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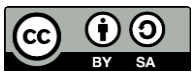

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AI and Language: A Critical Discourse Analysis of Anima Anandkumar's AI TED Talk

Ahmad Vahry Lilam Putra[1*], Hanny Wulandari Fernanto[2], Nabila Yanwarita[3], Suprayogi[4]
[1,2,3,4]Fakultas Sastra dan Ilmu Pendidikan, Universitas Teknokrat Indonesia, Bandar Lampung
E-mail: a_vahry_lilam_putra@teknokrat.ac.id[1*]
hanny_wulandari_fernanto@teknokrat.ac.id[2]
nabila_yanwarita@teknokrat.ac.id[3]
suprayogi@teknokrat.ac.id[4]

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Abstract

This study thoroughly investigates Anima Anandkumar's TED Talk, "AI that Connects the Digital and Physical World," to explore how the narrative of AI is built in the talk. This study employs Van Dijk's socio-cognitive method. The examination focuses on the analysis of discourse of the integration of AI into physical sciences. The study uses qualitative methods in gathering data based on Van Dijk's three levels of framework, it includes; macrostructure, superstructure, and microstructure, it reveals how the idea exploration and linguistic features implemented by the speaker is carefully woven to emphasize the great implications of the speaker's invention that serve as a bridge between AI and physical worlds. The results show how effective language is in spreading information about new developments in technology and the possible effects of artificial intelligence (AI) on different scientific domains. They also highlight the speaker's attempts to build trust and foster cooperation in the face of global issues. communities. This study contributes to the understanding of technological discourse and its influence on public and scientific communities for the general public.

Keywords: *Artificial Intelligence; Critical Discourse Analysis; TED Talk*

Introduction

Artificial Intelligence (AI) is a wide term that includes a range of systems and technologies that may mimic intelligent human cognition and behavior. These systems and technologies can be used in a variety of disciplines, such as entertainment, law, and medicine (Mainzer, 2019). For the past couple of years, AI has taken over the world. According to Ramesh (2023), AI has changed many sectors of industry and facets of contemporary life. It has advantages and disadvantages as well as the potential to influence humankind's future. At least 77% of companies are either using or exploring the use of AI in their businesses (National University, 2023) and 83% of companies in the world claim that AI is their top priority in business plans (Authority Hacker, 2023). However, AI does not only impact the business but also the health department. Around 79% of healthcare firms are already using AI technology as of 2023, and the $19.27 billion global AI in healthcare market (Grand View Research, 2023). This shows how impactful AI has become these past years.

Considering the influence of AI that has been thriving, AI, without a doubt, is the future. However, according to Zuboff (2019), AI is frequently depicted as something that is inevitably flawed and occasionally operates beyond human control. It will cause future AI users to utilize AI with false optimism by overshadowing the worries about emerging AI inventions. Therefore, it is vital for the audience or prospective user of this new AI tool to be more cautious and not just accept it as the future, which is why the study of AI-related discourse is crucial. Thus, this study demonstrates if the arguments held true for all AI discourses, including the one that was selected, as well as how the speaker and the new AI creation were presented in this particular AI discourse.

This study focused on AI discourse on the TED Talk video entitled, “AI that Connects the Digital and Physical World” by Anima Anandkumar, aiming at exploring the construction of discourse of AI through her thoughts. Anima is a professor of Computing and Mathematical Sciences at Caltech and the Director of Machine Learning Research at NVIDIA, a global scale company claiming itself as “World Leader in Artificial Intelligence Computing”. Anima focused on neural networks and AI applications in physics. Therefore, she’s one of the leading figures in technological discourse. Her TED Talk served as an important study case on understanding the strategy used in her AI-discourse to shape the public's perception. This TED Talk discusses how AI can combine the digital and physical worlds.

This study is seen from the perspective of Van Dijk’s framework of Critical Discourse Analysis (CDA). In his perspective, discourse or language in context includes not only the written or spoken words but also how these components interact with and are formed by the social, cultural, and situational settings in which they are used (van Dijk, 1997). In addition, Van Dijk contends that

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understanding a discourse necessitates taking into account the process of text generation in addition to textual analysis. Van Dijk breaks the text down into three levels, which are macrostructure, superstructure, and microstructure.

