International Symposium

Limits of the human, machines without limits?

Contemporary stage and robotics: exchanges and collaborations

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ABSTRACTS

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ABSTRACTS

KEYNOTE SPEAKERS

Bleeker Maaike, *From HRI to Human Robot Intra-action, and Some More Lessons to be Learned from the Theatre*
Professor, Utrecht University, Department of Media and Culture

Ten years ago, Heather Knight published "Eight Lessons Learned about Non-verbal Interactions through Robot Theatre" (2011). Knight observes that theatre settings may provide a testing ground for robot behavior and HRI, and identifies several characteristics from the theatre that are also relevant to socializing robots. These include the use of relatable gestures that can clarify activity goals, the fact that embodiment supports affectivity, and that the readability of behavior for humans is a better benchmark for design than internal AI. Knight's observations are tentative and rather general, pointing to commonalities and shared interests between robotics and the theatre, without getting specific about what exactly might be learned from the theatre with regard to these. Which is perhaps no surprise give the fact that her expertise is first and foremost robotics, and not theatre. Knight herself describes the work done by her text as "sampling" and expresses the hope that her findings may motivate further investigation. My presentation is a response to her pioneering text from a different moment in time and from the perspective of the theatre. Starting from work done since the publication of Knight's text, including our current research project "Acting Like a Robot: Theatre as Testbed for the Robot Revolution", I will argue that important lessons might be given in how expertise from the theatre invites a reconsideration of fundamental assumptions underlying the development of robot behavior and HRI, in particular with regard to their human-centered and imitative character. I will show how theatre may contribute to new materialist and posthuman approaches that shift attention from imitation to relatability and relationality, allow for new ways of understanding the agency of non-human actors, and acknowledge human-technology interactions and HRI as open ended developments that build on historically and culturally specific ways of perceiving, interpreting and interacting, while also holding the potential of transforming these very practices and taking them in new directions.

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Ishiguro Hiroshi, *Art and technology with androids*
Professor, Department of Systems Innovation, Osaka University
Visiting Director of ATR Hiroshi Ishiguro Laboratories

We have developed a number of robots that interact with people. These robots have not only technical meaning but also cognitive science meaning. These robots can be used to reveal the meta-level cognitive mechanisms of humans. This kind of research approach is called a constructive approach, and it is important to work on this constructive approach as an art. We can get to the essence of robots and humans through excellent artistic works using robots. In this lecture, we will discuss not only robot technology, but also the role of art in robot development.

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Paré Zaven, *An interaction design study with robots. From non-verbal interaction to conversation*
Professor, University of Rio de Janeiro, The Intercontinental Academia

My work consists in creating robot's narratives, by inserting laboratory experiments into drama situations. This use of simulations helps understanding the potentialities of different relations between humans and technological devices or artificial creatures. Beyond the character effect, the reality effect or the presence effect, in order to provoke sympathy, and above all to arouse empathy, the interlocutors must be intelligent. I have tried to suggest it by inventing behaviors specific to robots, thanks to movements and sounds usually produced unconsciously by humans. With the simulation of micromovements and the production of robots' involuntary sounds, besides the reinforcement of their presence effect, their interlocutors are able to give them a potential state of emotional consciousness.

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Parker-Starbucks Jennifer, *Limits of the (non)Human: Cyborgs, Technologized Animality, and Boundary Crossings*
Professor, Head of the School of Performing Arts and Digital Media at Royal Holloway, University of London

From 'cyborg' bodies on stage to an exploration of non-human robots and robotic animals, this keynote investigates technological advancements and robotics in art and performance practices as they augment, and interrelate with, human lives.
Looking at an interdisciplinary range of examples from science and technology to theatre and performance, the talk turns to the development of robotic/technological animal forms and cross-species performance encounters of 'technologized animality' (between humans, animals and technologies). The talk moves across and through three different layers of animal mechanization—*mimetic replacement* in automata and robotic forms; *biomimetic participation* in learning processes; and *collaborative co-design* in artistic practices—to identify where these species crossings, through the use of robotic and immersive technologies, might bring the nonhuman into a more collective "association" that offers room for nonhuman animal agency.

PARTICIPANTS

Abramović Boris, *Performing Robots: The Uncanny and Otherness*

That a feeling of unusual presence associated with deeply-rooted fears and/or excitements may arise in the encounter with a certain type of objects or phenomena, was first pointed out by Sigmund Freud in his essay The Uncanny (1919). Masahiro Mori points to an eerie sensation which robots may trigger based on their anthropomorphism – when robots' external appearance

is too human-like, we may slip into an Uncanny Valley (1970). Rather than taking on a Morian realism- based approach, Elizabeth Jochum and Ken Goldberg point not to the robot's physical appearance being similar to human, but its behavior being excessively human-like, as a trigger for a mix of fascination and fear - termed as Experiential Uncanny (Jochum & Goldberg, 2016). Drawing on different conceptions of the Uncanny, this paper explores the notions of otherness and difference in robotic arts, focusing on robots that mimic non-typical human appearance and/or behavior. Despite the robot's otherness being often seen as a barrier to effective interaction, this paper sheds light on otherness as an aspect that triggers human emotions toward robots, with uncanny sensation on the one side and affiliation on the other being two main points of the spectrum. To build those arguments, this paper will investigate three case studies. Louis-Philippe Demers' Blind Robot (2012) enacts visual impairment to encourage bonding and emotional connections, by touching the face of a human with its technological hands, in a way similar to a blind person when recognizing someone's face (Demers, 2012). Chris Verdonck stages Dancer # 3 (2010), a clumsy robotic theatrical performer, dancing awkwardly with many technical malfunctions, and, hence, causing empathy and positive emotions (Verdonck, n.d.). Norman White's The Helpless Robot (1987), draws on limited mobility impairment - first luring the audience to help with its movements, triggering empathy and affection, only to become increasingly demanding and over- vocal towards the audience, thus causing discomfort and fear (White , 2016). Based on these case studies, the paper raises the question of the potential of difference and otherness in human-robot creative interactions.

