

Humanoid in Contemporary Theatre

— Dealing a Collaboration between Artists and Robotics Engineers

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Abstract: This paper is dedicated to androids in contemporary stage and to the interdisciplinary collaboration between theatre directors and robotics engineers. My paper is organized in two parts. The first one is a general thinking on robotics in contemporary theatre. I give here examples of the different works and various forms of the use of the robotic device (robotic arm, installation, exoskeleton, android). The second one is the case study dedicated to Japanese android called “Geminoid” and to how the collaboration is organized between artists and engineers, especially between the theatre director Oriza Hirata and the professor of robotics Hiroshi Ishiguro. I will focus on developing of three performances: *Sayonara. Version 2* (2012), *Three sisters. Android version* (2012) and *La Metamorphose. Version androïde* (2014).

Key Words: Interdisciplinary Collaboration; Robot; Geminoid; Research; Process of Creation, Interdisciplinary Dialogue; Artiste; Robotics Engineer; Oriza Hirata; Hiroshi Ishiguro

Introduction. Some Reminiscences of the Avant-garde 1920s

The idea of the *mechanical* and of the *automaton* has an interesting history in theatre, both creatively and reflectively, on stage and in the artists’ writings. The beginning of the 20th century, known as the “mechanization era”, was characterized by considerable scientific, sociological and artistic transformations. It is the apotheosis of science that seems to give all the

tools for understanding the world. We are in the period of the triumph of rationalism and materialism. The scientific mind is undergoing a considerable transformation, with the dynamic and creative research ^[1]. Several artists of the 1920s proclaim in their manifestos the *new art* and the *new man* ^[2]. The new man will often appear as the figure of the mechanized man and the prosthetic man for whom technology constitutes a stimulating source and a perfect control of his emotions.

The machine will symbolize here first of all a force and speed. Thus, we are dealing with the response to the artistic and cultural needs of a society transformed by the industrial revolution. It should be noted that the cult of technique provides a vision of the mechanized body. The figure of the machine and the imagination generated by the technique very quickly occupied Filippo Tommaso Marinetti and Enrico Prampolini, leading figures of Italian futurism, already in 1910. These postulates are proclaimed, among others, in the manifesto *Mechanical and Geometrical Splendor* and *Sensitivity toward numbers* or in *The Futurist Dance* where they evoke the idea of the “puppet actor” and the “robot dancer” who are mechanized and who can represent a machine ^[3]. Following his futurist colleagues, Fortunato Depero offers, for example, in his *Song of the Nightingale* dancers wearing costumes and masks equipped with lamps instead of eyes and megaphones instead of mouth ^[4].

In Soviet Russia, El Lissitzky developed a project for the play *Victory over the Sun* in 1923 ^[5]. In this conception, it is called the “electro-mechanical show”, putting together anthropomorphic figures, transcribed into geometric and abstract forms. El Lissitzky speaks of them in terms of “play bodies” animated by a device to which they are connected and directed by a sin-

gle artist ^[6]. On the German side, Oskar Schlemmer, a Bauhaus artist, is interested in the transcription of the body into space and produces the geometric costumes that assimilate technical inventions and that the public can see in particular in his *Triadic Ballet* created in 1922. Schlemmer himself refers to the possibilities offered by the progress of his time as “[...] machines of the precision, scientific apparatus made of glass and metal, artificial limbs of surgery, fantastic suits for suits and military personnel, etc.” ^[8]. The artist in his work *Figurative Cabinet* goes even further and presents the actor in flat effigy, a pictorial figure half-grotesque and half abstract that is moved by a hidden actor-manipulator ^[9]. He finally pronounces a possibility of the disappearance of the actor’s figure:

“We must therefore imagine shows where only the movement of shapes, colors and light takes place. If the movement is mechanical in nature, with man being completely eliminated, except on the control panel, this requires a technical device with a precision similar to that of a prodigious automaton”. ^[10]