Previous studies have applied Van Dijk's Critical Discourse Analysis Model to various types of speeches, including political discourse analysis (Alzobody and Naser, 2022), gender representation in motivational speeches (Lestiani et al., 2023), the portrayal of countries in political speeches (Ivana and Suprayogi, 2020), and the persuasive elements of political rhetoric (Nursanti and Triyono, 2022). Furthermore, studies on AI discourse have also been conducted, such as the portrayal of AI in higher education (Bearman, Ryan, and Ajjawi, 2022), AI evolution in mass media (Zhai et al, 2020) and AI discourse in chinese media (Zeng, Chang, Schäfer, 2020). However, there remains a significant gap in the use of this model to analyze speeches related to technology, which play a growing role in shaping public opinion and influencing policy decisions in such a big stage like TedTalk. This oversight leaves a significant area unexplored, particularly in understanding of technological discourse. Accordingly, this study examines the TED Talk by Anima Anandkumar to understand how the speaker used various linguistic devices to bridge knowledge regarding AI to a wide audience.

Method

This research implements the use of qualitative methods. This method places a strong emphasis on investigating detailed phenomena through collecting and analyzing a great deal of highly detailed data, frequently from observations, interviews, and written and visual resources (Denzin & Lincoln, 2018). Moreover, Holosko (2010) defines qualitative research as a kind of study that gathers and uses non-numeric data to understand the meaning of the data. Therefore, this method fits perfectly to the research conducted. Using the text as a guide, this method can assist in comprehending the speech's discourse structures (Ivana & Suprayogi, 2020). In this body of work, this method is used to examine the qualitative data gathered by implementing a Critical Discourse Analysis (CDA), particularly Van Dijk's Sociocognitive approach on a TED Talk discussing AI and the physical world. The data gathered from the source are in the form of words, phrases, and sentences.

The findings in this study are collected from a TED Talk video titled, "AI that Connects the Digital and Physical World" by Anima Anandkumar, uploaded on July 15, 2024 AM using streaming video facility in YouTube. The duration of the video is 9 minutes and 54 seconds and has gained 41.000 views since the release. The TED Talk discusses the real-world applications of AI and how it significantly aids various fields. In gathering the data, the author watched the video on YouTube and transcribed the dialogue using an AI tool, "HappyScribe". To gain a valid

transcription, the researcher watched the video to check if the transcript matched with the dialogue in the video. The researcher implemented the use of Van Dijk's Sociocognitive approach to gather the data.

In Van Dijk's approach, there are three categories of findings the researcher must focus on. The microstructure of a text is the initial level. At this level, the researcher looks at the topic or concept that is discussed in a news story to determine the overall or broad meaning of the specific issue, or, to put it another way, the theme of the topic. The second level, known as the superstructure level, explains the discourse framework in relation to a text's structure, or how its portions are organized to form the entire report. Stated differently, this level enables the researcher to analyze the introduction, substance, and conclusion of the topic and identify the theme in each section (Van Dijk, 1980). The final level, known as microstructure, is a discourse that can be discerned from a short textual excerpt and encompasses lexical coherence, syntax, semantics, and rhetoric.

The researcher looks at the tiniest aspect of the topic at this level, beginning with the words used, speech patterns, etc. The researcher then looks into the meaning of each word choice and if it conveys a power dynamic between the audience and the speaker (Van Dijk, 2008).Because it enables the researcher to extract explicit or concealed signals from the language elements to influence the public's view of AI, this framework is ideal for this study. Finally, each piece of data is examined by the researchers to ascertain its meaning. The writers arrive at a conclusion that encapsulates the results of the investigation after interpreting all the data.

Results

Macrostructure Analysis

The central theme of the TED Talk by Anima Anandkumar revolves around the idea of how to integrate AI in physical sciences, which has become a groundbreaking invention. She stated how neural operators have become a factor of transformation in the wide fields of science and engineering. As stated as well in the title, it introduces the idea on how, "AI that Connects the Digital and Physical World", the TED Talk brings an innovation in the form of a bridge that connects the digital and physical worlds. The speaker also emphasizes the power of AI to create a revolutionary movement in the world of scientific research, engineering, and practical applications. These ideas have been mentioned several times by the speaker, for example;

> ***Excerpt 1.*** *"I am working on AI that transforms the way we do science and engineering. Scientific research and engineering design currently involve a lot of trial and error... You need these experiments to validate findings and spark new ideas."*

> ***Excerpt 2.*** *"We invented an AI technology called neural operators that represents the data as continuous functions or shapes, and allows us to zoom in indefinitely to any resolution or scale".*

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By understanding the first quotation, we can see the idea the speaker tried to expose towards the audiences in the room and watching the video. She stated that, "I am working on AI that transforms the way we do science and engineering", meaning the speaker introducing an innovation that changes the way that we know in regards to the world of science and engineering. In the last example, the speaker demonstrated how the integration work between AI and physical sciences by stating, "We invented an AI technology called neural operators", the speaker explained that, through neural operators, it will allow them to model complex phenomena like cloud movements and fluid dynamics in detail.

