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Performing/Watching Artificial Intelligence on Stage

Abstract

In the last two decades, we have observed the experimenting with Artificial Intelligence algorithms as a tool for performances. From the early tests, mostly carried out in the Universities' Labs, to the first public performances, the practice has produced enough evidence to consider the implications, both from the point of view of the design and of the reception. Computer scientists have used performance and drama to test the potential of AI. Artists have used AI to express a new criticism to both presence and disembodiment. As robots became relevant in our society, they walked their first steps on stage; Artificial Agents have been dialoguing with actors; some algorithms have managed the interaction among participants in the interactive performances.

Therefore, we can foresee a new multifaceted practice in theatre, and this may further affect the notion of live event. Yet, the analysis of this practice is not relevant only for the creators but may open new consideration from the point of view of the audience experience. The notion of the "here and now" that instantiated the aesthetic of performance as relation between performer and spectator, might be reconsidered in the light of the artificial agency of the algorithm.

KEYWORDS: Artificial Intelligence; algorithm; artificial agents; intermediality; drama; audience

1. Introduction: Algorithm, Agents, Robots

In the last two decades we have seen enough examples of algorithms and Artificial Intelligence along the contemporary history of theatre and performance, at least to start wondering if any new relevant elements emerge to the practice. Rather than defining an overall general meaning of their presence, in this paper we wish to verify how they participate in the dramaturgy of the live event. Yet, before we appraise the use of algorithm and Artificial Intelligence both from the point of view of the contents' creation (author and performer) and from that of the reception (audience), it is worth to prompt the basics of these novel protagonists in the theatrical performance.

The simple definition of algorithm is a finite sequence of instructions to perform a task. One of the most used examples is the recipe for baking a

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cake: given some inputs (the ingredients), there is a sequence of instructions (the preparation) that produce the expected output (the cake) (Harel 2004; Cleland 2001). Clearly, the algorithms in computers have by now reached a high level of complexity; they contain a vast number of features such as the conditional role if/then/else, and loops, and variables, and values to consider. However, one has always to remember that algorithms are instructions that describe actions to be executed.

We can continue with the recipe example to define other elements included in the wide topic that usually falls under the term Artificial Intelligence (shortened in AI from now on), thus stretching the basic notion of algorithm toward more specific applications. In brief, we can describe the artificial agent as the one who does not only know the instructions, but also identifies the content of your fridge, detects your cooking appliances, has the goal of baking, and deploys a plan that will allow the delivery of the recipe (maybe it also knows that you are short on flour and you must go shopping). In other words, the agent is able to build a plan with all the needed actions, according to a given situation, to yield the projected outcome. Yet this agent might prefer to select only organic ingredients or can describe each operation using classical examples from cooking books. In other words, the agent can be programmed to show some personality traits that will characterize its actions.

Finally, the robot is the one that is left in the kitchen baking the cake (enacting the planned actions) while you have a drink with your friends before dinner. No matter if the robot resembles a human being or it is a very complex cooking appliance, the important fact is that it will be able to interact with the physical world. It may have a vocal interface that asks your confirmation before beginning each step of the process, and it could also show happiness when the cake is done.

To sum up: the algorithm describes, through some formal language, the instructions to execute actions to yield a predicted outcome. The artificial agent is based on algorithms that allow us to reach a given goal thanks to plans that are based on the specific configuration of facts; the robot is rooted in the ability of the agent but is mainly characterized by its power to interface with the real world.

Clearly, these examples overlook the fundamental question of all the knowledge needed for a machine to function: for example, an instruction such as 'beat the eggs', in a recipe, implies that the machine 'knows' how to execute the action 'beating' and 'knows' what an 'egg' is. The firsts examples of AI were based on explicitly described knowledge (i.e., a human operator coding that knowledge in some formal language). More recently, there are special algorithms that allow the machine to learn from example (i.e., we can show ten images of eggs until the computer creates its 'idea' of egg). This is called 'machine learning'. In late years, thanks to a further development in

the configuration of computational systems (mainly, the neural network), the machine can learn autonomously: fed with thousand hours of TV cooking shows, the machine can learn about baking, and even invent a new cake.

Although those definitions are broad and simple, and even if in real implementation they are often indistinguishable from each other, they are to be taken into account when we discuss the elements of AI in drama and theatre.

There are examples (that we will discuss later) in which the performance puts the emphasis on the instruction (such as Annie Dorsen's *A Piece of Work*), others where the centre of attention is the autonomous agent (such as Susan Broadhurst's character Jeremiah in *Blue Bloodshot Flowers*), and others where the focus is on the presence of robots and machines that take the place of the actors (such as Marcel·li Antünez Roca's robots in *POL*). And there are even examples in which the computer learns from the actions of the performer and starts participating to the performance (such as *Discrete Figure* by Daito Manabe, Kyle McDonald and Elevenplay dance group).