It is important to emphasize that the figure of the robot in the theatre tradition does not seem to have been built up directly as artistic figure, as Louise LePage points out when she quotes Kara Reilly and her book *Automata and Mimesis on the Stage of Theatre History* ^[11]. The robot was first named by Karel Capek in his play *R.U.R. (Rossum’s Universal Robots)* written in 1921 and was referred to the action of the “work” (“robota” in Czech language) and was considered as “mechanical worker”. It is true that his close family member the *automaton* and the general idea of the *mechanical* was present much earlier in the arts. Jacques Vaucanson’s or Pierre Jacquet-Droz’s automata such as the famous mechanical *Duck* or the *Writer* were artifacts intended to distract and to amaze

the spectator. Even if I will not go into the details of the discussion, let me underline that some researchers place the robot in direct line with the automaton as evoked by René Burassa in her talk *Figures de l'automate : simulacres, figures de synthèse et vie artificielle dans les dispositifs médiatiques contemporains* (*Figures of the automaton: simulacra, synthetic figures and artificial life in contemporary media devices*) as part of the symposium *L'outre-humain* (*Beyond the human*) in 2017. We will see in this paper that the contemporary robot exceeds largely this question and has his own complex history, built in the interdisciplinary field and convening artistic, scientific and philosophical paradigms.

Robots in Contemporary Theatre

The relationship of contemporary theatre with robotics engineering is defined today in several areas of this artistic endeavor. A number of more precise

definitions strive to capture this relationship, namely: "Robotic Theatre" or "Metal Performance" ^[12]. They are part of the more general concept called "Digital Performance" ^[13], as coined by Steve Dixon in 2007 or "Cyborg Theatre" ^[14] as defined by Jennifer Parker-Starbuck. It can be seen that the performance, which then integrates robotics, will form a subset of the "Digital Performance" and will challenge "Robotic Theatre", i.e. performing forms including robots only, as well as "Cyborg Theatre" in which the performer is rigged with a device, or prosthetics he wears and can manipulate. The latter uses the figure of the cyborg, hence half-human, half-machine and translates that figure on stage.

Nowadays, theatre and performing arts artists who work with robotics are relatively numerous; among others:

Artists involved in real artistic and scientific research:

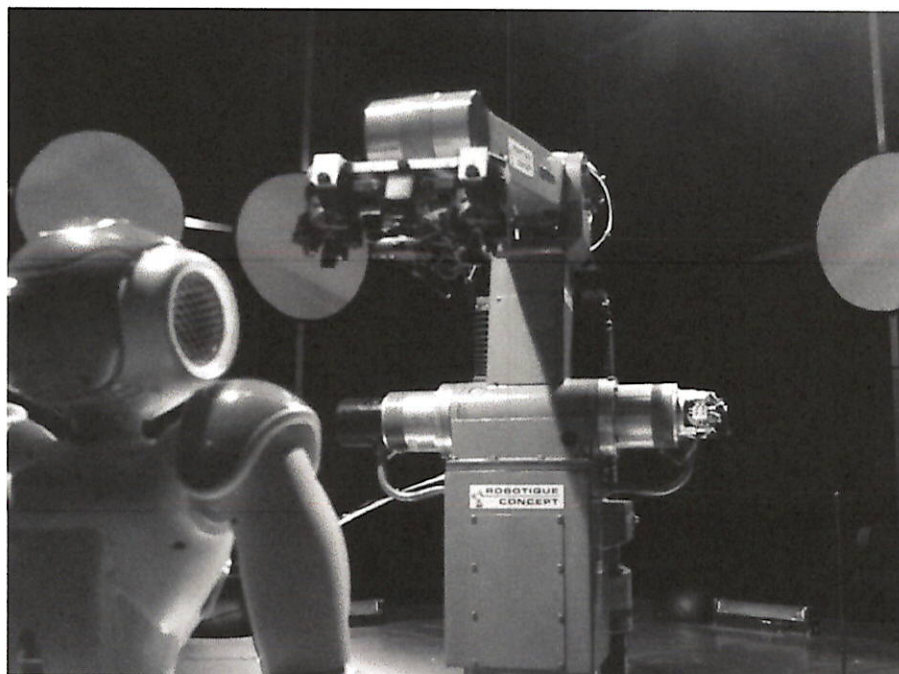


Fig. 1 *ThéRo-Gnômôn*, conception: Clément-Marie Mathieu, Damien Schahmanèche, 2013, Phot. Clément-Marie Mathieu©

