Exploration of Artificial Emotional Intelligence in Tobias S Buckell's "Scar Tissue"

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Abstract:

Artificial Intelligence (AI) is one of the most significant innovations in technology. Among its varieties, Artificial Emotional Intelligence, also called Affective Computing (AC) is an upcoming technology that enables machines to identify human emotions, process them in a timely manner and react properly and appropriately. AI is also instrumental in providing such emotion - oriented human machine communication. AEI is mainly found in Anthropomorphic robots, text, voice chatbots, and video bots that actively demonstrate their knowledge and skills combined with emotions through the framework of Artificial Intelligence.

An important stand of research in the field of Artificial Emotional Intelligence is how robots can respond to emotions of human beings. AEI enables robots to incorporate emotions into their interfaces through a variety of modalities like textual content, speech, video and facial expressions and react to them compatibly. A number of recent studies are conducted to make human interactions with computers and robots in a more natural and engaging way. This paper analyses Tobias S. Buckell's short story "Scar Tissue" from the perspective of AEI. It also highlights the life in robots and aids in understanding the appropriate emotions of robots instilled through Artificial Emotional Intelligence.

Key words: Artificial Intelligence, Emotions in Robots, Artificial companion , Robot, Interactions & Communications, Artificial Emotional Intelligence, Prosthetic devices

Science and Technology have become the watchwords of the contemporary era. Among the two, technology has become more dominant with its products of internet and robotics. Moreover, technology has shrunk the world into a digital society or online society and has made work, communication and connection processes easier. Any kind of development without the presence of science and technology is unheard of and thereby enhances human skills, thinking and wellbeing. The development in the fields of technology also paves way for new research developments and revolutions in various fields such as Medicine, Agriculture, Education, Information Technology and all walks of human life. Some of the radical changes of technology include Space Exploration, Introduction of Nuclear Power Plants, Defence Techniques and Constructive Technologies. Martin Bridgstock, a senior lecturer, School of Biomolecular and Physical Sciences at Griffith University opines that "it is equally clear that science can alter our entire conception of ourselves and our place in the universe". (Bridgstock 3). He states that by solving the world's riddles, from the tiniest subatomic particles to the wide expanse of galaxies, science has the potential to fundamentally alter the perception of mankind and its place in the universe.

Technological developments have always been the catalysts of change in society, underpinning innovation and influencing everyone's lives economically, culturally and environmentally. Undoubtedly, it is believed that in the forthcoming years, there will be a sharp increase in the development of science and technology and thereby the newer generation would encounter more innovations. It is also observed that people who embrace technology and love to learn about it, create a new environment for better living. The technological knowledge helps its learners and users to live independently by fulfilling their lives and also contributing to society and culture in various ways. Frolov, a Russian Philosopher opines,

... a firm foundation for sciences' value orientation, for the unity of scientific cognition and humanistic ideals in which the determinative, regulating role belong to the technology. The importance of this has never been felt so acutely as today, particularly because it is precisely man that is increasingly becoming the object of modern science (120)

He adds that science and technology has become inevitable towards development and must also be governed by universal moral principles.

Artificial Intelligence (AI), is one such a product of science that has made lives easier. The twenty first century witnesses its rampant growth and integration into various fields. The recent innovations like AI, Deep Learning Advancement, Cloud Computing, and Interactive Bots are widely used in many walks of life. The earliest substantial work in the field of Artificial Intelligence was carried out in the mid - twentieth century by the British logician and computer pioneer Alan Mathison Turing. In 1935, he introduced

an abstract computing machine consisting of a limitless memory and a scanner that moves back and forth through the memory and produces desired products in the form of symbols.

The first AI program was created in 1951 by Christopher Strachey, the director of the Programming Research Group at the University of Oxford. His 'Checkers' program ran successfully, at the university and it could play a complete game of checkers at a reasonable speed. In 1952 another program, named 'Shopper' written by Antony Oettinger at the University of Cambridge, ran on the EDSAC computer. This was used to find an item among the numerous products available in the shops in order to make buying easier for shoppers. According to Georgios I Zekos, an economist and attorney at law defines AI as,

... a machine designed to operate any general intelligent action that a human is capable of. To that extent, an advanced artificial intelligence will have the capacity to perform multiple cognitive tasks, displaying a resourcefulness in its performance at a level equivalent to that of a human with 'AI Intelligence and AI Consciousness' (414).

