Artificial Intelligence Improvisation

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Abstract

Improbotics is a transnational, interdisciplinary theatre company experimenting with improvised comedy where human actors perform alongside artificial intelligence (AI)-powered chatbots and robots. It functions as a theatre laboratory that bridges the arts and sciences to develop AI technology, conduct academic research, and stage entertaining shows for the general audience. Co-design between actors and AI developers enables synergies where playful, creative, and exploratory interests of artists stimulate novel ludic applications of technology originally designed for pragmatic purpose, and technology itself inspires novel forms of performance. The company explores aspects of AI deeply embedded within modern human culture, from chatbots and machine translation to video communication, and integrates them within traditional performances and cultural spaces.

Improbotics is based in 4 different countries (UK, Canada, Belgium, Sweden), and during the pandemic, has rehearsed and practiced together online in virtual reality. It has also designed a theatre show around real-time live translation and the comedy of (speech recognition) errors in the attempt to blur linguistic boundaries.

Integrating live AI within traditional performance practice fosters a co-creative ethos where the AI becomes experienced as a creativity support tool and then ultimately an anthropomorphised stage partner that actors endow with personality through role-play. The cast members in turn, find humour and inspiration from both limitations and possibilities stemming from imperfect AI.

This experiential trajectory of the performer has become a design focus where we use AI to engage the public about the risks of AI to human culture while also presenting a co-creative mindset to technology as a tool for cultural creation. Our shows are co-created with audiences who act as allies for the actors and technologists, experimenting together on stage as they try to make sense, in real-time, of the uncanny presence of a seemingly intelligent and creative technology.

The focus on playfulness and celebration of failure encourages a different kind of exploration with the technology, and lowers the barrier to entry to experimental work with AI. The success of our troupe both in finding new forms and modalities of live performance through and with technology as well developing novel technologies with applications both for live performance and other ludic domains may rely on the core improvisational activity of accepting the offer—whatever it may be—from the other objects encountered on stage. Following this logic of acceptance and collaboration shifts the nature of interaction with AI from replacement to empowerment and enhancement for human creativity.

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1 Description

The 3-minute video *Artificial Intelligence Improvisation* documents the development and performance process of our theatre company *Improbotics*, which stages improvised theatre and comedy shows with a human cast performing alongside generative artificial intelligence and physical robots.

Our company uses the following promotional description on its website[1]:

> Improbotics is a science comedy show and a live Turing test. An artificial intelligence-based chatbot is performing alongside a human cast, and it tries to pass as human as it sends lines to one of the improvisers via an earpiece. Our hilarious challenge is to attempt to justify, physically and emotionally, AI-generated lines that may make no sense at all.
>
> Improbotics was co-created by AI and robotics researchers Piotr Mirowski (UK/France/Poland) and Kory Mathewson (Canada) in 2016. They were later joined by drama director Jenny Elfving (Sweden), science communicator Ben Verhoeven (Belgium), communications and digital media lecturer Boyd Branch (US) and drama lecturer Sarah Davies (UK). Our show combines ideas from our previous troupe HumanMachine's Artificial Intelligence Improvisation, and from the classical improv game called "Actor's Nightmare" or "Lines From a Play".
>
> Improbotics has been featured in the New York Times, Time Magazine, Financial Times, Wall Street Journal, New Scientist, BBC, Sky News, RTÉ One, Globals News Canada, Bloomberg. The award-winning show has received critical praise in numerous reviews: ***** (Theatre and Tonic, Edinburgh Fringe 2023). **** "Exceptional" (Everything Theatre, AI Festival London 2023). "Groundbreaking work [...] high-quality comedy theatre [...] poses serious philosophical questions" (Fringe Review, Brighton Fringe 2022). **** and Ballsy Award (Binge Fringe 2020). Most Innovative Show Award (Paris Online Fringe 2020). ***** "If I were introduced to a show like this as a kid, I would definitely have paid more attention to science class" (Phoenix Remix, Brighton Fringe 2019). **** Edmonton Fringe 2018. "This could be revolutionary" (Broadway Baby, Brighton Fringe 2018). "I will stick with artificial stupidity" (Colin Mochrie, Edinburgh Fringe 2017).