A/ dedicated to the robot:

The director Oriza Hirata and the professor Hiroshi Ishiguro are working in Japan with highly specialized androids; The French artist and researcher Zaven Paré has invented the electronic puppet; The French sound engineer Clément-Marie Mathieu has created the *Laboratoire de l'inquiétante étrangeté* and are elaborating robotic installations for theatre; Canadian directors Denis Marleau and Stéphanie Jasmin are working for several years now with video projections, mechanic puppets, dummies and propose the theatre without human actors.

B/ dedicated to the device in the cyborgization perspective:

The visual artist Stelarc known for his third arms; British performer Julie Wilson-Bokowiec and engineer Mark Bokowiec are working on Bodycoder, the software allowing the sound and voice manipulation; Marcel.li Antunez Roca, Spanish performer, who has invented a mechatronic performance; French

artists Ezra & Organic Orchestra are working on interactive glove and develop the concept of “beatboxing”.

Artists from other fields who dramatize robots:

Let's quote Chico MacMurtrie and his Amorfic Robot Work which is presenting the theatricalisation of robots; Leonel Moura, robotic artiste, has presented the performance *R.U.R, The Birth of the Robot* based on the dramatic text of Karel Capek, Louis-Philippe Demers, visual and robotic artiste who presented the choreographic installation *The Tiller Girls*, for ex.).

We can formulate the question once again, perhaps this time naively since we live in a highly technological society, why this use of the figure of the robot in theatre? Kathy Cleland offers an interesting answer:

“Our technological ‘others’ reveal a lot about what we believe is important to the notion of the human. Robots and virtual characters help to define the human – they are our technological reflections—idealised or inverted—held up as mirrors that affirm or



Fig. 2 Ezra with the interactive glove. Phot. Benjamin Juhel©



Fig. 3 Julie Wilson-Bokowicz with Bodycoder, University of Montréal, 2007. Phot. Izabella Pluta©

challenge our humanity”^[15].

The arrival of the robot on the contemporary stage now takes various forms and types of collaborations, and creations are more and more numerous. In theatre, the issue of the robot appears to be moving today from operating in scenic settings, and as part of the device, towards more interaction with the actor. The point is then to ask the first question related to stage-presence, improvisation, unpredictability and bugs, leading to one of the most fundamental question in drama: acting on stage. The second one concerns the interdisciplinary team which is confronted with various working methods, with the communication between different trades and with two fundamental questions: that of the author of the artwork and the purpose of the artwork.

In the field of theatre, robotic theatre, has not yet homogenized its study and exploration object, where the robotic element appears in the following ways:

- humanoid robot alongside actors,
- robotics construction: a robot arm, e.g., in direct or indirect interaction with the actor,
- robotic construction in direct or indirect interaction with the audience, who can become an actor / manipulator.
- a robotic item worn by the actor / performer.

It is important to emphasize that we are talking here about the exhibited robotic element, not the robotics integrated in the stage master control, since we can assume controls are almost all digital now.

