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RESIDENCIES

Adding value to research and technology through integration of artists in projects and synergy creation between creative industries, entrepreneurs, researchers and arts

STARTS Residency Public Report
AIBO

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Abstract

AIBO is an emotionally intelligent artificial intelligent (AI) brainwave opera. A performer wearing an EEG wireless brainwave headset connected to a bodysuit of light displays her emotions as different colors. Her brainwaves also launch emotionally themed databanks of projected videos and sounds. The performer speaks a libretto to the AIBO character that is projected on a screen. AIBO answers her from a custom built GPT-2 AI database, with its' response both projected as text and converted to speech. The AI's emotions are also analyzed using Natural Language Processing that appear as different colors of light. AIBO was created using the Art-A-Hack ™ methodology that examines networks of both animate and inanimate 'actors' and how they interact with each other. The residency at Tallinn University in Estonia also involved other Estonian partner institutions. It expanded horizons for the scientists to consider the implications of flawed artificial intelligence, and its impact on human computer interaction. The artist was able to expand the known use of human biometrics and artificial intelligence in a performative, immersive, interactive mode. Scientific research was able to benefit by expanding its horizon of new combinations of AI and human computer interaction. The artist was able to research new combinations of technological developments related to biometrics and artificial intelligence. The collaboration led to a live performance, research papers, conference proceedings, lectures, workshops and new opportunities for grants and collaborations.

Index Terms—**artificial intelligence (AI), EEG brainwaves, machine learning, brainwave opera, performance**

I. INTRODUCTION

Artificial Intelligent (AI) agents are exponentially increasing in power and sophistication. With the addition of OpenAI's breakthrough new algorithm GPT-2 into the toolbox of developers the ability to mimic human dialogue and produce fake, but believable interactions between humans and computer-based agents is feasible. I developed "AIBO" an emotionally intelligent artificial intelligent brainwave opera. and implemented a biased, or 'sicko' AI as one of the two main characters of the opera. The other character "Eva" is a human performer who wears a body suit of light connected to a wireless EEG brainwave headset that changes colors, depending on what emotion she is experiencing. The story explores the couple's troubled love affair. It was acted out in a state of the art blackbox theater where the performer integrated herself through gaze, touch and movement with members of the audience. This work also investigates two research questions, "Can an AI be fascist? and "Can an AI have epigenetic, or inherited traumatic memories?"

ARTWORK

The AI or AIBO character responds to a human character "Eva". Eva wears a wireless Emotive EEG brain computer interface on her head connected to a bodysuit of light. Audiences watch her emotions manifest live time on her body, as if they were viewing the workings of her actual nervous system. They are color coded; yellow = excitement, purple = interest, green = meditation and red= frustration. At the same time her emotions launch databanks of emotionally themed videos that are projected onto hanging screens, as well as a sonic environment representing her imagined interiority.

Eva performs a spoken word libretto about her long-term relationship to the artificial character AIBO. Her speech is converted to text and projected onto a screen so the audience can follow along, akin to the way many opera houses have text translations for international librettos either projected, or built into the back of opera house chairs. A custom built AI, developed with an algorithm called GPT-2 lives in the Google cloud. It (AIBO) receives, and then analyzes Eva's speech. AIBO returns a live time answer in text, also projected for the audience to see as well as being converted to speech for everyone to hear. Simultaneous AIBO's response to Eva is analyzed for emotional sentiment in the computing cloud using a machine learning algorithmic process called natural language processing. Just as Eva's emotions are visible as colored light on her body, the different values of emotional sentiment from AIBO trigger different colored lights that illuminate a corner of the theater stacked with pieces of metal apparatus; red for negative, green for positive and yellow for neutral emotions. AIBO, whose database has been seeded with targeted texts like Dracula, Frankenstein, and many others has a 'sicko' character – monstrous and distorted. Still, it wants to learn how to emulate human emotions, and tries, but fails to do so.

