Media Arts Cultures Consortium
Danube University Krems – Aalborg University – University of Lodz
Coordinator - Department Image Science Dr.-Karl-Dorrek-Straße 30, A-3500 Krems
www.mediaartscultures.eu

The Non-Human Turn in Performance Art: Conversations

Handed in to
Aalborg University, Denmark
and the
Media Arts Cultures Consortium

Media Arts Cultures

Supervisor
Asst. Professor Phd. Elizabeth Ann Jochum

By:
Boris Abramović

Date of Delivery:

August 12th 2019

Acknowledgments

My gratitude for the wonderful opportunity to pursue this research goes to the Education, Audiovisual and Cultural Executive Agency of the European Commission and the Admission Board of *Media Arts Culture* Programme for awarding me the Erasmus + scholarship for *MediaAC* master studies.

I would like to thank my supervisor Elizabeth Ann Jochum, PhD for tremendous support and careful guidance throughout this research and the exciting world of the histories and the present state of robotic arts.

I would also like to extend my thanks to the Aalborg University and Danube University Krems (Austria) for providing this unique framework for theoretical exploration of media arts field.

I am truly grateful for the relentless support from my parents, sisters, friends and *MediaAC* fellow students.

Declaration of authorship: I hereby declare that the content of this master thesis developed at the Aalborg University, within the framework of the *Media Arts Cultures* Erasmus + Program, is entirely my own scholarly work developed through my own research. The scholarly work of other authors I have used in this thesis has been properly acknowledged through references. All the sources, images and data used in this thesis have been acknowledged.

Signature:

Date: August, 12. 2019.

I. Abstract

Robots existing alongside us in our realities (virtual and physical), performing social tasks or performing on stage, might trigger our anxiety or, contrarily, we may develop feelings of affection towards them. Whether we fear them or are drawn to them, most people have a stance on robots and hold certain expectations in that regard. Among them is the expectation that they should overcome the status as mere technological objects. This expectation that robots ought to possess, or at the very least exhibit, a degree of agency and a certain level of liveness is ingrained in our active perception. This thesis examines the *liveness* of non-human performers that emerges in an interplay of cybernetics and performance as a discipline when performing robots and cyborgs leverage the techniques of live art. The grounding for this research is the notion of conversation between machines and humans that occurs in "aesthetically potent environments", as proposed by cyberneticist Gordon Pask. The conversations I examine occur through “an imitation of life” (William Gray Walter) or “human-machine confusion” in performance (Jane Goodall). This thesis takes up the topic of imitation and liveness through the following central research question: how do the concepts of performance and cybernetics explicate the liveness and performative life of non-human technological performers? To address this question, I analyze the degree to which the liveness of embodied robots stems from technological systems, and the degree to which that liveness evolves from audiences' perceptions. I also pose the question of who is actually performing these conversations and other life-like behaviors in non-human performances. The machine activated on stage, the human who is behind the concepts of performance, or both of those subjects might be considered performers. My methodological approach is focused on a middle-ground between metaphorical non-humans, proposed by theoretical scholarship and performing robots, and cyborgs enacted in on-stage practices.

II. Table of Contents

III. Prologue: The Performative Turn

I begin the analysis of the *liveness* of performing non-humans by tracing the elusive influences and positions of robotic art and performing robots within the "performative turn" in art history: a period in the nineteen sixties when performance shifted toward transformation and expansion to other disciplines and fields. A stream of the "performative turn" that was propelled with those transformations was the diversification of performance and its aesthetics in the domain of arts (as explored, among others, by Erika Fischer-Lichte), while the other notable stream was the influence of performance on humanities and social sciences (as explored in particular by Jon McKenzie).

The "performative turn" launched various reconsiderations of performance as discipline and its widespread use within and beyond art. Among those diverse utilizations of performance, the essential was how social sciences embraced performance as a favorable research methodology. With the 1955 Harvard lecture *How to Do Things with Words,* the British philosopher of language J.L. Austin famously proposed the influential concept of performativity of language as production of realities that takes place through "performative utterances" expressed through speech. Thinking of spoken words not as only a sentence but as an "act of speech" out of which the sequence of acts is logically constructed (Austin, 1962: 20), Austin emphasized the importance of context in which words are spoken and the way of speaking as constructive of meaning (Austin, 1962). Austin's views on the performativity of language and speech inspired the emergence of several theories of performativity across disciplines. One of these theories was proposed by the Canadian sociologist Erving Goffman whose conception of performativity addresses the actions that an individual takes in everyday life as a framework to construct one's social identity, as described in *The Presentation of Self in Everyday Life* (Goffman, 1956).

When the social sciences and humanities embraced the notion of performativity as the central thread of identity and self-construction, conceptions of self-reflection as an intimate process shifted to research on the implications of self-reflection in a broader context of the society.

In *Perform or Else: From Discipline to Performance,* performance scholar Jon McKenzie charts these shifts in art and how performance transforms and is taken up by different art disciplines and genres (McKenzie, 2001: 22). But his interest follows another stream: social sciences and

humanities turning to performance as a methodology for research in the social and cultural domains (McKenzie, 2001). McKenzie argues that types of performance that have cultural and social reflections are "cultural performance" or performance seen as "embodied act of cultural forces" (McKenzie, 2001:8). McKenzie's concept of performance is located in between theory and practice of performance. Performance practices influence the formation and rise of the theoretical domain integrated under the umbrella of the research discipline known as Performance Studies, whereas, in turn, Performance Studies inform and encourage performance practices (McKenzie, 2001: 8, 30). Thus, for McKenzie, Performance Studies are situated between theory and practice of performance and as such, Performance Studies are liminal between theory (theoretical and philosophical considerations of what performance should be or might achieve) and actual, real practices of performance:

> Theory becomes performance (and performance becomes theorized) as an assemblage of liminal processes: reflection and definition, alternative embodiment, transgressive transformation. (McKenzie, 2001: 37).

Inspired by how the anthropologist Victor Turner used and re-tailored the notion of liminality, McKenzie brings to focus the term liminal in re-considering Performance Studies and how this research discipline was formed and proliferated in an inseparable relationship with "cultural performance".[1] For Turner, performance was a space for "public reflexivity" (Turner, 1979: 465), an interstice in which the individual becomes expressive in the social and cultural dimension. In that sense, Turner used terms "rites of passage" or "liminal rites" (Turner, 1979: 466), to depict a state in which an individual is going through initiation or an important social transition, for example when a child becomes an adult, or when communities mark the end of the war and the beginning of peace (Turner, 1979: 466). Both Turner and Goffman emphasize performativity as a mode by which the body becomes expressive of identity within the social domains.

German performance studies scholar Erika Fischer-Lichte explored the "performative turn" in terms of how it was reflected in artistic genres and domains, how performance (seen from the aspect

[1] Turner's contextualization of performance was largely influenced by the writing of the Belgian folklorist and ethnographer Arnold van Gennep who used the term liminality and "rite of passage" (McKenzie, 2011:36).

of theater and in the sphere of visual arts) transform, and how these transformations bring about new aesthetic considerations when performance takes on the qualities of an event (Fischer-Lichte, 2008: 8,161-181). Besides the trend for theater performance and performance art to "shift from art to event" (Carlson, 2008), Fischer-Lichte traces how performance influences different art genres and how qualities and strategies associated with "performative turn" spread through genres from music to literature (Fischer-Lichte, 2008: 11-24):

> The dissolution of boundaries in the arts, repeatedly proclaimed and observed by artists, art critics, scholars of art, and philosophers, can be defined as a performative turn. Be it art, music, literature, or theatre, the creative process tends to be realized in and as a performance. Instead of creating works of art, artists increasingly produce events which involve not just themselves but also the observers, listeners, and spectators. (Fischer-Lichte, 2008: 22).

Neither of the two streams of the "performative turn" have been analyzed at great length in relation to the emergence of performing non-humans in exhibition venues and theater stages. From today's perspective, the parallel pathways of the "performative turn" and performing non-humans are more apparent: besides the human performers from the nineteen sixties opposing modernist art paradigms through radical and expressive performing practices, a technological body was taken up in various performing contexts as a vehicle of artistic and/or social expression. Such activation of non-human performers in museums and/or theatrical stages was instantiated by the works such as the robotic piece *The Senster* (1969-1970) by the Polish artist Edward Ihnatowicz, a three-meter tall interactive cybernetic robot that responded to human presence and sounds (Penny, 2012: 150), or the technologized bodies in a cyborg context, as seen in the event *9 Evenings: Theater and Engineering* in New York (1966).

As for the social sciences stream of the "performative turn", in relation to performing non-humans, Austin, Goffman and Turner have tailored these theories on performativity, having in mind the intentional human as the subject that originates and enacts the performance. From this perspective, the question arises as to whether and to what extent we can view non-human agents on stage as entities that manifest those concepts of performativity. The fact that we cannot assume that robots operate on a similar level of consciousness or intentionality as humans is a crucial aspect of these

considerations. One way of looking at performing robots is to view them only as a tool executing a line of code that is conceived and scripted by a human, as a machine that does not contribute to the concept of performance, in line with the nineteenth century programmer Ada Lovelace's "objection" - proclaiming that machines are incapable of creativity, originality or intelligence (Carlucci Aiello, 2016: 62).

From that perspective, the human who assigns the robot with performance would be the one signaling the message within the acts of performativity staged or enacted by robots. Performing robots would then be a mere executor of the line of code. These considerations lead us to one of the crucial questions in relation to performing robots: who is actually performing in non-human performances? The machine or the human? Or are both the machine and the human performing through a mixture of agencies and reciprocity between performed technological realities on one side, and human-tailored concepts and programming on the other? In the quest for answers to these complex questions, cybernetics appears to be the central mode of engaging technology in on stage art practices. Cybernetics enabled the emergence of the "cyborg art" i.e. cybernetics driven robots and cyborgs in art (Burnham, 1968: 333) to perform the concept of the human who is behind the performance. Simultaneously, the non-human on stage with its degree of agency performed through *live presence*, becomes the entity that might enact more than the human-scripted concepts and more than a medium for the human-made message.

In this respect, I would propose that one conception of performativity relevant for analyzing the *liveness* of non-human performers (both performing robots and performing cyborgs) would be Turner's concept of liminality. Reference to Turner's "liminal rites" or "rites of passage" (Turner, 1979: 466) in the case of robotic performance is conditional on our view of robots that operate from their interstices, located between the imaginary and the real. It is conditional on whether we see robots as a non-vital technological construct, or as something more, which would be driven by our contact and interaction with them. In other words, when audiences projects *liveness* onto robots, these non-human agents, at least for a moment, become representative of a state that we could define as fleeting or lingering between skillfully assembled and programmed technology and the different modes of *liveness.* From that perspective, these performing robots might operate on a liminal plane in a way that resonates with what Turner frames as a passage from one state into another. Such a passage for performing robots and cyborgs appears to function as an ongoing

shuttling between the inanimate and the living. With the discipline of performance as a practical strategy, and with cybernetics as a back-and-forth approach through processes such as feedback loops and control and communication, the non-human performers become activated on stage as technological performative bodies, and they become liminal between different states and ontologies.

IV. Introduction

> Performance operates through representation and presentation, and therefore may be understood as an aesthetic discourse on what it means "to be." In performance, artists present and represent themselves in the process of *being and doing*, and these acts take place in a cultural context for a public to witness.
>
> - Kristine Stiles

> When the machine takes on the status of performer, it undergoes a transition from the functional to the marvelous. In its creation, the roles of the sorcerer and the technologist overlap […]. The performer embodies the human-machine confusion thematised by writers and scenographers and can therefore be said to engage with it more immediately.
>
> - Jane Goodall

From cultural imagination to laboratory, humans often look towards objects and/or technology, seeking more than their main functionality and expecting more than the services that facilitate our lives, in a yearning for an object that transcends the mere inanimate status. Perhaps by animating and/or perceiving *liveness* in those objects, we turn to technology in search of our own reflection, in re-determining and defining ourselves as human beings. Performance art as a laboratory of *liveness* and a site of production of encounters offers the most striking modes for technological objects to *come alive*. Performance as a hallmark of life was embedded in manifestos and practices of Futurists, Constructivists and Dadaists, who sought after modes and strategies to blur the boundaries between art and life. For the art historian Roselee Goldberg, performance art is the strategy of artists who "create work which takes life as its subject'" (Goldberg, 1979: 7)**.** Performance theorist Erika Fischer-Lichte defined "linkage of art and life" as the very objective of performance aesthetics (Fischer-Lichte, 2008: 206). It is precisely this slippage between performance and life that resonates also in non-human performances.

I examine this slippage between performance and life of non-human performers through two separate but interwoven processes: active animation and active perception. Active animation is the deliberate attempt by engineers, scientists or artists to animate technology with the purpose of making it seem *alive* or life-like, through design or appearance, or through the situations in which they place these objects, and the behaviors they instill in them. Another aspect of *liveness* of these non-humans on stage is unintentional and unconscious, derived from the observer's perceptions, i.e. from the humans' unconscious projection of life onto objects, based on the contention that these objects or technologies cannot be fully inanimate, but that there must be at least a spark of *liveness* within those objects. When active animation and perception meet in confluence, these non-human performers, at least momentarily, find themselves situated in the interstices between vitality and the sum of inanimate technology, between a certain mode of *liveness* and a technological construct.

The performer's body as a medium represents a hallmark of discipline of live performance from old rituals and medieval mystery plays to today's technological performances in the posthuman discourse. Driven by vitality and immediacy of the body, performance art has for a long time provided a framework for creation of different agendas and meanings through the ways that art historian Kristine Stiles terms as a performer's "being and doing" (Stiles, 1996: 75). With the emergence of robotic arts in the mid-twentieth century (Penny, 2012: 147) a curious twist started to unfold on performance stages, when "being and doing" was assigned to technological agents (robots) and when "being and doing" was sought in the interconnection of living bodies and technology (cyborgs).

Once the stakes were raised with non-human performers attempting such "being and doing" on the stage, these performing robots and cyborgs, drawing from the strategies and tactics of *live art* by human performers, proved to be not only moving and movable, operative and operating but also responsive and, hence, capable of executing complex performances, stretching across engineering and cybernetics, from human-scripted and human-controlled operations to autonomous behavior. This thesis explores how such *liveness* is signaled or exhibited by non-human performers within the framework of "being and doing", when a combination of performance as a discipline, and cybernetics as a model by which a system operates, enables these agents to adhere to the state I term *performative life.*

To build my argument, I explore the definition of performance proposed by the theorist and scholar Jon McKenzie, for whom performance is "an onto-historical formation of power and knowledge" (McKenzie, 2001: 18,142). This definition is aligned both with my analysis of the state of media arts in terms of performing robots and cyborgs, and with the exploration of the post-human condition in relation to these non-human performances.

I explore the *liveness* of performing robots and cyborgs using the theoretical domain of references from art history and philosophy, while looking into the artistic practices of non-human performances. I probe the *performative life* of non-human actors driven by cybernetics, as the science that underlies the crossover from the machine age to modern day technological paradigms, while in parallel also providing an insight into how such life of non-humans evolves by drawing from human performer's strategies and tactics. The performing robot is central to my research, but I consider it necessary to include the cyborg, which is part-human and part-machine, and functions as an instance of *live presence* situated between human and non-human. The approach to these non-human performers that I take in this research can be traced back to the art historian Jack Burnham's analysis of robots and cyborgs as a hallmark of the inflow of cybernetics into mid-twentieth century arts (Burnham, 1968). Additionally, my approach is consistent with the performance scholar Steve Dixon's research of "metal performance" as a genre that brings together those non-human performers (Dixon, 2007: 271-275).

My thesis addresses the following central research question: how do the concepts of performance and cybernetics explicate the *liveness* and *performative life* of non-human technological performers? Through this research question, I examine the *liveness* of performing robots and cyborgs, looking into how these agents and the technologies upon which they operate *come alive* on stage, questioning to what extent is such *liveness* enabled by the technological system (cybernetics), and examining which portion of such non-human, performed or enacted *liveness* comes from the observer's perception. Simultaneously, I examine the actor that is performing in these non-human performances: is it the machine on the stage, or the human being who is behind the concepts and the technologies that these performers utilize? Or is it that both the machine and the human that are performing?

The premise I rely on in examining these questions is the concept of *conversation*, proposed by the British cybernetician Gordon Pask, who saw the potential of cybernetics in creating "aesthetically potent environments" that should respond to humans and engage them in a *conversation* (Pask, 1971: 76). This notion of *conversation* which Pask applied in his works in the human-machine context implies more than utterances and entails embodied and corporeal encounters via physical *live presence* on stage.

I choose the interdisciplinary science of cybernetics as a lens to explore the *liveness* of performing robots and cyborgs, through which these non-humans leverage the techniques of *live art*. It is precisely the transformative science of cybernetics that stands as a vehicle of advance in computing and robotics as the paradigm that underlies the rise of media arts through the theories and practices of self-organizing and self-maintaining (homeostatic) systems, as proposed by Norbert Wiener and his contemporaries. Wiener's *Cybernetics: Or the Control and Communication in the Animal and the Machine*, which we understand from today's perspective as the "cybernetics manifesto" (Penny, 2017: 42), framed the concept of the machine operating in a unison of control and communication by means of feedback mechanisms flowing within and outside of the machine (Wiener, 1948). Setting one of the central premises of cybernetics, Wiener insisted on the essential similarities between how living organisms function and how machines operate (Wiener, 1948).

The field of performance art, often referred to as *live art*[2] from avant-garde manifestos and practices to nineteen sixties and seventies performances, instantiated the process of shifting from representation of life onto life itself. With an art object, whether it is an image or a sculpture, reception evolved through the observer's insight and analysis, but without the dynamics or the immediacy - i.e. without the modes by which performance stands out among other art genres. As noted by Chris Salter, performance chooses "real-time, dynamic processes over static objects or representations" (Salter, 2010: 10). Such dynamics and the real-time mode in performance occurs through *live presence*, immediacy, spontaneity, and experience, which are all modalities that are in many respects consistent with the main principles of the first order of cybernetics, marked by self-organizational systems that rely on feedback mechanisms, input and output, and unison between control and communication. This linkage between performance and cybernetics, both literal and

[2] RoseLee Goldberg, Amelia Jones, Kristine Stiles

metaphorical, becomes particularly evident when human performers are replaced on stage by performing robots and cyborgs.

While researching how performing non-humans *come to life* in correlation with cybernetics, performance and the perception of the observer, I consider another essentially interlinked notion that can be defined as the simulation of life. Such simulation of life occurs once humans on stage appropriate features of the machine or, on the other hand, when machines are fitted and assigned, by humans, with features of living organisms. In the nineteen sixties, the art historian Jack Burnham discussed the link between cybernetics and robots and cyborgs in art as "the first attempt to simulate the structure of life literally" (Burnham, 1968: 332-333). The concepts related to such simulation and transference between the living organisms and machines sprouted from Wiener's theories and that of his peers, while cybernetic machines were built in laboratories by engineers and cyberneticians. In 1950, the cybernetician William Gray Walter introduced cybernetic machines named Elmer and Elsie, two self-organizing robots often identified as tortoises due to their animal-like appearance and movement. As described in Walter's 1950 article *An Imitation of Life*, these electro-mechanical tortoises were programmed to stimulate life through "performance and behavior" (Walter, 1950: 42). Fitted with motor-based mobility, and driven by extreme sensitivity to light, Elmer and Elsie quite successfully performed imitation of life. Although they were not designed as cybernetic sculptures i.e. as works of art, these cybernetic machines performed imitation as seen in early robotics, as they were similar in their strategies and capacities to the movable and operable performing robots in art.

Such simulation or "imitation of life" is deeply rooted in behaviorism, a branch of psychology that emerged in the early twentieth century, very closely related to cybernetics (Penny, 2017: 91) as it is, at times, used in the performance field, as seen in the instances of performers imitating the qualities of machines, or instances of objects or machines seeming human-like on the stage. The performance scholar Steve Dixon used the term "metal performance" to frame the genre of performing robots and cyborgs as centrally linked to our fascination and fear of these machinic embodiments, manifested when humans take on the qualities of machines and when machines are being humanized (Dixon, 2004: 15).

In my view, it is precisely the ongoing transference between human and machine features in performance that holds the answers to the question of *liveness* of performing robots and performing

cyborgs, whether such transference is defined as simulation of qualities and properties, or an imitation of a profile, or whether we take the performance scholar Jane Goodall's proposal, and define it as the conception of transference of agencies. For Goodall, as described in the 1997 article *Transferred Agencies: Performance and the Fear of Automatism*, the drive for these performers adopting machinic profiles comes from our cultural anxieties that technologies would assume control over humans (Goodall, 1997). According to Goodall, the performer appropriating machine-like features through movement or costume, as seen in the dance troupe *The Tiller Girls* from the end of nineteenth century, or machines fitted with human-like features or behaviors, as seen in historic automata, embody the anxiety of losing agency over machines (Goodall, 1997).

