELLIGENCE

1.1 Introduction

This unit focuses on providing a background to the history, application and technique of machine learning in Artificial intelligence. In our previous unit, we discussed the possibility of Artificial Intelligent machines truly perceiving data the way that humans do. In this unit, we'll be looking at the ability of machine learning in the growing field of Artificial Intelligence and the ability of artificial intelligence in language processing and understanding. Do machines have minds? We ask this because the idea that machines can learn may seem absurd to some, as it has been argued that machines can only do what we ask them to do. However, as we can see in the realm of Computer Science, machines are been programmed to learn like adults. But can the intellect of a machine be comparable to a human?

1.2 Intended Learning Outcomes

Towards the end of this study unit, learners in this field of study should be able to:

- Understand and explain the concept of Machine Learning
- Discuss in detail the possibility of intelligent machines learning and achievingknowledge.
- Differentiate between the types of learning in Machine learning
- Discuss the idea of natural language in artificial intelligence.

1.3.1 The Idea of Machine Learning

Machine learning is a branch of artificial intelligence (AI) and computer science which focuses on the use of data and algorithms to imitate the way that humans learn, gradually improving its accuracy. Machine learning is an important component of the growing field of data science (IBM, 2020).Machine learning is not a new concept or idea. The term was first defined by Arthur Samuel in 1959.

Machine learning is an area of artificial intelligence (AI) with the concept that a computer program can learn and adapt to new data without human intervention. Machine learning is a field of artificial intelligence (AI) that keeps a computer's built- in algorithms current regardless of changes in the worldwide economy. A complex algorithm or source code is built into a computer that allows for the machine to identify data and build predictions around the data that it identifies. Machine learning is useful in parsing the immense amount of information that is consistently and readily available in the world to assist in decision making. Machine learning can be applied in a variety of areas, such as in investing, advertising, lending, organizing news, fraud detection, and more (Frankenfield, 2022).

According to Bringsjord and Govindarajulu (2020), machine learning is concerned with building systems that improve their performance on a task when given examples of ideal performance on the task, or improve their performance with repeated experience on the task. Algorithms from machine learning have been used in speech recognition systems, spam filters, online fraud-detection systems, product- recommendation systems, etc.

Machine learning studies inductive strategies as they might be carried out by algorithms. The philosophy of science studies inductive strategies as they appear in scientific practice. Although they have developed to a great extent independently, the two disciplines have much in common (Korb, 2004).

In simpler terms, a machine “learns” by looking for patterns among massive data loads, and when it sees one, it adjusts the program to reflect the “truth” of what it found. The more data you expose the machine to, the “smarter” it gets and when it sees enough patterns, it begins to make predictions.

Despite the algorithms that have been developed to improve the functioning and capacity of artificial intelligent machines, machines do not learn nor perceive in the way and manner that humans do; even the

most sophisticated machine with a developed algorithm needs to receive instructions from a human. When children learn, they ask questions, doubt information and develop new patterns, make generalizations, transfer knowledge, unlike humans either children or adults, intelligent machines can only seem to understand speech and predict outcomes but do not have the human mind that allows them express other human cognitive learning abilities.

3.1.2 Types of Machine Learning

Machine learning has three major types of techniques: supervised learning, unsupervised Learning and the Reinforcement Learning. Others include Hybrid- Learning Problems, Statistical Inference and Learning Techniques.

Supervised Learning: Supervised Learning (SL) is the machine learning task of learning a function that maps and input to an output based on example input- output pairs (Stuart and Norvig, 2010).There are two main types of supervised learning problems: they are classification that involves predicting a class label and regression that involves predicting a numerical value.

Classification: Supervised learning problem that involves predicting a class label.

Regression: Supervised learning problem that involves predicting a numerical label. Both classification and regression problems may have one or more input variables and input variables may be any data type, such as numerical orcategorical (Brownlee, 2019).

Unsupervised Learning: Unsupervised learning is a type of algorithm that learns patterns from untagged data. The hope is that through mimicry, which is an important mode of learning in people, the machine is forced to build a compact internal representation of its world and then generate imaginative content from it (Hinton and Sejnowski, 1999).

Reinforcement Learning: in this type of learning, a machine is set loose in an environment where it constantly acts and perceives and only occasionally receives feedback on its behaviour in the form of rewards or punishments. The machine has to learn to behave rationally from this feedback (Murphy 2013, Alpaydin 2014). Reinforcement learning is a machine learning training method based on rewarding desired behaviours and/or punishing undesired ones. In general, a reinforcement learning agent is able to perceive and interpret its environment, take actions and learn through trial and error (Carew, 2020).Reinforcement learning differs from supervised learning in not

needing labelled input/output pairs be presented, and in not needing sub-optimal actions to be explicitly corrected. Instead, the focus is on finding a balance between exploration (of uncharted territory) and exploitation (of current knowledge) (Kaelbling, Littman and Moore, 1996).

1.3.3 Intelligent Machines and Language Understanding.

As we know, computers and machine are programmed in software and codes; this means that they have their unique language codes that enable them to understand the instruction written and programmed into them, which is known as machine language.

In computer programming, machine code is any low-level programming language, consisting of machine language instructions, which are used to control a computer's central processing unit (CPU). Machine language is the language understood by a computer. It is very difficult to understand, but it is the only thing that the computer can work with. All programs and programming languages eventually generate or run programs in machine language. Machine language is made up of instructions and data that are all binary numbers. Machine language is normally displayed in hexadecimal form so that it is a little bit easier to read (Schmit, 2014).

Natural language processing (NLP) is a subfield of linguistics, computer science, and artificial intelligence concerned with the interactions between computers and human language, in particular how to program computers to process and analyse large amounts of natural language data. The goal is for a computer to be capable of "understanding" the contents of documents, including the contextual nuances of the language within them (Seaman, 2012). While Natural-language understanding (NLU) or natural-language interpretation (NLI) is a subtopic of natural-language processing in artificial intelligence that deals with machine reading comprehension. Natural-language understanding is considered an AI-hard problem (Roman, 2013).

The umbrella term "natural-language understanding" can be applied to a diverse set of computer applications, ranging from small, relatively simple tasks such as short commands issued to robots, to highly complex endeavours such as the full comprehension of newspaper articles or poetry passages (Peng Fi Li et al, 2007).

The history of natural language understanding for intelligent machines can be traced to Daniel Bobrow’s who during his PhD program and dissertation in MIT in 1964 wrote a program called STUDENT; which showed how a computer could understand simple natural language to

solve algebra word problems (Russell and Norvig, 2003:19).The following year in 1965, Joseph Weizenbaum at MIT wrote the program ELIZA, an interactive program that carried on a dialogue in English on any topic especially psychotherapy and was designed with a database of real-world knowledge and a rich lexicon (Weizenbaum, 1976). In 1971, Terry Winograd finished writing SHRDLU for his PhD thesis at MIT. SHRDLU could understand simple English sentences in a restricted world of children's blocks to direct a robotic arm to move items. At Stanford, Winograd would later advise Larry Page, who co-founded Google (Winograd, 1983). Subsequently, other Computer programmers, scientists began to develop and write natural language programs such as Googleamong others.

Self-Assessment Exercise

1. _____ is a subfield of linguistics, computer science, and artificial intelligence concerned with the interactions between computers and human language, in particular how to program computers to process and analyse large amounts of natural language data.

2. _____ is a type of algorithm that learns patterns from untagged data.

1.4 Summary

In this unit, this unit will be concluded on the premise that the machines are intelligent and capable of learning through programming and computer engineering. Considering the various types of learning, it is possible that in the future, intelligent machines will begin to learn from experience and data to deduce their course of actions. Currently, we can assert that machines learn but intelligent machine learning may not be equated with human learning, as machines still carry out orders based on the data and instructions that have been input in them by humans. This study unit has taken a critical look into the subject matter of Artificial intelligence, where the idea of machine learning and learning understanding is analysed and explained. Here we looked into philosophical notion of perception and the idea of intelligent machines having the capacity to perceive in the manner that humans perceive and thereby gain knowledge.

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1.6 Possible Answers to SAE

1. Natural language processing (NLP);
2. Unsupervised learning

UNIT 2 ARTIFICIAL INTELLIGENCE AND THE QUEST FOR KNOWLEDGE

1.1 Introduction

What is the role of artificial intelligence in the quest for knowledge? Artificial intelligence as we have been discussing, refers to machines or computer systems stimulated to mimic human cognitive capabilities such as thinking, learning and behaviour. Humanity is driven by the quest for knowledge and the study of knowledge itself is a perennial problem in philosophy, even in the sciences. How can man arrive at "Justified True Belief"? How is knowledge derived? How can humans improve their ability to arrive at true knowledge? How do we distinguish between opinions andtrue knowledge?

1.2 Intended Learning Outcomes

By end of this unit, students should be able to:

- Be familiar with why there is surge in AI interest;
- Know the difference between human intelligence and artificial intelligence; and
- Understand the relevance of AI.

1.3.1 The Quest for Artificial Intelligence

AI is a technology that mimics human intelligence, allowing computer applications to learn from experience via iterative processing and algorithmic training. AI systems getsmarter with each successful round of data processing since each interaction allows the system to test and measure solutions, and develop expertise in the task it's been set to accomplish.

You have probably heard that artificial intelligence could be used to do lots ofimpressive tasks and jobs. AI can help designers and artists make quick tweaks to visuals. AI can also help researchers identify "fake" images or connect touch and sense. AI is being used to program

websites and apps by combining symbolic reasoning and deep learning. Basically, artificial intelligence goes beyond deep learning. Here are five reasons why AI is important to you.

Artificial Intelligence will create new jobs: It is no news that AI will replace "repetitive jobs." It literally means that these kinds of jobs will be automated, like what robots are currently doing in a myriad of factories. Robots are rendering the humans that are supposed to do those tasks practically jobless. And it goes further than that – many "white collar" tasks in the fields of law, hospitality, marketing, healthcare, accounting, and others are adversely affected. The situation seems scary because scientists are just scratching the surface as extensive research and development of AI. AI is advancing rapidly (and it is more accessible to everybody).

The great news about AI is that it can create new jobs. Some believe that AI can create even more new jobs than ever before. According to this school of thought, AI will be the most significant job engine the world has ever seen. Artificial intelligence will eliminate low-skilled jobs and effectively create massive high-skilled job opportunities that will span all sectors of the economy.

For example, if AI becomes fully adapt to language translation, it will create a considerable demand for high-skilled human translators. If the costs of essential translations drop to nearly zero, this will encourage MORE companies that need this particular service to expand their business operations abroad. To those who speak different languages than the community in which they reside, this help will inevitably create more work for high-skilled translators, boost more economic activities. As a result of this, more people will be employed in these companies due to the increased workload. Boosting international trade is one of the most significant benefits of our "global" times. So yes, AI will eliminate some jobs, but it will create many more.

Artificial Intelligence will improve healthcare: AI can be used extensively in the healthcare industry. It is applicable in automated operations, predictive diagnostics, preventive interventions, precision surgery, and a host of other clinical operations. Some individuals predict that AI will completely reshape the healthcare landscape for the better. AI is revolutionizing how the health sector works by reducing spending and improve patient outcomes. And here are some of the applications of artificial intelligence in healthcare:

- Doing repetitive jobs.
- Managing medical records and other data.
- Digital consultation.

- Treatment design.
- Medical management.
- Virtual nurses.
- Precision medicine.
- Drug creation and a myriad of other uses of AI.