Superstructure Analysis

The following is the superstructure of Anima Anandkumar's speech in TED Talk, which basically consists of three big structures namely, orientation, content and reorientation.

Table 3.2. Superstructure Data

<table>
<tr><th colspan="3">Structure of Discourse</th></tr>
<tr><th colspan="3">Superstructure</th></tr>
<tr><th>Orientation</th><th>Content</th><th>Reorientation</th></tr>
<tr><td rowspan="3">Personal experience of Anima Anandkumar.</td><td>Pressure from Society</td><td rowspan="3">Summary of the implications and future directions of AI</td></tr>
<tr><td>Introduction of Neural Operators as the Bridge between AI and Physical World</td></tr>
<tr><td>Potential for a Generalist AI Model in Wide Range Scientific Studies in the Future</td></tr>
</table>

Orientation

In the orientation or the introduction part of the TED Talk, the speaker begins with a personal story about how her parents were engineers and that led to the growing interest in the speaker's mind regarding computerized manufacturing. These are stated in the example below;

> ***Excerpt 3.*** *"I grew up with parents who are engineers. They were among the first to bring computerized manufacturing to my hometown in India. Growing up as a young girl, I remember being fascinated how these computer programs didn't just reside within a computer, but touched the physical world and produced these beautiful and precise metal parts."*

This part of the TED Talk established the speaker's credibility in the eyes of the audience. It will help the audience to have this sense of trust towards the speaker through the sharing of her personal experience that revolves around computer engineering and having it started for her at a very young age. This is a good start for a talk revolving around sciences, because later on, when the speaker talks about AI and how to integrate it with the physical world, every word stated by the speaker will hold credible value and knowledge.

Content

In the content, there are three main ideas the speaker was trying to share with the audience through her TED Talk. The first idea can be gathered by the speaker conveying the limitations of the current AI worlds. This can be seen in the excerpts below;

> ***Excerpt 4.*** *Language models (ChatGPT) hallucinate because they have no physical grounding. While language models may help generate new ideas, they cannot attack the hard part of science, which is simulating the necessary physics to replace the Nab experiments.*

From the example above, the opening statement says the current language models of AI lack physical grounding. It emphasizes the lack thereof from the current AI model. Therefore, it needs improvement so AI can drive the world to a better future. This is brought up on the next idea the speaker shared, which stated that Neural Operators can act as the bridge between AI and the physical world.

> ***Excerpt 5.*** *We invented an AI technology called neural operators that represents the data as continuous functions or shapes, and allows us to zoom in indefinitely to any resolution or scale.*

> ***Excerpt 6.*** *With neural operators, we can simulate physical phenomena such as fluid dynamics as much as a million times faster than traditional simulations.*

From the first excerpt, the speaker shared an invention called Neural Operators that allow them to work better than the previous models. Then, in the next excerpt, we can see the implementation of the invention as the bridge. Neural Operators can work perfectly in simulating physical phenomena better than traditional simulations, which work without the use of this new AI invention. This

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shows the speaker and her team have finally found a way to integrate AI into the real world.

Lastly, the third point the speaker shared in this part is the potential of Neural Operators in a wide range of scientific studies, as stated in the excerpts below;

> ***Excerpt 7.*** *Last year, we used neural operators to invent a better medical catheter.*

> ***Excerpt 8.*** *Exactly a year later, we released FourCastNet. Using neural operators, we built the first fully AI-based weather model that is high resolution and is tens of thousands of times faster than traditional weather models.*

Excerpt 7 shows the use of Neural Operators to invent a better medical catheter. This shows how the invented AI can be used even in the medical field. Moreover, in the excerpt, it shows that it also can be used in numerical weather models. This further emphasizes the broad use of AI in many scientific fields.

Reorientation

In this part, the speaker must tie up the points introduced in the content. In these examples, the speaker, again, emphasizes the power of AI in changing the world and the plan with the invention;

> ***Excerpt 9.*** *"What if you had an AI model that could solve all and any scientific problem? From designing better drones, aircraft, rockets, and even better drugs and medical devices? Such an AI model would greatly benefit humanity. This is what we are working on."*

> ***Excerpt 10.*** *"We are building a generalist AI model with emergent capabilities that can simulate any physical phenomena and generate novel designs that were previously out of reach. This is how we scale up neural operators to enable general intelligence with universal physical understanding"*

Excerpt 9 shows the impact AI would have to humanity in a good way. The speakers gave the audience these hypothetical questions to give a strong impact for the following phrase, which is, "This is what we are working on". This part also means that the speaker and team are in the process of creating a much-enhanced AI tool for humans to use in the future. Lastly in excerpt 10, the speaker explained what kind of invention she was talking about. "generalist AI model with emergent capabilities that can simulate any physical phenomena and generate novel designs that were previously out of reach", based on this quotation, the speaker intends to create a breakthrough AI model that helps humans to reach sectors that were

previously out of reach. This highlights the hope and the plan for the future. The speaker closed the TED Talk by reinforcing the ideas she had on leveling up the inventions and enabling integration between AI and the physical world.