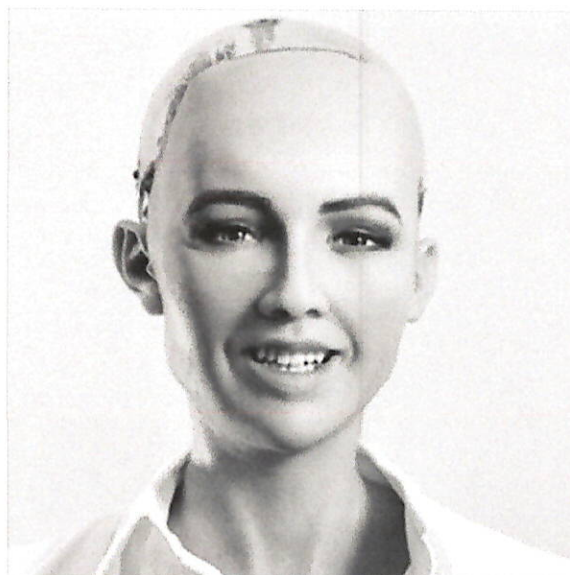


Fig. 4 Sophia. Hanson Robotics. Phot. DR

Artist/Engineer Duo: Example of Oriza Hirata and Hiroshi Ishiguro

Humanoid social robots have already marked the ultra-advanced research in robotics. ATR Laboratories and Prof. Hiroshi Ishiguro from Osaka created in 2001 a robotic double of 4-years-old girl who is Ishiguro's daughter. Hanson Robotics based in Hong Kong, activated in 2006 robot Jules, the realistic and conversant android, created with its partner Personality Forge. Sophia created by Hanson Robotics in 2015 and modelled after the actress Audrey Hepburn, is considered as one of the most intelligent robots in the world, developing above all the ability to draw.

In the field of theatre, the most emblematic work with social robots is done by a Japanese duo, director Oriza Hirata and engineer Hiroshi Ishiguro. I would like to dwell on that example in my study because the staging Hirata and Ishiguro develop and the type of collaboration they offer are an important threshold towards bringing theatre and robotics closer together in

the way of the idea of the staging and of the acting of and *with* non-human actor.

Hiroshi Ishiguro, a professor of robotics, is currently working in two research units: Hiroshi Ishiguro Laboratories in environment of the Advanced Telecommunication Research Institute International (ATR) in Kyoto (four laboratories) and the Department of Systems Innovation in the Graduate School of Engineering at Osaka ^[16]. These are the diverse types of robots designed by the teams of these laboratories, for example the Telenoid, a teleoperated android, with minimal human likeness, without gender or age, and whose body has the contours of a human silhouette.

Among these androids, the most fascinating are the Geminoids (“*Geminus*” in Latin, meaning “Twin”) designed in the image of actually existing people. In the early 2000s, Ishiguro made Repliee R1, his first Geminoid as a replica of his daughter and then a copy of a TV presenter - Repliee Q2. He developed, finally, his own double, the Geminoid HI-1, which had implants of his own hair, and later a more perfected



Fig. 5 Hiroshi Ishiguro and Geminoid HI-1 in Hiroshi Ishiguro Laboratory in 2006. Phot. Hiroshi Ishiguro Laboratory, ATR©

version of it as Geminoid HI-2 and today – version HI-5 ^[17].

This twin android seems a veritable aspiration of Pygmalion's dream since it approximates the human appearance like no other android thus far designed has managed. In fact, the objectives of this robotics research are ambitious: since 2004, the work on human appearance, through research on artificial skin and the development of micro facial movements; and, since 2009, work on the unconscious movements that, in the human, are evidence of brain activity ^[18].

Note that the Geminoid is so complex that there is no one on the staff of the laboratories that knows all the functioning elements. Research results are striking at this moment: the silicone skin perfectly imitates human skin (texture, color, imperfections like pimples) ^[19]; the face is given lip movements and blinking eyelids. The Geminoid can move its hands, fingers - especially the latter - resembling gestures linked to stress, impatience, in a human being. The Geminoid cannot walk and is operated remotely by an engineer

who lends his voice. Some types already have a second mode of operation without teleoperator, much more autonomous in its interaction with an interlocutor and equipped with a synthesized voice.

Since the beginning of his research, Ishiguro probes into the concept of "*Sonzai-kan*", which means "feeling of being in the presence of another person" and what is called in robotics the effect of Uncanny Valley ^[20]. This feeling was analyzed in 1970 by Masahiro Mori who observed the discomfort in the person looking at a humanoid robot. These days, the engineer Takenobu Chikaraishi (et al.) states:

"In fact, 76% of subjects cannot distinguish an android robot from a human after watching the android for less than two seconds. Therefore, the negative feeling is induced after long-term exposure to an android robot and remains a central barrier to comfortable human – android interactions." ^[21]

Currently, the research conducted by Ishiguro's teams aims to extend the time during which the user has the impression of being in front of a living being

and also get him to establish a relatively spontaneous interaction with the android. So, Ishiguro orients the work in the direction of increasing the edge of the unforeseen and the unexpected in the android, which is currently an important issue for robotics in global research.