Artificial Intelligence will revolutionize agriculture: AI is also used in the agriculture industry extensively. Robots can be used to plant seeds, fertilize crops and administer pesticides, among a lot of other uses. Farmers can use a drone to monitor the cultivation of crops and also collect data for analysis. The value-added data will be used to increase the final output. How? The data collected is analysed by AI on such variables as crop health and soil conditions, boosting final production and it can also be used in harvesting, especially for crops that are difficult to gather.

Artificial Intelligence will eliminate the need for you to perform tedious tasks. AI is changing the workplace, and there are plenty of reasons to be optimistic. It is used to do lots of tedious and lengthy tasks, especially the low-skilled types of jobs that are labour-intensive. It means that employees will be re-tasked away from boring jobs andbring significant and positive change in the workplace. For instance, artificial intelligence is used in the automotive industry to do repetitive tasks such as performing a routine operation in the assembly line. In allowing robot to take care of such tasks, there has been a shift in the workforce.

AI is used to increase auto safety and decrease traffic complications:

Auto accidents are one of the most popular types of accidents that happen in America. It kills thousands of people annually. A whopping 95 percent of these accidents are caused by human error, meaning accidents are avoidable. The number of accident cases will reduce as artificial intelligence is being introduced into the industry by the use of self-driving cars. On-going research in the auto industry is looking at ways AI can be used to improve traffic conditions. Smart systems are currently in place in many cities that are used to analyse traffic lights at the intersections. Avoiding congestion leads to safer movements of vehicles, bicycles, and pedestrians.

Artificial intelligence is very useful in all industries as more research is being done to advance it. The advancements in this AI tech will be most useful if it is understoodand trusted. An important part of it is that artificial intelligence and related technologies such as drones, robots, and autonomous vehicles can create around tens of millions of jobs over the next decade. Having more jobs created — not less — will be great news for everyone. More jobs will help boost the GDP of the economy.

Advancement in AI and its impressive computational power has already led to the concept of supercomputers and beyond.

Aim of Artificial Intelligence: Artificial intelligence is mostly the subject of discussion in the current day technological landscape. Some people love it. Some people hate it. Some people believe it is the one thing that will advance humankind even further than we have already achieved. And others think it will destroy us. One thing is for sure, though, AI is not nearly the technological feat that it will one day be. So, what are the goals/aims for AI's future? Below are some aims and objectives of artificial intelligence:

Artificial intelligence aims to solve problem: When it comes to artificial intelligence, there is a Frankenstein urge to create AI programs that look, act, and feel like real humans. However, many computer scientistsnow understand that the real goal is not to make a human-like robot. Instead, they would rather create a robot that works to make our lives easier, no matter what it looksor sounds like. Moving forward, it is likely that we will see some serious work being put into the ability for AI to learn and understand, and less on forcing them to act like real humans. That will probably just come with time.

Artificial intelligence completes multiple tasks: Completing multiple tasks is another aim and objective of artificial intelligence. Oneof the largest difficulties to overcome has been making it possible for an AI programor a "robot" to do more than one task. It is very easy to program a system to complete a certain task. For instance, it can bring an item from point A to point B. However, if you want the program to understand that it must pick up the item and then either bringit to point A or throw it in the trash based on arbitrary rules that a human would know (such as: these are underwear, they do not go to the trash. This is an apple core, it does go into the trash), that's a different story. In simpler terms, it might be a while before your housemaid is a robot.

Artificial intelligence aims to shape the future of every company: AI is quickly becoming a crucial tool for all companies. They are using this technology to streamline their processes, such as using Chabot software for customer service operations. It's no secret that the goal is to continue this trend for as many low-level tasks as possible. It ultimately saves the companies money in the long run, and it allows them to increase productivity in other areas.

Artificial intelligence prepares for a boom in big data: Big data has already taken the world by storm. If you don't already know, big data is the large-scale, and sometimes even random, collection of data about people's lives, habits, conversations and more. AI will be able to do

much more for the analysis of this data than humans ever do, so data-driven research, advertisements, and content are going to explode. Remember, the goal of computers has always been to assist humans. The very first computers were calculators. From there we see word processors and software that made life easier for everyone in a big way. This is the next step.

Artificial intelligence creates synergy between humans and AI: The problem that computer scientists are running up against is the fear and rejection that people have to AI. People do not want to lose their jobs and they do not want to work with something they don't understand. One of the key goals in AI is to develop astrong synergy between AI and humans, so that they can work together to enhance the capabilities of both.

Artificial intelligence is good at problem-solving: So far, AI is unable to employ advanced problem-solving abilities. That is, it can tell you a factual answer, but cannot analyse a specific situation and make a decision based on the very specific context of that situation. You can program a computer totell you when a good time to fly is based on the price of flights. However, the computer cannot take into account the current political landscape, current events, or other data that might inform you that despite the cost of flights being low, flying is a bad idea. Currently, the only way to force a computer to make a decision is to employ logic or an "if this, then that" scenario.

Artificial intelligence helps with planning: One of the most human traits in existence is the ability to plan and make goals and subsequently accomplish them. And one of the goals for AI is for it to be capable of doing these things. To do this, we have to figure out how to give a computer the concept of a future that does not exist. It's complex for a machine that only understands in a true/false binary.

1.3.2 What is Human Intelligence?

Human Intelligence refers to the humans' intellectual capability that allows one to think, learn from different experiences, understand complex concepts, apply logic and reason, solve mathematical problems, recognize patterns, make inferences and decisions, retain information, and communicate with fellow human beings. What makes human intelligence unique is that it is backed by abstract emotions like self- awareness, passion, and motivation that enable humans to accomplish complex cognitive tasks.

Here's a head-to-head comparison/relationship between Artificial Intelligence andHuman Intelligence:

Nature: While Human Intelligence aims to adapt to new environments by utilizing a combination of different cognitive processes, Artificial Intelligence aims to buildmachines that can mimic human behaviour and perform human-like actions. The human brain is analogous, but machines are digital.

Functioning: Humans use the brain's computing power, memory, and ability to think, whereas AI- powered machines rely on data and specific instructions fed into the system.

Learning Power: Human Intelligence is all about learning from various incidents and past experiences. It is about learning from mistakes made via trial-and-error approach throughout one's life. Intelligent thought and intelligent behaviour lie at the core of Human Intelligence.

However, Artificial Intelligence falls behind in this respect – machines cannot think. They can learn from data and through continuous training, but they can never achieve the thought process unique to humans. While AI-powered systems can perform specific tasks quite well, it can take years for them to learn a completely different set of functions for a new application area.

Artificial Intelligence is a branch of Data Science that focuses on building smart machines capable of performing a wide range of tasks that usually require human intelligence and cognition. These intelligent machines are imbued with learning from experience and historical data, analysing their surrounding environments, and performing the befitting actions. AI is an interdisciplinary science that leverages concepts and tools from multiple fields like computer science, cognitive science, linguistics, psychology, neuroscience, and mathematics.

1.3.3 Relevance of artificial intelligence to knowledge

Today, the amount of data that is generated, by both humans and machines, far outpaces humans' ability to absorb, interpret, and make complex decisions based on that data. Artificial intelligence forms the basis for all computer learning and is the future of all complex decision-making. Artificial intelligence technology offers several critical benefits that make it an excellent tool for virtually any modern organization, including:

Automation – AI is able to automate a repetitive task that was

previously done manually, without feeling any fatigue or having to take breaks like a human employee would need to do.

Enhancement – AI can make products and services smarter and more effective, improving experiences for end-users, via capabilities like optimizing conversation bots or customer service menus, and delivering better product recommendations.

Analysis – AI can analyse data at a much faster rate than humans, allowing it to find patterns much more quickly, and it can also analyse much larger datasets than humans, allowing it to uncover patterns humans would simply miss.

Accuracy – AI can be trained to become more accurate than humans, utilizing its ability to harvest and interpret data to come up with better decisions for tasks like tracking financial investments or identifying cancerous growths on x-rays.

ROI – AI maximizes the value of data since it's able to do a better job analysing complex, multi-variety relationships, without having to take any breaks and with fewer mistakes, making it an incredibly important technology for any business that relies on data and operates at scale.

Simply put, AI allows organizations to make better decisions, improving core business processes by increasing both the speed and accuracy of strategic decision-making processes.

Self-Assessment Exercise

1. _____refers to the humans' intellectual capability that allows one to think, learn from different experiences, understand complex concepts, apply logic and reason, solve mathematical problems, recognize patterns, make inferences and decisions, retain information, and communicate with fellow human beings.

2. Artificial intelligence is very useful in all industries as more research is being done to advance it. (a) True (b) False (c)

1.4 Summary

AI is an interdisciplinary science that leverages concepts and tools from multiple fields like computer science, cognitive science, linguistics, psychology, neuroscience, and mathematics. What makes human intelligence unique is that it is backed by abstract emotions like self-awareness, passion, and motivation that enable humans to accomplish

complex cognitive tasks. Granted that AI has helped develop intelligent machines that can outperform humans in some respects they are yet to match the human brain's potential. This study unit has taken a critical look into the nature of human intelligence and knowledge. We have examined how intelligent machines and technology have become of great benefit to humans.

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1.6 Possible Answers to SAE

1. Human intelligence;
2. (a)

UNIT 3 THE EPISTEMOLOGICAL SIGNIFICANCE OF ARTIFICIAL INTELLIGENCE

1.1 Introduction

The focus of this unit is to apply the knowledge of philosophy to underscore some fundamental issues that emanates in the use of artificial intelligence. Epistemology is the branch of Philosophy that deals with the acquisition and certainty of knowledge.

1.2 Intended Learning Outcomes

- Towards the end of this study unit, learners in this field of study should be able to:
- Understand and explain the concept of Epistemology
- Differentiate between the both types of knowledge, A priori and A posteriori
- Discuss the epistemic significance of Artificial intelligence and its benefit toman.

1.3.1 What is Epistemology?

Epistemology is the study of the origin nature and limits of knowledge. Epistemology is concerned with the understanding of the world by inquiry into the nature of the ideas, concepts of theories of knowledge. In other words, we focus mainly on the subject matter of epistemology as a sub-discipline in philosophy. This is necessary as it prepares our minds to face some of the themes that would be concern of this unit in latter times. A familiarity with the concern of epistemology thereby prepares our overall comprehension of what and what does not constitute knowledge.

Before we proceed to epistemology, some general notes on philosophy will suffice. Bertrand Russell of blessed memory sees philosophy as the intermediary between religion and science. (1975:4). In a related development, *The New Webster's Dictionary of the English Language* explains that "philosophy is the love or pursuit of wisdom, i.e. the

search for basic principles. Traditionally, Western philosophy comprises five branches of study: metaphysics, ethics, aesthetics, epistemology and logic" (Cayne;1992:755). It must be stated that Philosophy of Other Disciplines makes the branches of philosophy six. This latter branch of philosophy investigates the knowledge claims of other disciplines. Hence we have Philosophy of Biology, Philosophy of Physics, and Philosophy of Education, Philosophy of Law, Philosophy of Politics etc. It must be told at this point that Socio-Political Philosophy is one of the branches of philosophy that is most concerned with governing. However, a very central feature of the discipline is that it is anti-dogmatic. Most scholars often claim that philosophy is the base and apex of any endeavour of study. This is why regardless of whatever one has studied, the highest academic qualification one can have is the PhD – Doctor of Philosophy.