The theme of each part of the TED Talk as stated in the explanation above showcases a very coherent, compelling and structured narrative that conveys a complex idea in a very effective way. Opening the speech with personal stories that expose her first-encounter with computer engineering enhances the credibility of the speaker in the eyes of the audience in the first one minute of the talk. Moreover, it also creates an emotional connection by being vulnerable enough to share personal stories. Then, the content shows a clear progression of the problem from the current AI limitations to the solution and how to apply it in real life. This offers such clarity of the narrative to be followed. In the conclusion or the reorientation, the speaker gives a plan on what to do next with the new invention. This allows the audience to think beyond the present. Overall, the TED Talk was effective in sharing complex scientific concepts but also an engaging narrative for the audience.

Microstructure Analysis

Syntactic Aspect (Inclusive vs. Exclusive Pronouns)

Pronouns that encompass both the speaker and the listener within the same referential group are known as inclusive pronouns. These pronouns are used to convey unity, shared experiences, or a group's identity in various languages. In contrast, the listener is not included in the referential group when exclusive pronouns are used. These pronouns are frequently used to regulate social connections, indicate membership in or absence of a group, and establish boundaries during talks (Cumming & Ono, 2018).

Table 3.3. Inclusive and Exclusive Data

Inclusive Pronoun	**Frequency**	**Exclusive Pronoun**	**Frequency**
I	5	*You*	*5*
My	1	*They*	1
Me	2	*Them*	*2*
We	25		
Our	4		
Us	4		
Total	**41**		**8**

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The microstructural analysis of Table 3.3, focusing on the significantly higher frequency of the pronoun "We" compared to "My," reveals the speaker's deliberate use of inclusive strategies. The speaker utilizes "**We**" to highlight the importance of collaboration in addressing global scientific and technological challenges, such as the application of AI in solving major issues like climate change and nuclear fusion. This strategy creates a narrative that the achievements are not solely individual efforts but rather collective endeavors that require contributions from many people or groups.

Excerpt 11. *"We need to be able to zoom into the fine details of the turbulent fluid flow"*

Excerpt 12. *""Last year, we used neural operators to invent a better medical catheter..."*

In excerpts 11 and 12, it can be seen that the use of the pronoun, "We", is only to refer to the speaker and the team. "*we used neural operators",* and, "*We are building a generalist AI",* these quotations do not refer to the audience as the audience was not involved in the process, rather it's her and her team. Moreover, this also creates a divide between the speaker and the audience.

Exclusive pronouns such as 'You,' a total of 5 times, which suggests the speaker sometimes creates distance between the audience and the speaker. In the context of scientific and technological speeches, it is often used to engage individual listeners, challenging them to think about their role in technological change or development. For example, when the speaker says

Excerpt 13. "*You need to be aware of these changes,*'

Excerpt 14. "*What if you had an AI model that could solve all and any scientific problem? "*

Moreover, other than creating a space between the speakers and the audience. The use of "*You*" can create an urgency among the audience, saying they can participate in the ever-growing AI inventions and to actively participate in the topic at hand. The table above shows that the three most used pronouns by the speakers are We (25), I (5), and You (5). These pronouns serve a different function and most appeared only in one of the parts in the speaker's TED Talk, for instance: In the introduction part, she often time used the pronoun *"I"*. Then, in her content, she switched to, *"We"*. Lastly, in her closing, she switched to a different pronoun, *"You"*. Thus, when we compare the use of inclusive and exclusive pronouns in the TED Talk, there is a pattern found. Anima used the pronoun *"I"* plenty of times in her introduction, such as in her personal experience, what she learned from them and what she had done because of them.