Methodology

My research methodology is based on an interdisciplinary approach with a focus on critical theory (critical analysis), art historical analysis, and cultural studies insight. The primary data I use for this research are digital video recordings of performances available online, as well as textual data such as literature, articles and journals, reviews and press available in hard copy or online. In investigating the *performative life* of robots and cyborgs. I take on a methodological approach that is centered on a combination of theory and practice, drawing from the performance scholar John McKenzie's outlook on the exchange between performance practice and theory (McKenzie, 2001:8). Performance practices enacted on stage inspire and influence Performance Studies in construction of performance theories, while in turn, performance studies challenge practices to be more effective and more influential (McKenzie, 2001). The basis for my methodological stance is the McKenzian angle on reversibility and circulation between performance theories and practices.

Performance theories and practices jointly contribute to the production of meanings on stage. On the one side, theories and philosophical reflections of the late twentieth and twenty-first century, such as those of Donna Haraway, N. Katherine Hayles or Jean-François Lyotard discussed the metaphorical non-human techno-bodies and their role in construction of social and cultural domains, framing imagined, prospective realities indicative of the posthuman condition. On the other side, media arts, through the non-human performance genre, and the works of artists such as Stelarc, Louis-Philippe *Demers or* Ken Rinaldo introduced not abstractions or metaphors, but embodied, performed, lived instances of robots and cyborgs on stage and in other performative

frames and contexts. With this methodological approach I pursue a middle-ground between theory-generated metaphorical robots and cyborgs, and the staged (enacted) robots and cyborgs. Looking through the lens of cybernetics and performed *liveness*, I examine the ways in which robots and cyborgs in performance art articulate or manifest the theories and philosophical considerations from cybernetics to the posthuman condition. In some instances, these performing non-humans on the stage disrupt the theoretical image of robots and cyborgs, and others seem to revitalize it, reframe it, and provide an embodied physical figure that might be fully or partially harmonized with the proposed theoretical frameworks, and that might be used to explore the figure of posthumanism and to stimulate the discussion on what it means to be human. Theory builds on practices, and practices simulate theories, while the meanings of *performative life* are constructed and found in between these two disciplinary lines.

V. Cybernetics and Conversation

> Robotic art, since its inception, has displayed expressive choices radically opposed to modernist aesthetics: focus on medium specificity; autonomy of the artwork from its environment; rejection of narrative; anthropomorphism and theatrality; and separation of high and low culture.
>
> -Ghedini & Bergamasco

> Machines carry on brilliant dialogues with articulate human beings and very uninspired conversations with dull people.
>
> -Jack Burnham

In this chapter I explore the emergence and the position of robotic arts in the mid-twentieth century art histories with the aim of examining the linkages between early performing robots, cybernetics and performance as an art genre. Drawing on these historical perspectives, I explore whether the *liveness* of those early robots stem from their technological system, or from audiences' perceptions. Who is the performer in these performances – the artist, or the cybernetic robots on the stage? Or is it that both these cybernetic sculptures and the artist are performing?

The work of British scientist William Gray Walter is an exploratory venture into the timelines of the cybernetic object. Walter's vision of robots came into effect with movable electro-mechanical machines called Elmer and Elsie, introduced in 1950, often identified as tortoises due to their animal-like appearance and movement. Walter perceived the functionality of machines as similar to circuits of living organisms, and in particular to the nervous system (Walter, 1950: 44-45). As described in Walter's 1950 article *An Imitation of Life*, the small robotic tortoises were programmed to stimulate life through "performance and behavior" with motor-based mobility and sensitivity to lighting (Walter, 1950: 42). With simple photocell light sensors connected to steering mechanisms and small motors powered by batteries, Elmer and Elsie moved independently, avoiding bright lights or full darkness. They were moving across their surroundings searching for spots with moderate lighting, maneuvering around objects or obstacles in the way (Walter, 1950). Once the

tortoises' batteries drained, they would be drawn to the light of the battery charging station where they would connect to the power unit until fully charged, in a true self-organizational manner (Walter, 1950: 44-45).

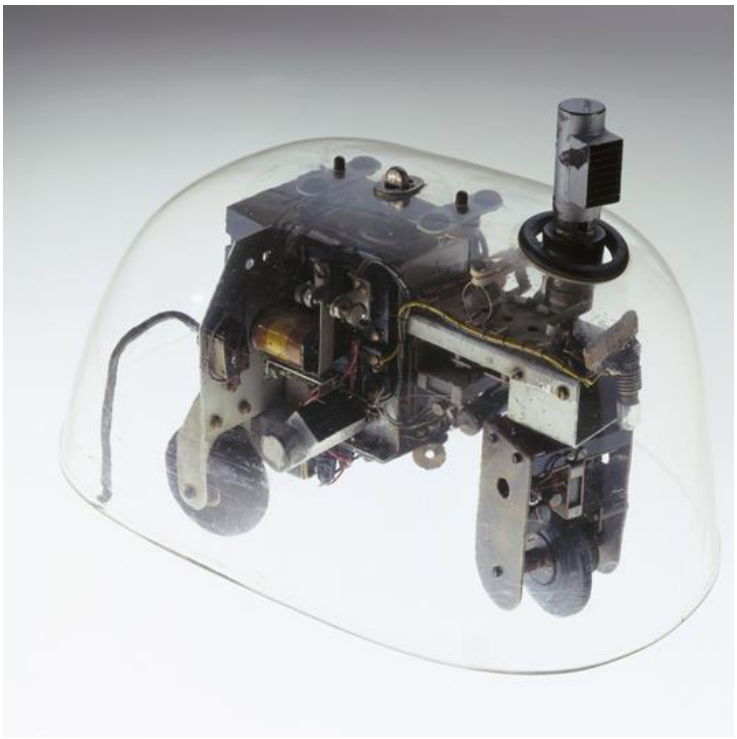

Fig. 1. *Cybernetic tortoise*, < https://www.sciencemuseum.org.uk/>, accessed 01 August 2019. (©Science Museum SSPL)

Walter's tortoises, an early effort with cybernetic artifacts *coming alive*, were a vital part of the tendencies that instigated technological objects in the mid-twentieth century, when robots and other cybernetic objects began to appear more commonly in galleries, museums and theater stages. Those tendencies motivated the development of robotic arts as a stream of media arts growing in parallel with various artistic trends that, similarly to robots in art, opposed modernist paradigms and expressed affinity for innovation and experimentation with the then-new technological reach. The role of robotic art in the landscape of art history has not been fully critically explored. A branch of robotic art called robotic performance and, importantly, the general linkage between (embodied) robot art and performance art have been particularly vaguely represented. Many of the perspectives and studies on the place of robotic art within the broader framework of art history appear to be elusive and often purely technologically orientated. What has hitherto been overlooked in many of these studies and considerations is the link between robotic art and performance art.

By slipping a technological body such as that of a robot into the discipline of performance art and into various performative contexts, with a robot propelled on stage and taking on the role of the performer, the technological body was shifted towards the context of *live art* thereby setting the artistic and social position of the robot in a way that from today's perspective can be considered as formative to the art of robots and cyborgs. Whether the *liveness* was expressed in theater or under the umbrella of different practices of performance art (as part of a visual art genre) or in other social and everyday performative contexts, we can look at this confluence between robots and performance as one of the central threads of robotic arts.

Theoretical reflections introduced very distinct views on robotic art and how this genre might be placed in the mid-twentieth-century art histories. Fiametta Ghedini and Massimo Bergamasco indicated the origins of robotic art as essentially linked to minimalist and conceptual art (Ghedini & Bergamasco, 2010: 1-3). The artist Eduardo Kac saw robotic art as a hybrid medium which integrated in different art disciplines and genres, from installation or telepresence to theater and performance (Kac 1997: 60). The approach that is closest to the paths pursued in this thesis, is the artist Simon Penny's angle on the line between robots and performance. For Penny, robots in art are the signifiers of the shift from representational to performative ontologies, based on the aesthetics of behavior (Penny, 2016: 63). Penny places robotic art among the genres of sculpture, installations and performance:

> Rather than synthesizing the skills of the programmer and the painter, robotic art integrates the sensibilities of the sculptor, installation artist, and performer with the computational systems equipped with both sensors and mechanical effectors. (Penny, 2012: 147).

In these considerations on the origins and foundations of robotic art, the art historian Jack Burnham's concepts of "system esthetics" is one of the central references. Burnham's theory on systems in art, when it first emerged in his 1968 essay *Systems Esthetics*, in the *Artforum* magazine, did not explicitly refer to streams of art such as robotic or cyborg art. However, his next edition on the future of sculpture, entitled *Beyond Modern Sculpture*, published in the same year, features an apparent connection between system theory and performing non-humans. Burnham's *Systems Esthetics* proposed a framework for understanding the growing tendencies in the art of the mid-twentieth century that went beyond the modernist art object. "We are now in transition from an

object-oriented to a systems-oriented culture" claimed Burnham, in describing art that is largely grounded in the interconnection between the object, people and the environment, often embedded in new technologies, and organized in a system-like way, or the art of "system esthetics" (Burnham, 1968: 31).

When Burnham's essay *System Esthetics* first appeared, visual arts experiencing a sharp polarization between modernist traditions and newly emerging practices at the time. Those innovations grew in "post-formalist esthetics" (Burnham, 1986: 32) and in line with aspirations for dematerialization of the art object. Traditional modernist approaches to art, such as those defined by art theorists Clement Greenberg and Michael Fried, who advocated for an art object that is separated from the viewer, static and self-sufficient, were challenged by artistic innovations such as those seen in certain forms of sculpture and kinetic works, happenings and mixed media, light and environmental works, all termed by Burnham as "unobjects". (Burnham, 1968: 31).

With proliferation of works such as Hans Haacke's *environmental* interventions or Allan Kaprow's happenings "system esthetics" has been largely defined by the concepts of the work of art instead of its materiality, often influenced by technology and industry instead of modernists' notions of the beauty of the object, and defined by the possibilities of the post-medium condition, instead of the limitations of media specificities. The "system esthetics" emerged in different expressions that were essentially marked by deviation from the traditional, and by experimentation with new paradigms, through diverse practices that rely on technologies, interaction, performing bodies, robotic art or cyborg art.

All of those system practices were fundamentally expressed through modes of interconnectivity between the art piece and the viewer, and all of them occurred according to a certain mode of organization of the work of art. The system-logic in arts was in many respects analogous with the organization of the system as seen in biology or the military (Burnham, 1968: 31-32). All these imprints of systems in art clearly indicate the linkage with the groundbreaking science of cybernetics, which rose from the mid-twentieth century with a great influence on technology and beyond.

Confident that "systems esthetic will become the dominant approach to a maze of socio-technical conditions rooted only in the present" (Burnham, 1968: 35), Burnham sought to reposition the

"unobjects" and the central attribute of "system esthetics" from the margins to the forefront of the art world. From today's perspective, Burnham's "system esthetics" is more than a testimony to the tendencies of the art of the sixties; it has remained one of the central references for understanding much of contemporary and media arts, from its onset, over the decades, to the present moment, and the role and importance of computation and technology on the view of sculpture more generally.

Burnham further elaborated his systems theory in *Beyond Modern Sculpture*, exploring what he defined as a crisis for the medium of sculpture in the mid-twentieth century, turning to the central question - what is the future of sculpture? The answer to this question is to fully consider the profound changes and opportunities that came with the new technologies of the time, a sphere that Burnham analyzes from the aspect of a broader framework of relationships between humans, technologies and science.

From Burnham's perspective, the history and future of sculpture can be viewed through the lens of deep-rooted preoccupation with the "living sculpture" or in Burnham's words, with the human urge to "concede a soul or indwelling vitality to inanimate objects." (Burnham, 1968: 16). Burnham's solution for the crisis of the medium of sculpture was the shift of sculpture from the condition of an object to the status of a system (Burnham, 1968: 10). A work of art that is framed as a system with qualities such as responsiveness, movement, interactivity, in light of the new technologies of the time, and above all in the scope of cybernetics, becomes the framework for a sculpture of the future that is best instantiated through the art of robots and cyborgs (Burnham, 1968).

Burnham foresaw the essential role of cybernetics in arts through his interest in the stream of sculpture that emerged as "the art of cybernetic organisms" or "cyborg art" (Burnham, 1968: 333). The connection between cybernetics and the *liveness* of a technological object is expressed through Burnham's standpoint of "cyborg art" as the kind of art that represents the "the first attempt to simulate the structure of life literally" (Burnham, 1968: 332-333). The type of simulation of life that was enabled by cybernetics for technological bodies such as robots indeed enabled the process of blurring the boundaries between inanimate objects and a technological entity that at least seemingly became expressive in its vitality or *liveness.*

Burnham used the term cyborg more broadly compared to the connotation of this term in popular culture and to the writings of a majority of authors and scholars. For Burnham, the term "cyborg

art" encompassed the art of robots and cyborgs, and at the same time it referred to generally cybernetic-based art in the broader sense. “The term cyborg refers to both electromechanical systems with lifelike behavior and man-machine systems which parallel (through feedback) some of the properties of single biological organisms” (Burnham, 1968: 333).

The aspirations in visual arts and related artistic disciplines that Burnham explored and framed theoretically rose in parallel with mid-twentieth century technological and scientific development currents, among which cybernetics emerged as the central discipline, rising partly due to the development of war technologies, fomented by the anxieties of the Cold War.

Cybernetics grew as a multidisciplinary field. From computation and engineering, the concepts of feedback, information, control and communication, were transmitted toward disciplines such as biology, physics, psychology and, importantly, to the social sciences, followed by the widespread application in military, the industry and everyday life. The potentials of cybernetics were explored with philosophical and theoretical inquiry.

The mathematician Norbert Wiener, often referred to as the father of cybernetics, defined the theoretical basics of cybernetics in *Cybernetics: Or the Control and Communication in the Animal and the Machine* (1948) exploring the structure of the cybernetic system and its dependence on the key elements, starting from feedback mechanisms to communication and control, and pointing to the similarity in the functioning of machines and living organisms (Wiener, 1948). In *A Logical Calculus of the Ideas Immanent in Nervous Activity,* scientists Warren McCulloch and Walter Pitts investigated the brain’s neural structures through the lens of logic and computation (McCulloch & Pitts, 1943). Mathematician Claude Shannon's *The Mathematical Theory of Communication* probed into information as a pillar of cybernetics proposing the information theory (Shannon, 1948). Computer scientist John von Neumann’s explorations on automata included discussions on the prospect and implications of self-reproduction of automata as well as on machine intelligence as presented in the 1948 lecture and the subsequent paper *The General and Logical Theory of Automata* (von Neumann, 1951).

The strong connection between cybernetic machines/objects and living systems was implied in most of these theories. One of the arguments that some of the above theories highlighted was the logical comparability between machine systems and natural systems (such as those of living

organisms). Those considerations also pointed out how the organization of living systems can be used in cybernetics. For example, in the McCulloch and Pitts research as well in Von Neumann's work, the brain and its neural networks were interpreted as analogous with computational systems and thus indicative of how cybernetic systems or machines can be structured in accordance with models of organization inherent to living organisms. Wiener's cybernetics, Shannon's information or McCulloch & Pitts neural theories known as first order cybernetics were closely linked to the concept of homeostasis i.e. the capacity of biological organisms to maintain stability regardless of external conditions such as temperature. As discussed at Macy's conferences[3] by Wiener and his contemporaries, not only organic systems but also machines, through the principle of feedback loops, assume the ability of homeostasis. (Hayles, 1999).

The influence of cybernetics in art emerged with a variety of intersections, ranging from metaphorical application of cybernetic principles in art projects to literal usage of computing and cybernetics, as presented in several exhibitions that focused on the possibilities of computer-based and/or technology-driven art. The exhibition entitled *The Machine as Seen at the End of the Mechanical Age* (1968), curated by K.G. Pontus Hultén at the Museum of Modern Art in New York, symbolized the break with the traditions of mechanical aesthetics and a call for an artistic embrace of the new technologies of the time (Broeckmann, 2016: 47-56).

Jack Burnham's curatorial *project Software: Information Technology: Its New Meaning for Art* (1970) with a selection of artists including Allan Kaprow, Vito Acconci and Hans Haacke (Burnham, 1970: 70), showcased in The Jewish Museum in New York, explored the notion of software as a base for system processes in arts. Although the title *Software* suggested the utilization of computing, the link between exhibited works and cybernetics was largely metaphorical as many of the artworks explored principles such as feedback mechanisms and the concept of system without using any technical means or new technologies (Broeckmann, 2016: 94).

The ten-day staging of various performances under the title *9 Evenings: Theater and Engineering* (1966) in the New York's 69th *Regiment Armory* exposition venue, led by the engineer Billy Klüver and the artist Robert Rauschenberg, was an unusual event, mostly focused on technologically

[3] The New York based Macy conferences on cybernetics were mid-twenty century gatherings of influential engineers, scientists and scholars.

augmented performing bodies via cybernetic and electromagnetic innovations. Among these pioneering exhibitions, it is also worth mentioning the Yugoslav art movement *New Tendencies* and their exhibitions held in Zagreb (1961-1973), which fully contributed to creating an aesthetic and social discourse of the computer as an art medium (Rosen, 2012). The *New Tendencies* 1986 exhibition entitled *Tendencije 4: Computer and Visual Research* — held in parallel with the groundbreaking London show, *Cybernetic Serendipity* — presented many computer works including that of the engineer and media artist Vladimir Bonačić, and a group of American artists, *California Computer Products.*

Undoubtedly, it is precisely Jasia Reichardt's exhibition *Cybernetic Serendipity* (1968) held at the London Institute of Contemporary Arts, which later toured in the United States that holds exceptional relevance for the research theme of robotic art and robotic performance. This curatorial venture presented many "cybernetic devices" among which it was difficult to discern the work of artists from the work of engineers, as it gathered a selection of "various robots, machines and graphic", including works by Edward Ihnatowicz, Nam June Paik, Jean Tinguely and Nicolas Schöffer (Reichardt, 1968: 5).

One of the pioneering robotic works showcased within *Cybernetic Serendipity* was *The Colloquy of Mobiles* by the British cyberneticist, inventor and artist Gordon Pask, one of the figures associated with the rise of cybernetics in the mid-twentieth century. Gordon Pask was involved with cybernetics through multiple streams, from practical work to theoretical considerations and cybernetics-based art works. These art works were responsive machines, often produced and staged as interconnected systems in a manner similar to what we, at present, define as the genre of robotic performance. With these responsive machines and through their encounter with humans, Pask sought to create "aesthetically potent environments" that would be engaging for humans through a type of interaction he defined as *conversation* (Pask, 1971: 76). Pask's concept of *conversation* in his later theoretical work developed into a complex "conversation theory" on learning systems based on the principles of cybernetics.

The *conversation* occurred through Pask's art machines entitled *Musicolours*, electrically fitted systems, dominated by sound and light. The *Musicolours* were based on custom-made microphones that translated the sound of real-time musical performance into an electrical signal, which was processed to modulate light. (Pickering, 2002: 427). One of the works derived from the practices

of *Musicolour* machines was the robotic work *The Colloquy of Mobiles* which consisted of five "complicated electro-mechanical robots" (Pickering, 2002: 428). These robots, or as Pask defined them "powered mobiles" were shaped as sculpture-like machines with programmed motion that was managed by a computer[4] (Pask, 1971: 88). These groups of mobiles were linked through interactive environments that sparked unusual encounters. Namely, the mobiles were designed, actuated and staged to function as responsive systems in a twofold way: through communication between machines or through participation of people and their contact with machines (Pask, 1971: 88), functioning (both technically and contextually) on the cybernetics principles of feedback loops, in a way which is implicit in the systemic aesthetics that Burnham foreshadowed as a path toward the sculpture of the future.