On the meaning and nature of philosophy, prominent African philosopher Professor J.I Omeregbe is of the view that "philosophy is essentially a reflective activity" (Omeregbe;1985:1). We agree with him because to philosophize is to reflect on any human experience, to search for answers to some fundamental questions that arise out of man's continuous curiosity. Philosophy is imbued in every man as it arises out of wonder. Based on this analysis, it will be foolhardy to agree with the West who categorized Miletian Thales as the father of philosophy, or what other authors have termed the first philosopher. But this claim is totally wrong. By positing that Thales is the first philosopher, logically means that no one before him had done any reflective activity. We must recall that human experience is the source of the reflective activity known as philosophy as Professor Joseph Omeregbe (1985:1) already points out. If we agree with this statement, then it becomes important to reject the claim that Thales is the first philosopher as ill-founded and logically out of place. Those who promote the claims that Thales is the first philosopher are promoters of the propaganda of the West.

In our own opinion, philosophy began with man's existence. There are many obstacles, challenges, wonder, curiosity that causes man to reflect deeply. J.I Omeregbe, on the nature of philosophy argues that:

To reflect on such questions in search of explanations or answers is to philosophize. There is no part of the world where men never reflect on such basic questions about the human person or about the physical universe. In other words, there is no part of the world where men do not philosophize. The tendency to reflect on such fundamental philosophic questions is part of human nature; it is rooted in man's natural instinct of curiosity – the instinct to know (Omeregbe;1985: 1).

The above excerpt makes our point more obvious. There is no particular

race that is endowed with the ability to philosophize while others lack this gift. Notable Western philosophers who have denied the Africa the possibility of any reflective activities are Friedrich Hegel, Jean-Jacques Rousseau, Thomas Hobbes etc. Friedrich Hegel, for instance, saw philosophy as the self-consciousness of the Absolute Spirit was led by racism to say that in Africa, the Spirit had not yet attained self-consciousness, meaning that there is no philosophy in Africa, no rationality, no thinking. But the above analysis has shown that their claims are ill founded. Just as we have intellectuals who promote ideologies in any other sector of the society, some African philosophers were also quick to admit that philosophy was alien to Africans on the grounds that what the Africans engaged in was bald and non-argumentative; they called it folk philosophy. A prominent scholar who holds such position is the Ghanaian philosopher, Kwasi Wiredu, who in 1980 argues that: "without argument and clarification, there is strictly, no philosophy."(Wiredu;1980: 47) Our analysis will not pursue the apologist and non-apologists views on the existence or non-existence of African philosophy as we see this to be of little relevance to this discourse. The point we exhume from this analysis is that the denial of a philosophizing ability in Africa merely points to the advancement of ideologies of Western hegemony on other parts of the world. Meanwhile, in the opinion of C.D Broad "philosophy is what philosophers do" (Broad, 1969:59).

On the whole, philosophy is a rational enquiry of anything to produce and explain something. It is synonymous with humans regardless of their race and culture. Every attempt to deprive Africans the ability to philosophize holds no water. Hence, philosophy in our own opinion is in every man and not until one comes to the four walls of a lecture hall can one reflect as Henry Odera Oruka points out in his philosophic sagacity. Let us now proceed to some ideas on epistemology.

Epistemology is one of the core branches of philosophy. Epistemology is derived from the Greek words: 'episteme' (knowledge) and 'logos' (discourse, study) (Hospers, 1999); (Warbuton, 2000). When we conjoin these terms, what we have is the study of knowledge. Hence, epistemology may be regarded as theory of knowledge. Epistemology is the study of the nature and scope of knowledge and justified belief. It analyzes the nature of knowledge and how it relates to similar notions such as truth, belief and justification. It also deals with the means of production of knowledge, as well as skepticism about different knowledge claims. It is essentially about issues having to do with the creation and dissemination of knowledge in particular areas of inquiry. As said earlier on, epistemology is that branch of philosophy whose prime concern is to look at the ways and certainty of our claims to knowledge. Epistemology is a branch of philosophy that studies the

nature of knowledge, its presuppositions and foundations, and its extent and validity (Jonathan;1995). Epistemology asks questions like: "What is knowledge?", "How is knowledge acquired?", "What do people know?", "What are the necessary and sufficient conditions of knowledge?", "What is its structure, and what are its limits?", "What makes justified beliefs justified?", "How we are to understand the concept of justification?", "Is justification internal or external to one's own mind?" (Biernecker & Pritchard, 2011).

Epistemologists ask questions such as *how we know* and *how do we know that we know?* It is the discipline that subjects human knowledge to extensive inquiry abouthis knowledge of the external world and other minds. Is knowledge derived through sense data or ideas? This has been a major question and topical debate in the field of epistemology. Some epistemologist believes that arriving at true or certain knowledge deals with the mind or mental states, while others have attributed knowledge toconsciousness.

A Priori Knowledge and A Posteriori knowledge: The distinction between these kinds of knowledge plays a huge significance in the field of epistemology. These two concepts are used to distinguish knowledge and provide justification or evidence for our knowledge claims. Since the time of Kant, it is believed that any knowledge derived independently of any particular experience is referred to as A priori knowledge. While A posteriori knowledge justifies or provides evidence for our knowledge claims based on experience. This is also known as empirical knowledge.

Rationalism and Empiricism: Rationalism is a theory based on the claim that our source of knowledge is reason and intuition. For rationalists, individuals have an innate knowledge about things and concepts; as such our reasoning is the source of justification of our perceived knowledge. Alternatively, empiricists hold that knowledge primarily comes from sense experience. This implies that we can have justification of our knowledge based on experiences. As such, knowledge of metaphysics or religion in this regard cannot be justified as knowledge.

There are various strands or orientations that make up the field of epistemology. There is empiricism, rationalism and skepticism (Hospers, 1999). These three have permeated into different ideas such as direct realism, indirect realism, skepticism and even idealism. This is why Michael Huemer hinted that in recent times, epistemology focuses on four divisions: Direct Realism; Indirect Realism or Representationalism; Ideaslism; and Skepticism. We shall focus on each of them very briefly (Huemer, 2002).

Representationalism, also known as "indirect realism," maintains that in perception, we are directly aware of certain internal, mental states or entities—referred to by various philosophers as "ideas" (Locke), "impressions" (Hume), "mental images," or "sense data" (Russell)—and we are indirectly aware of external things (that is, our awareness of them depends on our awareness of the images). The mental images are usually said to be caused by external, physical objects/events and to "represent" the latter. Representationalists usually also say that we can have knowledge or justified beliefs about the external world by inferring facts about external objects from the character of the mental images. Usually, it is thought that the hypothesis of external objects (objects existing independent of the mind) having certain characteristics provides the best explanation for why we have the sort of sense data that we do. Representationalism, more than any other position, probably deserves to be called the traditional theory of perception among philosophers (Huemer, 2002:28).

By contrast, direct realists maintain that in perception, we are directly aware of external objects, that is, that our awareness of external objects does not depend upon the awareness of mental images or any other non-external things. Direct realists also generally claim that we have immediate (non-inferential) knowledge of the existence of, and some of the properties of, the external objects that we perceive (Huemer, 2002:28). This view has sometimes been called "naive realism" (chiefly by its opponents), partly because it seems to be the view of common sense and also, probably, partly because its opponents have considered it too simplistic.

Idealism holds that there is no external world; all there are are minds and "ideas" in the mind. Perception, on this view, is simply the process of experiencing a certain particularly vivid sort of idea. (Note that "idea" is here used in an extended sense—it covers all mental phenomena.) There is thus no problem about how we know about external objects. Very few philosophers hold this position today, although it enjoyed surprising popularity during the nineteenth century.

Finally, skepticism holds that we cannot know whether there is an external world or not; nor can we know, if there is, what it is like. Note that this position is not idealism, because the skeptic, unlike the idealist, does not deny the existence of external objects; he merely says that we do not know they exist (Huemer, 2002:28).

So far, we have been concerned with the notion of philosophy and its sub discipline, epistemology. In the next section, we shall focus on the notion of knowledge as holds by Plato. In this sense, we mean the

traditional definition of knowledge.

1.1 Plato's *Theatetus* and the Traditional Notion of Knowledge

Plato is the first Western philosopher who left us a substantial body of writing. Instead he wrote dialogues: dramatic works in which different characters represent and argue for different philosophical positions. In Plato's dialogues the central character is usually his teacher, Socrates, whose philosophical technique was to proceed not by stating a position but by asking questions and leading those with whom he talked to their own answers. (This is sometimes called the Socratic method.) In the dialogue called the *Theaetetus* Socrates discusses the question "What is knowledge?" with a young man called Theaetetus. Because Plato's discussion of knowledge has been as central to the Western tradition as Descartes' view of mind has been to modern philosophical psychology, I want to begin considering what knowledge is by examining some of the ideas discussed by Socrates and Theaetetus in this famous dialogue Appiah, 2003:41).

Theaetetus begins answering Socrates' question "What is knowledge?" by giving examples of knowledge: geometry, for example, and the technical know-how of a shoemaker. But Socrates objectsthat what he wants is not a bunch of examples of knowledge, but rather an explanation of the *nature* of knowledge. In answer to the philosophical question "What is knowledge?" what is wanted is a definition that we can use to decide whether any particular case really is a case where somebody knows something. Theaetetus then makes other attempts at answering the question that *do* give definitions of this sort. But Socrates argues against all of them. Finally, Theaetetus suggests that to know something is just to believe something that is true (Plato, 1973).

Socrates points out that it follows from this theory of Theaetetus' that when a skilled lawyer persuades a jury that someone is innocent, then if the person is in fact innocent, the jury knows he or she is innocent, *even if the lawyer has persuaded the jury by dishonest means*. This consequence, Socrates argues, shows that Theaetetus' theory must be wrong, because in such circumstances we would not allow that the jurors *knew* that the accused person was innocent, even if they *correctly believed* it.

Socrates has a point. Suppose, for example, my lawyers believe that I am innocent and that I am being framed. They might decide that it was more important to protect someone from being framed than to respect the law, which the prosecutors are, after all, abusing. So they might fake "evidence" that undermines the fake "evidence" produced by the

prosecutors. Suppose they persuaded the jury: the members of the jury would *correctly believe* I am innocent, but they certainly wouldn't *know* that I am innocent. Here is the passage where Socrates summarizes his objection and Theaetetus responds:

SOCRATES: But if true belief and knowledge were the same thing, then the jury would never make correct judgments without knowledge; and, as things are, it seems that the two [knowledge and true belief] are different.

THEAETETUS: Yes, Socrates, there's something I once heard someone saying, which I'd forgotten, but it's coming back to me now. He said that true belief with a justification is knowledge, and the kind without a justification falls outside the sphere of knowledge (Plato, 1973:94).

Theaetetus realizes that this case shows that we need some third condition for knowledge: knowing *does* involve believing, and it does involve the truth of what you believe, but it also requires something else. And, since he is nothing if not persistent, Theaetetus suggests that knowledge is true belief along with a justification. The rest of the *Theaetetus* is taken up with discussing what sort of justification is necessary. But the essential idea is that to know something,

a) you must believe it,
b) it must be true, and
c) you must be justified in believing it.