Although it is highly inappropriate to assign machine functions that are not part of its protocolary use in the Japanese scientific tradition, Ishiguro is interested in the actions of his robots in other contexts. Thus the Robot Actors Project was born, in which the stage becomes a new laboratory for robot study, a place of experimentation. For this staging experiment, Ishiguro chose the female version, Geminoid F, a young and beautiful 25-year-old Asian woman, a “lighter” model that requires only 12 pneumatic actuators. Designed in 2007, this robot went directly into Oriza Hirata’s staging project, becoming part of the Android-Human

Theatre ^[22].

Let me explain that Oriza Hirata really started to work with Hiroshi Ishiguro in 2008 when he produced a twenty-minute performance that he wrote, *I Am a Worker*, with two actors and two household robots of the Wakamaru type. Since the assimilation of robots into this show was a success, Ishiguro rapidly proposed an even more difficult test to Hirata: to work with Geminoid F. The main goal was to integrate Geminoid F into a live performance and put it in a situation of acting alongside professional actors. Hirata explains:

“The two of us [Ishiguro and Hirata] are not only of the same generation, but the extent to which we share the same view of humanity and the same thinking about communication is astounding. Our research accelerated at full throttle from the start. Professor Ishiguro aspired to be a painter in his youth, and I have written many plays with science and technology as the theme, so our mutual histories were a reason why the project proceeded so smoothly.”^[23]

Hirata agreed of the collaboration and visited the Ishiguro’s Lab to become familiar with operating the android. The integration of the robot into staging clearly brought him a new challenge ^[24]. Let me specify that Hirata is not only a director and one of the best-known Japanese authors, widely recognized for his “Contemporary Colloquial Theatre Theory (CCTT)”. He is also artistic director of the group Seinendan, director of the Theatre Komaba Agora and a professor at Osaka University. His extensive knowledge about the theatre clearly brings to the Android-Human Theatre project the artistic dimension of the role of robots in Japanese society, without losing sight of the sociological aspects.



Fig. 6 Geminoid F as a double of a young Asian women whose identity is confidential. Phot. Hiroshi Ishiguro Laboratory, ATR©

Process of Creation and Programming: Methodological Crossover

By opting to perform with highly humanized robots, the director entered a creative process that became, in essence, a process of experimentation, where different issues emerge from the beginning, working with the Geminoid F.

The whole process is based on "Contemporary Colloquial Theatre Theory" mentioned above but also on simple and complex technical, logistical, artistic, issues and questions, such as:

1. What play to choose, taking into account the lack of the robot's motor mobility?
2. Integration of the android into the scenography: whether to hide or show the wiring, the speakers, the chair on which it sits;
3. Dubbing work to be performed by an actress (she lends her voice)
4. Directing the performance of another actor with the robot on the stage;

5. Teaching the actors how to deal with the unexpected arising from some operational defect in the android, such as a breakdown;

6. Organization of the creative process between the artistic team and the laboratory: communication, sharing the steps of staging and robot control integration in the production ^[25].

As Louise Lepage notices:

"That the robot's identity finds form in the acts of its performance has implications that extend beyond theatre. Theatrical processes and structures, such as performativity, modes of theatrical representation and perception, and an understanding of the workings of character, can support understanding of, and engagement with, robots in all kinds of real-world settings, not just theatrical ones. I am starting to think about how the robot's positioning in specific contexts and forms, as particular sorts of identities, work upon the responses of audiences to particular robots." ^[26]

In 2010, Hirata elaborates a performance *Say-*



Fig. 7 Performance *Sayonara*, 2010. Phot. Tatsuo Nabu©

onara and put on the mise-en-scène, with Bryerly Long in the leading role, the Geminoid F as the companion robot and Minako Inoue, who operated the robot backstage by remote control. The half-hour long performance took place in a minimalist space with only two chairs, developing at a quiet pace in an intimate atmosphere. The robot is there to recite poems, but at the same time to help the young woman in her departure.