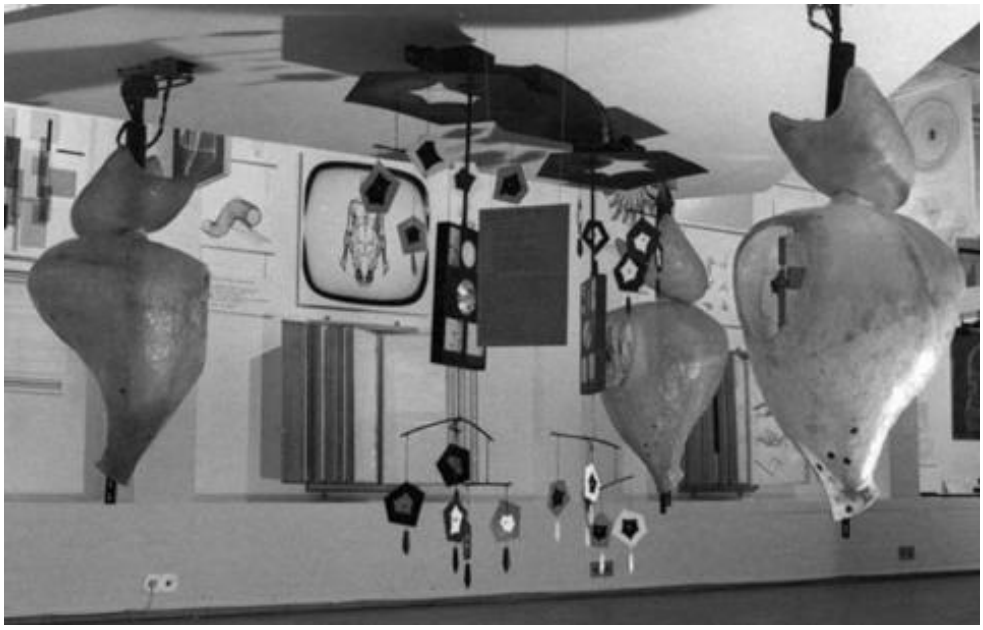

Fig. 2. *The Colloquy of Mobiles*, < http://www.medienkunstnetz.de/>, accessed 01 August 2019. (©medienkunstnetz)

Although tailored for gallery exposure, *The Colloquy of Mobiles* evolved through a multitude of interactions and narratives in a way that resembles theatricalized or performance practices. The hanging mobiles were fitted to perform versatile responsive actions in relation to sound and light, as the two main elements that triggered the exchange and contact. These electronically actuated

[4] Mobiles are a form of kinetic sculpture whose motion is possible due to flow of air or through an electric motor. Mobiles were popularized with the work of artist Alexander Calder in the thirties of the twentieth century.

forms that included human participants performed what Pask described as "co-operative encounter" (Pask, 1971: 89). Such formulation of a "co-operative encounter" may be an indication of an inherently social character of these abstract entities/forms, which structured the thought of early artistic notions about machine-machine and machine-human contact.

The feature of *The Colloquy of Mobiles* machines that set the grounds for aesthetic frameworks and provided a narrative for this complex performance is that these robots were assigned with a gender. Some of those mobiles were envisioned as females, and others were in the role of males. Pinned to the ceiling of the gallery, the mobiles were programmed to independently rotate on their axis in search for a mobile of the opposite sex, demonstrating an interplay associative of mating. Both the activities and the attributes of "female" robots were largely different from that of the "male" robots. The female machines were curved fiberglass structures with technological mechanisms placed centrally within the object, while males were shaped with abstracted, geometric, aluminum forms (Pickering, 2002: 427).

The interaction and exchange between the machines would be provoked when female objects start signaling the beginning of the interplay by increased glowing. Next, the male robots that were fitted with the ability to produce light would cast rays of light toward the female objects. To show responsiveness, the female robot would have to be struck with the beam of light in the central part of the body, where the technology with feedback mechanisms was placed. Once the light beam emitted by male robots reached the central part of the female machine, both robots would stop rotating and focus on interaction or *conversation* with each other. In a way that was similar to a somewhat chaotic and passionate exchange of light beams, male to female and vice versa, these machines would engage in an interplay of lighting until they would reach an instance of "satisfaction" (Rosen, n.d.).

After the act of "satisfaction" all the mobiles would temporarily inactivate themselves until the next set of interactions. Human audience that observed the interaction among the machines, was also brought into the *conversation*. Humans as spectators became participants in Pask's "aesthetically potent environment" by using mirrors to catch the rays of light produced by machines, bouncing the light back to the machines and thus interfering with the situation, and interrupting the light interplay of the machines (Rosen, n.d.).

Both Walter's electro-mechanical tortoises and Pask's *The Colloquy of Mobiles* robots were triggered by light, and assigned gender. Pack's robots and Walter's tortoises bore somewhat similar features, and both reflected a shared pursuit of imitation of life through cybernetic self-organizational principles. In these shared aspirations, Pask's robots, perhaps due to the greater technical possibilities of his time, were, however, more interactive and ultimately more social than Walter's tortoises. Pask's robots were equipped with feedback mechanisms that enabled them to respond to each other. While rotating, they searched for each other and were strongly drawn to each other, but were also responsive to humans. Walter's tortoises were responsive to light and the environment, but not particularly inclined to interact with each other. The tortoises would interact in the environment in a way that appeared to be incidental – contact would only occur between them while maneuvering not to collide with each other.

Fig. 3. *The Colloquy of Mobiles*, < https://cyberneticserendipity.net/>, accessed 01 August 2019. (©cyberneticserendipity)

Pask's robots, driven by cybernetic technologies - moving, rotating, and through light impulses engaging in *conversation* with each other and with humans - exhibit a central thread of their *liveness* –uncontrolled aspects, which alludes to the unpredictability of their behavior. The first

research question I pose throughout this thesis is whether the *liveness* of these embodied robots comes from the technological system by which they operate, or whether it is drawn from the audiences' perceptions. In the case of Pask's mobiles, this question might be answered with the proposal that both the system and the observers contribute to the *liveness* of these moving and responsive cybernetic machines. As for my second research question of who is the performer, the artist or the robot, I would imply that Pask is the performer based on his concepts of this performance, and his efforts in putting together and powering the cybernetic technologies behind those robots, while cybernetic sculptures i.e. mobiles, indeed, also become performers on stage, through their unpredictable behavior.

The encounter of art and cybernetics turned out to be transformative across art genres and practices, regardless of whether they were object related, staged or performed. As can be seen from the example of Pask's works, cybernetics enabled artists to assign the machine or the object with diverse technical or aesthetic features, including movement and life-like or human-like behavior. Such treatment of the machine or the object meant that artists were thinking in a discourse that, by the end of the twentieth century, would come to be defined as the posthuman discourse.

The responsiveness of self-regulating *The Colloquy of Mobiles* robots manifested through meaningful and purposeful motion, through sensitivity to light and the possibility of transmitting and receiving light signals, and the ability to react to such signals made these sensitive machines appear to be potentially convincing in their *liveness* in a way that was unimaginable for a pre-cybernetic machine. Their signs of *liveness,* in fact, are grounded primarily in observations of the behaviors they manifest, i.e. in the observers who project such a *liveness* on the robots. These robots, as self-regulating systems, essentially have a social purpose. By staging or performing a social encounter (between themselves and with humans) these robots would seize their share of projected *liveness.* Importantly, by fitting the machines with gender, modeled in line with human (or animal) genders, and by attributing those biological traits to machines, Pask's robots were brought closer to a status in which people would potentially perceive them as more than inanimate sculptures, more than just a technological set, assembled and programmed to run one set of pre-assigned tasks after another. This outlook allowed Pask's machines to seemingly approach the blurred but ever-present boundaries of *liveness.* At least these robots were asked to be perceived as agential or *alive*, and although the kind of agency or mode of *liveness* they exhibited could certainly

not be proportionate to that of natural or biological entities, these robots were fitted with abilities to perform *liveness* or perform a *life*, and the essence of the *performative life* of these robots is the uncontrolled aspect of their behaviors. In other words, what fitted these robots with their *performative life* was the unpredictability and spontaneity of the behaviors they exhibited.

Such *performative life* was less likely to be achieved by kinetic sculptures, with their behaviors and movements being predictable in terms of how the motion of those sculptures would take place and the degree of responsiveness with which these sculptures were fitted. Kinetic artists often concealed the motor that kept them in motion (Burnham, 1968: 333), as if they wanted to create a more credible impression of *liveness*, or to mystify the processes or the mechanics behind the motion of their sculptures, perhaps knowing that technologies that they were using were not powerful enough to create the convincing illusion of a living sculpture. Pask transparently placed the computers that controlled his machines in the exhibition venue next to his movable and responsive mobiles, not wishing to mask any of the computational tools that kept his machines running and interacting, as if he wanted to proudly demonstrate the power of cybernetics in which he implicitly believed.

This chapter concludes that *liveness* with early cybernetic robots arises from the technological systems and from the observer's perceptions, while both the artists and those early robotic sculptures can be seen as performers on the stage. This chapter also concludes that the position of robotic arts in the twentieth century art histories is firmly intertwined with performance as an artistic genre and with cybernetics as a scientific and technological paradigm.

VI. The Posthuman: from Embodiment to Artificial Intelligence and Artificial Life

In the first chapter I explored the emergence of non-human performance in the mid-twentieth century and the modes of *liveness* in the early robotic art that followed from a combination of cybernetics, performance, and the disruption of modernist paradigms. In this chapter, I analyze the *liveness* of performing non-humans through the lens of posthuman theories and practices, with a central focus on the notion of embodiment as one of the core elements in performance art[5] and by analyzing the ways in which performing robots and cyborgs instantiate posthuman embodied subject. Through comparing the theories on the posthuman condition with practices of performing robots carried out with cutting-edge technologies such as Artificial Intelligence and Artificial Life, I raise the question of the degree to which the *liveness* of selected embodied robots streams from their technological systems and to what extent those performing robots *come alive* through observer's perceptions. Who is actually performing in these performances, artists, robots, or both?

When Wiener pointed out the essential similarities between the operation of living and machine systems, drawing a common line between these distinct categories through cybernetic theory, humans and technologists were not nearly as interconnected as in the late twentieth and twenty-first centuries, when the linkages between living systems and technologies became more immediate. In these conditions, and often on the premise of cybernetics and computing, theories have been developed on the basis of a posthuman discourse, many of which analyze what it means to be human in the age of high technology.

The reference I consider central to the discussion on the posthuman condition is the cyborg theory of the feminist author Donna Haraway. In her 1985 work *A Cyborg Manifesto,* Haraway puts forth the metaphor of "cybernetic organism, a hybrid of machine and organism" (Haraway, 1991:1) which outlines the prevailing rise of cybernetics, and our connection to cybernetic-based technologies as a way of constructing empowered identities that might engage in the creation of the social self and address the established social conventions (Haraway, 1991). Although she does not deploy the term posthuman in her reflections on the cyborg as a human/technology chimera,

[5] Amelia Jones, Peggy Phelan, Kristine Stiles

Haraway's cyborg can be seen as the herald of the later theoretical scholarship on posthuman identity.

On a rather similar trajectory to Haraway's "cybernetic organism", another central theory grounded in cybernetics emerged as a potential framework for the posthuman condition at the end of twentieth century. In *How We Became Posthuman: Virtual Bodies in Cybernetics, Literature, and Informatics,* scholar and critic N. Katherine Hayles uses the lens of cybernetics to explore the changes in the status and position of humans in relation to technology, bringing the notion of posthuman to the fore. Akin to Haraway, Hayles uses the term *posthuman* for elaborating the connection between humans and cybernetics within a framework that opposes the social paradigms marked by the image of the liberal subject long-established over the centuries. The link between the two theories by Haraway and Hayles is constituted precisely by the common cybernetics' lens through which they both examine and frame the posthuman condition, approaching the figure of the posthuman from the stance of the deconstruction of the long-rooted social domination of the modern subject.

Hayles' views on the power of cybernetics gave rise to her theory on the emergence of the posthuman which is rooted in three strongly interconnected "stories" (Hayles, 1999: 2). These three stories, i.e. the three central influences that have been seminal in framing the posthuman are the change in the materiality of information, the emergence of the cyborg, and the profound shift from the status of human towards the posthuman as the new stage of the development of human kind (Hayles, 1999: 2).

More specifically, Hayles' concept of the posthuman is instantiated with the collapse of the materiality of information, which ceases to be represented or conveyed in material form, becoming largely virtual. This first story sets the stage for the second one, i.e. for the emergence of the figure of the cyborg as a creature part-human and part-technological, established in the gaps between technological actualities and cultural imagination. The cyborg may be seen as an embodied signifier of the paradigm shift – Hayles' third story – that occurs with the renouncement of the status of the human, and grants access to the posthuman condition, which better reflects the prevailing technological and social realities at the end of twentieth century (Hayles, 1999: 2).

For Hayles, the science of cybernetics and its principles of circulation of information via feedback loops are essentially linked to the "deconstruction of a liberal humanist subject" (Hayles, 1999: 2). Feminist scholar Rosy Braidotti explores a similar trajectory from the standpoint of the twenty-first century technologies. In her article *Posthuman Humanities*, Braidotti looks at the posthuman from the stance of the changes that are caused by the recent technological and environmental paradigm shifts that occurred with the rise of biotechnology, information technologies and climate issues, and that have a great impact on the human of today (Braidotti, 2013: 1). The cyborg, for Haraway, arose as capitalism's disobedient offspring (Haraway, 1991: 4), whereas Braidotti points to the interlinking of capitalism with the twenty-first century bio-technologies which created an amalgam that she conceptualizes as "biogenetic capitalism" (Braidotti, 2013: 8). While the economies of "biogenetic capitalism" operate as post-anthropocentric in its core, the post-anthropocentric approach for Braidotti concomitantly entails the possibility of the formation of the subject in a posthuman context, and the alternative for the deconstruction of the liberal humanist subject – the "Universal Man", which stands for the white, privileged European (Braidotti, 2013: 6, 8). For Braidotti, therefore, post-anthropocentrism is the framework that allows the emergence of different subjects within the posthuman discourse, and provides grounds for deconstruction of the dominance of humans or any particular species – a promise of the posthuman condition that Braidotti terms "a colossal hybridisation of the species" (Braidotti, 2013: 8).

Theories proposed by Braidotti, Hayles and Haraway metaphorically frame posthuman figures of cyborgs with allowing the possibility to perceive also the image of robots among the posthuman subjects. For Haraway cybernetics brought about "boundary confusion" between distinct categories such as human and technology or material and virtual worlds (Haraway, 1991), Hayles recognizes in cybernetics the mode of posthuman embodiment that exceeds human-machine distinctions (Hayles, 1999: xiv), Braidotti in high technologies of the twenty-first century perceives the opposition to dominance of humans or that of any species (Braidotti, 2013: 8); these theoretical reflections on ways in which technologies re-shape our realities permit interpreting and/or imagining formation of the subject of performing robot within the posthuman framework.

Central to Hayles' theory is the embodiment of the posthuman. She calls for the posthuman "grounded in embodied actuality rather than disembodied information", building the theory of embodiment in strong opposition to roboticist Hans Moravec's concept of storing human

consciousness into a computer in order to achieve the eternal life of the mind (Hayles, 1999: 1, 2, 287). Embodiment, for Hayles, is inclusive, as it does not imply human/machine distinctions or those based on gender (Hayles, 1999: xiv). Hayles' focus on embodiment comes in a historical moment when realities become increasingly technologized and virtual. When information loses its materiality, it is paramount that the posthuman body retains its materiality within the world it occupies (Hayles 1999: 244). Prompted by the first order cybernetics, embodied non-human performers have already appeared on stage and in the theoretical reflections that proceeded the human transition to posthuman conditions, but within the posthuman discourse these non-human performers acquire and modulate new meanings.

Hayles' inclusive approach towards embodiment in the posthuman world asks for materializations which must not be burdened by distinctions between "humans who can think and machines which cannot" (Hayles, 1999: xiv). Such an approach enables us to look towards embodied robots and other embodied non-humans as instances of posthuman subjects, regardless of the fact that the non-human status may arise from media art practices, philosophical reflections or from daily experiences. The notion of embodiment in performance frameworks is developed through broader conceptual approaches, allowing diverse materializations in terms of the performer's body and bodily presence, ranging from the established paradigm of the on-stage physical presence, to mediatized digital practices or interconnections of the two modes of presence.

Throughout the history of visual art and theatre, whenever performing bodies, technologies, and media meet, those confluences were fully embraced into the genre of performance. Such was the case when, in 1960s, Bruce Nauman tested the limits of *liveness* through the then-new media of video, which combined the artistic disciplines of video art and performance art with works such as *Bouncing in the Corner* or *Lip Sync* (Daniels, 2011: 64). From another point of view, the scholarship on performance gave rise to discussions on embodiment in relation to *liveness* that range from views such as performance scholar Peggy Phelan's notion of *live*, tied to the concept of performances' only life being in the present (Phelan, 1993), or Phillip Auslander's *liveness* that extends beyond on-stage practices and abundantly draws from the depths of digital, algorithmic worlds where virtual agents, such as e.g. an online chatterbot, perform *liveness* in their encounters with human users (Auslander, 2002). In relation to these considerations, my focus in this thesis

remains on those embodied robots present in on-stage performances whose *liveness* is derived from their *live presence* on-stage and the *conversations* that occur in the fashion of corporeal actions.

Hans Moravec's 1990 work *Mind Children: The Future of Robot and Human Intelligence* launched the theoretical considerations of the concept of preserving the mind after the death of an individual. French philosopher Jean-François Lyotard additionally raised the stakes by posing the question of how the mind may be retained after the death of all humanity. In his 1998 essay *Can Thought Go on Without a Body?* Lyotard develops the theory of embodiment in relation to "the death of the sun" as the certain destiny that awaits the human species in several billions of years (Lyotard, 1991). Starting from the explosion of the sun as the ultimate end of the Earth and all human life, Lyotard questions how to preserve life after this explosion. According to Lyotard, the mind, or the "bodiless thought", might continue living in the form similar to software, and endowed with an artificial body that would be manufactured as hardware (Lyotard, 1991: 14). Such manufactured body would be either autonomous in relation to the conditions of the life on Earth, or it should be transferred, prior to the explosion, to another location in the universe far away from the Earth (Lyotard, 1991: 14, 17). Lyotard calls for the embodiment of "post-solar thought", given that, without an artificial body, thought would remain only a "poor binarized ghost" (Lyotard, 1991: 17). The research field of Embodied cognition, linked to phenomenology and mind-body unity (Penny, 2017: 199) can be seen as a field that has, in applied and concrete ways, taken up the philosophical reflections and views on the essential roles of embodiment, such as those expressed by Lyotard.

One of the instances of embodied robots exploratory in analyzing non-human *liveness* produced through on-stage practices is the *Articulated Head*, developed jointly by performance artist Stelarc, engineer Christian Kroos and software developer Damith Herath, and exhibited since 2010 as an elaboration of previous Stelarc's work titled the *Prosthetic Head.*

The *Articulated Head*'s physical shape is constituted by several technological elements of diverse materiality and function, from mechanical to virtual. A large yellow movable industrial robotic arm extends from the central base. A digital screen is mounted on the robotic arm with an unusual virtual portrait: Stelarc's digital face programmed for *conversation* and mimics. Through a system of cameras and sensors, the robot is enabled to track human presence in the surroundings, so that after having spotted it, the robot responds by turning its body towards the visitors. Combining

elements of physical and virtual worlds, the type of embodiment featured in the *Articulated Head* is consistent with Hayles' call for an embodied posthuman.

Fig. 4. *Articulated Head,* <https://www.elektramontreal.ca/stelarc>, accessed 01 August 2019. (© Stelarc, Christian Kroos, Damith Herath)

Resonant with Gordon Pask's call for *conversation* between autonomous art machines and sentient humans, the key mode through which the *Articulated Head*'s robot achieves its *liveness* is precisely by means of conversation. This *conversatio*n takes place thanks to a text-to-speech software that endows this embodied robot with audio speech simultaneous with the motions of Stelarc's virtual face, while the human converses back by typing on the keyboard (Kroos, Herath & Stelarc, 2011). Using chat-bot software, at times, it is the robot that initiates the contact and starts conversing with the human, while first contact can be initiated also by a human, by typing on the keyboard. Although the authors of this work define it as an interactive artistic installation (Kroos et al., 2012: 403) or robotic art installation (Kroos et al., 2012: 401) this piece might be interpreted as robotic performance based on immediate one-on-one encounter between the performing robot and the participants.

Already in then nineteen sixties, Jack Burnham anticipated that, by the end of the twentieth century, "the aesthetics of artificial intelligence" would be endorsed by artists (Burnham, 1968: 15), which today we see instantiated in the conversational abilities of the *Articulated Head.* This chatterbot software, based on A.L.I.C.E. artificial intelligence system for speech, is further enhanced by a rich conversation database based on a broad set of questions and answers.

The robot's "artificial mind" utilizes artificial intelligence in the fashion of a *homunculus* placed inside the machine, and this virtual "agent within the agent" cannot be the sole producer or carrier of the agency (Kroos et al., 2012: 401). The agency in this robotic performance emerges and flows through actions and contributions that occur in the environment, which involves both the action carried out by robot and the input of the human (Kroos et al., 2012: 401). Importantly, as clarified by the authors of this work, the driver of the shared agency in part arises from the interaction between humans (audiences) and the robot (Kroos et al., 2012: 401).