It is the recognition that we need this third condition—which I'll call the justification condition—that is the *Theaetetus'* major legacy to epistemology. That the justification condition and the first two conditions, taken together, are necessary and sufficient conditions for knowledge is a central philosophical claim of the Western tradition since Plato. This idea is often expressed in the slogan "Knowledge is justified true belief." Socrates never accepts any of Theaetetus' attempts to define exactly which kind of justification is necessary to turn true belief into knowledge, but the idea provides the starting point for many philosophical attempts to define knowledge since. Typically, philosophers have first argued for the view that knowledge is justified true belief and then gone on to ask the question "What *kind* of justification do you need in order to have knowledge?"

Theaetetus' idea is suggested by a diagnosis of why the jurors don't really know I'm innocent. That diagnosis is, roughly, that though the jurors have a true belief, it isn't one that they are entitled to have, since my lawyers could have used the very same evidence to convince them I was innocent, *even if I had been guilty*. In other words, the evidence my

lawyers gave the jury for the claim that I was innocent was consistent with my being guilty, even though it persuaded them that I was not. This diagnosis is at the root of the first of two major ways in which philosophers have tried to say exactly what the justification condition amounts to (Appiah, 2003:43).

1.3.2 Epistemological Significance of Artificial Intelligence

The epistemological part of AI deals with how facts from experience and memory can be represented by a machine. Today, we now have intelligent computers that have theories and help in showing how the cognitive process go in human beings. Therefore, to some people there are now machines or computers that have minds and such minds are the explanation of these cognitive processes. Through processes such as Machine learning, Deep Learning, Natural Language Processing and Understanding, it is believed that machines can perceive from their environment and act accordingly.

Consequent of this can be gleaned from the fact that there are currently various computers, robots such as the Self-driving cars, drones, etc. that can perceive the world directly. These machines can think and behave intelligently and are used in different human sectors and even in the military.

In fact, in highly industrialized societies like The United States of America, Japan and Germany, for example, companies and factories now prefer robots to man because they are capable of doing what humans would do in a shorter time and at the same time, they are much easier to maintain than human beings. In addition to this, is the fact that with the aid of digital computers which is the tool of Artificial Intelligence, machines now command the knowledge which they possess. Also, in Japan, there are now industrial robots with mechanical "hands" that allow them to grip even very fragile items, they also have special sets of fingers that ensure a firm grip and these hands are very useful in many assembly operations. Likewise, in U.S.A, there are now computers that can translate from English to French, German, etc.

James Lighthill (Qtd in Balogun 1991) pointed out three main areas of research within the broad field of Artificial Intelligence. Category A is for advance automation which has as its main task the ability to replace human beings by machines for specific purposes which may be industrial or military, on one hand, and mathematical or scientific, on the other. Category B involves the building of robots that are capable of mimicking some special functions that are particularly highly developed in man like the coordination of eye and hand, visual scene and analysis; use of natural language; common sense, problem solving. Category C is

mainly concerned with theoretical investigations related to neurobiology and psychology.

When one looks at these main areas of research in Artificial Intelligence, one could see that they aim at giving the machines the ability to perform some special functions that are associated with intelligence, if performed by man. This is the common factor that unites the categories together; while under category A, attempts are made to make machines perform military works and solve mathematical problems. Under B, attempts are made to give machines the ability to perceive so as to gain the knowledgeof its environment; while under C, machines are being equipped in order to be able to think since it is all these that make human activity to be intelligent. Artificial Intelligence is trying to put the intelligence of man into machine.

Before the invention of modern computers, there was Turing machines; machines that operated on tape containing only 1's and 0's and capable of imitating any other Turingmachine. Alan Turing in a paper written in 1936 announces that there exists a Turing machine (actually a whole class of machines) whose alphabets consist of the two symbols '0' and '1', such that, given any procedure written in any precise and unambiguous language and a Turing Machine 'L' embodying the transformation rules of that language, The Turing machine 'U' can imitate the Turing machine 'L' in 'L's' execution of that procedure.

With this, Turing concludes that in as much we have machines that can imitate in the way he described above and behave intelligently, especially in solving Mathematical problems, such machines should be credited with intelligence. There are modern computers that have surpassed the early invention made by Turing, even though they resemble the Turing machine in that they have the ability of imitating every other computer, but of course, they differ from it because their construction and way of instruction are much more complex.

It is commonly believed that the processes that go on inside the computers that are capable of intelligent action are very much similar to those which go on inside the human being. As the processes inside the subject's skin involve sensory organs, neural tissue and muscular movement controlled by neural signals, the one inside the computer includes symbol transmission, stored symbols, copying system which enable it to detect, record, transmit, store and copy in connection with the help of themechanism of the system.

According to Balogun (1995) in extending the scope of human knowledge, Artificial Intelligence has succeeded at least in giving us a clue on whether there can be a valid distinction between the analytic and

synthetic propositions. Starting from the time of David Hume, epistemologists have been battling with the problem of analytic and synthetic distinction; Hume on the one hand believes that the distinction holds as he claims that the object of human inquiry can be divided into two, the relation of ideas (analytic) and matters of fact (synthetic).

On the other hand, philosophers like Quine believe that the analytic and synthetic distinction cannot hold because it is not possible to draw a sharp line between those sentences that are true because of the meaning of the words involved (analytic) and those that are false because of the facts of experience (synthetic). In essence, Quine is saying that there is no sharp contrast between the analytic and synthetic sentences; instead, we have a vast and blurry theory connecting various sentences that would count as false or true. Consequently, for Quine, there is no way of distinguishing thosethat are purely a matter of the meaning of word from those that are connected with experience.

In Quine's thinking, for one to argue that there are some analytical or logical problemsthat can be solved without referring to experience as the empiricists believe is nothing but a dogma of empiricism. Now through Artificial Intelligence, there are intelligent machines that are capable of solving mathematical and logical problems through their reasoning processes without referring to experience. This is not to under-estimate the usefulness of experience in acquiring knowledge, but the fact is that through Artificial Intelligence, there are some logical and mathematical problems that can be solved without necessarily referring to experience.

Similarly, Artificial Intelligence has helped greatly in solving some epistemological problems like the problem of memory, thereby extending the scope of human knowledge. Without memory, it is impossible to have the knowledge of the past since it is logically impossible to observe past events. One can never have a valid reason for believing that such past events never occurred and as a result, one cannot boast of the knowledge of the past.

Self-Assessment Exercise

1. Without _____, it is impossible to have the knowledge of the past since it is logically impossible to observe past events.

1.4 Summary

Apart from what Artificial Intelligence has done in extending the scope of human knowledge, it has also helped to raise some new epistemological problems which make epistemologists to reflect the more. As Daniel Dennet has rightly observed, "Artificial Intelligence's best contribution to philosophy is a deep, a new, unsolved epistemological problem ignored by the generation of philosophers: the frame problem. Without doubt, Artificial Intelligence has aided and extended the scope of human knowledge than what human capacity can do; it has shown us that we can now rely on the knowledge of the past and that to some extent such knowledge of the past can still be seen experientially when we are punching the expert's system to reproduce knowledge; thereby reducing the problem of memory to the barest minimum.

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1.6 Possible Answers to SAE

1. Memory;
2. Representationalism

UNIT4 MACHINE LEARNING AND CONFLICT RESOLUTION: THE FARMER-HERDSMEN CONFLICT AS CASE STUDY

1.1 Introduction

In this unit, we are going to apply the benefits of AI to a very important and disturbing issue to Nigeria's state of peace and security. Specifically, we are going to consider in detail the negative toll that the crises have had on Nigeria as well as how machine learning can serve as a solution.

1.2 Intended Learning Outcomes

By the end of this module, students should be able to:

- Comprehend the origin and cause of the Herder-Farmer's Crises;
- The political implication of the crises; and
- The impact of artificial intelligence via machine learning toward rectifying the crises.

1.3.1 An Introduction to the Herders-Farmers' Crises in Nigeria

Among several other challenges that seem to be pushing the Fulani Herdsmen to the lush vegetation of the southern regions of Nigeria, the search for fodder for their flock is prominent. This is a consequence of the finding that "The land which has been specifically reserved for grazing over the years is disappearing and has totally disappeared in many areas due to environmental degradation, desertification, rapid population growth and urbanization. Most of the 415 grazing reserves established by the northern regional government in the 1960s have since been lost. Only 114 were formally documented or demarcated, though the government failed to back these agreements with legislation guaranteeing exclusive usage or take active measures to properly develop the reserves" (Olomola 2019, 6). The reason for the tussle between the herders and the crop farmers is therefore not far-fetched in the light of this revelation. Hence, the menace left in the wake of the encounter between herders and crop farmers in some states in Nigeria is too demeaning to require further elaboration. This is connected, mostly,

to the quest for vegetation for their cattle yet it is imperative to discern as well that the encounter with crop farmers, is not limited to Nigerian herdsmen but may also be traced to a persistent in-flow of trans-boundary pastoralists. As a result, "In traditional patterns of transhumance, nomadic pastoralists move their animals between grazing areas in the Niger (the largest livestock producer in West Africa) to the south in Nigeria, Chad and even the Central African Republic, through a seasonal cycle in response to patterns of rainfall and resulting fluctuations in the availability of grazing resources in different regions" (Olomola 2019, 9). This accounts for the overwhelming burdens that crop farmers have been forced to bear. Some instances of these bloody encounters between crop farmers and herders suffice at this juncture.

It has been reported that "Farmers in Zagga district of Bagudo Local Government Area in Kebbi State have decried the persistent destruction of their farm produce by cattle grazers" (Olomola 2019, 10). Elsewhere, the tale is even more gruesome: "Suspected herdsmen have destroyed a farmhouse belonging to Benue State Governor, Samuel Ortom in attacks on Waku village and a part of Gbajimba town, in Guma Local Government Area of the state. Two persons were also killed in the attacks which occurred less than 24 hours after suspected herdsmen attacked Yogbo, another community in the same local government area, leaving six persons killed and several property including farmlands destroyed" (Olomola 2019, 10). Further down the country at Ibadan in Oyo State, "Herdsmen have reportedly set ablaze a 150-acre oil palm plantation in Lagun, a suburb of Ibadan, the Oyo State capital, Sunday night. An estimated 1,500 palm trees were destroyed in the fire" (Olomola 2019, 11). In Ondo state, "The end to herdsmen menace is not yet in sight as the herders are waxing stronger in the business of terrorizing their victims unchecked. Several farmers are presently receiving treatment in an undisclosed hospital after sustaining gunshot injuries from their attack on Friday at Nirowo Forest, Odigbo local government area of Ondo state" (Olomola 2019, 11).

When a section of a country feels deprived of certain rights and amenities, the last resort is the government, if other available channels have been explored. Regarding the case of clashes between farmers and herders in Nigeria, it is important to understand that the failures of government are symptomatic of the theoretical approaches to violence in nearly all African states. These approaches are: (a) state-failure; (b) frustration-aggression; and (c) resource curse (Oyekan and Ofuasia 2017, 22). The state-failure thesis suggests why African states fail in the pursuit of authentic governance – protection of lives and properties of their citizens against internal and external aggressions. The primary reason is that the Nigerian government does not control all of her geographical territory. Specifically, "with regards to Nigeria, the creeks

in the Niger-Delta region and the northeastern city of Maiduguri lie beyond the direct and continuous control of the federal, state, and local governments due to the activities of dominant insurgent groups" (Oyekan & Ofuasia 2017, 22). This crack of its borders is one of the justifications for the persistent in-flows of trans-border pastoralists into Nigeria. The implication is that pastoralists from Niger and Chad Republics may diffuse into Nigeria, cause mayhem and flee back to their countries.