2 Media and Creativity

Our AI improv show has pioneered the use of language models on the theatre stage, to provide a human actor with an AI stage partner embodied by a physical robot [6, 5]. An evolution of the show replaced the robot by a human actor (the so-called *Cyborg*) and who is performing verbatim theatre by taking and repeating lines generated by the language model, combining theatrical interpretation skills with the freedom not to worry about what to say in unscripted performances [4, 8], and investigating absurdist theatre [3].

Subsequent versions of the show introduced live performance with real-time machine translation, enabling multilingual improvisation [7], image-based improvisation where actors react and inspire AI-generated imagery or automatically generated presentation slide decks [9], and tele-immersive improvisation where actors rehearse and perform together in a virtual space without the need of VR headsets, simply by combining the video feeds of different actors into a shared virtual space [1].

Our approach allows to demystify aspects of machine learning and AI for theatre audiences, and in turn helps initiate a dialogue on the current concerns around generative AI.

3 Relevance to Diversity

Our project is interdisciplinary in nature and bridges the arts and the sciences. We illustrate, through our practice, how interdisciplinary collaboration between theatre practitioners and technologists can address the lack of diversity in technology, and how technology can be used to blur geographical and linguistic borders.

[1] `https://improbotics.org`

First of all, we collaborate with researchers in AI or in digital media design, as well as with theatre industry professionals such as actors, directors and dramaturgs, to create a show for diverse audiences.

Secondly, our shows challenge the lack of diversity in technology by using satire to highlight, in front of the audiences, the various biases inherent to machine learning models.

We are based in 4 different countries (UK, Canada, Belgium and Sweden), and during the pandemic, we have rehearsed and practiced together online by building and leveraging virtual reality tools for tele-immersive performance [1].

We have also designed a theatre show [7] build around the concept of real-time live translation, mutual understanding and the comedy of (speech recognition) errors.

4 Copyright and Licenses

We follow the license terms of all technology tools that we use, and respect copyright for all visual and music material that we use in our shows.

By its nature, improvised theatre remixes existing cultural artefacts into ephemeral storytelling performances. These performances are co-created between the actors and the audience but exist only in the moment of said performance[2]. As the audience can witness, generated text or images are not the final artistic output, and are not distributed post-performance: instead, they were impermanent, like improvised theatre. Generated images went through a layer of transformation by serving as source material to inspire live, improvised performance of human actors.

5 Security, Safety and Ethics

We follow the guidelines of theatre and improvised theatre and conform to a code of conduct agreed by leading theatres and improv schools in the UK (Hoopla)[3] and in Canada (Rapid Fire Theatre)[4].

When we interact with AI language models and image generators, we first rely on a combination of automated filters (keyword-based), and of Perspective API toxicity filters to avoid presenting inappropriate material to the actors who operate the AI. Second, the actors operating the AI filter the content based on relevance and suitability for the audience. Third, the company takes responsibility and ownership for the content of the shows.

Our philosophy and humour consists in "punching up" (as in satire and irreverence) rather than "punching down" (as in mockery towards individuals).

Whenever we conduct human-computer interaction studies, we obtain ethical approval from our research institutions.

[2]Each performance is unique and we do not use improvisational techniques to devise the script of comedy sketches that will be published and performed again at a later date.

[3]`https://www.hooplaimpro.com/code-of-conduct-performers.html`

[4]`https://rapidfiretheatre.com/anti-harassment-policy/`

Figure 1: Three performances of visual theatrical improvisation. Left photo shows image generation process with “brush strokes”. Left and center photos show image prompter in front of the laptop. Right photo shows the image curator holding a tablet. Credits: Stuart Hollis, Lidia Crisafulli.

5.1 Ethical Implications of Using Image Generation

As image generation technology developed, it became widely available to both visual artists and the general public. The fact that images can be generated in the style of specific visual artists gave rise to controversies and ethical concerns about plagiarism and misappropriation of artistic work that cannibalise creative economies[5] [2].

By employing image generators in the context of a show for diverse theatre festival audiences, we provoke and then engage members of the general public attending our show about their perception of generative AI, illustrating possible uses of AI, inviting their scrutiny during and after the performance, and addressing concerns of the cast members and artists with whom we discussed about the show.

Specifically, we discussed the format and aim of the visual improvisation with our cast members, with members of the public to whom we flyered the show, with audiences in informal discussions before and after the show, with audiences during the performance through a qualitative survey[6], with journalists from over 10 different press venues who interviewed us[7], and with participants of a panel on art and AI during Edinburgh Festival Fringe 2023. Common concerns focused on copyright and the misappropriation of artists' work when using image generation, and its destructive impact on the creative economies. Additional concerns included the appropriateness of generated images, their multiple representational biases, and the devaluation (via automation) of human creative work.