All these features are now incorporated into various devices and witness AI's potentials. It is to be underscored that AI has entered into all the spheres of life and are developing more and more efficiently every day.

Millions of people come in contact with AI from the simple to complex forms, yet there is always a wide gap between humans and AI devices as the emotion between the two do not match. Emotions are unique in human beings which are expressed in many different degrees, qualities and intensities. Often human experiences comprise of multiple emotions, which are expressed through various verbal and non-verbal means and on the other hand, with the increase in the population of robots, shared with other living organisms of the world to which human have been connected for many centuries. As a new non-human entity, humans are still apprehensive of sharing their emotions with the AI devices. With the increase in the population of robots, the need for Human – Machine interactions has simultaneously increased and also requires high level AI programming.

The highly - programmed bots are now designed with capacities to give accurate responses to complex queries. Earlier this advanced way of understanding and reciprocating emotions was considered as a farfetched goal for AI to achieve, but now it has become a reality. In recent times the AI bots are well made, capable of responding and reciprocating to human emotions. This unbelievable turn in AI technology is known as Artificial Emotional Intelligence (AEI) or Affective Computing. Richard Yonck, a futurist and speaker, rightly affirms:

... now we find ourselves entering an astonishing new era, an era in which we are beginning to imbue our technologies with the ability to read, interpret, replicate and

potentially even experience emotions themselves. This is being made possible by a relatively new branch of artificial intelligence known as affective computing. (Yonck 15)

He is of the view that as a powerful technology, affective computing is destined to transform human life and this world over the forth coming decades.

AEI has reached its milestone of helping machines gain the capacity to understand, interpret and respond to human emotions through robots. The MIT Media Lab and Dr. Rosalind Picard, the pioneers of this AEI, initially used the idea of AEI in the field of medicine to treat the patients with empathy. They found that empathy given by robots quickens the recovery of patients. Being an emerging form of AI, AEI's influence has spread to all the disciplines like healthcare, insurance, education and transportation. It is expected that in the future AEI will be used to diagnose depression, detect insurance fraud, determine how a student comprehends a lesson or assess a driver's performance and so on. Emine Kambu, a Professor in Business Administration presents, "AI technologies perform simple and limited tasks with various programs that will make life and work easier. However, nowadays it has come to the point of detecting emotions. AI can detect emotions according to voice and face" (Kambu 152). He states that, AI technology has advanced to the point that it can correctly identify human emotions by analysing speech and facial clues and connect to the people in a more personalised and empathetic way. In short, AEI is a mixture of computer science, robotics, cognitive science and psychology. All the developments in science and technology gets reflected in literature and sometimes sci-fi becomes a source for technological innovations.

The twenty- first century witnesses and frequently addresses the wondrous nature of emerging technologies in literature. It appears in the form of novels, short stories, poems and plays. Since ancient times, technology has aided in writing and reading literature but in the modern world, technology has made easier for people to discuss about books and literature via Book Twitter, Book Blogs, Book Tube and also provides unimaginable methods of sharing books. Technology has also allowed writers and readers to connect more easily than they ever could before and it could be said that electronic media has revolutionised literature. This is evident through the fact that more people love to prefer audio and video sources, e books, movies, cinemas and podcasts than the physical books. Social Media and video sharing channels have also drastically changed people's perspective towards literature and education. Rui Alexandre Castanho, a Professor of Applied Science at WSB University comments,

In education, AI is being used to enhance the learning experience and improve educational outcomes. One of the latest developments in the field of AI is the ChatGPT model, which is a type of language model that can generate human-like responses toa wide range of questions. (Castanho 375)

It is foreseen that all the conventional teaching techniques would be modernised and replaced by more and more new approaches using new technology such as computers, mobile devices, screens, audio-visual contents and applications.

The transformative impact of technology can be seen in the forms of literature, such as audio, digital, and video files. With the advent of sensory technology, the sensors detect the physical, chemical or biological quantities and convert them into readable signals. Engelberger, an America physicist, reports, "...the action taken by the robot after due reflection on its sensory inputs might very well be prompted by a situational judgement that we would call Artificial Intelligence" (100). This proves that the growth of machine intelligence is on par with human intelligence. Some of the best known and renowned writers of technology-based sci-fi are Arthur C. Clarke, John Mc Carthy, Philip K. Dick, Calm Chace, Max Tegmark, H. G. Wells, Nick Bostrom Bernad Marr, Tobias S Buckell and Mike Kaput. Among them, an American Sci-fi writer, Tobias S Buckell is known for addressing the positive advancements of technology through his works.