The frustration-aggression thesis adduces factors such as severe poverty, unemployment, and elite corruption cause aggression within the affected masses (Adibe 2012a). Citizens who feel alienated, frustrated, and abandoned either find refuge in their religious groups or are manipulated to wage insurgent struggles against the state (Adibe 2012b). Regarding resource-curse, it is the failure of government to deal fairly with regions of the country where the wealth of the state is being drained. The Niger-Delta region of Southern Nigeria, and the mining regions of Congo DR attest to this dimension on resource curse, with various factions making demands to the central government, and seeking through militant agitation to advance group interests. On the other hand, resource curse leads to violence and extremism in places where resources have actually drained and become extinct. As a consequence of the extinction of the one-time colossal Lake Chad, agricultural activities such as crop and pastoral farming have been grounded, leaving locals jobless and very poor. While assessing the connection between Lake Chad and the standard of living of Chadians in the region, Raymond Fisman and Edward Miguel (2008, 112-3), muse:

When all of the fishes are dead and drought has killed off the crops, a young Chadian has little to lose by joining a rebel band, no matter how brutal. He may actually eke out a better living from stolen loot than by going it alone, especially since farmers who aren't linked to any armed group are easy prey for the rebels or the national army. In the name of survival, we'd probably do the same thing if we walked in their shoes. The calculus of survival can turn anyone into an economic gangster.

It is the case that the herder-farmer conflict cannot obviously be settled by failed governments, one that has let her people down several times. The Nigerian government seems to have failed to wield her political influence in a just and fair manner, failing to live up to the expectations of her citizens. And once this happens: "the obligations it has to its citizens, it loses legitimacy to insurgents whose main ambition is to overthrow an existing government using a variety of violent and non-violent tactics to gain the support of the aggrieved citizens" (Babalola 2013, 16). Furthermore, conflict theories have shown that when a group's shared grievances about marginalization is combined with a

strong sense of group identity, there is a tendency for the outburst of violent responses against the source of their marginalization, either real or imagined (Gurr 1994, 89).

From the discussion thus far, three main points may be inferred: firstly, the clash between herders and farmers persist because of the need for the former to find pasture for their flocks; secondly, government has failed to live up to its billing concerning putting a lasting end to the clash; and thirdly, various proposals have either been short-lived and eyed with suspicion, thereby fuelling the continuation of the menace and its horrific aftermaths. It therefore becomes pertinent to provide an alternative approach that will cater for an end to these clashes and also check against the possibility of their recurrence. Machine learning is the answer to this problem as the rest of this research is dedicated to accounting for its usefulness in agriculture and conflict resolution within the Nigerian clime.

1.3.2 Machine Learning and Farmers-Herders' Conflicts in Nigeria

The principal reason why crop farmers and pastoral farmers clash is connected mainly to the movement of the latter into the region of the former in search of lush fodder for their cattle. It is therefore important to understand how these confrontations can be eradicated via machine learning, in a way that will insure food security, one of the Sustainable Development Goals (SDGs), in sub-Saharan Africa. If the needless clashes between herders and crop farmers can be extinguished, each of these can concentrate on food production rather than the fruitless energy expended on grazing reserves, with a weak government to follow her policy through. How then is it possible for artificial intelligence to achieve these accomplishments? To know how these may be achieved, it is important to explore the benefits of machine intelligence, which is a subset of artificial intelligence.

In clear terms, machine learning is a technique that explores data analyses to automate and build analytical model (Elisa 2018, 9). Even when it is an outgrowth of artificial intelligence, machine learning, employs algorithms that iteratively learn from data. Artificial intelligence, itself in the simplest of terms, is the replication of human intelligence in machines (Geli et al 2019). Techniques in artificial intelligence are robotics, machine learning, deep learning, computer vision, collaborative systems and the internet of things (IoT) (Geli et al 2019). For the purpose of this research, the application and benefits of machine learning will be the crux.

As Noe Elisa (2019, 9) puts it, "Machine Learning field evolved from the broad field of Artificial Intelligence, which aims to mimic intelligent abilities of humans by machines." It "allows computer to find hidden insights without being explicitly programmed where to look" (Wen et al 2012, 42). Machine learning (ML) is used in "Web search, spam filters, recommender systems, ad placements, credit scoring, fraud detection, stock trading, drug design, and many other applications" (Kotsiantis 2007, 252). In the field of robotics, ML, "helps in taking an optimized decision for the machine which eventually increases the efficiency of the machine and more organized way of performing a particular task" (Qui et al 2016, 67). There are two aspects of machine learning: supervised and unsupervised (Kotsiantis et al 2006). In the former, a human can supervise the simulation process whereas in the latter such is absent.[1]

At this juncture, it becomes important to foreground the connection between ML and agriculture as well as how these can dictate the mitigation and eradication of crop farmers and herders in Nigeria. Specifically, ML has proved successful in its use for analyzing weather and crop data months before farmers begin to cultivate. This, no doubt, has the capacity to assist in guaranteeing better crop yield. As Noe Elisa (2018, 11) explains:

This will reveal drought on the horizon, and farmers will be advised to skip a planting season, saving them a lot of million US dollars in input costs. The weather report system with the help of machine learning would enable governments, donors, farmers, relief agencies, NGOs and others to implement more rapid, tailored interventions to prevent food crises. More specifically, the technology has the capability of forecasting underperforming crops in African countries and situations that will call for an international convention.

In addition to the foregoing, ML has also assist agriculture in other continents in the area of food security; one of the major points of the SDGs. ML can be used to "detect plant diseases using images captured by low-cost mobile phones" (Quinn & Leyton-Brown 2011, 1392). This has the capacity to save farmers from investing so much in seeds and plants that will frustrate crop yield and then frustrate the effort toward the attainment of this SDG. More so, ML, through Smart Agriculture has the potential to tell precisely soil fertility, percolation and the best times to plant (Elisa 2018). This possible through the exploration of its arrays of algorithms, such as decision trees and support vector machine (see Elisa 2018). From this understanding, smart technology also has the capacity to assist with food security since it can assist crop farmers with what to plant and when to plant for a better yield. It is in this way that

[1]For a detailed engagement concerning the nature and application of ML, the following works are helpful: Wen et al (2012); Kotsiantis (2007); Kotsiantis et al (2006); Elisa (2018).

ML, through smart technology can dispel conflict and initiate food security, promoting some of the fundamental of the SDGs.

On the one hand, ML can assist farmers in Kebbi and Benue states in Nigeria, for instance, to predict when to plant; what type of seeds to plant for better yield; and what time to engage in these activities where weather will not be a gross challenge. This is possible via the extensive researches expended over the nature of soil and how it can be tweaked to aid improved yield. It needs no elaboration that the soil is a crucial aspect of any successful crop agricultural venture. It is also true that it serves as the original source for the nutrients used to grow crops. Soil is the basis of all production systems in agriculture, forestry and fishery. Soil stores water, nutrients and proteins in order to make them available for proper crop growth and development (Eli-Chukwu 2019: 4377). Through the various techniques and algorithms of ML, it has been noticed to provide the following for proper soil management:

1. Minimize nitrate leaching and boost production;
2. Classify soil and the risks involved in artificial vegetation;
3. Predict soil enzyme activity;
4. Predict monthly mean soil temperature and texture;
5. Estimate soil nutrient after erosion and in areas affected by desertification; and
6. It is 92 percent (%) accurate (Eli-Chuwku 2019, 4378).

One important fact that must not be wished away at this juncture is that ML is cost-effective, especially when contrasted with the various ways the Nigerian government has explored to curbing the clashes between pastoral farmers and crop farmers in the country. It is on this line of thought that Clara Ngozi Eli-Chukwu (2019, 4381) adds that "robotics and autonomous systems (RAS) are set to transform global industries. These technologies will have great impact on large sectors of the economy with relatively low productivity such as agro-food (food production from the farm to the retail shelf)."

On the other hand, it will also assist herders to note places where crop farmers have their cultivations, as to avoid any form of confrontation via sensor networks. In places in Nigeria, where desertification is forcing the herders downwards, leading to the clashes or conflicts with crop farmers, the Nigerian government only needs to explore the benefits of ML to note where crops are miles away, such that a confrontation between herders and farmers can be avoided. Since desertification, as argued hitherto, "is one of the most serious problems facing the northern Nigeria with dire economic consequences for the nation. Deserts are extremely dry areas with sparse vegetation" (Mohammed 2015, 23), the exploration of the promises of ML is crucial. With ML as a sub-set of

AI, herders can know where and when to move their cattle. They can also know beforehand where quality fodder can be acquired without necessarily clashing with crop farmers. This is possible via sensor networks. Geli et al (2019) expatiate that "sensor networks for climate and range condition, decision support for where and when to move animals, autonomous systems for sample forage quality and provide supplements, and data analytics to connect in situ measurements to the landscape scale are promising areas for innovation." It is clear that a proper appreciation and application of artificial intelligence to pastoral farming in Nigeria can mitigate and even eradicate clashes with crop farmers, once the use of sensor networks is explored.

Self-Assessment Exercise

1. _____field evolved from the broad field of Artificial Intelligence, which aims to mimic intelligent abilities of humans by machines.

2. The _____ thesis adduces factors such as severe poverty,

1.4 Summary

In this unit, we have been able to bring the usefulness or relevance of AI to bear on the challenges faced by the Nigerian government over the Farmers-Herders menace. This as has been shown can go a long way toward allowing peace to reign in these regions such that crop farmers and pastoral farmers will have no reason to confront one another.

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1.6 Possible Answers

1. Machine Learning;
2. frustration-aggression

End of Module Questions

1. _____ learning studies inductive strategies as they might be carried out by algorithms.

2. Which of the following is not an example of Machine Learning? (a) Supervised learning (b) Unsupervised Learning (c) Reinforcement Learning (c) Calculative Learning

3. _____ is a branch of Data Science that focuses on building smart machines capable of performing a wide range of tasks that usually require human intelligence and cognition.

4. _____allows computer applications to learn from experience via iterativeprocessing and algorithmic training.

5. Which of the following will eliminate low-skilled jobs and effectively create massive high-skilled job opportunities that will span all sectors of the economy (a) AI (b) Human Intelligence (c) Training (d) Economics development

6. A posteriori knowledge is also known as knowledge.

7. A theory of knowledge based on the claim that our source of knowledge is reasonand intuition is known as___.

8. How many areas of research within the broad field of Artificial Intelligence was identified by James Lighthill? (6) (1) (2) (4) (3)

MODULE 3 CHALLENGES OF ARTIFICIAL INTELLIGENCE

UNIT 1 THE EPISTEMOLOGICAL LIMITATIONS OF ARTIFICIAL INTELLIGENCE

1.1 Introduction

As discussed in the last unit, epistemology is the branch of philosophy that studies knowledge and the standards of knowing. The study of knowledge entails perception, analysis of concepts, taking decisions based on environment etc. The problem that arises is how intelligent machines can be created with a standard of knowing and perception that can be used in formulating different kinds of knowledge. Here, we examine the epistemological limitation of artificial intelligence. How do intelligent machines acquire knowledge? Is it through perception, rationalism or experience? What are the mechanisms that are built in intelligent machines to assume certainty of knowledge or data?

1.2 Intended Learning Outcomes

Towards the end of this study unit, learners in this field of study should be able to:

- Understand and explain the relationship between epistemology and the field ofArtificial intelligence.
- Discuss the limits of intelligent machines
- Explain the epistemic importance of human reasoning over machines.