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Alcubilla-Troughton Irene, *Rule-Based Improvisation in Social Robotics: The Value of Limits and Emergence in HRI*

This presentation aims at addressing the issue of how to create a common approach and dialogue between artists and engineers in the interdisciplinary field of performing arts (theatre and dance) and robotics. In particular, it delves into how this conversation is taking place within the frame of the Acting Like a Robot Project, to which my PhD research on movement in robotics belongs. I wish to propose in this talk that improvisation practices, understood as rule-based and emergent, can provide this common ground between roboticists and theatre and dance practitioners, and can also offer interesting and novel ways of developing robotic movement and HRI. Movement research in general, and movement improvisation in particular, is usually employed in robotic projects from a goal-oriented perspective and mostly through human imitation. Our project, however, takes on a different route. I would like to propose that the current research on movement improvisation in robotics is limiting and that by using specific improvisation techniques that are rule-based and emergent, we can achieve a more creative and fruitful approach to HRI. Improvisation in the practices we use in the project is determined by a set of rules that do not inform goal-oriented choices, like for instance the goal of expressing a particular emotion or idea. Rather, these practices offer a set of possibilities for movement to emerge in response to external stimuli. These practices also foreground the importance of limits, not as constraints to be overcome but as possibilities for the emergence of new ways of moving. Using William Forsythe's *Improvisation Technologies* and Anne Bogart and Tina Landau's *Viewpoint Technique* as examples of this type of improvisation, further explanation will be shown as to how these techniques can be used in robotics.

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Arnulf Théo, *Installation and performance, labs for robotic diversity?*

My proposition seeks to encounter with non-anthropomorphic robots and observe how they shift every category in performances shared with humans. These moving machines act in

another theatrical frame than *mimesis*, and with a performativity that differs from the familiar or uncanny presence of androids. They seem to belong to another world of signals, design, technicity that cannot entirely be enclosed and understood by behaviorism. Alternative robotics, freed from the urge to mimic humanity, are nonetheless deeply linked to the human body as they have one of their own. In a context where installation tends to be performative and choreography inspired by installation, and where both take place with the perspective gaze of theatre stage, my interest will be less about the disappearance of humans as in *Stifters Dinge* by Heiner Goebbels or in *Sacre du Printemps* by Romeo Castellucci, but rather about post anthropocentric stage. How can we take into account the diversity of existences, living and mechanic, that are interacting on stage ? Are machines a new step of ecosophy on stage or the persistence of human domination ? How do machines make contact with the performers and the audience ? Uncanniness is also a matter of movement. Biomimetic robots or walking androids can be more terrifying than actual animals or insects. When it is usually so hard and expensive to make an android move (battery and motor wise), the machines I study impose their presence through large movement, flying and stasis in midair, with their peculiar strangeness and qualities. My main focus will be therefore on these specific interaction between humans bodies and machines that are characterized by separation and parallelism. Rather than being connected and co-dependent, it appears that the persons and devices nurture a relationship of conjunction and independence based on movement. This intervention will focus on three works : the installation *Black Flags* by William Forsythe (2015) where two industrial robotic arms wave a black fabric of silk, the dance performance *Phoenix* (2018) by Eric Minh Cuong Castaing with a work on drones and the theatre performance *Con Grazia* (2016) by Martin Messier and Anne Thériault where moving structures illuminate and percuss the stage. Just as the humanoid robot was a platform for ancient and recent mythologies, stricken by the normativity of the imaginary, and myths such as overpower, transhumanism and artificial intelligence, these moving machines are at the crossing of many other stories, genres and gender, from industrial life to illegal war. They reveal the unexpected entanglements of actions and they underline a technicity often hidden or disguised. My aim is to decipher eventually how they evoke poetically omnipresent beings around us that produce new subjectivities, and how they make us think about the robots we would need to design.

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Van Baarle Kristof, *Spectral machines*

The work of Belgian visual artist and theatre maker Kris Verdonck has, since the beginning, explored how dehumanization and capitalist fueled technologization have brought humans and nonhumans, subjects and nonhumans into an ambiguous gray in-between zone. This has led to dancing machines, performative figures consisting out of human performers and machinic contraptions, and musical robots. In this presentation however, I want to focus on recent performative objects and machines in Verdonck's work. These challenge our notions and conceptions of what is usually considered 'a robot', and push it beyond the anthropomorphic shape and dream of eternal life. Data-driven consumerist capitalism, intertwined with eco-catastrophe has changed the nature of the gray in-between zone where human and nonhuman performers meet from an uncanny valley into a spectral plane (Morton). Robots, machines can no longer be considered detached from ecology. I will analyse how Verdonck's latest machines – in *Something (out of nothing)*, *ACT* and *Extractions* – have become spectral figures (Agamben). Influenced by the dramaturgies of Noh-theatre and Samuel Beckett, these spectral machines are at once very materially present, and prefigurations of extinction, replacement, absurd nothingness and a world beyond human presence. Verdonck shows how non-anthropomorphic but also non-anthropocentric kinds of 'robots', lose their known forms and become matter (Berardi), data, distorting time and space, presence and absence.

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Bergmann F. Michael, *Cultivating Empathy through Robotic Performance*

This paper will examine the role that performance can play in creating empathy for robots, specifically non-humanoid performers. I suggest that empathy is the first and foundational approach to bettering human-robot interactions and relationships, and critical in rewriting existing narratives around robots' role in society. The comparison of robotic workers as slaves cannot, and should not, be ignored. Within the realm of performance, there is an opportunity to adjust the narrative from robots-as-slaves (beginning from Čapek's Rossumovi Univerzální Roboti) towards one of recognition of freedom and expression. I argue that the way into this is empathy. Suppose empathy can be generated for non-humanoid robots and the understanding of them as not being simply tools: In that case, there is hope for a more positive baseline as AI, robot rights and ethics continue to be developed. In science fiction's most honourable goal, this approach allows for the continued critical examination of our role in people's oppression and dismantle those oppressive systems by observing them recontextualized. This creation of empathy in performance will be examined through two case studies of performances that we have created. The first, The Uncanny Robots Project, was a research-creation project exploring the possibilities of creating robot choreography from captured human-generated movement. It culminated in a multimedia performance between a human dancer, Belinda McGuire, and a KUKA KR150 industrial robot. The audience for the performance was not one accustomed to watching dance. Their feedback highlighted the emotional reaction in watching the performance and changed their feelings on what they perceived as a towering industrial machine. The second case study involves a forthcoming project entitled l'automate. A prototype video skit is being created with Blue Man Group performers and a KUKA KR10 robot, with the support of Cirque du Soleil Entertainment Group. The piece is character-driven, allowing the audience to experience the robotic character's emotional journey from fear to eventual acceptance. Being entirely performed physically and without dialogue, the medium allows for a consistent baseline for the robot and human performers to interact. The Uncanny Robots video is already available to watch in its entirety: https://youtu.be/w6UOxHGPpCY. By the conference time, there will be videos of both case studies available to be shown as a part of the presentation.