Tobias S Buckell was born in Grenada in 1979. He has published over sixty novels and fifty short stories. Most of his novels have been translated into nineteen different languages. His works have been nominated for the **Hugo Award**, **Nebula Award**, **World Fantasy Award**, and the **Astounding Award for Best New Science Fiction Author**. **"Scar Tissue"** is one of his recent and highly admired Sci-fi short stories. In the story Buckell dexterously portrays how Artificial Emotional Intelligence can bring productive changes in the world through robots. **"*Scar Tissue*"** begins with the protagonist sharing to his friend about how his life changed because of his robot. The story proceeds with the flashback of the   protagonist, who buys a newly created Robot from Advent Robotics which behaves like a baby in its pre- language and pre-memory stage. In the early stages, the protagonist found it difficult to tame the robot and suffered from physical and psychological damage. For instance, the robot unknowingly smashed the coffee table on awakening. He felt that it was difficult to use the robot and his work was doubled because it had to be taken care   like a baby who cannot perform personal activities on its own. The protagonist narrates how he had to carry the robot to the charging platform as the robot is not aware of it. And he added that like a baby, progressing to the mimicking stage, the robot imitated the actions of the protagonist like punching the wall in sleep and so on.

The protagonist's friend then advises him about the various stages of robots' evolution and says that his life would change affirmingly. In the next stage, the robot, is named as Rob, which rapidly grows up and attains maturity like a human. It grows from an uncomprehending baby stage to an argumentative teenager. Besides handling the transformation processes of the robot, the protagonist has to deal with his Daddy's therapy and physical and attempts to continue with his own physical rehabilitation. Later in Rob's mature stage, the protagonist suffers from a heart attack and Rob helps

him to recover from it. At the end of the story, the protagonist appears to share an inseparable bond with Robot. When the protagonist shared about his plan to get rid of the prosthetics and regrow his limbs, the robot thwarts it. Later the protagonist understands the consequences of his original plan and matches Rob's subsequent scrimshaw on his prosthetics with tattoos on the skin above. Subsequently, following Rob's recommendation the protagonist receives the artificial heart.

The idea of robot growing up like a human with emotions is well explained in "Scar Tissue". The robot in the story, exhibits how Artificial Intelligence can induce the capacity to analyse, react and stimulate human emotions to machines and turn them into devices that can reason, learn and act intelligently. This research paper, titled "Exploration of Artificial Emotional Intelligence in 'Scar Tissue' by Tobias S Buckell" highlights the use of AEI focused technologies in achieving emotional mastery in robots through emotion recognition systems and attempts to explore how robots can be used as human companions that can take cues from humans' expressions and reflect in its actions.

AEI highly relies on natural language processing, sentiment analysis, voice emotion and interprets human emotional signals from sources such as text, audio and video. In analysing text, the natural language processing and sentiment analysis are vital. In AEI, robots are made to acquire language and sense the feelings through text or coding. The audio analysis uses voice emotion AI, that is to make the robot analyse the voice of humans and understand their emotions. The analysis of facial movements, gait and interpretation of physiological signals come under the category of video characteristic. Any one of these characteristics or a combination of these also can be found in AEI devices.   An Economist, Max Roser envisions, "just 10 years ago, no machine could reliably provide language or image recognition at a human level. AI systems have become steadily more capable and are now beating humans in tests in all the domains". (Roser 1) He adds that Artificial Intelligence enables computers to think and act more in a human way and replace humans in many of the jobs.

The robot in the "Scar Tissue" is a mixture of all these elements of AEI and is able to detect emotions and express appropriate emotional replies accurately. The most natural way for a computer to recognise emotions automatically is to detect its emotional state from the text that appears in front of it or in any place. This indicates that the computer would examine whatever textual material that was provided to it or was available to it in any context and draw conclusions about the emotions that were communicated within that text. According to S.N. Shivhare, an Associate Professor of Computer Science and Engineering at Galgotias University

… in case of recognizing emotion from a piece of text document or a blog, any human can do this better than a machine only problem is he/she takes time. Proposed emotion detector system takes a text document and the emotion word ontology as inputs and

produces one of the six emotion classes (i.e., love, sadness, joy, fear and surprise, anger) as the output. (52)

He propounds that the emotions expressed through words and non-lexical fillers in human's speech can be easily recognised by robots.