In the last two decades, we have witnessed an increase in experimenting with AI and algorithms as a tool for performances. However, we may also recall earlier experiments. Why should not we consider *ELIZA*, the first chatbot created in 1966, as the first drama improvisation between a human being and a computer? After all, Weizenbaum, the author, resorted to drama when he explained the program: "Like the Eliza of *Pygmalion* fame, it can be made to appear even more civilized, the relation of appearance to reality, however, remaining in the domain of the playwright" (Weizenbaum 1966, 36). *ELIZA* was paired with a more general effort to bend the newly born mainframe computers toward creativity. In the same decade, in fact, we recall the first examples of automatic story generation. In the early Sixties, linguist Joseph E. Grimes programmed an IBM computer, at the Universidad Nacional Autónoma de México, to generate stories (Ramos et al. 2020; Ryan 2017). For the first time, a machine worked as a storyteller, and produced short stories (just few lines) that made sense for the reader. In 1965 A. Michael Noll used the early computer animation technology to create the first example of computer-generated ballet at the Bell Telephone Laboratories, Incorporated (Noll 2016), where a carefully arranged composition of lines and dots represented a group of dancers (three males and three females) moving on a squared stage. Besides, the whole history of online chat, and the continuous spreading of chatbot, might be intended as a form of drama co-creation between the users and the artificial agents. In the late Nineties, as matter of fact, Nina LeNoir interpreted the role-play world of MUD (the multi-user domains) as a territory that challenges the notion of player and actor (LeNoir 1999). Playing an online text-based adventure and reacting in real time to other players (human or artificial), configured a brand-new kind of performance, in which the skills of a playwright merged with the talents of an actor.

Contemporary dance has been the first to investigate the power of algorithm. In fact, it was the perfect setting to experiment with computer generated music in a live event, but it proved to be also apt to practice with algorithmic driven choreographies, and to test the presence of computer guided elements on stage (Menicacci and Quinz 2001; Sagasti 2019). Notoriously, Merce Cunningham used the software LifeForms to create choreography since 1991, but we may also recall that in 1985 the composer Michael McNabb created the score for *Invisible Cities* (Memorial Auditorium, Stanford University) where the choreograph Brenda Way included the movement of a robotic arm (McNabb 1991). We can track back an uninterrupted development of the integration between dance and algorithms; this assimilation usually took the form of a network of software and devices that allow the dancers to interact with the media contents. Notably, a famous software for interactive digital performance (Isadora) is the offspring of the collaboration between the media artist/programmer Mark Coniglio and Troika Ranch dance company.

Complex algorithms have been used in theatre practice also to enhance the intermediality of the performance. There is a whole category of software designed to gain computational control over a performance, and these types of computer applications have played a key role in the history of the interrelation between performance and computer science/engineering (Birringer 2007).

Theatre and performance came along soon after dance. Take for example the case of Marcel·lí Antúnez Roca's *Afasia* (1998). The artist joined the engineer Sergi Jordà to create soundbots (robots that work as remote-controlled musical instruments) driven thanks to a wearable device (the so-called dress-skeleton). For this purpose, Antúnez Roca also produced the first version of a software that runs all elements of the stage technology (video, sounds, lights, robots); this was further developed and named after a 2002 performance (*POL*) (Antúnez Roca 2014; Pizzo 2016). *POL* software aimed to provide the performer with full control over the entire web of technology onstage.

There is a large list of this type of software; in their variety, they share the goal of capturing and analyzing the events and actions, but they can also be used to create hypermedia, audiovisual, or, more generally, multimedia events. In all cases, they are based on algorithm and may include some form of autonomous intelligence (Damiano et al. 2019).

In 1997, Claudio Pinhanes and Aaron Bobick presented *It/I: An Interactive Theatre Play* at the MIT Media Lab. Again, like *ELIZA*, this was more a test for the application of intelligent algorithms, rather than a proposal for a new theatrical genre. Nevertheless, it offered a glimpse of the integration between AI and dramatic theatre. In this performance, the artificial character was not partaking in a conversation, but was a sort of hidden entity reacting to the human character's actions by means of sounds, lights, and video pro-

jections onstage. The play was composed of four short scenes in which the computer presented the actor with several challenges. Compared to ELIZA, the seminal step forward, in this case, was the fact that the agent, although not personified by a specific line of text or by some anthropomorphic image, was proving that the algorithm could produce a dramatic agency. Rather than reacting to the user's stimuli, as ELIZA did, the autonomous agent had its own initiative and cued the human actor to react accordingly. Therefore, the agent – as a dramatic character – was manifested by its own intentionality (Bobick and Pinhanez 1998; Pinhanez and Bobick 2002).

This opened a new thread of research that saw the intentionality of the action as the core element of the dramatic performance to be implemented in the software. Here the early experiments of story generation merged with the goal of creating a software driven agents' behaviour, and this was a step toward an interactive dramatic digital narrative.