In our show format, illustrated on Figure 1, we presented alternative collaborative and co-creative applications of generative art that invite human performers directly into the generation loop, curating and responding to outputs from image generation systems as part of live interaction. As the audience could witness, generated images were not the final artistic output, and were not distributed post-performance: instead, they were impermanent, like improvised theatre. Generated images went through a layer of transformation by serving as source material to inspire live, improvised performance of human actors.

6 Funding

Our theatre company has been self-funded and is operating thanks to proceedings from show ticket sales and occasional corporate training workshops.

7 Biographies of the Proposers

Dr. Piotr Mirowski is a Staff Research Scientist at DeepMind. His research on artificial intelligence covers the subjects of reinforcement learning, navigation, weather and climate forecasting, as well as a socio-technical systems approach to human-machine collaboration and to computational creativity. He is the author of over 60 papers that have been published in Nature, Genome Biology, Clinical Neurophysiology or at ICLR, AAAI and NeurIPS. Piotr studied computer science in France at ENSEEIHT Toulouse and obtained his PhD in computer science in 2011 at New York University,

[5] https://www.judiciary.senate.gov/imo/media/doc/2023-07-12_pm_-_testimony_-_ortiz.pdf

[6] Results from our survey, approved by the Ethics board of the University of Kent, will be the object of a longer publication.

[7] Tina Daheley for the *BBC World Service - Cultural Frontline*, "What the AI revolution means for arts ", 4 March 2023, https://www.bbc.co.uk/programmes/w3ct37sv, Mike O'Sullivan for *Voice of America*, "Artificial Intelligence Can Create, But Lacks Creativity, Say Critics", 26 April 2023, https://www.voanews.com/a/artificial-intelligence-can-create-but-lacks-creativity-say-critics/7068177.html, Gary Baum for the *Hollywood Reporter*, "Why AI Isn't Funny: At Least Not Yet", 1 June 2023, https://www.hollywoodreporter.com/business/digital/why-ai-isnt-funny-at-least-not-yet-1235503678/, Jay Richardson for *The Scotsman*, "AI is taking over Fringe comedy; can robots be funnier than humans?", 31 July 2023, https://www.scotsman.com/arts-and-culture/edinburgh-festivals/ai-is-taking-over-fringe-comedy-can-robots-be-funnier-than-humans-4238383, Elizabeth Greenberg for *DIGIT News*, "Yes-anding AI: Artificial Intelligence Stars at the Edinburgh Fringe", 16 August 2023, https://www.digit.fyi/yes-anding-ai-artificial-intelligence-stars-at-the-edinburgh-fringe/, Gillian Tett for the *Financial Times*, "Can AI crack comedy?", 26 August 2023, https://www.ft.com/content/818f2cab-57ff-42c3-917b-4a83f1d87802, Katie Collins for *CNET*, "AI Took the Stage at the World's Largest Arts Festival. Here's What Happened", 2 September 2023, https://www.cnet.com/tech/ai-took-the-stage-at-the-worlds-largest-arts-festival-heres-what-happened/

with a thesis supervised by Prof. Yann LeCun (Outstanding Dissertation Award, 2011). A trained actor himself (London School of Dramatic Art), Piotr founded and directs Improbotics, a theatre company where human actors and robots improvise live comedy performances and investigate the use of AI for artistic human and machine-based co-creation.

Dr. Kory Mathewson is a Senior Research Scientist with Google DeepMind and an Associate Industry Member at Mila - the Quebec Artificial Intelligence Institute in Montreal, Canada. Kory holds a Ph.D. in Computing Science from the University of Alberta with the Alberta Machine Intelligence Institute. His research focuses on understanding intelligent interaction between humans and machines, most recently in the domains of interactive, conversational systems, and creative applications of artificial intelligence. Kory is also a Canadian Comedy Award-winning improvisor, producer, and innovative theatre creator currently living in Montreal, Canada. He is known for his productions and performances around the world including Improvised TED Talks (alongside Julian Faid), The Professors and Plays by Bots (alongside Joe Vanderhelm), as well as Improbotics and HumanMachine (alongside Piotr Mirowski).