What does it take for robots and humans to hold a *conversation,* either through speech or through physical, corporeal exchange that occurs in performative contexts? The *conversation* between two counterparts should imply intentionality, which is the feature that artist and engineers behind this work attempted to attribute to this robot through artificial intelligence chatterbot software. The difficult question of "Can machines think?" posed in 1950 by British computer scientist Alan Turing (Turing, 1950) comes to mind in the discussion about such *conversations* in which artificial intelligence software becomes the driver of *conversation* in the framework of performance, and when the *conversation* itself should reflect understanding and advance coherently and meaningfully between a technological object, such as a robot, and a sentient human. In this discussion, it might be valuable to look into Gordon Pask's observation on machine intelligence, written in the introduction of Nicholas Negroponte's 1976 book *Soft Architecture Machines*:

> The contention is as follows: intelligence is a property that is ascribed by an *external observer* to a *conversation* between *participants* if, and only if, their dialogue manifests *understanding.* (Pask, 1976: 7).

The *conversation* itself, as Pask points out, when derived on the basis of machine intelligence, might not be purposeful, unless it takes place with a certain degree of understanding between the two conversing counterparts. Despite the rise of Artificial Intelligence from the mid-1960s to

1980s, when stronger processors and larger memories enabled faster operations and larger databases (Penny, 2011: 77), the twenty-first century presented a relative stagnation in terms of the AI within the field of computer sciences. Computing today successfully deploys artificial intelligence in the branches of science such as machine learning, and AI may also be credited for various virtual agents that provide different services that facilitate our daily lives. However, it is debatable to what extent, in robotic art, and more specifically in robotic performance, Artificial Intelligence might prove to be an effective, powerful or extraordinary model of *understanding* either in spoken, written or other form, in *conversations* that take place in *live presence* encounters between a robot and a human. By this I mean that performance, whether carried out by artificial or human bodies, develops by virtue of the types of *understanding* within the framework of tried-and-tested performance strategies, such as spontaneity and immediacy in *live presence* corporeal encounters. In performance, the *liveness* that is generated through those understandings and feedback loops between two counterparts is often underscored by a number of uncontrolled and unexpected aspects.

What remains arguable from this perspective is whether, and to what extent dynamic processes and instantaneity between the two bodies may be achieved through AI software. Namely, the artificial mind that is run through AI software operates through a brute force method, by which the *conversation*, in terms of questions and responses through spoken or typed words is generated within the established framework and without spontaneity of behavior, excluding any deviation from the programmed set of questions and answers. Lyotard calls for the embodiment of artificial mind and body in pursuit of a solution in the case of the death of the sun, when life on Earth would end (Lyotard, 1991). Discussing cybernetic-life systems, Lyotard points out the disappointment that is often felt towards the way in which the artificial mind and its organs "operate on binary logic" (Lyotard, 1991: 80). Lyotard indicated that these disappointments largely come from the comparison of such binary logic with the organic logic, tackling the well-rooted juxtaposition between the logics of human which operates on the sum of biological modes and processes, and is therefore both operational, and intuitive and lateral at the same time, while the artificial thought operates on units of information which cannot allow for intuition and spontaneity (Lyotard, pp. 80). Such juxtaposition, which might indeed trigger our disappointment with robots, logically extends beyond the comparison of human thought and what Lyotard defined as "bodiless thought" and can be seen as a key distinction between humans and robots, from appearance to morphologies

and movement. The organic body (operational on natural organs) and the cybernetic body (operational on bytes and units of information) indeed function with completely different organs, which reflects on the level of intuition, laterality, spontaneity, naturalness and all those traits are instinctively expressed by humans while in the case of robots they are not necessarily excluded, but it proved to be difficult to install robots with those traits that would be expressed in a human-like manner. Indeed, such cybernetic-based expressions and modes of operations that robots carry out might cause disappointment when we consider techno-objects such as performing robots or social robots in the quest for expressions of vitality and *aliveness.* For Lyotard, however, these distinctions do not impair the concept of embodiment as the possibility for continuing life after the explosion of the sun, perhaps simply because there is no adequate alternative for preservation of life other than through the "post-solar thought" installed within a manufactured body.

Looking back to the *Articulated Head* from another perspective, even though artificial intelligence in its current state does not endow this robot with qualities such as spontaneity, naturalness, and laterality, the strategies deployed in designing and programming this *live art* robotic performer might guarantee its *performative life* through several other interlinked modes. The *liveness* comes forth from the robot's simulation of human behavior that takes place not only in *conversation,* but also when Stelarc's digital image – representing a robotic head – mimics speech and facial expressions, or through responsiveness, when the robot, alerted to human presence in the environment via special sensors, turns its body, shaped as a robotic arm, towards the humans and starts tracking their movement in the gallery venue. This instantiates the mode of perceived *liveness* that comes into effect when machines are fitted to simulate those properties or features inherent to human nature – a phenomenon that Goodall explored as a manifestation of human "anxieties about programming and control" (Goodall, 1997: 441). It is precisely through these *live presence* anxieties that the *liveness* derived from a technological system convenes with the *liveness* derived from observers' perceptions.

Analyzing the question of who actually performs in the *Articulated Head,* the robot or Stelarc, it becomes apparent that the positions of the performing robot and Stelarc are intermixed in this work. By conceiving the robot's head as the representation of his own – as a conversing and mimicking digital portrait – the artist, at least to a certain degree, appropriates the performer's position, perhaps turning the emphasis away from the robot's autonomy to his own authorship of the performance

concept. Stelarc designed this robot as an on-stage representation of himself and therefore the robot does perform, but without achieving independence from the image of its creator. The robot is given an opportunity to perform, but only as Stelarc's avatar.

In my considerations on the *liveness* of a technological object, what can be significant especially from the aspect of those embodied robots drawing on cybernetic technologies such as Artificial Intelligence and A-Life, is the later phase of what is considered to be the second order cybernetics, as well as third order cybernetics. The mature stage of cybernetics' second wave was marked by Chilean scientists and philosophers Humberto Maturana and Francisco Varela's theory on living systems, defined as self-organizing autopoietic systems, as described in their 1980 work *Autopoiesis and Cognition: The Realization of the Living* (Hayles, 1999: 10,131-160). Through autopoiesis, as Hayles notes, "Maturana and Varela extended the definition of the living to include artificial systems" (Hayles, 1999: 222). One of Maturana and Varela's comparisons between biological systems and machines, proposed in the *Autopoiesis and Cognition* section *Living Machines*, implies that "living systems are machines" (Maturana and Varela, 1980: 76) by describing living organisms as consistent with a mode of organization of certain types of machines defined as "autopoietic machines" (Maturana and Varela, 1980: 78-85). The third wave of cybernetics, which began in the 1980s, entailed the transition from self-organizing and self-making systems to self-evolving ones. The emergence of A-Life discipline through the association of computing with evolutionary technologies gave rise to the notion of *emergence* in regards to various artificial and/or digital organisms that evolve independently within computer programs or other kinds of virtual systems (Hayles, 1999: 222-247).

The work of Ken Rinaldo, for example, may be seen as linked with the second and third order of cybernetics. We recall Rinaldo's approaches to *liveness* through the robotic work entitled *The Flock* (1994), in which a group of robotic sculptures designed as a mix of grapevine branches, infrared sensors and software, exhibits responsiveness to sound and movements in a way similar to an animal flock (Rinaldo, 1998). Another Rinaldo's robotic work, entitled *Augmented Fish Reality*, explored how fish communicate and express intentionality when they are placed inside large glass bowls on movable technological platforms and enabled to move together with the bowls around the gallery, coming closer to one another (Huhtamo, 2004: 6). The materials and concepts explored in *The Flock* were an overture to Rinaldo's grandiose robotic project entitled *Autopoiesis* (2000).

Autopoiesis premiered in a group exhibition titled *Outoaly* in the Kiasma Museum of Contemporary Art in Helsinki, as a robotic installation composed of fifteen robotic arms that operate jointly in a single environment through *live presence*. The robotic arms are designed as branches of grapevines tied with colorful plastic ribbons, with the upper part attached to technologies by which they operate, and pinned to a metal ceiling construction. Consistent with Maturana and Varela's notion of "autopoietic machines embodied in physical systems" (Maturana and Varela, 1980: 81), these embodied robots operate in a designed physical environment.

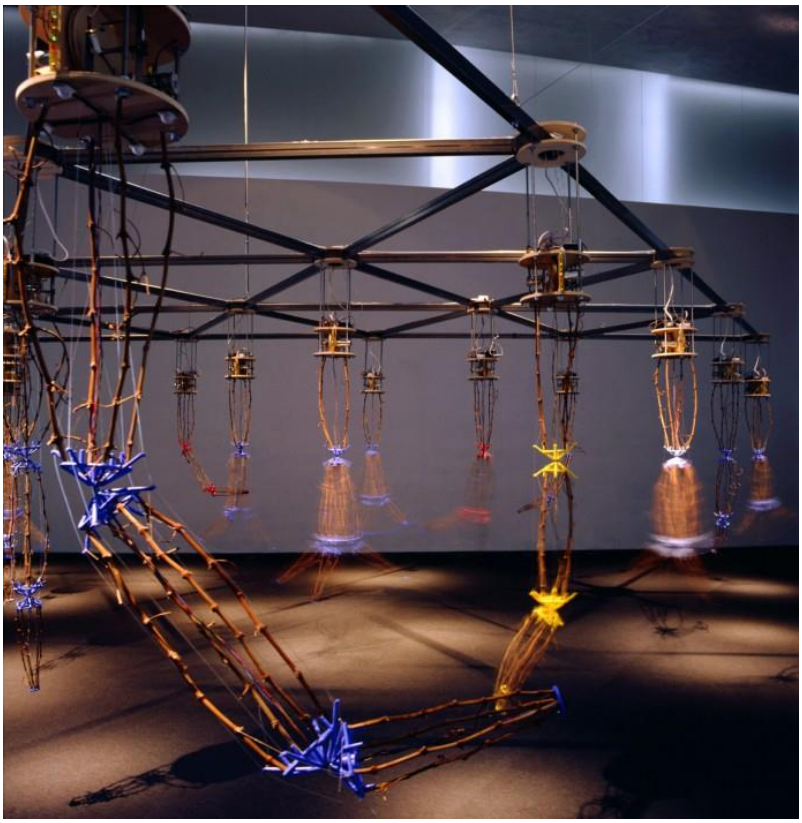

Fig. 5. *Autopoiesis,* <http://kenrinaldo.com/portfolio/autopoiesis/>, accessed 01 August 2019. (© Ken Rinaldo)

The software thanks to which these robots operate is written in the C+ programming language (Rinaldo, 2016: 123-124). These robots engage in *conversation* in two ways. First, they interact with each other as closed, self-referring systems by exchanging mobile telephone sounds via RS-485 electrical signal system for serial communication (Rinaldo, 2016: 113-149). Secondly, these robots display social behaviors towards humans, sensing when a human enters the environment, tracking the human movements and performing for the humans in synchronized choreography. As

artist and scholar Jennifer Hall puts it, these robots operate “as both a closed system and an open life form” (Hall, 2015).

The synchronized dance-like movements of these grapevine robotic arms resembles a motion of animals in a flock or a swarm. While the *Articulated Head* approaches the observer through modes of *conversation*, the *Autopoiesis* robots simulate movement or dance to approach the observer – embodied in the part-technological and part-bio figures, resonant on Haraway’s “hybrid of machine and organism” (Haraway, 1991:1). The movements of these robots are automatically controlled via a sensor microcontroller device that receives information from all the single sensors attached to each of the robots, while data is instantly transmitted to the computer control system, therefore enabling movements that are almost identical for all robotic units that make up this system (Rinaldo, 2016: 123 -126). When a human comes too close to a robot, to only a few centimeters’ distance, the robot retreats in order to avoid direct physical contact, in accordance to Maturana and Varela's conceptualization of "autopoietic machines" as self-organizational systems whose processes take place "completely within the boundaries of the machine" (Maturana and Varela, 1980: 78). As Maturana and Varela put it, "autopoietic machines have individuality" (Maturana and Varela, 1980: 80) and despite their interaction with the observers, these robots indeed maintain their individuality and independence while performing for humans.

The *Autopoiesis* technological system has less data to process when confronting an individual or a smaller group of people, and thus the robotic group is powered to perform more actively, while in case of larger groups, due the technical limitations, robots become less expressive and slower-moving (Rinaldo, 2016: 126). This element of behavior of the *Autopoiesis* robots is another point of comparison with the behavior of animals, which in principle react more courageously towards smaller groups, whilst being more alert when spotting or encountering a larger group. Ihnatowicz's *The Senster*, for example, would approach the sources of low sounds or soft movements, whereas avoiding louder sounds or unexpected, sudden movements (Woolf & Thompson, 2002: 236). Another element that makes the *Autopoiesis* robotic group credible in imitating animal behavior is how these robotic arms with installed cameras monitor the humans while the footage is projected on the wall (Rinaldo, 2016: 125). This mode of surveillance appears to be similar to when animals observe their prey, further emphasizing the *liveness* of these robots and potentially triggering anxieties that occur when humans encounter expressions of animal-like behavior in technological

agents. Elmer and Elsie, as their creator William Gray Walter proclaimed, were in carrying out "an imitation of life" and these mobile robots performed said imitation by mimicking animal-like appearance and behavior. Rinaldo's *Autopoiesis* robots are also programmed to imitate animal behavior through uniform and graceful movement, which we might perceive as dance or choreography, replicating the movement of a bird flock or perhaps an animal herd on the go.

Rinaldo defined his *Autopoiesis* work as "cybernetic ballet" (Rinaldo, 2016: 126), a formulation that might evoke a reference to the avant-garde "mechanical ballet" designed by Italian Futurist Fortunato Depero. In Depero's 1924 "mechanical ballet" entitled *Aniccham del 3000,* two human dancers acting as locomotives, moving in a mechanical fashion while dressed in metal tubes with large cylinders on their heads, develop emotions for the railway station master (Berghaus, 2011: 80-82). Depero's pre-cybernetic ballet is analogous to Goodall's theory of transferring agencies from human to machine, in line with the general preoccupation of Futurists, who largely explored the possibilities of on-stage performances through the points of contact between humans, technology, and inanimate objects. Drawing on what robotic art scholar Elizabeth Jochum defines as the "urge to create (or simulate) autonomous performing objects" (Jochum, 2012: 80) the Futurist theatre plays and performances, similar to the performances of the Bauhaus artist, often staged objects as seemingly animate, whereas the then available technological means could not endow such an object with a convincing expressions of *liveness*. Indeed, the Futurists' endeavors in the continuous shuffling between what was expressed as *live presence* performance and what was considered as inanimate object are well known. This preoccupation of the Futurists is what the art historian RoseLee Goldberg defined as a "back and forth between performance and object making" (Goldberg, 1980: 375). Certainly, in those slippages between performance as the hallmark of *live presence*, and an inanimate pre-cybernetic object, the Futurists did not have the technical means to design their on-stage objects as more credible expressions of agency and liveness or, put in Maturana and Varela's terms, to design an object that would operate as a self-organizational and self-making system. Rinaldo, in comparison, drawing on the more advanced technologies of his time, had access to computing technologies and was inspired by the concept of artificial life, thanks to which he enabled his grapevine robots to perform "an imitation of life" in a manner of *live presence* that is more convincing and credible at least to the extent of triggering the anxieties of the audience.

On a different note, artificial life from today's perspective is chiefly evaluated as a technological paradigm with limited reach in terms of credible imitation of biological models or technological objects *coming alive*. Artificial life emerged partly as a model for overcoming the crises of Artificial Intelligence (Penny, 2017: 142) but, despite the advantages it offers, the great and perhaps unrealistic expectations that were placed upon it have not been met. It seems that today many of the *evolutions* and *emergences* instantiated via concepts of artificial life function in online environments, whereas their application to embodied agents, including performing robots or real-world technological settings, produce somewhat limited outcomes.

On the one side, the *liveness* of these delicate and graceful *Autopoiesis* robots derives from an advanced and responsive underlying technological system, whereas on the other side, the *liveness* stems from perceptions of the observers, when anxieties are triggered by robotic behaviors such as responsiveness to movement and performing, which is amplified by being kept under robot surveillance. As a result, it is hard to distinguish who is actually performing in this robotic work, the artist or the group of embodied robots made of grapevine branches and powered by software, sensors and related technologies. These robots and their creator appear to be inseparable in this original concept, and without a doubt both the artist and the group of robots perform. The *Autopoiesis* performance relies on previous Rinaldo's works, as seen from the grapevines which he tends to use in many of his works (Rinaldo, 2016: 121), and from the unique and subtle responsiveness of the robots through which *Autopoiesis* underscores Rinaldo's artistic sensibility i.e. personal signature. The term personal signature stands for hallmark of authorship, an involuntary and deeply embedded element of the artist's work by which the observers recognizes a particular artist (Boden, 2012: 92), and such a personal stamp is strongly expressed in this work, thanks to which Rinaldo can be regarded not only as the artist behind the performing robots, but also as a performer. While in the *Articulated Head,* Stelarc endowed the robot with his own digital portrait, Rinaldo imprints his own image into these robotic performers not literally, but through his unique personal signature.

The *Autopoiesis* instantiates how concepts and technologies linked to the concepts of A-Life were applied in robotic arts at the rise of the new millennium, whereas the ways in which some of the more recent possibilities in the fields of computer science associated with artificial life are put into artistic practice may be illustrated by the British artist's Ruairi Glynn's work entitled the

Performative Ecologies, developed in 2007 in the labs of the London's Bartlett School of Architecture.

In this robotic performance, a group of playful, restless robots hanging from the metal ceiling construction performs in a darkened venue for groups of observers. In terms of their embodiment and appearance, these robots have been fully designed following technological aesthetics, and without analogies to human-like or animal-like appearance, with the exception of a clearly recognizable small robotic head fitted with two glowing lights that very much resemble eyes (Glynn, 2008). In accelerated motions, these robots move and make gestures using their entire bodies while flashing light with their neon-illuminated tails (Glynn, n.d.).

Fig. 6. *Performative Ecologies.*<http://www.ruairiglynn.co.uk/portfolio/performative-ecologies/>, accessed 01 August 2019. (© Ruairi Glynn)

The interplay of light in the darkness, and the robots' urgent movements often attract the observer to approach these robots in order to examine them from the immediate vicinity, or in an attempt to touch them. Drawing on Gordon Pask's *Colloquy of Mobiles*, Glynn uses technologies such as artificial intelligence and machine self-learning (Glynn, n.d.) by strongly relying on concepts evocative of Gordon Pask's "aesthetically potent environments", defined by Pask as art systems that should be responsive to humans and engage in *conversation* with humans (Pask, 1971: 76).

Glynn's robots are programmed in accordance to a Darwinian natural selection model via an evolutionary computing software i.e. Genetic Algorithms, a computational method for selection-based problem solving.[6] More specifically, these robots are installed with facial recognition interface that measures "attention levels" of the audience during each of the performances (Glynn, n.d.). This selection principle implies that those movements and gestures that observers found uninteresting i.e. those motions that received less attention, become excluded from robots' databases and thus discarded from the later performances, whereas the kinds of motions and gestures that attracted attention are re-performed and highlighted in the next performance.[7] Braidotti's theory inspired by bio-technological realities might be instantiated precisely in Glynn's efforts to utilize computer programs that evoke or simulate biological processes for non-human, non-organic artifacts.

We recall how human performers sought immediate contact and full attention from audiences with spontaneity and certainly without compromising or having to adapt to the audiences. Performance art, as noted by RoseLee Goldberg, from its first practices and manifestos by the Futurists, has been an "expression of dissidents" and an anarchic practice that relied on performer's ideas often combined with different tactics deployed for shocking the audience (Goldberg, 1979: 6). Glynn's *live performers* however, would not approach the audience through provocation as avant-garde performers, whereas these restless robots, which appear to be competing for attention against one another, are more than willing to compromise. These *live art* robotic performers tailor their performances through feedback loops with audience by dismissing any movements that did not catch audience's attention. As Glynn puts it, "rather than being pre-choreographed, these creatures propose and negotiate with their audience, learning how best to attract and maintain their attention" (Glynn, n.d.).

This kind of input and output based on audiences' attention span shows a clear preference for what audience finds interesting or pleasing, which, however, might be a tactics that is rather inconsistent with the core principles of performance as a genre that is inclined towards provocation and the

[6] Genetic Algorithms were introduced in cybernetics theory by American scientist John Holland in the sixties of the twentieth century, as a method that draws on adaptation of living organisms i.e. natural selection as defined by Darwin. Today's Genetic Algorithms software in computing are often utilized for finding a solution to a particular problem.