In 2005, Michael Mateas and Andrew Stern released the first fully operating dramatic game: *Façade*. The player participated in a dramatic improvisation with two artificial character (Trip and Grace, a married couple) who invited he/she for a drink at their apartment. The game is played in first person on a computer screen where the two characters appeared in cartoons-like shape but talked with real voices (recorded non synthesized) and – most important – showed believable human behaviours. During the game, soon the player realized that the couple was experiencing a marriage crisis and he/she had to cope with the arguments and quarrelling (Mateas and Stern 2007). *Façade* has been one of the upfront experiments to use AI to create a dramatic experience; it puts the player in a situation that resembles a theatre improvisation and is not based on typical game style rewards. Indeed, for his research on this topic, Mateas coined the terms Expressive AI to define a specific area of experimenting with AI and Arts.

2. The Author and the Agent: Performing AI

The early examples that we have recalled so far, were born in university research labs or have stemmed out of the collaboration between scientists and artists. More recently, and as a consequence of more powerful computers and more approachable programming languages, there has been a new wave of artists for whom programming is the central part of their own creative process.

In 2010 Annie Dorsen presented *Hello Hi There*, a performance where two chatbots were used as autonomous player on stage. The piece took a cue from a famous debate between Michael Foucault and Noam Chomsky about the nature of language and human creativity (broadcasted by Dutch TV in

1971) and presented the chatbots dialoguing on stage. As we know, chatbots were invented to dialogue with humans, therefore watching two machine dialoguing with each other produced a hilarious and yet disconcerting effect. Two years later, Dorsen launched her influential idea of ‘Algorithmic Theatre’ that has proved to be pervasive in the debate, because it foresees a shift in the very nature of the performance (Dorsen 2012). Although, as we have seen, she was not the first to exploit the power of computation in live events, nevertheless she has been successful in embedding the opportunities of playing with algorithm within a coherent and steadily developing artistic career, putting the focus on the cultural, social, and political implications of those opportunities (although, leaning toward the dystopian vision of human computer interaction).

In brief, it is possible to say that, from the early tests in the university labs till the first public performances, the practice has produced a number of evidences, enough to consider their implications both from the point of view of the design and of the reception.

On one side, it is true that computer scientists have used performance and drama to test the potential of AI. In fact, the framework of theatre and drama represents a rich repository of human behaviours and it is a perfect match for the challenge of an AI that aims to create a seamless, lifelike, autonomous interaction between computer and humans. Yet, on the other side, artists have used the new opportunities provided by AI as a new criticism to both presence and disembodiment in theatre (and in the society as a whole).

The pervasiveness of computers, algorithms and AI in our life has been mirrored in the creation of theatre works. As robots became relevant in our society, they walked their first steps on stage; from their birth, artificial agents have been dialoguing with actors; at the dawn of personal computing, algorithms have managed the interaction among participants in interactive performances.

No wonder that most of the time something as pervasive as the algorithm is staged, there is some critique to its function in our life. As much the appearance of video on stage in the Eighties was implicated with the mass media universe, there is no doubt that the representation of algorithm is relevant because of the cultural and political relevance that it has gained in the last decades. And this raises questions about how technologically advanced societies relate to the complexity of the world they have created.

For example, in 1999 Blast Theory’s *Desert Rain* engaged the spectators in a mixed reality environment, merging videogame and performance where the theme was to revise the true/false opposition in the mediatization of the Gulf War (Giannachi 2004). Jeremiah, the artificial agent protagonist of *Blue Bloodshot Flowers* (2001), “questions orthodox notions of origin and identity” as much as “subverts assumptions of reproduction and representation”

(Broadhurst 2006, 144). In 2008 robot were fully operational as characters in the famous *I, worker* by Hirata Oriza, where the typical situation of husband and wife was revisited thanks to the presence of a mirroring couple of artificial servants; the overall “message concerns the loneliness and the individualism in which human race has locked itself by means of new technologies” (Toscano 2019, 160).

Overtime, the use of algorithms and AI applications in theatre became a way to consider the consequences of their spreading in contemporary society.

Annie Dorsen reckons that, in her algorithmic theatre, the power relies on “the tension between the understructure, i.e., – she explains – the computer code written by my collaborators and me, and the surface content chosen by the algorithm, i.e., the particular words spoken or notes sung”. In her view, the interesting part of those performance is “the interplay between the rules and the results, and how that interplay activates or frustrates the desire of the audience to make meaning from what they see and hear”. This certainly brings upfront “the epistemological crisis that algorithms have brought in our culture, and the political consequences of a deep, and ever-deepening confusion about appearances, illusions, fakes, and copies” (Dorsen 2019, 114). Yet, besides the political stance of this performance, the tension, quoted by Dorsen resonates the well-known tension between the written text and its performance on stage.