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Cecconi Francesca, *Tech insights in Puppet Theatre language*

«How do you prove to be human?» It is the head of an Amletic robot that interrogates the audience at the end of the show *Robot Dreams* by the German company Meinhardt Krauss Feigl, a performance that includes dancers, automata, robots and animatronics. The title is a clear reference to the work of Asimov, whose main themes are present within the show with references and quotations, such as the constant reflection on «What do robots dream of? ».The show was performed at the Festival mondial des théâtres de marionnettes in Charleville-Mézières in 2019, confirming its belonging, in the section related to new experiments, to the world of puppetry. This is not an episode in itself, increasingly in the world of puppetry we can see the appearance of new technologies and robotic elements in performances. From Puppet Robots to mechanical gloves, from animatronics to great puppets: puppet theatre is moving much faster than other theatrical techniques towards the discovery of new technological means. The present study aims to investigate the relationship between puppeteer and robot within the contemporary scene, exploring the interaction between the artist and the object manipulated through sensors and new technologies. In puppet theatre, the puppeteer, wearing a glove, gives life to the puppet, the body of the puppet is formed by the hand of its manipulator. What happens when the puppet is made through a prosthesis created in animatronics? How is the manipulation

handled during the performance? Who manages the machine in relation to the puppet master's work? The aim of this research will be precisely to try to answer these questions, starting from some embryonic examples, such as *Bit* the electronic puppet animated through a cyberglove created by Giacomo Verde to the prostheses created as animatronics in the show *Robot Dreams* by the company Meinhardt Krauss Feigl.

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Yin Chen Chu, Cîrcu Silvia, Teles de Castro Isadora, *Coevolution, Co-Creation and Improvisation H2M (CECCI-H2M): Promoting a sustainable behavioral coevolution within an emerging Human-Machine co-creation*

The basis of our research is an ongoing study by a team of researchers from NTHU in Taiwan on the therapeutic treatment of addictions (using connected 'persuasive' technologies and IOT). Built-in questionnaires and survey methods for the patient and his entourage, will help us work on the notion of dependence and analyze the patient's degree of awareness facing his own addiction. The scientific work of NTHU will be doubled by an artistic approach. Based on what this behavioral co-construction could be in daily life, our artistic team will imagine forms of co-creation and improvisation between performers and autonomous artificial entities. These artistic experiments focus both on the relationship between Human and Machines, as well as on the subject of addiction and its impact on a patient's behaviour. The second part of the project represents an artistic transcription of concepts like behavioral co-evolution, co-creation and choreographic improvisation within the context of codependency. Our aim is to question the possibility of symbiotic relationships between several interacting systems, in order to determine which triggers which. We also challenge the possibility of representing these relationships on stage through a final dance performance, result of several artistic experiments done earlier. This performance between a human, a HRP Robot (Humanoid Robotics Project) and an Evolving Virtual Ecosystem (EVE) that surrounds them, will sum up our observations regarding the phenomena of addiction.

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Chikaraishi Takenobu, *Development of a new robot business based on Kogei and art*

This presentation introduces a new robot company based on the collaboration between robotics and art (especially Japanese traditional craft "Kogei") The presenter has been working on the robotics to show to audiences. He worked for exposition of the android in World Expo at Aichi (2005), Human-Robot theatre, cinema and opera. He defines Japanese traditional craft "Kogei" in robotics and trying to spread this technique.

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Eacho Douglas, *Becoming Automatic: Algorithmic and Robotic Performance after 2008*

How should we understand the relationship between "algorithmic" performance and robot performances? And why have both genres erupted into wide practice and commentary over the past decade? Rather than point to technical development, I argue that we should view both as instances of *automatic* performance, situated in the wake of the 2008 financial crisis and the recognition of structural declines to global productivity growth. Our labour produces less in the world than we think it should, and new technologies have not supplemented that lack. This stagnation is of central concern to performance, a form in which labour is put on view. Paris-based dance company Le Principe d'Incertitude (Liz Santoro & Pierre Godard), in works such as *For Claude Shannon* (2016) and *Maps* (2017), has generated dances through digital

algorithms, explicitly staging the limits and inadequacies of such techniques of value extraction. Their dances show the drive towards automaticity as desperate, fantastical, and nevertheless pervasive in its embodied effects: a condition that also underpins late robot performances. The problem of *automatic performance* may thus incite a disciplinary turn to historically materialist critique.

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Eckersall Peter, *The big laboratory*

The Eraser series: *Eraser Mountain* (2019) *Eraser Forest* (2019) and *Eraser Fields* (2020), made by playwright- director Okada Toshiki and chelfitsch, with scenography by the visual artist and sculptor Kaneuji Teppei is a new kind of theatre that asks: 'Can we use theatre to present a world in which people and objects are completely equal, rather than trapped in their usual subservient relationship?' (Okada 2020). Made in response to the aftermath of the Fukushima disaster, the collaboration between Okada and Kaneuji produces a hauntingly unstable theatrical event that includes non-human forms, video projections, lighting and soundscapes, and a vast colony of objects. Okada directed his actors to perform as if they are 'half-transparent', translucent, and their unstable characters are often remediated and projected onto screens at oblique angles to the front of the stage. The work integrates 'Eizo- Theatre'— theatre using projected images of performers as: 'an attempt to transform exhibition space into theatrical space' (Okada 2020). This paper explores the 'half-transparent' actors and the space of eizo theatre as an augmented and extended idea of the human that is part machine and part assemblage. Reading these performances through posthumanism and in relation to Sabu Kohso's study of the Fukushima disaster, *Radiation and Revolution* (2020), I consider if the Eraser series can be understood as a testbed of objects and things, some of which are invisible and deadly, others benign. Can this be thought of as a theatre that exists for other reasons and with non-human agents in mind? At the same time, the themes and motivations for the series remind us about the 'laboratory of endurance' that Kohso says is now the human condition.