The use of this pronoun in the beginning to let the audience enter her mindset, allowing a sense of credibility to her story. Moreover, it shows the story she shared in the beginning is hers and importantly puts the audience into her perspective first. Consequently, it helps the speaker to gain trust from the audience later on when she explains her and her team's invention. However, when the speaker takes the audience into her main content and introduces her work, there is a switch of pronouns used. She utilizes the pronoun *"We"* for a significant amount in this part of her TED Talk with the intention of being more inclusive to the actor that has an important role in the invention she's introducing as explained in the previous paragraph. Lastly, when the speaker is almost at the end of the TED Talk, there is a switch again for the most used pronoun which is, "You". As stated before, this helps the audience to know what to do after listening to her Talks. *Unlike the use of "I" in the introduction which helps to give personal credibility and the use of "We" in the content part to emphasize collaboration, the use of "You" towards the ending of the TED Talk serves a function to engage with the audience, to tell them that, this is what you can take away from this talk.*

Syntactic Aspect (Passivation)

As one of the major syntactic features, passivation contributes decisively to the structuring of discourse within the CDA approach by Van Dijk. Darmawan (2020) described that passivation or passive sentence is a sentence in which the subject of the sentence in an active sentence becomes the object in passive voice. In Van Dijk's CDA the examination of language is interwoven with the identification of concealed ideologies and power relationships, so it becomes crucial to determine the function of passivation.

When a sentence is passivated, its original subject is either eliminated or occurs in a prepositional phrase that is introduced by the word "by." The object of the active sentence becomes the subject of the passive sentence. By doing this, the sentence's emphasis is changed from the action's doer to its recipient (Huddleston & Pullum, 2002). Passive voice can maintain topic continuity, accommodate accessible concepts, and be communicatively equivalent to active sentences, making it a useful and grammatical tool for scientific talks (Ferreira, 2021). Thus it is crucial to mention the use of passivation in this study.

Excerpt 15. *"...our* ***catheter is being tested*** *in the lab."*
Excerpt 16. *"The* ***natural operators were specialized*** *to understand fluid flow in a tube."*

Essentially, in the given excerpts, what is branded as passivation is the objective of presenting a view of the information where the agents who are executing the action are obscured. For example, in the sentence "*our catheter is being tested in the lab*", showcase how the AI-based catheter they have invented is

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being tested for its effective ways of usage. So, the product will run in ways they have expected. Then, in the last excerpt, "*The natural operators were specialized to understand fluid flow in a tube*", it highlights the action being done towards the AI product they have invented called, "natural operators", showing how this product was made specifically to understand the fluid flow. Moaddab (2014) explained that passive voice is often used when the speaker or writer wants to emphasize a result or when the doer or actor of the action is exposed to danger, risk, loss, blame, or shame, and sometimes resulting in vague description about who is responsible for the action. In all these cases, passivation functions to reframe the narrative, influencing how readers perceive agency, responsibility, and importance. According to Van Dijk's CDA approach, this syntactic option is vital to decipher hegemonic, ideological or power-preserving features of the discourse that aim at diverting attention from particular actors and focusing it on processes and results.

Syntactic Aspect (Discourse Markers)

Discourse markers play a central role in speech production, with their inter-relationships and patterns of use varying across languages and repair types (Crible & Pascual, 2020). Connectivity between discourse markers and the syntactic aspect of Van Dijk's CDA is quite profound as these markers shape the structure and coherence of the discourse. When analyzing discourse markers from a syntactic point of view, CDA reveals how they fit into constructing meaning, framing arguments, and/or perpetuating or subverting ideologies. It is therefore important to be aware of how certain markers work in discourse if one wishes to map out how language plays a role in constructing power and social realities in discourse. There are two types of discourse markers found in the speech, transition markers and hedging markers.

Table 3.5. Discourse Markers Data

Discourse Markers	**Frequency**	**Sample**
Transition Markers	19	But (7), So (4), In fact (2), Instead (2), While (1), And not just that, also (1), Exactly a year later (1), So far (1)
Hedging Markers	14	Can (8), May (3), What if (2), Sometimes (1)

Transitional discourse markers can be used to change, deepen, insert information, shift topics, and connect words in a sentence, influencing the receiver's pragmatic inference (Hu, 2015). Transition markers in discourse, such as "but," serve to introduce shifts in argumentation, guiding the audience through contrasting ideas, conclusions, or comparisons. These markers are important in defining the patterns of rationality of the discourse as well as stressing the relations between the points being made. For example, the word "but" is commonly used to show opposition. This marker became the most used throughout the TED Talk. From the excerpts below, we can see the function of the transition markers, "but", as the tool to introduce the opposing ideas or argument.