On one side, this approach aims at gaining an understanding about algorithms by following the tradition of selecting drama as a tool to analyze and expose relevant issue of contemporary society. On the other side, this approach tends to obliterate that also the “surface content chosen by the algorithm” is the consequence of author’s choice. The tension quoted by Dorsen has been fueling much theatre works of the whole last century, where the interpretation of some human being (director, actor, ...) managed the nexus between the text and the performance. However, Dorsen is right in pointing out this tension because the distinction (and autonomy) that these two notions gained in the twentieth century, is blurred in the case of algorithm, where the difference between the code and the execution seems much more an abstract logic that an instantiated reality. As we have hinted at the beginning of this paper, the very notion of algorithm dims the gap between the instruction and the execution, because the former must precisely describe the latter. Although this is common sense in the abstract world of mathematics, it resonates differently in the world of dramatic theatre. For this reason, the emergence of the use of algorithm in performance became an intriguing subject for artists and scholars. It challenges a core notion rooted in the contemporary culture and forecasts an unknown future for performance.

One of the challenges to algorithmic theatre, as noted by Ulf Otto, is the question of control that plays a key role in understanding the algorithm as

“deeper than its stage appearance; the challenge concerns theatre itself, not its aesthetics but its ontology... What is at stake with the advent of an algorithmic culture is a new regime of power . . . that foregrounds the relation between aesthetics and organization” (2019, 125).

Undeniably, control is a relevant issue because it crosses the notion of authorship. Rather than arguing if the known elements of drama and the codes of performance undergo some transformation, either by disappearance or augmentation, the notion of control looks for an insight on how they are organized. It works as a bridge between the traditional concepts of authoring, directing, and the notion of algorithm. Moreover, it helps to consider the performance as process rather than as a datum. Therefore, the question of control functions as an analytical tool to consider the differences in the procedure that runs the performance. And this seems a more appropriate approach for a technology like algorithm that has the control at its own core.

Otto has built his argument based on the Berlin based Turbo Pascal’s production of *Algorithmen* (2014). The whole performance consisted in the rearrangement of the spectators’ seats according to different sorting rules. The production used very simple technology, such as a printer that distributes instructions, yet “this implementation of algorithms in the performance space produced a situation that was no longer oscillating between meaning and experience, between semiotics and performativity, as theatre had been during the better part of the 20th century” (Otto 2019, 125). His argument is clearly rooted in the understanding of the aesthetic of drama as based on meaning and semiotic, and that of performance as hinged on experience, and he stresses that this is the sort of binarism that had guided the theatre debate in the last century.

In algorithmic theatre – Otto continues – this opposition is reshaped because the automatic procedure bridges the “signs and body”, because there is a meaning (a kind of narrative that makes sense, like in drama) that is directly instantiated in the materiality of the event (the performance). As we said, computational procedure reduces the distance between the written code and its execution; and, in practical application, the two notions overlap. Under this light, we might conclude that the issue of relation between text (meaning) and performance (experience) is overridden by the algorithmic theatre (to use Dorsen’s definition) because, in this case, the text is the performance.

The new multifaceted digital practice in theatre has brought new advances in how we consider the live event. The works stems out of an intense transdisciplinary collaboration between dramatists, directors, and computer scientists. The very notion of authorship in theatre is challenged by the idea that the algorithm may be seen as text and performance in the same moment. Furthermore, the design of the performance departs from the traditional practice of the linear ordering of actions; and the score of the live

event is no longer the sequencing of dramatic units. Instead, writing the performance resembles the creation of a hypertext where each node may be the start of different continuations; moreover, the dramaturgy of the performance gets closer to the creation of a rule-based procedure, such as the well-known conditional statements (if/then/else) in programming languages.

Drama and performance, as we know, are centred on the actions of some agent; yet the latter finds a new light within the realm of algorithms. The artist David Rokeby notes that “algorithms often work in tandem with human creativity” but when they simulate aspects of human behavior the situation changes: “the algorithmic performer differs . . . from a human performer in that it will perform its defined behavior with a rigorousness that is non-human. It creates a sort of mirror through which to reexamine what it means to be human . . . The algorithm presents a truly alien subjective perspective on familiar human acts, which can have the fascinating effect of making visible to us again aspects of our humanity that have disappeared into invisibility through familiarity” (Rokeby 2019, 94-5).

The staging of autonomous agent, or any autonomous algorithm, usually brings in a non-human quality that is perceived by the audience as the effect of computation. Yet the well-crafted artificial agent, even if it might mimic the human, (being a machine) will be entirely constructed. Unlike what happens with the human performer, the behaviours of the artificial agent are a direct output of the author’s work; even when they take the audience’s reactions as an input for their action. So far, thus, the creation of an artificial agent (far from giving birth to a person) looks like the work of a dramatist who can have complete control over the manifestation of the character.