Text analysis adopts two approaches to the study of emotions, aiming to detect the emotional state of the user. The first approach is the classification of emotional text and determine what type of emotion it is. This is evident from the words uttered by the protagonist's friend in the story, "It's a mind in a Pre- language stage, Pre-memory state. The language matrix plug-in will be aiding it, though, and even human babies start recognizing names and language must faster than you realize" (**ST** 5). Here, the robot learns and picks up its vocabulary through natural language acquisition and stores in its memory along with the emotions attached to the words. It is to be noted that the robot's memory preserves not just linguistic data but also the emotional value associated with each phrase, similar to that of people associating certain words or concepts with emotions and personal experiences. This language acquisition in the robot is seen when the protagonist's friend offers some suggestions to train the robot.

"Talk as much as you can. Language acquisition is key", Advent has explained. "Narrate everything you're doing as you go, and even when your foster robot is older, explain why you do everything you do. Context is key. The more you can do that, the better". (**ST** 5)

This shows how AEI, can be instilled in the robots by the owners. It provides an opportunity for the owners to train the robots with their own vocabulary and emotions so as to make the robot feel the owner's emotions.

The sentimental analysis in the robots takes place by detecting the human emotions and comparing the input text to a reference. The analysis is done in a quick manner and the robot returns a score immediately. It also helps the robot to determine whether a text is negative or positive, toxic or aggressive and so on. The goal of sentiment analysis is to comprehend the underlying feelings that people or groups have about a given subject, goods, service, or event. The friend in the story suggests that soothing tones and patience are the best keys to teach the robots emotions, as it acquiresthe qualities of the owner, so the owner must teach with patience. The Protagonist explains, "When you look at the picture of your son, who has just left a home that now feels empty without him in it, that heart surges with Love" (**ST** 14). The words echo the similarity of emotions in the AEI robots and human beings. The robot here is treated as the protagonist's son and they mutually share a warmth of love. A strong emotional connection between the owner and the son is denoted by the term "love." It includes the emotions like warmth, concern, affection, and a sense of connection. The Protagonist's heart pounding with love connotes a powerful and overpowering surge of happy feelings, including joy and happiness as well as a deep

sense of love and devotion. This shows that in sentiment analysis' machine learning techniques tend to obtain better results than lexical based techniques.

The Advanced AI technologies have been delivering on the promise of banded voice assistants that deliver conversational AI in the customer care section of leading brands. In order to facilitate natural interaction between the owner and the Robot (machine), Speech (audio) is used to detect and recognise emotion. Robots will be then able to recognise the emotional state of the owner and react to the emotion with an appropriate response or action. Charles Spence, an experimental psychologist narrates,

...what is heard is determined by much more than the sounds entering the ears, and the real-world perception needs to be understood as a multisensory experience... It focuses on interactions between audition and vision, both for reasons of space and also because, as it happens, the majority of the research published to date has tended to focus on cross-modal interactions in human information processing between these two senses. (1)

As speech is the expression of emotions, it can be understood before one can understand what is being said. This technique applied through AEI, makes robots recognise the vocal effects even though they presumably cannot comprehend what is being said.

Emotion detection in speech technology is only the beginning of an effort to make the voice experiences more human and personal. This is reflected through the robot's words, "Have you ever thought about how I feel?" Rob shouts. "Do you even think about anyone else besides yourself?" (*ST* 13). It is evident that Robot's emotion and its acquisition of personal identity implies a sense of indifference or negligence. Rob, the shouter, believes the other party is self-centred and uncaring about the feelings of others. This expression denotes the frustration of Rob and its need to be given greater empathy and understanding by the protagonist.

The story also brings out how emotions are attached to sounds and how emotions when triggered, can provoke certain actions and behaviours in the robots. The protagonist explains it as, "It crunches around in the glass, and you can hear its eyes snick in their sockets as it anxiously looks all round your small apartment. The sound unnerves you". (*ST* 4) This conversational voice user interface is one of the most natural, instinctive and interactive mode for humans and robots. The sound created by Rob made the protagonist uneasy, which might be interpreted as fear, worry, or a general sense of uneasiness.