[7] This model of evolutionary computing is correspondent with the brute-force method, used for breaking passwords by trying out thousands and thousands of combinations until the right one is found.

emphasis of the unexpected. Perhaps such compliance on behalf of Glynn's robots would be more consistent with the forms of popular performance or commercial art, or with the profile of service robots – such as workplace robots, or the ones used in hospitals or museums, which are commonly designed to be more appealing and more unobtrusive for the users.

On a different note, even if not aligned with the concepts of performance as a provocative genre, these robots really need attention to survive. By this I mean that without such mode of *conversation* though which these robots capture attention, in all probability they would end up being short-lived performers, replaced perhaps before long by the next, more technologically advanced machines. Prioritizing what the audience finds interesting or appealing might entail for these robots their only chance to remain on stage and re-perform in dim venues, thus prolonging their *performative life* largely devoted to audience reception.

The *liveness* of these robots, grounded between Darwinian natural selection on the one hand and a mechanical/computational system on the other, is derived both from the underlying technological system and through the observer. However, the position and the role of the observer turns out to be very central for these robots to perform *liveness.* Who performs in this work, the artist or the group of restless dancing robots? Both do, but as the robots are presented with limited autonomy (conditioned by the attention levels of audience) it appears that the position of the artist as a performer can be seen as more prevalent.

This chapter concludes that the selected examples of embodied robots embarking on the AI and Artificial Life technologies instantiate modes of *liveness* that stem both from the technological system and from the observer, whereas those technological systems, perhaps due to the high expectations towards those disciplines in the context of the *liveness* of the technological object, failed to provide a type of credible and convincing *liveness* in a way that would be more advanced compared to how robots and other technologies were *coming alive* through the earlier stages of cybernetics. In that regard, is not technologies, but human natural inclination to perceive these embodied performing robots as agential or *alive,* that triggers and makes sense of such human-machine *conversation*s, thus producing the robot's *liveness*. This chapter also concludes that the question of who performs in these performances largely depends on the concept of the work and on the artist's personal signature, while the image of the performer also remains bound to the outcomes of the *conversation*, i.e. it is dependent upon the audience's perceptions.

VII. Performative Life - Emotions and Anxieties

> As the automatic machine became increasingly suggestive of agency, any appearance of the automatic in human behavior conversely seemed to suggest loss of agency. It was as though agency could leak from bodies into machines through the circuitry by which they were interconnected.
>
> -Jane Goodall

> The historian proceeds to link Western culture with an unstoppable craving to wrest the secrets of natural order from God with the unconscious aim of controlling human destiny, if not in fact becoming God itself. The machine, of course is the key to this transference of power. If it constructs our destiny, it can do no less than become the medium through which our art is realized.
>
> -Jack Burnham

In the second chapter, I considered how *liveness* develops in the embodied twenty-first century robots running on advanced and largely cybernetics-based technologies such as ALife, AI, machine learning or digital computing. In this chapter, I focus on robots that source *liveness* more so from observers' perceptions by triggering emotions and anxieties than from technological systems on which these robots operate. What level of such *liveness* is produced by the system as compared to the levels of *liveness* streaming from the observer? Who actually performs in these works, the artist behind the concepts of performance (and often at least partially behind its technologies), or those twenty-first-century robots enacting the *live presence* on the stage? Or is it that both the robot and the artist are performing?

Machines designed to simulate human-like features to appear intentional and agential so that they produce *liveness* might be best understood through Jane Goodall's conception of "transferred agencies" caused by anxiety over the loss of agency and control over the machines (Goodall, 1997: 441). The curious twist with human endeavors around transference of agency to machines, according to Goodall, begins with mix-ups between the profile of human and that of machine. This

circularity in performance could have a twofold manifestation. On one side the performer, whether by own authorship and concepts, or when being assigned by those behind the scenes (director, screenwriter, costume designer) takes on features, properties or behaviors typical of the machine and simulates those machine-like properties on stage. Conversely, as seen throughout history of performance and in various types of performing technological objects such as historic automata, at times, humans behind the machine performances would attribute those machine performers with human-like threads, appointing the machine to simulate said threads on stage. Those embodied and performed reflections of our long-rooted anxieties over power issues in the human-machine context, and above all, anxieties with losing agency over machines, are leading to what may be understood as the transference of agency onto a machine:

> Surely a being that is empty of agency must draw it from somewhere, and the only source to which it is connected is its own creator, who after all, deserves what is coming to him because, not content with making objects that are agency neutral, he has created an agency vacuum that must- automatically, so to speak-seek to fill itself. (Goodall, 1997: 444).

The shifting of agency from human bodies to technological objects throughout histories appear to be, as Goodall implies, largely interlinked with power relations, fear of automation, technological embodiments, programming and control. For Michel Foucault the purpose of eighteen-century automata, life-like animated figures modeled on human or animal images and behaviors, were not only to astonish and impress the masses but to serve as "political puppets, small-scale models of power" demonstrating the power of rulers (Michel Foucault, cited in Dixon, 2004: 19).

Robots, like cyborgs, especially throughout twentieth century, were largely represented as powerful or at times even aggressive figures, causing anxieties and curious sensations. From science fiction to popular culture and arts, these technological agents would often approach humans from the position of supremacy, which is best seen in the early robotic art of Jean Tinguely's self-destructive robots or colossal *Survival Research Laboratories* machines that demonstrated power by confronting each other. Similarly, cyborgs were largely depicted as dominant or violent figures, such as Mary Shelley's Frankenstein in literature or Ridley Scott's *Blade Runner* in film.

One of the recent robotic works ensuing *liveness* in the mixture of narratives of power and anxiety, presently being showcased at Venetian Art Biennale[8] is the robotic performance by Chinese artists Sun Yuan and Peng Yu Bring titled *Can't Help Myself* (2016). The robotic arm is shaped as a huge, black, shiny figure centrally placed in what appears to be a huge blood pool that spills around the gallery floor. The pouring liquid that by color and density resembles blood springs from below the robotic body (Hongliang, 2019). With graceful motion, the robot pedantically swipes the floor with a broom-like ending attached to the robotic arm, collecting the liquid. The robotic arm and its interference with blood as a substance that drives our organism potentially stands for metaphorical representation of new frameworks of control, perhaps by outlining scenario by which technology assumes control over natural life. The environment in which this self-organizing robot operates is a designated space that resembles a cage, thereby audiences may only observe the robot through the large glass surfaces and these encounters do not evolve based on the one-on-one mode of direct contact, but resemble a model of observation as in a zoo. However, the feedback loops between the robot and the observer evolve via deep anxieties growing in the encounter with this massive machine preoccupied with concealing the spurting of blood.

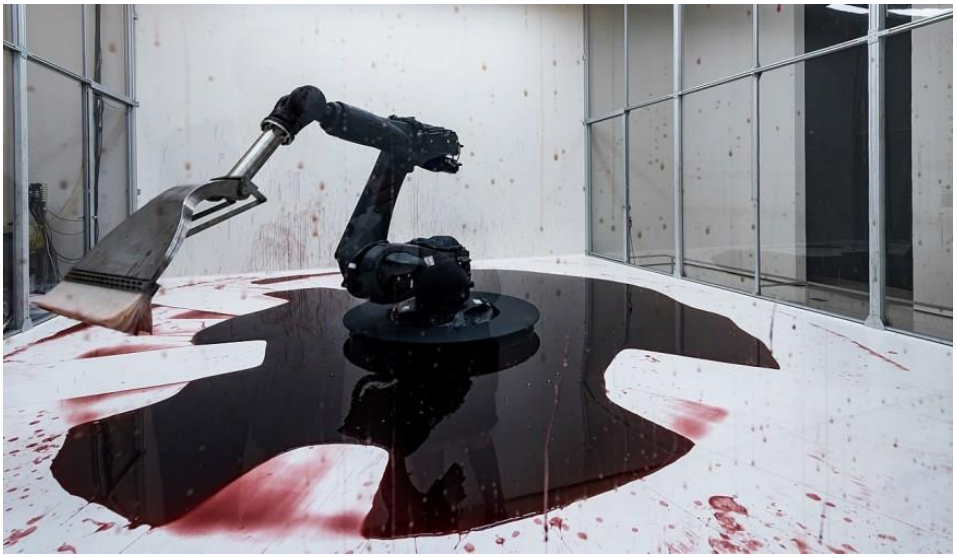

Fig.7. *Can't Help Myself*, < https://www.guggenheim.org/artwork/34812/>, accessed 01 August 2019. (© Sun Yuan & Peng Yu**)**

[8] La Biennale di Venezia 2019 - *May You Live In Interesting Times*.

Robot's motions carried out in repetition loops (Weng, 2016) build on observers' anxiety caused by appeared endlessness of choreography performed as an infinite loop to which the observers are drawn. Repeating masterfully the same set of motions time and again, skilfully and graciously dealing with blood, the robot appears to be performing a dance choreography. With such stunning performance it can be asserted that machine on stage becomes the only performer, suppressing the argument that human is actually behind this performance and that human, in a certain sense, might be performing. The *liveness* of this robot streams from its technological system, while concomitantly it comes from observers' anxieties.

Turning to a different perspective within the narratives of power, what cybernetics has brought about in robotic performance and robotics in general is the diversification of power that, especially over the last several decades, manifested itself less with robustness of the robot, as it was often the case with images or tales of robots and cyborgs during the twentieth century. Cybernetics has propelled machines with power and influence through a variety of more delicate and more subtle ways.

One of the striking examples instantiating those kinds of delicate power narratives is French Canadian artist Louis-Philippe Demers' the *Blind Robot*, an embodied technological agent that approaches us from the position of weakness and impairment, exemplifying the type of power outlined by Demers as "suggestive power of the afflicted agent "(Demers, 2019).

The *Blind Robot* has first been *brought to life* at the 2012 *Kibla Festival* in Maribor (Slovenia) and later shown internationally. The appearance of this robot is fully technological in its aesthetics. The main body parts are two industrial-like arms that are fitted with hands, in shape and size quite similar to human hands. The hands are pre-programmed for an articulated and subtle touch that robot applies to the face of a person seated across in a simple chair. Robot's maneuver with metal hands against the person's face, as if discovering facial features, resembles an act of a blind person recognizing an object or a face through touch.[9] This effective and intimate one-on-one physical contact, or, in Pask's terms, the *conversation,* is the basis for creating relationships in which the

[9] Blind persons commonly use sense of touch for orientation in space, object recognition, Braille etc.

Blind Robot, at least temporarily, in the eyes of the human sitting on a chair across the robot, potentially becomes more than a technological construct.

Fig.8. *The Blind Robot,* <http://www.robotsandavatars.net/exhibition/jurys_selection/>, accessed 01 August 2019. (©Louis-Philippe Demers**)**

> Our hypothesis is that the social role (a blind) will augment the act of touching via the potential of the created emotional connection between the human visitor and the robot (Demers, 2012).

As stated above, the *Blind Robot* is enacting blindness and utilizing touch with an aim for creation of emotional connections with humans. Crucially, one-on-one encounter mode utilized in this robotic performance produces grounding for the relational aspect that may trigger the audience's bonding with the performing non-human agent, thus producing the *liveness* of this robot.

Jane Goodall's discussion on "transferred agencies" point to our anxieties over power and control issues in human-machine relations as manifested in the performance, whereas the analogous conception marked with the term “uncanny” stands for the subtle mixture of anxieties and thrills humans might feel towards embodied robots. The notion of the uncanny first came into focus with Sigmund Freud's 1919 essay *The Uncanny* on discomfort towards objects or phenomena linked to our long-rooted fears (Freud, 2004) and half-century later re-interpreted by Japanese scientist Masahiro Mori's 1970 essay *The Uncanny Valley* centering on robot’s human-like appearance as a

trigger of mix of anxieties and fascinations (Mori, 2012). Elizabeth Jochum and Ken Goldberg's 2016 article *Cultivating the Uncanny: The Telegarden and Other Oddities*, termed as "experiential uncanny" as a type of emotions that emerge in the mixture of fascination and anxiety occurring when an "object transcend its objectness" (Jochum & Goldberg, 2016: 172). Such sensation, however, is not triggered by robot's appearance but comes from their life-like behaviors, leading the observers to perceive awareness of robots when imaginary and real are intermixed (Jochum & Goldberg, 2016: 149-177). Jochum and Goldberg see the *Blind Robot* as one of the examples of the robotic works that triggers "experiential uncanny", pointing out to trust and uncertainty as central in such physical contact with robot:

> The artwork raises issues surrounding proxemics, trust, and predictability which are important factors in social robotics research. The artwork dramatizes an intimate, physical interaction between a human and a robot in order to defamiliarize the physical experience of the human body in the world. (Jochum & Goldberg, 2016:171).

Indeed, key to this kind of corporeal encounters is the question of trust. When humans engage with technology through physicality, and in particular, when they allow robot to touch their face – what we perceive as the most fragile and identity-carrying part of the human body – there are no assurances whether the experience may evolve as pleasing or rather as hostile or harmful for the participants. Whether to engage or not in such personalized physical contact with a technological agent might turn out to be a difficult decision. While the participants in this robotic performance are instructed on the expected course of the action, there are many variables which could turn the permission for such form of contact with a robot into an unpleasant experience. Mistrust towards the robot and anxiety might easily arise. The participants might question how the robot is really programmed and the kind of hand gestures it could apply to their face. Even if the underlying programming would be harmless, is the robot really able to deliver its programming successfully, without any malfunctions that could hurt them?

When discussing how physical contact with robots could turn into an unsettling experience, it is worth recalling the Canadian artist Norman White's *Helpless Robot* (1987). This cybernetic robot, embodied as an abstract rotating sculpture, performs *liveness* through physicality with humans in a mode somewhat similar to that of the *Blind Robot.* The *Helpless Robot* is imparted with electronic

speech, used for asking the audience for help with its rotation and movement (White, 2016: 227-229). As audience members help moving and rotating the robot, it becomes more demanding, voicing more and more instructions and finally exhibiting arrogance towards those who are helping ("The Helpless Robot | transmediale", 2006).

Allowing a technological hand to touch one's body is certainly a mode of *conversation* that involves a degree of risk and might bring out unnerving sensations and deep anxieties. Those who overcome those anxieties and decide to engage in similar input/output processes with a robot enter into an unique experience with a seemingly intentional agent, which captures its human counterpart's attention less with the effects of its technological system and more through the production of sensations – anxiety and uncanniness representing one stream of those sensation and another one is tied to developing emotional connections i.e. bonding and compassion towards robot. Although users might believe they are placing their trust in a robotic personality, their trust is actually bestowed onto a consonant sum of on-stage and off-stage mechanical and electrical technologies operating behind the motion of robotic hands.

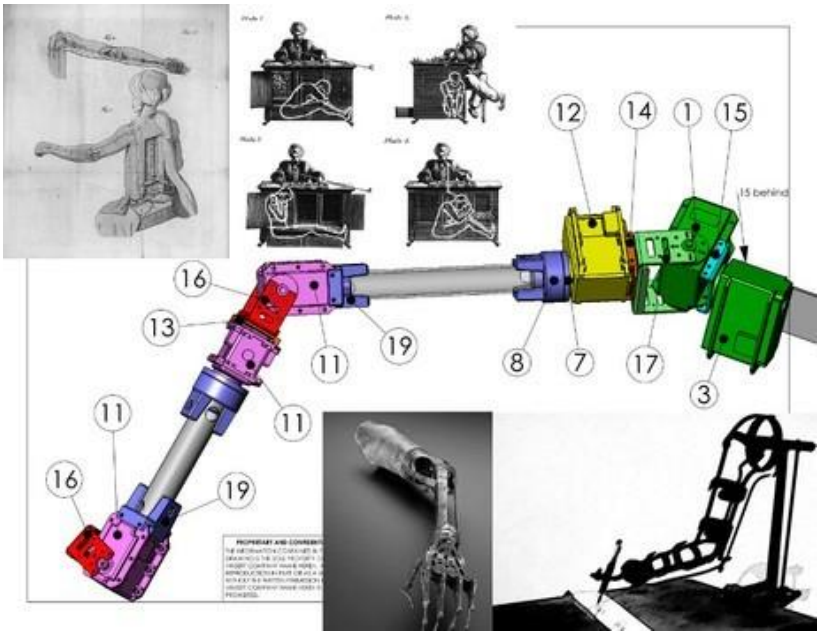

Fig.9. *The Blind Robot,* < https://v2.nl/archive/works/the-blind-robot-1/>, accessed 01 August 2019. (©V2_, Lab for the Unstable Media**)**

Looking back at how the concept of trust between the performer and the audience has been explored in human performances, we might recall Yoko Ono's *Cut Piece* performance which premiered in 1964 in Kyoto. One of the key threads explored in this performance is precisely the question of trust that arises when the artist is subjected to strangers' touch with a sharp tool in their hands (Rothbart, 2004). In this performance, Ono is well-dressed and sitting alone centrally on the empty stage while the only object placed next to her are sharp scissors. The feedback loops between audience and the artists evolve in a rather extreme way, when audience members, as instructed by Ono, approach the artist one after another, using scissors to cut off pieces of her clothes ("MoMA | Yoko Ono. Cut Piece. 1964", n.d.). Such radical narrative builds on anxieties especially when sharp metal scissors slide along the artist's skin. Ono's scissors work in a similar way to the *Blind Robot's* technological hands. Both performances enact an intertwining of two opposites and the establishment of a relationship between them, whether between the artist and audience, as in the *Cut Piece*, or between humans and a robot, as in the *Blind Robot*, while the means of such intertwining is an anxiety-filled theme of trust and physical vulnerability.

Fig.10. *Cut Piece,* < http://semioticstreet.com/YOKO3.html/>, accessed 01 August 2019. (©Yoko Ono**)**

As noted so far, in the *Blind* Robot, the activity associated with blindness is touch as a way of "seeing". Robotic performances and a wider field of robotic art generally require a certain

immediacy and close proximity between the performer and the viewer, but they rarely integrate the touch, a means that – especially when subtle and delicate – potentially evokes sensations similar to those that occur between humans, or animals: affection, tenderness, closeness and bonding. This kind of touch could lead to relations that, if developed, would allow the robot to temporarily access the interstices between the non-living technology and *liveness*, entering into an interposition similar to a passage that is associative of Victor Turner's "rites of passage" (Turner, 1979: 466).

In theatre performance, as discussed by Erika Fischer-Lichte in *The Transformative Power of Performance*, the sense of touch stands as opposite to the sense of sight, whereas theatre is based on seeing as the central process in the performance-audience exchanges (Fischer-Lichte,2008: 60-68):

> The various examples have shown that the fundamental opposition between seeing and touching in performance is connected to a number of other interrelated oppositional pairs: public vs. private, distance vs. proximity, fiction vs. reality. They are all based on the seemingly insurmountable, fixed opposition between seeing and touching. (Fischer-Lichte,2008: 62).

In the case of *the Blind Robot*, perhaps fiction and reality may merge through the perception of the observer when the technological agent performs touch instead of seeing.

Several elements used in this robotic performance, starting from touch as a means of physical proximity and immediacy, can be traced to human performance practices. Marina Abramović, in 1974 performance *Rhythm 0,* in the gallery *Studio Morra* in Naples, invited the audience to touch her body with different objects ranging from a gun to a rose. Austrian artist Valie Export, in her 1968 performance *Tap and Touch Cinema,* appealed for sexual freedom liberation by inviting the passers-by to touch her breasts in a public space in Munich (Export, nd). Another tactic deployed in the *Blind Robot*'s performance that reflects the tried-and-tested strategies of performance art is the confronting the performer and the spectator by placing them seated on chairs one across the other. Croatian performer Sanja Iveković and naked art historian Enrico Lunghi sat opposite each other at a chess table in a 2009 performance entitled *Eve's Game* at Bétonsalon, Paris. Similar sitting positions between the performer and the audience were used in Marina Abramović's 2012 performance *The Artist is Present* in New York's MoMA (Jones, 2011).

The *Blind Robot* follows strategies similar to those employed by *live art* performers seeking immediate and intimate one-on-one encounters with the audience. In this type of encounters, humans adopt a certain perspective towards the machine. Such perspective may develop in relation to proximity between two counterparts, spatial configuration and modes of staging the encounter. For example, facing two subjects in close proximity on chairs and placing them at the same height implies intimate mode of *conversation*, which in all probability might trigger sensations, whether those sensations would result in bonding and creating emotional connections between two counterparts, or lead to anxieties, or those types of emotions might intermix. The perspective humans take on *liveness* of the inanimate subjects tied to the unconscious, active perception also crucially depends on the context of the encounter and agenda of the performance. In works such as Stelarc's the *Articulated Head* or in *The Senster*, the robot towers over the human participant - the power dynamic between the two counterparts is contextually different then that staged in the *Blind Robot's conversation* with the audience. With the *Blind Robot*, the disposition of the two counterparts implies the same level of sitting and immediacy through close proximity, thus setting the stage for more intimate modes of interaction and exchange.