1.3 Epistemic Limitations of Artificial Intelligence

How can epistemic justification be applied to intelligent machines? Epistemology and artificial intelligence are interdisciplinary and research in AI and intelligent applications are now part of the decision-making process of many human co- operations and organisations. Yet, there are many epistemic and social problems arising due to the limitation of artificial intelligent knowledge. Can the externalisation of human cognitive abilities through artificial intelligent programming and designtruly overcome the epistemological challenges of man's intelligence? Can knowledge derived by intelligent machine be trusted as real knowledge? Are intelligent machines really *intelligent*? Can intelligent machines stimulate adequately human consciousnessand thought process? Another contention of this unit is to determine *if machine can think?* Are machines capable of reflection? And lastly, can machines fully grasp objects and their properties the same way as humans?

Although based on recent research in the field of Artificial intelligence, it is true that intelligent machines have been designed in recent times to do what man cannot do anditt has provided a way to overcome certain epistemic limitations of man. Nevertheless, artificial intelligence is not without faults and limits.

Artificial Intelligence has come a long way from being a component of science fiction to reality. Today, we have a host of intelligent machines like self-driving cars, smart virtual assistants, Chat bots, and surgical robots, to name a few. Since AI became a mainstream technology in the present industry and a part of the common man's daily life, it has sparked a debate – Artificial Intelligence vs. Human Intelligence.

While Artificial Intelligence seeks to design and create intelligent machines that can perform human-like tasks, one cannot help but think, "Is Artificial Intelligence sufficient in itself?"

Perhaps the biggest fear is that AI will replace humans and outsmart them in a few years. However, this is not entirely true. Although AI is highly advanced – now that machines can learn from experience and make smart decisions – AI cannot function optimally without relying on innately human attributes like human intuition. Vadapalli (2020).

According to Balogun (1991) the limitations of Artificial language are glaring and in so many ways; Artificial language is incapable of giving us the type of knowledge, human languages will afford us like in the area of poetry, drama and much more. Most significantly, computers cannot use language to make assertions, ask questions or

make promises since speech acts are but a species of intentional action.

Balogun (1991) also notes that, another vital point that follow from this is the fact the machines cannot engage in intentional behaviour of any kind, for example, they cannot tell lies, since lying involves the intent to deceive; they cannot try to avoid mistakes, since trying to avoid mistakes entails intending to conform to some normative rules and that is why they are not blamed whenever they make mistakes.

Furthermore, Artificial Intelligence systems are incapable of re-identification, theprocess which will enable them to know whether they have acquired enough knowledge in one area or not. This explains the reason why they cannot detectwhether any knowledge programmed into them is faulty or not.

It must be noted that a defeasible reasoning is a type of reasoning that is obtained in a situation where one has reasoned to a conclusion and in subsequent reasoning, he discovers that such original reasoning is wrong and he is able to retract the original conclusion, thereby replacing it with a new one. Some of the conditions for itspossibility include the ability of any agent to sense his own reasoning processes and to be able to use reasoning strategies to solve problems.

Today's computers are faster and more objective, but not more intelligent than man. Artificial intelligence lacks autonomy, in as much as they cannot be held responsible for their faults and programming it follows suit that intelligent machines are not autonomous and as such not more intelligent than man. Without access to data and instructions machines cannot function hence the need for man's direction and input.

Machines cannot be creative. Intelligent machines are only programmed to act as instructed. Even autonomous machines are programmed for directions, actions and language. This makes it difficult for them to keep up with the dynamics of their environment. In recent times, we have witnessed Autonomous cars involved in accidents despite the programming to avoid human beings and always obey traffic rules and regulations. Although, computer engineers are working to develop intelligent machines that can store memory and make decisions based on previous experiences, machines cannot improve with experience or time unlike humans.

Artificial intelligence cannot think outside the box, which is one of the epistemic advantages of man? If TESLA cars can become creative, it would learn to manoeuvre itself from hazardous situations such as the accident in 2016 (The Guardian, 2016). Machines cannot think for themselves even though programmed to communicate as humans or win

chess games, where humans would be in full control of their cognitive capabilities, machines require sleep mode to recharge with the help of human intervention.

As Balogun (1991) also notes, intelligent machines cannot sense their own reasoning processes because whatever form of reasoning they might be capable of exhibiting are what the designers programmed into them. They cannot generate any reasoning processes on their own, not to even talk of sensing their own reasoning processes. In fact, as of now, such machines that are capable of defeasible reasoning have not been built.

Self-Assessment Exercise

1. Which of the following better describe epistemology and artificial intelligence? (a) Interdisciplinary (b)Relational (c) Connectives (d) Epistemological

2. Pick the odd choice: (a)Virtual assistants (b) Chat bots (c)

1.4 Summary

From the epistemological limitations of Artificial Intelligence that have been analysed above, one will see that there is no way the attempt to equate man with machine can be justified. However magnificent the contribution of Artificial Intelligence is to the growth of human knowledge; it is still epistemologically limited within the confines of human intelligence. This fact is predicated on my strong conviction that machines cannot be said to possess that irreducible quality in man, that is, self-consciousness. As a result of this, the role of human beings in social development cannot be underestimated. This study unit has taken a critical look into the subject matter of Artificial intelligence and its connection to epistemology, where the limitations and disadvantages of artificial intelligence were discussed. Here we looked into epistemic limits of machines in relation to perception, reason and memory. In this unit, it was emphasized that the standard of artificial intelligent agents despite its uniqueness cannot be compared to humans. This is because unlike human that can observe objects and their properties, or makes inferences from experience and respond to the ever- changing nature of the world and our knowledge of it, machines cannot do the same and their programming poses limitations to that.

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1.6 Possible Answers to SAE

1. (a);
2. (d)

UNIT 2 CAN MACHINES BE EQUATED WITH MEN? – SOME NOTABLE DEBATES

1.1 Introduction

According to Mario Klingemann, a German artist "Humans are not original, we only reinvent, make connections between things we have seen." In his opinion, while humans can only build on what they have learned and what others have done before us, "machines can create from scratch."

Years later, the economist Herbert Simon, prophesied some years later that "machines will be capable, within twenty years, of doing any work that a man can do", thereafter Marvin Minsky a computer scientist, declared that "within a generation, I am convinced, few compartments of intellect will remain outside the machine's realm — the problem of creating 'artificial intelligence' will be substantially solved."

The aim of current artificial engineering now is not mainly to produce machines that can mimic human behaviour and intelligence but that would replicate the human thought processes. The idea that machines can perform better and smarter than humans has been a core idea and motivation for the development and creation of intelligent agents such as AlphaGO and DeepBlue.

In today's world, technology is expanding and becoming creative along with more innovative ways to augment humans in order to improve their response to the dynamicnature of the world and the competitive edge in businesses and industry. The challenges humans face and their perceived flaw continues to push computer scientist and engineers to go beyond the boundary of technology and develop smarter machines, because these intelligent machines may represent the most practical way to augment human capabilities. The question however still remains, can machines replace man?

1.2 Intended Learning Outcomes

In this unit, learners will:

- Know the place of artificial intelligence and humans; and
- Be able to argue for the extent to which artificial intelligence will require human intelligence

1.3.1 Artificial Intelligence and Human Intelligence: Comparing and Contrasting

Artificial intelligence (AI) is the simulation of human intelligence programmed into machines. It is the ability of a computer or robot to do tasks that are usually done by humans because they require human intelligence. While in the beginning AI started as machines performing only trivial human tasks and enhancing the speed of production processes, or computers teaching themselves how to play chess better, it has evolved greatly throughout the years. AI can be seen everywhere today, it enhances most phone cameras to allow better pictures, helps us manage our finances and is integratedin our daily lives in many ways.

But besides helping us automate our world and enhance the efficiency of jobs, which "computer intelligence" is expected to be able to do, there are examples of AI coming closer and closer to human intelligence. With robots being able to participate in conversations and even quizzes, or producing paintings and music and exhibiting creativity in different forms, even coming close to mimicking human emotions, one can start to wonder what the future of AI will bring to us.

The vision of making machines that can think and act like humans has evolved from movie-fiction to real-world facts. We have long attempted to inherit Intelligence in Machines to ease our work. There are bots, humanoids, robots, and digital humans that either outplay humans or coordinate with us in many ways. These AI-driven applications have higher speed of execution, have higher operational ability and accuracy, while also highly significant in tedious and monotonous jobs compared to humans.

On the contrary, Human Intelligence relates to adaptive learning and experience. It does not always depend on pre-fed data like the ones required for AI. Human memory, its computing power, and the human body as an entity may seem insignificant compared to the machine's hardware and software infrastructure. However, the depth and layers present in our brains are far more complex and sophisticated, that machines still cannot beat at least not in the near future! Here is a timeline predicting the whole idea of comparing both machine and human intelligence over a period of time.

Artificial Intelligence tries to create computers that can replicate human behaviour anddo human-like tasks, whereas Human Intelligence aims to adapt to new surroundings by combining various cognitive processes. Machines are digital, whereas the human brain is analogue. The brain's computational capacity, memory, and ability to reason are used by humans, but AI-powered computers rely on data and particular instructions provided into the system. Learning from numerous occurrences and past experiences is at the heart of human intelligence. It's all about learning from one's blunders through trial and error throughout one's life. Artificial Intelligence, on the other hand, falls short in this regard - robots cannot reason.

1.3.1 Equating Machines with Humans

Coming to the debate of Artificial Intelligence Vs Human Intelligence, recent AI achievements imitate human intelligence more closely than before, however, machines are still way beyond what human brains are capable of doing. The ability of humans to apply the acquired knowledge with a sense of logic, reasoning, understanding, learning and experience is what makes us stand out. With knowledge comes power, and with power comes great responsibility. Although, Machines may be able to mimic human behaviour to a certain extent, their knowledge may fall apart when making rational decisions like us. AI-powered machines make decisions based on events and their association with them; however, they lack “common sense”. AI systems are clueless in the understanding of “cause” and “effect”. Meanwhile, real- world scenarios need a holistic human approach.

“Each one of us has a different emotional quotient and absorbs information in varying contexts and styles. The learning model that we adapt must include humanness and the frequency that matches our mindset,” Vivek mentioned. To be precise, AI cannot offera real human touch to our learning journey.

Learning is not momentary; it is a gradual practice of absorbing information and processing it and eventually adds up to our experience. The learning experience differs in each being and is an invaluable asset in guiding and mentoring others. Mentor-guided learning not only helps you build skills faster but also enables career growth. A mentor brings to the table his/her real-time experience, which makes your learning worthwhile in connecting with the real world. A coach guides you in your developing phase to help you understand things at a granular level, to synchronize and customize your learning behaviour at many human and emotional levels.

That's how our education system shapes our thinking and with the same intention, online education has taken it a step further with human-led courses. Learning thought processes linked to human-led online education/ No Machine can Mentor like Humans.

We live in the world of the internet, with tremendous amounts of information flowing at the blink of an eye. In spite of the best content available to us online, we sometimes deviate from our goal. Vivek pointed out that in e-learning the risk of doing away with human touch altogether has the following consequences.

It can lead to lack of motivation. As a solo contributor, we may give less attention to the challenge at hand and eventually end up not completing our learning journey. Having a mentor/human intervention brings humanness in learning preventing motivation issues in learners.

E-learning could leads to a lack of accountability. We all learn better and remain committed to our goals when we have someone to look up to, get inspired by and most importantly be accountable to. Humans are social animals; learning or anything for that matter demands a community to share openly and learn from others.