> ***Excerpt 17.*** *A full ten days earlier, our FourCastNet model correctly predicted that the hurricane would make landfall,* ***but*** *the traditional weather model predicted the hurricane would skip the coast.*

> ***Excerpt 18.*** *Design a version of the catheter, build it out, take it to the lab, observe a hypothesis, if something went wrong, rinse and repeat, and redesign again.* ***But*** *instead, we taught AI the behavior of the fluid flow inside the tube….*

We can see from the first excerpt that the speaker, first, introduces the ability of the FourCastNet to predict the hurricane to make a landfall. Then, the next idea is to show the contrast ability of the traditional model, as it is not able to do the same thing and would even skip the coast. Then, in the next example, we can see the first idea introduced was the old way of usage of medical catheters without neural operators. However, the next idea following it, is that with neural operators, the doctors just have to teach AI about the behavior of the fluid flow inside of the tube. This, again, emphasizes the contrast idea with the use of "but" as the bridge.

While transition markers regulate the logical connections and organization of discourse, indicating shifts, immediacy, and stress and delimiting events in time, hedging markers facilitate mitigation by introducing uncertainty and an affordable approach that invites multiple readings and interpretations. Hedging instruments in language serve as tools to express uncertainty, highlighting the increasing presence of uncertainty in modern linguistic consciousness (Hyryn, 2020). They do not state facts but create a possibility. That is why modal verbs such as "can" convey the element of possibility and potential, which may shield the speaker from arguments and enable one to make statements more easily acceptable by a wide range of listeners. We can see the use of these hedging markers in the example below.

> ***Excerpt 19.*** *With neural operators, we* ***can*** *simulate physical phenomena such as fluid dynamics as much as a million times faster than traditional simulations*

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In the example above, the speakers showcased the possibility of ability by the neural operators to work a million times faster than traditional simulations. This further emphasizes the use of "can" to show a potential or possibility without holding it as a cold hard fact.

Syntactic Aspect (Rhetorical Aspect)

TED Talk by Anima Anandkumar implements anaphora several times as a way to bring more impact on the speech towards the audience. Creative recurrence of a word or phrase is known as anaphora (Karimovna, 2021). By utilizing it, it will help the speech to be catchy as it repeats a phrase over and over again. For example;

> ***Excerpt 20.*** *"**What if** I ask ChatGPT to come up with a better design of an aircraft wing, or a drone that flies on a turbulent wind?"*
> ***Excerpt 21.*** *"**What if** you had an AI model that could solve all and any scientific problem?"*

The purpose of anaphora in the example is to serve as a hypothetical scenario that will challenge the current situations and create a vision of the future potential of AI's application. Both of the anaphora examples appeared twice in the transcript of the TED Talk.

The syntactic analysis found that the speaker's pronouns, passive voice, discourse markers and rhetorical aspect usage works together perfectly to enhance persuasiveness and provides accessibility of the message to the audience. The strategic use of the pronoun *"I", "We",* and *"You"* serves as a rhetorical tool to show what the speaker wants to emphasize in each part of her TED Talk, from showcasing personal credibility, emphasizing collaboration between the speaker and her team, and making the message to be clearer for the audience to received. The intentional use of personal pronouns in speech is vital in situating the speaker, creating authority, and engaging the audience (Hyland, 2002). Similarly happens with the usage of passivation in her talk, which put the agency of every remarkable finding the speaker and her team got to the AI, which is something the speaker tries to promote here.

According to Fairclough (2003), the use of passive voice in scientific and technological discourse frequently serves to disguise agency, presenting achievements as impartial, inevitable processes rather than human-driven decisions. Then, the use of *"but"*, and *"can"* in the discourse markers help to push the idea of what the AI can do. For instance, introducing what this invention of hers can do, then using "but" to show the limitations of the old invention is a rhetorical tool that promotes persuasiveness again towards the benefit gained from this new invention. Lastly, in the most rhetorical aspects in the TED Talk, anaphora, helps

the persuasiveness by inviting the audience to wonder about a hypothetical situation, and then directly swerves to the introduction of her invention. Anaphora-based repetition add rhythmic emphasis, strengthening essential ideas in the audience's memory and making arguments more powerful (Karimovna, 2021).

Semantic Aspect

Table 3.6. Frequency of Processes

Processes	Frequency
Mental Process	23
Verbal Process	18
Material Process	15
Total	*57*

In the transcript of the TED Talk by Anima Anandkumar, the researcher found the use of mental, material, and verbal processes in a total of 57. In material, the speaker used a total of 15 words, such as: *built, produced, simulate, invent, change, printed, train, propel, validate, replace, attack, seeing, taking, working, need, doing.* Here are the examples of use of those material processes;

Excerpt 22. *"But instead, we* ***taught AI*** *the behavior of the fluid flow inside the tube..."*

Excerpt 23*."I am working on* ***AI*** *that* ***transforms*** *the way we do science and engineering."*

Based on the exceptions above, we can see that AI is very helpful to many people in various fields, one of which is science and engineering. In Except 22, AI can be taught to show the ability of AI to understand complex processes such as fluid flow in tubes, which usually requires a long time and effort. But with AI, it is very helpful to simplify and speed up the analysis of problems that occur in the fields of science and engineering.