Dr. Boyd Branch (Improbotics London/Online) an Assistant Professor at Coventry University where he directs the virtual and augmented reality masters program, and is an APiRE fellow for the Centre for Dance Research. He is an improvisational media, collaborative AI, and performance specialist. He works across disciplines with scientists, engineers, and artists to develop novel tools, experiences, and pedagogies aimed at fostering adaptive radical social change through play. A former Fulbright fellow, Branch's critically acclaimed art, designs, lectures, and workshops have been produced off-off-Broadway and major cities in the U.S., England, Colombia, the Netherlands, and Pakistan (sponsored by the US State Department). He directs Improbotics (Online) and co-directs Improbotics (London), He is also the founder of the Improvisational Media and Performance Lab, which explores how improvisational pedagogies can be utilized to create accessible, adaptive, and socially supportive technologies. He holds a PhD in Engineering and Digital Media from the University of Kent, and an M.F.A. in Interdisciplinary Digital Media from Arizona State University, and an M.A. in theatre studies from the University of Utrecht in the Netherlands.

Jenny Elfving (Improbotics Stockholm), is a Swedish actor, improviser and playwright, who trained at Boulevardteatern, Stockholms Improvisationsteater, and Västerbergs Folkhögskola. Since 2011 she has taught numerous improv classes at Stockholms Improvisationsteater, International Theater Stockholm, and Improvisation & Co. As a member of the independent improv group Dramatiska who focused on dramatic genre based longform, she has co-produced and performed in Improvised Tennessee Williams, Improvised Ingmar Bergman, Improvised Woody Allen, Improvised Hitchcock, and the smash hit that played for a full house for 5 seasons: Improvised Roy Andersson. With Dramatiska, she performed at the New York City Improv Festival 2013, SWIMP 2017 and Best of Stockholm 2017. She is also the founder and producer of the improv group Hybris, which performs frequently in Stockholm and is known for their modern Impro-Flow concept. Jenny has also played 7 seasons in the improvised children's show Sagogrottan, co-founded the experimental group Achtung Impro in 2017. She is currently directing her own play Invulnerable at Teaterstudio Lederman.

Dr. Ben Verhoeven (Improbotics Flanders) is a Belgian science communicator and improviser. He has a strong scientific background as PhD in Computational Linguistics and has let improvisation take over his life ever since. In his own company ERLNMYR, he performs improvisation shows about science (Hoofdstof, Improbotics, Full STEAM Ahead) and provides applied improvisation training to scientists. He is the co-founder and managing director of Swaajp Improtheater in Antwerp. They perform regularly in English and Dutch and have their own Swaajp School of Improv in which Ben is a teacher. As a member of Commotie — musical improvisation — he won the Kemphanen competition for best long-form improvisation show in Flanders in 2017. He also travels to international improv festivals to take workshops and masterclasses, to see shows, to teach, but also to perform with — for example — the Dutch-Belgian ensemble "Werewolves, the improv show" which he co-directs. He is also active in his new trio Prism, and the Brussels-based group ImproBubble. As a passionate organizer he is also a founding member of The SIN — an international network of ambitious improv players and organizers in Europe.

Sarah Davies (Improbotics London) is an Improviser, Drama Lecturer (UAL Acting) Producer and Playwright. She has a BA (Hons) in Drama with English, a Masters Degree in Drama and a PGCE in Post-Compulsory Education. In addition to performing with Improbotics since 2018, Sarah is part of duo Twinprov, and co-runs troupe Plus Support. She performs in house teams Shuffle and The MOB

with Hoopla (London), Close Distance with The Global Improv Project (Queen City Comedy, USA), City Impro (London/touring) and co-runs The British American Experience with Highwire Improv (USA). Sarah has coached improv widely, running improv school Improv Gym, Kent, and teaching for organisations including The Global International Improv Symposium, Improv College Canada, Mount Olymprov Festival, Greece (with Will Luera, Big Bang Improv) and Extreme Improv. Sarah particularly enjoys experimenting with new formats in improv, taking risks and pushing boundaries whilst focusing on connections and relationships. Sarah trained in playwriting at The Royal Court Theatre's Young Writer's Programme and her commisions include for Theatre Centre, Cambridge Junction and Now Press Play. Her plays have been performed at festivals, new writing nights, and at venues including Waterloo East Theatre, Southwark Playhouse and The Royal Court's Site. Sarah has also worked as a Theatre Reviewer for Total Theatre, and a Director for new writing, Fringe and student productions.

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