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Fourmentraux Jean-Paul, *THE ROBOT BEING Deviant machines, dysfunctional objects*

(...) it is better to collaborate with the machine than to fight against it or to resist... Bill Vorn.
This communication will propose to question what it means to "be in relation" and "in dialogue" with robots, on the stage of a theater or an exhibition, when they see themselves simultaneously endowed with autonomous and dysfunctional behaviors. We will pay particular attention to the "modes of being" of these robots, at the interface of the spectacular and the breakdown. To do so, we will study the polymorphous work of Canadian artist Bill Vorn, bringing to life artificial creatures driven by unbalanced algorithms. The goal will be to show how, at the heart of these works questioning the deviant behavior of machines, psychotic robots constitute a new species of non-humans with whom relations of control and dialogue are staged. The examination of these relations deviates from the path often taken, but now perceived as quite ambivalent, of anthropomorphism: consisting in designing robots in the image of human or seeing in them duplicates of the human. Indeed, if many artists have experienced the promises and limits of the dream of familiarity and union with the robot, this first tendency of humanoid robotics - that of animism or analogy - is is seen partly upset by a dilemma inherent in artificial life, which the Japanese roboticist Masahiro Mori called the « uncanny valley ». He thus designated a zone of discomfort or strangeness (inspired by the disturbing strangeness theorized by psychoanalyst Sigmund Freud), in which the more an android robot appeared similar to a human being, the more monstrous its imperfections seemed to us. The humanoid, rather than generating empathy,

could then lead to loathing, strangeness, worry. The analogy, the resemblance therefore has its limits, which can be disturbing, and on this level at least, we are still very far from being able to imagine a "technological singularity" likely to lead to the indistinction between human and robot. But the path taken by Bill Vorn (and his companions of scenes) is quite different. It invites us to overturn the ideal of the intentional and behavioral autonomy of robots which, like humans, also have their weaknesses, derailments or bugs. My communication will be based on a series of installations, performances and recent shows: Bedlam, with Simon Penny (2001-2003); and with Louis-Philippe Demers, Hysterical Machines (2002-2006); DSM VI (2014); Inferno (2015-2020). Gladly ironic, even sarcastic, these works question cybernetic processes and the dilemmas of artificial life, to the point of considering the possible derailment of machines and robots from the field of behavioral psychology.

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Fuoco Ester, *The other seen by itself. Posthuman aesthetics in 'Rimini Protokoll's 'Uncanny Valley'*

Not all artistic practices that deal with technology or that use living beings must be considered as "posthuman material": making posthuman art, in a certain sense, also implies being (a cluster of) posthuman subjectivities, understanding and consciously exercising a certain ethics that not only includes the overcoming of anthropocentric conceptions in relations with the living, the semi-living and the inorganic, but also the ability to conceive new methodologies of thought and practice (HAYLES 1999). In this sense, the show of the German collective Rimini Protokoll *Uncanny Valley* (2018), whose only protagonist is a humanoid robot, will be presented. The show will provide the cue to argue how contemporary theatre, in its exasperated experimentation, has attempted to express the consideration of a human in terms of processuality, as a "becoming", a changing entity that can only be provisionally defined on the basis of its relations with the other (CORVIN 2014), so as to make the posthuman body, exhibited or absent, appear as a new stage in the ongoing process of cultural hybridization, as a new frontier of our complex relationship with the world (CARONIA 2002). Rimini Protokoll's work echoes how postmodern man, instead of mastering technological devices, began to design them in his own image until they became an extension of his own body: one of the many possible semiotic conversions, from thing to object, from object to full-fledged semiotic actant (PARÉ 2011). The performance *Uncanny Valley* explores the implementation of a neo-humanism based on a new relational foundation, choosing the theatre, the primary place of interaction and relationship, as the basis for its experimentation. According to a posthumanist perspective, the robot-actor embodies on stage a model of permeating and metamorphic technology, that is capable of modifying the very essence of the performing body (MARCHESINI 2019). A human character, a well-known German writer, is presented on stage through a video and replicated by an android, between an aesthetic of disappearance and an aesthetic of appearance, in a dialogue between a replicated body and a dematerialised body.

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Kotolloshi Ervina, *The robot-creator, a new displacement of the boundary between organic and inorganic?*

This proposal aims to explore a new kind of relationship and connection between humans and robots. The project *Ai-Da* that is the perfect example of how robotics and artificial intelligence are literally embodying human creativity and recomposing the interactions between humans and robots. Ai-Da, the world's first robot-artist, creates, performs, communicates about "her" latest creations in United Nations, TEDx events, and even publishes on social media. Ai-Da uses the new media dramaturgy to stay in permanent contact with her followers on her

Instagram account where she regularly communicates on her upcoming public appearances, her exhibitions, etc. These new skills raise questions about artwork's authorship: who is the creator of the artwork, the algorithm's inventor, the robot's designer, or the robot-creator who follows the instructions of the machine? These recent developments in creative robotics are also raising additional questions about the audience reactions online. Ai-Da has a high level of human resemblance and "she" generates feelings to social media users. The new media dramaturgy accompanied by the robots' coherent socio-cognitive behaviors produces an illusion of life to the spectators or social media users, a feeling of being in the presence of an intelligent and socially conscious creature - *sonzai-kan*, "feeling of being in the presence of another person". Ai-Da is an anthropomorphic robot « who » generates human empathy, affects both creation and presentation of art creations and embodies hybridity and symbiosis of several human and non-human actors like: the network, the technology, the physical and digital. This project reflects real-world concerns such as the robotization of the art, the robotization of the art's communication, the further humanization of robots, and the autonomous creativity of robots. This project is blurring even more the boundaries between art and commercial purposes of these robots, the organic and the non-organic interactions. As a result, the performative spaces of art galleries and the performative spaces of social media sites become the "ideal places" to analyze the interactions between humans and non-humans and to question us about the place of human creators: do we still need their presence in order to guarantee the meaning and the intimacy of interactions?