Indeed, also in this case, the intervention of the algorithm shifts the paradigm to which we are accustomed. The use of artificial agents collapses the difference between character and performer. Again, the gap between the written instruction and the manifestation is dimmed, and this impacts on the configuration of the performance. For example, imagine how the notion of live performance could be affected by a computational system that allows the author to design real time actions for the stage (here and now), as much as the modern technology allow the graphic artists to draw characters for an animated movie.

In *Discrete Figures* (2018) five dancers “interact with cubes of images and light, drones, cameras, and machine learning algorithms that emulate them in live time” (Pearlman 2020, 56). There is a moment when “a camera projects a performer’s avatar, which appears as a shiny blob. The “blob” learns through live time algorithmic processing of the dancer’s movements to simulate, and eventually becomes the exact replica of the dancer . . . The avatar emerges from algorithmic processes that come into being in front of the audience. It creates a displayed virtual self in motion with an actuated self

unique each time it is enacted” (Pearlman 2020, 57). Clearly, *Discrete Figures* was based on the relation between the real and the synthetic dancer, yet it gives insight in the possibility that an intelligent system may produce in real time a new synthetic actor able to dance or enact a drama autonomously.

Rather than foreseeing the obliteration of humans in the live event, this use of AI in theatre rather calls for a new generation of authors. Annie Dorsen believes that the algorithm poses three questions: the first relates to the way theatre can avoid falling into the fashion of “tech-boosterism or gizmo-art”; the second concerns the possibility of developing a new kind of dramaturgy that “accounts for the complex embedded systems of cognition we are living in”; but the third question asks “What would acting look like if it didn’t rely on traditional oppositions between realistic and artificial, spontaneous and rehearsed, true and false?” (Dorsen 2019, 119).

This seems the hardest question to answer. Evidently, we are describing the merging of theatre and AI as the rise of a kind of interactive, autonomous environment in which the performance (at least until now) is the outcome of the dialogue between live and artificial agents. Therefore, the performers for this kind of digitally augmented theatre stage must learn to consider this form of interactivity. Learning the lines in a text or the movements in a choreography would not be enough, and the performer should familiarize with the interaction roles, as a game player learns how to play in a new videogame.

For instance, the actress protagonist of *DoPPioGioco*, produced by CIRMA in 2018, had to learn to collaborate with an algorithm that was there to prompt her with the portion of story to be told, once the system had detected the audience’s emotional response to the previous part of the narrative (Damiano et al. 2019). But also, the author had to adopt a new form of writing to compile a network of narrative units, each tagged with an emotion that he was intending to elicit in the audience, making sure that each possible narrative path was a well-formed story.

Otto thinks that “Dorsen’s ‘algorithmic theatre’, like many media performance, re-erects traditional theatre scaffolds to re-perform its by now canonical critique”. Yet, he thinks that changing the traditional aesthetic parameters might not be so interesting at all. Once more, for Otto the real core issue is agency: “Referring to Aristotle first and Brecht later, [Dorsen] assumes that theatre is generally about action, and action for her is fundamentally based on making a decision – that is (again according to Dorsen), choosing from alternatives” (Otto 2019, 135). In the notions of action and intentionality, Otto sees a core concept to approach the match between algorithm and theatre. As we have seen, intentionality has been put in a new light by the implementation of automatic procedures that can design and execute complex planning. Hence, given that action is the key notion for

drama, and given that intentionality in drama has been rendered mainly as the human ability to make choices, the authors are driven to reconsider the notion of drama once that ‘doing actions’ and ‘making choices’ may be artificial processes in a computer.

3. The Audience: Watching AI

Yet, the impact of algorithms and AI in theatre is not relevant only for the creators but may also open a new critique from the point of view of the audience. Miriam Felton-Dansky wonders: “What matters more is what it is like to watch [algorithms], and what it means that we are doing so” (Felton-Dansky 2019, 69). To try to answer that question, I would suggest that our ‘watching’ depends on what is represented, and the meaning comes out of ‘where’ the audience is in the act of watching the algorithms at work. In other words, I do not think we can define one overall meaning of the presence of the algorithm on stage as much as we cannot define an overall meaning for the appearance of any proactive entity as such (human being or animal). This attribution will always be the results of how the relation between the performance and the audience is configured. Yet, Felton-Dansky brings out a more important problem when, recalling her attendance at Dorsen’s *Hello Hi There*, she writes that the performance “was already asking something urgently new of its audiences, something that, even if our conscious mind were occupied with the pleasure of watching nonhuman interlocutors engage in earnestly silly behavior, also required us to inhabit a mode of being that would become increasingly necessary for survival in the year that followed” (Felton-Dansky 2019b, 67). In this excerpt we can appreciate the four main issues that are currently under discussion regarding the act of watching AI on stage.