Finally, Artificial Emotional Intelligence interprets and detects human emotional signals in the form of video, using facial movement analysis, gait analysis and through physiological signals. Combining these methods enables AEI systems to analyse many facets of human behaviour and physiology and properly decipher

emotional signals. AEI can thus enable more individualised experiences, improve mental health monitoring, increase user engagement, and contribute to a deeper knowledge of human behaviour by comprehending and responding to human emotions. Yizhang Jiang, a scientist, points out,

...human emotions involve numerous external and internal activities and play an essential role in our daily life. Facial Expression, Speech, and Body Gestures are some of the external activities affected by emotional situations. (Jiang 381)

Understanding facial expressions is an important part of communication and it is incorporated in the machines with recent advances in AI. This new advancement allows a digitised system to interpret emotions automatically through facial expressions. Tracking and examining facial movements, include adjustments of positions and motions of the brows, eyes, nose, mouth, and other facial features. Artificial intelligence systems are developed to infer emotions like happiness, sorrow, anger, surprise, or contempt by looking at these minute indicators. In the story the protagonist describes the facial expressions of the Rob as, "You wake up as Rob taps your chest, his red eyes open wide as he stares down at you. You blink and pull back the blanket" (**ST** 9). He explains Rob's care towards the protagonist through its actions of watching over the protagonist during his sleep.

The story stands as a testimony that technology can implement various types of applications to improve the quality of human-robot interaction. AEI focuses on giving computers the capacity to understand human emotion as well as to generate human like movements for various applications. Gait analysis aims to investigate the relationship between human emotions and their gait or postures. It gives an assessment of the way the body moves, usually by walking or running from one place to the other. This data can offer understanding into emotional states including assurance, tiredness, or tension.

"Scar Tissue", presents Rob recognizing various postures of the protagonist. The protagonist says, "Rob gently crouches down in front of you and starts to pet your shoes, fascinated by the laces. Keeps picking them up and letting them fall back to the top of your shoes" (**ST** 5) Rob's action here is an example of its expression of love, an emotion to the protagonist. Rob is shown in the description as acting inquisitively and like a child, finding joy and excitement in the straightforward act of fiddling with protagonist shoelaces. The act of touching the shoes and tugging on the laces repeatedly implies the innocence and curiosity of expressing the love or appreciation by the robot. This scene depicts a light hearted and carefree exchange between Rob and the protagonist that is marked by intrigue and a feeling of closeness.

Emotion Recognition based on physiological signals play a crucial role in AEI. Physiological Signals are generated in human bodies during the functioning of various physiological systems. Hence physiological signals hold information which can be

extracted from these signals to find out the state of the functioning of these physiological systems. These actions which are considered to be only available to living things can be now seen in robots. In the story narrator expresses, "When it opens its mouth, a gurgling electronic scream warble out", "Rob rolls his Lazer- red eyes dramatically" (*ST* 10). With its dramatic motions and laser-red eyes, Rob is described in these terms as an interesting non-human being with the capacity to make peculiar electronic noises when the mouth opens. These physiological actions performed by the robot, is possible with the physiological system instilled in robots without the presence of the living organs in it. This new trait makes it possible for more human – like interaction between a machine and a human being.

It is true that Emotional Artificial Intelligence can blur the divide between machines and humans. The ability for robots to comprehend and react to human emotions through the use of emotional artificial intelligence has the potential to obfuscate the boundary between humans and technology. This technology bridges the gap between human experiences and machine capabilities by enabling robots to empathise, engage and connect with people on a more emotional and intuitive level. AI technologies are now being used to sense, think, learn and make autonomous decisions for the benefit of human society by providing them with skill sets.

AEI stands for the study and development of technologies and computers that can read human emotions by the means of analysing body gestures, facial expressions, voice tone etc. and react appropriately to them through the story "Scar Tissue". The present study has found that instead of considering AEI as a threat to human beings, it can be used for proactive living. It is further explored that machines with AEI can serve as good companions and helpers to humans. The paper has thus highlighted that a positive environment with love and care, the need of the hour, can be created in future with the help of AEI robots. The story can explore the broader societal impact of human-robot friendships. The future scope could explore the integration of AI in those domains, such as healthcare, space exploration, or environmental protection. Also, leaving readers pondering the possibilities and implications of a future where humans and robots coexist and form deep connections.

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