The second Except 23 states that AI is being developed to change the way we do research and other things in science and engineering. This shows that AI has the potential to revolutionize the way we work in both fields, by improving efficiency, accuracy, and the ability to solve complex problems. Processes that used to take days, months and even years can be accelerated to a matter of months or even weeks, which has seen AI fundamentally change the way we conduct research and development in various fields of science and engineering. AI is used to predict the properties of materials before they are made, thus speeding up the process of

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discovering new materials for high-tech purposes such as longer-lasting batteries or stronger building materials. AI helps us speed up complex processes and provide fast and accurate results, which is very helpful for many people in various fields.

Then, in the mental process, the speaker uses a total of 23 words, such as: *remember, inspire, hope, understand, predict, imagine, know, seeing, felt, think, believe, realize, expect, wonder, focus.* Based on an understanding of mental processes, it describes the cognitive acts including perception, affection, and cognition that represent how people in order perceive the outside world. These cognitive processes—thinking, knowing, wanting, and perceiving—often disclose the underlying attitudes, ideologies, or views of a writer or speaker (Fairclough, 2003). Therefore, the mental process allows us to deep dive into the mind of the speaker, to see how their mind works and how it manifests itself in the talk. Here are the examples;

> ***Excerpt 24.*** *"I **remember** being fascinated how these computer programs didn't just reside within a computer but touched the physical world."*
>
> ***Excerpt 25.*** *"This memory continued to **inspire** me to connect the physical and digital worlds together."*
>
> ***Excerpt 26.*** *"We can **hope** to stop the bacteria from swimming upstream because of these vortices."*

These mental processes correlate to the mental being of the speaker. For example, the sentence, "*I remember being fascinated by how these computer programs…*", this allows the audience to enter into the speaker's state of mind, specifically, into something that the speaker remembers, a fraction of memories exist in the mind. Then, in the sentence, "*We can hope to stop the bacteria from swimming upstream…*", the speaker holds on to this fraction of belief into what he would love to happen in the future. This, again, plays around with the thinking of the speaker. Lastly, in the sentence, "*Scientists think that AI could help…*", this shifts the perspective as the speakers introduce another actor, which is," scientist", but still play around the concept of mental, which stated with the word. "*think*", which again, allows the speaker to see the state of mind of the actor being represented in the talk.

Lastly, in the verbal process, the speaker utilized a total of 18 words, such as: *ask, suggest, propose, explain, claim, describe, state, argue, declare, announce, report, mention, point out, express, indicate, inform, and question.*

Excerpt 27. *"What if I **ask** ChatGPT to come up with a better design?"*

Excerpt 28. *"It may **suggest** something."*

Excerpt 29. *"Our neural operator model was able to directly **propose** an optimized design."*

Those are used in the text to convey ideas and direct the audience to understand what the speaker said and stated. In the context of the TED Talk, these verbal processes are central to shaping the discourse, as they allow the speaker to share information, raise questions and assert the importance of the issues being discussed. For example, the speaker uses the phrase "What if I ask ChatGPT to come up with a better design?" This verbal process highlights the speaker's inquiry into the potential capabilities of AI, and invites the audience to consider future possibilities. Similarly, in "It may suggest something," the speaker shifts attention to AI's role in generating ideas, further emphasizing AI's interactive potential in problem-solving scenarios.

Furthermore, phrases such as 'Some scientists argue that deep learning is not enough' and 'The team explained their findings in a recent publication' reflect the scientific discourse surrounding the development of AI. These verbal processes demonstrate the exchange of ideas and findings within the scientific community, contributing to the broader conversation on the topic. The speaker's use of verbal processes such as ask, suggest, explain, state, argue, and declare functions to guide the audience through complex concepts, establish credibility, and engage the audience in the ongoing dialogue about the role of AI in science and engineering. These verbal actions are essential not only for conveying information, but also for fostering interaction and collaboration between the audience, the speaker, and the wider scientific community.

The findings in microstructure analysis showcased that every single word used in the speaker's TED Talk are not neutral, rather a strategy to shape the audience's perception towards this AI invention the speaker introduced. Every microstructure aspect works hand in hand to ensure that AI is framed as a product of collaboration, a needed improvement from the existing tools and also, helps the speaker be framed as someone credible to be sharing about this. Therefore, it showcases a positive perception of the speaker and the work.