First, and very simply, to be perceived AI must be – somehow – manifested on stage. If this goes without saying for any other element of the performance, it isn’t a trivial matter for the computational procedure whose manifestation may not be patent as such. It must be noted that the use of AI (as of any other technology) doesn’t involve as such a shift in the theatrical codes: AI must gain some form of presence in the dramaturgy of the event, in the setting, in order to be relevant among the other elements. In other words, the question does not concern ‘using’ AI as much as representing AI.

Second, the ‘pleasure of watching’ technology at play has been usually one of the assets to resort at, in many of the cases along the history of such kind of performance. But it is true that most of the works that we recall as intermedial theatre, rather than take pride in the advancement of digital technologies, brought upfront an implicit or explicit critic to the influence that

those technologies have on our life. For example, the works of The Builders Association, well known for an original form of mixed digital media in their shows, confronted themes such as fake realities, workers' technological exploitation, citizen surveillance. Thus, that 'pleasure' seems to be both amazement and disconcert.

Third, there are the human-like behaviours. This stems out of a more general impact that digitally augmented performance has had on the audience's appraisal abilities. Following Gieseckam's definition, the multimedia theatre may be intended as the use of various technological apparatus "that collectively support performances that are otherwise built around fairly traditional understanding of the role of the text and the creation of character". The more recent term intermedia theatre indicates a "more extensive interaction between the performers and various media [that] reshapes notions of character and acting, where neither the live material nor the recorded material would make much sense without the other, and where often the interaction between the media substantially modifies how respective media conventionally function and invites reflection upon their nature and methods" (Gieseckam 2007, 8). This shift in the relation between media require a new audience's competence for decoding the intricate web of meaning created by interconnections of live and mediatized performance. Yet, in the case algorithms and AI theatre, the media participates to the representation of an autonomous behaviour in which it is possible to see a level on intentionality. In other words, because intelligent algorithms bring into the intermedial performance a new level of autonomous agency, the audience perceive actions that cannot be directly ascribed to a human agent. Watching non-human agency may mean to recognize the presence of some sort of artificial agent (no matter if it is a chatbot, a robot, a voice, as far it is somehow recognizable). This artificial agency may also be represented through an entity with no resemblance to the human, as for example the chandelier in the musical opera *Death and the Powers* (2010) by Ted Machover. In short, it may be enacted by any device that shows some understandable behaviours related to what is happening on stage. But it can be perceived also as a system that governs the overall structure of the event, like some sort of behind-the-stage entity that interferes with the action (as we have seen for *It/I*). As much the audience makes sense of human actions on stage, it must learn to read into computer generated behaviours.

Forth, and last, there is the broad issue of how algorithms refashion the audience's participation. When David Rokeby remembers his early approaches to interactive design for his installation, he writes: "I was increasingly casting the audience in the role of performer, asking them to activate the work with their movements. The installation was generally silent and invisible until the audience engaged with it. The data generated by their actions were processed by algorithms that generated particular responses

out of the field of possibilities that their code defined” (Rokeby 2019, 89). As matter of fact, when producing algorithmically enhanced live performances, it is common to include the audience in the opera. In other word, the computation introduced interactivity as form of co-creation of the performance. As matter of fact, many reviews and papers that portray digital interactive theatre focus less on the recording of the acting or the plot and more on the what the audience is allowed to do.

Rokeby further specifies: “It was important to me to acknowledge that the audience brings their entire life experience, fears, desires, and confusions to the process of experiencing an artwork. I wanted to make work that acknowledged and opened itself to embracing that contribution” (2019, 89).

Playing with the algorithm, according to Rokeby, does not bring up the randomness of creation, quite opposite; algorithm is approached as a tool for the careful design of the sharing of the event with the audience. Random events can still be part of the work, but the focus shifts toward the investigation of new practices of participation allowed by computation and digital interfaces.

Watching human-like artificial behaviours that are manifested as one of the elements of drama and performance to participate in, as much as taking pleasure from it, is a new asset in the audience’s activity.

Nevertheless, there is an effect that must not be overlooked to grasp both the allurements and the uneasiness of algorithms and AI on stage. Otto notes that, “unlike previous media technologies, the digital technologies do not confine themselves to changing what humans can perceive, know, or think, but produce a knowledge that is beyond human access, that is, the world of big data, where only the algorithm can prevail. The effect is that algorithms now know things about us that not only do we ourselves not know but that we cannot even retrace to their origins nor critique because they are based on more than we can process” (Otto 2019, 127).

Maybe it will not be the case in fifty years, but until now, when facing the active presence of some intelligent algorithm, it produces an effect that can be describe as a sort of “grasping the unknown”. In other words, the representation of algorithm on stage has to do with the incapacity of grasp it, and – at the very same moment – with the effort to make sense of it. Let us consider for example how Felton-Dansky describes the audience’s reading into Dorsen’s *Yesterday/Tomorrow*. The performance stages three singers who sing the musical score produced by the algorithm; it begins “with the Beatles’ song “Yesterday” and culminate[s] in “Tomorrow” from the musical *Annie*, with an algorithmic procedure leading the singers through each step in between” (Felton-Dansky 2019, 76). Remembering her own response as audience, Felton-Dansky notes: “We recognize that this was the algorithm’s plan all along, we recognize the singers’ labor in picking their way through

the maze, and we recognize the labor of ourselves as spectators, holding out until ‘Tomorrow’ come what may” (Felton-Dansky 2019, 78).