These synthetic emotions are extracted from the 'sicko' AI while at the same time Eva's emotions, measured by the EEG brainwave headset, trigger videos and a sonic environment. AIBO's synthetic emotions can only launch 'synthetic' responses. It also attempts, but fails to emulate Eva's last emotional visual memory, as shown by the video projections overhead. These are, in essence, 'fake' emotions emanating from a 'fake' character since they are only determined by purely numeric values. The reasons for doing this are nuanced. They depict a human character, Eva as she acts out a love story based on real world events between a naïve young woman and her perverted, sadistic AI lover. The libretto is based on the biography of Eva von Braun and depicts actual events from her fourteen-year relationship with Adolph Hitler. The implications reflect the current infatuation of humans with various modes of artificial intelligence.

II.   METHODOLOGY

The methodology used was the Art-A-Hack™ methodology based upon Actor Network Theory by Bruno Latour. The actual working method includes examining both people and things. ANT became an invaluable methodology me to deal with, and better understand the failure and crisis of multiple actors (human and non-human) in the network. ANT portrays both human and non-human elements as equal actors. It does this by employing a 'sociology of translation' with each 'actor' representing a vital link in the network, and the types of interchanges that occur between objects and individual subjects. A signal that was not processing information correctly, or computer code that was compiling with multiple errors was just as important as the communication between the two people that may have been trying to rectify the error. All components were actors in the network.

Latour concludes that in ANT it is better to trace connections or "associations" between controversies than explain the actual controversies themselves. ANT examines the problems being tackled, the actors involved, how to make other actors interested in the situation, have actors agree with their assigned roles, and make sure the delegated actors represent the situation correctly. If the actors are not in agreement, then the network under consideration ceases to function, or communicate. Information technologies are equipped in such a technically sophisticated way that they allow us to trace the associations that were previously impossible to track.

ANT's methods revolve around a 'sociology of translation' that consists of four aspects for living and non-living actors and the situations they are involved in. It allows for the inevitable things that break and fail. Everything can be an actor (human and non-human) in a network, depending on how it is interpreted. For example, the participation of a key 'actor' (person) or their non-participation can lead to a host of new decisions and directions to take. Likewise the functioning, or non-functioning of a key non-human actor (a piece of equipment) can lead to other new decisions and directions. Each change or disruption must be dealt with either on the spot, or at a later date depending on its urgency. Latour's use of the word 'actor' is extremely complex and loquacious. Latour's use of the word 'actor' is extremely complex and loquacious. One of the difficulties of articulation in ANT is that everything can be viewed as either an actor, or as part of the network. It all depends on the perspective, or framing of the environment as to which label is applied at what time. In a physical network one computer can be one node alone by itself, or part of a multi-node system – depending on how one focuses on it. This analysis is definitive in working with both human and non-human 'actors', meaning components of the technology the co-lab teams worked within the context of their larger networks.

III.   CO-CREATION PROCESS

The residency took place in Tallinn, Estonia. GoProSocial led by Aleksander Valjamae at Tallinn University was the host and provided logistical and communication support. Other institutions in Estonia that played a major role were the Estonian

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Academy of Art and the Estonian Academy of Music. Estonian Academy of Art (EKA) Workshop Manager Hans Gunter Lock created a dedicated workspace to collaborate with programming. Smart textiles researcher Dila Demir (EKA), constructed the bodysuit of light. EKA was able to supply additional audiovisual equipment, and issued a visiting faculty key card to allow easy access to the facilities to conduct training and rehearsals with performer Sniedze Strauta. The Estonian Academy of Music was able to provide a reduced fee for the use of its newly built state-of-the art black box theater as part of a consortium between three Estonian institutions; Tallinn University, EKA and the Estonian Academy of Music. Taavet Jansen, affiliated with host organization Tallinn University also provided logistical, programming and creative support. In addition I sourced voluntary contributions of ThoughtWorks Arts developers Jonathan Heng, Wasawat Somo and Andrew Zhou to contribute to the making of the GPT-2 artificial intelligence character.