Hirata puts the android not only in a acting situation, as it did with the Wakamaru, but gives it a scenic importance equal to that of the actress, the two then become partners in the stage interpretation^[27]. The text of the piece explains, perfectly, all staging exigencies: the slow pace is explained by the intimate aspect of the piece, the limits of robot motion in the reserved activities and stoicism in the face of the young woman's death. In 2012, Hirata presented *Sayonara Ver. 2* with a new epilogue in honor of the tragedy at Fukushima:

after the death of the young woman, the android is transferred to the location of the radiation, which is forbidden to living beings and where only a robot can survive and recite poems for the victims of the disaster.

It is important to mention that in the recent study written by T. Chikaraishi, Y. Yoshikawa, K. Ogawa, O. Hirata, H. Ishiguro authors explain that a questionnaire was proposed to the audience after *Sayonara's* performances in several countries, including France, Germany, Austria, Italy^[29]. Questions were organized into three groups - baselines of judgment: mind, attractiveness and weight of words. These results have been analyzed and then the findings are integrated into scientific research in the ATR Laboratories to improve the Geminoid F. T. Chikaraishi (et al.) underlines:

"In this study, it is not very clear how much the obtained evaluations were influenced by the context of



Fig. 8 Geminoid F and Wakamaru in performance *Three Sisters, Android version*, 2012. Phot. Tsukasa Aoki©

the stage. The treatment of subjective evaluation independently of the context of interaction is a kind of open problem of HRI and should be also concerned in our work. To go beyond the report of a single experiment focusing on a specific context to meaningfully generalize it, we need to pile up many evaluations of realistic scenes of human – robot interaction by changing contexts. We believe that android theatre studies can effectively contribute to this approach in terms of creating necessary, very realistic pieces of interaction to be evaluated.”^[30]

Hirata decided soon to continue the experiment, proposing to expand the creative team and introduce a second robot to performance. For his text, he turned to an icon of European drama, Chekhov's *Three Sisters*. He elaborates an adaptation of this drama strongly contextualized in Japanese reality. The challenge of staging is, this time, more difficult, because the play is

much longer, and the play is represented by nine actors and two robots, Geminoid F and Wakamaru Robovie-R3. The process of creating the *Three Sisters. Android version* went on stage with and without robots and laboratory preparation played an important role.

Louise Lepage makes an interesting point as it concerns the robot “acting” and the robot “character”:

“Hirata's plays are naturalistic. The traditional approach of the naturalistic actor is character work, which is psychologically focused. The actor develops his character's backstory, relationships, and intentions, with a view to transforming himself into his character. All this is done to enhance the plausibility, the authenticity, the *believability* of an actor's performance. However, Hirata rejects such a psychological and ostensibly transformative approach and attends, instead, to the physical details of performance, mod-