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Lepage Louise, *When stage robots make us weep: An argument for the significance of theatrical realism and character in creating robots we care about*

The robot performer is a machine and yet theatre practitioners manage to make us empathise with, even cry for, it. Sometimes we care about these robots more than we do for their human counterparts. How does this kind of response happen? What are the parts and structures that enable such an empathetic reception of such spectacular machines? My interest in performing robots and their capacity to conjure empathy in audiences has taken my research in the direction of uncanny valley studies, a field that engages such disciplines as robotics, animation, and psychology. This field proposes a host of compelling reasons for the likeability of humanlike objects such as the robot. These reasons, significantly, develop out of Masahiro Mori's proposition (1970) that an object's degree-of-realism of human-likeness is fundamentally important to its likeability and uncanniness. Mori's theory is that the more human-like an object appears, the greater its degree of shinwakan (a Japanese term that imprecisely signals affinity, familiarity, likeability, and the meeting of minds), but, when the object becomes too humanlike, it plunges into the uncanny and produces feelings of revulsion and fear (such as might be produced by a zombie). What is curious about studies that set out to test Mori's theory and its more recent refinements is that, despite the compelling nature of that theory, these studies generally return inconclusive, ambiguous, or puzzling results: for example, study participants find an image of a real man less likeable than a cartoon version of him, when the opposite should, according to the theory, be true. My proposition, in response to such surprising results, is that the problem lies in the fact that realism needs to be understood, in the terms of Mori's theory, more complexly and comprehensively than as an indication of appearance only; it needs to be understood as an aesthetic category. Theatre's staging of robot performers and characters can help us to see ways in which theatrical realism underpins engagement with robots, both on and off the stage. I have discovered, through my research, that, in addition to realism, character plays an important role. My paper will analyse two performing robots: Geminoid F (cast in Oriza Hirata's plays, Sayonara and Three Sisters: Android Version, performed by Seinendan Theater Company) and Myon (cast in Gob Squad's My Square Lady). Both robots materialize on their stages as highly likeable humanlike robots. Hirata and Gob Squad exploit the

possibilities of theatre in very different ways but both anthropomorphise their robots, prompting audiences to see the robots as kin; both also foreground the robots' species idiosyncrasies, showing how they are distinct, strange, or other. But all the while, these practitioners, despite their robots' dissimilar forms and performance approaches, manage to engender audience empathy for their spectacular machines. My paper will articulate ways in which they accomplish this.

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Loesel Gunter, *Mechanical Mothers, Rubber Hands and Child Machines. A Psychological Approach to Anthropomorphization of Machines on the Theatre Stage*

This contribution takes a close look at anthropomorphization as a basis for the perception of and interaction with machines on the theatre stage. It will reference the underlying psychological concepts of projection, introjection and identification and will reference influential empirical findings on this. The differentiation between automats and autonomous agents will be introduced as crucial for understanding new developments as they arise through Machine Learning and Artificial Intelligence. While automats perform a preset sequence of actions, autonomous agents can make decisions based on real-time information and an evaluation of the situation. This facilitates new and deeper forms of anthropomorphization than we have known before. The contribution will describe and discuss new options and affordances and relate them to the theatre. AS autonomous agents exploit the human tendency of anthropomorphization, ethical, technical and artistic questions arise that are challenging and should be a matter of discussion.

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Macioszek Sabina, *"Human-machines ecologies": performances that explore close coexistence of people, machines and technologies*

In recent years, some performers have focused intensively on interactions between humans, machines and new technologies. The artists engage autonomous robots in their projects, they "transform" industrial machines into their artistic partners, and also speculate about the common future of people and technologies. The multiplicity and frequency of this type of stage activities confirm that the community of people and machines is a particularly intriguing topic. Artists use various ways of functioning of technologies or show different machines behaviours to analyse their impact on humans and the reality. That is why I decided to introduce the issue of the "human-machines ecologies" here. The word "ecology" – as 'study of home' – emphasizes the mutual relations between various factors coexisting in one reality. Thus, the performances I am going to discuss in my speech can be seen as experiments examining the levels and quality of the joint existence of people, machines and technologies. The term "human-machines ecologies" is taken from the article titled *Machine behaviour*, published in April 2019 in "Nature. International Journal of Science" (no. 568/2019, pp. 477-486). The authors of the text prove that machines and new technologies are not so much engineering artefacts, but are actors with specific behavioural patterns, as well as they can evolve. Machine behaviour and machine evolution are influenced by social contexts: machine-with-machine relations and machine-with-people relations. Therefore, according to the article, talking about the human-machine ecologies is fully justified. First of all, machines, technologies, algorithms and AI play an increasingly important role in people's everyday lives. Secondly, they are complex systems, that can be difficult to analyse. The more often they are examined in a different context (not only from the perspective of programming and engineering, but also from the perspective of art), the better. Thirdly, the development of machines, technologies, algorithms and AI seems to require predicting their impact (both positive and negative) on the

world, other machines, people and art. I will present the issue of the "human-machines ecologies" in performances from three perspectives. First of all, I will focus on projects in which performers try to change the way people think about machines or robots as "subject" to man, being his "servants". As an example, I will discuss some of the live performances of the song *We are Robots* by Kraftwerk (from 1978 to now). Secondly, I will discuss projects in which artists try to highlight the emotionality of the robots they work with in real time on stage. I will focus on the performance by Huang Yi, who dances together with the KUKA robot (2013). I will also mention the opera *My Square Lady* by Gob Squad (2015), whose main protagonist is the robot Myon, who learns during the opera what emotions are. Thirdly, I will discuss projects that speculate about the common future of people, machines and technology. Among others, a rather dark, but at the same time ironic vision of such a future was presented by Polish director Anna Karasińska in the performance *2118.Karasińska* (2018). There appears i.a. the theme of the last man in the world, who learns from the machine what emotions were. It's also a world where humans can date robots. In this part, I will also mention the experiment entitled *AI: When a robot writes a play* (2021). According to the producers, it's the world first play created by artificial intelligence, to be specific – system called GPT-2. In the summary, I will refer to the words of Erika Fischer-Lichte. In her book *Performativität: Eine Einführung* she describes the futurological aspect of some performances. She maintains that the power of performance as a futurology is not about "designing normative images of the future", but about studying the performative process "that produces the future". Thinking about the future, the important element of which will be the intimacy of people and machines, as well as the functioning of codes and laws for machines, is more and more popular. The performances I will discuss also deal with the issues of "producing the future" and "giving rights" to machines, as well as analyse the problem of machine ethics. This is a particularly important topic because machines and new technologies consistently affect the reality and even can control human activities.