This process can be described as the audience ‘decoding’ the algorithm. In fact, when watching a drama, and maybe having in mind the text or the story, the spectator engages in a very common type of mixed inductive and deductive reasoning. Notably, watching a plot unravelling on stage, the spectator uses general knowledge (about the genre, the historical setting, the author, ...) to deduce information about what is happening. The spectator considers the specific sequence of actions to draw conclusion about what they mean (for example, the boy is courting the girl; therefore, he loves her). In doing so, he/she is also applying an anticipatory reasoning to sketch hypothetical outcomes of the actual arrangement of event (as far as he/she is aware of). This is a source of ‘pleasure’ because it is the ground where the audience tests its capacity to understand the whole story. No matter how much it fails or succeeds; the pleasure is exactly in the cognitive process of foreseeing what may happen thanks to our problem-solving strategies.

Similarly, this happens when we see the algorithm take control of the events on stage. Once we are made aware that what is happening is the result of a given procedure, we engage in a problem-solving strategy to decode the rules behind that procedure. Like when we read a character that enters the stage, we need to make sense of what the artificial agent (the algorithm) is doing.

Therefore, watching AI on stage includes two facts: first, there must be a perceived intentionality of the algorithm’s behaviours; second, the audience does not have a clear insight of the whole rule-based structure that yields that intentionality. Because that intentionality cannot be watched as lines of a written code, therefore the audience’s cognition tends to perceive ‘liveness’ and ‘presence’ in the actions executed. In other words, the audience tends to embody the action in some autonomous (although synthetic) agency. Otto notes: “As Philip Auslander convincingly showed in 1999, the liveness of theatre was a historical phenomenon, ambivalently relating to television’s virtue of not being recorded and at the same time distancing itself from the distance produced by the broadcast. But after years of ongoing debates about this ontology of performance, these discussions are finally of the past, appearing to have been put on ice by a development that fundamentally changed what a record and an archive are” (Otto 2019, 128). Otto defines the unavoidable entanglement of theatre and digital culture not in terms of media devices on stage, but in the cultural shift that algorithmic culture has produced in our everyday experience of reality and social interaction. Thus, the debate on presence has been outdated by the change in ‘what a record and an archive are’, or, in other words, by the change in the ontology of the real given the pervasiveness of algorithms and AI.

Even if we have so far linked the representation of AI on stage with the presence of some autonomous agency (either as a recognizable agent in front of the audience, or as an entity behind the scenes), we must remember the fact that AI and algorithms may be offered just as a theme. Yet, (maybe even more) in this case too it must be represented by agency on stage. CIRMA has been co-producing a theatre show (*Queer Picture Show*, directed by Irene Dionisio) where the protagonist (the actor Giovanni Ansaldo) is a gender liquid storyteller who recalls the history of queer cinema (helped by several clips from famous movies). Along the show, at given moments, a second character is manifested by a voice who challenges the audience with questions about moral values. The audience is asked to express their stance using a voting paddle; a specifically designed software counts the votes, shows the results, and a content is played accordingly (a clip video, an image, a chunk of text). There are times when the actor reacts against the selected content, and there are times when he consents to it. In the last scene, the artificial agent reveals his identity, but only to allow the audience to see themselves mirrored in a clip that shows a sequence of all the moments when they voted.

This kind of reference to AI as autonomous machine, has a long history. We may think of Elmer Rice's *The Adding Machine* in 1923 that tells the story of an accountant who is fired because of the introduction of an adding machine that appears on stage in the moment the protagonist is dismissed by his boss. As we have seen, there are works that resort to various technological apparatus to represent the problematic interlink between our life and the power of algorithms. For example, the project *D.A.K.I.N.I.* is described by the creators (the group Ajariots) as "a multidisciplinary and transdisciplinary project aimed at investigating and creating dialectic bridges between the theme of Artificial Intelligence, new technologies and contemporary Feminist Theories", with a performance "in which physical theatre and dance-theatre, video projections, interviews and sound experiments will be the key languages of our research . . . How can AI serve Feminist Theory and life? How can women take control of it? What does happen after they take control of it? What do women want to pass on to future generations?" (Pei 2021). Even in cases like *D.A.K.I.N.I.*, where the performance makes large use of digital apparatus, AI emerges as a theme rather than a new way to control the production.