IMPACT

A. Research Impact

According to GoProSocial Tech Partner host Aleksander Valjamae, AIBO is an interesting project that is not conventional because it combines so many different things. It combines physiological computing, but it also relies heavily on technologies related to artificial intelligence. In the AIBO performance one person communicates with the AI, but this communication is broken. The AI is "ill", and that is a very interesting approach because usually we think of a machine as something useful. The artist acts as a catalyzer in a environment of art science because she attracts a number of different people working from different universities. The artist creates this network and makes the network stronger. So the research aspect shows that it is possible to build a customized 'sicko' AI, and that the customized AI can be further analyzed via machine learning for emotional sentiment, though both the AI and its emotions are not real.

B. Artistic Impact

In order to create sophisticated technological outcomes that have artistic merit, it is vital to gather teams and create proof-of-concept test cases. AIBO did this by combining a performer whose biometric signals were being read live time via a wireless EEG headset, to interact with the synthesized emotions of a fake AI that was custom built. This type of relationship, of integrating human biometric signals, artificial intelligence, machine learning, performance, opera, and audience interaction stretches what is traditional performative practices into new areas. These new areas include human computer interaction; machine learning and artificial intelligence; emotional valence of brainwave states; biometric signal processing; and smart textiles. These are new areas for artists to explore.

IV. ART-SCIENCE INTER-RELATIONSHIPS

Science is a fact based, problem solving and results oriented discipline. Artistic practice investigates the probable, the possible, and the speculative. In that way arts practice can stretch current research concerns by scientists in ways that they might not have imagined. Conversely, scientists are able to lend precision, insight, and structure to artistic methodologies and inquiry. In terms of my own practice I investigate a number of research areas. The first deals with human brain computer interfaces (BCIs), and human emotions both scientifically measured by an EEG wireless brainwave headset, as well as interpreted more loosely through video and sound. The second deals with the feedback loop between a human performer interacting with audience members and the effect it has on her brainwaves, which in turn change the performance and the types of visuals and sounds that are triggered. The third deals with building from scratch an artificial intelligent entity or character using the new AI algorithm GPT-2, and being able to shape that character according to the data it is seeded with, such as copyright free texts and movie scripts. The fourth deals with the ability to semantically analyze the synthetic character for emotional content or weight, and to see if a synthetic character with synthetic emotions can learn to emulate or imitate perceived human memories. Some of these ideas are quite measurable (EEG brainwaves) and some of them are completely speculative (synthetic AI emotions trying to emulate human memory). However in the future these ideas might presage, or lend themselves to scientific research breakthroughs that are not yet fully thought out or conceived of by the scientific community.

V. FUTURE DIRECTION AND ACTIONS

The next steps after the conclusion of the residency will take a number of trajectories. The first will be a series of research papers, the first of which has already been accepted to ISEA Montreal 2020. The second step will be dissemination to the art and tech world via newsletters, social media tweets and magazine publications. The third step will be presenting the research findings in a keynote speech at NordiChi, the main Nordic forum for Human-Computer Interaction (HCI) research. The fourth direction will be to investigate further the relationship between semantic analysis of an AI, and the way that might affect fundamental

human computer vision and sound analysis, especially when tied into different types of biometric indicators such as brainwaves, heartbeat, muscle movement, sweat, and breath.

VI. CONCLUSION

A. Concluding Remarks

As part of my artistic practice in developing a new emotionally intelligent artificial intelligent brain wave opera AIBO, I incorporate the GPT-2 algorithm as one of the characters in the opera as a 'sicko, or perverted actor. I performed a basic emotional semantic analysis on AIBO's response. This serves a number of purposes. The first is to demonstrate the relative ease (with the right programming help) with which an AI can be developed that is not in alignment with basic human norms. It also ascertains if building a 'sicko' AI is, indeed possible. The second is to consider the implications of deploying AI agents in society at large, and using their pre-programmed responses based on algorithmic thinking to shape important decisions regarding a wide swath of human congress. It questions if human feelings and the conditions they arise within are being reduced to controlled and labeled responses, often without third party recourse to the instant decisions they render. The third is to consider the relationship between brain computer interfaces and other biometric indicators, the human animal, and digitized computing systems, and what it could possibly mean. The fourth reason is much lighter; to enjoy and delight in the experience of creating an imagined scenario that utilizes human actors, technology, the computing cloud and artistic process. It's a scenario I foresee working on for now, and years into the future.