And finally, a mentor is the one who gets you onboard to meet your goals. A mentor leads the way and helps you prepare for the career path that lies ahead. And, that's the reason machines can never fully replace humans. Humanness in Ed-tech is just one of the examples where humans will win over machine

The decision-making power of AI systems is primarily based on events, the data they're trained on, and how they are related to a particular event. AI machines cannot understand the concept of "cause and effect" simply because they lack common sense. Nick Burns, a SQL Services Data Scientist, puts it quite well: "No matter how good your models are, they are only as good as your data…"

Humans possess the unique ability to learn and apply their acquired knowledge in combination with logic, reasoning, and understanding. Real-world scenarios require a holistic, logical, rational, and emotional approach that is specific to humans.

Self-Assessment Exercise

1. Which of the following is a description of AI? (a) Set of computer network with assigned specific responsibility (b) the ability to solve problems using high level technology (c) Sets of computer programmed by man (d) the simulation of human intelligence programmed into machines.

2. _____aims to adapt to new surroundings by

1.4 Summary

AI is an invaluable tool shaping the industry, and automation, coupled with intelligentworkflow, will be the norm across all sectors in the near future. And while AI has mastered intelligent behaviour quite well, it cannot mimic a human's thought process. Since scientists and researchers still don't know the mystery behind the human thought process, it is highly unlikely that we'll create machines that can "think" like humans anytime soon. To conclude, the future of AI will be governed mainly by human abilities. It will be complemented by human intelligence and cognizance. In this study unit we have discussed the subject-matter which entails the question *Can machine be equated with man.* Based on our analysis and discussion, it is argued that machines cannot be equated with man despite their technological advantages and advancement.

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1.6 Possible Answers to SAE

1. (a);
2. Human Intelligence

UNIT 3 THE IRREDUCIBILITY OF HUMAN CONSCIOUSNESS

1.1 Introduction

In the last unit, we critically discussed the fundamental question that philosophes always ask as a result of the development of AI and its growth over the years. The question '*Can machine be equated with man?'* was therefore our focus. Based on our analysis and discussion, it is argued that machines cannot be equated with man. In thisunit we shall examine the idea of consciousness in order to determine the possibility of equating human consciousness with machine consciousness.

1.2 Intended Learning Outcomes

In this unit, we are going to:
Understand the limitation of reducing human consciousness; and
Realise the problems of equating machines with humans.

1.3 Irreducibility and Consciousness

In philosophy, a phenomenon is governed by the principle of irreducibility when a complete account of an entity is not possible at a lower level of explanation because the phenomenon exhibits novel properties beyond prediction and explanation. (Polayi,1968). According to Karol Wojtyla (2013) humans are fundamentally irreducible to any natural, biological, social, or even cosmological function. The question of whether there can be any physical reduction of human consciousness seems to be a contention among philosophers. Searle asserts that Consciousness, in short, is a biological feature of human and certain animal brains. It is caused by neurobiological process and is as much a part of the natural biological order as any other biological features such as photosynthesis, digestion, or mitosis (Wojtyla 1992, 90).

For philosophers like Searle, consciousness is not reducible to physical facts because consciousness arises from physical basis. Hence, Searle is often tagged as a materialist or property dualist. However, scholars like Pollock (1988) in an attempt to debunk he irreducibility of human consciousness argues that there is no fundamental difference between

mindand body; the two are related in that mental events are just physical events that can be sensed in a second way. Similarly, he asserts that men are physical objects andwhatever they perceive through their inner sense is the neurological state of their bodies. Like the intelligent machines which have reasoning faculties that entail a way of encoding information, facts of proposition, language of thoughts, which is useful in a descriptive way of thinking about others; man also has such reasoning faculties that enable him to think about himself and others under these types of description.

In addition to the Pollock's position is Kenneth Sayre's argument that "consciousness is a form of information processing, which can be brought within the capacity of machines." He opines that: "Consciousness is a sort of patterned response on the part of an organism's information processing systems to stimulation of sensory receptors."

With the information processing capacity of intelligent machines, they are capable of self-consciousness, since they can easily process information through the help of their data base. With this type of argument, Sayre believes that he has succeeded in convincing us that: "Self-Consciousness is not the exclusive prerogative of biologically generated systems." He thereby justifies the equation of man with machines.

In order to debunk such claims, Balogun (1991) in showing that the attempts made by philosophers like Pollock and Sayre in equating men with machines are mistaken (because machines are not capable of possessing that irreducible quality in men, that is, self-consciousness), posits that Pollock's conception of the mind – body problem is too narrow. In Balogun's opinion, what Pollock has done is to transform the traditional mind-body problem of how mind, an immaterial entity can interact with a body, a material entity, into a purely materialistic view.

Balogun (1991) goes further to argue that having pointed out that the attempts by philosophers like Pollock to equate men with machines is mistaken; my stake on this issue is clear- that machine cannot be equated with man because it does not possess the irreducible quality of man, that is, self-consciousness. It must be noted that machines are not able to formulate intentions. To formulate intentions, an entity must have an irreducible first-person perspective, which an agent that is self-conscious must have. Therefore, machines are not capable of the irreducible self-conscious quality in man. This is in consonance with the view of Baker.

In order to be an agent, an entity must be able to formulate intentions. In order to formulate intentions, an entity must have an irreducible first-person perspective. Machines lack an irreducible first-person perspective. Therefore machines are not agents. A number of conditions must be met before we can ascribe to a thing a first-person perspective. First, that thing must be self-conscious. And to be self-conscious, it must be capable of making first person reference in a language, including the ability to use pronouns like 'I', 'Me', 'My', etc. Such indicators are neither our names nor any other description of ourselves; but they refer to the thinker uniquely without characterizing him/her in any other way. This differs from a case where one thinks of someone who fits a given third person description and such description may apply to himself without entering into the first-person perspective. "Thus thinking about oneself in the first- person way does not appear reducible to thinking about oneself in any other way."

Coupled with the above fact, is that an agent who is self-conscious must be capable of conceiving himself in the first-person perspective, and must have the ability to conceive his thought as his own. Also his ability to make irreducible first-person reference is another necessary condition for the agent to be self-conscious.

Until an entity is capable of doing this, such entity may only be conscious of his thought, but will not be conscious that they are his own. Finally, Balogun argues that machines lack the biological constitution which is common to all humans. Most of human knowledge is grounded in a biological constitution which is common to all human which is modified by culture. As a result of this, the type of knowledge man is capable of acquiring through his culture cannot be exhibited by any intelligent machine. Besides this crucial point, ethical norms and values cannot be associated with machines. This is particularly so because unlike human beings, who do not accept arbitrarily, the values imposed on them by their environment but only those that foster development and harmony in their society, machines have to swallow everything that the programmers give to them. Hence it is ludicrous to talk about machines being morally upright or wrong, since they cannot be held responsible for their actions like men do.

Self-Assessment Exercise

1. _____ is a sort of patterned response on the part of an organism's information processing systems to stimulation of sensory receptors

2. _____ are fundamentally irreducible to any natural, biological, social, or even cosmological function.

1.4 Summary

This unit comes to a conclusion with the assertion that, human consciousness is irreducible and that machines' perception or consciousness cannot be equated with humans. Machines are neither self-aware nor do they possess a first-person perception. Intelligent machines neither possess ethics or religion as such cannot be held responsible for their mishap. Despite the efforts of philosophers like Pollock trying to equate man with machine, it is obvious that machines are not capable of the irreducible self-conscious quality. This study unit has taken a critical look into the idea of consciousness in order to determine the possibility of equating human consciousness with machine consciousness. As concluded, machines do not possess this quality. In as much as machines lack the biological functions of man, then they cannot be said to possess irreducible consciousness regardless of their potentials and physical attributes.

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1.6 Possible Answers to SAE

1. Consciousness;
2. Humans

UNIT 4 THE PSYCHO-MORAL IMPLICATIONS OF ARTIFICIAL INTELLIGENCE: CYBER-BULLYING AS CASE STUDY

1.1 Introduction

As a way of coming to terms with some of the limitations to artificial intelligence vis-à-vis human intelligence, this unit is going to consider the place of cyber-bullying as illustration. What then is cyber-bullying? How does it continue to reveal the negative limitations of artificial intelligence? These are the contentions of this unit.

1.2 Intended Learning Outcomes

In this unit, you will learn:

- What cyber-bullying means;
- How cyber-bullying extends to artificial intelligence; and
- The limitations of artificial intelligence via cyber-bullying.

1.3.1 What is Cyber-Bullying?

The prevalence of electronic technology in today's world has led to the upsurge of cases traceable to cyber-bullying among teenagers. This has become a source of concern to parents in the moral development of their children. It seems that some children find an avenue for their frustrations through bullying others. There is no doubt that there is psychological underpinning latent in it. As a matter of fact, before now, these antisocial actions could be better controlled because they were limited to face-to-face interactions. But technological evolution has made the issue more perilous and complex to contain (Samson, 1994). Various forms of technology like cell phones, social media sites, chat rooms, among others have allowed bullying to flourish in the cyberspace. Incidentally, all of these are the aftermaths of artificial intelligence.

In this section, the meaning and distinction between cyber-bullying and traditional bullying would be juxtaposed. Further, the rift also unfolds the variant modes of cyber-bullying and the psychological and moral

repercussions on the victims. However, before we engage with the distinction, it would be proper to analyse the root word 'bully/ing'.

In a common parlance, the term 'bullying' refers to an act of insult and harassing a person. According to Advanced Oxford Learner's Dictionary, bullying is to frighten, hurt, or threaten (a smaller or weaker person). Put differently, bullying is when a person or group of persons with more power, intentionally and continually cause a harm or hurt on a person or group of persons who are most times are helpless to respond. Accordingly, Kowalski, et al (2008), defines Bullying as an aggressive behaviour that is intentional and involves an imbalance of power strength. Sometimes this imbalance involves differences in physical strength between children, but often it is characterized by differences in social power or status. Because of this imbalance of power or strength, a child who is being bullied has a difficult time defending self. Typically, bullying does not occur just once or twice, but is repeated over time. In the light of the foregoing, Alanah and Madeline Foundation (2016) propose that physical bullying, verbal bullying, covert/hidden bullying and cyber-bullying are the four kinds of bullying. The unit is concerned principally with the last of these, it needs to be hinted that the first three fall under the category of traditional bullying. Hence, it is pertinent to make this distinction properly after defining each of these.

The term 'Cyber" is a prefix that is mostly used to describe an individual or a person, thing, information and idea which are part of computer and information range. With the advancements in technology, a new form of bullying called Cyber-bully has emerged. So, the intimidation of peers in the classroom has taken another dimension. Students intimidate or harass their peers online. According to Larissa (2004), Cyber-bullying "is the use of technology to harass, threaten, embarrass, or target another person. In the same vein, Lanhart (2010) defines Cyber-bullying as the use of technology to harass, hurt humiliate and embarrass another person.

Corroborating this, Chris (2005) opines that Cyber-bullying refers to the act of bullying an individual through Information and Communication Technologies (ICTs), medium such as mobile phones, text messages, internet chat rooms, emails, phone calls, social networking websites *et cetera.* A person who uses technology to bully, just like one who bullies face-to-face often aim at the vulnerable.

Accordingly, Hinduja and Patchin (2014), define Cyber-bullying as the willful and repeated harm inflicted through the use of computers, cell phones and other electronic devices. Put differently, Cyber-bullying involves the use of Information and Communication Technologies to support deliberate, repeated and hostile behaviour by an individual or

group that is intended to harm others.