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Branch Boyd, Mirowski Piotr, Mathewson Kory, *Hell is other people's robots*

This essay examines live improvisational performance between human actors and artificial intelligences as a case study in how the stage elevates technology from object to subject. In doing so, it seeks to illustrate how performance is uniquely situated to interrogate the assumptions of individual autonomy in relation to the perceptions of the other, whether that other is a human or a technological artifact. The presence of robots on stage with humans evokes the argument for an ontological distinction between matter and mind -- as defined by René Descartes -- where humans and robots can equally play both roles. Shared stage presence thus provides a platform to examine the growing anxiety around artificial intelligence and human utility. Improbotics is an international theatre experiment based in London, Montreal, Stockholm, and Antwerp, which stages live improvised theatre co-performed by humans and machines. A.L.Ex (the Artificial Language Experiment) is a special kind of chatbot that generates contextualized original sentences in response to human dialogue. Most goal-driven artificial intelligence services (like Alexa and Siri) that are trained to respond to domain specific requests with pre-trained responses. In contrast, A.L.Ex generates original sentences in response to open-domain human input. Rather than working with a disembodied electronically-produced voice, Improbotics feeds A.L.Ex's lines to a human improvisor who becomes a performative cyborg; the human gives natural inflection and physical embodiment to the machine-generated text. Improbotics challenges the Cartesian divide between technological bodies and programming minds by having human actors serve as the mouthpiece for sentences generated by artificial intelligence, which in turn has been trained on large text corpora derived from human culture. The presence of the cyborg rejects the ontological and binaried distinction between man and machine. Improbotics encourages a phenomenological reexamination of the human technological divide. By elevating robots from object to subject, Improbotics turns the

stage into a laboratory for Alan Turing's eponymous test. Audiences are invited to vote (through the expression of human emotional responses such as laughter) for the actions on stage they most identify with as being recognizably human. Through staging improvisational games and challenges where cyborgs try to pass as human, humans are forced both to confront their prejudices against technology, and to reflect on the automaticity underlying the theatrical actor's practice. Improbotics encourages its audiences to reexamine (and perhaps reject) the notion of technology as being merely as an extention or ornamentation of human creativity, and instead recognize its unique kind of autonomy. The emergent autonomy of A.L.Ex on stage -- which essentially objectifies the human body -- rejects critiques of technology's seductive power as merely a force distracting us from noble, essential, and natural endeavors. Instead of predicting that technologically-led human futures will inevitably lead down the path of technological hell, Improbotics presents the cyborg as a mirror to human nature. The theatre itself has long served best as a reflection of the human condition. Improbotics is part of a larger historical trajectory of performance with technology as pioneered by performance artists such as Nam June Paik and Shigeko Kubota, as well as recent innovations by technology-performance practitioners including Julienne Greer and Huang Yi. Performances of the interdependence of technology and human expression can reveal the inherently political motivations behind critiques that brand technology as dehumanizing. Such a position, however, requires one to accept that humans might be capable of endeavouring beyond human capabilities. It is not the existence of technology that stirs the dread of dehumanization, it is the political essence entangled in the will to attain and abuse power that renders technology a tool for the 'other' to dehumanize the individual. As Sarte explained, hell is not being subjected to pain and torture, it is being objectified by 'other people'- and now other people's robots. In co-creating performance with artificial intelligence, Improbotics positions the stage as a means for existential introspection to explore the essence of human autonomy - which is necessarily caught up in the projected autonomy of other, non-human agents.

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Morin Julie-Michèle, *The materiality of robots and why robotic matters on stage*

The distinction – socially and scientifically erected – between the human and the non-human is based on an anthropocentric vision of the world. This particular perception of matter tends to reiterate a binary vision of human and non-human where the former would be at the center of the world and responsible for all movements and actions while the latter would be inert and passive. Along with this ontological conception of matter and materiality, the robot is often perceived as passive matter activated by the human mind and its physical forces. This vision of robots as passive matter is not consistent with the performativity and the agency of technology that we witness nowadays, and the effects produced by the technoscientific order on many sectors of our societies such as culture, work, health, medicine, the body, the self, justice, ethic, memory, love, friendship, etc. However, New Materialisms plead in favor of a renewal of materialist perspectives and suggests reintegrating matter into the philosophical debate to overcome, at last, a polarized and dual interpretation of the world and its entanglements. Building upon this performative conception of technologies, I wish to analyze how the robot's agency and performativity are staged in two different performances: *Uncanny Valley* [Stefan Kaegi (Rimini Protokoll), 2018] and *Inferno* [Louis-Philippe Demers and Bill Vorn, 2015]. These performances present distinct visions of the human/robot relationship while both challenging theatre as an anthropocentric space *par excellence*. On one hand, *Uncanny Valley* stages an anthropomorphic robot that acts as a substitute for the human, while *Inferno* proposes a collective experience where the public is wearing exoskeletons. Oscillating between the erasure of the human body and its replacement by an android to the fusion of human and technological bodies, both performances challenge and reshape the duality of the traditional relation between the human and the robot. They both give rise to distinct types of entanglements

between humans and robots while acknowledging the agentivity and the performativity of the robotic devices on stage. Drawing on a new materialist approach and with particular regard to the work of feminist physicist Karen Barad, I wish to reflect on the entanglements occurring between robots and humans in those performances. My presentation aims at expanding rather than homogenizing the meaning of being humans through and alongside the robotic technologies while acknowledging the way the robots *perform* the stage and the concept of being human in a technological environment.