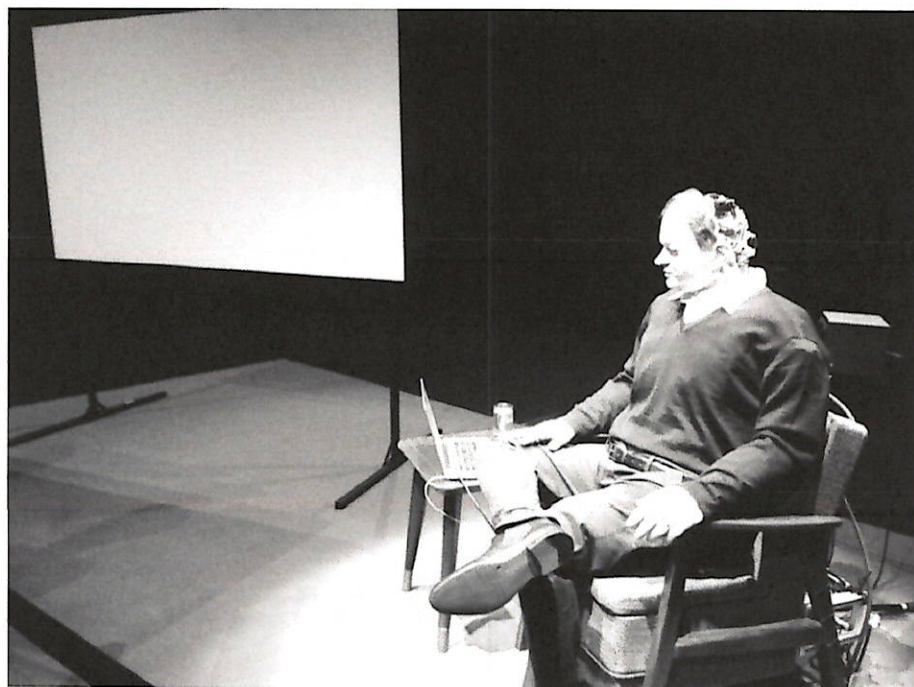


Fig. 9 The writer Thomas Melle represented by his mechatronic double. Performance *Uncanny Valley* directed by Stefan Kaegi. Phot. Izabella Pluta©

elling his actors' performances – android and human alike – on closely observed human behavior. This is to say, Hirata depends upon the work of the audience to effect the transformation of his actors – including his android performer – into the character".^[28]

In 2014, Hirata presented *La Métamorphose. Version androïde*, a production inspired by Franz Kafka's text. This time, Hirata confronted the actors and the audience with a robot that was instantly recognizable as such. Here, the contingent strangeness of the robot is intrinsically linked to the character's unexpected metamorphosis.

Artiste and Engineer in Artistic Field: Inventing New Dialogue

The integration of androids into the performing arts raises artistic, scientific and ontological questions. We don't know what land these robots will bring us to: "promised" or damned land. In any case, they promise a lot and the experimentation continue.^[29]

Recently, the Swiss director Stefan Kaegi, has developed a mechatronics double of the German famous writer Thomas Melle and places him as a per-

former in his show *Uncanny Valley* (2018)^[30]. The robot replaces the human figure: the writer but also the real actor who we only hear as a recorded voice (in the German version the voice of Melle himself). In that way, Kaegi questions the phenomenon of *Uncanny Valley* and discusses the disappearance of the human axiom in the performing arts.

The Geminoid F for its part, constitutes and creates the link between the collaborative teams and the different functions of artists and scientists, allowing the meeting of scientific and artistic worlds. Moreover, the staging initiatives enable the discovery of potentialities for uses not yet considered by the production industry. Through Oriza Hirata's staging, the robot becomes part of a very important experience, in which a uniquely acting function is given to a humanoid robot. It's an innovation whose technological level is unprecedented and puts into question one of the constituent theatre paradigms: *presence*. While Android-Human Theatre is still a highly experimental work, Hirata raises several key issues for the theatre and thus leads an aesthetic path, no doubt, to be continued.

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当代戏剧中的仿真机器人 —— 剧院导演和机器人工程师之间的合作

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内容摘要: 本文专门论述当代舞台上的机器人,以及剧院导演和机器人工程师之间的跨学科合作。本文由两部分组成。第一部分是对当代戏剧中机器人技术的总体思考。本文举例说明机器人设备(机械臂、装置、外骨骼、人形机器人)的不同作品和各种使用形式。第二部分是日本机器人“双子机械人”(Geminoid)的案例研究,以及如何组织剧院导演和机器人工程师之间的合作,特别是戏剧导演平田(Oriza Hirata)和机器人学教授石黑浩(Hiroshi Ishiguro)之间的合作。本文将重点讨论三个表演的创作:“再会”第2版(2012)、“三姐妹”机器人版(2012)和“变形记”机器人版(2014)。

关键词: 跨学科协作;机器人;双子机械人;研究;创造过程;跨学科对话;艺术家;机器人工程师;平田;石黑浩