Instead, when intelligent algorithms become intertwined with the methodology for carrying out the performance, we may identify a new form of dramaturgy. If, for example, the algorithm takes the form of an autonomous agent, the writing of a dramatic action implies the use of intelligent systems for expressive purposes; the act of writing coincides with the act of coding, and coding a software becomes creative writing. For example, writing a character as *Façade* does, does not consist in defining a specific sequence

of dialogues, but it has to do with defining the rules that govern his/her behaviour, describing the specific type of planning that motivates his/her intentionality, providing him/her with a procedure to recognize and represent emotions. That character will be very much the outcome of all this coding, and his/her performance will vary according to the elements that the author has decided to implement.

The last question to rise is whether the audience may build, with the artificial agents, the same sort of emotional bond that has shaped its relation with characters played by humans. Given the established tradition in cinema where audiences have developed an emotional participation with cartoons and CGI characters, the answer might be positive. Nevertheless, as we said, in theatre lays the question of presence. Therefore, the bond is not with some sort of representation, but with the perception of agency, the intentionality of the act and real time event.

Felton-Dansky resorts to the well-known notion of suspension of disbelief by Coleridge: “an emotional bond between chatbots would be the result of our collective suspension of disbelief – that old theatrical paradigm, couched in double negatives and glittering with new danger in an age of fake news and election interference” (Felton-Dansky 2019, 72).

In dramatic theatre that suspension is commonly applied to the actions that are taking place: i.e., the audience believe that that guy is that character and assume that the actions are motivated by his intentions (the same suspension applies to space, props, etc.).

This does not apply gracefully to the algorithm because its activity cannot be read through the opposition of fiction and reality. What it does is nothing but real. We could accept the algorithm as a prop (like a chair that became *the* chair of Elsinor Castle only because participates in a character’s action that depicts it as such). In this case (as the chair) the algorithm enters the fictional world according to how it participates to the action. Yet, the chair does not have any autonomous action, while the algorithm does. This means that also the actions of the algorithm must be ‘used’ by someone: the actor, the audience, or even the author that have coded it for his/her own purposes.

4. Conclusions

Although it is premature to draw a general conclusion about the intervention of AI on stage, we are keen to reckon the emergence of the autonomous artificial agency as a key fact that impacts both on the notion of authorship and on what we perceive as presence.

Besides we have noted that, from the advent of digitally augmented performance to the rise of AI on stage, there is a sort of substratum of meaning

that hinges of the exposition of technology. Whether it is employed to amuse the audience with high tech solution, or to disconcert them with allusions about the dystopian future of our society, the exposition of technology has become a sort of seduction. Indeed, the perils of resorting to technology to seduce the spectator are becoming more evident. In fact, the Zecora Ura Theatre company has recently challenged the fashion for immersive theatre experience with a post-immersive theatre manifesto that incites to a more politically aware use of technology and that tries to refocus on the intimacy of the relation between actor and spectator (Ramos et al. 2020).

Yet, beside the political and ethical implications of seducing the audience and transforming the experience in a commodity, even if we do not place any judgment on the amusement of watching high tech solution (that is not far away from the enthusiasm for CGI effects in movies), as long we focus on the codes of the dramatic and performative event, there is no doubt that the presence of AI on stage is going to gain more relevance and as such it should catch the attentions of critics and scholars.

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An excerpt of Annie Dorsen's *A Piece of Work* is available on Vimeo, <https://vimeo.com/114190127>. Excerpts of *Afasia*, *POL* and more Marcel·li Antünez Roca's performances can be found at the artist's website, <http://www.marceliantunez.com/>. Different clips of *Discrete Figure* by Daito Manabe, Kyle McDonald and Elevenplay dance group are available on YouTube, https://www.youtube.com/watch?v=hauX-QQhwbgM&feature=emb_logo. There are numerous clips that document Michael Noll's dance animation, for example the one available on YouTube, https://www.youtube.com/watch?v=uLU2hIV7n_I. More information documentation about Blast Theory's *Desert Rain* is available on their web page, together with a short video trailer, <https://www.blasttheory.co.uk/projects/desert-rain/>. The game *Façade* can be still downloaded (Windows operating system only) on Playablstudios, <https://www.playablstudios.com/façade>. An excerpt from Annie Dorsen's *Hello Hi There* can be seen on Vimeo, <https://vimeo.com/49328509>. The whole show *I, worker* (2008) by Hirata Oriza, is available within a longer video about Seinendan Theater Company and Osaka University Robot Theater Project (from 23'45" to 49'45") on YouTube, https://www.youtube.com/watch?v=BVPcjuyLfho&feature=emb_logo. An excerpt of Turbo Pascal's *Algorithmen* is available on Vimeo, <https://vimeo.com/111923001>. An excerpt from Annie Dorsen's *Yesterday/Tomorrow* is available on Vimeo, <https://vimeo.com/194698057>. Documents and videos about *DoPPioGioco* and other CIRMA's project about theatre and digital technology, are available at the Research page <https://www.cirma.unito.it>.