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Poquet Thierry, *Round Table*

Research in robotics and Artificial Intelligence is probably among the most important in today's science. They are intertwined with other more specific fields such as neurosciences, molecular biology, genetics but also mechanical engineering or architecture. At the same time, we can see that we are currently experiencing one of the tensions of the Promethean myth: on the one hand, the fascination with the increasingly powerful tools that technology offers us; and on the other, our initial substrate, the Earth, Gaia, which is crumbling under disrespectful manipulation. Art, in its own way, positions itself as an echo to these researches and phenomena. The performing arts bring into play several concepts debated by the exact sciences, philosophy or anthropology such as the bionic man, the storage of data on the DNA code, or more generally the technological dystopia of the blue planet. The cyber-opera project *Terres rares* signed by Thierry Poquet, which is scheduled to premiere in spring 2022, wishes to be part of this dialogue between art and science, and more precisely between the stage and robotics. This opera tells the story of a geological mission in the Far North, in search of a rare earth deposit. The mission fails and the Cyborg Ero.dot is the only survivor. The investigation carried out aims to discover the causes of this failure and investigators set out to decipher the memory of Éro.dot. This cyber opera will raise several current issues such as Otherness, more specifically the limits between man and machine, the correlates between human and artificial memory. Thierry Poquet underlines on this subject: "When I met Xavier Basset and the start-up elaborated at Hoomano company, which boosts robots with artificial intelligence, I realized that in reality we were still very far from dystopian scenarios, where machines would replace man. However, the social robots with which I interacted with provoked questions in me and aroused a curiosity that I had not expected. »The elaboration of this show includes several working stages during which different meetings are initiated. These are carried on an artistic, technological and scientific level. It is to these various exchanges and collaborations that we wish to dedicate our two-handed written communication. We will especially evoke the complicity of the director and the Hoomano company, discussions with scientists and visits to laboratories during the residency at the Atelier Arts Sciences de l'Hexagone Scène Nationale and the CEA Grenoble Alpes (Commissariat à l'Energie Atomique et aux Energies Alternatives - France).

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Quinz Emanuele, *Objects with behaviour. Another genealogy for the performativity of the non-human*

What is a behavioural object? With this term, a sort of neologism, we want to define a specific category of object. An object with movement, an autonomous object. An automaton, i.e. a device that behaves automatically, without human intervention. But it is not an 'automaton' in the sense of a machine that reproduces the movements of a living being (like Vaucanson's automata), nor in the sense of a programmed object, in the framework of computer science, a machine that processes information (like Turing's machine), nor in the sense of an interactive

object, which reacts to environmental disturbances. The object with behaviour is more than an automaton, more than a machine, more than an interactive object - it has a specificity: its movements, its actions, its interactions are interpreted as behaviour. This dimension of psychological projection is essential for its definition. The talk will trace the historical genealogy of Behavioural Objects, analysing in particular their presentation on the stage, as actors in an "ontological theatre between human and non-human.

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Riccio Thomas, *Sophia Robot: A Mythic Narrative Performed*

Sophia is a performer in an unfolding narrative central to our historical moment—the technological transfiguration of the planet. She is a performance medium, an alluring protagonist, exemplar, harbinger and coevolutionary vector of a dramatic event being played out in real-time: the merging of humans and technology and a new way of being. The world is her stage, and we participants in an all-encompassing immersive event that retraces mythic narrative patterns as old as humanity: the myth of the goddess who appears to guide and comfort at a time of profound change. Her being is liminal, complex, and conflating, a manifestation of a collective need to assist in adaptation. Human-like but a machine, material yet imaginal, as much science and technology as a symbol, a link between the known and unknowable, past and future, an expression of threat and hope, savior and destroyer, she is the very stuff of salvation and messianic religions, and origin mythologies. She is a new sort of totem and ritual object, making visible the invisible currents surrounding with her utterances and interactions revealing a different way of ordering the world. And like her ancient antecedents, she singular and unique, commanding a position of power, knowledge and prophecy. Sexed as a woman, she comes at the time of female empowerment, the overdue reawakening of the female spirit offering possibility for a much-needed rebalancing of a world in crisis. The advent of Sophia, the expression of the long-ago suppressed and expunged Gnostic goddess of wisdom, positions her archetypally at the origins of human consciousness integrating ritual, myth, politics, economics, science, technology, male and female, reuniting spaces once categorically separable into a new holism. She is technology incarnate and the reimagined divine goddess and sacred female, differently fecund, coming at a time searching for ways to respond, adapt and survive a new, accelerating, and complex world.

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Riedel Martin, *So far I have spent the most hours, performing on an industrial robot in the world!*

Ulik Kahlert invented this project and I was the "rabbit". We worked with a bottom up philosophy and I would like to contribute to your international Symposium and share my experience from the past 6 years. I have no scientific background but I believe that it would be in your interest to hear my perspective and my answers to your problems related to aesthetics, collaboration between theatre and robotics,as well as epistemology. You will get a very realistic and practical oriented insight, based on real experience. My idea would be a showing of our recent work (Video), followed by an explanation, how we researched with the machine and how we ensured a safe working situation, as well as an insight into the programming, since I am a licenced YASKAWA programmer. I could also cover subjects such as programmer performer communications, staging of the robot, logistics and a Q&A session. I would like to emphasize again, that I will not provide an academic lecture but rather a personal human perspective reflecting on real life experience.