Based on those aforementioned strategies, and on our generally empathetic associations to blindness, the *Blind Robot* has a good prospect of attracting humans into emotional bonding, simulating this form of physical impairment and the associated modes of human behaviour, i.e. gestures such as face touching. Ultimately, the prospect of any emotional connection with the audience is tied to the relational aspect, or, as put forth by Hayles, to the matter of reflectivity (Hayles, 1999: 8-10, 131-160). What such reflectivity implies is that some participants in the performance may experience bonding with a robot, and others may continue perceiving the robot as a technological construct, while the question remains on how much humans actually believe in the experience they are subjected to.

Despite the common assumption that emotions and machines have nothing in common, Australian author Elizabeth A. Wilson points to a well-rooted connection between cybernetic machines and emotions (Wilson, 2010). In *Affect and Artificial Intelligence*, Wilson traces the lineage between cybernetic machines and emotions to the very beginnings of cybernetics, when Alan Turing explored linkages between intellect and affect (Wilson, 2010: 32-58), turning to examples from the

end of twentieth century when, through affective computing, "artificial emotion" is integrated into Cynthia Breazeal's robot *Kismet* (Wilson, 2010: 53).

In contrast to some other forms of disability, for example the mental disorders which are known to be largely stigmatized, blindness in our culture(s) has long triggered emotions such as empathy or affiliation. Both today and historically, blindness seems to have its own position in our cultural imagination, with some cultures even attributing mysterious powers to the blind, intrigued how sight is compensated by other senses. The "artificial emotion" that Demers aims to encourage in this performance, counts on the simulation of human-like attitudes and behaviours, but in doing so, does not resort to the predictable or easily expected behaviour modes. In Gordon Pask's *The Colloquy of Mobiles*, machines were assigned with gender, Stelarc's the A*rticulated Head* has been given the ability of conversation, albeit through a keyboard interface; these are all simulations of human traits that reflect what we usually resort to in order to define a typical human being. Instead, Demers chooses blindness as an atypical human condition, and thus the robot, as *other than human*, appropriates the human mode of *otherness* to initiate this curious *conversation*, in which the robot's *atypical* status might incite a myriad of sensations, from anxieties to affiliation even, at levels greater than if robot were simulating a typical human being.

Unlike Norman White's the *Helpless Robot* which draws on a somewhat similar strategy of impairment – staged as an immobile cybernetic sculpture seeking help from humans to facilitate its movements – the *Blind Robot* appropriates blindness but without seeking any physical help from humans to operate in a functional way. Instead of assistance, the *Blind Robot* appears as if needing contact and/or emotional connection with humans, and such a need makes this robot inherently social. Demers' robot has appropriated a form of human impairment that holds good potential for triggering emotional connection. When performed by robots, other types of human impairment would hardly have such potential to cause emotions other than anxieties. For example, Canadian Artist Bill Vorn's *DSM-VI* robots, shown in Montreal's Wood Street Galleries in 2012, appropriate the movement and morphologies indicative of mental disorders ("DSM-VI - Wood Street Galleries", 2012), staging the conditions from schizophrenia to paranoia (Vorn, 2012). However, stigma and discrimination attached to mental disorders (Arboleda-Flórez, 2003; Cohn, 2015) would arguably diminish any possibility for robots staging those conditions to cause emotional connections, affinities or empathy, which are part of the *Blind Robot*'s agenda.

Common to the robots that I analysed in the previous chapters is that they operate as cybernetic bodies i.e. self-organizing systems running on cybernetics and computing in a literal way. Those self-organizing and self-making systems operate on a mechanisms of feedbacks, an interdependence of inputs and outputs, a relationship of control and communication, as well as the circularity of information inside and outside the system. Those cybernetics elements however, may be running in a similar way throughout a system grounded in another type of underlying technologies and through performance as a set of processes between two counterparts. The *Blind Robot* essentially does not represent the cybernetic system in a literal, technological sense, because it operates on the sum of divergent technologies mechanically and partly pneumatically driven. The *Blind Robot* operates metaphorically as a cybernetic self-organizing system by relying on feedback loops with participants, through the input of robotic touch and the output of participants resulting in emotional connections (closeness, affection and/or empathy) intermixed with anxieties.

The *performative life* of on-stage robots manifesting through what might appear as qualities of *liveness,* agency, perhaps even intentionality, have so far been discussed as a phenomenon coming from two streams. In the first stream, the underlying technological system by which those agents operate, often based on cybernetics, empowering those robots and other virtual or hybrid agents for coming closer towards humans, in more vigorous ways, with graceful movement and/or profound behaviours, credibly and convincingly signalling *liveness* and thus becoming more connected to humans. The technological system of the *Blind Robot,* however, is not in the range of those cutting-edge technologies. Rather than from the technical system, the *Blind Robot* draws on *liveness* largely from its relational aspects and inter-subjectivity, approaching the humans through the mixture of anxieties and emotional bonding it incites. By triggering emotions, this robot *comes alive* through the observer's perception, when humans perceive this robot as more than a sum of networked technologies, engineering and software, when they are drawn to the robot and when they believe in the simulation of life performed by the robot.

Turning to the role of observer in cybernetics, the observer has been somewhat elusively represented through first order cybernetics of Wiener and his peers, ranging from considerations that the observer belongs outside of the observed cybernetic system to the contrasting standpoints inclusive of the observer as an inseparable part of the system through the flow of information and feedback loops (Hayles, 1999: 9). The role of the observer has been emphasized with influential

“frog experiment” on the perceptual differences between reality and construct, as elaborated in 1959 article *What the Frog's Eye Tells the Frog's Brain* by Lettvin, Maturana, McCulloch and Pitts (Hayles, 1999: 131-160). The inclusion of the position of the observer as central for cybernetic systems came to the fore in the early 1970s as a contribution of philosophy to cybernetics that was brought about with Austrian-American scholar Heinz von Foerster’s conceptions on reflectivity (Penny, 2017: 55). “Objectivity is a subject’s delusion that observing can be done without him” proposed von Foerster (Heinz von Foerster, cited in Penny, 2017: 55). Shifting the interest towards the role of the observer in cybernetics came into focus also with Maturana and Varela's complex explorations on the observer, consistent only to a certain extent with von Foerster’s reflectivity, and instantiated in Maturana's statement that "Everything said is said by an observer" (Maturana, 1980: xix).

Examining the question on who it is that performs in the *Blind Robot*, Louis-Philippe Demers as an artist behind the concept and in part behind the technologies or a robot itself, I would suggest that the performer in this robotic work is blurred and divided between the artist and the robot. Regardless of its *live presence* on the stage, the *Blind Robot* is based on striking concepts in which we recognize the personal signature of the artists, which is why it is possible to claim that it is both the machine and the artist who perform on-stage. Being designed as an unobtrusive, almost depersonalized technological profile, unmarked by distinctions such as face or other characteristic expressions, the *Blind Robot* also allows to imagine the image of artist at the position of the performer.

A concept comparable to the *Blind Robot* may be found in Belgian artist Kris Verdonck’s robotic performance entitled *Dancer #3* (2010). In the work *Dancer #3*, staged in theatre-like ambiences, the robot performs dance-like movements but is unable to maintain the balance, falling one time after another and quickly rising up with dignity only to keep attempting successful performance many times over. The persistence that this robot demonstrates signals an underlying optimism irrespective of constant failures (Verdonck, n.d.). This robot, customized for theatre stage, runs on a combination of pneumatic and cybernetic technologies tied together: the base of the robotic body

is a customized, old-fashioned captive boat pistol[10] that works on pneumatic control, connected to a software (van Baarle, 2018:166).

The theatricality of *Dancer #*3's artificial agent evolving through constant failures produces a performed simulation of human-like treats such as weakness, vulnerability and imperfection, by which this embodied robot becomes more similar to humans and potentially more inclined towards bonding with the audience. In other words, the robot's performed failure stands for the mode of *conversation* and can be seen as strategic approach for reaching out to the audience. For Belgian performance scholar Kristof van Baarle, the initial emotion that these robot's failures evoke is sympathy arising from audience's disappointed expectations:

> The sympathy we experience when watching the jumping robot is related to this recognition of clearly distinct human and robotic capacities. It is a machine, so a degree of perfection is expected, but this dancer falls, improvises and loses the rhythm (van Baarle, 2018:166).

Fig.11. *DANCER #3*.< http://www.atwodogscompany.org/en/projects/item/173-dancer-3?bckp=1>, accessed 01 August 2019. (© Jasmijn Krol)

[10] The steel captive boat pistol is pneumatic device commonly used in the cattle industry.

I have pointed out to two different lines in terms of emotions that the *Blind Robot* potentially activates: while causing on the one side emotional bonding, closeness, affection and empathy, this robot concomitantly triggers underlying anxieties and uncanniness coming from such a close physical contact with the technological agent. Kristof van Baarle points out the similarities between sympathy and uncanniness, as sensations triggered by Verdonck's *DANCER #3* robot:

> Once the distinction between the human and the non-human is blurred, we enter in what Masahiro Mori has called the uncanny valley (Mori 2012 [1970]) (van Baarle, 2015: 40).

Analogously to the *Blind Robot*, Verdonck's *DANCER #3* does not operate on cutting-edge technology system, but is largely based on a daring, unique concept that essentially aims for *liveness* via perceptions of the observers by provoking emotions ranging from sympathy to uncanniness. Both artist and robot perform this unique concept although the staged *live presence* is entrusted to an "unskilful" robot.

Jean-François Lyotard pointed to the disappointments with binary logic and binary modes of expression of artificial agents, and how such binary logic in many ways manifests differently to the true-to-nature biological or natural logic on which human bodies operate (Lyotard, 1991: 15). Perhaps those disappointments are much less felt in an encounter with robots such as the *Blind Robot*, which still operate on a binary logic, but actually triggers emotions that seem to be genuine and natural. Regardless of the naturalness of the robot's operation, when emotions that humans experience in these encounters are genuine and powerful, when strong sensations are produced, when emotional boding between human and machine is activated, does it matter that those emotions are triggered via binary logic and binary modes of operation? Such binary logic, ultimately, does appear to produce the type of *live presence* that permits these robots to, at least momentarily, overcome the status of an artificial agent constructed from a set of functional but lifeless technologies, approaching the boundaries of *liveness* and, in Goodall's terms, **"**cross the other way over the vital dividing line" (Goodall, 1997: 445).

This chapter concludes that the type of robotic performances based on provoking audiences into anxieties and/or emotional bonding, might produce *liveness* that is derived more from the observer's perceptions than from capabilities or affordances of the underlying technological systems. The cutting-edge technologies behind the robots analyzed in the second chapter, such as

that of Stelarc's *Articulated Head,* or Ruairi Glynn's work *Performative Ecologies* did not secure an extensive degree of *liveness,* whereas somewhat limited technological affordances of robots like *the Blind Robot* and *DANCER # 3* trigger sensations in human through unique and powerful conceptions, and by more intimate pathways, thereby securing the *liveness* of these robots. This chapter also concludes that the answer to the question who it is that performs – the robot or the artist behind the concept – also depends on how powerful the concept is, and if the personal signature of the artist is successfully incorporated into the robot performing on stage.

VIII. Cyborgs: from Transhuman to Parado**x**

> There are ways in which creating a character for the stage and creating a technological model of the human are analogous. In particular, they are attended by similar anxiety driven fantasies. What if the simulation of life turns into life itself?
>
> -Jane Goodall

> The machine is not an *it to* be animated, worshipped and dominated. The machine is us, our processes, an aspect of our embodiment.
>
> -Donna Haraway

In this chapter, I turn to cyborg performers that, either literally or metaphorically, operate on cybernetics to produce *liveness* via simulations, anxieties, and *conversations* that occur around and within the body and technological assemblage. The question of *liveness* as explored in this chapter ranges from the transhuman approach to cyborg embodiments, i.e. the enhanced-body of the nineteen sixties, to present-day cyborgs that signify a posthuman condition that deploys the exoskeleton as a paradox between liberation and restraint. To what extent does the *liveness* of cyborgs and the technologies by which those bodies are upgraded and automated stem from technological systems, and to what extent is it based on the perception of the observer? Who is performing in these cyborg-based performances - the artist or the technologies that embrace and drive these compounded bodies?

Why cyborgs? Apart from robots, this "cybernetic organism" (Haraway, 1991) mirrors our deeply rooted anxieties and captivation with machines and performed or lived machinic embodiments, manifested through a framework that Mark Seltzer defined as "the machineliness of persons and the personage of machines" (Mark Selzer, cited in Goodall , 1997: 441). The *conversation* between bodies and technologies, which is explored in this thesis through embodied robotic performers, takes on different turns when human bodies, whether those on stage or those in our daily realities, merge with cybernetic technologies, when the reflection of theories on metaphorical cyborgs are

evoked, revitalized, or disrupted, and when observers, through feedback loops, interconnect with those on-stage cyborg bodies.

Haraway's cyborg - "a cybernetic organism, a hybrid of machine and organism, a creature of social reality as well as a creature of fiction" shows potential for creating socially empowered identities in alliance with technologies (Haraway, 1991). The promise of Haraway's cyborg emerged in the late twentieth century when technologies started to expand at a faster rate than ever before to encompass the various spectrums of our lived realities. In the 1985 essay *Cyborg Manifesto*, the creature that had been wandering between science fiction and reality, between popular culture such as comics or movies and the medical and military industry, between instinctive fear and excitement, penetrated the domains of society as a vision for (re)construction of the self (Haraway, 1991). Analogous to how Norbert Wiener pointed out the similarities between modes of operation of machines and living organisms (Wiener, 1948) Haraway, in relation to the rise of the cyborg, alludes to the loosening of the boundaries between human and technology (Haraway, 1991: 4-5). The blurring of those boundaries, according to Haraway, occurs also between animals and humans and between material object and non-physical formations i.e. the virtual worlds (Haraway, 1991 4-7).

Harway's cyborg is both a metaphor and a promise for feminist practices to rise by embracing technologies and mastering technical skills, a perspective by which gender identities in technological realties might become obsolete and the multiplicity of identities might blend into a common identity that from today's perspective is understood as a posthuman identity. Race, language, gender, and sexuality are some of the perspectives that can be influenced by assuming the status of a cyborg. However, the possibilities of the cyborg expand broadly beyond the potential for otherness and minority identities to oppress the apparatus of capitalism. Haraway's cyborg cannot be a promise limited to particular identities; rather this promise is expanded across the diversity of social worlds, ultimately providing everyone with the opportunity to become more powerful in social domains through technology. In other words, the promise of Haraway's cyborg is tailored for each individual: in her own words, "we are cyborgs" (Haraway, 1991:2).

The cyborg, indeed, appears to be an inclusive framework that stretches over different perspectives and across different ontologies, many of which might offer exploratory insight into the post-human condition. Among those ontologies arises a figure of an animal, inextricably attached to the human

subject. Haraway saw the loosening of the boundaries between human and animal as one of the streams that set the stage for the activation of the cyborg within social domains (Haraway, 1991: 4-6). In her essay *Becoming Animate*, the performance studies scholar Jennifer Parker-Starbuck turns to the cyborg in the domain of on-stage performances. Parker-Starbuck focuses on the figure of the animal, whether it appears on the performance stage through on-screen projections, or it is metaphorically represented and evoked by different modes of the cyborg's *live presence* (Parker-Starbuck, 2006).

Parker-Starbuck's concept of "becoming animate" draws on several theoretical considerations, from Donna Haraway's concept on technology as a central perspective between humans and animals, (Haraway, 1991) to Deleusian "becoming-animal" (Deleuze & Guattari, 1987) and Giorgio Agamben's "anthropological machine" (Agamben, 2002), both probing into the long-rooted divisions (and alliances) between humans and animals. Premised on those theoretical reflections, Parker-Starbuck explores the triangle human-animal-technology in the context of cyborg-based performance, as a trigger for activation of the processes of *becoming* (Parker-Starbuck, 2006). Akin to her concepts of the *Cyborg Theater* by which performance is envisioned as a model for production of a metaphorical DNA when on-stage bodies and technologies are twisted together and intertwined (Parker-Starbuck, 2011: 36-38), in *Becoming Animate* Parker-Starbuck points to performance as a laboratory for the *becomings* (Parker-Starbuck, 2006: 650-652). "Never fully fixed, open to new alliances, and mutually dependent upon its components, performance is an obvious arena for experiencing and exploring becomings." (Parker-Starbuck, 2006: 651).

"Becoming animate" arises as the sum of experiences triggered by the collision of human-animal techno-ontologies on stage. These processes represent the performer's embrace of transformation, and they simultaneously, through feedback loops, also enable the observers to experience *becoming* (Parker-Starbuck, 2006: 668). "In the becoming ani / mate in the moment of performance we all become-animal, sharing the alliances in the room with each other, with the technology, with the animal." (Parker-Starbuck, 2006: 668).

How do the theories on cyborgs from the late twentieth and twenty-first century foster linkages with cyborg art practices of the media arts? This question might be worth exploring starting from

interdisciplinary event, with a focus on the performing body in cyborg aesthetics, entitled *9 Evenings: Theater and Engineering* (1966), presented in New York's 69th Regiment Armory.

The performances featured by *9 Evenings: Theater and Engineering* explore the body-technology relationships, mostly relying on cybernetic technologies through live-mode electronics with devices such as portable technological units, remote controls, sensors and photo cell devices (Daniels, n.d.). Burnham sees the performances of *9 Evenings* as "man-machine systems with a completely different set of values from those found in structured dramatics or the one-night kinetic spectacular" (Burnham, 1986: 360). These series of performances led by the artist Robert Rauschenberg and engineer Billy Klüver were made possible by collaboration of New York visual artists, dancers and musicians with a group of engineers from the telecommunication company *Bell Laboratories*. Despite the somewhat negative reactions by media and critics, mostly due to the technological malfunctions that ensued, from today's perspective, *9 Evenings* is often perceived as one of the key milestones of media arts.

In his performance entitled *Grass Field,* Alex Hay enhances his body with electrodes that capture delicate body vibrations and almost inaudible sounds produced by muscles, brain waves and eyes. By attaching additional makeshift electronic devices for transmission and amplification of sound to his body, Hay performes on stage while his body sounds emanate across the venue. (Garwood, 2007: 40-42). In Robert Rauschenberg's performance entitled *Open Score*, the performers' extensions are tennis rackets fitted with electronic devices. Each strike of the ball enables loud and resonant gong-like sounds and reduction of light until the venue is engulfed in complete darkness (Kluver, n.d.). In the *Carriage Discreteness* performance, Yvonne Rainer as a cyborg equipped with a walkie-talkie extension, instructs choreographic movement for a group of performers wearing electronic receivers onto their wrists and shoulders (Garwood, 2007: 40). For Lucinda Child's piece *Vehicle*, engineers designed an acrylic-glass cube powered to slide along the stage and at times rising several inches above the stage with a performer inside. Öyvind Fahlström's complex piece entitled *Kisses Sweeter Than Wine* featured human-puppet performers "flying" across the space (Fondation Langlois, 2006).

Jack Burnham describes the devices used by *9 Evening* performers as "constructed as physical extensions of the human performer's abilities" (Burnham, 1968: 361). Indeed, what appears to be common for all of the abovementioned *9 Evening* performances is the approach to technology as a

means of enhancing the body i.e. performer's abilities. Alex Hay's electrodes attached to his body, Rauschenberg's tennis rackets, Lucinda Child's floating acrylic box, Yvonne Rainer remote controlled devices all instantiate apparatuses for the enhanced-body conception.

Fig.12. *Kisses Sweeter than Wine*. < http://www.medienkunstnetz.de/works/kisses-sweeter-than-wine/images/3/>, accessed 01 August 2019. (©medienkunstnetz)

These performers' apparatuses, and the artists and engineers behind those concepts were producing enhanced bodies by placing a central focus on the human subject through what we can define as a transhuman approach to the body-technology paradigm. The cyborgs of the late twentieth and twenty-first centuries, in contrast to those transhuman bodies, largely exceed the emphasis on the human subject, indulging in various modes of interrelationships between the body and the technology fostering *becomings*, transformations and body-technology paradoxes in line with posthuman condition.

Posthuman cyborgs might be recognized in the work of the French artist Orlan, as seen in her multi-annual work *The Reincarnation of Saint Orlan* (1990) where she transforms the body with implants as a social commentary on the beauty industry and the expectations imposed on the female body, or in the work of Stelarc, an artist who does not perceive the body as a subject to be upgraded but as an object to be transformed and redesigned with technologies. "His work is related to philosophy

of posthumanism in which the human subject is deposed from its central position". **(**Broeckmann, 2016: 169).