Furthermore, PACER's National Bullying Prevention Center (2013), states that Cyber-bullying is the use of technology to harass, hurt, embarrass, humiliate, and intimidate another person. Students using technology to bully, just like those who bully face-to-face, often look for targets who are vulnerable, socially isolated, or who may not understand social norms.

This suggests that Cyber-bullying basically refers to incidents where adolescents use technology to hurt, harm, threaten and humiliate their peers. For example, a youth may send a text message to others or spread rumours using cell phones or the internet. Hence, Cyber-bullying refers to bullying that occurs through electronic communication devices.

According to Hinduja and Patchin (2009), the definition of Cyber-bullying must incorporate bullying's essential elements. In other words, the broadest sense of the term Cyber-bullying must have the following necessary elements: (1) willful; (2) repeated; (3) such that causes harm perceived by its target; and (4) perpetrated via computers, phones, or other electronic devices The first three elements of Cyber-bullying mirror those of traditional bullying; the requirement that Cyber-bullying is perpetuated via electronic device is the main distinguishing feature between the two. But what in the first place is traditional bullying?

According to Fegenbush & Oliver (2009) traditional bullying usually occurs in schools during the period when students are less monitored or unsupervised. The aftermath brings quarrelling and bruises which would later call the attention of school administrator. In the same vein , Stephenson and Smith (1989), define traditional bullying as a form of social interaction in which a more dominant individual {the bully} exhibits aggressive behaviour which is intended to and do in fact, cause distress to a less dominant individual [the victim]. The aggressive behaviour may take the form of a direct physical and/or verbal attack or may be indirect when the bully hides a possession that belongs to the victim or spread false information about the victim.

There are three main types of traditional bullying: verbal bullying, physical bullying, and social bullying. All three involve the harassment of a victim by an aggressor whose intent is to inflict harm. Verbal bullying is a situation whereby an individual verbally mocks and teases their victim in a direct or indirect way. The direct verbal bullying consist of face-to-face interaction with individual(s) involves which may result in name-calling, threat, hurtful comments and so on. The indirect verbal bullying is done without the immediate knowledge of the victim, but makes comments about the victim to others. The physical bullying

includes; pushing, punching, kicking, striking that causes pains on the victim. Social bullying is a situation in which an individual spread rumours about another that ostracized the victim from his or her peers.

The use of Internet/computer and electronic devices: Cyber-bullying is the willful and repeated harm inflicted through the use of computers, cell phones and other electronic devices. On the other hand, traditional bullying is not done through internet or electronic devices but that which involves physical contact or that is carried out throughout non-electronic means.

Anonymity/Impersonation: People who cyber-bully may attempt to remain anonymous. Unlike the traditional way of bullying, Cyber-bullying do not requires physical strength on the person that is bullying another, it does not requires face-to-face contact, a person who bullies another on the internet may not reveals his or her true identity. This implies that Cyber-bullying can be done anonymously. In this case, victims may not know who the bully is, or why they are being targeted. The Cyber-bully can cloak or masquerade his or her identity behind a computer or phone using anonymous email addresses. Thus, it is sometimes difficult to trace the source in cyber-bullying.

Large audience/rapidly reached/Hard to control: In Cyber-bullying, the audience can be very large and rapidly reached . Unlike the traditional act of bullying that may be carried out at a particular place and seen by few persons, the person who engages in Cyber-bullying can torment their victim all through the day and anywhere (home, bedroom, school, kitchen, shopping mall et cetera) and the humiliation is seen by hundreds and thousands of people online. Besides, emails could be forwarded to hundreds of people, while social media posts can be viewed by many people. The victim of Cyber-bullying can be reached at any time and in any place. The hurtful actions of Cyber-bullying are viral in nature that means that a large number of people (at school, in the neighbourhood, in the city, in the world) will know that a person is been bullied and they too can be involved in the victimization or find out what the incident is all about. The victims, offenders and witnesses are limitless.

Invasion of home/personal space: Unlike the traditional bullying that is restricted to a particular place, Cyber-bullying can take place at any time and most often intrude into spaces that have previously been regarded as safe and personal. In other words, Cyber-bullying can happen 24 hours a day, 7 days a week, and reach a kid even when he or she is alone. It can happen at any time of the day or night. Besides, the person who bullies another person does not have to see the immediate response of the target. Sometimes the teen who bullies another teen may

not recognize the serious harm done to the victim.

Fear of Reporting: In most cases, Cyber-bullying victims are afraid to report to their parents, teachers and other adults because they feel they could be punished and lose their computers, laptops, internet, or cell phone privileges. However, those who are bullied traditionally are most likely to report to parents, teachers and other adults because the physical harm is visibly seen by the parents.

In any case, both Cyber-bullying and Traditional bullying are devastating to the victims. Bully is bully whether they exists in the online realms or physical realms. Bullying is a serious problem with several consequences. However, Cyber-bullying appears to pose greater threat to young people than traditional forms bullying. Therefore, the need to combat this menace.

1.3.2 Causes and Psychological Implications of Cyber-Bullying

While the social media and the internet are the main sources of Cyber-bullying, the following signs and symptoms may be noticed:

(a) being emotionally upset during or after using the Internet or the phone;
(b) being very secretive or protective of one's digital life;
(c) withdrawal from family members, friends, and activities and spending a lot of time alone;
(d) avoiding school or group gatherings;
(e) slipping grades and “acting out” in anger at home;
(f) changes in mood, behavior, sleep, or appetite;
(g) wanting to stop using the computer or cell phone;
(h) being nervous or jumpy when getting an instant message, text, or email;
(i) avoiding discussions about computer or cell phone activities;
(j) Low self-esteem;
(k) Reluctance to let parents or other family members anywhere near their mobiles, laptops etc;
(l) Finding excuses to stay away from school or work including school refusal;
(m) Friends disappearing or being excluded from social events;
(n) Losing weight or changing appearance to try and fit in;
(o) Fresh marks on the skin that could indicate self-harm and dressing differently such as wearing long sleeved clothes in the summer to hide any marks; and not limited to
(p) A change in personality i.e. anger, depression, crying, withdrawn.

Causes of Cyber-Bullying: If these are the possible and usual outcomes of the activities of Cyber-bullying on an individual, it is therefore pertinent, to demand what are the likely causes of this act that diminishes self-esteem. There has been a great deliberation among intellectuals to explain why people engage in cyber bullying. According to Lawrence (1995) although those who engages in cyber bullying see it as a fun fact activity but most often, it is emotional and behavioural problems and disturbances that leads children to indulge in cyber bullying activities. Peoples' perceptions, attitudes, or internalized sentences about outside things and events consciously or unconsciously affect their behaviours, reactions as well as their relationships or feelings towards others. A genealogical research into various forms of cyber bullying which includes and not limited to: flaming (electronic transmission of angry or rude messages), harassment (repeatedly sending insulting or threatening messages) cyber stalking(threats of harm and intimidation), denigration(insults, spreading painful rumours), Masquerading (pretending to be someone else and sharing information to damage a person's reputation), outing(revealing personal information about a person which was shared in confidence), exclusion (maliciously leaving a person out of a group online, such as a chat line or a game, ganging up on one individual) shows that it stems from teens' beliefs, perceptions, attitude, as well as internalized judgments about things and events which contributes to unhealthy feelings and self-defeating behaviours that inspires or leads them to engage in cyber bullying.

Psychological Harm of Cyber-Bullying: The impacts of cyber bullying finds expression in violence and suicidal thoughts as well as mental disorder due to much depression and stress pressure (Jerry and Clayburn 2010). Sequel to the foregoing, Kowalski (2012) asserts that cyber-bullying has psychological, physical and academic harm on the child that makes him to become a menace to the society if not properly handled. Many targets of Cyber-bullying report feeling of depression, fear, anger, sadness and frustration.

Physical Harm of Cyber-Bullying: This type of cyber bullying impact lures the victims to cause them-selves harm. Some teens have been reported to have nurtured suicidal thoughts and while some have committed Suicide as result of Cyber-bullying. There have a number of examples in the United States and other places where youth who were victimized ended up taking their lives (Hinduja & Patchin, 2014). Indeed, there are series of physical harms that are done as a result of Cyber-bullying. A child may skip school because he or she is ashamed to go to school. More so, the child may begin to injure his himself or herself physical because of the stress that he is experiencing.

Emotional Harm of Cyber-Bullying: The effect of this makes victims to lose their self-esteem and sense of self-worth and most of them end up revenging in a more devastating way. Some go as long as posting their own nude picture on internet or upload private videos of their friends. According to Sourrander et al (2010), cyber victims are prone to psychosomatic symptoms like headaches, abdominal pains, and sleeplessness.

Social Harm of Cyber-Bullying: Man by nature is a social being and he finds the fulfillment of his being in associate with others. Besides, anything that hinders one from socializing makes one to become anti-social and non-relational with others. A child by nature would want to play around with his friends and peers in the neighbourhood. Cyber-bullying is a public nature of humiliation can have a long lasting effects. Thus, when a child experiences Cyber-bullying, he withdraws to himself and stays away from other children. For example not going out for picnic and may be shy to go and see Santa Clause (or 'Father Christmas' as commonly called).

Academic Harm of Cyber-Bullying: Most times, the act of Cyber-bullying usually occurs outside the school. However, its effects manifest in the classroom. The impact of this makes a child to skip school and classes. Besides, when a child engages in anti-school activities his academic performance is invariably affected. Cyber-bullying results in poor academic performance of a child because a child that is cyber bullied lack concentration during classes due to emotional instability and often skips school. Hence, some of the victims that managed to go to school end up unleashing their angers on whoever comes across their path and this kind of attitude may result to school violence.

Social Vices of Cyber-Bullying: Most teens that are victims of cyber-bullying skip school, and they may end up joining bad gangs or becomes agents of bad guys in their environment by going on errands for them and learning their bad behaviours. Some even use hard drugs to overcome their depression. This type of attitude can make a child to become a cultist, an armed robber, a smoker and a drunker or even a terrorist in the society which affect the child in the future as he grows to adolescents and then adulthood.

Self-Assessment Exercise

1. _____basically refers to incidents where adolescents use technology to hurt, harm, threaten and humiliate their peers.

2. Pick out the odd choice (a) Verbal Bullying (b) Spiritual

1.4 Summary

In this unit, we have been able to discuss the idea of cyber-bullying and its psycho-moral implications as one of the pitfalls of artificial intelligence. All of these have been able to show once more that no matter how we look at it artificial intelligence cannot be able to overcome its lapses and will always need human intelligence for it to be useful.

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1.6 Possible Answers to SAE

1. Cyber-Bullying;
2. (b)

End of Module Exercises

1. What is human biggest fear about AI? (a) It will replace and outsmart humans (b) It will end up simulating human memory (c) Artificial Intelligence will create unemployment (d) Artificial Intelligence cannotthink as humans will do

2. Artificial Intelligence is not capable of defeasible reasoning which is very essential for sophisticated epistemology. True or False

3. Artificial intelligence lacks _____ in as much as they cannot be heldresponsible for their faults.

4. Intelligent machines can sense their own reasoning processes. YES or NO?

5. Karol Wojtyla believe that _____ are fundamentally irreducible to anynatural, biological, social, or even cosmological function.

6. According to Balogun, machines lack the _____constitution which iscommon to all humans.