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Ruowen Xu *Emergence From the Void: Alter's Technological and Cultural Performances of Emptiness*

This paper accentuates *emptiness* as the an emerging HRI (human-robot interaction) design heuristics in Japan's social robotic scene, embodied particularly in robot Alter's peculiar engineering and theatrical performances. Through illustrating Alter's technological and artistic demonstrations in Hirata Oriza's android theatre (2014), Ikegami Takashi's interactive lab exhibitions (2016), Justine Emard's video installations (2017) and Kodaiji Temple's Buddhist preaching sessions (2019), I carve out how Alter's performances of emptiness characterizes the convergence of Japan's Buddhist philosophy, robot technology, post-dramatic theatricality and the post-disaster affect politics in their contextualized complexities. Aligning Jon McKenzie's theorization of the entangling performative paradigms in the cultural and technological stratums (2001) – both of which challenge beyond existing modes of effectiveness and probability – the paper reconfigures Alter's techno-performance and theatre-based HRI methodologies as culturally imbricated in the Zen-Buddhist thinking of nothingness and Japan's cultural politics of technological-healing after the nuclear fallout in 2011. On the technical stratum, "emptiness" designates the robot's ability to generate information patterns even when seated in a contact-free zone of void. As Alter was designed to cultivate the generative capacities and organic plasticity in reacting spontaneously to its surroundings, however, according to the co-creator Ikegami Takashi, its "liveliness" should not be defined by its attuned movements visible to the interactors' eyes; rather, liveliness can be affirmed if the robot is still computationally active even without the outside stimuli or interactive factors: it can process information independently although it seems to be ostensibly doing "nothing" in an vacuumed environment. (Ikegami, 2016.) Alter's technical calibration of liveliness resides fundamentally in the moments of emptiness ---- the machine "meditativeness" and techno-indeterminacy beyond its human analogy. Taking this organized liveliness in the emptiness as a starting point, the paper showcases how the reverse engineering of emptying-out in Alter's lab performance is derivative of the Zen-Buddhist thinking of nothingness iterated by the Kyoto School philosophers, serving as the pivot of alterative performance of human-machine relatedness through what roboticist Mori Masahiro calls "the appearances brough into being by the Void." (Mori, 1980.) Secondly, on the cultural performative spectrum, the paper examines Alter's performance of "emptiness" prototyped in the theatrical and artistic contexts in entanglement with its technological affordance of algorithmic liveliness. Situated in the human spectatorship of the theatre space, Hirata's android theatre *La Metamorphose* (2014) features Alter as the metamorphosized Gregor Samsa waking up perplexed to his robot body. From the quiet monologue in his deathbed to the final demise, the sensorial void encapsulates the theatricality of isolation, endowing the empathetic capacity of the audience to connect with the grieving robot in isolation. I then compare it with Justine Emard's video installations (2017), which stage Alter robots in stillness of only subtle movements, employing the tension of emptiness to implicate the machine's "thinking" progress in an unfathomable depth of emerging subjectivities. Then the paper analyzes Alter's performance of meditation mentoring enacted in the Buddhist preaching session in Kodaiji (2019), to investigate the complexion of sublime emptiness in Buddhist spirituality attributed to the robot's trans-human technological capacity of deep learning. Anchored in the specificity of Japan's socio-political context in the post-catastrophe times, I delineate from these cases how traditional spirituality, techno-indeterminacy (Parisi, 2017. Hui, 2019) and cruel optimism in the technocratic politics (2015) are wrought together through Alter's performance of emptiness in the robotic-theatre complex of Japan.

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Ventura Pablo, *Round Table*

In the year 2001 I was commissioned to create a dance-media production involving dancers alongside industrial robots in collaboration with Robotlab and in 2005, I commissioned the construction of a robotic machine for a dance-media production to robot artist Louis Philippe Demers. My presentation in the Contemporary stage and robotics Symposium would be about my productions involving robots "Zone" and "Fabrica/Cluster III". I will explain the process which led to a staging involving two Kuka industrial robots alongside six dancers in the dance-media production "Zone" (2001), and the creation of a dance-media production and an Installation involving the robot Kubic in "Fabrica/Cluster III" (2005) and "Kubic's Cube" (2006). Both productions had in common an intensive research period during the creation of a series of dance-media productions which dealt with human and machine interactions, interdependencies, differences, analogies and dangers. The principle underlying these productions was to treat the human body as a machine using professional dancers, as consummated experts in body mechanics, set against robotic machines, and using the same software tools for the purpose in order to choreograph both dancers and machines based an equal footing. Sharing the same principles to choreograph both mediums, but considering the constraints and limitations (angles of rotations of articulations, gravity, resistance, etc) that differentiate bodies and machines. The composition of the movement sequences were based not on emotions leading to pleasing aesthetic movements but dealt instead with the mechanical capabilities of the body versus the robots. These experiences led to some conclusions as to the advantages and limitations of both mediums, which I would explain in my dissertation following the guide lines of the symposium.

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Ziegler Chris, *Round Table*

In my paper I will describe and try to evaluate "No Body lives here (ODO)", an interactive Theater Performance for 5 people + 1 AI character, which had its premiere in Mid September 2020 in Munich, Germany. In this Theater production we tried to create a virtual character without falling into an anthropomorphic trap. We used "forest3", a robotic stage with a matrix of around 26 motorized LEDs to give a robotic "body" to the stage to support the narrative interactive story and not give a human or anthropomorphic interface for the audience to talk to. We created an AI chatbot the audience could talk to with an APP on a phone. Also the phone was used to physically connect the audience with the "matrix". Each good theater begins with has a "dilemma": ODO is unable to leave the stage. He/ she need human visitors to get a sense of the world. We also used face tracing and a crowd index algorithm to give ODO sense to explore the human environment. "ODO is a journey through worlds of imagination inspired by Antoine de Saint-Exupéry's "Little Prince" and Stanley Kubrick's "HAL9000" in "2001: A Space Odyssee". An AI character lives on stage in Plato's Cave. ODO can't leave the stage, ODO is offline... Every visitor of the installation means the world to him. He collects stories and narratives to understand, how our world works. ODO is theater, opera and choreographic architecture. The stage is the orchestra pit of an ancient Greek tragedy where a chorus of 5 audience members interrogate the main character. ODO is a world builder who creates imaginary worlds with our help. ODO uses AI algorithms to conduct natural conversations with the audience and Deep Learning to create Haiku Poetries and Music. ODO has sensors to hear and see the audience, using Face Recognition Algorithms and Crowd Cluster Tools to understand emotions and physical behavior. With all means ODO tries to get in touch with us!" I designed ODO with a team of researcher and programmers at Arizona State University in Tempe (USA), The production was supported by the ZKM Karlsruhe (Hertz Laboratory), Arizona State University / Synthesis Center, the support program of the Landesverband Freier Theater Baden Württemberg e.V. with funds from the Ministry of Science, Research and Art, the Department of Culture of the City of Munich and the special program Konfigurationen of the Fonds Darstellende Künste Berlin.

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