For Jane Goodall, the work of Stelarc is marked with an interest in the human evolution (Goodall, 2005: 1). Stelarc's *Exoskeleton* (1998) is one of the works with an evolutionary imprint that explores the lines between the human, technology and animality. The cyborg figure entitled *Exoskeleton* is embodied as a massive and powerful 600-pound walking compound that achieves motion through six mechanical legs movable through pneumatic actuators.

The machine *comes alive* with the artist positioned inside of the metal and wire structure. In this human-machine compound, the figure of the walking robot might, as Steve Dixon noted, evoke the figure of an animal as a result of the design of this animal-like technological figure, and its cautious, spider-like movements around the designated space (Dixon, 2004: 30).

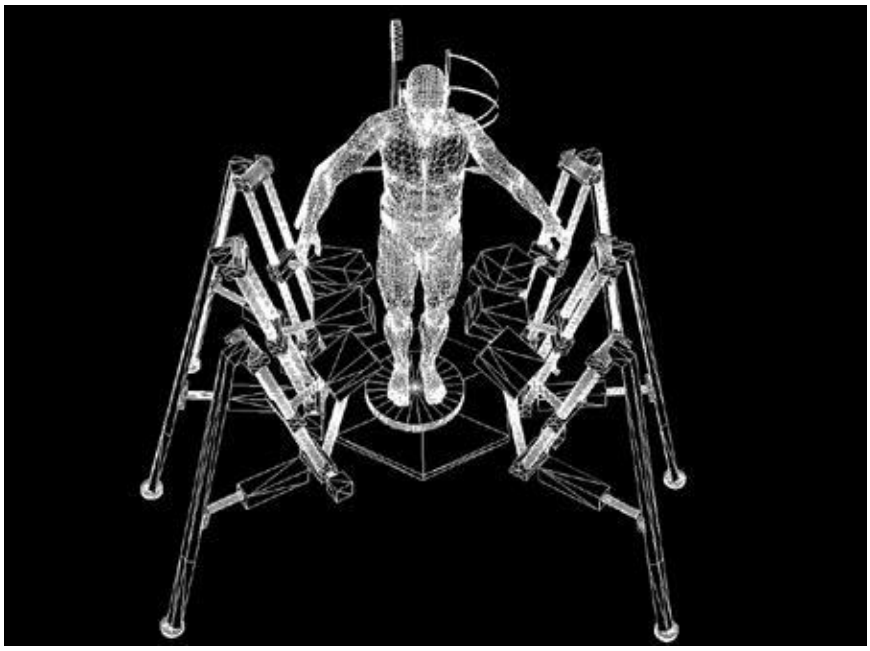

Fig.13. *Sketch 2: Exoskeleton* <https://stelarc.org/?catID=20227/>, accessed 01 August 2019. (© Stelarc)

The machine is fitted with microphones that capture pneumatic noises produced with every leg movement. The noises are amplified and transmitted across the venue through speakers, thereby reinforcing associations with mechanical or industrial realities. The dramatic visual effects increase when the machine surfaces from darkness into the light (Stelarc, n.d.). The feedback loops flowing

between the human and the exoskeleton extend to the observer who is not directly engaged in on-stage actions, but participates precisely through reciprocation of feedback loops.

The *liveness* in this cyborg performance comes from the *conversation* between the body and this massive walking mechanical construction, which evolves through simulation of the animal profile analogous to Parker-Starbuck's "triangulation of animal, human, and machine" (Parker-Starbuck, 2006: 649). If, as Stelarc argues, the human body is obsolete, then transformation and *becoming* other than human through actions and moments deriving from machine embodiments might be the pathway for exploring the evolutionary links between the human and animal, in line with the concepts of "becoming animate". In the words of Parker-Starbuck: "These moments expand the performed limits of the human and expose a becoming-animate, a condition of sensory attunement palpable and vibrant that reveals the interrelationships and traces left between animal, human, and machine." (Parker-Starbuck, 2006: 649).

The machine, with all its power and massiveness, appears to be dominant within this compound. Although the artist may, with his hand and arm gestures, affect the movement of the machine to an extent (Stelarc, n.d.), the human body is captured and immobilized. For the Italian scholar and artist Marco Donnarumma, such deprivation is a manifestation of the "subtraction" that might occur in body-technology compounds. Donnarumma points out that *Exoskeleton* stands in opposition to the well-known concept of the enhanced body. "An exoskeleton is generally used to enhance human motion; here instead, the exoskeleton impedes human motion." (Donnarumma, 2014: 152). For Donnarumma, the term subtraction corresponds with the limitations imposed by cyborg technologies, e.g. when Stelarc's body is in a tight embrace of the exoskeleton, and becomes deprived of freedom of movement in its natural capacity (Donnarumma, 2014: 152-154). Perhaps the only power that the artist might assume within this disproportionate compound is to be found in the old myth of *the ghost in the machine* or in the figure of *homunculus*, as a mode by which this cyborg creature draws its *liveness.*

For Maturana and Varela, "living systems are machines" (Maturana and Varela, 1980: 76), whereas Stelarc, in redesigning the obsolete body, resorts to the strategies of "machining the body" (Broeckmann, 2016: 171). The anxious theme of machining the body and/or technological embodiments in Stelarc's work falls into focus through the paradox of the exoskeleton, or the "paradox of techno-corporeality" (Braidotti, cited in Jochum, et al. 2018: 4). On the one hand, the

exoskeleton appears to be the promise of liberation and enhancement of the body through movement, experience, transcendence of body's given and natural possibilities. However, on the other hand, the human movement and physical control of the body comes out as restrained by technologies when body is attached to this wearable device.

Does the *liveness* in this performance come from the technological system or from the observers' perceptions? I would propose that *liveness* of *Exoskeleton* is primarily derived from the technological system, which might not be operating on cybernetics and computing, but evolves on the basis of similar principles: feedback loops, input and output, communication and control. In parallel, this human-machine-animal creature also *comes alive* through observers' perceptions. In exploring the question of who actually performs in this work, Stelarc or the sum of mechanical and pneumatic technologies, I propose that artist and the technology are inseparable and thus the coupled entity simulating the animal stands as the image, figure or representation of the performer., evocative of crossing the borderlines between the categories of human and animal as discussed in previous chapters through the theories by Wiener, Haraway or Braidotti. This performer is, therefore, partly the artist who is machining the body, entangled in automatism through a tight embrace of technology, and partly the controlling exoskeleton machine.

Assistive tools such as the exoskeletons, smart robotic prosthetics, various wearable devices, once envisaged to support and/or enhance the human body, are currently being customized or re-made for media art purposes, and serve as the central operative technologies in on-stage performances such as Louis Philippe Demers' *Devolution* (2006), a theater piece that brings out a stage full of performing robots next to human dancers turned cyborgs through various spectacular prosthetic and technological upgrades, or Laura Beloff's robotic work that connects the user's body to the surrounding environment when a user puts on a tail-like exoskeleton construction called the *Appendix* (2011), which moves the body in line with parameters and data received in real-time on sea wave height and public transportation (Beloff, 2016).

The device of the exoskeleton is at the core of a performance entitled *Inferno* by Canadian artists Louis-Philippe Demers and Bill Vorn. First shown in 2015 at the *Stereolux* festival in Nantes. *Inferno* is a dance cyborg performance that evolves on the basis of a number of upper-body robotic exoskeletons customized for human torso. The participants mostly have no prior experience in stage practices or using technological prosthesis. Once these wearable robotic devices are fixed on

the users, the bodies indulge in the experience of rhythmic dance. The feedback loops are flowing in multiple directions, from artists to cybernetic technologies and to participants, and from computers to exoskeletons. This choreography evolves through pre-programmed and live tele-operated sets of inputs and outputs, which does not allow spontaneity or naturalness of movement, but in turn, users can indulge in the experience of machinic embodiment, an experience closely linked to our anxieties and fascinations of losing agency over machines.

Fig.14. *Inferno* < https://zkm.de/en/event/2015/10/inferno/>, accessed 01 August 2019. (© Fidelis Fuchs)

The *liveness* in *Inferno* emerges through entangled modes of automating the body. The anxieties and thrills, bodies and embodiments, power-issues between humans and machines, subordination and controlling systems - all merge into user's experience when gripped by the dancing robotic exoskeletons. Although it is named by the first part of the *Divine Comedy*, describing Dante's vision of hell, the experiences and meanings of *Inferno* performance extend beyond the analogies of eternal punishment or hell operated by machines, to encompass more positive perspectives on experiences with technology. This performance can be seen to exploit the themes of losing agency over machines - both in terms of anxieties and as a framework that brings about liberation through technology and tech-embodiments.

In the article *Becoming Cyborg*, robotic art scholar Elizabeth Jochum with artists Demers and Vorn and a research team probes *Inferno* as a work that "capitalizes on human fears and fascination with machinic embodiments" (Jochum, et al. 2018: 3), looking into what it means to become a cyborg in a paradox when bodies are grasped tightly by exoskeletons and users find themselves between the excitement of transcending the bodily limits, and the anxieties of losing physical freedom (Jochum, et al. 2018: 4).

"Exoskeletons instantiate the techno-corporeal paradox of embodied movement: the human body is simultaneously master and slave, agent and object, in a transgressive assemblage that is enacted in a relational process of becoming." (Jochum, et al. 2018:2). The article *Becoming Cyborg* describes the mode of human coupling with the exoskeleton, as seen in *Inferno*, as a paradox. The quality of spontaneity is inscribed in the nature of the movement, whether it is human or robotic movement. It is through movement that we understand and experience ourselves and others (whether humans or machines) as animate. However, through the use of exoskeleton such movement becomes largely subordinated to the power of technology. This paradox lies in the exoskeleton itself, the device that seemingly represents the promise for the human body to transcend its limitations and leads the body outside the given, human corporality, while it simultaneously subordinates the body by restricting spontaneity and freedom of movement (Jochum, et al. 2018).

What operates behind the *liveneess* of *Inferno* couplings, in all respects, does seem to be derived partially from the exoskeletons i.e. from the underlying technological system that powers the exoskeleton devices and activates the bodies associated with them but also largely from the participants' perceptions and their on-stage experiences. Turning to the question of who actually performs on stage, I would suggest that the position of the performer in this performance encompasses the artist who created this concept, participants i.e. users of exoskeletons, and finally, perhaps the most dominant of these positions, the exoskeleton itself.

The *liveness* that emerges through the paradox of the exoskeleton is also evident in Stelarc's performance entitled *StickMan*, which premiered in the 2017 edition of the *Fringe World* festival in Perth. In contrast to the *Exoskeleton*, an animal-like massive and robust figure, the *StickMan* exoskeleton is minimally designed and somewhat anthropomorphically shaped. Unlike *Exoskeleton*, which is a mechanical figure, mostly pneumatically controlled, *StickMan*'s motion is

based on pneumatic engineering but powered by a computational sensor system that enables augmentation of sound on the basis of the performer's and the machine's movements.

While Stelarc's work *Exoskeleton* brings out the type of body-technology *conversation* that does not represent true coupling, but rather limits the natural capacities of the human body with the dominance of the machine, Stelarc's perspective in *StickMan* is contextually different. The *StickMan* is a true body-technology coupling, primarily because the artist's body is granted partial freedom of movement. In the *StickMan* performance, Stelarc stands upright on the stage with his entire body attached to an exoskeleton suit which is in charge of the motions, but in a way that allows the artist rotation of the body in different directions (Tetem, 2018).

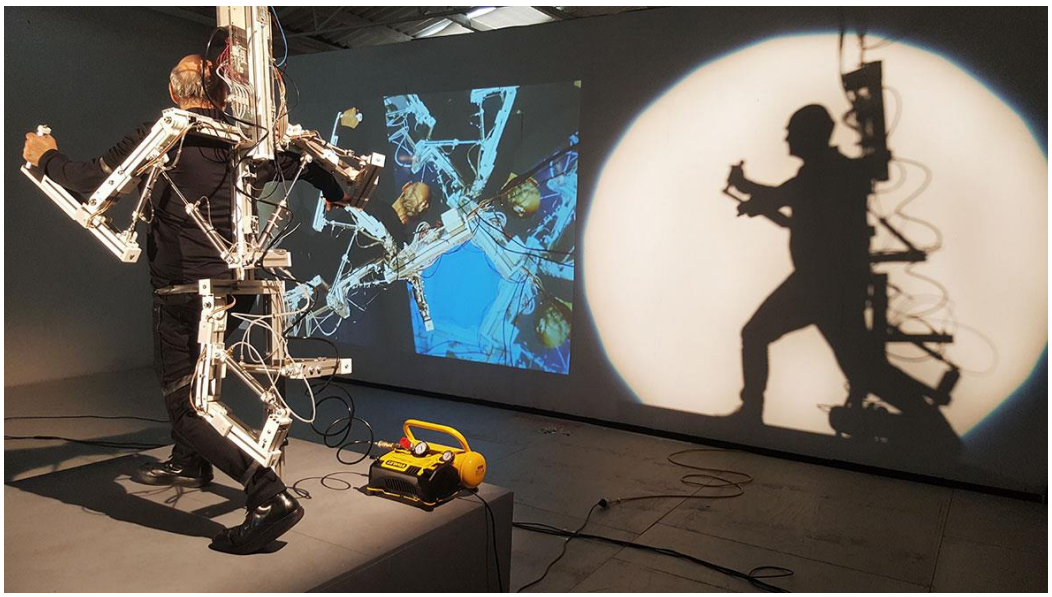

Fig. 15. *StickMan*, < https://stelarc.org/stickman.php/>, accessed 01 August 2019. (©Toni Wilkinson & Steve Berrick)

Extensive pneumatic noise produced with every movement of the closely compacted body informs the *StickMan* - thus, bodies become a sound machine. Sourced and transmitted via contact microphones set within the limbs and spine of the exoskeleton, sound is amplified and played in live mode via multi-channel speakers (Stelarc, 2017). Two additional visual displays are projected in live mode at the wall surfaces behind the human-robotic performer. One is a large screen projection that displays how the performance evolves, while the other is a striking shadow of the human-robot coupling. The silhouette, that perhaps represents one of Stelarc's avatars, visualizes

the contours of the creature that emerges when body flows into metal and wire. The feedback loops flowing between the performer and the robotic exoskeleton extend to the audience.

Jane Goodall's description of Stelarc's strategies depicts tight coupling as seen in the *StickMan* performance: "Stelarc confuses the traditional master/slave terminologies that are attached to the human/machine relationship by increasing the feedback loops to a point where the body and the robot are effectively one operational system." (Goodall, 2005: 13). Such a master-slave paradigm is, once again, instantiated through the exoskeleton paradox.

The later staging of this work, starting from the one performed in *Tetem Kunstruimte* gallery in *Enschede* in 2018, expanded to interactivity and involvement of audience by adding another robotic figure, named *mini StickMan* ("The 'man with three ears' in Twente", 2018). The *mini StickMan* an interface-based smaller replica of the *StickMan* exoskeleton, through which the audience controls the movements of the original exoskeleton. The smaller version utilizes the logic of a voodoo-doll, which assumes moving the limbs, or in another way impacting the small replica of the person, would magically in the same way affect the real person. In a similar fashion, the user of the *mini StickMan* through the use of the interface tailors the movements of the original *StickMan* robotic exoskeleton. The role of the audience extends to collective, social experience via participation, allowing feedback loops through interaction and shifting from the role of spectators to that of participants and into a three-way *conversation* engaging the artist, audience and technology.

The *liveness* of the *StickMan* comes both from an extensive range of performing technological systems and from the observers. In answering the question of who is performing in this work, the primary focus is on the coupled assembly made of the exoskeleton and the artist. However, the role of the performer extends to the participants when they manipulate *StickMan's* small replica interface to choreograph the movements of the original robotic exoskeleton.

"The medium of performance most insistently begs the question of bodily *presence,* materiality, unpredictability, sweat, and stench. Performance is, by definition, polluted by irrationality—the threats of potential disaster and erotic seduction hover over every *live* event" (Jones, 2011). Many of these elements of performance as a genre, outlined by the performance scholar Amelia Jones, might explicate how *StickMan* operates between the body and technologies. The common ground

between Stelarc's work and the performance of the nineteen sixties and seventies revolves around exploring the limits of the body, testing its endurance and vulnerability, and examining the body in contexts that are both intimate and tied to broader social frames. But for those twenty-century performers, the body is exploratory in its natural capacities, while Stelarc believes that the body is obsolete and therefore an object that needs to be redesigned, re-evolved or perhaps re-engineered. "The radicality of Stelarc's project is constituted by the fact that it does not address the notion of the human body, and of relationship between body and technology, from the perspective of an integral body-subject, but from the perspective of a techno-logics that, first and foremost, considers the primary obsolescence, or limited applicability, of the human body" (Broeckmann, 2016*:* 171).

This chapter concludes that *liveness* in cyborg performances comes both from the technological systems and the observer's perception, whereas modes of *liveness* are shifting over timelines from those types of *liveness* that stem from transhuman enhanced bodies to those that stem from posthuman cyborgs entangled in the "machining the body" through apparatuses such as exoskeleton and modes of simulation and transformation leading to experiences of *becoming.* This chapter also concludes that, in cyborg performances, both technologies and humans on the stage are performing, inseparable in their *live presence* and often firmly intertwined in the paradox of simultaneous liberation with techno-embodiments combined with restraint by technology.

IX. Conclusion

This thesis explored the notion of *liveness* of non-human performers and the *performative life* that these non-humans attain in the admixture of cybernetics, performance as discipline, simulation or "imitation of life" and, finally, through the observer's perceptions.

I begin with the Prologue section, introducing the linkage between robotic art and the "performative turn" of the nineteen sixties, when performance shifted towards the fields of humanities and social sciences, showing that emergence of performing robots and cyborgs correlate to the "performative turn" and that technological performers foster close connections with concepts of performativity, such as that proposed by Victor Turner.

In Chapter One, I demonstrate that robotic art was firmly interconnected with the shift of paradigms in the mid-twentieth century art, and most strongly linked to Wiener and his peers' cybernetics, as well as Jack Burnham's "unobjects" and "system esthetics". Additionally, I probe into Gordon Pask's cybernetic work *The Colloquy of Mobiles* and his conception of *conversation* that applies to the human-machine context (Pask, 1971), demonstrating that the *liveness* of early cybernetic performing robots comes both from the technological system and from the observer's perceptions, and that both the artist behind the concepts and the robot on stage might be considered as performers in these works.

In the second chapter, I demonstrate the linkages between theories that anticipated and/or developed the notion of the posthuman (Donna Haraway's cyborg, N. Katherine Hayles's posthuman and Jean-François Lyotard's artificial mind and body) and practices of robotic performance. Drawing on those interconnections, I illustrate the ways in which posthuman modes of embodiment function in terms of the *liveness* of performing robots, using examples of Stelarc's AI avatar, and groups of robots by artists Ruairi Glynn and Ken Rinaldo, which source the *liveness* based on the Artificial Life paradigm. I demonstrate that the technological systems on which those robots operate - albeit drawing on cutting-edge computation - failed to provide extensively high ranges of *liveness* for those robots, and that the roles of the audience, or the perception of the observer, nevertheless remain central to the question of *liveness*. I also show that the question of

who actually performs in those performances largely remains tied to the specific concepts of the work and to the artist's personal signature.

Accordingly, in Chapter Three, I focus on the modes of *liveness* sourced by embodied robots that simulate human-like impairments or imperfections such as Demers' the *Blind Robot* and Kris Verdonck's *DANCER #* 3, to demonstrate how these robots, on the one hand, activate emotional connections and bonding with humans, while on the other, those robots set off anxieties (Goodall, 1997) or uncanny sensations (Jochum & Goldberg, 2016), and how those two kinds of sensations intermix. In that regard, I demonstrate that the *liveness* of these embodied robots does not necessarily rely on technology i.e. the system by which they operate as much as it does on perceptions triggered via artists' strategies and agendas, leading the humans to perceive these technologies as agential or *alive*. I also demonstrate that the role of the performer, in the selected examples explored in this chapter, depending on the concepts of performance, which remains largely tied to both the artist and the robot that realizes the artist's conception.

Finally, the fourth chapter demonstrates the shift from *liveness* emerging from the transhuman approach in cyborg performances prevalent in the mid-twentieth century (*9 Evenings: Theater and Engineering*), towards a posthuman approach of cyborg performers, such as that by Demers and Stelarc, when artists are crossing the boundaries between bodies and technologies to produce modes of *liveness* in experiences of *becoming*, or through the paradox of the exoskeleton. I demonstrate that the *liveness* of cyborg couplings largely streams both from the technological system and the audience's perception, and that, in cyborg performances, both technologies and humans are performing, firmly intertwined and inseparable in their *live presence.*

Throughout the chapters, I approach the question of *liveness* of non-human performers by examining the selected examples of embodied non-human performers, while considering theoretical scholarship on cybernetics, performance and posthuman discourse, and identifying practices that approximate theories that flow from artistic discourses, social agendas or both. Alongside different timelines, I explore the notion of non-human *liveness* within the different streams of performance, mostly focusing on performance art as a branch appropriated by the visual arts genre, while also reflecting on performance as understood within the discipline of theater.