Power Dynamics in Language Choices

Based on the findings in the pronoun's usage, the speaker uses "I", "We", and "You" not only to showcase the message but also to emphasize the power structure that needs to be received by the audience. Starting from the use of "I" to explain her authority to her experience, the use of "We" showcases scientific credibility of the speaker and her team by explaining every tried and true they have done to achieve the recent more improved AI invention, and lastly, the use of "You" positions the

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audience as the future or potential user of this AI invention. From these findings, the researcher found that this TED Talk puts the speaker as the experts of this AI invention and the audience is here to learn from her. Despite the fact that TED Talk is a place for the audience to learn from many speakers, her use of certain pronouns for certain parts of the talk emphasize that power dynamics even more.

Then, the passive voice helps to create a sub-power to AI beside the speaker and her team. It also helps to erase the existence of institutions' interests in doing the many tests of the AI, rather she presents AI as a force outside of human control. Passive voice in technological speech frequently serves to depersonalize responsibility, producing the illusion of objectivity and inevitability (Van Leeuwen, 2008). The use of discourse markers further takes the sub-power of the new invention of AI to a new level. By using, "but" in her TED Talks, the speakers emphasize the limitations of the old tools and promote the improvement of the new AI-based tool. This helps the audience to perceive the new AI-based tool as not only an improvement but needed in the relevant sector, which helps in giving power to this new invention. The purposeful use of contrastive speech markers can enhance ideological dominance, favoring one viewpoint over others (Schiffrin, 1987).

Based on these findings, there's three levels of power dynamics in the TED Talk; the speaker -> new AI invention -> audience. The speaker alongside her team is the one above all the invention and credible to be working on it, as well as introducing it to the audience. They are also the one the audience can learn from in regards to the topic. Then, the second place is the new AI invention, where some moments AI is presented as tools that work outside of human's authority, but in one of the example in excerpt 22, it shows how human sometimes has the authority towards AI, putting AI as a tool that works with both feet standing in two sides. Lastly, when it comes to the power dynamics of the audience with the new AI-based tools and the speaker, the audience is the future user of this new invention and the students of this talk. Based on the findings in pronoun usage, the speaker addresses the audience directly when it comes emphasizing the message or the 'call-to-action. This analysis of the power dynamics in this TED Talk helps us to better understand the message that the speaker's sharing. By knowing what role each of the actors in this talk, allows us to know based on the positions of us in the power dynamic, what message to receive.

Conclusion

In her TED Talk, Anima Anandkumar discusses how artificial intelligence (AI) can potentially be applied to science and engineering in particular to bridge the digital and physical worlds. The speaker makes the connection between difficult concepts in artificial intelligence and real-world applications using approachable

language, personal stories, and technological examples. By utilizing Van Dijk's methodology for Critical Discourse Analysis, the research reveals how Anandkumar's TED Talk is carefully planned and structured from the theme, opening, content and closing. How each part serves a different message or idea, yet, together, creates a coherence for the audience to understand. The use of inclusive pronouns was essential, as it served a function to make the talk didn't feel one-sided, instead, everyone in the room felt included and shared a responsibility in the process of AI enhancement.

Rhetorical devices like anaphora were intended to make the talk sound catchy and leave a mark in the audience's memory. Also, organized discourse markers to engage the audience and make AI understood for non-experts. The power dynamics in the TED Talk better help the audience to know their position in this talk and what message that needs to be taken. Moreover, the power dynamics also most times erase the authority of humans in the process of improving the AI invention and portraying AI as an independent tool. This aligns with what Zuboff (2019) argues in her work that AI is often portrayed as a product that works beyond human decision-making, especially institutions or corporations' interests. Moreover, it is inevitable for the speaker based on her expertise to avoid biases in her talk. In fact, in her talk she focuses only on the positives of this new AI invention, and erases any concerns that appear in AI discourse.

By using Van Dijk's methodology to analyze technical discourse, this work closes a gap, especially when it comes to conversations about artificial intelligence to a range of audiences. This research only focuses on the linguistic aspects of the TED Talk and does not include visual elements, which would emphasize the message more. Future researchers can incorporate multimodal discourse analysis to provide more comprehensive findings. Moreover, future studies can analyze how AI discourse in various sectors such as business, education, etc., are different. This extension of analysis to various domains will help to uncover the differences of how AI is framed and the power dynamics exist in certain discourses. Consequently, researchers can help a deeper and more inclusive AI conversation.

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