Thinking across disciplines and timelines, I demonstrate how the performed *liveness* of non-humans is partly based on cybernetic systems, whereas the other prevailing part comes from the observer's perception – from human inclination that a technological embodied object must be saturated with more than a mere sum of inanimate technologies. In this regard, I demonstrate how the ratio between these two sources of *liveness* varies among different non-human performances. I also demonstrate, while drawing on Walter's "imitation of life", how in different performances the mode of simulation termed as "humane-machine confusion" (Goodall, 1997: 441) functions between living and inanimate profiles to produce the *performative life* of non-human performers on stage.

This thesis concludes that despite the technological rise that marked the previous decades, Wiener's cybernetics remains tied to the *liveness* of non-human performers, whereas the uprising of techniques and methods by which artists and engineers attempted to uplift such *liveness*, such as Artificial Intelligence and Artificial Life, did not succeed to launch any major influxes that would have extensively elevated *liveness* of non-human performers, at least not in a way that could be considered more advanced compared to the first crucial cybernetic sculptures such as those by William Gray Walter, Gordon Pask or Edward Ihnatowicz. When driven by first order cybernetics, Walter's self-organizing tortoises Elmer and Elsie and Pask's responsive *The Colloquy of Mobiles* robots were *coming alive*, and those robots would grasp just as much of *liveness* as some of the embodied robots of the twenty first century – Stelarc's AI conversation robot, or Ruairi Glynn's "attention span" machines – secure via cutting-edge technologies such as those from the realm of Artificial intelligence or Artificial life.

Pask's performing robots were signaling *liveness* by drawing on unpredictability and spontaneity of behavior. Since they were showcased at the 1968 *Cybernetic Serendipity*, the technologies, although constantly developing, did not devise more advanced modes for human-machine interaction, nor did they succeed in fitting robots or other performing agents with the ability to express and exhibit such unpredictability and spontaneity of behavior that would uplift the levels of *conversation* and, hence, boost the levels of *liveness* towards blurring the boundary between living organisms and lifeless objects. In other words, although many of today's performing robots operate on cutting-edge technologies, it appears that the entire paradigm of interaction driven by technologies remains fixed at the same level as in the very beginnings of cybernetics.

Despite the fact that cybernetics appears to have reached its limits in terms of producing *liveness* of technological objects, several robotic works explored in this thesis – the *Blind Robot* and *DANCER # 3*, in particular – do not appear to be reliant on high-end technological systems in pursuit of human-machine *conversations.* Rather, they rely on unique and striking concepts tailored to trigger the observer's perception of robots' *liveness*, regardless of the complexity of its computation. By the mode of "imitation of life" putting forth robot's impairments, imperfections or malfunctions, these concepts, in a combination of anxiety and affiliation, create emotional connections by which these robots appear agential or even *alive.* In a rather similar manner, Demers and Vorn's cyborg experience *Inferno*, drawing on anxiety as much as it does on technological systems, produces *liveness* that streams from the paradox of liberation from technology being concomitant with enslavement by technology. In these robotic performances, perception and experience seem to be more crucial for *liveness* then their technological systems.

Walter's tortoises performed agency through the same paradigm as the cutting-edge robots of today, and such a paradigm appears to have come to a standstill with regards to the *liveness* of the object. Perhaps the quiescence of cybernetics in the human pursuit for *performative life* of robots, whereby they would be perceived as agential, smart, or finally, as *alive*, calls for a completely different approach.

A point of uncertainty in the context of today's state of the art technologies is the very notion of *conversation* between machines and humans, proposed with Pask's practices and theories, and later appropriated in works such as Stelarc's the *Articulated Head* with text-to-speech software or Glynn's *Performative Ecologies*. A true *conversation,* whether taking place in the fashion of utterances, or as a body *conversation* through embodied and corporeal encounters, does imply intentionality and a desire for contact, as well as a degree of consciousness of counterparts being brought into conversation. Today's technological solutions, however, cannot seem to produce machines equipped with those capacities of an intentional agent. We dreamt of advanced technologies seeking for agential, intentional, and conscious counterparts based on capabilities or affordances of technological systems. But it appears that it is not technology but humans' ingrained, natural inclination to the perceived *liveness* of the machine that holds greater relevance to the issue of objects and technologies *coming alive.* The human, designing intentional systems, through perceptions develops and supports meaningful interaction between humans and machines.

This brings us back to the question who is actually performing these *conversations* and other life-like behaviors in non-human performances? The machine or the human? I believe the answer to this question is the recognition that both the machine and the human perform through a common, shared agency. The human (or humans) behind concepts, technologies, and uphold of such *liveness* remain the central performing figure in these performances, although they are replaced on the stage by non-human performers. Namely, these performances derive from human intentionality and human creative agency, which is essential for the answer to the question of who actually performs on stage.

The fundamental truths about human active perception towards technological objects and human inclination to interact with those objects and assign them with agency and intentionality remains the hallmark of object's *liveness.* Certainly, human longing and vigorous pursuit of the *liveness* will continue through active animation (animating technology with the purpose of producing its *liveness*), and unconscious, active perception. We can speculate that such pursuit will remain to an extent attached to technologies, but it will certainly remain inextricably bound to the ways in which humans respond and adapt to *conversation* with machines.

Perhaps these pursuits will evolve under different provisions and different terms, which would presumably imply an entirely new paradigm. We can speculate that the well-rooted anxieties regarding automation, control, machine embodiments, body and technology will not dissolve over time, but will rather continue to provoke further pursuit for *liveness* of technological objects. Consequently, those anxieties might trigger new modes of *conversation* with machines that we might instantiate through "imitation of life", or through completely different models that transcend simulation. However, the anxieties will, in all probability, continue to trigger human intertwining with intelligent, responsive (performing) machines, which, under a different paradigm, might bring about more intimate encounters between robots and humans that would enable intensified modes of *conversation*, and deepen the exchange of emotions, physicality and hybridity. A different approach or a different paradigm would probably entail unfolding in terms of non-humans' *performative life*, but would also imply unfolding around all aspects of our lived realities, and the position of robots and other technological agents in those realities. The new paradigms to come would be the framework by which humans might be brought into *conversation* with machines based on intentionality and consciousness, as anticipated decades ago by Gordon Pask.

X. References

Agamben, G. (2002). *The Open*. Stanford, Calif: Stanford University Press.

Arboleda-Flórez, J. (2003). Considerations on the Stigma of Mental Illness. *The Canadian Journal Of Psychiatry*, *48*(10).

Auslander, P. (2002), *Live from Cyberspace: Or, I was Sitting at my Computer This Guy Appeared He Thought I was a Bot*, *PAJ: A Journal of Performance and Art*, 24: 70, pp. 16–21.

Austin, J. L. (1962). *How to Do Things with Words*. London: Oxford University Press

Beloff, L. (2016). Art as A Playground for Evolution. *Acoustic Space Journal*, *15*, 158–64.

Boden, M. (2012). Personal Signatures in Art. In M. Boden, *Creativity and Art: Three Roads to Surprise* (pp. 92-124). Oxford: Oxford University Press.

Burnham, J. (1968). *Beyond Modern Sculpture* (1st ed., pp. 312-379). New York: George Braziller.

Burnham, J. (1970). *Software: Information Technology: Its New Meaning for Art*. New York: The Jewish Museum.

Burnham, J. (1968). Systems Esthetics. *Artforum*, *7*(1), 30-35.

Bourriaud, N. (2002). Relational aesthetics. Dijon: Les Presses du Réel.

Berghaus, G. (2011). From Avant-garde to Mainstream. In P. Benoy & J. van Schnoor, Historische avant-garde en het theater in het interbellum (pp. 75-90). Brussels: Academic & Scientific Publishers.

Braidotti, R. (2013). Posthuman Humanities. *European Educational Research Journal*, *12*(1), 1-19.

Broeckmann, A. (2016). *Machine Art in the Twentieth Century*. Cambridge, Mass: The MIT Press.

Carlucci Aiello, L. (2016). The Multifaceted Impact of Ada Lovelace in the Digital Age. *Artificial Intelligence*, *235*, 58-62.

Carlson, M. (2008). Introduction. In Fischer-Lichte, E, The Transformative Power of Performance. New York: Routledge.

Cohn, J. (2015). The Long and Winding Road of Mental Illness Stigma. *Milbank Quarterly*, *93*(3), 480-483.

Daniels, D. (2011). Was war die Medienkunst?. In C. Pias, *Was waren Medien?* (pp. 57-80). Zürich/Berlin: Diaphanes.

Daniels, D. Media Art Net | 9 Evenings: Theater & Engineering. Retrieved from http://www.medienkunstnetz.de/exhibitions/9evenings/images/2/?desc=full

Deleuze, G., & Guattari, F. (1987). *A Thousand Plateaus*. Minneapolis: University of Minnesota Press.

Demers, L. (2012). The Blind Robot. Retrieved from http://www.processing-plant.com/web_csi/index.html#project=blind

Demers, L. (2019). Up-Close Experiences with Robots. In International Symposium on Computational Media Art (ISCMA). Hong Kong: Unpublished. Retrieved from https://eprints.qut.edu.au/128263/

Dixon, S. (2004). Metal Performance Humanizing Robots, Returning to Nature, and Camping About. *TDR/The Drama Review*, *48*(4), 15-46. doi: 10.1162/1054204042442017

Dixon, S. (2007). *Digital Performance*. Cambridge, Mass.: MIT Press.

Dixon, S. (2004). *Metal Performance Humanizing Robots, Returning to Nature, and Camping About*. *TDR/The Drama Review*, *48*(4), 15-46.

DSM-VI - Wood Street Galleries. (2012). Retrieved from http://woodstreetgalleries.org/portfolio-view/la-cour-des-miracles-bill-vorn-and-louis-philippe-demers/

Export, V. Media Art Net | Export, Valie: Tap and Touch cinema. Retrieved from http://www.medienkunstnetz.de/works/tapp-und-tastkino/

Fischer-Lichte, E. (2008).*The transformative power of performance*. New York: Routledge.

Fondation Langlois. (2006). Lucinda Childs : Vehicle (performance). Retrieved 29 July 2019, from http://www.fondation-langlois.org/html/e/page.php?NumPage=1734

Freud, S. (2004). The Uncanny (1919). In D. Sandner, *Fantastic Literature: A Critical Reader* (pp. 74–101). Santa Barbara: Praeger.

Garwood, D. (2007). The Future of an Idea: 9 evenings—Forty Years Later. *PAJ: A Journal of Performance and Art*, *29* (1), 36-48.

Goffman, E. (1956). *The Presentation of Self in Everyday Life*. New York: Anchor.

Goldberg, R. (1979). *Performance: live art 1909 to the present*. New York: Harry N. Abrams, Inc.

Goldberg, R. (1980). Performance--Art for All?. *Art Journal*, *40*(1-2), 369-376.

Goodall, J. (2005). The Will to Evolve. In M. Smith, *Stelarc: The Monograph* (pp. 1-32). Cambridge, Mass: The MIT Press.

Goodall, J. (1997). Transferred Agencies: Performance and the Fear of Automatism. Theatre Journal, 49(4), 441-453

Ghedini, F., & Bergamasco, M. (2010). Robotic creatures: Anthropomorphism and Interaction in Contemporary Art. In *IEEE 2010 RO-MAN*. Viareggio.

Glynn, R. (2008). Conversational Environments Revisited. In *19th European Meeting of Cybernetics and Systems Research*. Vienna: Emerald Publishing Limited.

Glynn, R. Performative Ecologies. Retrieved from http://www.ruairiglynn.co.uk/portfolio/performative-ecologies/

Hall, J. (2015). An Autopoietic Aesthetic in Interactive Art. In A. Scarinzi, Aesthetics and the Embodied Mind (pp. 297-315). London: Springer.

Haraway, D. (1991). A Cyborg Manifesto: Science, Technology, and Socialist-Feminism in the Late Twentieth *Century. Simians, Cyborgs and Women: The Reinvention of Nature*. Routledge.

Hongliang, W. (2019). People's Republic of China. In R. Rugoff, *May You Live In Interesting Times* (pp. 38-40). Venice: La Biennale di Venezia.

Huhtamo, E. (2004). MediaArtHistories Archive: Trouble at the Interface, or the Identity Crisis of Interactive Art. Retrieved from http://mediacultures.net/jspui/handle/10002/299

Jochum, E. A., Demers, L-P., Vorn, B., Vlachos, E., McIlvenny, P., & Raudaskoski , P. (2018). Becoming Cyborg: Interdisciplinary Approaches for Exoskeleton Research. In Proceedings of EVA Copenhagen 2018 - Politics of the Machines - Art and After (pp. 1-9). British Computer Society.

Jochum, E. (2012) Deus Ex-Machina: Towards an Aesthetics of Autonomous and Semi-Autonomous Machines. (Dissertation). University of Colorado.

Jochum, E., & Goldberg, K. (2016). Cultivating the Uncanny: The Telegarden and Other Oddities. In D. Herath & C. Kroos, *Robots and Art: Exploring an Unlikely Symbiosis* (pp. 149-177). Singapore: Springer.

Jones, A. (2005). Stelarc's Technological "Transcedence"/Stelarc's Wet Body. In *Stelarc: The Monograph*. Cambridge, Massachusetts: The Mit Press.

Jones, A. (2011). “The Artist is Present”: Artistic Re-enactments and the Impossibility of Presence. *TDR: The Drama Review*, *55*(1), 15-46.

Kac, E. (1997). Origin and Development of Robotic Art. *Art Journal*, *56*(3), 60-67.

Kluver, B. Open Score - 9 Evenings - Dance, Music and Theater Performances. Retrieved 29 July 2019, from http://www.9evenings.org/openscore.php

Kroos, C., Herath, D., & Stelarc. (2012). Evoking Agency: Attention Model and Behavior Control in a Robotic Art Installation. *Leonardo*, *45*(5), 401-407. doi: 10.1162/leon_a_00435

Kroos, C., Herath, D., & Stelarc. (2011). From Robot Arm to Intentional Agent: The Articulated Head. In S. Goto, *Robot Arms* (pp. 215-241). Rijeka: InTech.

Lyotard, J. (1991). *The Inhuman: Reflections on Time*. Palo Alto: Stanford University Press.

McKenzie, J. (2001). *Perform or Else: From Discipline to Performance*. London: Routledge.

McCulloch, W., & Pitts, W. (1943). A Logical Calculus of the Ideas Immanent in Nervous Activity. *The Bulletin Of Mathematical Biophysics*, *5*(4), 115-133.

MoMA | Yoko Ono. Cut Piece. 1964. Retrieved 23 July 2019, from https://www.moma.org/learn/moma_learning/yoko-ono-cut-piece-1964/

Mori, M., MacDorman, K., & Kageki, N. (2012). The Uncanny Valley. *IEEE Robotics & Automation Magazine*, *19*(2), 98–100.

Rinaldo, K. (1998). The Flock. *Leonardo*, *31*(5), 405-407.

Pask, G. (1971). A Comment, a Case History and a Plan. In J. Reichardt, Cybernetics, Art, and Ideas (pp. 76-100). London: Studio Vista.

Parker-Starbuck, J. (2006). *Becoming-Animate;Theatre Journal*,*58*(4), 649-668.

Parker-Starbuck, J. (2011).*Cyborg Theatre*. London: Palgrave Macmillan.

Pask, G. (1971). A Comment, a Case History and a Plan. In J. Reichardt, Cybernetics, Art, and Ideas (pp. 76-100). London: Studio Vista.

Pask, G. (1976). Introduction: Aspects of Machine Intelligence. In: N. Negroponte, ed., *Soft Architecture Machines*. Cambridge: The MIT Press, pp.7-33.

Penny, S. (2012). Art and Robotics: Sixty Years of Situated Machines. *AI & Soc*, *28*(2), 147-156.

Penny, S. (2017). *Making Sense: Cognition, Computing, Art, and Embodiment*. Cambridge, Mass: The MIT Press.

Penny, S. (2016). Robotics and Art, Computationalism and Embodiment. In D. Herath, C. Kroos & Stelarc, *Robots and Art: Exploring an Unlikely Symbiosis* (pp. 47-67). Singapore: The Springer.

Penny, S. (2011). Towards a Performative Aesthetics of Interactivity. *The Fibreculture Journal*, (19), 72-109.

Phelan, P. (1993).*Unmarked: the politics of performance*. London & New York: Routledge.

Pickering, A. (2002). Cybernetics and the Mangle: Ashby, Beer and Pask. Social Studies Of Science, 32(3), 413-437. doi: 10.1177/0306312702032003003

Rinaldo, K. (2016). Trans-Species Interfaces: A Manifesto for Symbiogenisis. In D. Herath & C. Kroos, Robots and Art: Exploring an Unlikely Symbiosis (pp. 113-149). Singapore: The Springer.

Rosen, M. Media Art Net | Pask, Gordon: The Colloquy of Mobiles. Retrieved from http://www.medienkunstnetz.de/works/colloquy-of-mobiles/?desc=full

Reichardt, J. (1968). *Cybernetic Serendipity*. London: Studio International Special Issue.

Rosen, M. (2012). They Have All Dreamt of Machines and Now the Machines Have Arrived. In H. Higgins & D. Kahn, *Mainframe Experimentalism* (pp. 89-112). Berkley: University of California Press.

Rothbart, D. (2004). Daniel Rothbart - YOKO ONO PERFORMANCE AT THE ISE FOUNDATION. Retrieved 23 July 2019, from http://semioticstreet.com/YOKO3.html

Salter, C. (2010). *Entangled*. Cambridge, Mass: The MIT Press.

Stelarc. STELARC | EXOSKELETON. Retrieved 30 July 2019, from https://stelarc.org/?catID=20227

Stelarc. (2017). STELARC | STICKMAN. Retrieved 30 July 2019, from http://stelarc.org/stickman.php

Stiles, K. (1996). Performance. In R. Nelson & R. Shiff, *Critical Terms for Art History* (2nd ed., pp. 74-98). Chicago: University of Chicago Press

Tetem. (2018). StickMan - Tetem. Retrieved 30 July 2019, from https://www.tetem.nl/portfolio/stickman/

The 'man with three ears' in Twente. (2018). Retrieved from https://www.utoday.nl/spotlight/65500/the-man-with-three-ears-in-twente

Turing, A. (1950). Computing Machinery and Intelligence. *Mind*, (236), 433-460.

Turner, V. (1979). Frame, flow and reflection: Ritual and drama as public liminality. Japanese Journal Of Religious Studies, 6(4), 465-499.

van Baarle, K. (2018). *From the Cyborg to the Apparatus* (PhD). Ghent University.

van Baarle, K. (2015). The Critical Aesthetics of Performing Objects – Kris Verdonck. *Performance Research*, *20*(2), 39-49.

Varela, F., & Maturana, H. (1980). *Autopoiesis and cognition*. Dordrecht: D. Reidel.

Verdonck, K. Projets - DANCER #3. Retrieved 28 July 2019, from http://www.atwodogscompany.org/en/projects/item/173-dancer-3

Vorn, B. (2012). Bill Vorn DSM-VI. Retrieved from http://billvorn.concordia.ca/robography/DSM.html

von Neumann, J. (1951). The General and Logical Theory of Automata. In *The Hixon Symposium*. New York: John Wiley & Sons.

Walter, W. (1950). An Imitation of Life. *Scientific American, 182*(5), 42-45. doi: 10.1038/scientificamerican0550-42

Weng, X. (2016). Can't Help Myself. Retrieved 22 July 2019, from https://www.guggenheim.org/artwork/34812

White, N. THE HELPLESS ROBOT - NORMAN WHITE. Retrieved 27 July 2019, from http://www.year01.com/archive/helpless/statement.html

White, N. (2016). Way of the Jitterbug. In D. Herath & C. Kroos, *Robots and Art* (pp. 212-229). Singapore: Springer.

Wiener, N. (1948). *Cybernetics: Or Control and Communication in the Animal and the Machine* (1st ed.). Camb. Mass.: MIT Press.

Wilson, E. (2010). *Affect and Artificial Intelligence*. Seattle: University of Washington Press.

Woolf, S., & Thompson, A. (2002). The Sound Gallery: An Interactive A-Life Artwork. In P. Bentley & D. Corne, Creative Evolutionary Systems (pp. 223-251). Burlington: Morgan Kaufmann.